# Investigating Tourists' Airport Choice in the Multi-Airport Region of Aklan, Philippines and Its Implications on Airport Capacity Expansion Decisions

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**Abstract**: Airport development decisions in a multi-airport region are rather complex because the concerned airports are part of a network of airports. The decision-making process to a great degree depends on reliable estimates of passenger demand at the different airports. Previous researches highlight the need for airline authorities to know the potential passengers' sensitivity to price, frequency and accessibility when developing a new strategy or new market. These sensitivities are necessary to accurately forecast the demand and opportunities for cost recovery of investments in airport or airline capacity. This is clearly the case for the Kalibo and Caticlan airports which both serve Boracay island, a world-famous tourist destination. This paper argues that airport capacity expansion decisions need to take into account a multi-airport perspective in assessing the value and timeliness of such investments. Planning scenarios based on calibrated airport choice model are developed to evaluate the market size of each airport.

*Keywords*: Airport choice, Multi-airport region, Airport planning

## 1. INTRODUCTION

### 1.1 Background

Airport development decisions in a multi-airport region are rather complex because the concerned airports are part of a network of airports. The decision-making process to a great degree depends on reliable estimates of passenger demand at the different airports. The evolution of these systems typically occurs over long time horizons and involves multiple stakeholders (i.e. passengers, airlines, airport developers and operators, local and national regulatory authorities, etc.). Given the capacity constraints on existing major airports and the limited ability to increase their capacity, the transition and development of multi-airport systems appears to be key mechanism by which air transportation systems around the world will be able to meet future demand.

Analytical methods used to analyze and evaluate multi-airport systems have relied on modeling airport or airline choice as the basis for passenger forecasts. Previous researches highlight the need for airline authorities to know the potential passengers' sensitivity to price, frequency and accessibility when developing a new strategy or new market. These sensitivities are necessary to accurately forecast the demand and opportunities for cost recovery of investments in airport or airline capacity.

It is argued that a multi-airport system perspective is largely unheard of in the case of airport planning and development in the Philippines. This is manifested by the seeming absence of a strategic approach to airport development and management. The World Bank (2009) cites that the Philippines has a large number of airports but with inadequate air transport facilities. These consist of 85 national (public) airports, including 4 regular international airports; of these, 62 have paved runways and 23 have unpaved runways. In addition, there are around 130 private/non-national airports, mostly with unpaved runways. As such, there is a need to explore the incorporation of multi-airport system perspective in airport planning and investment decisions based on the local context.

### 1.2 Study Objectives

The objective of the study is to explore the application of airport choice modeling in a multi-airport region context and demonstrate its value in evaluating airport capacity expansion decisions. The multi-airport region covering the Kalibo and Caticlan airports provides a case study.

### 1.3 Significance

The development of an airport choice modeling application in the local context provides a practical planning and decision tool that can be expanded to cover other potential airport systems in the country that operate under a multi-airport system. From an academic point of view, the study highlights determinants of airport choice based on the local setting.

## 2. LITERATURE REVIEW

### 2.1 Multi-Airport Region Concept

De Neufville and Odoni (2003) defines a multi-airport system is the set of significant airports that serve commercial transport in a metropolitan region, without regard to ownership or political control of individual airports. This definition involves several important points as follows:

- focuses on airports serving commercial traffic;
- refers to a metropolitan region rather than a city (and thus may contain several independent cities);
- looks at significant markets; and
- concerns the total market (not just that portion managed by a specific operator).

transportation demand.

Bonnefoy, et al. (2007) note that in Asia, multi-airport regions have generally evolved through the construction of new high capacity airports due to a weaker set of available airports, high perceived benefits of strong growth of traffic and weaker opposition to the construction of airports. They further suggests the need to apply a real option-based approach[1] (i.e. flexible and staged development approach) to develop multi-airport systems and asserts that while the development of multi-airport systems poses several challenges in terms of planning and development, these systems provide several significant advantages:

- relieve congestion at primary airports while providing additional capacity to the regional air transportation system;
- provide increased operational robustness by spatially decoupling operations and

[1] Where the existing under-utilized airport infrastructure is weak and where projections of high volume of demand -with high uncertainty- are high, his approach includes actions such as reserving land area for future airport development and keeping original airports open since this option has proven to be useful and successful in the United States.

reducing the effects of disruptions;

- offer new travel alternatives for residents of the metropolitan region, which translates into reduced airport access distance and travel time;
- generate direct, indirect and induced regional economic impacts (i.e. employments, revenue sources for surrounding cities from taxes, attract new companies, etc.); and
- reduce the effects of monopolistic positions that can sometimes emerge in single-airport systems.

Martin and Voltes-Dorta (2011) explores the problematic of airport capacity expansions from the perspective of the airport financial management, using the operating costs as the variable of interest. Predictions are obtained from a multi-output specification of the industry's cost function, estimated with a broad database of international airports. The results indicate the presence of non-exhausted scale economies at the current levels of production. Hence, the atomization of air traffic always increases operating costs at a system level.

Mirabueno and Yujuico (2014) asserts that there are policy imperatives to institutionalize multi-airport system planning in order to improve interagency collaboration and maximize economic opportunities in the air transport sector.

Recently, Bezerra and Gomes (2019) examines the drivers of passenger loyalty to the airport in a multi-airport region. They highlight the role of customer segmentation to define marketing and operational strategies, which should be used to strengthen the loyalty to the airport as well as to contribute to the improvement of the tourism destination image. Three important drivers of loyalty, with significant effects for all passenger segments were found, namely, airport service quality (ASQ), switching costs, and airport image.

## 2.2 Determinants of Airport Choice

Table 1 presents an evolution of airport choice studies. These studies suggest that wide use of discrete choice model formulation in modelling passengers' choice behavior ranging from multinomial to nested logit structures. The main attributes that are specified in the models are air fare, access time, access modes and frequency of available fights. It is noted however that attributed related to safe air traffic has not been given due consideration in the passengers' choice of airport. This aspect is addressed in this study.

Table 1. Airport Choice Studies

| Author/Year | Study Area | Model Specifications/Features |
|---|---|---|
| Skinner (1976) | Baltimore-Washington area | Utility functions that combine airline level of service and ground accessibility measure. Preferred level of service measure was the number of flight frequencies while best measure of ground accessibility is a combination of cost and time |
| Harvey (1987) | San Francisco Bay Area | Logit model incorporating the variables: access time to the airport, absolute and relative (without connections) flight frequencies |
| Ashford and Bencheman (1987) | Central England | Multinomial logit model of passenger's choice of airport. For business and inclusive tour travel, the most important variables of choice were access time to the airport and frequency to the chosen destination. For domestic and leisure trips there were three |

| Author/Year | Study Area | Model Specifications/Features |
|---|---|---|
| | | factors: air fare, access time, and frequency of available fights. |
| Windle and Dresner (1995) | Baltimore-Washington D.C. | Multinomial logit model incorporating access time, flight frequencies and passengers' experience |
| Pels et al. (2001) | San Francisco Bay Area | Nested logit model is used to describe passengers' sequential choice of airport and airline |
| Pels et al. (2003) | San Francisco Bay Area | Two-level nested logit model with the airport choice at the top level and the access mode choice at the lower level |
| Hess and Polak (2005) | San Francisco Bay Area | Mixed multinomial logit specification allowing for random preference variation |
| Blackstone, et al. (2006) | Baltimore-Washington, New York and Philadelphia | Probit model to evaluate the effect of low fares on consumer behavior; The availability of non-stop flights, wait at check-in, income, and distance from home were important considerations. |
| Loo (2008) | Hong Kong | Multinomial logit model incorporation airport level-of-service (LOS) attributes including air fare, access time, flight frequency and the number of airlines |
| Ishii, et. al (2009) | San Francisco Bay area and greater Los Angeles | Conditional logit model to measure the impact of airport and airline supply characteristics on the air travel choices of passengers |
| Jung and Yoo (2016) | Seoul metropolitan area, South Korea | Two-level Nested Logit model using airport and airline choice attributes; The study also estimated the parameters in the equations relating the latent variable by using Structural Equation Model (SEM) |

### 2.3 Modeling Airport Choice

As mentioned, airport choice model rely heavily on state-of-the art discrete choice modeling techniques, A basic assumption in discrete choice analysis is that each alternative in the choice set of a decision-maker is associated with a utility, and that the decision-maker chooses the alternative with the highest utility. The utility is assumed to consist of one observable part, and one part that is not observable for the analyst. In equation form, this is expressed as:

$$U_i = V_i + \varepsilon_i \tag{1}$$

where,

$U_i$ : the total utility for alternative *i*,
$V_i$ : the observable part, and,
$\varepsilon_i$ : the unobservable part.

The unobservable part is assumed to be stochastic. This means that we will not be able to predict which alternative a decision-maker will actually choose, but an assumption on the distribution of the stochastic past will allow us to predict the probability that it will be chosen. For a population of decision-makers, we will thus be able to predict the share of the population choosing each alternative.

The assumption of the distribution of the stochastic part of the utility determines the functional form of the model. In the Logit model case, the assumption is that it is identically and independently Gumbel distributed which is fairly close to the Normal distribution. This distribution assumption implies the following formula for the probability of choosing a particular alternative (the Multinomial Logit Model):

$$P_i = \frac{e^{\mu V_i}}{\sum_{j \in C} e^{\mu V_j}} \tag{2}$$

where,

$P_i$ : the probability of a decision-maker choosing alternative *i*,
$\mu$ : a scale parameter (inversely proportional to the standard deviation of the stochastic term),
$V_i$ : the observable part of the utility, and
$C$ : the choice set of the decision-maker.

In practice, $V_i$ is often assumed to be a linear function of parameters and variables. The model can then be formulated as:

$$P_i = \frac{e^{\beta' x_i}}{\sum_{j \in C} e^{\beta' x_j}} \tag{3}$$

where,

$\beta'$ : a parameter vector (to be estimated), and
$x_i$ : a vector of variables for alternative *i*.

Thus, the $\beta$ values reflect the sensitivity of the variables included in the model (such as price, service level, etc.).

## 3. STUDY AREA

### 3.1 Location and Geography

The Municipality of Kalibo is a 1st class municipality and capital of the province of Aklan, located in the north-west of Panay. The municipality is known for the Ati-Atihan festival and for the semi-urban and multi-awarded mangrove forest, the Bakhawan Eco-Park. The area is most famous for Boracay, a resort island one kilometer north from the tip of Panay Island. Boracay is a small island, only seven kilometers long and slightly over 1,000 hectares. It is most famous for Long Beach (also known as White Beach), four kilometers of white powder sand gently extending to the crystal blue waters of Sibuyan Sea. The island can be accessed by air either through Kalibo or Caticlan airport. A short 20-minute pump-boat ride is required to get from the main island of Panay to Boracay. Figure 1 presents the location map Boracay Island.

### 3.2 Boracay Tourism Trend

For Boracay Island, PIA (2018a) reports that a total of P56.15 million in tourism receipts was generated in 2017. The “tourist-spend” receipts in 2017 increased by 14.83 percent as compared to the 2016 figure of P48.89 billlion. The said earnings came from the 2,001,974 tourists the island received in 2017, surpassing the two million target. The record shows that

1,052,976 foreign and 42,060 overseas Filipino tourists from January to December 2017 were able to spend a total of P38.78 billion in Boracay. Meanwhile, the 972,994 domestic tourists spent about P17.36 billion for the whole year of 2017. The top 10 list of countries of origin were China, South Korea, Taiwan, USA, Malaysia, UK, Saudi Arabia, Australia, Russia and Singapore.

a) b)

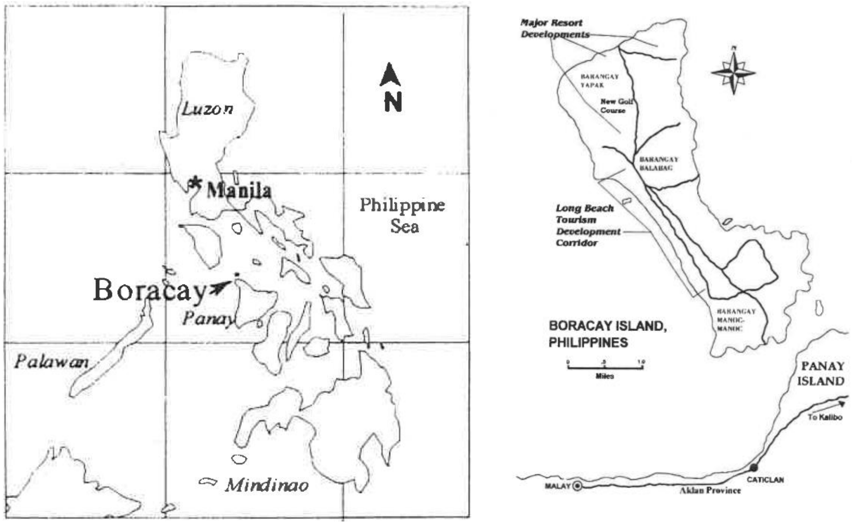


Figure 1. a) Location of Boracay Island; b) Vicinity map of Boracay Island
(Source: Trousdale, 1999)

### 3.3 Kalibo and Caticlan Airports

Table 2 presents the summary of airport characteristics for the Kalibo and Caticlan airports. Figure 2 presents the location map of the two airports. It is recognized that the two airports cater to the same market which are tourists bound for Boracay.

Table 2. Summary of Airport Information

| | Kalibo | Caticlan |
|---|---|---|
| ICAO ID | RPVK | RPVE |
| IATA ID | KLO | MPH |
| Operator | Civil Aviation Authority of the Philippines | Transaire Development Holdings Corporation |
| Location | Barangay Pook, Kalibo, Aklan | Barangay Caticlan, Malay, Aklan |
| Latitude | 11° 40' 45.95" N | 11° 55' 28.21" N |
| Longitude | 122° 22' 34.66" E | 121° 57' 14.58" E |
| Elevation | 4 meters | 5 meters |
| Runway Direction | 05/23 | 06/24 |
| Runway Length | 2,500 meters | 1,800 meters |
| Runway Surface | Asphalt/Concrete | Concrete |

Kalibo International Airport is an airport that serves the general area of Kalibo, the capital of the province of Aklan in the Philippines and is one of two airports serving Boracay. The airport is classified as an international airport by the Civil Aviation Authority of the Philippines (CAAP). The airport is situated 2 kilometers east of the main area of Kalibo and 68 kilometers from Caticlan port in Malay municipality. Regular and chartered flights to and from the airport accommodate thousands of travelers during the holidays from Asian routes such as Taipei, Seoul–Incheon, Busan, Shanghai, Chengdu, Hong Kong and Singapore. It offers more international destinations than domestic destinations. It is worthy to note that the Kalibo International Airport is one of the busiest airports in the country in 2016 as indicated in Table 3 with a 2.71 million passengers.

Figure 2. Location map of Kalibo and Caticlan Airports (Source: Google Earth)

Table 3. 2016 Busiest Airports in the Philippines

| No. | Airport | Code | Passenger Movement |
|---|---|---|---|
| 1 | Ninoy Aquino International Airport | MNL | 39,516,782 |
| 2 | Mactan Cebu International Airport | CEB | 8,830,638 |
| 3 | Francisco Bangoy International Airport | DVO | 3,553,201 |
| 4 | Kalibo International Airport | KLO | 2,711,036 |
| 5 | Iloilo International Airport | ILO | 1,943,719 |
| 6 | Laguindingan Airport | CGY | 1,776,353 |
| 7 | Puerto Princesa International Airport | PPS | 1,644,003 |
| 8 | Bacolod | BCD | 1,498,741 |
| 9 | Tacloban | TAC | 1,182,951 |
| 10 | Zamboanga | ZAM | 980,476 |
| 11 | Clark International Airport | CRK | 950,732 |
| 12 | Tagbilaran | TAG | 871,383 |
| 13 | General Santos | GES | 838,941 |
| 14 | Caticlan | MPH | 736,559 |
| 15 | Butuan | BXU | 681,263 |
| 16 | Legaspi | LGP | 564,372 |
| 17 | Dumaguete | DTE | 546,276 |
| 18 | Busuanga | USU | 321,595 |
| 19 | Ozamiz | OZA | 290,966 |
| 20 | Roxas | RXS | 267,388 |
| 21 | Cotabato | COT | 258,529 |
| 22 | Dipolog | DPL | 243,418 |
| 23 | Laoag | LAO | 206,015 |
| 24 | Pagadian | PAG | 188,920 |
| 25 | Tuguegarao | TUG | 186,193 |

Source: Philippine Airspace (2017)

Godofredo P. Ramos Airport also known as Caticlan Airport[2] and recently, Boracay Airport by its developer Trans Aire, is an airport serving the general area of the municipality of Malay. The airport is classified as a Class 2 Principal airport by the CAAP. Figure 3 presents the plan view of the Caticlan Airport vicinity in various years. It is observed that the situation in 2012 showed no difference from 2008 taking notice of presence of a hill at the extended transect at runway end no. 24. Clearly indicated is the stretch of the national highway that passes after the threshold line at the runway end no. 06. The situation in 2014 shows flattening of the hill and grading of land at the opposite end of the runway. The 2016 image clearly shows the runway extension and new apron.

a) b)


c) d)

Figure 3. Aerial images of Caticlan Airport for a) 2008; b) 2012; c) 2014; d) 2016
(Source: Google Earth)

The Caticlan International Airport Development Corp. (CIADC) won the Caticlan Airport Development Project in 2006, when its unsolicited proposal was unchallenged. As such, CIADC holds the exclusive rights, obligations and privileges to finance, design, construct, operate and maintain the Caticlan Airport by virtue of the concession agreement dated June 22, 2009, with the government, through the Department of Transportation and Communications (DOTC) and CAAP. Construction was originally slated in 2007 with commercial operations scheduled in 2008, but a host of problems, including issues regarding

[2] The Civil Aviation Authority of the Philippines (CAAP) earlier designated the Caticlan facility as a one-way airport, which means take-off should be towards the sea, and landing in the opposite direction. This shortened the portion of the airport runway that could be used despite its actual length. These changes were made to avoid incidents similar to Zest Air's flight overshot on the runway of Caticlan airport in 2009. PAL Express resumed its flights to Caticlan in December 2009 after the CAAP lifted its ban on the limited use of the Caticlan airport. Meanwhile, Cebu Pacific resumed Caticlan operations on March 1, 2010, seven months after suspending it on July 10, 2009 following the CAAP's advice regarding the airport's runway length and one-way runway rule (Philippine Star, 2010).

charges levied by the Ninoy Aquino International Airport 1, changes in the project design, and objections by local officials hindered the start of the project.

In July 2009, the then DOTC issued a notice to proceed to CIADC[3] and in January 2010, some minor works on the Caticlan airport started but full-scale construction was delayed again due to objections on the proponent's plan of leveling the hill at the airport's eastern side and the extension of the runaway to the sea; and the opposition by some stakeholders on the conversion of the airport from domestic to an international facility (Wallace Business Forum, 2010).

The P2.507-billion build-operate-transfer (BOT) project awarded to CIADC touted as the first ever privatization of an airport terminal in the Philippines. The airport project has a commercial component that entails the development of a P10-billion, 16-hectare mix-use property beside the airport. The upgrading involves the construction of a bigger airport passenger terminal, extension of the existing runway from 950 meters to 2,100 meters to accommodate larger aircrafts, improvement of the road network, and upgrading of airport facilities and air traffic control aids. The widening and lengthening of the runway allowed bigger aircraft such as the Airbus to bring in more passengers straight to Caticlan. subject to a condition that the planes may be rerouted to the bigger Kalibo airport, which is two hours by road, in case of changes of operating conditions at the Caticlan airport. On November 18, 2016, flag carrier Philippine Airlines landed its first Airbus A320, which marked the opening of the extended runway. Cebu Pacific followed suit on November 22, 2016, landing its first A320 as flight 5J 899/900.

### 3.4 Need for Multi-Airport Region Perspective

Recently, the Department of Transportation (DOTr) is pursuing changes to the design of the Caticlan Airport that will likely increase the investment cost to as much as P10 billion (Business Mirror, 2018). Figure 4 presents the actual and planned development of the Boracay Airport. On the other hand, DOTr and CAAP has granted Original Proponent Status (OPS) to Mega 7 Construction will be for the operation, maintenance and upgrade of facilities and systems in the Kalibo International Airport. (PIA, 2018b). While these investment decisions are consistent with the government's 'Build-Build-Build' program, there is a need to critically assess the value and timeliness of such investments.

a) b)

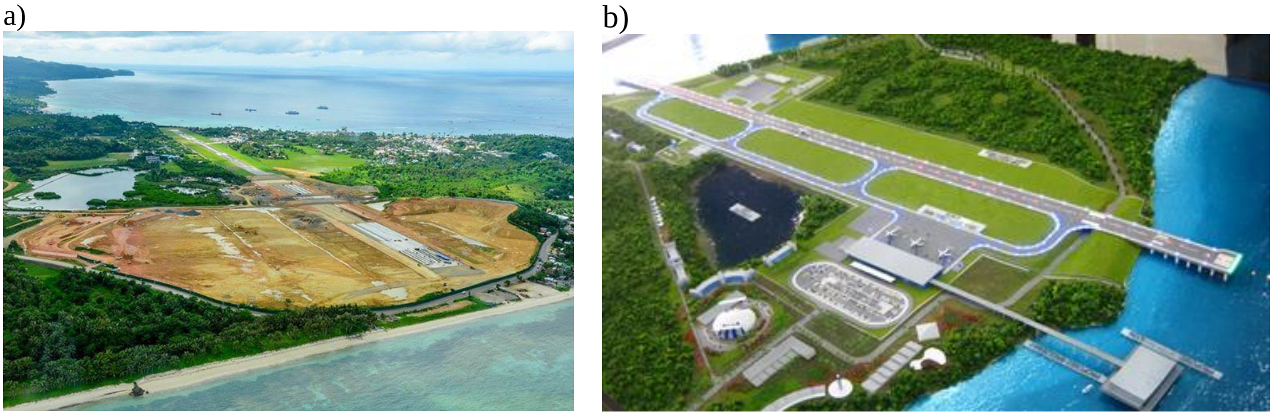

Figure 4. Existing and planned development for Boracay Airport
(Source: NO to Boracay Airport FB, Retrieved from https://www.facebook.com/CaticlanAirport/)

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[3] In April 2010, San Miguel Corporation (SMC) acquired the majority interest/stake of CIADC. SMC through its subsidiary Trans Aire Development Holding Corporation now holds the 25-year contract to rehabilitate and operate the airport.

### 3.5 Kalibo-Caticlan Multi-Airport Region

It is argued at the onset that the Kalibo and Caticlan airport constitute a multi-airport region. This is established on the following multi-stakeholder perspectives. Firstly, from the airline operators' viewpoint, both airports serve Boracay island. The passengers are provided with two possible choices of airports. Finally, the airport operators are faced with a dilemma on which airport to develop. As such, various decisions involving one airport will affect the other, a feature which is strongly attuned to multi-airport regions.

Table 4 presents the historical passenger statistics for the Kalibo and Caticlan airports for the years 2004 to 2009. It is noted that the share of annual passengers from Kalibo Airport ranges from 35% to a little less than 50%. It is also observed that up until 2009, the share of Kalibo Airport has never exceeded that of Caticlan Airport. The year 2009 presents a unique event since the annual passengers of Kalibo Airport has surpassed that of Caticlan Airport for the very first time and the difference is quite staggering. The increased market share of Kalibo Airport may be due to a couple of factors. First of all, Kalibo Airport opened to international traffic in 2008 and therefore is quickly becoming the gateway for foreign tourist bound for Boracay Island. Chartered flights from China and Korea are providing direct services for group tours. Secondly, severe load penalties have been imposed on flights to Caticlan Airport due to safety concerns. Up until recently, a 50% load penalty was in effect. Lastly, the local government particularly the Province of Aklan along with concerned municipalities has been quite active in promoting Kalibo Airport as the primary gateway for the Province.

Table 4. Market Share for the Kalibo-Caticlan Multi-Airport System

| Year | Annual Number of Passengers | | | Percent Share | |
|---|---|---|---|---|---|
| | Kalibo Airport | Caticlan Airport | Total | Kalibo Airport | Caticlan Airport |
| 2004 | 266,311 | 340,131 | 606,442 | 43.9% | 56.1% |
| 2005 | 286,540 | 516,834 | 803,374 | 35.7% | 64.3% |
| 2006 | 341,776 | 519,019 | 860,795 | 39.7% | 60.3% |
| 2007 | 515,327 | 552,987 | 1,068,314 | 48.2% | 51.8% |
| 2008 | 398,809 | 762,703 | 1,161,512 | 34.3% | 65.7% |
| 2009 | 797,750 | 550,064 | 1,347,814 | 59.2% | 40.8% |

Aviation activity forecasts based on econometric models relate measures of aviation activity to economic and social factors. These models are extremely valuable in identifying future scenarios. It is generally recognized that per capita GRDP can be used as a determinant for future air passengers and the econometric approach can be used to calibrate a forecasting model. Table 4 presents the historical per capita GRDP and total number of passengers for the Kalibo-Caticlan multi-airport region while Figure 5 presents the data graphically.

Table 4. Historical Values of Per Capita GRDP and Passenger Traffic

| Year | Per Capita GRDP | Per Capita GRDP Growth Rate | Annual Number of Passengers | | |
|---|---|---|---|---|---|
| | | | Kalibo Airport | Caticlan Airport | Total |
| 2004 | 12,347 | 3.63% | 266,311 | 340,131 | 606,442 |
| 2005 | 12,825 | 3.87% | 286,540 | 516,834 | 803,374 |
| 2006 | 13,092 | 2.08% | 341,776 | 519,019 | 860,795 |
| 2007 | 13,842 | 5.73% | 515,327 | 552,987 | 1,068,314 |
| 2008 | 14,166 | 2.34% | 398,809 | 762,703 | 1,161,512 |
| 2009 | N/A | N/A | 797,750 | 550,064 | 1,347,814 |

Source: NSO, CAAP

Figure 5. Per Capita GRDP and Total Passenger Traffic

The relationship between the annual number of passengers (*ANP*) and regional economy is found to be

$$ANP = 3006686.71 + 294.75\, GRDP_{Per\ Capita} \tag{4}$$

where.

*ANP* : Annual number of passengers,
$GRDP_{Per\ Capita}$ : Per Capita Gross Regional Domestic Product (GRDP)

The coefficient of determination $R^2$ of the regression model is 0.991 indicating that there is an extremely good relationship between the annual number of passengers and the regional economic activity. The coefficient for the explanatory variable is of the correct sign. The *t-values* of -14.0 and 18.2 for the intercept and explanatory variable, respectively, indicate that the parameter estimates are significant at the 95% confidence level.

In order to establish the future regional economic conditions, three regional economic growth assumptions were established as Low Growth (3%); Medium Growth (5%) and High Growth (7%). Figure 5 presents the Per Capita GRDP forecasts under various growth scenarios. Using the linear regression model, annual passenger forecasts were computed up to 2030 based on the various regional economic growth assumptions as presented in Table 5.

Figure 6. Per Capita GRDP Forecasts

Table 5. Annual Passenger Forecasts for the Kalibo-Caticlan Multi-Airport Region

| Year | Growth Scenario | | |
|---|---|---|---|
| | Low Growth | Medium Growth | High Growth |
| 2010 | 1,423,070 | 1,596,770 | 1,773,810 |
| 2011 | 1,555,963 | 1,826,943 | 2,108,445 |
| 2012 | 1,692,843 | 2,068,624 | 2,466,504 |
| 2013 | 1,833,829 | 2,322,390 | 2,849,627 |
| 2014 | 1,979,044 | 2,588,844 | 3,259,569 |
| 2015 | 2,128,616 | 2,868,620 | 3,698,207 |
| 2016 | 2,282,675 | 3,162,386 | 4,167,550 |
| 2017 | 2,441,356 | 3,470,839 | 4,669,746 |
| 2018 | 2,604,797 | 3,794,715 | 5,207,097 |
| 2019 | 2,773,142 | 4,134,786 | 5,782,061 |
| 2020 | 2,946,536 | 4,491,859 | 6,397,274 |
| 2021 | 3,125,133 | 4,866,786 | 7,055,551 |
| 2022 | 3,309,088 | 5,260,460 | 7,759,908 |
| 2023 | 3,498,561 | 5,673,817 | 8,513,569 |
| 2024 | 3,693,718 | 6,107,843 | 9,319,987 |
| 2025 | 3,894,731 | 6,563,569 | 10,182,854 |
| 2026 | 4,101,773 | 7,042,082 | 11,106,122 |
| 2027 | 4,315,027 | 7,544,520 | 12,094,019 |
| 2028 | 4,534,678 | 8,072,081 | 13,151,068 |
| 2029 | 4,760,919 | 8,626,019 | 14,282,111 |
| 2030 | 4,993,947 | 9,207,654 | 15,492,327 |

Assuming a 50-50 percent share between Kalibo and Caticlan Airports, the annual passengers of Kalibo Airport for the year 2020 is estimated to be around 2.95 million passengers based on the Low Growth scenario. However, existing passenger statistics point to higher values and the share of both airports are quite dynamic due to varying levels of investments as well as regional passenger trends. It is argued that more reliable forecasts will be developed by incorporating analysis of passenger preferences from a range of airline services, as well as, quality of airport facilities. Such analysis will be possible through the calibration of appropriate discrete choice models utilizing data from Stated Preference (SP) surveys.

## 4. KALIBO-CATICLAN AIRPORT CHOICE MODEL

To shed light on air travel behavior of passenger for the Kalibo-Caticlan multi-airport region, there is a need to develop a choice model that is able to capture the preferences of air passengers specifically tourists. Generally, the choice model would be able to predict the choice of an air passenger when faced with several choices of airline services. Once calibrated, the model will be able to estimate the probability of an air passenger choice one alternative over the others in the choice set.

Data obtained from a Stated Preference (SP) Survey conducted during Pre-Feasibility Study and Master Planning for Kalibo Airport Development Project was used (Par Excellence, Inc., 2010). To the author's knowledge, this was the first-ever conduct of an SP survey that investigated the airport choices of air passengers in a multi-airport setting in the country.

### 4.1 Sample Profile

The SP data set covers 692 samples from interviewed passengers arriving at both Kalibo and Caticlan airports during the period 5-7 June 2010. Figures 7 to 12 present the demographic profile of the respondents. The share of Filipino passengers is 94.5% and 88.2% for the Kalibo and Caticlan airports, respectively. It is noted that the is a greater share of foreign national flying into Boracay via Caticlan airport. The distribution of passenger by sex is balanced. The median range of age of the interviewed passengers is 18-30 for both Kalibo and Caticlan airports.

Figure 7. Nationality of Passengers Interviewed at Kalibo Airport

Figure 8. Nationality of Passengers Interviewed at Caticlan Airport

Figure 9. Sex Distribution of Passengers Interviewed at Kalibo Airport

Figure 10. Sex Distribution of Passengers Interviewed at Caticlan Airport

Figure 11. Age Distribution of Passengers Interviewed at Kalibo Airport

Figure 12. Age Distribution of Passengers Interviewed at Caticlan Airport

Figures 13 and 14 present the ticket price distribution for arriving passengers for Kalibo and Caticlan airports. It is noted that the interviewed passenger arriving at Caticlan airport reported higher ticket prices in the range of P3,000 to P4,500 which 1.5 to 2 times that of passengers interviewed at Kalibo airport. This is a clear indication of the market segmentation of both airports.

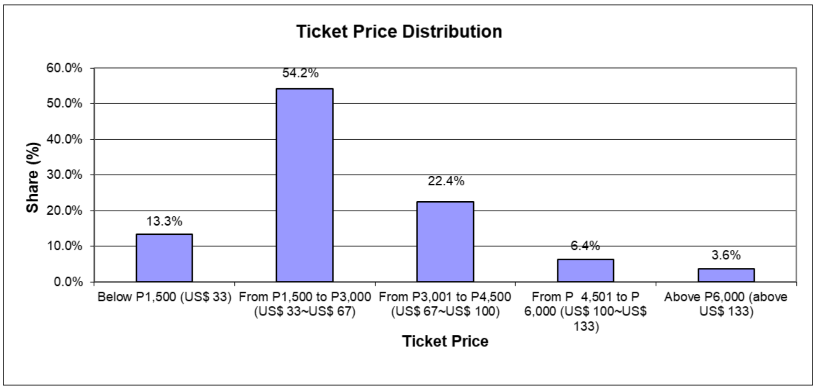


Figure 13. Ticket Price Distribution of Passengers Interviewed at Kalibo Airport

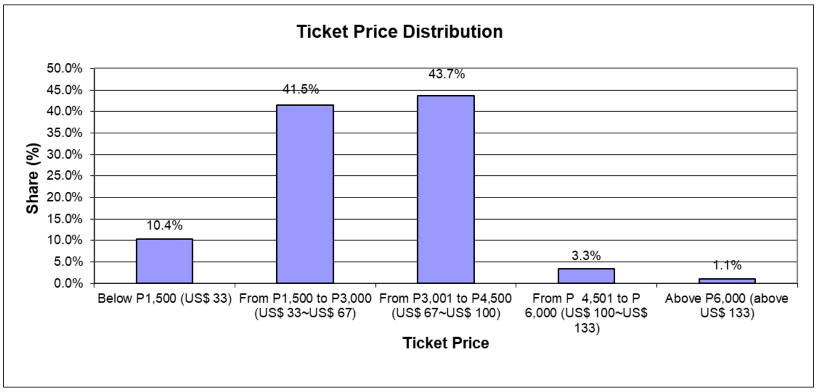


Figure 14. Ticket Price Distribution of Passengers Interviewed at Caticlan Airport

### 4.2 Survey Design

The SP survey was constructed as an unlabelled experiment incorporating four (4) attributes as shown in Table 6. Rather than use all the possible treatment combinations, it is possible for the analyst to use only a fraction of the treatment combinations. Designs in which we use only a fraction of the total number of treatment combinations are called *fractional factorial designs*. In order to present the survey questions in a form that respondents can aptly answer, the choice situations are organized into blocks. For the SP survey, the choice situations were divided into 9 blocks containing 4 choice situations. Figure 15 presents a typical SP survey choice.

Table 6. Attributes specified in the SP Survey

| Attribute | Variable name | Levels |
|---|---|---|
| Ticket price | *TPRICE* | P1500, P3000, P4500 |
| Departure time | *DEPART* | 7AM, 10AM, 1PM, 4PM |
| Type of aircraft | *ACTYPE* | Jet, Turbo-Prop |
| Travel time | *TTIME* | 1.5hours, 2hours, 3hours |

**PART 2. STATED PREFERENCE (SP)**

**In the next section, please allow us to present you with four choice situations, from which, we would like to elicit your response.**

**Choice Task 1**

| | Current Route | Route Alternative 1 | Route Alternative 2 |
|---|---|---|---|
| **1. Ticket price** | | P3,000 | P3,000 |
| **2. Departure time from Aklan** | | 11am | 5pm |
| **3. Type of aircraft** | | Turbo-Prop (50-70 seater) | Jet (~150 seater) |
| **4. Travel time to your final destination** | | 3 hours | 3 hours |
| **5. If you can still choose your current alternative, what will you choose among the three alternatives?** | ☐ | ☐ | ☐ |
| **6. If you are to choose only among the new alternatives, which route will you take?** | | ☐ | ☐ |

**Choice Task 2**

| | Current Route | Route Alternative 1 | Route Alternative 2 |
|---|---|---|---|
| **1. Ticket price** | | P4,500 | P4,500 |
| **2. Departure time from Aklan** | | 11am | 2pm |
| **3. Type of aircraft** | | Jet (~150 seater) | Turbo-Prop (50-70 seater) |
| **4. Travel time to your final destination** | | 2 hours | 2 hours |
| **5. If you can still choose your current alternative, what will you choose among the three alternatives?** | ☐ | ☐ | ☐ |
| **6. If you are to choose only among the new alternatives, which route will you take?** | | ☐ | ☐ |

**Choice Task 3**

| | Current Route | Route Alternative 1 | Route Alternative 2 |
|---|---|---|---|
| **1. Ticket price** | | P1,500 | P1,500 |
| **2. Departure time from Aklan** | | 5pm | 5pm |
| **3. Type of aircraft** | | Jet (~150 seater) | Turbo-Prop (50-70 seater) |
| **4. Travel time to your final destination** | | 3 hours | 3 hours |
| **5. If you can still choose your current alternative, what will you choose among the three alternatives?** | ☐ | ☐ | ☐ |
| **6. If you are to choose only among the new alternatives, which route will you take?** | | ☐ | ☐ |

**Choice Task 4**

| | Current Route | Route Alternative 1 | Route Alternative 2 |
|---|---|---|---|
| **1. Ticket price** | | P4,500 | P4,500 |
| **2. Departure time from Aklan** | | 8am | 5pm |
| **3. Type of aircraft** | | Turbo-Prop (50-70 seater) | Turbo-Prop (50-70 seater) |
| **4. Travel time to your final destination** | | 2 hours | 2 hours |
| **5. If you can still choose your current alternative, what will you choose among the three alternatives?** | ☐ | ☐ | ☐ |
| **6. If you are to choose only among the new alternatives, which route will you take?** | | ☐ | ☐ |

Figure 15. SP Survey Choice Task

### 4.3 Airport Choice and Passenger Forecasting

Figure 16 presents an improved passenger forecasting methodology that takes into account airport choice in a multi-airport setting. The starting point in assessing the future air traffic demand is the estimation of future regional economic activity as represented by the Per Capita Gross Regional Domestic Product (GRDP). It is noted that GRDP provides a good picture of the economic activity for the region as a whole but is a rather poor indicator for aviation activities for each airport individually. The peak-hour passenger demand for each airport can be estimated using an Airport Choice Model that is calibrated from passenger interview surveys that includes both Revealed Preference (RP) and Stated Preference (SP) information. This allows for a more flexible analysis of passenger choices even considering future airline services. The peak-hour passenger estimates can then be the basis for the estimation of peak-hour aircraft movements for capacity planning of both airside and landside facilities.

Figure 16. Improved Passenger Forecasting Methodology

### 4.4 Model Results

Table 7 presents the parameter estimates for the SP-only model. The sign for Ticket price (*TPRICE*) is negative indicating the utility decreases as ticket price increases. This is quite logical since the traveler will usually look for flights with lower price all else being equal. The parameter estimate for Departure time (*DEPART*) is negative indicating that travelers prefer early flights over late ones. The parameter estimate for Type of aircraft (*ACTYPE*) is negative indicating that travelers prefer jet aircraft over turbo-prop. Finally, the parameter estimate for Travel time (*TTIME*) is expected to be negative indicating that travelers prefer flight options with lower travel times to their final destination.

Note that the parameters estimates for the SP-only model are estimates from an unlabelled experiment and should be treated as generic parameters. Most frequently, the parameters from an unlabelled-choice experiment are imported into a labelled-choice context in which there exist calibrated alternative-specific constants and alternative-specific variables.

This is a strategy when using a mix of stated preference and reveled preference data.

Table 7. SP-only Model Estimates

| Variable | Coefficient | t-value |
|---|---|---|
| *TPRICE* | -0.42234 | -5.498 |
| *DEPART* | -0.00051 | -5.519 |
| *ACTYPE* | -0.50639 | -8.559 |
| *TTIME* | -0.0087 | -9.796 |

Table 8 presents the parameter estimates for the combined RP-SP model. The generic parameters from the SP only-model were used to generate the parameters for each of the alternative. An alternative-specific constant, *DUMMYKAL*, a dummy variable indicating that the service is available for Kalibo airport. Again, the parameter estimates were found to be statistically significant and of the correct signs. However, the combined model fails to produce a statistically significant parameter estimate for travel time.

Table 8. Combined RP-SP- Model Estimates

| Variable | Coefficient | *t*-value |
|---|---|---|
| *TPRICE* | 0.43267 | 4.306 |
| *DEPART* | 0.34227 | 2.229 |
| *ACTYPE* | -0.18188 | -7.012 |
| *TTIME* | 0.16817 | 1.179 |
| *DUMMYKAL* | -0.41294 | -4.175 |

## 4.5 Model Application

Several airport development scenarios were established in order to utilize the Airport Choice Model developed in the previous section. Table 9 presents the different scenarios indicating the available services that might ensue once improvements at both airports are implemented. The scenarios are concerned with the mix of air transport rd services, namely, Large Jet (LJ), Medium Jet (MJ), Small Jet (SJ) and Turbo-Prop (TP).

Table 9. Airport Development Scenario

| Scenario | Description |
|---|---|
| 1 | All aircraft (LJ, MJ, SJ & TP) operate at Kalibo<br>Only TP aircraft operate at Caticlan |
| 2 | All LJ, MJ and part SJ operate at Kalibo<br>All TP and part SJ operate at Caticlan |
| 3 | All Jet and TP aircraft operation at Kalibo, in case Caticlan is not available |

Under Scenario 1 and assuming that the ticket prices for Kalibo and Caticlan flights are in the same bracket, the passenger sharing is 52.6% and 47.4% for Kalibo and Caticlan airports, respectively. Under Scenario 2, the passenger demand will shift towards Caticlan airport due to the introduction of Jet operation. Here the passenger sharing is 36.7% for Kalibo Airport and 63.3% for Caticlan Airport. Scenario 3 was not considered as jet operations is vigorously being pursued for the Caticlan Airport as envisioned in the BOT scheme. It is noted that during the conduct of the SP surveys, there has been no jet operations at Caticlan airport and the common experience is that there is a great degree of diversions of flights due Kalibo Airport due to turbo-prop operations on short runway, as well as, significant tail-wind conditions at Caticlan Airport.

The result of the choice model indicate that tourist passenger do put high premium in air safety as manifested by high proportion of respondents choosing indirect jet service for Kalibo Airport rather than direct turbo-prop service for Caticlan Airport.

## 5. CONCLUSIONS

The study has provided an application of airport choice modeling for the Kalibo and Caticlan airports. It has argued and demonstrated the value of taking a multi-airport perspective in addressing passenger demand forecasting and its implications to airport capacity decision expansion decisions. Several points are highlighted as a result of this study. Firstly, there is both a theoretical and practical value of establishing the Kalibo-Caticlan airports as a multi-airport region from an airport planning perspective. Secondly, a key finding is that tourist passenger value air safety as indicated by preference to jet services. Lastly, the operation of the Kalibo Airport by national government and the Caticlan Airport as a PPP scheme necessitates the need to address a coordination problem on airport capacity expansion as decisions on one airport directly affects the other and vice versa.

## 6. RECOMMENDATIONS FOR FUTURE WORK

It is recommended that further research on extending the approach provided in this study be conducted in order to improve airport planning and development decisions for other multi-airport regions in the country (e.g. Manila-Clark, Davao-Gensan-Cotabato). Several research areas that can be explored are:

- Evaluate other forms of airport choice model structures in analyzing passengers' airport choice;
- Incorporate and test other latent factors of airport choice behavior including airport service quality, loyalty and airport image;
- Develop a set of criteria for identifying other multi-airport regions based on multi-stakeholder perspectives (i.e. airline, passenger, airport operators, local and national authorities);
- Develop an improved passenger forecasting methodology incorporating state-of-the-art airport choice modeling techniques; and
- Explore formal methods and strategies for real options-based approach to development of multi-airport regions

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