Avian Flu and International Tourism Demand: A Panel Data Analysis

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EXTENDED ABSTRACT

Highly pathogenic H5N1 avian influenza, otherwise known as Avian Flu, emerged in Hong Kong in 1996-97, and by June 2007 had resulted in outbreaks in poultry or wild birds in nearly sixty countries and 317 human cases, including 191 deaths. South-East and East Asia were the earliest affected regions. Between the end of 2003 and the beginning of 2004, Avian Flu infections of poultry were suddenly declared in eight Asian countries, namely China, Japan, South Korea, Laos, Thailand, Cambodia, Vietnam, and Indonesia.

This paper investigates the impacts of Avian Flu on global and Asian tourism using panel data procedures. Both static and dynamic panel models are adopted to estimate the impacts of this infectious disease. The empirical results from static and dynamic panel models are consistent and indicate that the numbers of affected poultry outbreaks have significant impacts on international tourism of global and Asian affected countries.

The high mortality rate among humans, the potential of a global flu pandemic, and some media frenzy with hype and speculation might adversely affect the images of these infected destinations as a safe tourist destination. Moreover, it is found that the average damage to Asian tourism was more serious, which might be induced by an ineffective suppression in numerous Asian infected countries.

Asia was the earliest affected region, and the area infected most seriously by Avian Flu both in humans and in poultry. Since the potential risks and damage arising from Avian Flu and subsequent pandemic influenza is much greater than for previous diseases, the need to take necessary precautions in the event of an outbreak of Avian Flu and pandemic influenza warrants further attention and action in modelling and managing tourism demand and risk.

Avian Flu presently leads to a high mortality rate among humans as a result of the disease being transmitted from animals to humans, but not by close person-to-person contact. In general, since Avian Flu is still in relative infancy, its impact on tourism has so far been relatively moderate, although it has not seriously been examined from the perspective of international tourism demand.

Based on the empirical results presented in the paper, the destructive effects of Avian Flu on global and Asian international tourism demand are absolutely clear. In short, there have been significant negative effects arising from Avian Flu infections.

1. INTRODUCTION

Highly pathogenic H5N1 avian influenza, otherwise known as Avian Flu, emerged in Hong Kong in 1996-97, and by June 2007 had resulted in outbreaks in poultry or wild birds in nearly sixty countries and 317 human cases, including 191 deaths (WHO, 2007). South-East and East Asia were the earliest affected regions. Between the end of 2003 and the beginning of 2004, Avian Flu infections of poultry were suddenly declared in eight Asian countries, namely China, Japan, South Korea, Laos, Thailand, Cambodia, Vietnam, and Indonesia.

For the spread in poultry, Avian Flu epidemics were initially detected in East and South-East Asia, and were subsequently reported around the world in Asia, Europe and Africa. Meanwhile, about three hundred cases of humans have been infected by Avian Flu, and the mortality rate has been high at 60.3% (WHO, 2007). In addition, Asia is the most seriously affected by H5N1 avian influenza, both in humans and poultry. These figures account for about 88.0% of the world's human cases and 84.6% of the world's poultry outbreaks, respectively (OIE, 2007; WHO, 2007).

As for human Avian Flu infections, Beigel et al. (2005) note that the evidence of transmission routes is consistent with animal-to-human, and possibly environmental-to-human, and also limited, nonsustained human-to-human transmission. Moreover, as Page et al. (2006) indicated, because Avian Flu at this stage is not transmitted among humans, the critical link between Avian Flu and the tourism industry does not yet seem to have a potential global reach in that it can be spread through international travel. On the contrary, the concern among health professionals is that Avian Flu will create a new flu virus from animal reservoirs, which will then infect humans who will not have antibodies to resist infection.

Page et al. (2006) also observed that, in October 2005, the media frenzy with hype and speculation was largely a result of the impact on chickens as a food source, and also the potential of Avian Flu to mutate and trigger a global flu pandemic. Therefore, Avian Flu might reduce the competitiveness of affected countries while adversely damaging their image as a safe tourism destination, thereby leading to a significant reduction in international tourist arrivals. Furthermore, as Brahmbhatt (2005) suggested, the most immediate economic impacts of a pandemic disease might arise, not from actual sickness or death, but from the efforts of the public and private sectors to avoid becoming infected rapidly, which might lead to a severe demand shock for service sectors, such as tourism, mass transportation, hotels, restaurants, and retail sales.

Avian influenza might also damage destination marketing, a finding that is emphasized by Buhalis (2000) and Mohsin (2005). International tourism will be seriously affected, or possibly even restricted, to prevent the spread of Avian Flu and pandemic influenza. Page et al. (2006) observed that Avian Flu could have significant shocks on tourism. For instance, Brahmbhatt (2005) estimated that the 2004 avian flu outbreak in Vietnam led to a 1.8% decline in GDP, where a 5% decline in tourist arrivals could lead to a 0.4% decline in GDP. Furthermore, the World Bank estimated that the global economic influence of an outbreak of avian flu could be US$800 billion, equal to 2% of world economic output (Brahmbhatt, 2005).

Avian Flu could lead to a high mortality rate among humans while the disease was transmitted from animals to humans, but not by close person-to-person contact. If it were to become easily transmitted between humans, travel advisories and tourism authorities would almost certainly be more concerned about pandemic Avian Flu. Furthermore, Brahmbhatt (2005) indicated there are information gaps in understanding the epidemiological, health and economic issues of Avian Flu, which is of interest to all countries. In view of improving the imperfect information about Avian Flu, one of the purposes of this paper is to estimate the impacts of Avian Flu on tourism demand to provide useful insight into how this epidemic disease affects international tourism, and to determine how it might be modeled and managed.

In order to investigate the overall impacts on global and Asian tourism of Avian Flu in these infected countries, static panel data models using fixed effect estimators were implemented, while dynamic panel data models adopted the generalized method of moments (GMM) estimator of Arellano and Bond (1991). Hsiao (2003) indicated that, compared with the use of time series or cross section data, the use of pooled time series and cross section data has several advantages, such as greater degrees of freedom, the mitigation of multicollinearity, a reduction in omitted variable bias, and hence an improvement in the accuracy of parameter estimation. Therefore, the empirical analysis exploits the panel structure of the data set, for the 12 most serious Avian Flu infected countries, for the period January 2003 to December 2006, to estimate the impacts of Avian Flu on global tourism. In addition, 9 infected countries in Asia were divided in the sub-sample to investigate the damaging effects on Asian international tourism arising from Avian Flu.

The countries examined are dependent on the availability of data. The 12 most severely infected countries in Asia, Europe, and Africa include China, Cambodia, Indonesia, Japan, Korea, Malaysia, Thailand, Turkey, Vietnam, Romania, Hungary, and Egypt. In June 2007, the combined poultry outbreaks for these 12 countries were about 4678, which accounted for 90.0% of the world's poultry outbreaks. Moreover, the combined confirmed human cases in these countries were 301 persons, which accounted for about 94.9% of total cases These statistics demonstrate that the 12 affected countries accounted for a signification proportion of the world's human and poultry outbreaks. Owing to the increasing awareness of travellers' health, Avian Flu might reduce the competitiveness of these affected countries by adversely affecting their image as a safe tourist destination, thereby causing a reduction in inbound international tourist arrivals.

As the potential risks and damage arising from Avian Flu and subsequent pandemic influenza is much greater than for previous diseases, the need to take necessary precautions in the event of an outbreak of Avian Flu and pandemic influenza warrants further attention and action in modelling and managing tourism demand and risk. The remainder of the paper is organized as follows. Section 2 introduces the data set and the econometric approach to be followed, while the results of empirical estimation are presented in Section 3. Policy implications and some concluding remarks are given in Section 4.

2. DATA AND EMPIRICAL METHODOLOGY

2.1. Data

This paper uses monthly time series data for the 12 most serious Avian Flu infected countries or regions in Asia, Europe, and Africa, which include China, Cambodia, Indonesia, Japan, Korea, Malaysia, Thailand, Turkey, Vietnam, Romania, Hungary, and Egypt. Garín-Muñoz and Pérez-Amaral (2000) indicated that international tourism demand is usually measured by proxies such as the number of foreign visitors, the volume of earnings generated by foreign visitors, and the number of nights spent by visitors from abroad. As tourists face the potential danger of being infected by Avian Flu through international travel, tourists might be induced to reduce their non-essential travel to such affected countries.

Consequently, we use the number of foreign visitors, namely international tourist arrivals, to estimate the impacts of Avian Influenza H5N1 on international tourism demand. Monthly data for international tourist arrivals are collected from statistical data sets for each country, and the number of Avian Flu outbreaks (subtype H5N1) in poultry is obtained from the World Organization for Animal Health (OIE, 2007). The sample period is from January 2004 to December 2006. The econometric software program used in this paper is EViews 5.0. Furthermore, the panel models are estimated by using fixed effects for static models and panel GMM procedures of Arellano and Bond (1991) for dynamic models.

Seasonality is a widely known aspect of tourism time series data (Lim and McAleer, 2001), which might lead to spurious and biased results. In order to better reveal certain non-seasonal features, seasonal adjustment is the process of estimating and removing seasonal effects from time series data. Lim and McAleer (2001) noted that the conventional and frequently used technique for smoothing time series data is the moving average method. Hence, before estimating the effects of Avian Flu on tourism demand, the EViews econometric software package is used to implement the process of seasonal adjustment for the tourist arrivals series in order to remove the seasonal effects by means of the multiplicative moving average method. The seasonally adjusted series for international tourism demand is then obtained to process the panel data models.

2.2. Empirical Methodology

The primary purpose of the paper is to estimate the impacts of Avian Flu on global and Asian international tourism. Panel data models were constructed by using monthly data corresponding to 12 serious Avian Flu infected countries. The use of this type of data enables a relatively large number of observations to be used, and a concomitant increase in the degrees of freedom, thereby reducing collinearity and improving the efficiency of the estimates (Song and Witt, 2000). In this paper, balanced panel data sets are used, consisting of monthly data on 12 worldwide Avian Flu infected countries to investigate the average impact of the infectious disease on global tourism. In addition, 9 Asian infected countries were divided in the sub-sample to investigate the damage of Asian tourism.

Garín-Muñoz and Pérez-Amaral (2000) suggested that tourism has a great deal of inertia, so that the dynamic structure of consumer preference should be considered in the tourism demand model (Garín-Muñoz, 2006). In particular, if the impact of previous tourism is neglected, the estimated results of other relevant variables will be overestimated. Furthermore, Song and Witt (2000) noted that the static regressions of tourism demand models might raise some significant problems, such as structural instability, forecasting failures and spurious regression. Hence, including the lagged dependent variable in a dynamic model of tourism demand is one way of sensibly accommodating the dynamic structure of consumer preferences, where changes in tastes might be regarded as endogenous (Garín-Muñoz and Pérez-Amaral, 2000; Garín-Muñoz, 2006; Ledesma-Rodríguez, Navarro-Ibáñez and Pérez-Rodríguez, 2001). In our paper, the lagged dependent variable of tourism demand, which will be interpreted as being based on habit formation or as interdependent preferences, are included as regressors to consider the possibility of a change in consumer preferences over time.

The model to be estimated is given as:

$$TOUR_{i,t} = \alpha + \beta_1 TOUR_{i,t-1} + \beta_2 Poultry_{i,t} + \lambda_t + \mu_i + \varepsilon_{i,t} \quad (1)$$

where $TOUR_{i,t}$ represents tourism demand, i refers to Avian Flu infected countries, and $t = 1,...,T$ represents the time period. The parameter β_2 represents the impact of the Avian Flu outbreak on tourism demand, while $Poultry$ refers to the number of poultry outbreak of Avian Flu. In equation (1), λ_t is a month-specific intercept, μ_i is as unobserved country-specific effect ($E(\mu_i) = 0$), and ε_{it} is the disturbance term. It is assumed that ε_{it} is serially uncorrelated, with zero mean and independently distributed across countries, but there are no restrictions on heteroskedasticity across time and countries. A positive sign is expected for the coefficient β_1, while a negative sign is expected for the coefficient β_2.

Owing to the unavailability of suitable data to capture economic and social structures, there are other factors that are hypothesized to affect tourism demand but which have been omitted from the analysis. If certain variables excluded are correlated with the dependent variable, subsequently, the estimation results are subject to omitted variable bias. The panel data models were used in the paper in order to reduce the possible omitted variable bias.

However, autocorrelation may arise in a dynamic panel data model due to the inclusion of a lagged dependent variable, as well as individual effects characterizing the heterogeneity among the individuals (Baltagi, 2001). Since $TOUR_{i,t}$ is a function of μ_i, it immediately follows that $TOUR_{i,t-1}$ is also a function of μ_i. Therefore, $TOUR_{i,t-1}$, an explanatory variable in equation (1), is correlated with the error term. Garín-Muñoz (2006) noted that, when lagged dependent variables are included as regressors, not only is the OLS estimator biased and inconsistent, but so are the within groups (WG) and random effects estimators biased and inconsistent.

One solution to avoid the bias and inconsistency is to use the first difference transformation, and to treat the lags of the dependent variables as instruments for the lagged dependent variable (Garín-Muñoz, 2006; Ledesma-Rodríguez, Navarro-Ibáñez and Pérez-Rodríguez, 2001). The first difference transformation model, namely GMM-DIFF estimator, as suggested by Arellano and Bond (1991), is based on taking first differences to eliminate the individual effects, and regard the dependent variable lagged two or more periods as instruments for the lagged dependent variable. The solution used in this paper was to implement the GMM procedure of Arellano and Bond (1991).

The GMM-DIFF method of Arellano and Bond (1991) was used to investigate the impacts of Avian Flu on international tourism demand. The dynamic and first difference versions of the tourism demand model are given as follows:

$$\Delta TOUR_{i,t} = \beta_1 \Delta TOUR_{i,t-1} + \beta_2 \Delta Poultry_{i,t} + \Delta\varepsilon_{i,t} \quad (2)$$

where $\Delta TOUR_{i,t} = TOUR_{i,t} - TOUR_{i,t-1}$, and analogously for the remaining variables. It should be mentioned that using a dynamic panel model will generate more precise results by differencing the data and by removing the problem of non-stationarity (Garín-Muñoz, 2006).

3. EMPIRICAL RESULTS

This section presents the results of the static and dynamic models for investigating the effects of Avian Flu on global and Asian international tourism. This paper uses two panel data sets, namely one that covers 36 months for one group of 12 globally infected countries, and the other examines a group of 9 Asian affected countries.

3.1. Static model

Initially, a static version of the model is estimated, that is, a model without the second term in equation (1). Table 1 shows the results of a static panel model for estimating the impacts of Avian Flu on global and Asian tourism demand. For the static models in the paper, the non-observable individual effects are treated as fixed. Song and Witt (2000) noted that the fixed effects model includes dummy variables in OLS estimation to capture the differences between countries.

As expected, international tourism arrivals has been negatively affected by the Avian Flu outbreaks of poultry, at both the global and Asian levels of analysis. For the impacts of the Avian Flu on global tourism demand, it is found that global tourism demand is significantly reduced by about 67 arrivals for an outbreak in poultry of Avian Flu in the same period. These figures indicate that the average damage level of global Avian Flu affected countries is around 67.

The estimated effects of the impacts on tourism demand for poultry outbreaks in Asian infected countries are shown in the second column of Table 1. Asian tourism demand is significantly reduced by about 74 arrivals for an outbreak in poultry of Avian Flu. According to these empirical results by implementing fixed effect estimation of static models, it is found that the reduction in Asian tourism arising from Avian Flu was greater than the impact on global tourism of Avian Flu.

3.2. Dynamic model

Garín-Muñoz and Pérez-Amaral (2000) indicated that when lagged tourist arrivals were excluded from the set of explanatory variables in the model, the total (that is, direct and indirect) effects may result in overestimation of the estimated parameters. In order to avoid this problem, this sub-section describes estimation of dynamic panel models. The results of the GMM-DIFF method of Arellano and Bond (1991) for global and Asian infected countries are shown in Table 2. The consistency and accuracy of the estimates depend on whether the lagged dependent variables and explanatory variables are valid instruments in GMM-DIFF estimation (Garín-Muñoz and Montero-Martín, 2007). In GMM-DIFF estimation, if the null hypothesis of no second-order serial correlations (namely, the m2 test) in residuals, or Sargan's test of overidentifying restrictions, is rejected at a standard significance level, the estimates will be inconsistent. Failure to reject the null hypothesis in both tests in this paper does not show any indication of model misspecification.

Table 2 presents the results of the dynamic panel data models for investigating the impacts of Avian Flu on global and Asian tourism. In both the dynamic panel models, the lagged dependent variable is significant, suggesting the presence of significant dynamics. Furthermore, as for the average impacts of the Avian Flu outbreak on global tourism, it is found that the change in tourism demand was reduced by 147 persons for each additional poultry outbreak affected by Avian Flu. Finally, if an additional poultry outbreak were to be affected by Avian Flu in Asian countries, there would be a reduction in Asian tourism demand of around 168 international tourist arrivals.

Comparing the impacts of Avian Flu on global and Asian countries by the dynamic panel data models, the estimated coefficients for the poultry outbreak variables suggest that Asian tourism demand has been more seriously damaged by Avian Flu. It should be noted that both the static and dynamic panel data models appear to yield consistent results, such that Avian Flu would seem to lead to greater damage on Asian tourism.

One possible explanation for the significant estimates might be that the greater adverse image of these affected destinations arises from the spread of the epidemic being prolonged without any effective prevention and control of this infectious disease in most of the infected Asian countries. For instance, Avian Flu incursions were detected in China, Indonesia, and Thailand at the beginning of 2004, but the infected areas in these three countries have still not been eliminated. Such a lack of public health safety considerations would seem to be one of the misgivings of international tourists to return to some countries and regions in Asia.

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Table 1. Estimates for the Static Panel Model

Variables	2.1 Global countries	2.2 Asian countries
Constant	1647130.23*** (102.93)	1716656.76*** (101.24)
Poultry	-67.285*** (-4.14)	-73.858*** (-4.10)
Adjusted R^2	0.994	0.994
No. Observations	432	324

*** denotes significance at the 1% level ** 5% level * 10% level. Method of estimation: Fixed effect models. t ratios in parentheses.

Table 2. Estimates for the Dynamic Panel Model

Variables	3.1 Global countries	3.2 Asian countries
$TOUR_{it-1}$	0.846*** (55.70)	0.851*** (66.24)
Poultry	-147.01** (-2.43)	-167.89** (-1.99)
m2	0.207	0.150
Sargan(d.f.)	288.08 (317)	209.92 (187)

*** denotes significance at the 1% level ** 5% level * 10% level. Method of estimation: GMM-DIFF of Arellano and Bond.(1991) t ratios in parentheses. Estimates are obtained using instruments $Tour_{i,t}$ lagged one and two periods.