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Original citation & hyperlink:
Agiomirgianakis, G, Serenis, D & Tsounis, N 2016, 'Effective timing of tourism policy: The case of Singapore' Economic Modelling, vol 60, pp. 29-38. DOI: 10.1016/j.econmod.2016.09.001
https://dx.doi.org/10.1016/j.econmod.2016.09.001

DOI 10.1016/j.econmod.2016.09.001
ISSN 0264-9993

Publisher: Elsevier

Effective Timing of Tourism Policy-the case of Singapore

1. Introduction

Much of the literature on Tourism policy is focused either on the qualitative and/ or the quantitative effects of factors that may affect tourism arrivals and the revenues from Tourism. However, governmental tourism-policy actions need to be formulated on a rather short-run horizon. This is so, due to three distinct reasons: first, due to nature of tourism industry being sensitive to many short-run external and internal factors, such as volatility of exchange rates, oil shocks, political instability, social unrest and terrorist upheavals, factors that are often unforeseen for periods longer than six to nine months. Second, parliamentary procedures require that proposed tourism actions by the government, to be scrutinised and reformulated into a concrete Tourism policy mix of the country within a specific time period, as "timing of actions is related to their effectiveness", a motto often proclaimed by politicians. Finally, the implementation of the approved Tourism action-plan, could, in principle, be achieved via agreed contracts of the government with specialised international companies and agents, which is also another time consuming process. These three reasons contribute to further shortening of the limited time horizon available for shaping and implementing Tourism policy. Consequently, the timing for exercising tourism policy is getting, indeed, a critical issue for governments, parliamentary political parties, as well as, for companies involved in Tourism activities. Yet, this timing dimension of tourism policy, or equivalently when this policy could be effective, is an issue often left out from the literature.

The purpose of this paper is to identify the timing of the factors affecting tourist flows and therefore give a rule of thumb for an effective governmental tourism policy. Further, the method applied for exercising tourism policy may be applied in social sciences for finding the best timing effects of any social policy exercised either by national authorities or international institutional bodies such as the European Union (EU), the Organization of Eastern Caribbean States (OECS), the North American Free Trade Area (NAFTA), the Asia-Pacific Economic Cooperation (APEC)[1].

We examine tourist flows into Singapore, for the period 2005 – 2014, for thirty-seven countries of tourists' origin, using quarterly data. The choice of Singapore in our

[1] See e.g. Scott (2011) and OECS (2011).

analysis is based on the fast growth of Tourism sector in the post 1965 period, on a number of good governmental policies that improved infrastructure of the industry creating at the same time a well-diversified tourist product and, also, due to the availability of data for conducting the previously described type of analysis. Tourist arrivals in Singapore were available by the Singapore Tourism Board on a monthly basis for this period; however, we calculated arrivals data set in quarterly basis to match the time-frequency of the regressor variables. The empirical methodology we employ relies on the theory of panel data cointegration and error correction representation using the Pooled Mean Group (PMG) method.

The remainder of the paper is organised as follows: Section 2, examines the growth of Tourism Sector in Singapore since 1965. Section 3, presents a brief review of the literature on the factors affecting tourists' flows. Section 4, presents our model, the specification of variables used, it also, provides a description of the data and presents the estimating methodology. Section 5 discusses the estimation results, while Section 6, contains concluding remarks and states the policy implications of our findings.

2. Tourism in Singapore – A Historical Analysis

Tourism in Singapore has been a growing industry. The growth was substantial during the post 1965 period and was effected by a variety of events. During the post dependence period (after '65) Singapore experienced a growth in transportation and communications industry. These improvements stimulated tourism as they allowed for cheaper and faster travel (Teo, 1994). The resulting consequence was a considerable boom of the tourism industry. In an effort to improve and promote tourism more effectively the Singapore Tourist Promotion Board was founded which formed a campaign targeting the availability of the different accommodations as well as the safety and security of visitors (Toh & Low, 1990).

During the next period from 1980's and onwards the main achievements in Singapore tourism included changes to policies which allowed for better tourism management. However, during the same period the tourism industry was hit due to an international recession in 1985. The resulting consequence was that tourist arrivals were reduced to -3.4% during the year 1986 (Hornby & Fyfe, 1990). Singapore's response to this shock was a further improvement of the tourism infrastructure. This improvement constituted of new accommodations as well as further improvement of cultural attractions as well as emphasis on traditional activities. In line with all these activities the ministry of trade and industry developed a 223 million redevelopment plan which resulted in the creation of different cultural attractions (Khan et al., 1990; Wong & Gan, 1988). This policy pattern was continued on through the 1990's. As a result a new plan was put into effect called the Strategic Plan for Growth (Ministry of Trade and Industry, 1986). At the end of the 1990's new tourists' origin countries emerged such as Malesia and Indonesia. In addition changes in technology were also affecting tourism flows (STPB, 1996).

During the post 2000 period there is an effort to change the nature of tourism. As a result new air links with Asia are established and new changes in technology and travel have allowed for the implementation of the tourism hub generating flows from south East Asia. In addition new infrastructure has been developed which would be "Clean and Green" (Chang, 1998). In addition considerable efforts have been made to improve the attractions of tourists to cultural attractions and to hosting international events aiming to establish Singapore as a regional arts hub.

3. Literature Review

In addition to previously discussed governmental policies that increased substantially the overall tourist arrivals in Singapore, the vast literature on Tourist demand has established a variety of factors that may affect tourist flows[2], Much of the literature identifies that the economic capacity of the tourist origin country and an index of domestic to foreign country prices could be major determinants on tourist arrivals
The origin country income has been shown to have a positive effect on tourist arrivals. As the origin country's welfare expends, more tourists are induced to travel abroad. A recent study by Lee at al. (2015) for Singapore has shown that the origin country income is highly significant in Singapore's tourist receipts.

Another determinant of tourism flows is the relative price between destination and origin country (or even to a set of competing destinations). A high difference in

[2] See, e.g. Peng et.al. (2015) for an excellent review of 195 studies published during the period 1961–2011.

relative price could either induce or divert tourist flows into competitor countries that apply a different pricing strategy, e.g. a lower VAT. As a result the relative price is established as a significant factor of tourist flows see, e.g. Li et al (2005) and Lim (1999). Li et al (2006) findings suggest that relative prices is an important determinant when forecasting tourist flows for France, Greece, Italy Portugal and Spain. Their relative price coefficient proved to be for the most part negative and statistically significant. Gang, et al (2006) have also utilised a measure of relative prices in their estimation of demand modelling by utilising an Almost Ideal Demand System (AIDS) model. Their model incorporated a measure of relative prices which included the share of the price to an index of the total expenditure.

From the early 1990's researchers have been expanding tourism models to incorporate exchange rates. The reason for this is that exchange-rate changes induce responses not only by individually travelling tourists but also by risk adverse tour operators, which, in turn, may decide to switch their business operations towards other countries where exchange rate is more stable (Crouch, 1993). As a result some researchers claim that one of the most important determinants of tourism flows is the exchange rate (Patsouratis et al., 2005). Empirical studies suggest that currency appreciation (depreciation) in the tourist-origin country (in the destination country) induces tourism flows abroad (into destination country) (see e.g. Agiomirgianakis and Sfakianakis, 2012; Song and Li, 2008; Garin-Munoz and Amaral, 2000; Witt and Witt, 1995). Bunnanga et al (2010) examined the effects exchange rates on tourist flows between different sets of exchange rates which have been calculated between the main countries of arrival for Thailand. Their study concluded that exchange rate growth is a significant deterrent to tourist arrivals. Nanthakumar et al (2013) has examined potential effects from exchange rates to tourist flows for a variety of countries. His study concluded that there is relationship among exchange rates and tourist arrivals for Singapore. Also, Lee et al (2015) findings to a study on Singapore tourist arrivals indicate potential effects from exchange rates.

Moreover, exchange rates not only change but they change suddenly and unpredictably in response to economic fundamentals and to "news" in the globalized financial markets. However, a limited number of empirical research has incorporated the effects of exchange rate volatility to tourist arrivals (see Webber, 2001; Chang and McAleer, 2009; Yap and Lee, 2012; Santana et al., 2010). Webber op.cit. has suggested that exchange rate volatility does produce a significant long-run effect to tourist flows deterring them or in many cases delaying their travel to a destination. Some studies examine the issue further suggesting that exchange rate volatility does produce significant magnitude of negative effects, as well as, slipover effects to tourism. These effects can be ranked from stronger to weaker (Yap and Lee op.cit, Chang and McAleer op.cit.).

Other researchers such as Lee et al (2015) have modeled tourism flows in Singapore on a set of variables which are heavily linked to exchange rates. The basic notion is that if a relationship between these more general variables and tourism flows exist this would be indicative of a relationship between exchange rate volatility and tourist arrivals as well. Liu and Sriboonchitta (2013) have modeled the effect of exchange rate volatility to tourist arrivals in Singapore from China. Their conclusion is that there is a significant effect of exchange rates to tourist arrivals.

With regard to the estimation methods most empirical researchers model tourist flows in a single equation model. In order to avoid any spurious regression problems most researchers use Error Correction models (ECM) or Vector Auto Regressive models (VAR) which utilise time varying parameters to model exchange rate volatility (Song and Witt, 2000). Recently, however, researchers are utilising new econometric approaches when modeling tourist arrivals. These methods consist of Auto Regressive Distributed Lag models (ARDL) and AIDS. The advantages of these methods are that they provide more accurate estimations. More specifically, the AIDS models have been developed by Deaton and Muellbauer (1980). This modeling technique applied on tourism demand analysis can be modified in a variety of ways such as linear AIDS (LAIDS) models in order to provide more accurate results Li et al (2006). However, a smaller part of the empirical research is utilising panel data approaches despite the clear advantages that this method provides. Panel data analysis can be richer in estimating flows as it allows for estimations among a variety of origin countries. In addition panel data analysis reduces the problem of multicollinearity and provides more degrees of freedom to an estimation of an econometric model (e.g. Ledesma-Rodríguez et al (2001) which mainly concentrated in tourism flows for Tenerife).

4. The Model, Variables Specification, the Data and the Methodology

4.1 The Model

The model for examining the factors affecting tourist flows in Singapore uses variables that are identified by the literature as affecting tourist flows generally, i.e. disposable income of the tourists' origin countries and destination country competitiveness. Further, two additional factors are examined as determinants of tourist flows into Singapore, exchange rate volatility (ERV) and weather. ERV is found in the literature that affects package tourism offered via tour operators while good weather conditions is considered to be affecting the decision of the choice of destination for beach tourism, cruise tourism and cultural tourism, that are the main forms of tourism for Singapore (Yeoh et al, 2002).

Panel data analysis is used in an effort to explain bilateral tourism flows from all countries of tourism origin traveling into Singapore. The general model used is:

$$ARR_{it} = f(\,GDP_{i,t-p}, ER_{i,t-l}, ERV_{i,t-m}, D\_TEMP_{i,t-n},) \qquad (1)$$

i denotes country i, *t* denotes time (quarterly data is used); ARR is the number of tourist arrivals from country i at time t to Singapore and it is the number of persons arriving with sole purpose of tourism and *p, l, m, n* are the most effective time-lags of each regressor. GDP is a measure of tourists' disposable income measured as the per capita GDP of the origin countries of tourists, in constant prices and purchasing power parities (PPPs), ER is real exchange rate calculated as the bilateral nominal exchange rate between Singapore and each country of tourists' origin multiplied by the ratio of Singapore's price level over the tourists' origin country price level (see among others Witt and Witt (1995) and Patsouratis (2005) for a more detailed analysis)[3] and it is included as a measure of the Singaporean economy competitiveness.

The variable ERV measures the exchange rate volatility. It is calculated as a measure of time varying exchange rate volatility, using the standard deviation of the moving average of the logarithm of real exchange rate. Further, the D_TEMP variable is the difference between the temperature in Singapore and the capital or largest city of the tourists' origin country. It is included in the model to examine if the decisions of the choice for tourism holidays are affected by weather. The model in (1) was estimated in a double logarithmic form so that the estimated coefficients of the repressors measure

[3] The detailed construction of the variables used is presented in the subsection 4.2 bellow.

elasticities. This is particularly important in concluding policy implications of our findings. Finally, a time trend, T, was included[4].

4.2 Variables Specification

As we have seen in the literature review section, the demand for tourist services is affected positively by the disposable income. As a measure of tourists' disposable income the per capita GDP of the tourists' origin countries, in constant prices and purchasing power parities (PPPs) is included in the model. A positive sign of the estimated coefficient is expected because disposable income affects positively the demand for tourist services and increases outbound tourist flows. All variables used were included in their natural logarithms so that the estimated coefficients indicate elasticities.

According to the European Commission the term competitiveness is defined as "the ability to produce goods and services which meet the test of international markets, while at the same time maintaining high and sustainable levels of income or, more generally, the ability to generate, while being exposed to external competition, relatively high income and employment levels… (European Commission, 1999, p. 4)". While it is a broad term and incorporates all kinds of factors that may affect both the economic environment of a country and the specific characteristics of a firm we have included in the model the most observable of its factors, the real exchange rate. Real exchange rate (ER) is calculated as the bilateral nominal exchange rate between Singapore and each tourists' origin country multiplied by the ratio of Singapore's price level over the tourists' origin country price level. Nominal exchange rates were calculated as foreign currency units per Singaporean dollar. Hence, an increase in the nominal exchange rate indicates the appreciation of the Singapore's currency, a factor that, ceteris paribus, decreases the country's competitiveness. Since, bilateral exchange rates were not available for the whole period of the study (2005q1 to 2014q2) for the thirty-eight (38) countries that were included in the data set; these were calculated via the US dollar exchange rate. Singapore's price level and the tourists' origin countries

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[4] The full econometric specification of the estimated model is given in (4.4), bellow.

price level were measured by their consumer price index (CPI) with 2010 being the base year. Therefore, from the construction of real exchange, a negative sign is expected, as an increase in competitiveness that affects positively inbound tourist flows is caused by the decrease in the ER.

ERV is a measure that is not directly observable thus; there is no clear, right or wrong, measure of volatility. Even though some empirical researchers have examined alternative measures of volatility, for the most part, the literature utilises a moving average measure of the logarithm of the exchange rate.

$$ERV_{i,t+m} = \left(\frac{1}{m}\sum_{n=1}^{m}(R_{i,t+n-1} - R_{i,t+n-2})^2\right)^{\frac{1}{2}} \qquad (2)$$

where R is the logarithm of the real effective exchange rate, m is the number of periods, usually ranging between 4-12 and in our case since the data is quarterly m is taken to be equal to 4 and i is country i of the tourists' origin.

ERV affects the tour operators' behaviour negatively because increases the uncertainty of the revenues from tourism services exports (Agiomirgianakis et.al. 2014); many empirical researchers have in the past commented on the importance of unexpected values of exchange rate for exports. Akahtar and Hilton (1984) concluded that exchange rate uncertainty is detrimental to the international trade. Others researchers have applied volatility measures which attempted to incorporate unexpected movements of the exchange rate. Some have proposed the average absolute difference between the previous forward rate and the current spot rate as a better indicator of exchange rate volatility (Peree and Steinherr 1989). Awokuse and Yuan, (2006) applied a measure of volatility which included the variance of the spot exchange rate around the preferred trend. However, as suggested by De Grauwe (1988) risk preferences to unpredictable movements of the exchange rate play a vital role on exporters' behaviour. As a result, it is possible for a producer to either increase or decrease exports during a period for which exchange rates take up high and low values.

One of the novelties of the paper (the other being the inclusion of the ERV as a measure of the uncertainty for future revenues to tour operators caused by the fluctuations of the ER) is the attempt to examine the effects of the differences in weather conditions on the choice of tourists. Good weather is particularly important for beach, cruise and cultural tourism, the main types of tourism, in Singapore. The effects of weather on tourist flows into Singapore were attempted to be captured by the D_TEMP variable. It has been included in the model to examine if the decisions of the choice for tourism holidays are affected by weather. The D_TEMP variable was calculated as the absolute value of the difference between the temperature in Singapore's capital city and the capital or largest city of the tourists' origin country. The three-month average value of the temperature was calculated for each place because the rest of the variables are available at quarterly basis. If weather conditions affect tourist destination choices, a positive sign is expected for this variable.

4.3 Data Description

Tourist arrivals in Singapore by country of origin were available by the Singapore Tourism Board for 2005 to 2014 on a monthly basis. Thirty-seven countries were included in the data set and the tourist arrival data was calculated in quarterly basis to match the time-frequency of the regressor variables. Tourist arrivals from aggregate geographical areas (e.g. other countries in West Asia, other countries in Africa etc.) were not included in the dataset. The number of arrivals and the percentage in total arrivals that were not included in the data set is reported in Appendix A. This percentage ranges from 7.49% to 10.72% therefore, the conclusions arrived by this paper are for approximately 90% of the total tourist arrivals in Singapore. Consumer price index data (CPI) for the 38 countries (37 countries of tourist origin plus Singapore) for the first quarter 2005 to the second quarter 2014 has been extracted by International Financial Statistics dataset (2014). Nominal exchange rate data defined as tourist origin country currency units per Singaporean Dollar was constructed by the nominal exchange rates of each currency against the US Dollar. The latter was extracted by International Financial Statistics dataset (2014). Gross domestic product in constant 2010 prices and PPPs was extracted from the World Bank (2014). Extrapolated population data for the countries and period of the dataset was found in World Population Prospects (2014).Finally, temperature data were found on the tutiempo.net portal for the Singapore City and the capital or largest city of tourists' origin countries. Temperature data was daily; the average temperature for each place was calculated on a quarterly basis to correspond to the other variables in the dataset.

Table 1. Data sources and construction of the variables used

Data description	Frequency	Source	Variable constructed[5]
Tourist arrivals	Monthly converted to quarterly; quarter total	Singapore Tourism Board and authors' calculations	ARR_{it}: number of tourist arrival to Singapore
Consumer price index	Quarterly; base year:2010	International Financial Statistics	R_ER_{it}: Real exchange rate, ERV_{it}: Exchange rate volatility
Nominal Exchange Rate	Quarterly; end of period	International Financial Statistics	
Gross Domestic Product	Quarterly	The World Bank	GDP_{it}: Per capita GDP in constant prices and PPPs
Population	Quarterly (estimates)	World Population Prospects	
Temperature	Daily, converted to quarterly; quarter average	Tutiempo.net	D_TEMP_{it}: Temperature difference between Singapore City and the capital or largest city of tourists' origin countries

(Source) Authors' calculations

4.4 Estimating methodology

In order to examine the long-run relationship between the tourist flows and their prospect determinants with panel data a cointegration analysis has been used. Cointegration analysis is used to test for the existence of a statistically significant connection between two or more variables by testing for the existence of a cointegrated combination of the two or more series. If such a combination has a low order of integration this can signify an equilibrium relationship between the original series, which are said to be cointegrated. Cointegration analysis is necessary instead of common linear regression methods because if the latter are used on non-stationary time series it will produce spurious results.

We estimate an empirical model that examines both the short and long term relationships between tourist arrivals in Singapore and their determinants. This is particularly important if the econometric model is used for policy oriented conclusions that have differences in the time span. Instead of averaging the data per country, we estimate both short and long term effects between the tourist arrivals and their determinants using a data set composed of a large sample of countries (37) which account for all the main countries of tourists origin into Singapore (approximately 90% of the total tourist arrivals originate from these countries)[6]. The method used is the

[5] i,t denote country i and period t, respectively; i =1,…,37, t=2005q1-2014q2. The total number of observations included in the panel is 1406.

[6] See section 4.2 on variable specification for a detailed discussion.

Pooled Mean Group (PMG) method that can be characterised as a panel error correction model, where short- and long-run effects are estimated jointly from an Auto Regressive Distributed Lag (ARDL) model (Pesaran et al 1999a) where the short run effects are allowed to vary across countries with common long-run coefficients.

The usual methods for estimating panel data models can be categorised as dynamic 'fixed effects' models (with a control of country specific effects) that impose homogeneity on all slope coefficients allowing only the intercepts to vary across countries (see among others Arellano & Bond, 1991; Arellano & Bover, 1995) and 'mean-group' methods that consist of estimating separate regressions for each country and calculating averages of the country-specific coefficients (see among others Evan 1997, Lee et al 1997). The former type models are criticised by Pesaran and Smith (1995) that under slope heterogeneity the estimates of convergence are affected by heterogeneity bias. In the latter type of models the estimator might be inefficient because countries that are outliers could severely influence the averages of the country coefficients. The PMG method is an intermediate choice between the imposition of homogeneity on all slope coefficients (dynamic fixed effects methods) and no imposition of restrictions (Mean Group method). The PMG method allows the short run coefficients, the speed of adjustment and error correction variances to differ across countries, but imposes homogeneity on the long run coefficients. It is a less restrictive than the 'dynamic fixed effects' method and is a more efficient method relative to the Mean Group (MG) method (Pesaran et al 1999b). The long run homogeneity hypothesis of the PMG method allows the direct identification of the parameters of factors affecting the 'steady-state' path of the dependent variable.

Therefore, we chose the PMG method as an error correction method in the model with panel data because relative to its alternatives, the dynamic 'fixed effects' methods, it has two advantages: (a) averaging leads to a loss of information that can be used to estimate more accurately the interested coefficients allowing for parameter heterogeneity across countries; (b) averaging might hide the dynamic relationship between tourists arrivals and their determinants especially, when tourists come from countries of very different geographical regions as in the case of Singapore[7] particularly when the same factors are affecting tourists from different countries differently especially in the short run. Country heterogeneity is particularly relevant in short-term

[7] The countries of tourist's origin are reported in Appendix B and they are from all five continents.

relationships while we can expect that long-run relationships between tourists choice of destination would be more homogenous across countries in the long run.

Further, the PMG method has the advantage that produces consistent estimates of the parameters in the long-run relationship between both integrated and stationary variables. In this way, the model can be estimated when both I(0) and I(1)[8] variables are included while other methods require the variables to be I(0) or I(1) only.

The PMG method however, requires that the regressors are strictly exogenous. This, it is proposed in the literature, that it can be circumvented if the dynamic specification of the model is sufficiently augmented so that the regressors are strictly exogenous. However, this approach of arbitrarily increasing the number of regressors decreases the degrees of freedom. Further, it is required that the residuals are serially uncorrelated. Additionally, it is necessary to check that the variables are not I(2) because, in this case, the PMG method would produce spurious results. Consequently, before proceeding with the estimation of the model, we analyse the order of integration of the variables considered in order to establish that the co-integrating variables are either I(0) or I(1) and not I(2). This has been done by using the Im, Pesaran and Shin panel unit root test.

Table 2. Im, Pesaran and Shin panel unit root test results

series	Level	First difference
*ln*ARR	1.47	-35.91*
*ln*GDP	-1.34	-13.18*
*ln*R_ER	1.55	-18.38*
*ln*D_TEMP	-7.34*	-87.41*
ERV	-4.30*	-17.43*

(Source) Authors' estimates

(Note) All tests are performed using the 5% level of significance; *ln*ARR is the logarithm of tourist arrivals, *ln*GDP represents the logarithm of per capita GDP in constant prices and PPPs of the tourist origin countries, *ln*R_ER is the logarithm of real exchange rate calculated as the bilateral nominal exchange rate between Singapore and each country of tourists' origin multiplied by the ratio of Singapore's price level over the tourists' origin country price, ERV is exchange rate volatility measured as the moving average of the standard deviation of real exchange rate, and *ln*D_TEMP is the logarithm of the absolute value of temperature difference between Singapore City and the capital or largest city of

[8] I(d) denotes the order of the integration of a time series, *i.e.* it shows the minimum number of differences required to obtain a covariance stationary series.

tourists' origin country. The null hypothesis of a unit root is tested against the alternative. The asterisk denotes significance at least at 5% level.

The values of the panel unit root test are presented in Table 1. The null hypothesis (H_0) of a unit root (non-stationarity) in some panels (countries in this case) is tested against the alternative. H_0 was rejected at 5% level of statistical significance for and *ln*D_TEMP and ERV while *ln*ARR, *ln*GDP and *ln*R_ER were found to be non stationary at their level for all panels. Therefore, it is concluded that the variables *ln*D_TEMP and ERV are I(0) while *ln*ARR, *ln*GDP and *ln*R_ER are I(1).

In our case the system contains both I(0) and I(1) but not I(2) variables, i.e. the variables are either stationary on their level or at their first difference and therefore, the PMG modeling suggested by Pesaran, et al (1999b) can be used. A principal feature of cointegrated variables is their responsiveness to any deviation from long-run equilibrium. The PMG method is applied to an error correction model to estimate the speed of adjustment to the long run relationship allowing for unrestricted country heterogeneity in the adjustment dynamics and fixed effects.

Following Perasan op cit. the PMG restricted version of (1) is estimated on pooled cross-country time-series data:

$$\Delta lnARR_{i,t} = \varphi_i \left(lnARR_{i,t-1} - \sum_{k=1}^{\mu} \vartheta_{k,i} G_{k,i,t} \right) + \sum_{j=1}^{p-1} \lambda_{ij} \Delta lnARR_{i,t-j} + \sum_{k=1}^{\mu} \sum_{j=0}^{q-1} \beta_{k,i,j} \Delta G_{k,i,t-j} + \tau_i T + \nu_i + \varepsilon_{i,t} \qquad (3);$$

where i=1,…,37 and denotes countries, t=1,…,38 and denotes time, Δ is the first-difference operator, $lnARR_{i,t}$ is the logarithm of tourist arrivals to Singapore from country i at time t, μ=4 and is the number of determinants, *G=(ln*GDP, *ln*R_ER, *ln*D_TEMP, ERV*)* is the vector with the explanatory variables where *ln*GDP represents the logarithm of per capita GDP in constant prices and PPPs of the tourist origin countries, *ln*R_ER is the logarithm of real exchange rate calculated as the bilateral nominal exchange rate between Singapore and each country of tourists' origin multiplied by the ratio of Singapore's price level over the tourists' origin country price, ERV is exchange rate volatility measured as the moving average of the standard deviation of real exchange rate, and *ln*D_TEMP is the logarithm of the absolute value of temperature difference between Singapore City and the capital or largest city of tourists' origin country. The parameter φ_i is the error-correcting speed of adjustment to the long-run relationship. This parameter is of a particular importance because it shows whether or not the variables are co-integrated (there is a long-run relationship) and it is expected to be negative and statistically significant under the assumption that the variables show a return to a long-run equilibrium. Further, the estimated coefficients of the determinants $\vartheta_{k,i}$s show the long run relationship between the variables while the $\beta_{k,i}s$ are the short run coefficients of the determinant variables. T is the time trend, ν_i is the country-specific fixed-effect, ε is a time varying disturbance term, μ=4 is the number of explanatory variable and p and q is the number of lag length.

A brief description of the PMG method is given by the following steps: first, the ARDL order of the model described by (3) has to be determined. This means that we have to determine the value of p for the dependent variable and the value of q for each regressor. For this purpose equation (3) was estimated for each country separately and the lag order of the ARDL is determined using the AIC[9] lag selection criterion. For the determination of the lag order of the ARDL model for each country the maximum number of four lags in equation (3) was considered and therefore, $4x5^{\mu}=2500$ regressions were estimated[10] for each country[11]. Then the most common lag order across countries for each variable was used and we have arrived at the following final form of (3) for estimation:

$$\Delta lnARR_{i,t} = \varphi_i \left(lnARR_{i,t-1} - \sum_{k=1}^{\mu} \vartheta_{k,i} G_{k,i,t} \right) + \lambda_i \Delta lnARR_{i,t-1} + \beta_{1,i,0} \Delta lnGDP_{i,t} + \beta_{1,i,1} \Delta lnGDP_{i,t-1} + \beta_{1,i,2} \Delta lnGDP_{i,t-2} + \beta_{2,i,0} \Delta lnR\_ER_{i,t} + \beta_{2,i,1} \Delta lnR\_ER_{i,t-1} + \beta_{2,i,2} \Delta lnR\_ER_{i,t-2} + \beta_{3,i,0} \Delta ERV_{i,t} + \beta_{3,i,1} \Delta ERV_{i,t-1} + \beta_{3,i,2} \Delta ERV_{i,t-2} + \beta_{3,i,3} \Delta ERV_{i,t-3} + \beta_{4,i,0} \Delta D\_TEMP_{i,t} + \beta_{4,i,1} \Delta D\_TEMP_{i,t-1} + \beta_{4,i,2} \Delta D\_TEMP_{i,t-2} + \beta_{4,i,3} \Delta D\_TEMP_{i,t-3} + \beta_{4,i,4} \Delta D\_TEMP_{i,t-4} + \tau_i T + \nu_i + \varepsilon_{i,t} \qquad (4)$$

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[9] Akaike Information Criterion is a measure of the relative quality of a statistical model for a given set of data and therefore, it provides a means for model selection.

[10] It is $4x5^{\mu}$ because at it can be seen from Equation (3) the second summation term runs from 1 to 4 while the other four (μ=1,…,4) run from 0 to 4.

[11] The number of lags of the ARDL was set to four. There was no apparent reason to extend the lags for a longer time period since we are interested in the short-run effects of the tourism factors on arrivals. Further, the lag order of the ARDL could not have been extended for more than four lags due to unavailability of degrees of freedom.

Second, the estimation of the long run coefficients $\vartheta_{k,i}$s is done jointly across countries by a maximum likelihood procedure. Finally, the estimation of the short run coefficients, λ_{ij}s and $\beta_{k,i,j}$s, the speed of adjustment φ_i, the country-specific intercepts ν_i and the country-specific error variances is performed on a country by country basis using also a maximum likelihood method and the estimates of the long run coefficients that have been obtained in the previous step.

The PMG estimates have to be checked for the following specification conditions: First, the model is tested for dynamic stability (existence of a long-run relationship). The requirement for our model to be dynamically stable is that the coefficient of the error correction term be negative and not lower that -2 (i.e. within the unit circle). The value on φ_i is -0.712 and it is statistically significant at less that 1% level of statistical significance. Therefore, the condition for dynamic stability is fulfilled. A further requirement is the test for the existence of co-integration (long-run relationship) between dependent and the explanatory variables. It is required that coefficient on the error correction term φ_i is negative and statistically significant meaning that there is a co-integration. The value of this coefficient shows the percentage change of any disequilibrium between the dependent and the explanatory variables that is corrected within one period (one quarter). Its value signifies the speed of adjustment to the long run equilibrium. In our case, the value on φ_i is -0.712 signifying that a long-run relationship between the variables exists and 71.2% of any disequilibrium between the dependent and the explanatory variables is corrected within one quarter. Third, as described above, the PMG estimator constrains the long run elasticities to be equal across all countries. This pooling across countries yields efficient and consistent estimates when the applied restrictions are true i.e. the long run coefficients be the same across countries. If the true model is heterogeneous in the slope parameters the PMG estimates are inconsistent. To test this hypothesis of homogeneity a Hausman-type test is used. This test is based on the comparison between the PMG and MG estimators. The Hausman test statistic had a value of 0.59 and its level of statistical significance (p) was 0.96. Therefore, the null hypothesis that the difference in coefficients is not systematic cannot be rejected and it is concluded that the model is homogeneous in the slope parameters across countries.

5. Discussing the Estimation Results

The dynamic specification of the estimated model, found with the procedure described in the section above, is: ARDL (1,2,2,3,4). The first number represents the distributed lags of *ln*ARR, the second the distributed lags of *ln*GDP, the third the distributed lags of *ln*R_ER, the fourth the distributed lags of ERV and the fifth the distributed lags of *ln*D_TEMP. The long and short run impact of each regressor on tourist flows is shown in Table 3 and it will be discussed below.

Table 3. Long run and short run determinants of tourist arrivals into Singapore

Variables	Coefficient	Standard Error	p-value
Long run coefficients			
*ln*GDP	0.846^{**}	0.147	0.000
*ln*R_ER	-0.279^{**}	0.051	0.000
ERV	-1.655^{**}	0.526	0.002
*ln*D_TEMP	0.071^{**}	0.025	0.004
Joint Hausman test	0.59		0.964
Error correction coefficient (φ)	-0.712^{**}	0.074	0.000
Short run coefficients			
$\Delta ln\text{ARR}_{t-1}$	-0.163^{**}	0.059	0.006
$\Delta ln\text{GDP}_{t}$	0.519	0.580	0.371
$\Delta ln\text{GDP}_{t-1}$	1.094^{*}	0.521	0.036
$\Delta ln\text{GDP}_{t-2}$	-0.866	0.773	0.263
$\Delta ln\text{R\_ER}_{t}$	0.010	0.150	0.948
$\Delta ln\text{R\_ER}_{t-1}$	0.104	0.139	0.454
$\Delta ln\text{R\_ER}_{t-2}$	0.254^{+}	0.141	0.072
ΔERV_{t}	1.491	1.023	0.145
ΔERV_{t-1}	0.261	1.261	0.836
ΔERV_{t-2}	-1.863^{+}	1.035	0.072
ΔERV_{t-3}	-2.090^{*}	1.071	0.051
$\Delta ln\text{D\_TEMP}_{t}$	0.068^{*}	0.032	0.034
$\Delta ln\text{D\_TEMP}_{t-1}$	0.063^{*}	0.031	0.043

ΔlnD_TEMP$_{t-2}$	0.216**	0.049	0.000
ΔlnD_TEMP$_{t-3}$	0.064^{+}	0.039	0.104
ΔlnD_TEMP$_{t-4}$	0.039	0.025	0.122
Time trend	0.005**	0.002	0.003
Intercept	1.373**	0.304	0.000
Dynamic Specification	ARDL (1,2,2,3,4)		
Estimator	Pooled Mean Group (PMG) controlling for country fixed effects and time trend		
No. countries	37		
period	2005q1-2014q2 (38 time periods)		
No. of observations	1406		

(Source): Authors' estimates

(Note): *ln*ARR is the logarithm of tourist arrivals, *ln*GDP represents the logarithm of per capita GDP in constant prices and PPPs of the tourist origin countries, *ln*R_ER is the logarithm of real exchange rate calculated as the bilateral nominal exchange rate between Singapore and each country of tourists' origin multiplied by the ratio of Singapore's price level over the tourists' origin country price, ERV is exchange rate volatility measured as the moving average of the standard deviation of real exchange rate, and *ln*D_TEMP is the logarithm of the absolute value of temperature difference between Singapore City and the capital or largest city of tourists' origin country. Double asterisk, asterisk and cross indicate statistical significance at least at 1%, 5% and 10%, respectively.

The long-run impact of the explanatory variables to the dependent variable is shown from the values of long run coefficients (Table 3). Since, the estimated equation is in double-logarithmic form and the estimated coefficients are elasticities, they show the percentage change in tourist arrivals into Singapore, in the long-run, caused by any percentage change in the explanatory variables *i.e.* the per capita income of the tourist origin countries, the real exchange rate, the exchange rate volatility and the temperature difference between Singapore City and the capital or largest city of tourists' origin country. All long-run coefficients are highly statistically significant. They are all found to be of the expected signs: per capita income of the tourists' origin countries affect positively the demand for the tourist products offered by Singapore. However, the value of the long run elasticity is little less that 1 (0.85) indicating that Singapore tourist product is well established in the minds of tourists and their decision for travel to Singapore in the long run is affected less by the change in their income (a percentage change in tourists' income will change the number of arrivals by a smaller percentage – the long run demand is income inelastic[12]). Further, it is seen that the increase in

[12] The short run elasticities however, tell a different story (please see the discussion in the next paragraph): in the short run, Singaporean tourist product is a luxury good with a short term income elasticity higher than 1.

competitiveness by real devaluation of the ER affects positively tourist arrivals[13] and high temperature differences between Singapore and country of origin affect positively tourist flows into to the country i.e. weather affects tourists' choice. Further, the results from the examination of the effects of ERV on tourist arrivals indicate that ERV has a strong negative effect for Singapore indicating that ERV affects the decisions of tourists and tour operators[14]. From the examination of the short run coefficients it can be seen that in the short run, income affects tourist flows with one time lag i.e. it is the income of a tourist 4 to 6 months before the travel that it affects its decision to buy the tourist product and the value of the income elasticity is higher than 1 (1.09) an indication that the tourist product of Singapore is a luxury good. The short run coefficients of the real exchange rate variable become statistically significant on the second time lag which means that it is the price differences between the tourists' origin country and Singapore seven to nine months before travel that affect their decision to travel to Singapore.

Furthermore, temperature differences between Singapore and tourists' origin country have the highest effect on the tourists' decision to travel to Singapore seven to nine months before travel (at the second time lag); temperature differences affect tourist arrivals (statistically significant coefficient) one to six months before travel but the value of the coefficient is small (0.07 and 0.06 at t and t-1, respectively). Temperature differences after 10 months of the date of the travel are not important in the tourists' decision. Finally, ERV is very important and affects significantly tourist arrivals in Singapore in the short run; the values of the short run elasticities for t-2 and t-3 are statistically significant, the coefficients are negative and of a value of around |2|. ERV is not important up to six months (time t to t-1) before travel because tour operators have already sold the product with its highest effect being ten to twelve months before travel. The above findings can be visualised in Figure 1. As it can be seen each factor has its highest effect at different time-period before tourists' travel.

Figure 1. Time specific effect of determinants of tourism into Singapore

[13] The value of the coefficient is negative and it is of the expected sign because an increase in real exchange rate (as it is defined here; for definition of the variables please see section 4.2.) is expected to reduce tourist flows as it decreases competitiveness and vice versa.

[14] This finding accords with that found by other studies of the effects of ERV on tourism (eg. Agiomirganakis et.al. 2014).

Months 12 11 10 9 8 7 6 5 4 Visit

ERV

6. Conclusions and Policy Implications

This paper examines the determinants of tourist flows in Singapore for the period 2005 – 2014 using quarterly data, seeking to identify the best timing of short-run governmental Tourism policy, under conditions of uncertainty captured by the volatility of exchange rate. In our study we examine the income of the tourists' origin country, the real bilateral effective exchange rate, the exchange rate volatility (ERV) and the temperature difference as determinants of tourist flows. The ERV, measured as a moving average of the logarithm of real exchange rate affects tourist flows either by affecting potential travelers or the policy actions of tour operators by causing them to switch travel locations in order to hedge their activities. International tourist flows are measured by tourist arrivals from each country of origin; thirty-seven countries of tourists' origin are distinguished and included in the data set accounting for more than 90% of the total tourist flows into Singapore. The real exchange rate variable is calculated taking into account the bilateral nominal exchange rates and the price levels of both Singapore and the country of tourists' origin for each time period. Real exchange rates are used as measure of the price competitiveness of the tourist product. The temperature difference between Singapore and the country of origin was used as a measure of climate conditions difference that might affect the choices of tourists. The empirical methodology we use in our analysis relies upon the theory of cointegration in panel data and error correction representation of the cointegrated variables using the Pooled Mean Group (PMG) modeling to cointegration. This method allows the coefficients of the cointegrated variables to vary within each group (in our case each tourist origin country) while estimating single long-run values for each regressor. The Autoregressive Distributed Lags (ARDL) method to determine the order of the model of each group (country) and then the order of the PMG method was chosen as the most common order in the groups. Some direct policy implications for policy makers are derived.

Our findings suggest that in the long run tourist arrivals into Singapore are affected positively by (a) per capita income of the tourists' origin countries, (b) an improvement in competitiveness of Singapore and (c) by increases in temperature differences between Singapore and country of origin. On the other hand, Exchange Rate Volatility (ERV) has a strong negative effect to tourist arrivals into Singapore. More significantly, however, are our findings on the time effectiveness of factors affecting tourist flows into Singapore.

For example, tourists' income has its highest time impact in a period of four to six months before traveling abroad. Competitiveness of tourist industry in Singapore, affects effectively tourist travelling to this country, within a seven to nine months' time interval prior to actual travel. Similarly, weather conditions have their highest impact within a seven to nine months' time interval before actual travel.. ERV has its highest impact on tourism travelling to Singapore within a time interval of ten to twelve months. The above findings, may lead to useful policy implications that tourism authorities in Singapore may pursue in designing and implementing their tourism policy-mix. They may use these findings, as a rule of thumb, for the time interval of their policy-mix, e.g. either in choosing the timing of their campaign abroad or the timing of restructuring the tourism sector in Singapore.

Further, the method applied for exercising tourism policy may be applied in social sciences for finding the best timing effects of any social policy exercised either by national authorities or international institutional bodies such as the EU, OECS, NAFTA, APEC (see e.g. Scott op.cit. and OECS op.cit.).

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Appendices

Appendix A: Arrivals not included in the data set due to broad geographical aggregation

Quarter	Number of tourist arrivals not included	Percent of the total
2005Q1	157570	7.77
2005Q2	183737	8.51
2005Q3	226551	9.46
2005Q4	176716	7.49
2006Q1	180675	7.80
2006Q2	196408	8.28
2006Q3	240200	9.60
2006Q4	202386	7.90
2007Q1	207734	8.50
2007Q2	219040	8.79
2007Q3	270360	10.25
2007Q4	231229	8.52
2008Q1	226724	8.69
2008Q2	242195	9.74
2008Q3	270083	10.72
2008Q4	233642	9.34
2009Q1	217487	9.65
2009Q2	229901	10.19
2009Q3	254738	10.08
2009Q4	238308	9.00
2010Q1	240598	8.93
2010Q2	275838	9.73
2010Q3	317041	10.43
2010Q4	259486	8.45

2011Q1	264780	8.49
2011Q2	292022	9.02
2011Q3	345866	9.92
2011Q4	286220	8.60
2012Q1	316675	8.86
2012Q2	334493	9.54
2012Q3	354494	9.72
2012Q4	319587	8.49
2013Q1	348044	8.97
2013Q2	356673	9.26
2013Q3	407944	10.00
2013Q4	345811	9.21
2014Q1	364499	9.39
2014Q2	379258	10.44

Source: Singapore Tourism Board and Authors' calculations

Appendix B: Tourists' origin Countries

1	Canada
2	United States of America
3	Indonesia
4	Malaysia
5	Philippines
6	Thailand
7	Hong Kong
8	Japan
9	P R China
10	South Korea
11	India
12	Sri Lanka
13	Iran
14	Israel
15	Saudi Arabia
16	Austria
17	Belgium & Luxembourg
18	Denmark
19	Finland

20 France
21 Germany
22 Greece
23 Italy
24 Netherlands
25 Norway
26 Poland
27 Rep of Ireland
28 Russian Federation (CIS)
29 Spain
30 Sweden
31 Switzerland
32 Turkey
33 United Kingdom
34 Australia
35 New Zealand
36 Egypt
37 South Africa (Rep of)