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Effective timing of tourism policy: The case of Singapore☆

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ABSTRACT

In this paper, we examine the effective timing of economic policies actions in the tourism industry of a small open economy such as Singapore. The effective timing of policy actions is an open challenge issue to researchers and also a much needed rule of thumb to policy makers and private agents. This paper aims to (a) derive the influencing factors of a tourism demand function and (b) identify the time impact of these factors, thus, allowing the formulations of effective policy actions, by both, governmental tourism authorities and private tourism agents in Singapore. Our findings suggest that tourism government authorities and private tourism agents in Singapore should choose the timing of their actions depending upon the anticipated factor changes and their estimated impact. That is, if exchange rate variability is anticipated then policy actions should start at least twelve months prior to the start of the tourist period. If, a keen price competition is expected to prevail then the best timing of policy actions is nine months ahead the tourism period. If income improvements in origin countries could be expected, then a rather shorter timing action of six months would be available to tourism authorities and private agents in Singapore.

1. Introduction

Much of the literature on economic policies is focused on the qualitative and/or the quantitative effects of factors that may affect large sectors of an economy. However, governmental actions and policies need to be formulated on a rather restricted short-run horizon, for three distinct reasons. First, due to the nature of large and most extrovert economic sectors of an economy such as the services sector that are exposed to many external shocks. Consider, for example, the tourism sector that is sensitive to many short-run external and internal factors, such as seasonality, volatility of exchange rates, oil shocks, political instability, social unrest and terrorist upheavals; factors that are often unforeseeable for periods longer than six to nine months. Second, parliamentary procedures require that proposed policy actions by the government be scrutinised and reformulated into a concrete policy mix for 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 policy action plan, could, in principle, be achieved via agreed-upon government contracts with domestic partners (institutional bodies, domestic firms and agents) and specialised international companies, which is also another time consuming process. These three reasons jointly contribute to a shortening of the time horizon available for shaping economic policy. Consequently, the remaining time for implementing economic policies is becoming, indeed, a critical issue for governments and parliamentary political parties, as well as, for companies and people involved in these policies. Yet, this timing dependence of economic policy, or equivalently when economic policy could be effective, is an issue often missing from the literature.

The focus of our paper is on the effective timing of economic policies and actions in tourism industry either by governments or by private agents. To this purpose, we examine an economy with a large tourism sector simply because the tourism industry, by its nature, is facing both internal and external constraints and responds continuously to them. A typical example of such a country is Singapore that provides extended quarterly data. The purpose of this paper is, first, to derive the influencing factors of a tourism demand function and second, to identify the timing of the factors affecting tourist flows and thereby give a rule of thumb for effective tourism policy actions. Further, the method applied to exercise tourism policy may be applied to the social sciences to find the best timing effects of any social policy exercised by either national authorities or international institutional bodies, such as the European Union (EU), the Organization of Eastern

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Caribbean States (OECS), the North American Free Trade Area (NAFTA), or the Asia-Pacific Economic Cooperation (APEC).[1]

We examine tourist flows into Singapore for the period 2005–2014, for thirty-seven countries of tourist origin, using quarterly data.[2] The choice of Singapore in our analysis is based on the fast growth of its tourism sector in the post 1965 period; on a number of good governmental policies that improved the infrastructure of the industry, creating at the same time a well-diversified tourist product; and, also, due to the availability of data to conduct the previously described type of analysis. Tourist arrivals in Singapore were available from the Singapore Tourism Board on a monthly basis for this period; however, we calculated the arrivals dataset on a 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 the tourism sector in Singapore since 1965. Section 3 presents a brief review of the literature regarding the factors affecting tourist flows. Section 4 presents our model; the specification of variables used, and 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 since 1965 and was affected by a variety of events. During the post-independence period (after 1965), Singapore experienced growth in its transportation and communications industries. These developments stimulated tourism as they allowed for cheaper and faster travel (Teo, 1994). The result was a considerable boom in the tourism industry. In an effort to improve and promote tourism more effectively, the Singapore Tourist Promotion Board was founded; it conducted a campaign targeting the availability of different accommodations as well as the safety and security of visitors (Toh and Low, 1990).

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

During the post 2000 period, there has been an effort to change the nature of tourism. As a result, new air links with Asia have been established and new changes in technology and travel have allowed for the implementation of a tourism hub generating flows from Southeast Asia. In addition new infrastructure has been developed which is intended to be "Clean and Green" (Chang, 1998). Furthermore, considerable efforts have been made to increase the attraction of tourists to cultural sites and to host international events aimed at establishing Singapore as a regional arts hub.

3. Literature review

In addition to the previously discussed governmental policies that substantially increased the overall tourist arrivals in Singapore, the vast literature on tourist demand has established a variety of factors that may affect tourist flows.[3] Much of the literature finds that the economic capacity of the tourist origin country and an index of domestic to foreign country prices could be major determinants of tourist arrivals.

The origin country income has been shown to have a positive effect on tourist arrivals. As the origin country's welfare expands, more tourists are induced to travel abroad. A recent study by Lee et 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 prices in the destination country and the origin country (or even a set of competing destinations). A big difference in relative prices could either induce or divert tourist flows into competitor countries that apply a different pricing strategy, e.g. a lower VAT. As a result, relative price is established as a significant factor in tourist flows (see, e.g., Lim (1999) and Li et al. (2005)). Li et al.'s (2006) findings suggest that relative price 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) also employed a measure of relative prices in their estimation of demand modelling, utilising an Almost Ideal Demand System (AIDS) model. Their model incorporated a measure of relative prices which included the share of the price in an index of total expenditure.

Since the early 1990s, researchers have been expanding tourism models to incorporate exchange rates. The reason for this is that exchange-rate changes induce responses not only from tourists travelling individually, but also from risk adverse tour operators, which may decide to switch their business operations to other countries where the 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 the destination country) (see, e.g., Witt and Witt (1995), Garin-Munoz and Amaral (2000), Song and Li (2008), Agiomirgianakis et al. (2014, 2015)). Bunnag et al. (2010) examined the effects of exchange rates on tourist flows for different sets of exchange rates which were 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) examined potential effects from exchange rates on tourist flows for a variety of countries and concluded that there is a relationship between exchange rates and tourist arrivals for Singapore. Also, Lee et al.'s (2015) findings in 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

[1] See, e.g., Scott (2011) and OECS (2011).
[2] The 37 countries of the data set are listed in Appendix B.
[3] See, e.g., Peng et al. (2015) for an excellent review of 195 studies published during the period 1961–2011.

limited amount of empirical research has incorporated the effects of exchange rate volatility on tourist arrivals (see Webber (2001), Chang and McAleer (2009), Santana et al. (2010), and Yap and Lee (2012)). Webber (2001) has suggested that exchange rate volatility does produce a significant long-run effect on 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 produces a significant magnitude of negative effects, as well as slipover effects on tourism. These effects can be ranked from stronger to weaker (Chang and McAleer, 2009; Yap and Lee, 2012).

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 exists, this would be indicative of a relationship between exchange rate volatility and tourist arrivals as well. Liu and Sriboonchitta (2013) modeled the effect of exchange rate volatility on tourist arrivals in Singapore from China. Their conclusion is that exchange rates have a significant effect on tourist arrivals.

Recently, specific tourist attractions like UNESCO heritage monuments have been used as a determinant of inbound tourism for Italy (Cuccia et al. 2016). Furthermore, the effectiveness of tax-funded government tourism promotion spending has been examined by Shi (2012) with an application of a general equilibrium model on the Australian economy, while the effects of devaluation on tourism for a small open economy have been examined by Chao et al. (2012). The effectiveness of economic policies for tourism development to promote economic growth has been examined in the transition countries using panel data analysis by Chou (2013) and for Pakistan using time series Auto Regressive Distributed Lag (ARDL) cointegration analysis by Jalil et al. (2013). Further, visitor arrivals have been used to predict the main macroeconomic variables in Pacific Island countries by Narayan et al. (2013). However, although in the literature various inbound tourism determinants and the effects of the tourism sector on the economy have been extensively examined, the effectiveness of exercising tourism policy by time, or equivalently when this policy could be most effective, is an issue left out from the literature. Further, the literature on the influence of climate change on tourism demand patterns is reviewed by Gossling et al. (2012). However, very few studies (e.g. Eugenio-Martin and Campos-Soria, 2010) investigate the timing that weather conditions in both the origin and destination country affect tourists' choices. This paper aspires in filling in this gap with a diversified tourism demand model that allows examining the intensity of the impact of each variable over a time period that spans from one to eighteen months before travel.

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 (VAR) models which utilise time varying parameters to model exchange rate volatility (Song and Witt, 2000). Recently, however, researchers have utilised new econometric approaches when modeling tourist arrivals. These methods consist of ARDL and Almost Ideal Demand System (AIDS) models. 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 to 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 utilises panel data approaches, despite the fact that this method offers clear advantages. 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 in an estimation of an econometric model (see, e.g., Ledesma-Rodríguez et al. (2001) which have mainly concentrated on tourism flows for Tenerife).

4. The model, specification of variables, data and methodology

4.1. The model

The model for examining the factors affecting tourist flows to 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. Furthermore, 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 are considered to affect the decision regarding the choice of destination for beach tourism, cruise tourism and cultural tourism, which 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 origin countries to Singapore. The general model used is:

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

where 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 is the number of persons arriving for the 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 their origin country, in constant prices and purchasing power parities (PPPs).[4] ER is the real exchange rate calculated as the bilateral nominal exchange rate between Singapore and each tourist's country of origin multiplied by the ratio of Singapore's price level and the tourists' origin country price level (see, among others, Witt and Witt (1995) and Patsouratis et al. (2005) for a more detailed analysis).[5] It is included as a measure of the Singaporean economy's 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. Furthermore, 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 regressors measure elasticities. This is particularly important in the policy implications of our findings, given in the final section. Finally, a time trend, T, was included.[6]

4.2. Specification of variables

As we saw in the literature review section, the demand for tourist services is positively affected by 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

[4] Demand for tourism services is a consumption function. One of the main determinants of the latter is real disposable income. To approximate real disposable income per capita income of the tourist origin countries has been used. PPPs have been used so that purchasing power is comparable between countries of different level of economic development (on the use of real GDP in tourism models see, among others, Arslanturk et al. (2011, p. 666), Ivanov and Webster (2013, p. 484)).

[5] The detailed construction of the variables used is presented in Section 4.2.

[6] The full econometric specification of the estimated model is given in Section 4.4.

included in the model. A positive sign of the estimated coefficient is expected because disposable income positively affects the demand for tourist services and increases outbound tourist flows. All variables used were included in their natural logarithms so 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 ER. It is calculated as the bilateral nominal exchange rate between Singapore and each tourist's origin country multiplied by the ratio of Singapore's price level to 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 appreciation of the Singaporean 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 (2005q1–2014q2) for the 38 countries that were included in the dataset, these were calculated using the US dollar exchange rate. The price level for both Singapore and the origin countries of the tourists was measured by their consumer price index (CPI), with 2010 being the base year. Therefore, an improvement in competitiveness denoted by a decrease in the ER, is expected to increase inbound tourist flows.

ERV is a measure that is not directly observable; 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,

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

where R is the logarithm of the real effective exchange rate; and m is the number of periods, usually ranging between 4 and 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 negatively affects the tour operators' behaviour, because it 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 the exchange rate for exports. Akhtar and Hilton (1984) concluded that exchange rate uncertainty is detrimental to international trade. Other 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 regarding unpredictable movements of the exchange rate play a vital role in 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 high and low values.

Another factor that was considered in the tourism demand function was the differences in weather conditions on tourists' choices. Lise and Tol (2002) using a cross-section analysis of average temperature of the warmest month and average precipitation in summer on destinations of OECD tourists investigate the sensitivity of tourist demand for vacation destinations with respect to climate in order to draw conclusions for the possible impact of climate change in the long term. Moore (2010) provides an assessment of the impact of a change in the Caribbean countries' climatic features on tourism demand. Using a tourism demand model and data for the 1980–2004 period simulated the impact of changes in climatic features on regional arrivals. Eugenio-Martin and Campos-Soria (2010) investigate the climate in the region of residence as a relevant determinant of holiday destination choice using household level survey data for 1997 for fifteen European Union countries. They conclude that when there are four or more months with good weather at the domestic country, the most likely outcome is that the household will decide to travel domestically for holidays and not abroad. Hein et al. (2009) examine the impacts of climate change on the tourism industry in Spain. They forecast that climate changes will decrease the total number of tourists visiting Spain from 5% to 14% in 2060 compared with 2004. Goh (2012) uses climate as an important socio-psychological variable into tourism demand analysis. With the use of an error correction model for tourism flows to Hong-Kong found that long-haul travelers might be more sensitive to changes of weather in Hong Kong rather than short-haul travelers. So, the distance between the place of tourists' origin and destination affect the importance of whether as a determinant of tourists' choices.

Following the above stream of literature, a weather variable was included as a determinant in the tourism demand function. Good weather is particularly important for beach, cruise and cultural tourism, the main types of tourism in Singapore. The *D_TEMP* variable was used to capture the effects of weather on tourist flows into Singapore. It has been included in the model to examine if the decisions regarding 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 that in 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 on a 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 from the Singapore Tourism Board (2005–2014) on a monthly basis. Thirty-seven countries were included in the dataset and the tourist arrival data was calculated on a 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) were not included in the dataset. The number of arrivals and the percentage of total arrivals that were not included in the dataset are reported in Appendix A. This percentage ranges from 7.49% to 10.72%, therefore the conclusions reached in this paper are based on approximately 90% of the total tourist arrivals in Singapore. The CPI for the 38 countries (37 countries of tourists' origin plus Singapore[7]) for the first quarter of 2005 to the second quarter of 2014 has been extracted from the International Financial Statistics dataset (2014). Nominal exchange rate data, defined as tourist origin country currency units per Singaporean Dollar, was constructed from the nominal exchange rates of each currency against the US Dollar. The latter was extracted from the International Financial Statistics dataset (2014). GDP 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* (United Nations, 2014). Finally, temperature data were found on

[7] The 37 countries of the data set are listed in Appendix B.

Table 1
Data sources and construction of the variables used.
Source: Authors' calculations.

Data description	Frequency	Source	Variable constructed[a]
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; quarterly average	Tutiempo.net	D_TEMP_{it}: Temperature difference between Singapore City and the capital or largest city of tourists' origin countries

[a] 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.

the tutiempo.net portal for Singapore City and the capital or largest city of tourists' origin countries. The temperature data was on a daily basis; the average temperature for each place was calculated on a quarterly basis to correspond to the other variables in the dataset (Table 1).

4.4. Estimating methodology

In order to examine the long-run relationship between the tourist flows and their prospective 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. It is necessary to use cointegration analysis 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 dataset composed of a large sample of countries (37) which account for all the main countries of origin of tourists visiting Singapore (approximately 90% of the total tourist arrivals originate from these countries).[8] The method used is the PMG method that can be characterised as a panel ECM, where short- and long-run effects are estimated jointly from an ARDL model (Pesaran and Shin, 1999) 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 and Bond (1991), and Arellano and 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, Evans (1997), and Lee et al. (1997)). The former type models are criticised by Pesaran and Smith (1995), who say 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 therefore less restrictive than the 'dynamic fixed effects' method and more efficient relative to the mean group method (Pesaran et al., 1999). The long-run homogeneity hypothesis of the PMG method allows for the direct identification of the parameters of factors which affect 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 more accurately estimate 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,[9] particularly when the same factors affect tourists from different countries differently, especially in the short run. Country heterogeneity is particularly relevant in short-term relationships, while we can expect that long-run relationships between tourists' choice of destination would be more homogenous across countries in the long run.

Moreover, the PMG method has the advantage that it 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)[10] 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 be strictly exogenous. This, it is proposed in the literature, 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 be 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.

The values of the panel unit root test are presented in Table 2. 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

[8] See Section 4.2 for a detailed discussion of specification of variables.

[9] The countries of tourists' origin are reported in Appendix B and are from all five continents.

[10] 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.

Table 2
Im, Pesaran and Shin panel unit root test results.
Source: Authors' estimates.

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*

Note: All tests are performed using the 5% level of significance; *lnARR* is the logarithm of tourist arrivals, *lnGDP* represents the logarithm of per capita GDP in constant prices and PPPs of the tourist origin countries, *lnR_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 to the tourists' origin country price level, *ERV* is exchange rate volatility measured as the moving average of the standard deviation of real exchange rate, and *lnD_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 null hypothesis of a unit root is tested against the alternative.

* denotes significance at least at the 5% level.

was rejected at the 5% level of statistical significance for both *lnD_TEMP* and *ERV* while *lnARR*, *lnGDP* and *lnR_ER* were found to be non-stationary at their level for all panels. Therefore, it is concluded that the variables *lnD_TEMP* and *ERV* are I(0) while *lnARR*, *lnGDP* and *lnR_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 at their level or at their first difference and, therefore, the PMG modeling suggested by Pesaran et al. (1999) 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 ECM to estimate the speed of adjustment to the long-run relationship allowing for unrestricted country heterogeneity in the adjustment dynamics and fixed effects.

Following Pesaran et al. (1999), the PMG restricted version of (1) is estimated on pooled cross-country time-series data as:

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

where $i=1,\ldots,37$ and denotes countries; $t=1,\ldots,38$ 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; $\mu=4$ and is the number of determinants; $G=(lnGDP, lnR\_ER, lnD\_TEMP, ERV)$ is the vector with the explanatory variables where *lnGDP* represents the logarithm of per capita GDP in constant prices and PPPs of the tourist origin countries; *lnR_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 to the tourists' origin country price level; *ERV* is exchange rate volatility measured as the moving average of the standard deviation of real exchange rate; and *lnD_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 particular importance because it shows whether or not the variables are co-integrated (there is a long-run relationship) and is expected to be negative and statistically significant under the assumption that the variables show a return to a long-run equilibrium. Furthermore, 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, $\mu=4$ is the number of explanatory variables and p and q is the number of lags.

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 q for each regressor. For this purpose, Eq. (3) was estimated for each country separately and the lag order of the ARDL was determined using the Akaike Information Criterion (AIC)[11] lag selection criterion. For the determination of the lag order of the ARDL model for each country, a maximum number of four lags in Eq. (3) was considered and, therefore, $4\times5^{\mu}=2500$ regressions were estimated[12] for each country.[13] Then the most common lag order across countries for each variable was used, resulting in the following final form of (3) for estimation:

$$\begin{aligned}\Delta\, ln\, ARR_{i,t} = {} & \varphi_i\left(ln\, ARR_{i,t-1} - \sum_{k=1}^{\mu} \vartheta_{k,i} G_{k,i,t}\right)\\ & +\lambda_i \Delta\, ln\, ARR_{i,t-1} + \beta_{1,i,0}\Delta\, ln\, GDP_{i,t} + \beta_{1,i,1}\Delta\, ln\, GDP_{i,t-1} +\\ & \beta_{1,i,2}\Delta\, ln\, GDP_{i,t-2} + \beta_{2,i,0}\Delta\, ln\, R\_ER_{i,t} + \beta_{2,i,1}\\ & \Delta\, ln\, R\_ER_{i,t-1} + \beta_{2,i,2}\Delta\, ln\, R\_ER_{i,t-2} + \beta_{3,i,0}\Delta ERV_{i,t} + \beta_{3,i,1}\\ & \Delta ERV_{i,t-1} + \beta_{3,i,2}\Delta ERV_{i,t-2} + \beta_{3,i,3}\Delta ERV_{i,t-3} +\\ & \beta_{4,i,0}\Delta D\_TEMP_{i,t} + \beta_{4,i,1}\Delta D\_TEMP_{i,t-1} + \beta_{4,i,2}\\ & \Delta D\_TEMP_{i,t-2} + \beta_{4,i,3}\Delta D\_TEMP_{i,t-3} + \beta_{4,i,4}\Delta D\_TEMP_{i,t-4}\\ & +\tau_i T + \nu_i + \varepsilon_{i,t}\end{aligned} \tag{4}$$

Second, the estimation of the long-run coefficients $\vartheta_{k,i}$s is done jointly across countries using 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, also using a maximum likelihood method and the estimates of the long-run coefficients that were 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 than −2 (i.e., within the unit circle). The value of φ_i is −0.712 and it is statistically significant at less than the 1% level. Therefore, the condition for dynamic stability is fulfilled. A further requirement is the test for the existence of co-integration (long-run relationship) between the dependent and the explanatory variables. It is required that the coefficient on the error correction term φ_i be 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 of φ_i is −0.712, signifying that a long-run relationship between the variables exists and 71.2% of any disequilibrium

[11] The AIC 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.

[12] The number of regressions is $4\times5^{\mu}$ because, as can be seen from Eq. (3), the second summation term runs from 1 to 4 while the other four ($\mu=1,\ldots,4$) run from 0 to 4.

[13] 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. Furthermore, the lag order of the ARDL could not have been extended for more than four lags due to unavailability of degrees of freedom.

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 are 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 of 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. The model also passes the RESET test for functional form misspecification[14]; the F-statistic had a value of 1.785 therefore, the null hypothesis cannot be rejected and it is concluded that the model is correctly specified.

5. Discussion of the estimation results

The dynamic specification of the estimated model, found through the procedure described in Section 4.4 is: ARDL (1,2,2,3,4). The first number represents the distributed lags of *lnARR*, the second the distributed lags of *lnGDP*, the third the distributed lags of *lnR_ER*, the fourth the distributed lags of *ERV* and the fifth the distributed lags of *lnD_TEMP*. The long- and short-run impact of each regressor on tourist flows is shown in Table 3.

The long-run impact of the explanatory variables on the dependent variable is shown by the values of the 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 in 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 positively affects the demand for the tourist products offered by Singapore. However, the value of the long-run elasticity is a little less than 1 (0.85), indicating that the Singaporean tourist product is well established in the minds of tourists and their decision to travel to Singapore in the long run is affected less by a change in their income (a percentage change in tourists' income will change the number of arrivals by a smaller percentage – that is, the long-run demand is income inelastic[15]). Further, it is seen that the increase in competitiveness by real devaluation of the ER positively affects tourist arrivals[16] and big temperature differences between Singapore and the country of origin positively affect tourist flows into the country, i.e., weather affects tourists' choice. Moreover, the results from the examination of the effects of ERV on tourist arrivals show that ERV has a strong negative effect for Singapore, indicating that ERV affects the decisions of tourists and tour operators.[17] 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 affects his/her decision to buy the tourist product, and the value of the income elasticity is greater 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 at 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 tourists' decision to travel to Singapore.

Furthermore, temperature differences between Singapore and the 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

Table 3
Long-run and short-run determinants of tourist arrivals in Singapore.
Source: Authors' estimates.

Variables	Coefficient	Standard error	p-value
Long-run coefficients			
lnGDP	0.846**	0.147	0.000
lnR_ER	−0.279**	0.051	0.000
ERV	−1.655**	0.526	0.002
lnD_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			
$\Delta lnARR_{t-1}$	−0.163**	0.059	0.006
$\Delta lnGDP_t$	0.519	0.580	0.371
$\Delta lnGDP_{t-1}$	1.094*	0.521	0.036
$\Delta lnGDP_{t-2}$	−0.866	0.773	0.263
ΔlnR_ER_t	0.010	0.150	0.948
ΔlnR_ER_{t-1}	0.104	0.139	0.454
ΔlnR_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
ΔlnD_TEMP_t	0.068*	0.032	0.034
ΔlnD_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		

Notes: lnARR is the logarithm of tourist arrivals, *lnGDP* represents the logarithm of per capita GDP in constant prices and PPPs of the tourist origin countries, *lnR_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 to the tourists' origin country price level, *ERV* is exchange rate volatility measured as the moving average of the standard deviation of real exchange rate, and *lnD_TEMP* is the logarithm of the absolute value of temperature difference between Singapore City and the capital or largest city of tourists' origin country. **, *, +: denote statistical significance at least at 1%, 5% and 10%, respectively.

[14] This is called also the 'Ramsey test'.

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

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

[17] This finding is in accordance with that found by other studies of the effects of ERV on tourism (e.g., Agiomirgianakis et al., 2014).

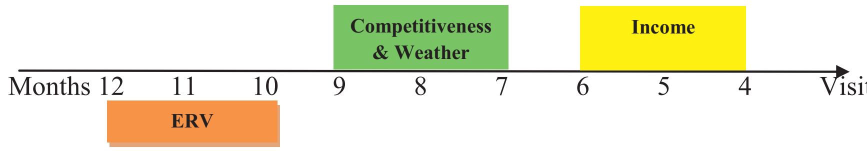

Fig. 1. Time specific effect of determinants of tourism to Singapore.

t and $t-1$, respectively). Temperature differences more than10 months from the date of travel are not important in tourists' decisions. Finally, *ERV* is very important and significantly affects 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 Fig. 1. As can be seen, each factor has its greatest effect at a different time period before tourists' travel.

6. Conclusions and policy implications

In this paper, we examine the effective timing of economic policies actions in the tourism industry of a small open economy. The choice of examining effectiveness of economic policy actions in the tourism sector is because, by its nature, tourism sector is facing both internal and external constraints and responds continuously to them. Therefore, formulating effective policy actions is not only an open challenge to researchers but it may also equip policy makers and private agents with a rule of thumb for effective tourism policy actions as to "how" and "when" to act.

A typical example of such an economy is Singapore that provides extended quarterly data. In this paper we, first, derive the influencing factors of the tourism demand function. However, knowing the affecting factors of tourism demand function and ignoring their time impact does not help in formulating effective responses from tourism policy authorities and private tourism agents in Singapore. For this reason, we extend the literature of tourism demand function by identifying the time dependence of these factors. This extension, allows us to formulate the best timing (effectiveness) of, both, governmental tourism policy and private agents' tourism actions.

The determinants of tourist flows to Singapore are examined for the period 2005–2014 using quarterly data. In our study we examine the income of the tourists' origin country, the real bilateral effective exchange rate, the exchange rate volatility and the temperature difference as determinants of tourist flows. The ERV, measured as a moving average of the logarithm of ER 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 dataset accounting for more than 90% of the total tourist flows into Singapore. Real exchange rates are used as a 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 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 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 in Singapore are affected positively by (a) per capita income of the tourists' origin countries, (b) an improvement in the competitiveness of Singapore, and (c) increases in temperature differences between Singapore and the country of origin. On the other hand, ERV has a strong negative effect on tourist arrivals in Singapore. More significantly, however, are our findings on the time effectiveness of factors affecting tourist flows into Singapore. It was found that tourists' income has its highest time impact in a period of four to six months before traveling abroad. Competitiveness of the tourist industry in Singapore affects tourist travel to the country within a seven to nine month time interval prior to actual travel. Similarly, weather conditions have their highest impact within a seven to nine month time interval before actual travel. ERV has its highest impact on tourism to Singapore within a time interval of ten to twelve months.

Although, some of the determinants of inbound tourism demand model used are not related to economic policies actions of destination country e.g. weather and disposable income of the origin countries, policy authorities and private agents in the destination country have a number of policy actions to react in these changing external conditions. These actions, include the participation in international exhibitions, the signing of intergovernmental agreements and private contracts to hedge visitors from unexpected financial changes, the reduction of indirect taxes such as VAT, abolishing visa requirements or cutting the "red-tape" in obtaining a visa and the starting of the marketing campaign for national and local tourism product. Consider, for example, our findings that tourists' income and weather conditions have their highest time impact in a period of four to six months and seven to nine month respectively, before traveling abroad. This provides a rule of thumb to Singaporean government and private agents that they should start their tourist-promotion campaign abroad six and nine months, respectively, prior to the tourism period in order to obtain the highest possible impact. Similarly, the competitiveness variable has its highest impact on tourist travel to Singapore within a seven to nine month time interval prior to actual travel suggesting that policy authorities and private tourism agents in Singapore should, in principle, avoid actions leading to reducing international competeviness of their tourism product such as increases in VAT.[18] Finally, ERV has its highest impact on tourism to Singapore within a time interval of ten to twelve months. This finding suggests that policy actions should be taken to reduce fluctuation of the exchange rate during this period and the government should avoid, during this period, using exchange rate policies in order to correct its international competeviness as these policies may end up to an exchange rate volatility that could in turn, reduce substantially the tourism inflows.

[18] The government does not have under its control the CPI of the origin counties which is one of the determinants of the competitiveness variable. It has however, to a considerable extend, the control of the CPI in the domestic country and to a lesser extend the nominal exchange rate of the domestic currency and therefore, it can partially control the competitiveness of the country.

In summary, policy implications of our findings suggest a time path of effective policy actions: if exchange rate variability is anticipated for the next tourism period, then policy actions as described above, should start at least twelve months prior to the start of this period. If, on the other hand, a keen price competition is expected to prevail then the best timing of policy actions is nine month ahead the tourism period. Moreover, if income improvements in origin countries could be expected then a rather shorter timing action of six months would be available to tourism authorities and private agents in Singapore. These policy implications could be used as rule of thumb for tourism policymakers and private agents when they design their policy actions.

The methodology we use in this paper may also apply to evaluate other economic policies as well; it can be used to find the best timing effects of any social policy exercised by either national authorities or international institutional bodies.

Appendix A

See appendix Table A1.

Table A1
Arrivals not included in the dataset due to broad geographical aggregation.
Source: Singapore Tourism Board and authors' calculations.

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

Appendix B

See appendix Table B1.

Table B1
Origin countries of tourists.

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)

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