FDI and tourism futures: a dynamic investigation for a panel of small island economies

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Abstract

Purpose – Based on a panel vector error correction model (PVECM), this study aims to investigate the impact of foreign direct investment (FDI) on tourism development in a selected group of 17 small island economies during 1995-2018. In the long run, a positive and direct relationship was found between foreign investment and tourists' arrival. Moreover, economic performance and tourists' income were also found to be key determinants of tourism development. It is further observed that there is bidirectional causality between the two variables. Hence, one can argue that FDI is a key element for tourism development. So, if the countries can attract more FDI and grow economically, these elements will contribute positively to the sector in the future.

Design/methodology/approach – This work uses rigorous dynamic time series analysis, namely, a dynamic PVECM, which takes into account dynamism and endogeneity issues in tourism modelling. Furthermore, the PVECM is also appropriately suited for integrating short- and long-run analysis.

Findings – The results confirm that FDI has been an important ingredient in the tourism development of the island economies in the long run. Interestingly, a bidirectional causality between FDI and tourism development is validated. Moreover, growth will as well be important. So, if the country can attract more FDI and grow economically, these elements will attract the tourists of the future.

Originality/value – Relatively few studies have rigorously studied the relationships between FDI and tourism development, particularly with respect to developing countries and small island states which rely heavily on tourism as well as FDI. As such existing research has neglected dynamic and reverse causality analysis in their respective FDI-tourism modelling. This study thus attempts to address the above and supplement the literature by investigating the direct and indirect relationship between FDI and tourism development for the case of small island economies over the period 1995-2018. Moreover, the implication of foreign capital inflows on tourism futures will as well be developed.

Keywords Causality, Tourism development, Foreign direct investment, Tourism futures **Paper type** Research paper

1. Introduction

The travel and tourism sector is the key economic sector for small island economies as it helps in job creations and boosts earnings. Indeed, many of these countries rely heavily on tourism revenue. This sector is crucial for economic development as well and these economies will suffer if ever the tourism sector contract in the future. To further expand the tourism sector, various resources are needed and foreign direct investment (FDI) has been identified to be crucial here. Indeed, tourism remains an activity where capital, infrastructure, knowledge and access to global marketing and distribution chains play an essential role, and FDI is considered as one of the most effective engines for supporting such critical elements.

Certainly, it plays a significant role in developing the tourism industry by providing the required capital and knowledge to invest in land improvements, infrastructure and buildings (Endo, 2006; Selvanathan *et al.*, 2012). It is also an important factor in the transfer of skills,

knowledge of products and techniques to the countries in which they have a presence (Blomström and Sjöholm, 1999 and Markusen, 1995). Moreover, these foreign companies also make a significant contribution with respect to investment in human capital in terms of training mainly which remains critical for tourism development. Also, international hotel and restaurant chains with reputation and proven track experience also attract more tourists. However, there are also certain drawbacks with FDI in the form of profit repatriation and mainly in terms of crowding out of domestic firms.

Because the benefits received from FDI constitute a key issue for policymakers, it is of utmost importance to investigate clearly the benefits flowing from these firms. It is also important to note that there has been a little mapping of the extent of FDI on the tourism sector even though many developing countries have been giving priority to attracting FDI. The present study concentrates on the case of small island developing states (SIDS). These economies are a distinct group of developing countries facing specific social, economic and environmental vulnerabilities. The common challenges include a narrow resource base, small domestic markets and heavy dependence on a few external and remote markets; high costs for energy, infrastructure, transportation, communication and servicing; long distances from export markets and import resources; low and irregular international traffic volumes; little resilience to natural disasters; growing populations; high volatility of economic growth; limited opportunities for the private sector and a proportionately large reliance of their economies on their public sector; and fragile natural environments[1].

These small island economies are very vulnerable and often associated with the fact that small economies are not able to influence their terms of trade due to their lack of international power (Liou and Ding, 2004). Scholars have debated that due to their small size, SIDS have difficulties to diversify their export and as a result of this, there is an overdependence on a narrow range of goods and services (Armstrong and Read, 2002; Briguglio, 1995). The unique characteristics of small island states, therefore, provide a special case for studying the tourism-FDI relationship (Nunkoo and Seetanah, 2018). Hence, by using a panel vector error correction model (PVECM), the present study attempts at investigating the relationship between FDI and tourism development for 17 small island economies over the period 1995-2018. Moreover, by using this framework, the dynamic feedbacks are captured and also permit the detection of any indirect effects among the variables.

The rest of this paper is organized as follows: Section 2 discusses the theoretical and empirical literature; Section 3 provides a brief overview of the tourism sector and FDI in selected island economies, whereas Section 4 defines the methodological approach used; Section 5 delineates and discusses the findings and finally, Section 6 presents conclusions.

2. Literature review

Analysing the literature on tourism, studies are rather concentrated on the link between tourism and economic growth. The tourism led growth hypothesis has been overwhelmingly discussed in various studies. This theory states that international tourism leads to a significant increase in economic growth. Sinclair and Stabler (2002) and Samimi *et al.*'s (2011) studies prove this relationship in their studies. Moreover, tourism development is seen to also increase the level of direct and indirect employment in an economy. For instance, the study by Fauzel *et al.* (2017) shows that tourism development has contributed towards boosting direct employment, indirect employment and induced employment in the small island economy of Mauritius. Hence, apart from directly creating jobs in the tourism industry, a development in the tourism sector also leads to employment in other sectors of the economy. Similar findings were obtained by McCatty and Serju (2006). In addition to that, international tourism also contributes to an increase in income enhancing efficiency through increased competition among firms and other international tourist destinations and

facilitating the exploitation of economies of scale in local firms (Krueger, 1980; Helpman and Krugman, 1985 and Samimi *et al.*, 2013).

Tourism development has various positive impacts on the economy. To further develop the tourism sector, several attributes are needed in an economy. These are in the form of capital, infrastructure, knowledge and access to global marketing and distribution chains (Samimi *et al.*, 2013). Foreign investment is viewed as an important avenue through which countries can get access to capital and help in the development of infrastructures such as international airports, highways, hotels and modern technologies. (Zhang *et al.*, 1999; Andergassen and Candela, 2009). Although FDI can boost the tourism sector, the reverse is as well possible. For instance, as highlighted by the dependency theory which is based on the Marxist thought, developing economies face negative impact from foreign investment due to profit repatriation, declining reinvestment and income inequality. Therefore, FDI inflows to the host country can harm local firms, stifle technological innovation and "crowd out" domestic firms (Dixon and Boswell, 1996).

Also, tourists demand goods and services such as accommodation, food, transportation services and entertainment (among others) in the host country, and it is known that this put pressure on the current level of production, especially for developing countries, which needs to be increased to meet this demand. As a result, FDI flow in these countries to meet domestic resources constraints. Moreover, FDI will as well flow directly in the tourism sector in terms of investment in international chains of hotels (Tang *et al.*, 2007). Hence, tourism development also encourages FDI inflow.

For instance, the study of Craigwell and Moore (2008) investigated the relationship between FDI and tourism in SIDS by applying panel causality tests. The results obtained from the homogenous and instantaneous causality tests showed the existence of a bidirectional causal relationship between FDI and tourism development. However, this causality is not homogenous for the group of countries. Indeed, heterogeneous causality tests suggest that there exists a bidirectional causal relationship for only a small set of countries.

Similar results were obtained by Haley and Haley (1997). They found that FDI has the potential to boost the tourism sector as these investment flow in new tourist attractions and accommodations. The study also found a reverse causality from FDI to tourism. Another study on the tourism FDI nexus is by Sanford and Dong (2000) which examine the influence of tourism on new FDI in the USA. They applied the Tobit analysis and found a positive and significant relationship between tourism and FDI. This paper further assumed that there exists a one-way causality running from tourism to FDI and, therefore, did not investigated the possible role that FDI flows can have on stimulating the tourism industry in a particular region or country.

Another strand of literature examined the relationship between FDI in real estate and tourism development. The concept of repeat tourism has been highlighted by Fereidouni and Al-mulali (2014). They investigated the empirical link between FDI in the real estate sector and international tourism. Foreign investment in integrated resort schemes and residential estate schemes, resulted in an increased number of repeat tourists, with owners coming to the destination quite regularly with family and friends to benefit from their investment. The panel co-integration and panel Granger causality techniques applied to analyse both long- and short-run relationships for the case study of selected Organisation for Economic Co-operation and Development countries showed the existence of the long-run and a bidirectional causal relationship between FDI in real estate and tourist development.

Several papers investigated the relationship between FDI, economic growth and tourism development. For instance, the paper by Tang *et al.* (2007), studied the causal relationships among FDI, economic growth and tourism demand in China. They used the error correction model and found a bilateral causal relationship between tourism demand and economic

growth thus confirming the tourism-led growth hypothesis. More so, a one-way causality link from FDI to tourism demand was obtained from the results. Such findings were confirmed by Selvanathan *et al.* (2012) who used quarterly statistics from 1995 to 2007 for the case of India in a vector autoregressive framework. Other studies investigated the impact of tourism on the environment and vice versa. For instance, climate scientists have argued that temperatures have risen rapidly during recent years mainly due to an increase in the CO₂ emission. Global tourism is seen to be closely associated with climate change (Sunlu, 2003). Although tourism may be a cause of climate change, they may as well be discouraged to visit certain locations due to unfavourable climatic conditions. Seetanah *et al.* (2019) observed that climate change discourages tourists' arrival in both the short run and long run.

Overall, empirical studies overwhelmingly show that there is a positive link between tourism development and FDI. However, studies on the FDI-Tourism relationship are relatively scant for the case of developing and small island economies. The present study aims at investigating the short run, the long run, as well as the causal link between FDI and tourism development for small island economies by using innovative econometric techniques.

Overview of tourism and foreign direct investment in the sample of small island economies

The tourism sector proves to be crucial for small island economies as it is an avenue through which there are job creations and economic prosperity. With an increase in global tariff and trade rules, manufacturing industries are contracting, thereby making the tourism sector even more important for these islands. Referring to the number of tourists' arrival in a sample of islands (tourists' arrival has been used as the main variable in the methodology), it is noted that on average it has increased (Figure 1).



On average, total tourists' arrivals for the above list of islands have increased by approximately 117 per cent with islands such as Maldives, Cabo Verde, Vanuatu, Suriname and Mauritius registering more than 100 per cent increase in international tourist arrivals from 1995 to 2015.

Caribbean SIDS are the one receiving most of the FDI. The reason for this has been explained by their proximity to and economic dependence on the large North American market. However, SIDS located in Africa, Asia and Oceania experienced relatively stronger FDI growth during the 2000s, increasing their share in total FDI flows to the group from 11 per cent in 2001-2004, to 20 per cent in 2005-2008, up to 29 per cent in 2009-2013. FDI flows into the SIDS accounted for only 0.4 per cent of global FDI over the period 2001-2013. The ratio of inflows to current gross domestic product (GDP) during 2001-2013 was more than twice the average for other developing and transition economies. Foreign investments have been flowing mainly through investment in greenfield projects. Resource-rich countries such as Papua New Guinea, Trinidad and Tobago and Timor-Leste represented 63 per cent of such transnational corporations (TNCs) announced investments. TNCs from developing and transition economies have focused their interest mainly on Papua New Guinea, the Maldives, Mauritius and Jamaica, which together represented 89 per cent of those TNCs' total announced investment. Investment capital has been obtained mainly from FDI to develop the small islands (UNCTAD, 2013). The figure below shows the top five recipients of FDI in the SIDS for 2016 and 2017 (Figure 2).

4. Model specifications

The aim of the present study is to investigate the impact of FDI on tourism development for 17 island economies over the period 1995-2018. Based on the findings, implications for tourism futures will be discussed. The basic specification of the model is based on the principles of some earlier studies carried out by Samimi *et al.* (2013) and Fauzel *et al.* (2017). In this regard, the econometric models take the following functional form:

Model:

$$Tou = f(FDI, RGDP, WINC, CPI, POL)$$
(1)

The dependent variable is tourist arrivals^[2], and data is obtained from the World Tourism Organization, Yearbook of Tourism Statistics, Compendium of Tourism Statistics and data files. In terms of an independent variable, the focus is on FDI and it



is measured by FDI inflow as a percentage of GDP. Studies like Forsyth and Dwyer (2003) argued that foreign investment and know-how are considered to be of paramount importance in creating and upgrading tourism-related infrastructure and also in fostering additional investment in the tourism sector. As such, a positive coefficient is expected in the present instance. Moreover, tourism development is often regarded as a crucial element for economic growth and vice versa. The variable real GDP as proxied by RGDP is as well included. This variable shows the level of development in countries included in the study. Tourists also prefer to go to countries which are developed and have a high level of infrastructure. For instance, the tourism led growth hypothesis, as propounded by Louca (2006), Noriko and Mototsugu (2007) and Gani (1998), supports the positive relationship between international tourism and economic growth for small island economies.

Following Hanafiah and Harun (2010), the consumer price index (CPI) is included in the study as a measure of inflation. High prices in the countries will normally discourage tourists' arrival. However, if inflation is relatively lower compared to tourists' countries of origin, then it will attract them. Moreover, the income of tourists will as well influence tourists' arrival. The world GDP per capita (WINC) is used to account for the income of tourists. Data is obtained from the World Bank database.

Pollution (POL) is as well considered as a factor deterring tourists' arrival as discussed in the literature. For instance, following Ng *et al.* (2016), carbon dioxide emissions are used as a proxy in the current study to measure POL level.

The econometric specification can be written as follows:

$$InTOUt = \alpha_0 + \beta_1 InFDI_t + \beta_2 InRGDP_t + \beta_3 InWINC_t + \beta_4 InCPI_t + \beta_5 InPOL_t + \mu_t,$$
(2)

where *t* denotes the time dimension and the natural logarithm of the variables are used for the ease of interpretation (that is in percentage terms).

4.1 Panel unit root testing

Variables in a PVECM needs to be stationary. If they are non-stationary then the regression results will be spurious. Hence, if the variables are non-stationary, by differencing them, they will become stationary. The stationarity of the underlying variables is tested using panel unit root tests, namely, Im, Pesaran and Shin (1998) test.

4.2 Panel cointegration testing

Next step is to test for the existence of a long-run equilibrium relationship between the variables. Actually, non-stationary variables may deviate from each other in the short run. But the existence of co-integration will cause them to be associated in the long run as they share the same stochastic trends. If the series are co-integrated, the above equation will depict a long-run relationship. A heterogeneous panel co-integration test developed by Pedroni (1999) is used. Pedroni panel co-integration uses a residual-based Augmented Dickey Fuller test.

4.3 Error correction model

Because the series are co-integrated, an error correction model is being used. Engel and Granger (Granger, 1983; Engle and Granger, 1987) argued that the presence of co-integration eliminates the likelihood of the estimates being spurious as a result of omitted variable bias and endogeneity. The short-run properties of the series are observed using PVECM, specified as follows:

$$\Delta (Z_{xt}) = \varphi + \rho \Delta (Z_{xt-1}) + \theta_{xt}$$
(3)

where:

 Δ = The first difference operator;

- Z_{xt} = vector of the six variables used in this study;
- φ = vector constant term;
- ρ = (6x 6) matrix of parameters;
- Zxt-1 = vector of the six variables lagged by 1 year; and
- θ = the vector error term.

After obtaining the short-run estimates, the long-run relationship will be estimated using a PVECM model whereby apart from the two main variables of interest (LTOU and LFDI); the other control variables (LRGDP, LCPI, LWINC and LPOL) are also examined to investigate their influence.

5. Analysis of findings

Using the Im *et al.* (2003) panel unit root test, it was found that the series is stationary at their first difference This means that the series follows an I (1) process (results are included in Appendix). Because all the variables in the sample are integrated of order 1, the presence of long-run relationships among the variables is being tested. The results show the presence of co-integrating vector and thus it was concluded that a long-run relationship exists between tourist arrival, FDI, RGDP, world income, inflation and POL.

5.1 Long-run estimates

The long-run relationship is first analysed in the equations below. More stimulating insights on endogeneity issues and indirect impacts are made possible by using the dynamic approach.

5.2 Results from panel vector error correction model

$$InTOUt = 0.24^{*} + 0.03 InFDI^{***} + 0.09 InRGDP^{***} + 1.08 InWINC^{***} + 0.19 InCPI^{***} + 0.52 InPOL^{***},$$
(4)

where * indicates the significance at 10 per cent, ** significance at 5 per cent and *** significance at 1 per cent.

The equation of interest is equation (4) with tourists' arrival as the dependent variable. From the results reported, it can be found that the main variable which is In FDI have the expected influence on tourism development. Also, it is statistically significant implying that a 10 per cent increase in FDI results in a 0.3 per cent increase in tourists' arrival. This result is in line with Craigwell and Moore (2008) as well as Mustapha (2016). It is argued that FDI is an important route through which developing countries can boost their tourism sector. Indeed, FDI provides the required inputs such as capital and infrastructure, for example, international airports, highways, hotels and modern technologies which are important for tourism development. Therefore, foreign investment is a crucial element for the development of the tourism sector for developing countries including island economies.

Though the main objective of this paper is to investigate the link between tourists' arrival and FDI, the effect of other macroeconomic variables on tourism development is as well studied. The variable RGDP is also of interest. For instance, it is noted that the coefficient RGDP is positive and significant. This implies that apart from FDI influencing tourism development, it

is observed that economic growth can as well increase tourists' arrival in the long run. This finding is in line with Shakur *et al.* (2017). In fact, the more the country do well the more stable and sounds are the economic, social and political situations. As a result of this, more tourists will visit the country.

The coefficient relating to the world income gives information on the link between tourists' arrival and tourists' income. Referring to the results, it is noted that the result is positive and significant as expected. Hence, the higher their income the more will be the demand for tourism activities. The result supports this concept. On the other hand, inflation in the islands is expected to have a negative impact on tourism demand. However, it is seen that even with high prices in the country, tourists are not discouraged to travel. This can be explained by the fact that prices are lower in the destination countries compared to the tourists' countries of origin. Regarding the POL variable, again it can be seen that it does not deter tourists' arrival in the countries included in the sample.

Investigating the existence of reverse causation, the FDI equation is analysed. The results are shown below:

$$InFDIt = -709.21 + 29.85 InTOU^{***} - 2.68 InRGDP^{***} - 32.28 InWINC^{***} - 5.74 InCPI^{***} - 15.44 InPOL^{***},$$
(5)

where * indicates the significance at 10 per cent, ** significance at 5 per cent and *** significance at 1 per cent.

It is found that reverse causation exists as well as tourism growth appears to be also a determinant of FDI. It is found that a 1 per cent increase in tourists' arrival results in 29.85 per cent increase in FDI inflow. It, therefore, implies that tourism development of the countries plays an important role in attracting FDI thus supporting a bi-causal and reinforcing relationship between tourism development and FDI. More so, it is observed that there is a negative link between FDI and the host countries' inflation. Countries with fast growth in prices discourage FDI inflow.

5.3 Short-run estimates

The short-run dynamics are examined via the PVECM approach.

Table I is a composite table, where each column can be viewed and analysed as an independent function, that is, each column in the table corresponds to an equation in the PVECM. The variable named in the first cell of each column is viewed as the dependent variable. The estimated coefficient of the explanatory variables is reported in the cells.

Analysing the short-run results in Column 2 that is the equation having D (LTOU) as the dependent variable it is found that the coefficient FDI is positive but not significant. This can

Table I Short-	run results					
Error correction	D(LTOU)	D(LFDI)	D(LRGDP)	D(LWINC)	D(LCPI)	D(LPOL)
CointEq1	0.001049	-0.225348***	6.136761***	0.034880***	2.733720***	-0.133912***
D(LTOU(-1)) -	-0.155653***	0.664248***	-2.307232	-0.010880	7.293618***	0.425130**
D(LFDI(-1))	0.000650	-0.417790***	-0.716228***	0.044470	-0.088849***	0.155295**
D(RGDP(-1))	0.007522***	0.015440***	-0.033002	-0.001572***	0.152847***	-0.017760***
D(CPI(-1))	0.005499***	-0.109486***	-0.215055***	-0.000983	0.035216	-0.009942
D(WINC(-1))	0.766490***	0.353976	16.28471***	0.328726***	1.700514***	-0.398470***
D(LPOL(-1))	0.087231	0.257197	4.730482	0.038236	2.933363	-0.261892
C	0.017310	0.013728	-0.586340	0.032273	–0.380880	-0.003343

be explained by the fact that this coefficient takes time to have its full effect on tourists' arrival. A close look at the results gives further useful insights on the possible determinants of tourists' arrivals. For instance, it is noted that in the short-run economic growth as measured by RGDP is a determinant of tourism development. Apart from this, the income of tourists as measured by the world income is as well seen to influence tourism development in the island economies. However, an insignificant relationship is observed for the variable POL in the short run.

Also, the estimates of the PVECM help to make further analysis of the results. Analysing the fourth column with RGDP as the dependent variable, another link is observed. For instance, it is noted that higher inflation reduces economic growth in the sample of countries considered under this study. Inflation refers to an increase in the price level and as price increases, there is a reduction in purchasing power of money. As a result, consumption falls and therefore GDP decreases. The results in the above table show that a 1 per cent in inflation reduces GDP by 0.21 per cent. This result is similar to Barro (1995). Finally, referring to the last column, it can be observed that an increase in tourists' arrival increases the level of POL in the SIDS countries. This finding is in line with numerous studies such as Ng *et al.* (2016), Arbulú *et al.* (2015) and Katircioğlu (2014).

6. Conclusion

By using the PVECM method, this empirical study investigates the link which exists between FDI and tourism development in a selected group of 17 island economies during 1995-2018. The motivation for this investigation comes from the mixed results obtained on the FDI-tourism nexus in the few papers that exist for developing countries. This study is believed to add to the literature on this topic and further deepen the understanding of the link between FDI and tourism development. The results show that FDI has eventually led to an increase in tourists' arrival in the long run. Furthermore, economic performance and income of tourists are seen to be a key determinant of tourists' arrival in the long run. Furthermore, bidirectional causality between FDI and tourism development is obtained for the long run.

Also, tourism has become the main economic activity for many SIDS, and thereby creating much employment and generating an inflow of foreign exchange earnings. To enhance tourism development in the future, more foreign investors should be attracted. Scholars support the view that FDI provides substantial financial capital, technological know-how and managerial expertise to the host economies. These investors are also important for economic growth. The findings emanating from this paper also support this argument. Moreover, it was found that FDI contributes to tourism development. FDI also has the potential to provide more advanced services in the tourism sector as these firms invest a lot in R&D and come up with innovation. Hence, there is a need from policymakers to intervene and implement various policies to attract FDI. These can be in terms of reducing restrictions on FDI as well as providing a better environment for boosting these investments. For instance, policies towards improved ease of doing business, relatively flexible labour markets, as well as the protection of intellectual property rights, are crucial. Hence, more FDI will boost the tourism sector in the future. Incentives to attract tourism-related FDI include grants or loans at preferential rates to these investors, tariff exemptions; tax holidays. Public-private partnerships, as well as the government financing infrastructure and underwrites investment. In addition to that, the establishment of investment promotion centres will be beneficial. Other policies include joint ventures between domestic and foreign investors' as well as multinational corporations (MNCs) in build and operate programmes. Furthermore, MNCs should be able to manage, lease or own hotels. Trade fairs for tourism and investment as well as training schemes for tourism employees will prove to be important. Moreover, policymakers can as well target policies directly in the tourism sector. For instance, the creation of a marketing plan is crucial and targeting

marketing segments will help here. All the above-mentioned policies will help the development of the tourism sector in the future. Moreover, sustainable tourism management in these countries will further help in the development of this key sector. There is a need to consider the environmental aspect as well to ensure that there is sustained economic growth contributed by the tourism sector. Hotels need to adopt best practices system to ensure sustainable development of the tourism sector in the future.

Notes

- 1. http://unohrlls.org/custom-content/uploads/2013/08/SIDS-Small-Islands-Bigger-Stakes.pdf
- 2. Due to lack of data more variables could not be included.

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Appendix

Table Al	Results of panel unit root tests	
Variable		IPS unit root test (p-value)
LTOU		0.6325
Δ LTER		0.0000
LFDI		0.4595
Δ LFDI		0.0000
LGDP		0.6655
Δ LGDP		0.0431
LWINC		0.9952
Δ LWINC		0.0000
LCPI		0.1557
Δ LCPI		0.0000
LPOL		0.7292
Δ LPOL		0.0000

About the author

Dr Sheereen Fauzel is a Senior lecturer at the University of Mauritius. Having completed a PhD in International Economics from the University of Mauritius, a Master's degree in Banking and Finance and a Bachelor degree in Economics and Finance, her areas of expertise are International Economics, development economics and related areas. She has participated in international conferences and has publication in notable international journals of business and economics. She is a reviewer for a number of refereed journals including Current issues in Tourism and Journal of Hospitality Marketing and Management among others. Sheereen Fauzel can be contacted at:s.fauzel@uom.ac.mu

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