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Economic Consequences of Tourism Specialization

Ubay R. Pérez Granja

Dirigida por:
Ofelia Betancor Cruz
Juan Luis Eugenio Martín

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Ubay R. Pérez Granja	Juan Luis Eugenio Martín	Ofelia Betancor Cruz

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Introducción

El turismo ha estado creciendo sin descanso durante las últimas décadas. Actualmente el turismo internacional es una de las mayores exportaciones a nivel mundial sólo por detrás de los combustibles y los productos químicos. Es por ello que el turismo se ha convertido en un elemento clave de la economía mundial. Este sector perteneciente a la rama de los servicios presenta una serie de particularidades que lo diferencian de otros sectores. El turismo es intensivo en factor trabajo, que no puede transportarse, sino que exige que el consumidor vaya al destino para consumirlo. Esto último vincula al turismo con el transporte de pasajeros, que a su vez presenta una estructura de mercado diferenciada en los destinos turísticos masivos. A su vez, muchas regiones especializadas en turismo suelen ser regiones pequeñas con escasa diversificación productiva y que necesita importar gran parte de los bienes que consumen, lo que presiona el tipo de cambio y los precios de los bienes importados. Además, a medida que aumenta la renta de los turistas estos ejercen también presión sobre el precio de los bienes domésticos. Estas entre otras cuestiones son las que convierten al turismo en un campo de estudio interesante al que merece la pena dedicarle tiempo de investigación.

Objetivos y estructura de la tesis

Esta tesis doctoral se realiza con el fin de profundizar el conocimiento en Economía del Turismo, así como iniciar una carrera investigadora en esta rama de la ciencia económica. La literatura actual en el campo del turismo está muy centrada en la gestión, donde el análisis económico tiene un espacio relativamente residual en comparación. Sin embargo, la especialización en turismo tiene una serie de implicaciones económicas que merecen la pena ser estudiadas y que son la motivación fundamental de esta tesis donde se presentan algunos ejemplos de estos efectos.

Para lograr el citado objetivo, esta tesis opta por afrontar diferentes preguntas de investigación dentro de la economía del turismo que ponen de manifiesto los impactos y las consecuencias económicas que algunas regiones afrontan con la especialización en turismo. En concreto, esta tesis se ha centrado en analizar tres elementos claves en economías turísticas: el transporte aéreo, la productividad y los efectos sobre el tipo de cambio.

La tesis consiste en 3 artículos publicados en revistas indexadas en el Journal of Citation Report (JCR) todas ellas ubicadas en los primeros dos cuartiles, concretamente uno en Journal of Travel Research (D1 en Tourism and Hospitality y A* en el ABDC Journal Quality List) y dos en Tourism Economics (Q2 en Economics y A en el ABDC Journal Quality List). Estos tres artículos plantean diferentes problemas relacionados con la economía del turismo y las particularidades de especializarse en este sector.

¿Han expulsado las aerolíneas de bajo coste a las aerolíneas tradicionales y chárter en destinos turísticos?

El primer artículo analiza el mercado del transporte aéreo en rutas que conectan con destinos turísticos usando los principales aeropuertos de Canarias y el aeropuerto de Málaga como caso de estudio. Tras finalizar el proceso de liberalización del transporte aéreo en Europa en abril de 1997, el sector sufrió un cambio de paradigma en la operación de servicios de transporte con la entrada de las aerolíneas de bajo coste. Estas aerolíneas disponían de un modelo de negocio inspirado en la aerolínea americana Southwest. Este modelo, al contrario del de las aerolíneas de servicio completo basado en un sistema "hub and spoke" con aeropuertos grandes y principales como ejes centrales como base, operaban vuelos punto a punto usando aeropuertos secundarios. El modelo de negocio de estas compañías ofrece, además, ventajas en términos de costes que se transforman en billetes generalmente más baratos.

Una parte importante de la literatura tradicional analiza cómo las aerolíneas de bajo coste irrumpieron en el mercado, comparando su operación con las clásicas aerolíneas de servicio completo. Sin embargo, en destinos turísticos estas aerolíneas no suelen tener tanta relevancia, especialmente si hablamos del transporte internacional de pasajeros. En su lugar, las principales operadoras son las llamadas chárter. Estas compañías están fuertemente vinculadas al desarrollo del turismo internacional en los destinos turísticos, y en los años previos a la liberalización eran estas las aerolíneas de bajo coste tradicionales. Estas aerolíneas, que en destinos turísticos tienen una fuerte vinculación con los turoperadores, e incluso pueden ser de su propiedad, dominaban el transporte internacional de pasajeros hacia los destinos turísticos. Sin embargo, con la irrupción de las llamadas operadoras de bajo coste, esta estructura de mercado establecida ha podido sufrir cambios. Para realizar este estudio se han tenido en cuenta dos mercados de origen, el británico y el alemán, que se caracterizan por tener comportamientos diferenciados en sus preferencias de aerolíneas.

Este estudio pretende analizar el impacto que la entrada de las aerolíneas de bajo coste tuvo sobre las chárter, y en menor medida sobre las de servicio completo. Para ello se utilizan modelos multivariables de series temporales estructurales también llamados modelos de componentes no observados. Estos modelos funcionan como un prisma en el que una serie temporal se descompone en sus elementos principales (nivel, pendiente, estacionalidad, y/o ciclo). Además, estos modelos permiten el uso de intervenciones. Las intervenciones no son más que eventos que afectan a la serie temporal y que pueden ser modelizados de diferentes maneras (intervenciones en pendiente, intervenciones en nivel o intervenciones puntuales). Esto nos permite analizar si se ha producido un cambio estructural en la serie de tiempo debido a un evento como, por ejemplo, la entrada de una nueva compañía. Además, en la versión multivariable, las series temporales están relacionadas a través de sus términos de error, lo que nos transmite información sobre su relación en el largo plazo (correlaciones en los componentes del nivel), como en el corto plazo (correlaciones en los componentes estacionales).

Los principales resultados de este estudio muestran que existe una fuerte discrepancia en los efectos de la entrada de aerolíneas de bajo coste entre los mercados de origen. Sin

embargo, en términos generales, el comportamiento de cada mercado de origen es muy similar para los distintos destinos turísticos. En el caso británico, se observa claramente que las aerolíneas de bajo coste han entrado de una manera muy intensa al mercado. Esto ha provocado un efecto expulsión de las operadoras de servicio completo debido a la irrupción de las compañías de bajo coste. Este efecto se observa parcialmente con las aerolíneas chárter, que si bien no han sido expulsadas del mercado, sí han visto reducido su volumen de pasajeros. Además, las correlaciones de nivel muestran una relación negativa, lo que implica que las líneas aéreas de bajo coste están poco a poco reemplazando a las chárter en este mercado. Por el lado contrario, para el mercado alemán no se ha producido ese efecto expulsión, de hecho, en este mercado la irrupción de las aerolíneas de bajo coste en los viajes turísticos ha sido mucho menos intensa que en el mercado británico.

Por último, también se analizaron dos salidas (una en cada mercado) de grandes compañías, Monarch Airlines en el mercado británico y Air Berlín en el mercado alemán. Los datos muestran que la mayor parte de los pasajeros que dejan de volar por la salida de estas operadoras no son absorbidos por otras líneas aéreas. Esto podría abrir el camino hacia políticas orientadas a la conservación de rutas/frecuencias o incluso a la generación de incentivos para cubrir la pérdida de asientos en caso de una nueva salida del mercado.

Analizando la productividad por trabajador y sus consecuencias económicas en los dos archipiélagos españoles

El segundo artículo analiza la productividad por trabajador y sus efectos económicos en las provincias españolas haciendo especial énfasis en los dos archipiélagos. Canarias y Baleares se caracterizan por tener más de un tercio de sus economías vinculadas al turismo. La productividad es un factor clave para un crecimiento económico sostenido en una región. Sin embargo, el turismo es habitualmente señalado como un sector de baja productividad debido a su estructura intensiva en factor trabajo. Esto implica unos bajos niveles de capital por trabajador y escaso cambio tecnológico que limitan dicha productividad. Esta situación produce lo que se denomina un “mal de costes” en el que los costes en el sector servicios crecen. Este “mal de costes” combinado con el incremento de los precios derivado que usualmente acompaña al crecimiento económico, puede reducir la competitividad del sector haciéndolo especialmente vulnerable a la aparición de destinos emergentes más económicos. La especialización en turismo, a su vez, afecta a la estructura productiva de las regiones, donde frecuentemente relega al sector industrial a un papel menor. Eso provoca una fuerte dependencia del sector turístico dificultando un cambio de estructura productiva si el turismo pierde fuerza. Es por ello que el análisis de la productividad por trabajador en sectores turísticos, así como sus impactos económicos, son un interesante objeto de estudio con escasa evidencia en la literatura.

Este estudio pretende aportar a la literatura analizando el efecto de la productividad por trabajador y sus efectos económicos en los dos archipiélagos españoles. Para ello se realiza un análisis de fronteras estocásticas para datos de panel. Las fronteras estocásticas son una herramienta econométrica que permite estimar la frontera de posibilidades de producción de cualquier unidad de medida que se pretenda analizar (empresas, provincias, países...). El modelo utilizado incluye además, variables para diferenciar el cambio tecnológico de las provincias más industrializadas y las dos regiones turísticas españolas, así como el impacto del empleo indefinido sobre la productividad. En una segunda etapa a través de la salida del modelo de fronteras estocásticas, se estima la productividad total de los factores para poder calcular de manera más precisa la productividad por trabajador de las distintas regiones.

Finalmente, en una tercera etapa se estima un modelo de equilibrio general computable en el que se introducen como inputs los resultados del modelo de fronteras estocásticas con el fin de estimar los efectos de la productividad sobre la economía regional de los dos archipiélagos españoles.

Las principales conclusiones de este estudio reflejan que, en términos generales, la productividad por trabajador en España para el periodo de estudio ha sido baja, pero esta ha sido aún más modesta en los dos archipiélagos turísticos. Además, se reafirma la hipótesis de que el cambio tecnológico en estas regiones es significativamente inferior que en las regiones más industriales. Esto sumado a la incipiente competencia de destinos como Turquía, Túnez o Egipto, plantean la necesidad de estudiar políticas para ganar competitividad. Mientras que el cambio tecnológico es una política deseable, esta es principalmente una decisión a nivel de empresa en la que el sector público tiene un margen de actuación limitado. Sin embargo, este estudio muestra el papel de la dualidad del mercado de trabajo en la productividad. Una reducción en la tasa de temporalidad produce ganancias de productividad. Una simulación realizada a través de un modelo de equilibrio general, muestra que, si los archipiélagos españoles tuvieran una tasa de temporalidad idéntica a la media de las regiones industriales del país, se hubiese producido un crecimiento económico significativamente mayor que el actual. Sin embargo, debe tenerse en cuenta el alto nivel de desempleo del que adolecen los dos archipiélagos, por lo que es crucial la elaboración de políticas que persigan tanto la reducción del desempleo como la reducción de la temporalidad.

Política monetaria y régimen cambiario en islas turísticas.

El tercer artículo versa sobre el impacto del turismo en la política monetaria ejecutada por el Banco Central del país. Para ello se han analizado tres países: Cabo Verde, Seychelles y Mauricio. Estos tres países son pequeños archipiélagos que, en general, padecen una escasez de recursos y una estructura productiva poco diversificada. Además, estos países comparten unas condiciones geográficas y culturales comunes. Los tres son archipiélagos localizados en África que fueron colonias europeas y que aún mantienen unas fuertes relaciones económicas con el viejo continente, lo que implica que tienen cierto grado de aislamiento con sus principales mercados. En el caso de Seychelles y Mauricio, la transición hacia una economía turística se inició en los años setenta mientras que Cabo Verde se encuentra actualmente en medio de dicha reconversión. Esta relevancia del turismo, sin embargo, no está desconectada de la política monetaria. Dado que el turismo es un sector no transable, el crecimiento del turismo presiona el tipo de cambio real de estos países. Además, a mayor renta de los turistas internacionales, se ejerce también una mayor presión sobre los precios locales. Estos países, además, suelen tener una fuerte dependencia de las importaciones dada su escasa diversificación productiva, lo que limita el crecimiento económico debido a que parte de los ingresos turísticos se usan para importar productos. El turismo, sobre todo en destinos emergentes, se desenvuelve en un entorno de demanda muy volátil. Esta volatilidad puede tener implicaciones en el tipo de cambio y a su vez en la inflación y en la competitividad de las exportaciones.

Este estudio analiza las implicaciones de un shock en la demanda turística sobre cuatro políticas monetarias diferentes para Cabo Verde, Seychelles y Mauricio. Para ello se emplea un modelo de equilibrio general dinámico estocástico. Este tipo de modelos son ampliamente utilizados en el análisis de la política monetaria, pero nunca habían sido usados para analizar la respuesta de ésta a un shock en el sector turístico en una región eminentemente turística. Los modelos de equilibrio general dinámicos estocásticos son

una corriente relativamente nueva de los modelos de equilibrio general, donde en lugar de programación lineal para alcanzar el óptimo, se usa el análisis econométrico para estimar parámetros. El proceso de estimación de este tipo de modelos se realiza en dos etapas. En primer lugar, varios modelos AR (1) de la economía extranjera son estimados para calibrar sus respectivos parámetros. A continuación, dichos parámetros y sus correspondientes ecuaciones se introducen en un modelo de equilibrio general dinámico estocástico donde una serie de parámetros estructurales son estimados mediante una regresión bayesiana. Finalmente, el estudio analiza la respuesta monetaria óptima a un shock turístico. Para ello, cuatro políticas económicas son consideradas, la primera de ellas es un tipo de cambio fijo convencional, y las tres siguientes consisten en políticas monetarias de control de la inflación. En primer lugar, una política de control de la inflación tradicional, en segundo lugar, una política de control de la inflación con un tipo de cambio controlado y en tercer lugar una política de control de la inflación de los productos importados.

Los resultados de este trabajo muestran que los problemas tradicionales asociados al turismo, como una apreciación del tipo de cambio real no pueden evitarse en ninguna de las cuatro políticas monetarias analizadas, sin embargo, el tipo de cambio fijo tradicional se revela como la opción en la que estos efectos son menos intensos. A su vez, las políticas de control de la inflación con un tipo de cambio controlado, y la de control de la inflación de los productos importados, son las que muestran una mayor sensibilidad al shock turístico para los tres países analizados. Por otro lado, la política de control de la inflación tradicional muestra unos resultados a medio camino, pero más próximos al resto de políticas de control de la inflación. Analizando las diferencias por países se observa que, en general, Cabo Verde es significativamente más sensible a un shock turístico que el resto de los países analizados, mientras que Mauricio, que presenta una economía más diversificada, es el país menos sensible a estos efectos.

Conclusiones

Los tres artículos contenidos en esta tesis ponen de manifiesto la relevancia del turismo en la economía y la importancia de tener en cuenta las particularidades del sector a la hora de realizar análisis económicos. Esta tesis doctoral se ha realizado con el objetivo de profundizar en el conocimiento de algunos aspectos de lo que conforma la economía del turismo realizando aportaciones a la literatura. Los trabajos incluidos en esta tesis ayudan a una mejor comprensión de las economías especializadas en turismo. Estas economías presentan ciertas particularidades inherentes a dicha especialización que justifican un análisis específico. Los resultados contenidos en esta tesis ponen de manifiesto algunos problemas a los que se enfrentan estas economías como: i) la debilidad del transporte internacional de pasajeros, muy dependiente de aerolíneas muy sensibles ante cambios en la demanda; ii) La baja productividad y alta tasa de temporalidad en las regiones turísticas; y iii) la dependencia del turismo como fuente de divisas y sus efectos en la política monetaria. Estos resultados son especialmente relevantes en un contexto como el actual en el que la demanda turística está virtualmente a cero en muchos mercados turísticos. Actualmente nos encontramos en una situación en la que las aerolíneas están solicitando ayudas públicas para evitar el cierre. El cierre de una aerolínea, como se recoge en el primer artículo de la tesis podría implicar una pérdida de turistas que no se recuperaría ni si quiera en el medio plazo. La baja demanda turística además afecta negativamente a la contratación estacional de empleados temporales en el sector turístico. Además, la incertidumbre podría trasladarse a un aumento de las tasas de temporalidad en las nuevas contrataciones, por lo que la productividad futura podría verse mermada, y con ello el crecimiento económico. Por último, en aquellas regiones turísticas con autoridad de la política monetaria, un parón

turístico corta de raíz la principal fuente de divisas internacionales. Esto en un contexto de regiones aisladas y muy dependiente de las importaciones afecta muy negativamente a la balanza de pagos de estos países, aumentando considerablemente su deuda externa.

Introduction

Introduction

The relevance of Tourism

Tourism has been growing non-stop during the last decades. According to the World Bank database the number of international tourism arrivals had grown from over 532 million arrivals in 1995 to 1441 million in 2018. Moreover, the international tourism receipts which are the measure of the tourism direct expenditure grew from over 485,000 million US$ to 1,649,263 million US$ during the same period. This means that international tourist arrivals increased over a 170% and international tourism receipts as much as 239% in just 23 years. However, the distribution of tourism is not homogeneous across the different countries. According to the World Tourism Organization (2019) the top 10 destinations receive 40% of international arrivals and 50% of international tourisms receipts. This growth of the international tourism has fostered tourism as the 3rd main good or service export worldwide, only behind chemicals and fuel (UNWTO, 2019). However, these numbers describe a significant part of the tourism, but not the whole picture. In addition to the international tourism, there is the domestic tourism phenomenon which, in fact, represents a significant part of the total tourism. According to the World Travel and Tourism Council (WTTC, 2020), the total contribution to the GDP of the tourism activity was about a 10.3% globally in 2019. Moreover, in terms of jobs about 10% (330 million jobs) of the total jobs and 25% of the new jobs created in 2019 are related to tourism. Pre-Covid19 forecasting of the WTTC estimates a growth rate over 11% in both GDP and jobs for the year 2030. These numbers manifest the increasing relevance of tourism, evidencing an interesting field for the economic research.

Tourism economics

There are several aspects of the tourism activity that can be studied from an economic perspective. Economics can provide some insights from both, the demand side, and the supply side. On the supply level, for example, it can be analysed if a destination is operating at its optimum capacity or, on the contrary, if there is a lack or an excess of capacity. Moreover, it can be analysed the efficiency of the tourism supply and the level of productivity of the tourism activity. This can help to compare the performance among firms or even regions (e.g. are the tourism regions less productive?) to understand how these measures can be improved.

On the demand side, widely used economic tools such as the time series analysis can be applied to analyse and forecast the tourism demand. This analysis can be also used to understand the changes in the tourism demand derived from certain events that changed the market structure (e.g. how can the entrance of a new airline impact the market?). Additionally, the use of economics can help to understand the reason for the travel decisions, the destination choice, or the length of stay.

Due to the relevance of the tourism activity, the analysis should not only be focused on the implications for the tourism sector, but also on the impacts and spillovers effects of the tourism activity on the rest of the economy. In terms of GDP, there are three different levels of implications of the tourism activity. The first one is known as the direct contribution to GDP, which is associated with the direct expenditure that tourists make in a destination. The second level is the indirect contribution to GDP, which is composed of intermediate goods that must be produced to fulfil the needs of the tourism supply. The third level is the

induced contribution to GDP, which is composed of the income (labour and capital earnings) increase derived from the tourism activity and is going to be used for consumption or investment (savings). Additionally, the tourism specialization has significant implications to the economic structure, for example, in the labour markets. Tourism labour markets tend to have a significant percentage of temporary jobs which affects the total productivity and in consequence, the level of output (GDP) that can be obtained given the available inputs. Thus, some questions arise at this moment (e.g. how is the economic impact of the tourist regions in comparison with other regions?).

Moreover, there is not only implications at GDP level or employment, but tourism specialization can also produce externalities in the economy. For example, the tourism activity implies a reception of foreign currency that can produce in the region that is known as "Dutch disease". This means that the tourism success can increase the local prices and reduce the economic competitiveness in the rest of the local economy. Thus, there can be negative effects that can diminish the overall effect of the tourism activity in the economy. This interaction of tourism activity with the rest of the economy opens up several interesting questions that can be researched (e.g. what is the role of the monetary policy in the economic impact of tourism?).

Objective and structure of the thesis

The tourism research has been growing significantly during the last decades. Nowadays there are 26 tourism and hospitality journals in the Journal of Citation Report (JCR). However, on the contrary to the transportation journals, which analyses a sector that has a significant relationship with tourism, the economic analysis is still residual in tourism. In fact, only one journal is included in both, tourism and hospitality and economics. Thus, most of the tourism literature is oriented to the management field. This gap in the tourism research agenda generate a great opportunity for economists that want to analyse the implications of the tourism in the economic activity.

The main objective of this doctoral thesis is to deepen the knowledge in Tourism Economics and specifically, about the impact and the consequences of tourism specialization in the economy. The tourism specialization can influence the economies in several ways. For the elaboration of this thesis, three different aspects have been analysed: transportation, labour markets and productivity, and monetary policy. They are an example of how tourism-led economies and other economies differ. In the air transport market, tourism-led economies are dependent on tour operators and low-cost carriers while other economies have full-services carriers dominating their routes. Moreover, the relevance of international routes is usually more significant in tourism-led economies. This means that the air transport market is more vulnerable to downturns in international demands in tourism-led economies than in other economies. Attending to the labour productivity of tourism-led economies, the literature has shown that tourism is a low productivity sector. The productivity is linked to economic growth, this means that a gap could be appearing between tourism-led and other economies in terms of economic growth. Moreover, tourism economies are characterized in general by a higher level of temporary contracts which in fact, negatively affects the labour productivity. Finally, in tourism-led economies, the tourism activity is the main

source of foreign currencies. Moreover, these countries usually have a poorly diversified economy which is related to a high level of import dependence. This means that tourism is a necessary activity in order to be able to reduce or even avoid the negative impacts of an increasing external debt. For this reason, the influence of tourism on the economy provide relevant information necessary to apply the right monetary policy.

This thesis focuses on the economic approach of some of the aforementioned questions by employing theories and methodologies of the economic literature applied to the tourism field. The thesis is composed of three published articles in journals indexed in the Journal of Citation Report (JCR) being all of them on the upper half of the distribution in the ranking. One is published in the Journal of Travel Research (D1 in JCR in Tourism and Hospitality and A* in the ABDC Journal Quality List) and the other two are published in Tourism Economics (Q2 in JCR in Economics and A in the ABDC Journal Quality List). All the articles analyse the economic consequences of different research questions applied to tourism markets.

The first paper presented analyses the competition in the air transport sector in tourism regions by considering the Canary Islands and the province of Malaga as case studies. After the air transport liberalization in Europe, the entrance of the Low-Cost Carriers (LCC) changed the existing paradigm in the sector. However, the air transport literature has been focused on the interaction between full service airlines and LCC. This paper focuses its analysis on the interaction with some other air carriers that have been monopolizing the trips to tourism destinations, the airlines owned by tour operators which in fact were the traditional LCC airlines before the new paradigm in the air transport sector arised. The paper analyses how the productive structure of air transport from the main origin markets to tourism destinations has been affected by the entrance of successful game changers LCC such as Ryanair, easyJet and Je2.com. In order to do so, the paper presents a time series analysis by employing a methodology known as Structural Time Series Modelling (STSM) or Unobserved Components. This methodology consists in the use of Kalman filters to decompose the original time series into its unobserved components (level, slope, seasonal and/or cycle components). This methodology allows for the use of intervention/s to analyse certain events such as the irruption of a new airline or the exit of an incumbent one.

The second paper focuses on the regional labour productivity in tourism in Spain and particularly, the differences between the two Spanish archipelagos with a tourism-led economy and the rest of the Spanish regions, specifically those with a more industrial-led productive structure. The paper also analyses the role of the labour market structure studying the impact of the permanent and temporal jobs in the economy. To measure the labour productivity a two-stage procedure is considered. On the first stage, a stochastic frontier model of the Spanish provinces is estimated. On the second stage, the total factor productivity is calculated by using the model output. Moreover, given the difference between the touristic archipelagos and the industrial-led provinces in terms of labour structure, a computable general equilibrium is calculated. This model shows the actual impacts of the productive structure of the two archipelagos. Additionally, a second general equilibrium model is estimated by simulating the labour market structure of the industrial-led regions in the touristic islands to measure the difference in the economic impacts.

The third paper study the role of the monetary policy on tourism regions. The role of the monetary policy has been broadly studied in the macroeconomics literature. However, to our knowledge there are no literature about the impacts of the monetary policy in tourism destinations. For this paper, small isolated developing states (SIDS) in Africa were selected.

These countries have in common that they are all small archipelagos, with a barely diversified economy. These economies are far from their main markets (mostly the European markets) and they have a huge necessity of imports. For these countries, tourism can be a logical mechanism to foster development. However, due to the presence of externalities, tourism can have significant consequences on the monetary policy and its objectives. This paper employs a Stochastic Dynamic General Equilibrium to analyse four different monetary policies when addressing a 'tourism demand shock'.

As it has been mentioned, the thesis focuses on the analysis of the impacts and consequences of tourism specialization on the economy. On each one of the research papers included in this doctoral thesis, a gap in the literature has been identified. Several methodologies have been employed in order to provide relevant answers to the questions investigated. The final product is a doctoral thesis composed by three peer reviewed papers already published in journals indexed in JCR.

From this point onwards the thesis is structured as follow:

- Section 3 contains the paper: Have Low Cost Carriers Crowded Out Full Service and Charter Carriers in Tourism Destinations? A Trivariate Structural Time Series Analysis.
  (see published version in https://doi.org/10.1177%2F0047287520910801)

- Section 4 contains the paper: Analysing labour productivity and its economic consequences in the two Spanish tourist archipelagos.
  (see published version in https://doi.org/10.1177%2F1354816620917865)

- Section 5 contains the paper: Monetary policy and exchange rate regime in tourist islands
  (see published version in https://doi.org/10.1177%2F1354816620959496)

- Section 6 Main conclusions

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Have low cost carriers crowded out full services and charter carriers in tourism destinations?

A trivariate structural time series analysis

Have low cost carriers crowded out full services and charter carriers in tourism destinations?

A trivariate structural time series analysis

Authors:

Juan Luis Eugenio-Martín
Ubay Pérez-Granja

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Abstract

Long-haul tourist arrivals depend on the airline market, its size, and the degree of competition. This paper studies the entry and exit of full service carriers (FSCs), charter carriers (CCs) and low cost carriers (LCCs) from two origins: the United Kingdom and Germany, and five sun-and-beach destinations in Spain. The relationship among all types of airlines is captured with a trivariate structural time series model to disentangle the airlines' responses under common shocks of airlines' entry and/or exit and provides estimates of immediate responses and indicators of responses over time. The results demonstrate that in the British market, the entry of LCCs has crowded out FSCs and CCs. However, in the German market, the results are heterogeneous and overall do not support the existence of such crowding out effect.

Keywords: Low cost carriers; LCCs; Structural time series; crowding out; airlines; competition;

Introduction

At the end of the 20th century, air market liberalization and the advent of the internet transformed the international tourism market. Before that, the international air market was mainly run by flagship airlines, mostly owned by the public sector. International flights connected the main capital cities, and stopovers were necessary to fly regionally. Such traditional full service carriers (FSCs) are based on hub–spoke networks that offer high frequencies to and from the hub airport. Thus, FSCs can offer connected flights among the different nodes of the network and are characterized by geographical concentration around the hub, which boosts the number of passengers flying with stopovers (Pels, 2008). Nowadays, most FSCs belong to an airline alliance, which allows for passenger and baggage transfers among the flights of all its members. FSC flights usually offer frills such as food, beverages, and cabin classes, which requires a system of different fares driven by revenue management. These carriers have a diversified fleet of airlines to cater to the characteristics of each route.

Charter carriers (CCs) were created because some tourism destinations were located far from capital cities, and the travel time and cost to reach them were too high for tourists. These flights were characterized by nonscheduled flights. Pels (2008) referred to charter flights as "the original low cost carriers," with a high seasonality component and a lower cost than the traditional legacy carriers. Together with charter flights, tourists were provided with bundled services such as accommodations, meals, transportation, and excursions. Most of the market power was held by travel agencies, the main distribution channel at the origin. There was also a high degree of vertical integration among the charter airlines and tour operators (e.g., Lobbenberg, 1995; Williams, 2001 or Parton and Ryley, 2012). This integration responds to the essential driver of cost-efficiency because of the intense competition among the big tour operators. This phenomenon has resulted in a charter market that has a low profit margin and is susceptible to downturns in demand, especially for smaller airlines (Parton and Ryley, 2012). Modern CCs regularly fly leisure routes to achieve economies of density.

Air transportation liberalization in Europe began in the 1970s. However, the liberalization started progressively, with the first package of policies in December 1987, and a second package in 1990, which allowed the designation of new airlines but maintained capacity restrictions and bilateral agreements. The key measures were implemented with the approval of a third package in 1993, for example, the freedom to set airfares according to commercial criteria (see Morell, 1998, for details). In 1997, the so-called seventh, eighth, and ninth freedoms were implemented, and European airlines were allowed to operate without restriction among European Union (EU) air routes. These freedoms allowed low cost carriers (LCCs) to enter the European international air market.

The origins of LCCs are associated with the so-called Southwest model (Doganis, 2006: 157), that is, are airlines that use a point-to-point network characterized by direct flights that connect mainly secondary or regional airports. Frequency varies by route, but a low frequency is common. LCCs offer no transfers, a single cabin class with no frills, ticketless travel, and direct sales on the airline's website. Additionally, LCCs use a single aircraft model to reduce the maintenance cost, for example, Southwest employs the same type of aircraft (Boing 737), with high utilization per day (approximately 11 hours) and 15–20 minutes turn-rounds.

In Europe, the entrance of LCCs connected regional destinations of different countries, which

affected travel time and cost. LCCs also used the internet as their main distribution channel, decreasing costs by eliminating the profit of travel agencies. Similarly, most accommodation companies also offered direct online booking, and today, internet portals offer direct booking rooms in hotels, apartments, or private houses, with peer-to-peer services. Such portals facilitated the flow of information, namely, location, price, and quality. Moreover, customers could post reviews to help other tourists make better informed decisions. Hence, compared with the traditional packaged holidays, internet bookings allowed tourists additional freedom to customize their trips, for example, destination, accommodation, and services.

The entrance of LCCs affected the market; thus, an enquiry to understand the types of economic impacts on destinations is worthwhile. Such economic impact can be measured by considering the variations in the number of arrivals, expenditures, and the lengths of stay of new LCC passengers compared with the previous situation. A precise response to this issue is necessary to evaluate its impact and to consider policies that facilitate the entry of LCCs. For instance, in some Italian airports, some LCCs have received discounts on landing and terminal charges, revenue-guarantee schemes, and co-marketing agreements (Laurino and Beria, 2014). In other destinations such as Cyprus, stakeholders agree that LCC subsidization may be necessary (Farmaki and Papatheodorou, 2015).

Nevertheless, LCC entry may crowd out incumbent CCs or FSCs. Such redistribution has relevant consequences for tourism destinations. The FSC network contributes with arrivals from farther nodes in the network, which are difficult to cover by LCC routes. Moreover, CCs provide bundling services that can also influence certain tourists. Moreover, tourists' profiles differ. For instance, Eugenio-Martin and Inchausti-Sintes (2016) demonstrated that LCC travelers usually save money at the origin (i.e., cheaper transportation) but spend part of that savings at the destination. The literature has studied net impacts of LCC entry but it has not sufficiently contemplated the redistribution among FSCs, CCs, and LCCs. The purpose of this paper is to fill that gap in the literature. More precisely, this paper tests the following hypotheses:

H1: LCC entry crowded out FSCs in a tourism destination.
H2: LCC entry crowded out CCs in a tourism destination.

We employ a trivariate structural time series with interventions for the key entry and exit of airlines. This methodology has several advantages, such as its ability to manage structural breaks, cointegration, and simultaneity analysis of the series. Additionally, the series do not need to be stationary, and the intervention analyses are not based on simple dummies on the series but on the unobserved components, especially on the irregular, level, and/or slope components.

This paper makes several contributions to the literature: i) It disentangles the market into LCCs, CCs, and FSCs to understand the impact of LCC entry in terms of the passenger redistribution among them; ii) It estimates the three series over time simultaneously so that their errors are seemingly unrelated and their correlations can be considered; iii) It estimates the impacts on each series after key entry and/or exit events; iv) It estimates the level error component of the series, which is a net of seasonal and irregular components, to obtain the correlations among the types of airlines and to illustrate the degree of crowding out effects if any. Hence, the paper provides two main results, it estimates immediate shocks to the series after entry/exit events, and it estimates level correlations that can be used as indicators of the degree of crowding out effects over time if any.

Literature review

Economic impact

The literature has demonstrated mixed results in terms of LCC entry impacts. Obviously, the market structure of each destination differs and determines such results (Moreno-Izquierdo, Ramón-Rodríguez and Perles-Ribes, 2016). However, most papers have shown that LCC entry has a positive impact on international arrivals (Graham and Dennis, 2010; Rey, Myro and Galera, 2011; Chung and Whang, 2011; Alsumairi and Tsui, 2017; Boonekamp, Zuidberg and Burghouwt, 2018; Bilotkach Kawata, Kim, Park, Purwandono and Yoshida, 2019) and domestic arrivals (Pulina and Cortés-Jiménez, 2010; Tsui, 2017). LCCs have been observed to mimic the seasonal pattern of incumbent air companies; thus, seasonality remains similar (Graham and Dennis, 2010; Chung and Whang, 2011). Concerning the length of stay, Ferrer-Rosell Martínez-García and Coenders (2014) demonstrate that LCC or FSC passengers' stay is usually shorter than CC passengers. Finally, for expenditure, LCC passengers' expenditure at the origin is lower than FSCs or CCs, but their expenditure at the destination is usually higher (Eugenio-Martin and Inchausti-Sintes, 2016). Similarly, Ferrer-Rosell, Coenders, and Martínez-García (2015) also find that lower and mid-income tourists traveling with LCCs have a different expenditure pattern than tourists traveling with FSCs, namely, former tourists spend (in relative terms) more at the destination and on discretionary expenditure. However, Ferrer-Rosell and Coenders (2017) demonstrate that differences between expenditures are decreasing and that both expenditure profiles are converging over time. Pratt and Schuckert conduct a comprehensive study that calculates the direct and indirect effects of LCC entry by (2018) using input–output analysis.

Market impact

Passengers' airline choice is based on the fares, service quality, schedule, and airports involved (Correia, Pimpão and Tão, 2012), and the advent of the internet has provided passengers with real-time information on these factors. LCC entry has been based on low fares strategies. Overall, Rosselló, and Riera (2012) demonstrate that the advent of internet channels decreased tourist package prices in Majorca. Fageda, Jiménez, Perdiguero, and Marrero (2017) demonstrate that in Spanish routes where an LCC replaced an incumbent FSC, the fares decrease significantly. Such a decrease also occurs when the LCC entrance occurs partially. Indeed, Moreno-Izquierdo, Ramón-Rodríguez, and Perles-Ribes (2016) demonstrate that the degree of LCCs' low fares depends, as expected, on their market power in the route. Thus, LCC entry has provoked a heterogeneous impact on the market. For instance, Abrate, Viglia, García, and Forgas-Coll (2016) demonstrate that for the Milan–Rome route, LCC fares react to FSCs and high-speed trains. However, economy tickets of FSCs vary similarly to LCCs, whereas business class tickets and high-speed trains are independent. Similar to FSCs, LCC fares are driven by revenue management. Alderighi, Nicolini, and Piga (2015) demonstrate that Ryanair dynamic pricing depends on seat availability and the remaining time to departure. Their conclusion is that an LCC fares series is U-shaped with respect to the remaining time of departure. Nevertheless, Bilotkach, Gaggero, and Piga (2015) demonstrate that in markets with a high presence of leisure traffic (holidays and VFR) on the route, the revenue management interventions are less sensitive.

Understanding airlines entry decisions

Initially, the literature modeled the entry of airlines with oligopolistic models. For instance, Reiss and Spiller (1989) develop an airline entry model à la Cournot and à la Bertrand. However, they recognize empirical difficulties due to endogeneity, unobservable costs, and

heterogeneity among airline markets. Berry (1992) investigates heterogeneous potential entrants, but still within a static city–pair market. Ciliberto and Tamer (2009) extend the heterogeneous approach by considering the role of networks in entry decisions. Moreover, they distinguish between FSCs and LCCs, provide a comprehensive set of entry determinants, demonstrate that the current number of firms deters entry, and are distinguished by airline; thus, deterrence capacity can vary among them. Other key determinants include market size (with population as a proxy), income per capita, income growth, presence of close airports, costs (with distance to origins as a proxy), location, and number of airline markets. Nevertheless, they point out that dynamic models that can capture long-run relationships are necessary.

Finally, Aguirregabiria and Ho (2012) develop dynamic games of network competition and estimate the decisions disentangling demand, cost, and strategic factors. They state that "airlines with a small number of connections in an airport must pay a large sunk entry cost to operate an additional route, airlines with many connections should pay negligible entry costs for that additional route." They also find evidence that hub-and-spoke networks can deter entry of competitors in spoke markets.

Crowding out effects

The entry literature has demonstrated that the dynamics of the supply do not need to be smooth with entries and exits of airlines. It motivates our paper to understand how sensitive incumbent demand is under such dynamics. Indeed, the strategic behavior of the airlines differs concerning entry deterrence. For instance, FSCs may expand their capacity to deter entrance (Ethiraj and Zhou, 2019), whereas LCCs may decrease fares but do not expand capacity. Moreover, under new entries, the incumbents may demonstrate some resilience to shrink the supply or they may exit. The reactions may be delayed, or they may be anticipated and result in exit straight away.

The research enquiry of this paper relies on the crowding out effects of LCC entry. Rodríguez and O'Connell (2018) show that despite deregulation, the relevance of package tours have remained stable (approximately 40%) in the outbound British market. However, Castillo-Manzano, Castro-Nuño, López-Valpuesta, and Pedregal (2017) demonstrate a smooth decline of CC market share over time for the outbound Spanish market. A similar decrease is found for some outbound Taiwanese routes (Wu and Hayashi, 2014). Obviously, the nature of the market is different, and each case study demonstrates different results, depending on the determinants and degree of LCC entry (Wang, Tsui, Liang and Fu, 2017) and exit (de Wit and Zuidberg, 2012; de Wit and Zuidberg, 2016).

Beyond descriptive analysis, causality models may provide insights into the relationship between the types of airlines. Khan, Kim, and Kim (2018) propose a predatory–prey model for the South Korean market, where on the one hand, LCC variations over time depend on a nonlinear trend and FSC time series, and on the other hand, inversely, FSC variations over time depend on a nonlinear trend and LCC time series. The results of this model and SARIMA alternative specification demonstrate a positive relationship between them. Nevertheless, we assume that both equations are independent, and cointegration is not considered.

Castillo-Manzano et al. (2017) employ dynamic linear transfer function analysis to understand Spanish outbound air travel market. They distinguish domestic, EU and non-EU destinations. Similar to Khan et al. (2018), they assume two independent models: a model where an LCC

depends on a CC time series, and a model where an LCC depends on an FSC time series. For the domestic and EU market, the results demonstrate a negative relationship between LCCs and CCs and a negative relationship between LCCs and FSCs. For the non-EU market, LCCs and FSCs demonstrate a positive relationship, whereas for LCCs and CCs, the result is not significant. The results make sense with the descriptive analysis, but running independent regressions and omitting relevant variables in the model specification may be problematic.

Our approach in this paper is to manage the three types of airlines simultaneously, by employing a trivariate structural time series analysis. This method allows us to employ error correlation matrices among the three series to better understand their short-term and long-term relationships. Such a structure contemplates cointegration as the common level among the series. Moreover, interventions on the unobserved components can be added to the specification to estimate the impulses of airlines' entries and exits. One of the purposes of the paper is to understand the LCC entry phenomenon and its consequences for policymaking. Thus, tourism destinations can better understand the degree of support that LCC entry should receive. Such support may be provided in terms of discounts on landing and terminal charges, revenue-guarantee schemes, co-marketing agreements, or subsidization (Laurino and Beria, 2014). This topic requires a wide analysis. Our paper focuses on the crowding out effects of LCC entry and its consequences for tourism destinations in terms of arrivals. For this reason, an inbound perspective is required. The details of the case study are explained as follows.

Case study

The case study comprises the air traffic between two origins: the United Kingdom and Germany and the main international airports of the Canary Islands (Spain). In 2017, according to the United Nations World Tourism Organization, Spain was the second-largest tourism destination in the world in arrivals (US$81.8 million) and receipts (US$68 billion). The Instituto Nacional de Estadística shows that the Canary Islands was the second-largest tourism destination in Spain in arrivals (14.2 million) during 2017. Finally, in 2018, AENA (Spanish airport operator) shows that the United Kingdom led in international air traffic to the Canary Islands with 37.7% of market share, followed by Germany with 22.7%. An advantage of working with isolated islands is that international tourists must arrive by air; thus, the accuracy of the tourism statistics is commensurate with the accuracy of air traffic documentation. Thus, we posit that the Canary Islands is a satisfactory laboratory for air traffic studies.

The United Kingdom is also a relevant outbound market because of its tradition of charter flights and a marked LCC entrance (O'Connell and Bouquet, 2015; Martín and O'Connell, 2018). Table 1 shows the relevance of the United Kingdom and Germany as origin market shares. The United Kingdom is the most relevant market for Tenerife (43.96%) and Lanzarote (54.18%), whereas Germany is the most relevant market for Gran Canaria (25.80%) and Fuerteventura (37.46%). Moreover, to doublecheck the robustness of the results, Malaga airport is also considered an additional destination located in mainland Spain. The market share details are shown in Table 1: comparative statics between 2007, when LCC entry was incipient, and 2018, when LCCs led the airlines' British market share.

Table 1:
Intenational markets shares of origin and kind of airlines (2007-2018)

		United Kingdom			
		Gran Canaria	**Tenerife**	**Fuerteventura**	**Lanzarote**
2007	Market share	24.55	47.76	26.83	50.32
	FSC	12.29	15.46	3.05	9.63
	CC	85.12	71.98	95.80	86.59
	LCC	2.59	12.56	1.15	3.78
2018	Market share	22.39	43.96	31.84	54.18
	FSC	1.00	4.13	0.69	2.50
	CC	37.66	34.03	34.80	36.26
	LCC	61.34	61.84	64.51	61.24
		Germany			
		Gran Canaria	**Tenerife**	**Fuerteventura**	**Lanzarote**
2007	Market share	27.69	21.10	47.67	19.38
	FSC	23.74	29.60	32.03	34.47
	CC	76.26	69.93	66.43	65.53
	LCC	0.00	0.47	1.54	0.00
2018	Market share	25.80	18.39	37.46	13.79
	FSC	10.98	6.16	7.17	6.39
	CC	64.94	60.82	83.46	70.04
	LCC	24.08	33.02	9.37	23.57

The source of the dataset is AENA, which provides monthly air traffic among international and domestic airports throughout Spain. We used a time series that starts in January 2004 and finishes in December 2018. To study the crowding out effects among airline types, proper identification and aggregation are required. Notably, the third package also removed the regulatory distinction between scheduled and charter airlines. Indeed, according to Budd, Francis, Humphreys, and Ison (2014), nowadays, FSCs have made a move towards LCC, creating a full-service subsidiary. Similarly, CCs have also made a move that creates diversified charter flights. LCCs are aggregated based on the ICAO's (2017) definition of an LCC. CCs were identified according to AENA classification, based on nonscheduled companies. However, some CCs already operate scheduled flights; thus, they are also added to the group as long as they are companies with business models based on selling tourist packages. The complete list of airlines and their distribution among each group is shown in Table 2.

Table 2:
List of Airlines (2004-2018)

Charter		
Air 2000	Futura International Airways	Nordic Leisure AB
Air atlanta Europe	German Sky Airlines	OLT
Air Scandic	Germania Flug	Olympus Airways
Air Via Bulgarian Airways	Germania	Orbest
Alba Star	Hamburg Airways	Privilege Style
ASL Airlines France	Hamburg International	RAF-Avia
Astraeus	Happag Lloyd	Sky Wings Airlines
Baleares Link Express	Hello AG	Small Planet Airlines
Britannia Airways	Holidays Czech Airlines	Sundair
Dutchbird	Iberworld Airlines	Thomas Cook
Enter Air SP Z.O.O.	Islandsflug	Travel Service
European Aviation Air Chater	LTE International Airways	Viking Airlines
Evelop Airlines	LTU International	Viking Hellas Airlines
Excel Airways	Monarch	XL Airways
First Choice	Mytravel Airways	
Flyjet	Neos	

Table 2 (cont.):
List of Airlines (2004-2018)

Full Service	Low Cost
Adria Airways	Bmibaby
Aer Lingus	Jet2.com
Air Europa	Deutsche BA
Air Malta	EasyJet
Aiberlin	Globespan Airways
British Airways	Lauda Motion
British Midlands Airways	Norwegian
GB Airways Ryanair	
Iberia Sunexpress	
Icelandair Volotea	
Lufthansa Vueling	
Spanair	
Transavia Holland	

Before LCC entry

The first tourists that arrived to the Canary Islands traveled by ships during the 19th Century. However, the great impulse to the tourism industry occurred after the entry of charter airlines at the end of the 1950s (Dominguez, 2008). According to Hernández, Armengol, González, and Sobral (2011), in 1952, an SAS airplane landed in Tenerife North as the first charter flight on the archipelago. In 1957, 15 charter airlines were already operating in Gran Canaria and/or Tenerife, where most of them were from the United Kingdom (Overseas, Starways, Transair Ltd., Tradair Ltd., Eagle Aviation, Cotinental, Derby Aviation, Orion, and Hunting Clan were the first charter airlines operating the route). In the early days, technical limitations only allowed for small airplanes with several stopovers. In 1962, Gran Canaria airport runway is widened to allow larger airplanes to land and obtains the international airport mention (Jorge, 1996). In 1967, Los Rodeos airport runway is also widened in Tenerife to allow larger jets to land for direct connections and boosting the mass tourism in the Canary Islands. According to Hernández et al. (2011), between 1955 and 1960, the number of arrivals increased from 39,500 to 69,000, reaching in 1970 the figure of 821,000 tourists and 2,521,500 by the year 1981.

During the 1980s and 1990s, as Sinclair and Dieke (1992) indicate, “overseas tour operators’ ability to negotiate low prices for hotel rooms is not dependent on their ownership of hotels, but on their powerful bargaining position vis-à-vis individual hoteliers.” Sinclair and Dieke illustrate the case of Kenya, but such oligopsony was commonplace in many tourism destinations, and the Canary Islands is no exception.

After LCC entry

Thus, LCC entry and the advent of the internet were a key to unbundling the tourist package and decreasing tour operators’ bargaining power. However, the distance of the Canary Islands with respect to the main origins was problematic for LCC optimal route designs, and its entrance was delayed notably. In October 2007, Ryanair entered the market in Tenerife, followed by easyJet in March 2008. The entrance in the other islands occurred on similar dates. Furthermore, during the financial crisis in approximately 2008, a set of bankruptcies and mergers in the airline market occurred (Figure 1) that conditioned arrivals and reshaped market shares. In October 2017, traditional CC Monarch exited the market, causing a relevant decrease in arrivals, especially in Tenerife. The market share of Monarch was not fully covered by any other airline, which motivated us to write of this paper. The list of air companies operating in the Canary Islands has been notably reduced in the British market (Table 3) but not in Germany (Table 4).

Figure 1:

Mergers and bankruptcies of airlines after 2008 economic crisis.

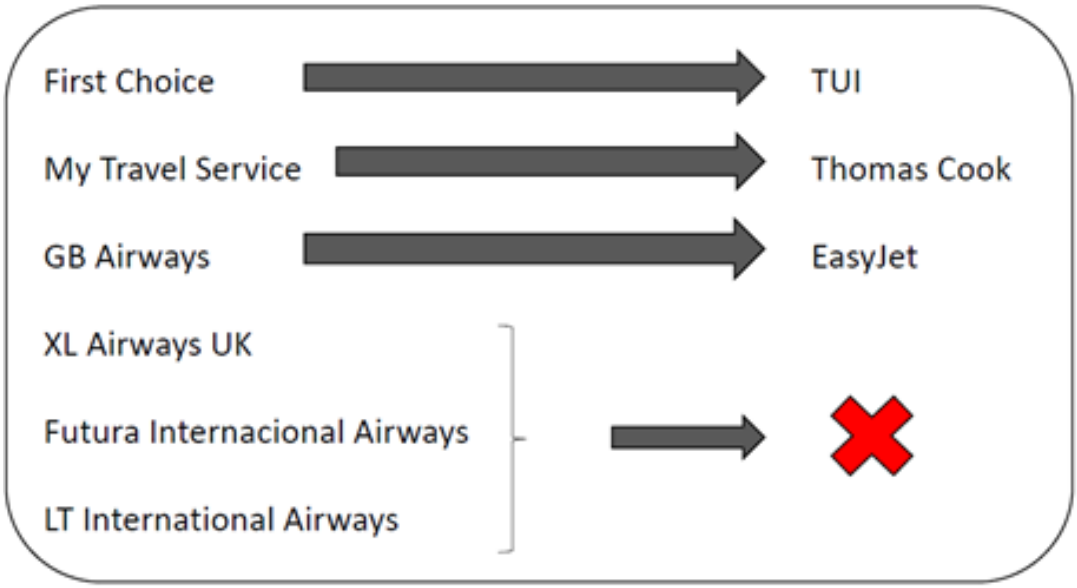


Table 3:

Market concentration evolution in the UK-Canary Islands markets

2007	2010	2018
Air Europa	Aer Lingus	Air Europa
Air Malta	Astraeus	British Airways
Astraeus	British Midland Airways	Easyjet
British Midland Airways	EasyJet	Germania
Jet2.com	Jet2.com	Jet2
European Aviation Air Charter	Monarch airlines	Norwegian
Frist Choice Airways	Ryanair	Ryanair
Flyjet	Thomas Cook	Thomas Cook
Futura Internacional Airways	Travel Service	Travel Service
GB Airways	TUI	TUI
Globespan Airways	Viking Airlines AB	Vueling
Iberworld Airlines	Viking Hellas	Airlines
LTE International Airways		
Monarch Airlines		
MyTravel Airways		
Ryanair		
Sky Wings Airlines		
Spanair		
Thomas Cook Airlines		
TUI		
Vikinig Airlines AB		
XL Airways UK		

Table 4:
Market concentration evolution in the Germany-Canary Islands markets

2007	2010	2018
Airberlin	Air Europa	TUI
Futura Internacional Airways	Air Via Bulgaria Airways	Easyjet
Hamburg International	Airberlin	Germania
Hapag Lloyd Express	Germania	Lauda Motion
LTU International	Hamburg International	Lufthansa
Ryanair	Hapag Lloyd	Norwegian
Thomas Cook	Iberwold Airlines	Olympus
XL Airways	Lufthansa	Ryanair
	Ryanair	Small Planet Airlines
	Thomas Cook	Sundair
	TUI	Sunexpress
	XL Airways	Thomas Cook
		Travel Service

The purpose of this paper is to understand the impacts of the entry and exit of such airlines. Because the number of airlines is too large, the strategy for the analysis is to aggregate them attending to Table 2 and build an LCC, FSC, and CC time series. The objective is to measure their degree of substitutability. A methodology that can manage such simultaneous and cointegrated (in case they are) time series is the multivariate structural time series model, which belongs to the family of state space models. The details are explained as follows.

Methodology

Univariate structural time series models (STSMs) have been widely used for tourism forecasting (González and Moral, 1996; Greenidge, 2001; Turner and Witt, 2001; Eugenio-Martin, Sinclair and Yeoman, 2005; Blake et al., 2006), especially after the publication of Harvey's (1989) seminal book, who suggests its use for forecasting passengers arrivals (see Harvey, 1989: 93-95), especially in the presence of seasonality. STSMs disentangle the series into unobserved components: level, slope, irregularity, and seasonal and/or cycle. The level, slope, and seasonal components can be either stochastic or fixed (Commandeur and Koopman, 2007). Such decomposition can improve the understanding of the series and forecasting accuracy (González and Moral, 1995). The model specification allows for time varying parameters (Song, Li, Witt and Athanasopoulos, 2011), and interventions on the components (Harvey and Durbin, 1986), which provides a deeper understanding of the impulses provided by significant events in the series (Eugenio-Martin, 2016). Moreover, the series does not need to be stationary; thus, series transformations are not required, and the interpretation is more straightforward.

In our case, the number of passenger arrivals on FSCs, CCs, or LCC may not be independent of each other. Thus, instead of running independent models, a seemingly unrelated time series analysis may be required. For that purpose, multivariate structural time series models (MSTSMs) are an appropriate approach. Du Preez and Witt (2003) explored MSTSMs in a tourism context, they state that in the presence of a "rich" error correlation structure, an MSTSM should outperform univariate time series models. More recently, Chen, Li, Wu, and Shen (2018) measured the accuracy of MSTSMs with respect to alternative tourism models. They found that in the presence of seasonality, MSTSMs outperformed alternative models such as SARIMA or univariate exponential smoothing.

In our case, the model specification is a trivariate structural time series model, which is specified as a local level with drift and a seasonal component. The following representation is based on Harvey (1989); Commandeur and Koopman (2007); Durbin and Koopman (2012); and Koopman, Harvey, Doornik, and Shephard (2009). The model can be represented as follows:

$$\boldsymbol{y_t} = \boldsymbol{\mu_t} + \boldsymbol{\gamma_t} + \boldsymbol{\varepsilon_t}, \qquad \boldsymbol{\varepsilon_t} \sim \mathrm{NID}(\mathbf{0}, \boldsymbol{\Sigma_\varepsilon}) \qquad (1)$$

Equation (1) represents the observation or measurement equation, where $\boldsymbol{y_t}$ denotes the N×1 vector of arrivals. In our case, we analyze three types of airlines so that N=3:

$$\boldsymbol{y_t} = \begin{bmatrix} y_t^{FSC} \\ y_t^{CC} \\ y_t^{LCC} \end{bmatrix}$$

Where y_t^{FSC} denotes the number of arrivals on FSCs, y_t^{CC} denotes the number of arrivals on CCs, and y_t^{LCC} denotes the number of arrivals on LCCs. For simplicity, for the remainder of the components, we consider the formulae in matrix form as shown for $\boldsymbol{y_t}$. $\boldsymbol{\varepsilon_t}$ denotes an error normally and identically distributed with a mean of zero and matrix of variances and covariances . denotes the N×1 vector of seasonal components. More precisely, $\gamma_t = \sum_{j=1}^{[s/2]} \gamma_{j,t}$, where each $\boldsymbol{\gamma_{j,t}}$ is generated for the multivariate case by using the trigonometric seasonal form:

$$\begin{bmatrix} \boldsymbol{\gamma_{j,t}} \\ \boldsymbol{\gamma_{j,t}^*} \end{bmatrix} = \left\{ \begin{bmatrix} cos\lambda_j & sin\lambda_j \\ -sin\lambda_j & cos\lambda_j \end{bmatrix} \otimes \boldsymbol{I_N} \right\} \begin{bmatrix} \boldsymbol{\gamma_{j,t-1}} \\ \boldsymbol{\gamma_{j,t-1}^*} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\omega_{j,t-1}} \\ \boldsymbol{\omega_{j,t-1}^*} \end{bmatrix}, \qquad \begin{matrix} j = 1, \dots, [\frac{s}{2}] \\ t = 1, \dots, T \end{matrix}$$

$\boldsymbol{\omega_{j,t}}, \boldsymbol{\omega_{j,t}^*} \sim \mathrm{NID}(\mathbf{0}, \boldsymbol{\Sigma_\omega})$ and $\lambda_j = 2\pi j/s$ is the frequency in radians.

$$\boldsymbol{\mu_t} = \boldsymbol{\mu_{t-1}} + \boldsymbol{\beta_1} + \boldsymbol{\eta_t}, \qquad \boldsymbol{\eta_t} \sim \mathrm{NID}(\mathbf{0}, \boldsymbol{\Sigma_\eta}) \qquad (2)$$

Equation (2) represents the state or transition equation, where $\boldsymbol{\mu_t}$ denotes the N×1 vector of the stochastic level component, with a matrix of error variances and covariances $\boldsymbol{\Sigma_\eta}$. It can be considered an equivalent of the intercept in a classic time series regression but in a dynamic fashion so that it can vary over time. $\boldsymbol{\beta_1}$ denotes the N×1 vector of the fixed slope components. Notably, the slope may also be stochastic, and $\boldsymbol{\varepsilon_t}$ and $\boldsymbol{\eta_t}$ are mutually uncorrelated in all time periods. These models are called seemingly unrelated time series equations (Commandeur and Koopman, 2007).

Additionally, in our case, we also have explanatory variables and interventions that can be added to the model; thus, equation (1) can be extended:

$$\boldsymbol{y_t} = \boldsymbol{\mu_t} + \boldsymbol{\gamma_t} + \boldsymbol{\delta_N} x_t + \boldsymbol{\Lambda w_t} + \boldsymbol{\varepsilon_t}, \qquad \boldsymbol{\varepsilon_t} \sim \mathrm{NID}(\mathbf{0}, \boldsymbol{\Sigma_\varepsilon}) \qquad (3)$$

Where $\boldsymbol{\delta_N}$ denotes the parameter estimates associated with the x_t explanatory variables and $\boldsymbol{w_t}$ denotes a K×1 vector of interventions associated with $\boldsymbol{\Lambda}$ parameters matrices.

Thus, the models have a stochastic level, fixed slope, stochastic seasonality, and interventions that vary with each market. For instance, the UK–Gran Canaria market has four level interventions related to easyJet entry (April 2008), the exit of CCs because of bankruptcies (October 2008), Ryanair entry (November 2009), and the exit of Monarch (October 2017). Moreover, the Iceland volcano eruption (April 2010) was considered with a pulse intervention on the irregular component.

One key question in the multivariate analysis of a structural time series is the relationship among the series, measured by the correlation of the component disturbances. If the correlation between the disturbances of an unobserved component is high, a test of the presence of common factors in that component is required. Common factors in STSMs mean that the disturbance matrix has a less than full rank. Furthermore, a common trend between two series implies the presence of cointegration (Harvey and Koopman, 1997). Thus, when the disturbance of the level components of two series are uncorrelated (e.g., $cov(\eta^{CC}, \eta^{LCC}) = 0$), the level components of the two series are independent. Thus, it is better to treat the series separately. By contrast, when $cov(\eta^{CC}, \eta^{LCC}) \neq 0$, the level components are related. The dependence between components can be measured by the correlation between disturbances. In our trivariate case, the resulting level disturbances variance–covariance matrix is shown below, and the correlation formula is as follows:

$$\boldsymbol{\Sigma_\eta} = \begin{bmatrix} \sigma^2_{\eta^{CC}} & cov(\eta^{CC}, \eta^{LCC}) & cov(\eta^{CC}, \eta^{FSC}) \\ cov(\eta^{CC}, \eta^{LCC}) & \sigma^2_{\eta^{LCC}} & cov(\eta^{LCC}, \eta^{FSC}) \\ cov(\eta^{CC}, \eta^{FSC}) & cov(\eta^{LCC}, \eta^{FSC}) & \sigma^2_{\eta^{FSC}} \end{bmatrix}$$

$$corr(\eta^{CC}, \eta^{LCC}) = \frac{\mathrm{cov}(\eta^{CC}, \eta^{LCC})}{\sqrt{\sigma^2_{CC}\sigma^2_{LCC}}}$$

Notably, is usually specified with full rank in the first stage. The analysis of such covariances is useful for a second stage, where common levels may be specified, and alternative specifications. More precisely, they can be specified as scalar, where the matrix is specified as the unity matrix scaled by a nonnegative value, that is; diagonal, where a diagonal variance matrix is considered with N different diagonal elements; ones, where the variance matrix is specified as a matrix of ones scaled by a nonnegative value; and common diagonal (see Koopman, Harvey, Doornik and Shephard, 2009: 88-90; or Commandeur and Koopman, 2007: 111-113).

Results

The paper analyzes five destinations, namely, Gran Canaria, Tenerife, Fuerteventura, Lanzarote, and Malaga, and two origins, namely, the United Kingdom and Germany; thus, 10 markets are studied. The series represent tourist arrivals that start on January 2004 and end on December 2018. A trivariate structural time series analysis comprising all three types of carriers is estimated. Level and level error component correlation matrices are obtained to understand the relationship among FSCs, CCs, and LCCs.

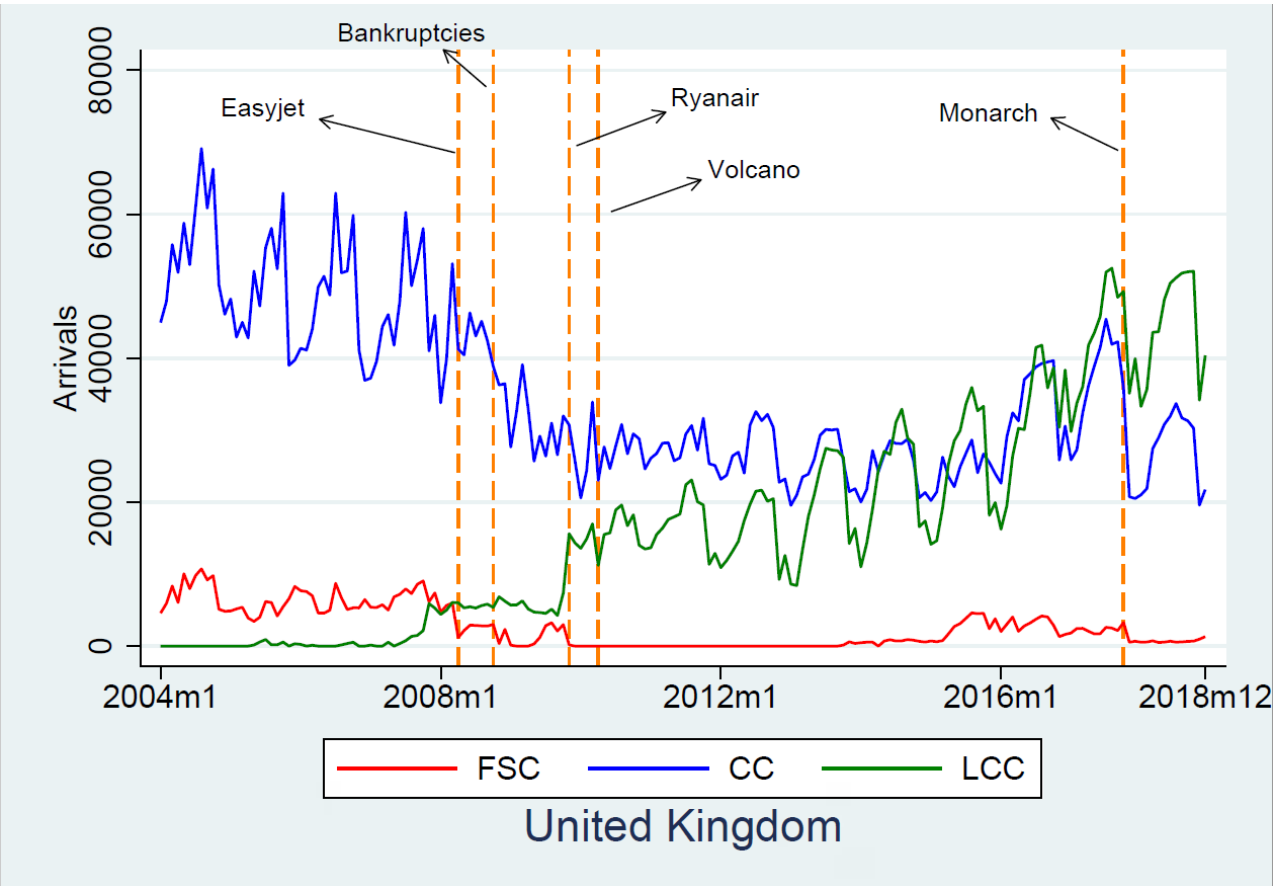
Key interventions are also considered on the irregular, level, and slope error components. They provide estimates of the impact of events, especially those related to the entry and exit of airlines. Any significant event that has occurred must be modeled to reveal its impact revealed and estimate the components with lower noise. Notably, several interventions were tested on the series, and the significant tests are shown in the tables.

Explicative variables are also considered, but neither origin gross domestic product (GDP) per capita nor real exchange rates were statistically significant. This finding makes sense for well-established routes, especially when traveling from high-income countries to mature destinations. In this sense, Smeral (2012) shows that income elasticity varies by origin and the business cycle. Furthermore, Eugenio-Martin and Campos-Soria (2014) demonstrate that during the global financial crisis, high-income origin countries hardly reduced their outbound tourism demand, especially for countries in colder regions. For illustrative purposes, we explain the UK–Gran Canaria market in detail, whereas the remainder of the markets are presented briefly.

UK – Gran Canaria market

In Table 1, the UK–Gran Canaria market in 2007 was dominated by CCs, with 85.12% of the market share. FSCs had a small presence, with 12.29% of the market, and LCCs were incipient (2.59%). Figure 2 shows the evolution of the market and key events.

Figure 2:
Time Series of Arrivals in the UK-Gran Canaria Market (2004-2018).



Two STSMs are estimated: an aggregate model of the whole market is estimated by employing univariate structural time series with the key interventions, and a trivariate model that disentangles the three types of airlines is also estimated. The former model estimates the impact on the whole market of entry and exit of airlines. However, the latter model can also understand the redistribution of passengers among them. The results are shown in Table 5.

Table 5:

Univariate and Trivariate structural time series models with interventions in UK-Gran Canaria market (2004-2018)

	Univariate	Trivariate	Univariate vs. Trivariate			
	TOTAL	**Full Service**	**Charter**	**Low Cost**	**Abs. Diff.**	**Rel. Diff.**
Level	88239.52	8522.52	49521.04	29834.48	361.48	0.004
	[0.000]	[0.000]	[0.000]	[0.000]		
Slope	404.37	15.9	95.56	313.97		
	[0.204]	[0.779]	[0.590]	[0.063]		
Seasonal $\chi 2$	184.743	12.77	47.42	306.23		
	[0.000]	[0.281]	[0.000]	[0.000]		
Volcano	-10529.16	582.51	-6279.57	-4900.52	68.42	0.006
	[0.001]	[0.363]	[0.019]	[0.001]		
Jet2/Easyjet		-1468.92	-3731.50	4204.65		
		[0.086]	[0.172]	[0.009]		
Economic Crisis	-10363.72	-3754.54	-5830.51	-504.76	-273.91	0.026
	[0.002]	[0.000]	[0.032]	[0.748]		
Bankruptcies	-7136.01	-309.99	-6552.73	-82.19	-191.1	0.027
	[0.003]	[0.715]	[0.017]	[0.958]		
Ryanair	11438.4	-2424.52	2877.87	11591.07	-606.02	0.053
	[0.001]	[0.005]	[0.291]	[0.000]		
Monarch	-8597.27	939.13	-9096.53	-616.97	-177.1	0.020
	[0.012]	[0.273]	[0.001]	[0.700]		
Normality	4.597	63.119	14.723	20.502		
	[0.100]	[0.000]	[0.001]	[0.000]		
Heteroscedasticity	0.45	0.367	0.331	28.741		
	[0.998]	[1.000]	[1.000]	[0.000]		
Durbin-Watson	1.916	1.9137	1.9092	1.3699		
R^2	0.9151	0.9177	0.91344	0.9843		
R^2s	0.38915	0.27559	0.39260	0.58769		
p.e.v.	2.0544×10^7	7.2876×10^5	1.28×10^7	4.0309×10^6		

The results of the estimation of the total market demonstrate that the stochastic level and stochastic seasonal components are significant, whereas the estimated slope is low and not significant. The results of the trivariate model demonstrate that FSCs have a significant stochastic level, CCs have a significant stochastic level and seasonal components, and LCCs have a significant stochastic level, a seasonal component, and a fixed slope, which shows marked LCC growth over time. Additionally, one of the main advantages of a structural time series is its ability to estimate the impacts of events. Below, the results of the estimation of the impact of the events are described. These results are key to understanding the crowding out effects among types of airlines.

Jet2 and easyJet entry

The CC series has been decreasing since 2004, whereas the FSC series remains stable until 2008. At the end of 2007, Jet2 (LCC) enters the market, followed by easyJet (LCC) in early 2008, which forces GB Airways (an FSC) to leave the market at the same time. Actually, GB Airways merges with easyJet (Figure 1). The total model estimates whether the entry and exit of such airlines have affected the total number of arrivals. Notably, LCC entry may crowd out FSCs or CCs exiting the market with the same number of passengers. For that type of situation, the parameter estimate of such an event is expected to be nonsignificant. Indeed, that is the case for this event: the entry of Jet2 and easyJet (LCCs) are not significant in the total market and such intervention is excluded from the model; however, they are significant in the trivariate model. The trivariate model shows a significant increase of approximately 4,204 LCC passengers, a significant decrease of approximately 1,469 FSC passengers, and a nonsignificant decrease of approximately 3,731 CC passengers. This example is the first where significant crowding out between LCC and FSC occurs.

Economic crisis and bankruptcies

The financial crisis negatively affected the GDP of the United Kingdom in the second term of 2008. The economic crisis causes a decrease of approximately 10,364 passengers, on average, per month. The trivariate model disentangles the effect among the types of airlines: the crisis implied a decrease of approximately 3,755 FSC passengers and 5,831 CC passengers but was not significant for LCC passengers. Such LCC strength in the economic crisis is relevant information for tourism destinations managers and to compare the results of the total model with the results of the trivariate model. If we sum up the effects on the three types of airlines, the result is approximately 10,090 passengers, which is a close figure to that obtained in the total model, that is, only 2.6% lower. The right side of Table 5 shows such absolute and relative differences. In all cases, the relative difference is smaller than 6%.

As depicted in Figure 1, the crisis also implied mergers and bankruptcies of certain airlines around October 2008, which redistributed the market shares. The total model estimates that the bankruptcies implied a decrease of approximately 7,136 passengers, whereas the trivariate model reveals that, as we expected, the main decrease was concentrated in the CC market, which lost approximately 6,552 passengers, and in the lower nonsignificant figures for the other types of airlines.

Ryanair entry

In October 2009, LCC Ryanair enters the market. The total model estimates a positive impact on arrivals of approximately 11,438 passengers. However, the trivariate model provides a richer picture. It estimates that the entry of Ryanair increases approximately 11,591 LCC passengers, causes a decrease of approximately 2,424 FSC passengers, and crowds FSCs out of the market. Indeed FSCs will no longer operate the market during the next five years. After Ryanair entry and the economic recovery, LCCs continue to grow, whereas CCs manage to maintain their size or recover by the end of 2016.

Monarch exit

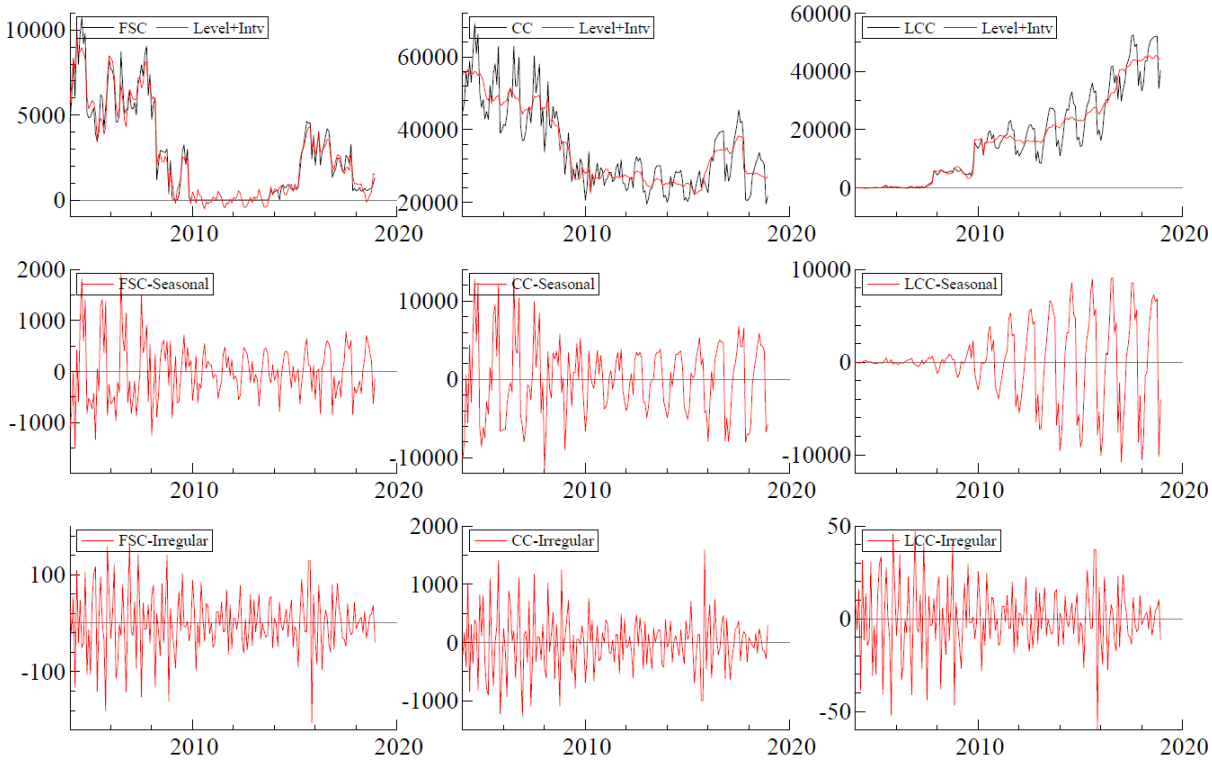
In October 2017, Monarch (a CC) collapses. Notably, Monarch operated in many markets around the world, and their decision depended on the profits of the whole company; thus,

it cannot be necessarily linked with profits in this market. The total model estimates a decrease of approximately 8,597 passengers. How many of Monarch's passengers were captured by the competing airlines? The trivariate model provides additional insights into this topic. The trivariate model shows that neither FSCs nor LCCs absorbed the CCs lost. All these figures confirm again that exit events markedly affect total arrivals, but more notably, it suggests that market resettlement is not straightforward. The lack of immediate reaction by other types of airlines may be explained by an airline's capacity constraints and the entry determinants shown in the literature. Moreover, the collapse also affected many other markets where the incumbents have operations. Thus, the incumbents may attempt to absorb part of the decrease but because the decrease occurs simultaneously in many other markets, the capacity constraints cannot be overcome soon. This result corroborates that entry and exit decisions are considered within a network context and do not concern only one particular route.

Notably, in April 2010, the Eyjafjallajökull volcano erupted in Iceland, causing a two-week closure of the air traffic of many routes. This event is controlled with a pulse intervention on the irregular component, which is required for one-off events, and it is significant for CCs and LCCs but not for FSCs. The series decomposition into level, seasonal, and irregular components is shown in Figure 3, that is, how the model fits the actual data. On top, the figure shows the series of the estimated level components, and in the center, it shows the estimated seasonal component. This figure shows the ability of MSTSMs to re-estimate the level after permanent structural changes and manages with such variations with a stochastic level and stochastic seasonal components. For the stochastic seasonal components, the figure shows a decrease in the seasonality of FSCs and CCs and a convergence process of LCCs to reach the CC seasonality pattern.

Figure 3:

Trivariate Structural Time Series Error Components for UK-Gran Canaria Market (2004-2018).



Diagnostic checking

The methodology relies on the assumption stated in equation 3, where residuals are assumed to be normally and identically distributed with constant variances. For the total market, the Bowman-Shenton normality test shows that the residuals are normal, the H(h) statistic for the heteroscedasticity test is also fine, and the Durbin-Watson of autocorrelation. The details of the first two tests are shown in Harvey (1989: 259-260).

However, the trivariate model fails some tests. The series are less stable, and the behavior of the LCC and FSC series is very peculiar (Figure 3). The LCC series starts from null values and it ends up with large figures of passengers. In this case, by definition, the size of the errors cannot be the same; thus, heteroscedasticity must occur, and normality cannot be achieved in a series of this nature. A similar phenomenon occurs with FSCs but all the way round, and even worse for periods with null values. The CC series has the most stable behavior. The tests demonstrate the non-normality of the three series, and heteroscedasticity and autocorrelation in the LCC series.

Commandeur, Koopman, and van Monfort (2010: 186-187) explain that the residuals necessary to satisfy independence, homoscedasticity, and normality, in this order of importance. However, under a maximum likelihood estimation, when we have a sufficiently large number of observations, the estimators are consistent and efficient. Concerning the multivariate structural time series, Commandeur et al. (2010: 191) say not to worry if the series is large.

Moreover, as a double check exercise, we compare the results from the total market with the results from the trivariate model. Because the total market model does not fail normality, nor heteroscedasticity, nor autocorrelation, we expect it to have consistent estimates of the components and interventions. On the right side of Table 5, the differences in the level and the interventions between both models are shown. The level of the total model estimates approximately 88,239 passengers, whereas summing up the level of the three types of airlines reaches approximately 87,878 passengers, which means a 0.4% relative difference. The differences in the interventions are also less than 6%, suggesting that the trivariate model results are close to the total model results and that the test failing has not biased the results.

Post-estimation level correlations

If the correlation of the errors of the level component among the series is high, they may share a common trend and be cointegrated (Harvey and Koopman, 1997). However, the results of such correlations are not high. The level error correlation is -0.216 for CC–FSC, -0.093 for LCC–FSC, and 0.198 for CC–LCC. Hence, the long-run relationship among the three types of airlines is weak.

Some LCCs enter the market abruptly; thus, a level intervention makes sense to be considered and is likely to be significant. However, in other cases, the airlines increase or decrease their supply smoothly over time, and that is the case of Ryanair entry in Tenerife or Malaga. In those cases, the degree of competition also varies smoothly, and intervention analysis is insufficient to capture the whole picture.

For this purpose, the relationship among the level series can provide useful information. Notably, the level is a post-estimation result of the model that represents the behavior of

the series net of seasonal effects and irregular components, and incorporates the estimated interventions and an estimate indicated that considers the errors of the other series simultaneously. The post-estimation level correlations among the three types of airlines is a useful indicator for measuring the degree of crowding out effects over time. In this series, the correlations are 0.864 for the CC–FSC pair; -0.546 for the LCC–FSC pair; and -0.632 for the CC–LCC pair. Such post-estimation level correlations imply a negative relationship between LCC growth and FSCs and CCs. Hence, for this market, the implication is that hypotheses 1 and 2 have occurred. Moreover, the detailed interventions also corroborate this result. By contrast, CCs and FSCs have been increasing or decreasing their traffic together over time.

UK - Rest of markets

The results of the parameter estimates of the interventions in the remainder of UK markets are shown in Table 6. Overall, the results are similar to the Gran Canaria case. Obviously, not all markets have exactly the same type of interventions, and they do not necessarily occur at the same time. Nevertheless, the LCC entry consequences are similar. For instance, the case of easyJet entry and the economic crisis has a negative impact on FSCs in Tenerife, Lanzarote, and Malaga. Thus, the existence of a contemporary crowding out effect between LCCs and FSCs is proven.

Table 6:

Parameter estimates of the interventions of the trivariate structural time series models of other UK markets (2004-2018)

	Tenerife			**Lanzarote**		
	FSC	**CC**	**LCC**	**FSC**	**CC**	**LCC**
Volcano	120.66	-12216.95	-8331.13	-30.05	-5177.54	-4306.44
	[0.899]	[0.036]	[0.000]	[0.955]	[0.192]	[0.019]
EasyJet/ Economic Crisis	-11314	-9887.58	5614.84	-3313.44	-3681.17	38.77
	[0.000]	[0.067]	[0.052]	[0.000]	[0.245]	[0.984]
Bankruptcies	-3335.89	-6297.89	947.92	-1841.46	-4772.7	5587.22
	[0.004]	[0.243]	[0.741]	0.002	[0.124]	[0.021]
Ryanair				-167.87	-103.3	10341.51
				[0.777]	[0.973]	[0.000]
Jet2				635.49	5360.22	4582.45
				[0.278]	[0.087]	[0.021]
Monarch	2063.99	-25895.55	477.63	254.64	-14377.19	5647.22
	[0.076]	[0.000]	[0.870]	[0.668]	[0.000]	[0.012]
	Fuerteventura			Malaga		
	FSC	CC	LCC	FSC	CC	LCC
Volcano	-21.31	-7476.58	2614.29	-1975.15	1238.67	-30551.64
	[0.957]	[0.002]	[0.101]	[0.164]	[0.756]	[0.000]
Economic crisis / Ryanair				-5839.22	-2453.97	-601.11
				[0.003]	[0.623]	[0.919]
Bankruptcies	-1386.35	-1997.43	2693.96	4486.1	-7591.29	-1057.09
	[0.000]	[0.246]	[0.077]	[0.024]	[0.129]	[0.858]
Ryanair	-226.91	-629.61	5315.21			
	[0.616]	[0.736]	[0.005]			
Monarch	185.02	-5343.01	1375.42	-192.41	-25273.49	-3652.68
	[0.687]	[0.003]	[0.372]	[0.923]	[0.000]	[0.542]

Nevertheless, LCC entry did not always occur abruptly. In Tenerife and Malaga, LCCs entered smoothly over time. In those cases, the level interventions are likely to be nonsignificant, and the crowding out effect must be understood with the level correlations (Table 7). The pattern of all the destinations is exactly the same: the negative level correlation between LCCs and FSCs, and between LCCs and CCs. This finding corroborates the crowding out effect over time. Additionally, we observe that the level of FSCs and CCs are positively correlated, suggesting that they grew together with the market size. Moreover, Ryanair entry showed a positive impact on Fuerteventura and Lanzarote, where it entered abruptly, and a delayed crowding out effect on FSCs, as suggested by the level correlations.

Table 7:

Level and level error correlations

		Level correlations				
		Gran Canaria	**Tenerife**	**Fuerteventura**	**Lanzarote**	**Malaga**
United Kingdom	CC-FSC	0.864	0.648	0.537	0.767	0.574
	LCC-FSC	-0.546	-0.566	-0.069	-0.561	-0.394
	CC-LCC	-0.632	-0.700	-0.643	-0.508	-0.804
Germany	CC-FSC	0.102	-0.584	-0.493	-0.234	0.457
	LCC-FSC	0.147	-0.112	-0.233	-0.646	-0.663
	CC-LCC	0.134	-0.303	0.372	-0.059	0.457
		Level error correlations				
		Gran Canaria	**Tenerife**	**Fuerteventura**	**Lanzarote**	**Malaga**
United Kingdom	CC-FSC	-0.216	-0.292	0.511	-0.403	-0.111
	LCC-FSC	-0.093	-0.199	0.062	-0.421	-0.499
	CC-LCC	0.198	0.283	0.026	0.764	-0.204
Germany	CC-FSC	0.501	-0.247	-0.549	-0.623	-0.308
	LCC-FSC	-0.254	-0.262	0.623	-0.584	0.033
	CC-LCC	-0.568	-0.263	-0.795	0.379	0.061

Finally, the Monarch collapse had a null response in Fuerteventura and Malaga on the other types of airlines. However, in Tenerife, a tiny part of the decrease was absorbed by FSCs, whereas in Lanzarote, one third was absorbed by LCCs.

Germany - Gran Canaria market

We now consider Germany because of its different market distribution. Table 1 shows that in 2007, CCs dominate the market, with 76.26% of the market share and with a relevant presence of FSCs (23.74%). LCC presence did not exist in 2007 but increased up to 24.08% in 2018. It represents a much lower presence compared with the 61.34% market share of LCCs in the UK–Gran Canaria market. Such low figures may also anticipate a low crowding out effect.

The results of the parameter estimates of the main interventions in the market are shown in Table 7. Ryanair entry implied an impulse of approximately 5,592 LCC passengers, without significant reductions in the other types of airlines. Subsequently, the Norwegian entry had the same positive result in terms of LCC passengers (approximately 1,721),

without significant decreases in the other types of airlines. However, at the end of 2017, FSC Air Berlin collapses, and The market loses approximately 16,658 FSC passengers. Similar to the Monarch case, the remainder of the airlines do not immediately absorb such a massive decrease and continue operating at the same capacity. Finally, LCC Lauda enters the market and captures part of the market share left by Air Berlin; it increases by approximately 4,619 LCC passengers, which still represents only approximately one quarter of the market size loss.

Figure 4:
Time Series of Arrivals in the Germany-Gran Canaria Market (2004-2018)

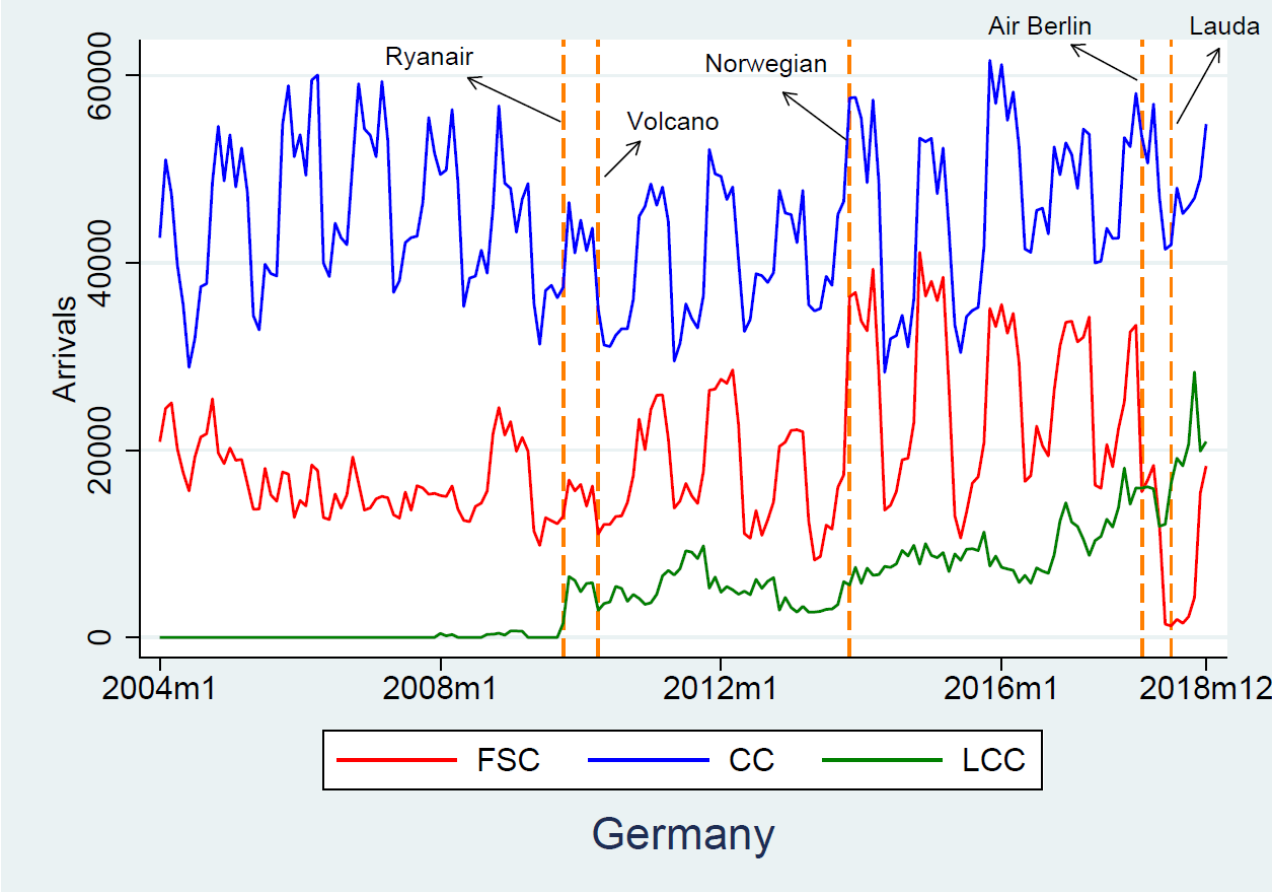


Table 8:

Parameter estimates of the interventions from trivariate structural time series models for Germany - Gran Canaria market (2004-2018)

	Full Service	Charter	Low Cost
Volcano	-4608.79	-6830.12	-1972.09
	[0.027]	[0.019]	[0.015]
Ryanair	-1068.84	-3395.72	5592.22
	[0.649]	[0.260]	[0.000]
Norwegian	3508.09	2368.44	1720.87
	[0.136]	[0.439]	[0.092]
Air Berlin	-16657.91	-2380.44	1273.56
	[0.000]	[0.451]	[0.256]
Lauda	-161.88	2550.65	4619.09
	[0.952]	[0.421]	[0.000]

More notably, the level correlations are all positive and low. They confirm that LCC entry had no negative influence on FSCs and CCs; however, they grew together with the market size.

Table 9:

Parameter estimates of the interventions of the trivariate structural time series models of other German markets (2004-2018)

	Tenerife			Lanzarote		
	FSC	**CC**	**LCC**	**FSC**	**CC**	**LCC**
Volcano	-4449.72	-5736.21	-374.59	-2033.68	-3796.28	-920.03
	[0.008]	[0.013]	[0.682]	[0.062]	[0.017]	[0.012]
EasyJet				-561.08	247.12	772.29
				[0.568]	[0.837]	[0.065]
Ryanair				1952.96	-968.27	1983.45
				[0.048]	[0.420]	[0.000]
Norwegian	-467.29	523.86	1267.48			
	[0.774]	[0.839]	[0.056]			
Air Berlin	-12867.15	-595.49	1267.48			
	[0.000]	[0.835]	[0.283]			
Lauda	-270.05	3780.91	2275.53			
	[0.874]	[0.192]	[0.005]			
	Fuerteventura			**Malaga**		
	FSC	**CC**	**LCC**	**FSC**	**CC**	**LCC**
Volcano	-3605.94	-6643.17	2679.29	-4142.97	-1295.91	-3118.88
	[0.072]	[0.037]	[0.000]	[0.110]	[0.285]	[0.044]
EasyJet	1520.15	-4870.59	584.19	-4841.89	-9209.23	5241.01
	[0.372]	[0.079]	[0.331]	[0.059]	[0.000]	[0.003]
Ryanair in	-5256.91	2574.45	2924.51			
	[0.002]	[0.340]	[0.000]			
Ryanair out	-1286.73	-3934.45	-4919.58			
	[0.449]	[0.145]	[0.000]			
Ryanair in	3356.47	-1597.94	3284.59			
	[0.103]	[0.633]	[0.000]			
Ryanair (new Terminal)	3356.47	-1597.94	3284.59	1851.77	-392.22	4478.13
	[0.103]	[0.633]	[0.000]	[0.466]	[0.797]	[0.011]
Ryanair (new runway)	3356.47	-1597.94	3284.59	162.01	9.67	414.04
	[0.103]	[0.633]	[0.000]	[0.462]	[0.958]	[0.023]
Air Berlin	-8292.98	-2205.68	350.99	-4423.18	-619.28	-824.19
	[0.000]	[0.456]	[0.574]	[0.099]	[0.706]	[0.683]
Lauda	-2201.44	2108.52	1703.93	-3221.96	-713.41	4743.83
	[0.204]	[0.478]	[0.007]	[0.228]	[0.666]	[0.021]

The remainder of the markets demonstrates heterogeneous responses after LCC entry (Table 9). Despite that, some differences are found for certain interventions, by overall, the results are also similar to the Germany–Gran Canaria market. For instance, the decrease caused by Air Berlin is partially captured by LCC Lauda in Tenerife, Fuerteventura, and Malaga. Such heterogeneity is also shown in the correlations (Table 7). Again, most of the correlations are low, but in the cases of LCC–FSC in Lanzarote and Malaga (higher than 0.60), LCC entry implies heterogeneous responses in different German markets, and the crowding out effect in British markets is less clear in German markets. The details of these markets are depicted in Figures 5, 6, 7, and 8.

Figure 5:
Time Series of Arrivals in the Tenerife Markets (2004-2018)

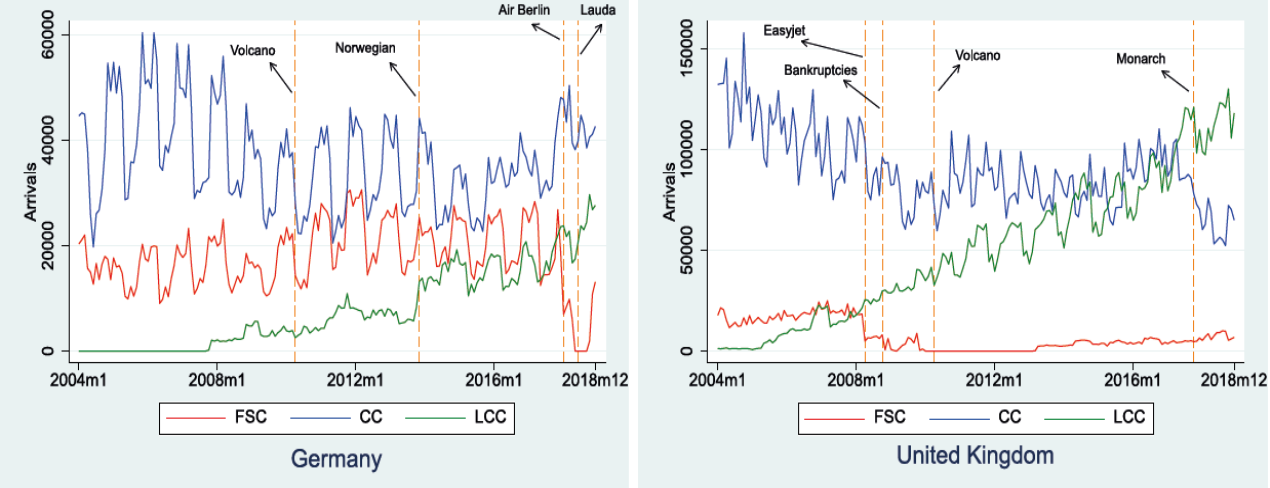


Figure 6:
Time Series of Arrivals in the Fuerteventura Markets (2004-2018)

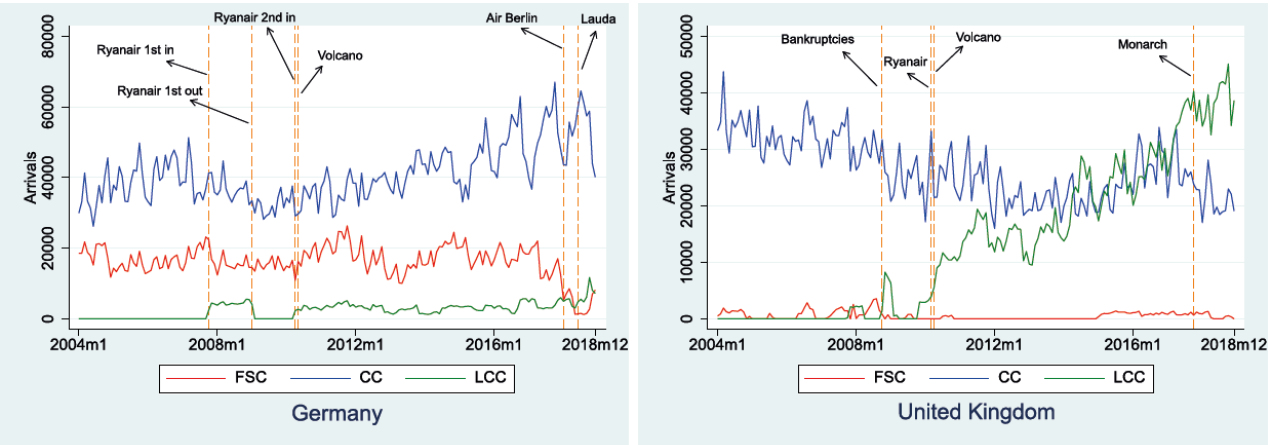


Figure 7:
Time Series of Arrivals in the Lanzarote Markets (2004-2018)

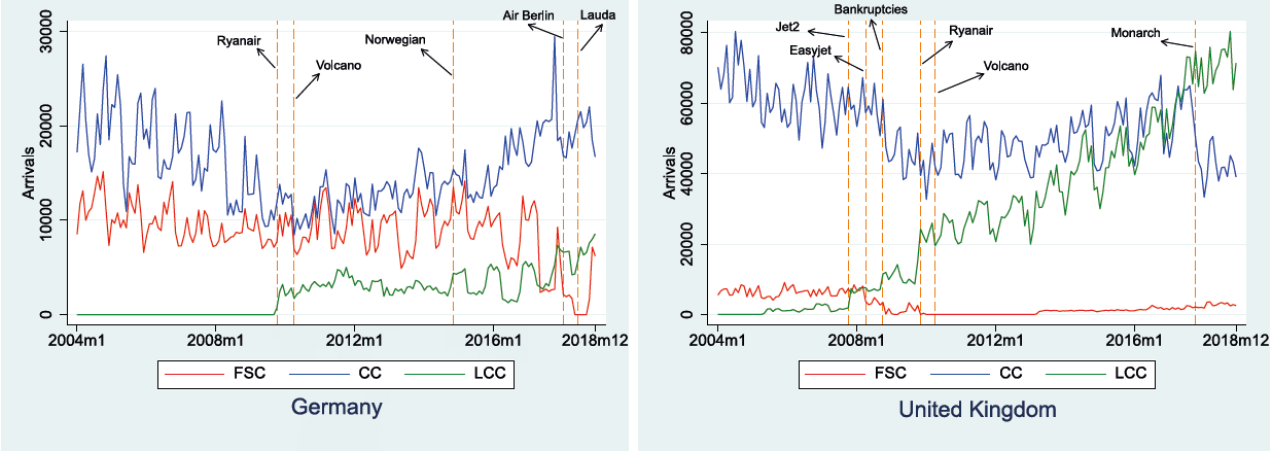
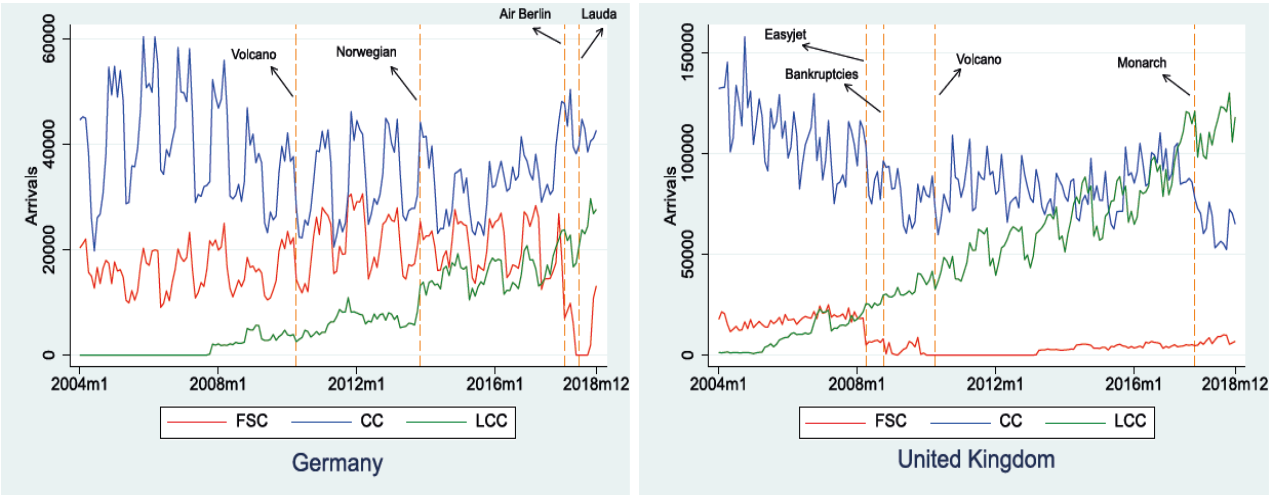


Figure 8:
Time Series of Arrivals in the Málaga Markets (2004-2018)



Hypotheses

H1: LCC entry has crowded out FSCs in a tourism destination

The results for the British markets support the first hypothesis and are based on the key interventions and the negative level correlations between them. For instance, the mergers and bankruptcies in 2008 implied a reallocation of the market share in favor of LCCs in Fuerteventura and Lanzarote. Moreover, Ryanair entry was very marked in Gran Canaria, where it crowded out FSCs. A similar FSC crowding out effect occurred in Tenerife after easyJet entry. Finally, the correlations demonstrate negative values for all five markets.

However, the German market has heterogeneous responses after LCC entry. Such entry has not always implied significant decreases in FSCs, but a net growth of the market. Nevertheless, the Air Berlin decrease was partially absorbed by LCCs Lauda in 2018. Moreover, Lanzarote and Malaga showed a high negative level correlation between LCCs and FSCs.

H2: LCC entry has crowded out CC in a tourism destination

In the British market, the main significant crowding out intervention effect occurred in Tenerife after easyJet entry. The remainder of the interventions were not significant. However, the level correlations were negative for all five markets. This finding suggests that LCC entry has crowded out CCs smoothly over time until the eventual collapse of the CC Monarch.

In the German market, such a hypothesis is unclear. The response has been heterogeneous, and overall, the level correlations have been low or have shown a common growth path between CCs and LCCs.

Conclusions

The trivariate structural time series analysis has proven to be a helpful tool for testing the simultaneous relationship among LCCs, FSCs, and CCs. Thus far, the literature has shown the impact of LCCs on the total number of arrivals. However, this paper employed a methodology to disentangle the effects of simultaneous impacts and provided estimates of individual responses. The methodology was applied in two origin markets—the United Kingdom and Germany—to assess how they have evolved from 2004 to 2018 in five sun-and-beach tourism destinations in Spain and provides useful information on the degree of reaction of each type of airline. More precisely, our research provides two main results: individual estimates of the short-run impact of entry and exit events on each type of airline, and estimates of level correlations that provide an indicator of the long-run crowding out effect.

Once an LCC enters a market, incumbents' reactions have been heterogeneous. The main source of heterogeneity is more related to the origin markets than the destinations. Overall, in the British origin market, FSC passengers were usually crowded out soon after LCC entry, whereas CC passengers did not switch so easily. However, over time, the level correlations showed a negative relationship between LCCs and FSCs, and between LCCs and CCs for all five markets studied. The finding suggests that LCC entry crowded out FSCs soon and CCs eventually.

However, the German market differs. The LCC market share is less than half of the British market share, and its entry has shown no significant immediate impact on FSCs or CCs. Similarly, most of the level correlations are low. The only exceptions are the cases of Lanzarote and Malaga between LCCs and FSCs. Overall, no strong evidence of crowding out effects is observed. This finding suggests that LCC crowding out effects cannot be generalized and that their impact depends more on the origin airline market structure than destinations.

One key enquiry posed by government institutions is on the LCC entry impulse. This paper has shown that depending on the intensity of the LCC entry, it can be significant. However, the paper has also shown the contrary situation, where an airline leaves the market, for example, the case of the exits of the CC Monarch or the FSC Air Berlin. In these cases, the number of passengers lost after exit was not covered by the incumbent airlines. This finding shows a narrow room for maneuver of LCC and provides a striking conclusion: retaining large airlines to operate the route is critical to maintaining long-haul tourist arrivals. Thus, the relevance of policies pursuing the attraction of new airlines to the destination is proven. These policies must be assessed according to the net economic effects based on net

arrivals, expenditure per tourist and night, and length of stay. Further research should focus on the assessment of such economic effects by considering the crowding out effect and the policy cost.

Hence, the paper has shown the presence of rigidities in the incumbent's capacity to absorb passengers after the event of airline exit, and resilience of CC incumbents after LCC entry, but not so much for FSCs; and, overall, a short-run net positive impact after LCC entry.

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Analyzing labour productivity and its economic consequences in the two Spanish archipelagos.

Analyzing labour productivity and its economic consequences in the two Spanish archipelagos.

Authors:

Federico Inchausti-Sintes
Ubay Pérez-Granja
José Juan Morales-Mohamed

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Abstract

Since the 1960s tourism has become a significant motor of growth for many economies. Its labour-intensive technology and lower labour skills requirements have eased its sectoral development. However, in contrast to industrial-led economies, in tourism-led economies the industrial sector contracts, while services grow strongly as tourism specialization increases. This disruptive effect impacts on the productivity and capacities of these economies in the long term. This paper estimates a stochastic production frontier and compares the differences in labour productivity between industrial-led and tourism-led provinces in Spain. Finally, these labour productivities are introduced in a dynamic CGE model of the two Spanish tourism-led economies (the Balearics and the Canary Islands) to analyze their respective macroeconomic impact. Labour productivity gains improve competitivity against foreign destinations, but tourism may crowds out domestic demand and investment; because of the higher real exchange rate depreciation. Furthermore, it allows for non-tourism production that enhances sectoral diversification.

Keywords: Dynamic CGE models, stochastic frontiers, technological change, efficiency and labour productivity.

Introduction

The evidence suggests that productivity, and not factor accumulation, is the key to ensuring steady growth in the long term (Solow, 1956, Swan, 1956, Abramovitz, 1956 or Romer, 1990). Productivity has a 'double effect' on the economy. First, it contributes to explaining most economic fluctuations due to its effect on the labour-capital relationship (Kydland & Prescott, 1988). Second, on average, countries or economies with steady increases in productivity are those with higher salaries, more competitive firms and, in general, show the highest level of human, technological and economic development in the long term (Hall & Jones, 1999; Baier, Dwyer & Tamura, 2006; Barro & Sala-i-Martín, 2009; or Weil, 2014). Historically, new technology can be embedded more easily in the capital-intensive sectors, which allow them to attain greater productivity in the long term (Weil, 2014).

In contrast, tourism has been regarded as a low productivity activity because it is labour intensive (Smeral, 2003). In other words, the lower level of capital and technological change in service activities places a limit on the level of worker production. As a result, costs continually increase in service sectors, which is now often referred to as cost illness (Baumol & Bowen, 1966). Improvement in industrial sector productivity generates higher incomes, which in turn produces an increase in demand in the service sector (Balassa, 1964; and Samuelson, 1964). On the other hand, tourism specialization also affects the productive-mix of the economies where the industrial sector represents a small share of total GDP, while services experience strong development (Inchausti-Sintes, 2019 and Capó, Riera & Rosselló, 2007). Such a productive-mix may result in some negative consequences in the long-term. First, intense specialization reduces the possibility of altering the productive-mix if tourism eventually falters. Second, as soon as economic growth leads to higher prices, the lower productivity in service activities and their cost illness may reduce its competitiveness; which make the tourism sector more vulnerable to cheaper destinations.

In consequence, given the strong dependence on services and its impact at the macroeconomic level in tourism-led economies, the analysis of productivity and its wider economic impact should be of special interest for these kinds of economies; especially when faced with increased competition from cheaper destinations. However, as highlighted by Sun, Zhang, Zhang, Ma and Zhang (2015) and; Hadad, Hadad, Malul and Rosemboim (2012) the analysis of productivity in tourism has been mainly focused at sectoral level: i.e. the hospitality sector (Barros, Botti, Peypoch, & Solonandrasana, 2011; Assaf, Barros, & Josiassen, 2012; Pérez-Rodríguez & Acosta-González, 2007 or Wang, Hung, & Shang, 2006; Cordero & Tzeremes, 2018 or Chatzimichael & Liasidou, 2019), travel agencies (Köksal & Aksu, 2007; Sellers-Rubio & Nicolau-Gonzálbez, 2009; or Fuentes, 2011), comparing tourism destinations competitiveness (Niavis & Tsiotas, 2019; Xiang, Khotari, Hu & Fesenmaier, 2007; Enright & Newton, 2004; or Fuchs & Weiermair, 2004) or analyzing the tourism industry (Sun et al, 2015; and Hadad, Hadad, Malul & Rosemboim, 2012). At the macroeconomic level, Blake, Sinclair and Campos-Soria (2006) are unique in analyzing its wider economic effect. However, they based their study on a descriptive analysis of a questionary-based survey to approach the productivity gains in tourism and focus on the UK, which is a non-tourism-led economy; thereby missing a number of macroeconomic insights that become clear when analyzing tourism-led economies. Finally, no single analysis of the study of labour productivity and its determinant exists, or its wider macroeconomic impact on tourism-led economies.

In order to fill this gap, this paper analyzes the factors that explain labour productivity and its

macroeconomic consequences on Spanish tourism-led economies during the period 2002-2012. More precisely, this paper contributes to the discipline as follows: firstly, by conducting an econometric panel-data analysis (stochastic frontiers analysis) on the performance of labour productivity. Secondly, the analysis also provides novel results in term of technological changes by differentiating between industrial and tourism-led provinces. Thirdly, the results of the labour productivity analysis feed into a dynamic CGE model of the Spanish tourism-led economies to quantify its economic repercussion in term of GDP, exports, consumption, investment, inflation and the real exchange rate. Consequently, the CGE model reports two additional novel results. Firstly, by showing the key role of the foreign sector in determining the wider economic impact of labour productivity improvements in tourism-led activities: i.e. labour productivity gains improve competitivity against foreign destinations, but tourism demand crowds out domestic demand and investment in the Balearics because of the higher real exchange rate depreciation. And secondly, by highlighting the effect of labour productivity and enhancing sectoral diversification beyond tourism.

Literature review

Productivity in tourism

In essence, economic specialization is a natural and expected consequence of trade. In the long term, each economy tends to focus on those goods/ services that it can produce in a more competitive manner compared to other goods/ services (Ricardo, 1821). However, such specialization always comes with consequences. In the case of tourism specialization, one of these is the strong tertiarization of the economy that can be clearly appreciated in the Spanish archipelagos.

Blake, Sinclair and Campos-Soria (2006) highlight the following key drivers of productivity: physical capital; skills and human capital; technology and innovation; and a competitive environment. In their analysis of UK tourism-related sectors they found that investment levels tended to be above average, but there was a lack of innovation, especially in small businesses, and they faced difficulties retaining skilled workers because of the low salaries. These latter two issues are important in explaining poor productivity in tourism-related sectors. The lower salaries found by these authors is also a consequence of the lack of productivity. Paraphrasing the authors, it might be said that the competitive sectors, those with higher productivity gains, do not rely on cost reduction and wage constraint to increase their competitiveness. On the contrary, they tend to offer higher salaries. This productivity gap between the more productive sectors (manufacturing) and the less productive ones (tourism services) explains price increases in the latter (Smeral, 2003). Sinclair and Stabler (1997), on the other hand, provide a different approach to productivity in tourism-based activities. According to them, proximity to suppliers is more important in explaining productivity gains (economies of density) in this sector, i.e. the tendency of tourism activities (accommodation and catering services) to agglomerate to reduce their unit costs.

Seasonality also plays a significant negative role in falling productivity in tourism activities (Basu, S, Fernald, J. G. & Kimball. M. S., 2006; Morikawa, 2012; Smeral, 2003). On the one hand, and in contrast to the manufacturing sector, most of the production provided by tourism-related activities cannot be ‘stored’, which would allow a varying response to changes in demand (Morikawa, 2012). On the other hand, and also highlighted by this author, both capital and labour cannot easily be adapted in these circumstances either. Consequently, many companies involved in tourism opt to hire temporary workers. This reduces the incentive of firms to invest in training and undermines innovation and knowledge accumulation that might improve productivity and lead to a more efficient use of resources.

As a consequence, the off-peak season can lead to an inefficient use of the tourism infrastructure and affect productivity in the sector (Sutcliffe & Sinclair, 1980; Manning & Powers, 1984; Williams & Shaw, 1991).

Measuring productivity

The main measure of productivity is output per worker. According to Coelli, Rao, O'Donnel and Battese (2005) in a multiple output or multiple input context, this measure can potentially mislead and misrepresent the performance of a region. Consequently, these authors opt for total factor productivity (TFP) as a preferable tool for measurement and comparison in term of productivity. The concept of TFP relies on a measurement of the performance of a country/region/sector in relation to the use of inputs. There are different measures of TFP, such as the Hicks-Moorsteen approach (Diewert, 1992) that assesses output growth in relation to input growth. Or the Caves, Christensen and Diewert approach (Caves, Christensen & Diewert, 1982), which compares the observed output of two different periods with the maximum feasible level of output; keeping the output mix constant. This latter approach has been employed on several occasions in the literature in tourism and its methodological approximation is known as the Malmquist index (Assaf and Dwyer, 2013; or Barros, 2005). Moreover, this index can decompose TFP into technological and efficiency changes. However, it fails to capture varying returns to scale. The aforementioned approaches are calculated using Data Envelopment Analysis (DEA). Finally, the use of stochastic frontier analysis (SFA) also permits productivity to be decomposed while addressing different economies of scales (Coelli et al., 2005; or Kumbhakar & Wang, 2005). In this context, the presence of varying returns to scale means that even assuming the same technology and efficiency, there are changes in productivity that can be explained by differences in the economies of scale.

The use of DEA based index has been used several times in tourism literature (see for instance Tzerenes 2019, 2020). However, even when the tourism literature has been using the stochastic frontier analysis for a long period (see for instance Barro, 2004, 2006; Pérez-Rodríguez & Acosta-González, 2007, Wu, Cheng and Liao, 2019 or Zhou, Xu & Lee, 2019) the use of TFP measures derived from stochastic frontier analysis is limited (see for instance Assaf and Tsionas, 2018).

Methodology

Stochastic Frontier

Briefly, this methodology consists in estimating a production function that provides a measure of the maximum amount of output obtained from given inputs and technology (Aigner, Lovell & Schmidt, 1977). Those observations below the frontier are regarded as less productive. The distance between these observations and the frontier is explained by technical inefficiency. One of the first measures of productive efficiency can be found in Farrell (1957) who estimated a deterministic production possibilities frontier and calculated the radial distance of each observation to this frontier. Since this pioneering study the literature on frontiers has been constantly evolving.

This analysis requires the selection of a functional form (Cobb-Douglas or translog, mainly) where the inefficiency is modelled as part of the error term i.e where denotes the noise component (the unobserved random component) and denotes the inefficiency component (Aigner et al., 1977). Since Aigner et al.'s development, the subsequent models mainly focused on different modelizations of the inefficient component. This field of research

has been especially fruitful and useful in panel data where the same observations can be followed over a number of periods of time and thus, the inefficiency can 'adopt different behaviour' depending on the assumptions held. For instance, the inefficiency could be time-invariant (Schmidt & Sickles, 1984) or time-varying (Cornwell, Schmidt & Sickles, 1990). Mathematically, . Additionally, the can be assumed as a fixed parameter or as a random variable. Finally, there is a third approach to model the inefficient component by disentangling it into two components: the stochastic time component (time-varying), and the stochastic individual component (individual-varying), (Kumbhakar et al, 2015). can adopt any specific functional form. For instance, Battese and Coelli (1992) opt for assuming that behaves according to the following exponential function: where represents the inefficiency term, denotes the time and is the terminal period of the sample.

On the other hand, the literature usually assumes constant technological change by units (countries, regions, provinces or firms) when estimating a stochastic production frontier (Kumbhakar et al, 2015; Kumbhakar and Wang, 2005; or Álvarez, 2007). This leaves the scale, and more specifically, efficiency, as the main source of difference in TFP. Nevertheless, in line with the explanation provided in this paper, such an assumption should be relaxed. Battese, Rao and O´Donnell (2004), O´Donnell, Rao and Battese (2008) and Huang, Huang and Liu (2014) assume a different technological change in stochastic frontier by units. These authors opt for a two-step procedure (metafrontier production function). In the first step, they estimate the specific stochastic production frontier for the regions or groups chosen. In the second, they estimate a metafrontier for all regions. Comparing both steps they obtain the differences in technological change. Battese et al (2004) and O´Donnell et al (2008) carry out a linear programming model to approach the metafrontier in this second step, while Huand et al (2014) apply a stochastic frontier estimation. The lack of cross-sectional observations limits the application of this estimation. For instance, Battese et al (2004) average around 255 observations (firms) for five regions. In contrast, our analysis draws on 50 provinces. This paper also assumes a different technological change by units, but, given the data limitations, it is estimated in one step. In this case, this paper distinguishes four technological changes by groups of provinces1. Firstly, the group/category of provinces regarded as 'industrialized' are the three Basque provinces (Álava, Guipuzcoa and Vizcaya), the four Catalonian provinces (Girona, Lleida, Barcelona and Tarragona) Navarre and Madrid. Secondly, the provinces of Las Palmas and Santa Cruz de Tenerife in the Canary Islands and the Balearic Islands form the "touristic" group.

1 These categories have been obtained by applying cluster analysis (k-means). The provinces were classified according to the following variables for the year 2012: industrial share, services share, tourism employees per working population, labour productivity at constant prices, unemployment rate and tourism beds per working-age population.

The third group (Albacete, Alicante, Almería, Ávila, Badajoz, Cáceres, Cádiz, Cantabria, Córdoba, A Coruña, Granada, Guadalajara, Huelva, Jaén, Lugo, Málaga, Murcia, Pontevedra, Salamanca, Segovia, Sevilla, Soria, Toledo, Valencia and Valladolid) is more heterogeneous but include most of the southern provinces of Spain and almost all the coastal provinces. Finally, the last group (Asturias, Burgos, Castellón, Ciudad Real, Cuenca, Huesca, La Rioja, León, Ourense, Palencia, Teruel, Zamora and Zaragoza) comprises provinces mostly located in the northern part of Spain. This paper, therefore, uses a stochastic frontier growth model2 following the framework proposed by Kumbhakar and Wang (2005). The model is specified as follows:

$$y_{it}^{log} = \beta_0 + \beta_1 k_{it}^{log} + \beta_2 t + \beta_3 tc_{ind} + \beta_4 tc_{tur} + \beta_5 tc_{other} + \beta_6 share\_permanent\_employment + \beta_7 crisis + v_{it} - u_{it}, \quad (1)$$

$$v_{it} \sim N(0, \sigma_v^2), \quad (2)$$

$$u_{it} = G_t u_i = \exp\left[\gamma\left(t - \underline{t}\right)\right] u_i, \quad (3)$$

$$u_i \sim N^+(u_i, \sigma^2), \quad (4)$$

$$u_i = \delta_0 + \delta_1\left(k_{i\underline{t}} - l_{i\underline{t}}\right), \quad (5)$$

$$\sigma_v^2 = exp(c_v), \qquad \sigma^2 = exp(c_u), \quad (6)$$

In this model (equations 1-6), the subscripts i refer to provinces and t refers to time in years. y_{it}^{log}, k_{it}^{log} , are, respectively, the log of the gross value added per labour (at constant prices) and the log of the stock of capital per labour (at constant prices). Labour has been adjusted by human capital (years of education), as proposed by Duffy and Papageorgiou (2000). The variable captures the trend, which can be interpreted as technological change over time. tc_{ind}, tc_{tur} and tc_{other} are specific technological dummy variables ($tc_{ind} = d_{ind}t$, $tc_{tur} = d_{tur}t$ and $tc_{other} = d_{other}t$) that capture the shift in technological change for the different clusters with respect to the base category. As highlighted by Kumbhakar et al (2015), panel data enables us to introduce these specific dummy variables to capture the individual heterogeneity by provinces in this case. Additionally, a dummy 'crisis' has been included in order to control the effects of the 2008 economic crisis, which had a particularly long effect on the Spanish economy compared to other European countries. Lastly, the share of permanent employment in the region is included in order to control for structural differences across provinces. Due to the difficulties to compute the model, y_{it}^{log} and k_{it}^{log} have been previously adjusted by the geometric mean (Álvarez & Arias, 2004; or Orea & Kumbakhar, 2004).

The production frontier function has a Cobb Douglass specification. This decision was

2 The model has been estimated in STATA 14 following the package developed by Kumbhakar, Wang, and Horncastle (2015).

made after several trials with other specifications including translog functional forms. The Cobb Douglass specifications has been used in the literature (see for example: Battese & Coelli, 1992; or Cardoso & Ravishankar, 2015).

Kumbhakar et al (2015) also highlight the advantages of panel data above cross-sectional data to analyze whether the inefficiency has been persistent over time and/or it is time-varying by units. The inefficiency term u_{it} measures the distance to the frontier for a province *i* at time *t*, while growth convergence implies a shrinkage of u_{it} over time. The inefficiency term is specified as a product of two components, G_t , a deterministic function of time (time-varying) and , a province-specific stochastic positive variable following a truncated-normal distribution.

The inefficiency term (see equations 3, 4 and 5) is based on Kumbhakar and Wang (2005) who employed the same analytical approach to that of Battese and Coelli (1992) where the term $\underline{t}$ denotes the initial time period and $u_{it} = u_i$ when $= \underline{t}$. The initial inefficiency (u_i) is assumed to follow a truncated-normal distribution, and the mean of this truncated-normal distribution is related to the log of the initial capital/labour ratio $(k_{i\underline{t}} - l_{i\underline{t}})$, which is province-specific. For instance, a positive and statistically significant capital/ labour ratio would imply that provinces with a higher initial capital/labour ratio would grow at a faster rate. Moreover, the inefficiency term is scaled by a parameter, which can be interpreted as "the percentage change in inefficiency over time" (Kumbhakar & Wang, 2005). Because $\gamma = \frac{\partial lnu_{it}}{\partial t}$, if $\gamma < 0$ then efficiency catch-up is observed.

Following Kumbhakar and Wang (2005), the change in total factor productivity3 ($T\dot{F}P$) can be decomposed into three components: technological change (TC), measured as a shift in the production frontier; a change in the efficiency ($TE\Delta$); and the economies of scale ($Scale$) (see equation 7).

$$T\dot{F}P = TC + TE\Delta + Scale, \tag{7}$$

$$\left.\begin{aligned} TC &= \frac{\partial y_{it}}{\partial t} = \beta_2 \\ TC_{ind} &= \frac{\partial y_{it}}{\partial t} + \frac{\partial y_{it}}{\partial tc_{ind}} = TC + \beta_3 \\ TC_{tur} &= \frac{\partial y_{it}}{\partial t} + \frac{\partial y_{it}}{\partial tc_{tur}} = TC + \beta_4 \\ TC_{var} &= \frac{\partial y_{it}}{\partial t} + \frac{\partial y_{it}}{\partial tc_{var}} = TC + \beta_5 \end{aligned}\right\} \tag{8}$$

$$TE\Delta = -\frac{\partial u_{it}}{\partial t}, \quad \text{where } \frac{\partial u_{it}}{\partial t} = \gamma \exp[\gamma(t - \underline{t})]u_i \tag{9}$$

$$Scale = (\theta - 1)\dot{k}, \tag{10}$$

Where:

$$\theta = \beta_1 \tag{11}$$

3 It should be remenbered that we do not measure total production, but total production per worker. Hence, this total productivity is per worker.

Paraphrasing Kumar and Russell (2002), the technical change (*TC*) implies a shift in the frontier. Moreover, the addition of dummy variables allows us to identify the technological change in the industrial (TC_{ind} , upper case) and tourism provinces (TC_{tur} , upper case), which in turn allows us to better accommodate the distinct performance of TC depending on the kind of province (see equation 8).

The technical efficiency (see equation 9) measures the improvement in the use of the technology or, in other words, the reduction in its inefficient use. A negative sign is necessary in the *TE* component of the *TFP* because, a reduction in inefficiency has a positive effect on *TFP*. The scale component measures the effect of the economies of scale (see equation 10). The scale parameter is a simplified version due to the model specification where y and k are related to the number of people between 16 and 64 years, which, in fact, allow us to estimate the returns of scale of only one factor.

Dynamic CGE model

In this section we introduce the basic structure of the dynamic CGE model of the two Spanish tourism-led economies[4]: the Canary and the Balearic Islands. The Input-Output tables were collected from the respective regional statistical offices (ISTAC and IBESTAT). The last available data corresponds to 2005 and 2004, respectively. During these years both economies have experienced changes in absolute values. However, CGE models rely on relative values to compute the equilibrium and simulations. In this sense, the sectoral share of these economies have remained stable from 2002 to 2012 ensuring the significance and validity of these tables to conduct CGE analysis. For instance, the sector that experiences the biggest fall is "construction", which reduces 5.31 percentage points (p.p) and 2 p.p in the Canary and Balearic Islands between 2002 and 2012, respectively. Both archipelagos are considered small-open economies formed by 19 sectors and two representative consumers (domestic households and tourists) and one central government, which form their expectations in a looking-backward manner. Furthermore, the model assumes an income elasticity of 2.33% and 1.6% for the tourism goods demanded by the tourists for the Balearic and the Canary Islands, respectively (Inchausti-Sintes, Voltes-Dorta & Suau-Sánchez, 2019). All sectors operate under competitive market behaviour and there is perfect factors mobility. Both domestic and imported goods are assumed as imperfect substitutes, which implies the existence of one new sector, which in turn demands domestic and import goods to produce a composite good (International Monetary Fund, 1969). The model closure relies on assuming zero government deficit, fixed foreign prices, unemployment (14% and 20%, for the Balearics and the Canary Islands, respectively1), while investment follows a savings-driven rule. The remaining elasticities are obtained from Hertel (1998)2. Finally, we assume the following values for economic growth, the interest rate, and depreciation of capital (steady-state): 0.76%, 5.4% and 5% for the Balearic Islands; and 0.9%, 2.3% and 5% for the Canary Islands, respectively. The values of economic growth are the real GDP growth experienced by both archipelagos during 2002-2012. The depreciation rate was sourced from Escribá-Pérez, Murgui-García and Ruiz-Tamarit (2017). Finally the interest rate is obtained endogenously with the other two values.

1 The average unemployment rate in both territories during 2002 and 2012.

2 We assume an elasticity of transformation between export and domestic production and elasticities of substitution between, labour and capital (VA), and between VA and intermediate demand, between domestic and imports goods, and finally, there are also elasiticities of substitution for tourism demand, household consumption, investment and goverment consumption.

Figure 1:
CGE structure

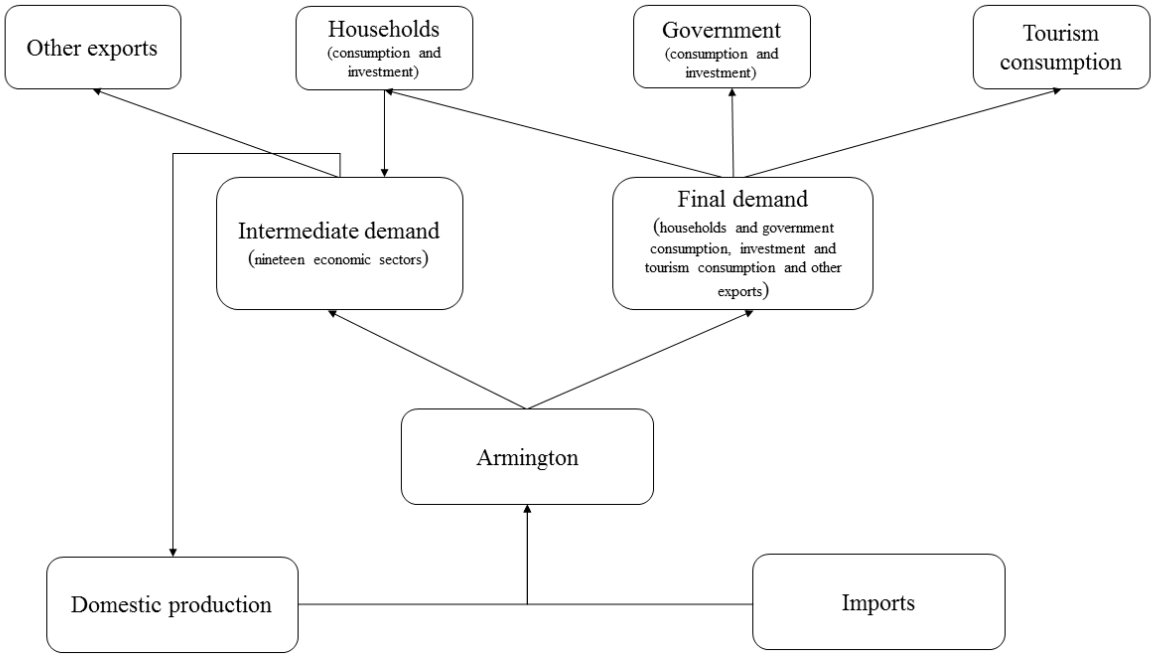

Figure 1 reproduces the basic structure of the CGE model. Briefly, the Armington sector demands all imports and domestic goods that will be sold as intermediate goods or as final demand. The latter is formed by the households that consume and invest according to the incomes obtained from renting labour and capital, the government that takes its economic decision according to the taxes collected in the economic process, and finally, the tourists who demand goods according to their tourism expenditure (tourism exports) . The sectoral production is finally devoted to export (rest of exports) or demanded as intermediate goods by the Armington sector closing the circular flow of income .

Results
Stochastic frontier

Table 1 shows the econometric estimation of the stochastic production function. The ratio of capital per labour shows a positive sign as expected. The technological change (Year) shows a negative sign, which can be explained by the relevance that the construction sector (which is a sector with low labour productivity) had during most of the period of study. Nevertheless, when disentangling by clusters, it should be noted that industrial provinces have a lower negative trend in comparison with other provinces.

On the other hand, touristic islands do not show a different technological change. This result shows the different technological change attained in industrial-led provinces where technological improvements are more easily embodied in the production of goods than in services. The dummy crisis shows a positive and significant parameter, which means that the sharper fall in employment was, on average, higher than the drop in output,

which improved the labour productivity during those years. The parameter of the share of permanent employment is significant and with the expected sign, which shows a positive relationship between labour productivity and job stability.

The initial capital per labour ratio has a positive and significant parameter, which means that on average, provinces with a higher capital per labour ratio will growth at a higher rate (an additional 1% in the capital per labour ratio will increase the growth rate by 0.356 %). This shows a permanent gap among Spanish provinces in terms of growth for the period considered. Nevertheless, on average the parameter shows a negative and significant sign, which means that the Spanish provinces are converging to the frontier at 2.6% per annum.

Table 1:

Estimation results.

K/L	0.452***
	(0.026)
Year	-0.023***
	(0.002)
$tc_{industrial}$	0.006***
	(0.001)
$tc_{tourislands}$	-0.002
	(0.001)
$tc_{various}$	-0.003***
	(0.001)
Crisis	0.039***
	(0.007)
Share_permanent employment	0.302***
	(0.082)
Constant	-5.977***
	(0.128)
δ_1	0.356***
	(0.056)
δ_0	-0.504
	(0.119)
γ	-0.027***
	(0.005)
usigmas	-5.233***
	(0.234)
vsigmas	-6.856***
	(0.063)
Log likelihood	1011.3556
wald	1049.19***
Observations	550

Table 2 summarizes the Total Factor Labour Productivity (TFLP) of the Spanish provinces. When focusing on technical variables (capital-labour ratio, technical change, technical efficiency and scale), on average the TFLP in Spain has been close to zero for the period of study. However, even when the effect has been low, on average productivity has been falling across all Spanish regions. Tourism-led provinces show the lowest productivity among the different regions in Spain, with, on average, a 0.006% and 0.004% fall in productivity per annum for the Canary and the Balearics Islands, respectively. On the other hand, industrial-led provinces have a lower average per year fall in productivity. Through disentangling by components of the TFLP it can be seen that technical efficiency has been improving during the period 2002-2012. Nevertheless, technical changes and the returns of scale has been negative during this period. It should be noted that industrial-led provinces are those that score better in all the components of the TFLP, as these provinces have a lower negative effect of technical change, greater efficiency and less negative scale effects. In fact, TFLP_2 shows the results of the TFLP without taking into account scale effects, and it can be seen that the total effect is positive (but closer to zero). Finally, when accounting for the impact of permanent jobs and crisis (structural variables), the total labour productivity yields small, but positive results. In sum, on the one hand, for the period 2002-2007, industrial-led provinces show the highest total labour productivity (0.219%); and both tourism-led provinces show a total labour productivity growth of 0.186% and 0.178% for the Canaries and the Balearics, respectively. On the other hand, when accounting for the crisis effect for the period 2008-2012, labour productivity also increases to 0.258%, 0.217% and 0.225% for the industrial-led provinces, the Canary Islands and the Balearic Islands, respectively.

Table 2:
Total labour productivity by kind of economy (%)

	TC	TE	Scale	TFLP	TFLP_2	Permanent-jobs share	Crisis	TOTAL (2002-2007)	TOTAL (2008-2012)
National average	-0.023	0.020	-0.017	-0.020	-0.003	0.211	0.039	0.191	0.23
Industrial-led	-0.017	0.022	-0.015	-0.010	0.004	0.230	0.039	0.219	0.258
Tourism-led									
-Canaries	-0.025	0.021	-0.017	-0.021	-0.004	0.196	0.039	0.178	0.217
-Balearics	-0.025	0.019	-0.026	-0.032	-0.006	0.218	0.039	0.186	0.225
Other	-0.026	0.020	-0.018	-0.024	-0.006	0.200	0.039	0.175	0.214

Other authors have estimated the Total Factor Productivity instead of labour productivity. According to Baier, Dwyer and Tamura (2006), the TFP in Spain from 1857 to 2000 grew by 0.29% per year. Taking a shorter and closer timespan, 1965-1990, the TFP grew 1.15% in Spain (Koop, Osiewalski & Steel, 2000). In brief, from 1965 to 2012, Spain averaged a TFP growth of 1.3%, approximately. The modest results of Baier et al (2006) were probably highly influenced by the Spanish civil war and the postwar period. Finally, Álvarez (2007) estimates the TFP growth in Spain (NUTS II), but assumes the same technological change by the regions for the period 1980-1995. His results average 1.25%, 0.46%, -0.05% and 2.36% for the Spanish national average, the Canary Islands (Santa Cruz and Las Palmas), the Balearic Islands and the industrial regions, respectively. In sum, although the results of the TFP are not exactly comparable with those of the TFLP, they report results of a similar order of magnitude to those obtained here.

Finally, the total values for the Canaries and the Balearic islands shown in Table 2 are introduced in their respective dynamic CGE model to quantify its economic impact. These shocks are applied upon the tourism activities ("accommodation", "catering services", "travel agencies", "real state", "rent a car" and "entertainment") to better analyze the consequences of labour productivity gains of these tourism-based sectors over the rest of the economy.

Dynamic CGE model

Table 3 shows that labour productivity gains in tourism activities increases competitiveness in both archipelagos. Nevertheless, the process is more intense in the Balearic Islands than in the Canaries. The main cause for these differences can be found in the greater import-dependence of the latter, where imports represent around 60% of GDP; while this rate falls to 40% in the former. Such dependence constrains the real exchange rate depreciation; limiting the gains of competitiveness. Nevertheless, the stronger foreign adjustment in the Balearic Islands also unleashes higher tourism demand, which crowds out domestic consumption and investment, and generates higher inflation. On the other hand, the domestic adjustment is less harmful in the Canaries, where consumer demand and investment rises. As a result, GDP growth is slightly higher in the Canaries.

Table 3:

The economic impact of labour productivity in the Canary and the Balearic islands (% deviations from the steady-state).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
CANARY ISLANDS											
Households	0.0037	0.0041	0.0045	0.0048	0.0051	0.0055	0.0066	0.007	0.0074	0.0078	0.0082
Government	0.0143	0.0147	0.0152	0.0156	0.016	0.0164	0.0199	0.0204	0.0208	0.0213	0.0218
Investment	0.0097	0.0101	0.0104	0.0108	0.0112	0.0116	0.0141	0.0145	0.0149	0.0154	0.0158
Tourism exports	0.0156	0.0157	0.0159	0.016	0.0161	0.0163	0.0198	0.02	0.0201	0.0203	0.0204
Other Exports	0.0211	0.0228	0.0245	0.0262	0.0278	0.0294	0.0356	0.0376	0.0395	0.0414	0.0432
Imports	0.0042	0.0046	0.0049	0.0053	0.0056	0.0059	0.0072	0.0076	0.008	0.0083	0.0087
PIB	0.0134	0.0139	0.0143	0.0148	0.0152	0.0157	0.0191	0.0196	0.0201	0.0206	0.0211
Inflation*	0.0066	0.0263	0.0266	0.027	0.0273	0.0276	0.0336	0.034	0.0343	0.0347	0.035
Real Exchange rate	0.0102	0.0433	0.0437	0.0442	0.0447	0.0451	0.0549	0.0555	0.056	0.0565	0.057
BALEARICS ISLANDS											
Households*	0.0742	0.0762	0.0783	0.0802	0.0821	0.084	0.0848	0.0865	0.0881	0.0898	0.0914
Government	0.3829	0.3814	0.3801	0.3787	0.3774	0.3761	0.3749	0.3737	0.3726	0.3715	0.3704
Investment*	0.0735	0.0755	0.0775	0.0795	0.0814	0.0832	0.084	0.0857	0.0873	0.0889	0.0905
Tourism exports	0.0969	0.0968	0.0966	0.0964	0.0962	0.0961	0.1003	0.1001	0.1	0.0998	0.0997
Other Exports	1.9709	1.9675	1.9642	1.9609	1.9578	1.9548	1.9548	1.9519	1.9492	1.9465	1.9439
Imports	0.6339	0.6328	0.6317	0.6307	0.6297	0.6287	0.6287	0.6278	0.6269	0.626	0.6252
PIB	0.0375	0.0357	0.0339	0.0322	0.0305	0.0289	0.0301	0.0286	0.0271	0.0257	0.0243
Inflation	0.0752	3.2184	3.2280	3.2328	3.2326	3.2419	2.7850	2.7885	2.7875	2.7954	2.7987
Real Exchange rate	0.1611	3.3066	3.3159	3.3204	3.3199	3.3289	2.8722	2.8755	2.8742	2.8818	2.8848

*households and investment show negative values for the whole period in the Balearics Islands. The inflation rate in the Canary Islands show a negative value for the first year.

Table 4:

The impact of labour productivity in domestic production in the Canary and the Balearic islands (% deviations from the steady-state).

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
CANARY ISLANDS											
Agriculture	0.0044	0.0048	0.0052	0.0055	0.0059	0.0062	0.0075	0.0079	0.0083	0.0087	0.0091
Energy and mining	0.0105	0.0115	0.0125	0.0134	0.0144	0.0153	0.0185	0.0197	0.0208	0.0219	0.0229
Processed food, beverages & tobacco	0.0105	0.0109	0.0114	0.0118	0.0122	0.0126	0.0153	0.0158	0.0162	0.0167	0.0171
Textiles	0.0125	0.013	0.0134	0.0139	0.0143	0.0147	0.0179	0.0184	0.0189	0.0194	0.0199
Industry	0.0159	0.0165	0.0171	0.0176	0.0182	0.0188	0.0228	0.0235	0.0241	0.0248	0.0254
Construction	0.0097	0.0101	0.0105	0.0109	0.0113	0.0117	0.0142	0.0146	0.015	0.0155	0.0159
Trade	0.0125	0.013	0.0135	0.014	0.0145	0.015	0.0182	0.0188	0.0194	0.0199	0.0205
Accommodation	0.0296	0.0299	0.0302	0.0305	0.0308	0.0311	0.0379	0.0383	0.0386	0.039	0.0393
Catering services	0.0181	0.0184	0.0187	0.019	0.0193	0.0196	0.0239	0.0242	0.0246	0.0249	0.0253
Road transport	0.0091	0.0095	0.0098	0.0102	0.0105	0.0108	0.0131	0.0135	0.0139	0.0143	0.0147
Maritime transport	0.0021	0.0024	0.0027	0.003	0.0033	0.0036	0.0043	0.0047	0.005	0.0054	0.0057
Air transport	0.0072	0.0075	0.0079	0.0082	0.0085	0.0088	0.0107	0.011	0.0114	0.0117	0.0121
Other transport services	0.0051	0.0055	0.0059	0.0062	0.0066	0.0069	0.0084	0.0088	0.0092	0.0097	0.0101
Real estate	0.03	0.0304	0.0308	0.0311	0.0315	0.0318	0.0387	0.0392	0.0396	0.04	0.0404
Rent a car	0.0081	0.0085	0.0088	0.0092	0.0096	0.0099	0.012	0.0124	0.0129	0.0133	0.0137
Entertainment	0.0322	0.0326	0.0329	0.0333	0.0337	0.0341	0.0415	0.0419	0.0424	0.0428	0.0432
Other services	0.0337	0.0341	0.0344	0.0348	0.0351	0.0354	0.0432	0.0436	0.044	0.0443	0.0447
Public Administration, education and health	0.015	0.0156	0.0162	0.0167	0.0172	0.0178	0.0216	0.0222	0.0228	0.0234	0.024
BALEARICS ISLANDS											
Agriculture	1.2519	1.2468	1.2417	1.2369	1.2322	1.2276	1.2212	1.2169	1.2128	1.2088	1.2049
Energy and mining	0.3708	0.3683	0.3658	0.3635	0.3611	0.3589	0.3575	0.3555	0.3534	0.3515	0.3495
Processed food, beverages & tobacco	0.8991	0.8971	0.8952	0.8934	0.8916	0.8899	0.8918	0.8902	0.8886	0.8871	0.8856
Textiles	1.0243	1.0269	1.0294	1.0318	1.0341	1.0364	1.0511	1.0532	1.0552	1.0572	1.0591
Industry	0.7316	0.7277	0.7239	0.7202	0.7167	0.7132	0.7066	0.7034	0.7003	0.6973	0.6943
Construction	0.3426	0.3407	0.3388	0.3370	0.3352	0.3335	0.3336	0.3320	0.3305	0.3290	0.3275
Trade	-0.2274	-0.2291	-0.2307	-0.2322	-0.2337	-0.2352	-0.2350	-0.2363	-0.2377	-0.2389	-0.2402
Accommodation	8.2286	8.2277	8.2268	8.2259	8.2251	8.2243	8.2519	8.2512	8.2504	8.2497	8.2490
Catering services	0.2039	0.2024	0.2010	0.1996	0.1982	0.1969	0.1997	0.1985	0.1973	0.1961	0.1950
Road transport	6.1497	6.1485	6.1472	6.1460	6.1449	6.1437	6.1455	6.1445	6.1434	6.1424	6.1415
Maritime transport	10.8032	10.8017	10.8003	10.7989	10.7975	10.7962	10.7882	10.7870	10.7858	10.7846	10.7835
Air transport	9.4511	9.4507	9.4504	9.4500	9.4497	9.4494	9.4481	9.4478	9.4475	9.4472	9.4470
Other transport sevices	0.2647	0.2641	0.2634	0.2628	0.2623	0.2617	0.2733	0.2728	0.2723	0.2718	0.2713
Real estate	0.7038	0.7010	0.6982	0.6954	0.6928	0.6902	0.6883	0.6859	0.6836	0.6814	0.6792
Rent a car	3.3788	3.3768	3.3748	3.3728	3.3710	3.3692	3.3834	3.3817	3.3801	3.3785	3.3769
Entertainment	1.6494	1.6483	1.6473	1.6462	1.6452	1.6442	1.6745	1.6736	1.6727	1.6718	1.6710
Other services	0.5768	0.5741	0.5715	0.5690	0.5666	0.5642	0.5614	0.5592	0.5570	0.5549	0.5529
Public Administration. education and health	0.3309	0.3295	0.3282	0.3269	0.3257	0.3245	0.3242	0.3231	0.3220	0.3209	0.3199

Another interesting and novel result is the general improvement in the production of domestic goods for both, tourism and non-tourism goods, in both archipelagos (see table 4). In other words, improvements in labour productivity in tourism activities foster sectoral diversification and alleviate the symptoms of the dutch disease detected in both archipelagos (Capó, Riera & Rosselló, 2007). The effect in the Canary Islands is much lower than in the Balearic Islands; precisely because of the higher import-dependence in the former. Further, the opposite effect of this result should also be highlighted when analyzing the economic impact of tourism. In this sense, authors such as Adams and Palmenter (1995), Zhou, Yanagida, Chakravorty and Leung (1997), Narayan (2004) and Inchausti-Sintes (2015), note that tourism boosts an appreciation of the real exchange rate by eroding traditional exports and detracting from domestic production. On the other hand, one negative aspect of labour productivity gains in tourism activities is the lack of employment creation, especially in two territories with a high unemployment rate such as the Balearic and the Canary Islands.
Overall, the results in both cases are modest, like the productivity gains estimated during these years. Nevertheless, according to the Spanish Statistical Institute (INE), the average economic growth attained during this period is modest as well, 0.76% and 0.9% for the Balearics and Canary Islands, respectively.

Reducing/increasing temporary jobs/permanent jobs

As mentioned in the literature review, services-based activities are more likey to hire temporary workers mainly because of seasonality. Furthermore, according to the results, permanent jobs enhance labour productivity. The rate of temporary workers in the Spanish archipelagos is 27.66% and 34.93% for the Balearic and the Canary Islands, respectively; which is 1.14 and 1.43 times above the industrial-led provinces, respectively. Assuming the same rate of temporary jobs of the industrial-led provinces as in the tourism-led ones, labour productivity increases to 0.19 and 0.2% for the Balearic Islands and the Canary Islands for the years previous to the economic crisis, respectively. Whereas, for the forthcoming years, labour productivity increases to 0.23% and 0.24%, respectively. Furthermore, these new levels of labour productivity would approach those of the industrial-led provinces (0.21% and 0.25% for both periods). In economic terms, this new labour productivity implies growth, on average, 1.03 times and 1.15 times higher than the base scenario for the Balearic Islands and the Canaries, respectively.

Sensitivity analysis

As highlighted in the results, the foreign sector provides a key role in determining the economic adjustment triggered by the improvement in labour productivity; boosting or crowding out domestic consumption and investment in the Canary and the Balearic Islands, respectively. Hence, the final step in this analysis consists in changing the elasticity of substitution between domestic and import goods in the Armington production to quantify the sensitivity of the results with respect to the base scenario. According to this analysis, assuming a 50% increase in this elasticity generates an average GDP growth 0.007 p.p. and 0.0004 p.p. higher than the base scenario for the Balearic and Canary Islands, respectively. Whereas assuming a decrease of 50% in this elasticity implies an average decrease of -0.010 p.p and -0.0007 p.p. with respect to the base scenario, respectively. Finally, the change of elasticities vanish or reinforce the effect already explained, but the conclusions remain the same in both cases.

Conclusions

Labour productivity was modest during the period 2002-2012 across the whole country and, specifically, in the two Spanish tourism-led economies. These values are similar to other authors findings of total factor productivity. Furthermore, the technological change is also below the Spanish industrial-led provinces. The low labour productivity, together with the current market situation with increasing competition from cheaper neighbouring destinations such as Tunisia, Turkey and Egypt, should encourage productivity gain mechanisms to address it. Furthermore, these results provide us with new insights about the economic impact of labour productivity gains in tourism activities in tourism-led economies. In the case of the Canaries, its stronger import dependence limits the competitiveness gain, but, at the same time, it allows for a bigger domestic improvement in terms of consumption and investment; reducing the tourism 'crowding out effect' observed in the Balearic Islands.

From a political perspective, the technical factors respond more to firm criteria, but the local government in both regions could act upon structural variables such as temporality. As the results show, if the same share of permanent jobs as the Spanish industrial-led provinces is assumed, the Balearic and the Canary Islands would have grown 1.09 and 1.27 times above their current share, respectively. From a company perspective, the customer information currently available on the internet, social networks or directly sourced from customers, represent an opportunity for service activities where the productive process is deeply conditioned by clients. Analysis of this information may yield valuable results about the need of clients for companies to offer more tailored products and better customer services. Given these particularities, we venture that the productivity gains obtained from this process would be higher than in non-service activities. Finally, quality improvements and rejuvenation policies should also provide an important complement to productivity improvement mechanism; especially in mature destinations such as the Balearic and the Canary Islands.

On the other hand, productivity gains are not an employment-driven mechanism per se. It should be remembered that both archipelagos suffer from a high and long-lasting unemployment rate. Specifically, it accounts for 8.33% and 11.21% from 2002 to 2007, and 20.61% and 27.89% since the beginning of the economic crisis in 2008 for the Balearic and the Canary Islands, respectively. The way to reconcile both productivity gains and employment creation will be a crucial policy area in these two mature destinations in the forthcoming decades. Additionally, the improvement in labour productivity because of the economic crisis should be analyzed cautiously. This rise responds to a sharper fall in employment than in production; yielding positive improvements in labour productivity.
The results also provide a novel insight to alleviate the negative consequences of tourism in tourism-led economies. While tourism specialization limits sectoral diversification, appreciation in the real exchange rate and erodes traditional exports; the labour productivity gains in tourism-based activities not only boost GDP, but also enhances non-tourism production. However, a higher degree of import dependence caps domestic improvement. The crowding out effect produced by tourism over the resident population could also feed negative feelings towards tourism as a motor of growth in tourism destinations.

Regarding the limitations of the analysis, we would highlight the lack of data availability for wider time horizons and the unavailability of more explanatory variables to model labour productivity at this aggregation level (NUTS III). Nevertheless, the analysis

addresses key variables such as years of education, capital-labour ratio, permanent-jobs share and technological change.

Finally, we briefly summarize the main findings of this study. Firstly, the technical factor yields negative results in term of labour productivity, and technological change is lower in the tourism-led economies than in those that are industrial-led. Fortunately, the previous negative values are compensated for by the structural factors yielding small, but positive, labour productivity gains. Secondly, the analysis detected a different economic adjustment in both tourism-led economies where the role of the foreign sector may allow for higher foreign competitiveness gains (that is, stronger real exchange rate depreciation), but at the cost of crowding out domestic consumption and investment. That aside, the foreign sector undoubtedly plays a key role in determining the economic effect of the labour productivity gains in both tourism-led economies. Thirdly, labour productivity gains in tourism activities enhance GDP growth in both cases, although the lack of employment creation should be a matter of concern in these two island territories. Fourthly, the rise of permanent jobs produces a positive impact on productivity in both tourism-led economies, which approaches the labour productivity of the industrial-led economies. Fifthly, labour productivity gains in tourism activities leads to moderation of the negative economic consequences of tourism specialization, and eases sectoral diversification.

Future research on this topic might address the performance of salaries in tourism-led economies. Specifically, studies could focus on the extent to which salaries are influenced by labour productivity or what the sources of discrepancy are with other more productive economies.

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Monetary policy and exchange rate regime in tourist islands

Monetary policy and exchange rate regime in tourist islands

Authors:

Federico Inchausti-Sintes
Ubay Pérez-Granja

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Abstract

The broad impact of the travel industry on economies has been comprehensively analysed in the tourism literature. Despite this, its consequences for monetary policy have remained unaddressed. This paper aims at providing a first approach in this line for the case of three small tourist island such as Cabo Verde, Mauritius and Seychelles. The research is based on a Bayesian estimation using a Stochastic dynamic general equilibrium model (SDGE), and where the optimal response to a tourism demand shock of four monetary policies are analysed. According to the results, both a conventional peg and an inflation-targeting policies achieve better economic performance. More precisely, the inflation is lower in the former. However, the rise in consumption and the gain in the external competitiveness is sharper in the latter. Finally, the other two policies, an inflation-targeting with managed exchange rate policy and an imported-inflation targeting policies generates higher consumption and external competitiveness, but, also higher inflation and interest rate.

Keywords: Stochastic dynamic general equilibrium models; monetary policy; tourism demand; and exchange rate.

Introduction

The economic context

Similar to other small islands, the economic development of Cabo Verde, Mauritius and Seychelles has predominantly been constrained by a lack of resources, its distance from international markets and/or low domestic demand. On the other hand, their economies have historically been defined by a poorly diversified productive structure, which mainly relies on low productive sectors such as agriculture and fishing. In the same line, these nations have been heavily dependent on imports, which is also the main cause of its chronic current account deficit. In 2019, imports account for around 55% of GDP in Mauritius, 61% in Cape Verde and 113% in Seychelles. All these factors help explain its difficulties in establishing stable economic growth throughout its history (Pratt, 2015).

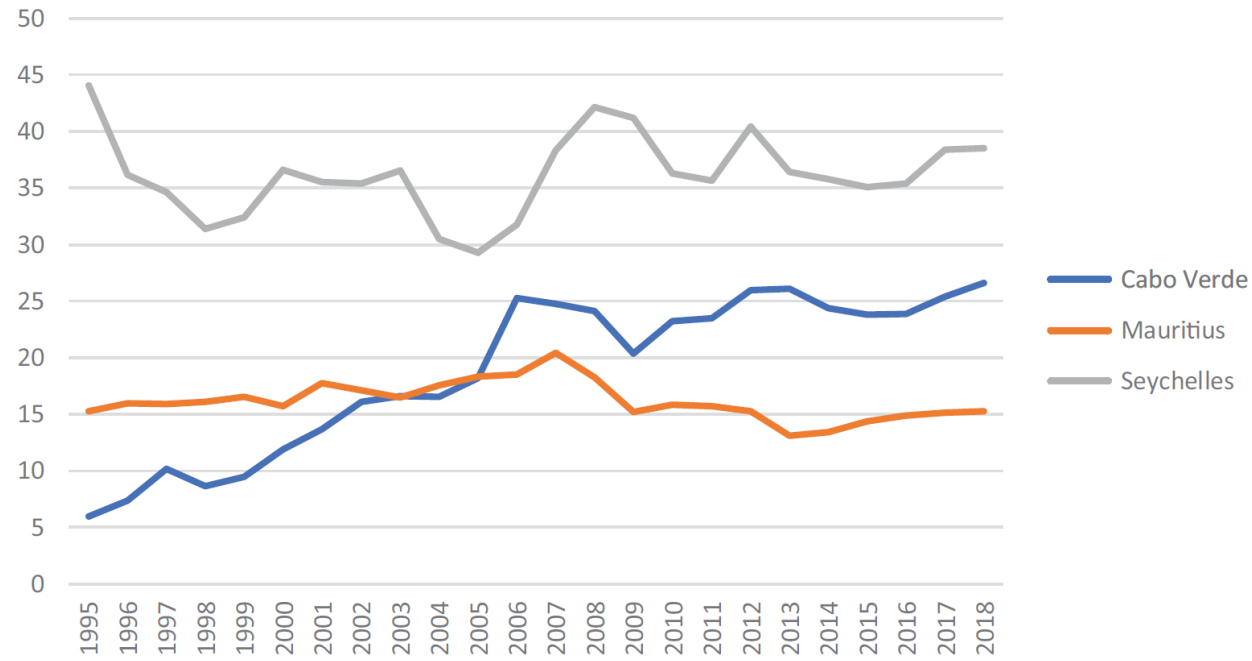
The three of them are located in Africa and, as former European colonies, they still have strong economic ties with Europe. According to the Observatory of Economic Complexity (OEC), in 2018, more than 80% of exports of goods in Cape Verde, and almost 50% and 40% in Seychelles and Mauritius, respectively, were demanded from European countries. Despite these figures, the economic importance of these exports is marginal in Cabo Verde (5.6% of the GDP) and Mauritius (2% of GDP), while in Seychelles, this share reaches around 23.75% during the period 1980-2017. By contrast, services have experienced a sharp upward tendency over the same time frame. In this sense, the exports of services represent a share of GDP of around 20.5% for Cape Verde and Mauritius, and 52.08% for Seychelles.

Tourism

Historically, remittances and international aid represented the primary foreign income of the Cabo Verdean economy (Bourdet and Falck, 2006; and Resende-Santos, 2016). For instance, in the late 1990s, remittances generated three times more currencies than goods exports and two and a half times more than tourism receipts. However, tourism became a significant economic factor that displaced remittances as a source of foreign income in the early 2000s. Currently, income from tourism represents more than 50% of total exports (around 75% of total service exports in 2018); and continues to grow. Both, the increasing importance of tourism and the steady fall in remittances, should be perceived as a positive symptom of the archipelago's economic and welfare development.

Seychelles and Mauritius started their transformation into a tourism-led economy in the 1970s (Archer and Fletcher, 1996; Durbarry, 2004) and the relevance of remittances has been significantly lower than in the case of Cape Verde for at least the last 30 years. In the case of Mauritius, Durbarry (2002) highlight the public effort to positioning the country as a leading tourism destination in the high-end segment. Overall, tourism receipts had averaged, as % of GDP, around 36.2% in Seychelles, 16.2% in Mauritius and 35% in Cabo Verde for the period 1995-2018 (see, Figure 1).

Figure 1.
Evolution of tourism receipts (% of GDP). Source: World Bank



The importance of tourism in these three nations and their economic contexts cannot be unconnected to their monetary policy or their exchange rate regime. In economic terms, tourism relies heavily on non-tradable sectors; thus, the pressure on the real exchange rate does not diminish. Besides, the higher income level of international tourists represents an increasing source of pressure on local prices. The import dependence also represents a significant growth limitation (leakage effects) in tourism-based economies (Dwyer, Forsyth & Dwyer, 2010), whereas, it also has a profound influence in the conduction of monetary

policy when aimed at controlling imported inflation. As noted by Larose (2003), the latter has been especially recurrent in Mauritius and Seychelles. Nevertheless, the share of imports may vary with the Tourism Life Cycle (TLC), showing high values at the first stage of tourism development (exploration and development), but falling at the end (Pratt, 2011).

On the other hand, tourism faces volatile demand, which becomes more apparent at emerging destinations, and where seasonality represents an additional factor of concern when dealing with tourism demand. In last term, this volatility may affect the value of the local currency. These sudden changes in value may affect inflation and the competitiveness of exports, causing, like in the case of Mauritius and Seychelles, timely interventions in this market, or adopting a fixed exchange rate to protect its value like in Cabo Verde.
In sum, this paper provides a novel approach to the discipline by analysing the economic impact of tourism in the conduction of monetary policy in these three economies. The study sheds light on the consequences of adopting four alternative monetary policies when addressing 'tourism demand shock': a conventional peg, an inflation-targeting, an inflation-targeting with managed exchange rate, and an imported-inflation-targeting policies. The research is based on a Bayesian estimation using a Stochastic dynamic general equilibrium model (SDGE) adapted from Justiano and Preston (2010). The dataset comprises quarterly economic data during the period 2007Q1-2019Q2.

Literature review

The economic impact of tourism

The overall impact of tourism on the economy has been widely addressed in the literature, and can be summarised as follows. Overall, tourism has been a significant cause of economic growth in many economies, especially on tourism islands (Brau, Lanza, & Pigliaru, 2007; Lanza, Temple and Urga, 2003; or Lee and Chang, 2008) and a source of poverty alleviation (Blake, Arbache, Sinclair and Teles, 2008; and Njoya and Seetaram, 2018). The small size, the lack of resources, the strong dependence on imports and/or the distance to major markets manifest the structural limitations of these kinds of economies to achieve significant economies of scales and compete internationally in many industrial activities. Historically, this represented one of the main causes of their economic underdevelopment. However, a key aspect of tourism is that it is perceived as a luxury good, which has been confirmed by several authors such as Untong, Ramos, Kaosa-Ard and Rey-Maquieira (2015), Smeral (2004), Algieri and Kanellopoulou (2009) and Falk (2014). This tourism demand behaviour leaves room for higher value-added gains allowing competition in this sector (Inchausti-Sintes, 2019a and 2019b).

On the other hand, the impact of tourism cannot be restricted to certain key sectors, because it affects the rest of the economy (Adams and Parmenter, 1995; Inchausti-Sintes, 2015; Narayan, 2004; Capó, Riera & Roselló, 2007). For instance, it triggers real exchange appreciation that detracts from traditional exports and increases imports. Moreover, the potential effects of tourism with other sectors, such as agriculture and fishing, light industry or construction to enhance economic diversification (Njoya and Nikitas, 2019; Pratt, 2011; Cai, Leung and Mak, 2006; Blake, 2008; Kweka, Morrissey and Blake, 2003; Valle and Yobesia, 2009) is somewhat blurred by evidence showing the marginal weight of these sectors in total GDP at most tourism destinations (Inchausti-Sintes, 2019a). In this regard, the manufacturing sector accounts for 6%, 11% and 6.2% of total GDP in Cabo Verde, Mauritius and Seychelles, respectively. while it reached its peak during the 1990s when it averaged 12% in Cape Verde and Seychelles, and 20% in Mauritius. The latter is not necessary or always caused by tourism, but, in most of the

cases, is an inherited structural flaw in these economies prior to tourism development.

Moreover, given the prevalence of imports in these kinds of economies, this rise simply increases the leakage effect - limiting the positive effect of tourism - although it tends to reduce with tourism development (Pratt, 2011). Finally, tourism also causes a sectoral shift from the tradable sector to the non-tradable sector, which exacerbates inflation, depletes sectoral diversification, and jeopardizes productivity gains. Fortunately, the appeal of tourism as a luxury good also allows compensating productivity gains with quality

Monetary policy and home bias

All these impacts in the real economy also affect the conduction of monetary policy in these kinds of economies, which consequently have to 'understand' and react to this impact. In this sense, the degree of openness (home bias), especially on small islands, is a key factor to address. As noted by Faia and Monacelli (2008), inflation volatility is U-shaped in the degree of trade openness (imports to GDP). Assuming extreme values of the latter (0 no-trade openness, or 1, no home bias) in a small-economy setting mimics a closed economy situation by generating lower inflation volatility in both cases. The authors also detect that the volatility of the real exchange rate decreases in the degree of openness. For instance, a greater degree of openness means a smoother nominal exchange rate would be prescribed, which leads to a smoother adjustment in both the real exchange rate and the terms of trade. Whereas, when it approaches purchasing power parity (low degree of openness), it requires a stronger adjustment in the last two variables to restore macroeconomic equilibrium.
Regardless of the structural conditions, the importance of imports in these kinds of economies is also ruled by domestic demand. Domestic preferences tend towards domestic goods (home bias), even with low trade costs (Obstfeld and Rogoff, 2000), whereas it reduces with economic integration (Mika, 2017) or inmigration (White, 2007). Furthermore, this helps explain the volatility of the nominal exchange rate and long-run deviations from PPP (purchasing power parity) (Warnock, 2003). Specifically, this latter author affirms that the nominal exchange rate depreciates more with an increase in the money supply when domestic goods prevail over imported goods (home bias) reducing the pass-through effect in domestic prices. According to the author, the facilitates a beggar-thy-neighbour monetary policy. Wang (2010) also argues that, with lower home bias, it is preferable to stabilise the real exchange rate under an uncovered interest rate parity (UIP) shock. According to him, in these circumstances, the real exchange rate allows output fluctuations to be reduced. This lower volatility in macroeconomic variables is higher under monetary union (an extreme case of a peg), while eliminating UIP shocks (Kollmann, 2004). Besides, this positive effect increases with lower home bias.

Monetary policy on small islands

The small size of the economy, the undiversified economic structure or high dependence on imports, among others, are not the only factors that influence economic growth or monetary policy on small islands. The proper management of the latter also presupposes an adequate financial system and credit demand. As noted by Jayaraman and Choong (2010), Jayaraman and Dahalan (2008) and Ramlogan (2004), the former usually show an insufficient degree of development, while the latter tend to be weak in these kinds of economies. This entails, for instance, that rather than the interest rate, both the money and the exchange rate emerge as the main channel of monetary policy to affect the real economy (Jayaraman and Dahalan, 2008; and Ramlogan, 2004). Unsurprisingly, many small islands have historically opted for fixed or managed exchange rate regimes (Yang, Davies, Wang, Dunn and Wu, 2012;

Jayaraman and Choong, 2010 and International Monetary Fund, 2019). Rodriguez-Fuentes (2017) goes a step further and argues that, given the aforementioned circumstances, Caribbean islands are 'incapable' of conducting their own monetary policy. Similarly, De Brouwer (2000) suggests, for the case of some small Pacific Islands, that they should adopt a fixed exchange rate with the Australian dollar.

The use of a foreign currency of a nominal anchor reduces economic volatility, the pass-through effect, and, overall, has proved its usefulness in controlling inflation. In some cases, inflation remains lower than other free-floating small islands (Boyd and Smith, 2006). Nevertheless, it entails the loss of control over monetary policy as an economic instrument. Under this regime, changes in the domestic interest rate depend on respective changes in the third country, which, at the same time, will raise or reduce its rate according to their economic circumstances. In general, decoupling in their respective economic performances may eventually trigger counter-productive policies; leading to exchange rate speculation in the pegged economy. In the worst scenario, it would imply entirely abandoning this regime (Cavallo and Cavallo, 2017). In a more "business as usual" scenario, Weber (2005) notes, for the case of Cabo Verde, that this regime leads to persistent high-interest rates that detract from domestic investment and economic growth. On the other hand, the lower capital inflows attracted by these kinds of economies allow them to enjoy a certain degree of freedom under a fixed exchange regime (Yang, et al., 2012).

The monetary policy in Cabo Verde, Mauritius and Seychelles

Shortly after gaining its independence, Cabo Verde managed its monetary policy by establishing a fixed interest rate; and where the Central Bank operated as both a central and commercial bank, simultaneously. In term of the currency, the country adopted a fixed exchange rate, but against a basket of currencies. The 1990s was a period of profound economic reform aimed at revitalising the economy and the public administration. The Central Bank also underwent profound changes in its management and responsibilities more aligned with its counterparts in developed countries. Monetary policy benefited from these changes and became more effective in controlling inflation (Oliveira, Frascaroli and da Silva, 2015). The last significant reform took place in 1998 when the country signed the Exchange Rate Cooperation Agreement with Portugal; which aimed at establishing full convertibility of the national currency and a fixed exchange rate, which came to operate as a nominal anchor that ensured price stability. In 1999 the euro replaced the Portuguese escudo as the nominal anchor in the country. As noted by Weber (2005), the appreciation of the euro has brought increasing pressure to bear on this regime, which has involved recurrent interest rate increases and led to falling domestic investment and economic growth. Conversely, the inflation rate has been steadily decreasing and, since the summer of 2003, has remained below 2% (the annual goal established by the European Central Bank for its country members).

In the case of Mauritius, the 1980s and 1990s was also a period of profound economic changes after years of economic instability (Larose, 2003). For instance, the control of prices has always been a key objective of the Bank of Mauritius (BoM). Nevertheless, previous to these decades, inflation averaged 17% during the period 1975-1982, while it reached 7.4% until the 1990s (Heerah-Pampusa, Khodabocus, Morarjee & Bissessur, 2006). During the 1990s, the erratic conduction of the monetary policy was progressively controlled by limiting the expansion of credit, establishing an annual ceiling in the interest rate (Fry and Roi, 1995). Even when the BoM was capable of reducing the volatility of prices, the inflation still averaged 6.8% for the period 1992-1999. In 1999, the BoM changed their monetary

framework, focusing on interest rates to control the monetary growth averaging an inflation rate of 5.1 for the period 200-2005. In 2004, the BoM act (Gazzete of the Republic of Mauritius, 2004) was changed and now clearly defines that the primary objective is to keep the price stability and promoting an orderly and balanced economic development (Tsangarides, 2010). In 2006 the Central Bank introduced its current framework, the KRR, where the overnight interbank interest rate is the operational target. According to the Annual Report on Exchange Arrangements and Exchange Restrictions of International Monetary Fund (AEAER, 2018), nowadays the Mauritius rupee is free-floating currency. However, the BoM apply some timely interventions in the market.

During most of its history, the Central Bank of Seychelles (CBS) had a monetary policy based on a fixed exchange rate linked to a weighted basket of currencies. The main regulations of the banks were established in 1982 but it has been amended several times since them (1986, 1999, 2001, 2004 and 2008). In 2008, the bank underwent a profound reform changing, drastically, the monetary framework of the institution. The new one replaced the exchange rate nominal anchor by a monetary policy focused on monetary aggregate (CBS, 2018). This change was part of a macroeconomic program of reforms promoted by the International Monetary Fund (IMF) (IMF, 2008). This policy aimed at liberalising the foreign exchange rate market and improving price stability. More recently, in 2019, the CBS changed again its monetary policy framework from monetary aggregate targeting to an interest rate-based economy.

Methodology

The model is a small-open economy proposed by Justiano and Preston (2010), and was programmed in Dynare 4.5.3. Firstly, we briefly introduce the main theoretical issues and assumptions of the model. Those interested in the mathematical formulation are referred to Justiano and Preston (2010). Finally, we transcript the log-linearised equations of the model used in the estimation.

Main theoretical issues and assumptions

The model allows for incomplete asset markets, habit formation and price indexation to past inflation. The premise of incomplete asset markets allows risk-premium discrepancies to be taken into account. This risk-premium contributes to explaining the persistent interest rate gap in the three economies. Moreover, as demonstrated by Justiano and Preston (2010), restricting the relative movements of the domestic and foreign interest rate, causes the law of one price (LOP) to fail ($\widetilde{\Psi}_t \equiv \frac{\tilde{e}_t P_t^*}{P_t} \neq 1$, where the *LOP* gap ($\widetilde{\Psi}_t$) depends on the nominal exchange rate and on the international and domestic prices (P_t^* *and* P_t, respectively)).

In terms of habit formation, the above implies assuming a certain kind of consumption inertia (i.e. the representative household not only derives utility from current consumption, but is also affected by past consumption patterns, which they try to maintain over time). In terms of economic adjustment, habit formation reduces the possibility of a sudden change in consumption pattern. In mathematical terms, it implies that the utility function is no longer additively separatable over time (Torres, 2003). Similarly, price indexation also seeks to capture the inflation inertia observed in the economy. The modelisation for this behaviour is based on 'Calvo price setting' (Calvo, 1983). This author introduces inflation indexation by assuming that, in any period, a fraction of firms set prices optimally, while

another fraction of them update their prices only to past inflation. Specifically, the model assumes the existence of two kinds of firms: domestic producers (H) and imported firms (F) (retail firms). Each of them determine their prices according to the Calvo setting.

Tourism is introduced in the model in the market-clearing condition: $Y_{H,t} = C_{H,t} + C^*_{H,t}$, where refers to the domestic economy in period t . $Y_{H,t}$ denotes the domestic production which is domestically ($C_{H,t}$), or internationally ($C^*_{H,t}$,) consumed. The latter is disentangled, at the same time, in tourism export and remaining exports according to a Cobb-Douglas demand: $\alpha_{tour} Ctour^*_{H,t}$; $\alpha_x X^*_{H,t}$, where $Ctour^*_{H,t}$ refers to tourism consumption, $X^*_{H,t}$ denotes the remaining exports and; α_{tour} and α_x refer to the share of tourism consumption and remaining exports in the domestic economy (% GDP), respectively. Theoretically, the foreign demand function of both goods/services are: $Ctour^*_{H,t} = \left(\frac{P^*_{H,t}}{P^*_t}\right)^{\tau} Y^*_t$ and $X^*_{H,t} = \left(\frac{P^*_{H,t}}{P^*_t}\right)^{\lambda} Y^*_t$, where λ and τ denote their respective elasticity of demands. Finally, the monetary policy is introduced in the model with the Taylor rule.

Log-linearised model

This subsection briefly introduces the equations used in the estimation and simulation of the model. The advantage of using log-linearised models is that all variables are in log-deviation from the steady-state (lower cases); and thus, the initial values of all variables are set to zero, facilitating the fulfilment of Blanchard-Kahn conditions.

Domestic households' Euler equation:

This equation arises from the optimal behaviour of the representative household and it is represented in equation (1).

$$c_t - hc_{t-1} = E_t(c_{t+1} - hc_t) - \sigma^{-1}(1-h)(i_t - E_t\pi_{t+1}) + \sigma^{-1}(1-h)(\varepsilon_{g,t} - E_t\varepsilon_{g,t+1}) \quad (1)$$

Where c_t denotes household consumption, h is the habit formation parameter, σ denotes the inverse elasticities of intertemporal substitution and labour. E_t denotes the expectation operator that apply over a one period ahead of inflation ($E_t\pi_{t+1}$) and over the $\varepsilon_{g,t}$ preference shock $(\varepsilon_{g,t})$ $(E_t\varepsilon_{g,t+1})$. The usual Euler equation for domestic household can be obtained if $h = 0$. Alongside exports, this optimal demand decision must be satisfied in the market by the production (domestic or imported). In sum, all these decisions are represented in the market-clearing condition (equation 2).

Market clearing condition:

$$(1-\alpha)c_t = y_t - \alpha\eta(2-\alpha)s_t - \alpha\eta\psi_{F,t} - \alpha(\alpha_x x^*_{H,t} + \alpha_{tour} ctour^*_{H,t}) \quad (2)$$

s_t refers to the terms of trade $(\Delta s_t = \pi_{F,t} - \pi_{H,t})$ and is related to the real exchange rate in the following manner:

$$q_t = e_t + p^*_t - p_t = \psi_{F,t} + (1-\alpha)s_t \, . \quad (3)$$

α denotes the share of import consumption in the total consumption basket, while ($\eta > 0$) is the elasticity of substitution between domestic and foreign goods, (see section 2.1 in Justiano and Preston, 2010). denotes domestic production and finally, the LOP gap is $\psi_{F,t} \equiv (e_t + p_t^*) - p_{F,t}$ .While the nominal exchange rate simply represents the price of one currency in term of others, the real exchange rate allows comparing the prices of different countries 'consumption baskets in term of one reference basket and currency. I.e. in this case, it allows measuring the degree of foreign competitiveness by comparing the prices of consumption baskets in Cabo Verde, Mauritius and Seychelles in respect to the European Union (reference country). The terms of trade (s_t) represents the difference in prices between exports and imports. I.e. how many units of exports are needed to purchase a unit of imports. Finally, $Ctour_{H,t}^*$ and $x_{H,t}^*$ were previously introduced and denote the tourism demand and remaining exports, respectively.

In the case of Mauritius and Seychelles, the nominal exchange rate is allowed to vary and adopt the following functional form: $e_t = e_{t-1} - (q_t - q_{t-1}) + \pi_t^* - \pi_t$ (4)

On the one hand, equation (2) implies that domestic consumption depends not only on domestic output, but also on three foreign sources: the terms of trade, the deviations from the law of one prices and foreign output. On the other hand, equation (3) implies that the real exchange rate varies with the differences in consumption bundles across domestic and foreign economies and the deviations from the law of one price.
The terms of trade and the real exchange rate are linked according to

Domestic firms' inflation

Equation (5) represents firms optimality condition, which imply the following relationship for inflation:

$$\pi_{H,t} - \delta_H \pi_{H,t-1} = \theta_H^{-1}(1 - \theta_H)(1 - \theta_H \beta) mc_t + \beta E_t(\pi_{H,t+1} - \delta_H \pi_{H,t}) \quad (5)$$

captures the degree of price indexation and the probability of a firm to set prices to past inflation, respectively. When β denotes the intertemporal discount factor of the utility of households. is the real marginal cost function of each firm and takes the following functional form: . $mc_t = \varphi y_t - (1 + \varphi)\varepsilon_{a,t} + \alpha s_t + \sigma(1 - h)^{-1}(c_t - hc_{t-1})$
This real marginal cost arises from the optimal production decision.

Retailers' inflation:

$$\pi_{F,t} - \delta_F F_{F,t-1} = \theta_F^{-1}(1 - \theta_F)(1 - \theta_F \beta)\psi_{F,t} + \beta E_t\left(\pi_{F,t+1} - \delta_F \pi_{F,t}\right) + \varepsilon_{p,t} \quad (6)$$

All variables and parameters maintain the same meaning in equation (6) as equation (5). but refer to imported firms (subscript F). The equation also includes a shock parameter $\varepsilon_{cp,t}$

Domestic inflation and home goods inflation:

Domestic inflation and home goods inflation are related according to equation (7):

$$\pi_t = \pi_{H,t} + \alpha \Delta s_t. \quad (7)$$

As noted, domestic inflation deviates from home goods inflation because of the terms of trade and the import share. As highlighted in the introduction, the imports share (α) is around 60% for Cabo Verde and Mauritius, and above 100% in Seychelles. Hence, a rise in imported inflation captured by the term of trade (Δs_t) will have a stronger impact on domestic inflation (higher pass-through effect).

Uncovered interest rate parity:

Briefly, this equation (8) mainly reflects the way domestic interest rate responds to the foreign interest rate. This effect is also affected by domestic and foreign inflation, the expected real exchange differential, the foreign asset position and the risk-premium.

$$(i_t - E_t\pi_{t+1}) - (i_t^* - E_t\pi_{t+1}^*) = E_t\Delta q_{t+1} - \chi a_t - \tilde{\phi}_t \qquad (8)$$

Where $a_t = \log\left(\frac{e_t B_t}{P_t \bar{Y}}\right)$ is the log real net foreign asset position as a fraction of steady-state output. The latter and the parameter χ come from the manipulation of the risk-premium function: $\phi_t = exp\left[-\chi(A_t - \tilde{\phi}_t)\right]$ (Benigno, 2001; Kollmand, 2002; and Schmitt-Grohe & Uribe, 2003). $\tilde{\phi}_t$ denotes the risk-premium shock.

Budget constraint:

Equation (9) allows representing the balance constraint of the economy.

$$c_t + a_t = \beta^{-1}a_{t-1} - \alpha\left(s_t + \psi_{F,t}\right) + y_t \qquad (9)$$

Taylor rule:

The monetary policy in a DSGE model is represented using the Taylor rule or the Taylor equation. The Cabo Verdean Central Bank pursues price stability as the main objective of its monetary policy, using the interest rate as an operational goal; and the exchange rate stability as an intermediate one to ensure the full convertibility of the currency. The latter is implemented under a conventional peg regime to the euro, in a context of free capital mobility (BO, 2002). Therefore, the Bank closely monitors the euro interbank offer rate (Euribor) to establish its operational goals. Hence, The Taylor rule equation is as follows:

$$i_t = \psi_i i_{t-1} + \psi_\pi \pi_t + \psi_y y_t + \psi_{\Delta y}\Delta y_t + \psi_{euribor}\Delta euribor_t + \varepsilon_{M,t} \qquad (10)$$

Where i_t refers to the interest rate which is explained by the interest rate in the previous period (i_{t-1}) , current inflation (π_t), current production (y_t), the production differences concerning the previous period (Δy_t) and the Euribor interest rate differential, also in respect to the previous period ($\Delta euribor_t$).

Both Mauritius and Seychelles adopt a floating exchange rate and aim at controlling inflation, but they conduct their monetary policy with slight differences. While the Mauritian monetary authority follows an interest-based policy using the overnight interbank interest rate as the operational target (BoM, 2006), Seychelles used money supply as the operational one (monetary-aggregate-targeting) from 2008 to 2019 (CBS, 2018).

The Taylor rule adopts the following function for Mauritius:

$$i_t = \psi_i i_{t-1} + \psi_\pi \pi_t + \psi_y y_t + \psi_{\Delta y} \Delta y_t + \psi_{er} \Delta er_t + \varepsilon_{M,t} \quad (11)$$

Where Δer_t refers to the exchange rate variation in respect to the previous period.

In the case of Seychelles, Li, O´Connell, Adam, Berg and Montiel (2016) propose the following Taylor rule when using monetary aggregate as operational goal (equation 12).

$$i_t = \frac{1}{\psi_{ma}} \left(\pi_t + \psi_{\Delta y} \Delta y_t + \Delta \varepsilon_{M,t} \right) - i_{t-1} \quad (12)$$

The advantage of this rule rests on modelling monetary aggregate, but without introducing a money demand equation in the model. In all cases, the monetary policy includes a monetary shock $\varepsilon_{M,t}$. Finally, y_t and Δer_t are introduced into the previous equation to provide a closer representation of the current monetary policy in this archipelago. In sum, the Taylor rule is as shown in equation (13):

$$i_t = \frac{1}{\psi_{ma}} \left(\pi_t + \psi_{\Delta y} \Delta y_t + \psi_y y_t + \psi_{er} \Delta er_t + \Delta \varepsilon_{M,t} \right) - i_{t-1} \quad (13)$$

Foreign economy block:

Finally, we assume the following first-order autoregressive model (AR(1)) to describe the exogenous evolution of the foreign economy in Cabo Verde, Mauritius and Seychelles (equations 14, 15, 16 and 17).

$$c^*_{tour,t} = \rho_{tour} c^*_{tour,t-1} + \varepsilon_{tour,t} \quad (14)$$

$$x^*_{,t} = \rho_{exports} x^*_{,t-1} + \varepsilon_{exports,t} \quad (15)$$

$$r^*_t = \rho_{interest} r^*_{t-1} + \varepsilon_{interest,t} \quad (16)$$

$$\pi^*_t = \rho_{inflation} \pi^*_{t-1} + \varepsilon_{inflation,t} \quad (17)$$

Dataset, calibration and estimation

The observed variables of the model for the three economies are: GDP in current prices (y_t), inflation rate (π_t), interest rate (r_t), real exchange rate (q_t),consumption (c_t)[9], tourism receipts $(c^*_{tour,t})$[10], remaining exports (x^*_t) and the foreign debt ratio (a_t)[11]and the nominal exchange rate(er_t).[12] The observed variables for the Eurozone are: inflation rate (π^*_t) and Euribor (r^*_t). The time series were sourced from the Caboverdian Statistical institute, The National Bureau of Statistics of Seychelles, the European Statistical Office (Eurostat) and the IMF database (International Financial Statistics); and cover the period 2007Q1-2019Q2. An essential strength of SDGE algorithm is the capability of achieving a fast convergence in

[9] There is no quarterly consumption data available for Seychelles.

[10] There are no quarterly tourism data available for Cabo Verde and Mauritius. In these cases, the tourism receipts were proxied using the expenditure in service export activities. In the case of Cabo Verde, it should be noted that tourism receipts average around 75% of services exports from 2007 to 2019. For Mauritius, this share is significantly lower (around 20% of services exports), but both series show a strong correlation of 86% for the period 1995-2018. Finally, in the case of Seychelles, there are quarterly data of tourism arrivals for the selected time frame.

the estimation, even in short samples (Herbst & Schorfheide, 2016)

A Hodrick-Prescott filter was applied to the logged time series to remove the cyclical component and to obtain a smoother representation of the time series (stationarity) to fit the log-linearised model better. Finally, three more shocks were introduced in the measurement equations of the observed variables: $y_t, \hat{x_t}, r_t,$ to avoid singularity problems. Hence, the number of observed variables equate to the number of shocks in the SDGE model. According to Iskrev (2010), there is no consensus about the number of observable variables and the identification of parameters. Nonetheless, quoting the author (2010, page 200): "the variables differ in the sensitivity of their moments to the parameters. This implies that the choice of observables would have consequences for the precision with which different parameters may be estimated". In consequence, we run a sensitivity analysis based on Ratto and Iskrev (2010). This analysis reports misleading information. On the one hand, the reduced-form and Spectrum analysis confirm that all parameters are identified. On the other hand, the test of moments detects identification problems in some errors terms when, precisely, these errors are introduced vis-a-vis with the observable variables to avoid singularity issues in the estimation. In sum, we can not reduce the number of errors without reducing the number of observable variables.

The estimation process covers two steps. Firstly, the AR (1) models of the foreign economy were estimated independently to calibrate their respective parameters $(\rho_{tour}, \rho_{exports}, \rho_{interest}, \rho_{inflation})$ Secondly, these estimated parameters, alongside their respective equations, were introduced in the SDGE model. Secondly, a series of structural parameters were estimated in the Bayesian regression (Table 2). Their means and distribution (inverse gamma) were sourced from Justiano and Preston (2010), while the standard deviation were obtained from (Kolasa, 2009). The latter assume higher standard deviations more in accordance with the value expected in developing economies, like that of Cabo Verde, Mauritius and Seychelles. In any case, the choice of the mean and std. deviations of the priors is also a source of debate. Fernández-Villaverde (2010) highlights two possible strategies when eliciting the values of the priors: either give more importance to the likelihood by assuming loose priors, or, conversely, adopt tighter priors. The author recommends the latter when the model is for policy analysis and the former when conducting research. In the case of Justiano and Preston (2010), the authors choose loose priors for those parameters that show a larger estimate variation in the literature. Finally, Table 1 shows the value of the parameters that remain fixed in the estimation.

[11] The foreign debt ratio is measured by the "net acquisition of financial assets", sourced from the financial account of the Balance of Payment. This variable could not be used for Mauritius and Seychelles due to the abundance of negative values which prevented the application of the Hodrick-Prescott filter.

[12] This variable is only observable for Mauritius and Seychelles which operate under a floating xchange

Table 1.

Fixed parameters in the SDGE model.

	Cabo Verde	Mauritius	Seychelles
Parameter	**value**	**value**	**value**
$\psi_{euribor}$	0.5	-	-
ψ_{er}	-	0.5	-
β	0.99	0.99	0.99
α	0.65	0.60	1.01
α_x	0.25	0.67	0.62
α_{tour}	0.75	0.33	0.38
σ	0.88	0.88	0.88
η	0.8	0.8	0.8
ρ_{tour}	0.36	0.402	0.17
$\rho_{exports}$	0.8	0.8	0.28
$\rho_{interest}$	0.69	0.69	0.69
$\rho_{inflation}$	0.079	0.079	0.079

Results

Bayesian regression

Table 2 shows the results of the Bayesian econometric regression after 1,000,000 runs. reports a low mean value for Cabo Verde and Mauritius (0.08 and 0.07, respectively) when compared with the prior one, showing the lack of habit persistency in Cabo Verdian and Mauritian consumption. Adolfson, Laséen, Lindé and Villani (2008) also report a similar value for habit formation when assuming fixed exchange rate rules in Sweden. Conversely, Seychelles reports a higher mean value (0.29).

Both domestic and imported firms show a low and similar degree of price indexation in the three economies (δ_H=0.06 and δ_F=0.11 in Cabo Verde, δ_H=0.08 and δ_F=0.13 in Mauritius, and δ_H=0.05 and δ_F=0.10 in Seychelles), meanwhile the probability of indexation to past inflation (θ_H and θ_F) remain high in the Cabo Verdian and Mauritian economies, whereas it is slightly lower in Seychelles. These results are broadly in line with economies with low inflation rates such as Sweden, Australia, Canada, USA, New Zealand, Spain and South Africa (Adolfson et al, 2008; Justiniano and Preston, 2010, Gupta and Steinbach, 2013; and Burriel, Fernández-Villaverde and Rubio-Ramírez, 2010). But they are significantly lower than Poland: an inflation-targeting economy that also has strong economic ties with the Eurozone (Kolasa, 2009). The risk premium (χ) in takes a value of 0.17, 0.07 and 0.29 for Cabo Verde, Mauritius and Seychelles, respectively, which is larger than that estimated by Adolfson et al (2008) for Sweden. The estimate of Justiniano and Preston (2010) is not comparable because they assume an AR(1) process for the risk-premium, which show strong inertia. Overall, the risk-premium of the three economies is much lower than other developing economies, such as Brazil, Colombia, Chile, Peru or Mexico, where it is above 1.40 (McKnight, Mihailov & Rangel, 2020).

Regarding monetary policy, it shows certain interest rate and inflation rate inertia in Cabo Verde and Mauritius (ψ_i= 0.53 in both economies, and ψ_π=0.75; and ψ_π=0.42 in Cabo Verde and

Mauritius, respectively), while the monetary aggregate target in Seychelles entails a tight monetary discipline (ψ_{ma}= 0.68). The results are in line with the cases of small-open economies such as Australia, Canada and New Zealand (Justiniano and Preston, 2010).

Table 2.

Estimates of the SDGE model.

	Prior values		Posterior values						Distribution
			Cabo Verde		Mauritius		Seychelles		
	mean	Std. dev	mean	Std.dev	mean	Std.dev	mean	Std.dev	
h	0.30	0.1	0.08	0.007	0.07	0.007	0.29	0.099	beta
δ_H	0.06	0.1	0.06	0.004	0.08	0.004	0.05	0.051	beta
θ_H	0.69	0.1	0.89	0.008	0.88	0.021	0.77	0.069	beta
δ_F	0.10	0.1	0.11	0.003	0.13	0.003	0.10	0.053	beta
θ_F	0.41	0.1	0.52	0.015	0.61	0.015	0.43	0.057	beta
χ	0.30	0.1	0.17	0.008	0.07	0.008	0.29	0.100	beta
ψ_i	0.74	0.1	0.53	0.006	0.53	0.006	-	-	beta
ψ_π	0.5	0.1	0.57	0.007	0.42	0.007	-	-	beta
ψ_y	0.08	0.1	0.45	0.003	0.24	0.003	-	-	beta
$\psi_{\Delta y}$	0.67	0.1	0.73	0.024	0.53	0.020	-	-	beta
$\psi_{\Delta er}$	0.5	0.1	-	0.021	0.47	0.021	-	-	beta
ψ_{ma}	-	-	-	-	-	-	0.68	0.111	beta
$\varepsilon_{tour,t}$	0.1	inf	0.08	0.008	0.11	0.031	0.07	0.008	Inverse gamma
$\varepsilon_{m,t}$	0.1	inf	0.15	0.005	0.06	0.005	0.04	0.011	Inverse gamma
$\varepsilon_{yobs,t}$	0.1	inf	0.02	0.0028	0.02	0.006	0.08	0.010	Inverse gamma
$\varepsilon_{\pi obs,t}$	0.1	inf	0.01	0.0012	0.02	0.004	0.03	0.004	Inverse gamma
$\tilde{\phi}_t$	0.3	inf	0.19	0.0948	0.07	0.019	0.09	0.019	Inverse gamma
$\varepsilon_{robs,t}$	0.1	inf	0.33	0.0145	0.43	0.037	3.78	0.376	Inverse gamma
$\varepsilon_{xobs,t}$	0.1	inf	0.15	0.0019	0.1	0.010	0.13	0.0136	Inverse gamma
$\varepsilon_{tourobs,t}$	0.1	inf	0.06	0.0011	0.09	0.243	0.08	0.0551	Inverse gamma
$\varepsilon_{qobs,t}$	0.1	inf	0.09	0.0077	0.05	0.012	0.16	0.0198	Inverse gamma
$\varepsilon_{aobs,t}$	0.1	inf	0.19	0.0173	0.07	0.015	0.07	0.0089	Inverse gamma
$\varepsilon_{r^* obs,t}$	0.1	inf	0.53	0.0162	0.53	0.058	0.53	0.0536	Inverse gamma
$\varepsilon_{\pi^* obs,t}$	0.1	inf	0.01	0.008	0.01	0.009	0.01	0.0009	Inverse gamma

Optimal monetary policy

Optimal monetary policy consists in minimising the quadratic loss function of the form (Juillard, 2011):

$$min_{\gamma} E(y_t' W y_t)$$

s.t:

$$A_1 E_1 y_{t+1} + A_2 y_t + A_3 y_{t-1} + C e_t = 0$$

The constraint represents the SDGE equations, where y_t is the vector of endogenous variables, e_t is the vector of shocks and , A_1, A_2, A_3 and C refer to coefficient matrices. is a subset of parameters of , A_1, A_2 and A_3(pertained to the policy rule equation) that minimises the quadratic loss function. Finally, W is a semi-definitive matrix representing the weight of the loss function. The latter can be alternatively expressed as a minimising weighted sum of variances and covariances of endogenous variables: $\sum_{i=1}^{n} \lambda var(y_{i,t})$ „ , where λ now denotes the weight of each variable in the loss function (in our case, it takes value 1 for all variances and covariances of the endogenous variables). In sum, the problem seeks to identify the optimal values of the parameters of the Taylor rule equation to minimise the welfare loss; constrained to the remaining equations and parameters of the SDGE model. In our case, we aim to analyse the optimal monetary policy response when addressing a tourism demand shock of 4.4%, which is the forecast of the World Tourism Organisation for developing economies for the period 2010-2030 (UNWTO, 2011). This shock is analysed assuming different Taylor rules representing different monetary policy regimes: one conventional peg (CP) and three alternative flexible exchange rate rules: a standard inflation-targeting rule (IT), inflation-targeting rule with managed exchange rate (IT-ER). And finally, an imported-inflation-targeting (M-IT):

CP: $i_t = \psi_i i_{t-1} + \psi_\pi \pi_t + \psi_y y_t + \psi_{\Delta y} \Delta y_t + \psi_{euribor} \Delta euribor_t + \varepsilon_{M,t}$

IT, IT-ER and M-IT: $i = \psi_i i_{t-1} + \psi_\pi \pi_t + \psi_y y_t + \psi_{\Delta y} \Delta y_t + \psi_e \Delta e_t + \varepsilon_{M,t}$

On the one hand, the CP rule aims at minimising inflation volatility by deciding the optimal values of this Taylor rule assuming a fixed exchange rate to the euro ($\Delta euribor_t$). Hence the bank implements its monetary policy by paying close attention to the evolution of the Euribor. the optimal policy calculates the optimal values o ψ_i, ψ_π, ψ_e, ψ_y, $\psi_{\Delta y}$ and $\psi_{euribor}$ to address this minimising criteria.

On the other hand, IT, IT-ER and M-IT follow the same Taylor rule, but in this case replacing Euribor variations ($\Delta euribor_t$) by exchange rate variations (Δe_t). The IT seeks to minimise inflation variation, whereas IT+ER minimises inflation and exchange rate variations (managed exchange rate). Finally, M-IT minimises imported inflation variations. In all cases, the optimal policy calculates the optimal values of ψ_i, ψ_π, ψ_e, ψ_y, $\psi_{\Delta y}$ and $\psi_{euribor}$ to address the respective minimising criteria.

Table 3 reports the estimated values of the Taylor rules and the variance of the respective objective loss function for the three economies. In the Conventional peg (CP), a 1% rise in the Euribor ($\psi_{euribor}$) implies an increase in the domestic interest rate of a similar magnitude un the three cases: 0.47%, 0.49% and 0.51% for Cabo Verde, Mauritius and Seychelles, respectively. Analysing the exchange rate variations $(\psi_{\Delta er})$, it is considerably higher for Seychelles whose values are, on average, above 0.92 for the three free-floating regimes (IT, IT-ER and M-IT). The latter reflects the higher home-bias in this country. Except for this previous effect in Seychelles, the one-period lagged interest rate (ψ_i) shows the highest values in the four monetary policy scenarios and in the three economies, which is never below 0.7. The IT-ER and I-IT policies tighten the one-period lagged interest rate, especially in Seychelles, while they soften the importance of inflation. Finally, regarding the volatility of the main macroeconomics variables, the CP policy provides the lowest volatility under a tourism demand shock in Cabo Verde and Seychelles, while the CP, the IT-ER and the M-IT show similar volatility in Mauritius.

Table 3.
Optimal monetary policy response to a tourism demand shock

	CP	IT	IT + ER	I-IT
Cabo Verde				
ψ_i	0.76	0.73	0.85	0.83
ψ_π	0.66	0.62	0.34	0.43
$\psi_{\Delta y}$	0.04	0.09	0.09	0.09
ψ_y	0	0	0	0
ψ_e	-	0.51	0.55	0.55
$\psi_{euribor}$	0.47	-	-	-
Std.dev				
Inflation	0.0006	0.0012	0.0014	0.0014
Production	0.0437	0.0407	0.0407	0.0408
Exchange rate	-	0.0113	0.0088	0.0088
Interest rate	0.0021	0.0077	0.0080	0.0082
Consumption	0.0204	0.0212	0.0216	0.0216
Mauritius				
ψ_i	0.75	0.70	0.77	0.74
ψ_π	0.62	0.61	0.59	0.64
$\psi_{\Delta y}$	0.06	0.07	0.10	0.13
ψ_y	0	0	0	0
ψ_e	-	0.48	0.60	0.54
$\psi_{euribor}$	0.49	-	-	-
Std.dev				
Inflation	0.002	0.0087	0.0004	0.0004
Production	0.016	0.0155	0.0159	0.0160
Exchange rate	-	0.0052	0.0038	0.0039
Interest rate	0.0011	0.0028	0.0038	0.0039
Consumption	0.0085	0.0087	0.0091	0.0091
Seychelles				
ψ_i	0.78	0.84	0.93	0.82
ψ_π	0.64	0.51	0.61	0.27
$\psi_{\Delta y}$	0	0.04	0.021	0.06
ψ_y	0	0	0	0
ψ_e	-	0.94	1.06	0.76
$\psi_{euribor}$	0.51	-	-	-
Std.dev				
Inflation	0.0005	0.0015	0.0015	0.0015
Production	0.0291	0.0268	0.0267	0.0267
Exchange rate	-	0.0042	0.0040	0.0042
Interest rate	0.0010	0.0045	0.0041	0.0044
Consumption	0.0099	0.0102	0.0101	0.0102

Figure 2, Figure 3 and Figure 4 show the impulse-response functions (IRF) of the tourism demand shock to some key economic variables under a CP (green-line), an IT (red-line), an IT-ER policy (blue-line) and a M-IT (black-line) for Cabo Verde, Mauritius and Seychelles, respectively. Initially, the tourism shock increases consumption (c) and triggers a real exchange rate appreciation (q); a general finding in tourism (Adams & Parmenter, 1995; Inchausti-Sintes, 2015; Narayan, 2004; Capó, Riera & Roselló, 2007). However, the intensity of the effects varies depending on the monetary policy under analysis. For instance, the real exchange rate and consumption react more sharply under the IT-ER and M-IT policy in the three economies, although in the case of Seychelles, the IT policy also mimics the performance of the other two. However, in term of production, the four monetary policies generate the same impact.

Comparing by countries, initially, the tourism demand shock triggers the highest real exchange appreciation and the highest rise in production in Cabo Verde. On the contrary, the tourism demand shock causes a higher appreciation of the real exchange rate in Mauritius than in Seychelles. However, the rise in production is higher in the latter. Similarly, the variation in the real exchange rate affects more markedly the inflation in Cabo Verde and Seychelles than in Mauritius, which means that Cabo Verde and Seychelles suffer from a higher pass-through effect.

Nevertheless, the reaction of the interest rate (r) is similar in Mauritius and Seychelles, but significantly higher in Cabo Verde. The foreign debt ratio (a) shows a sharp rise accompanied by higher inertia in the forthcoming periods in all cases, but the rise is higher in Cabo Verde and Seychelles.

Next, the aftermath of this tourism shock implies a progressive fall in consumption and production that is boosted by the higher interest rate, while the real exchange rate faces successive depreciations. The exchange rate flexibility in IT, IT-ER and M-IT allows for a pronounced “foreign” depreciation as observed when analysing the peak in the one-price-law gap. This effect is more marked in Mauritius and Seychelles than in Cabo Verde, whereas the real exchange rate depreciates more sharply in Seychelles.

In sum, the CP policy attains the lowest inflation, imported inflation and interest rate variation. Nevertheless, the rise in inflation in the other three policies is very mild, while consumption and the external competitiveness measured by the one-price-law gap rise more sharply with them. Moreover, the higher rise in the interest rate in the floating cases (IT, IT-ER and M-IT) is corrected sharply in the following periods; limiting the harmful initial effects. Hence, there is room for adopting different sorts of policies in these three economies capable of providing suitable monetary policy responses.

Figure 2.

Impulse response function of a tourism demand shock in Cabo Verde (%).

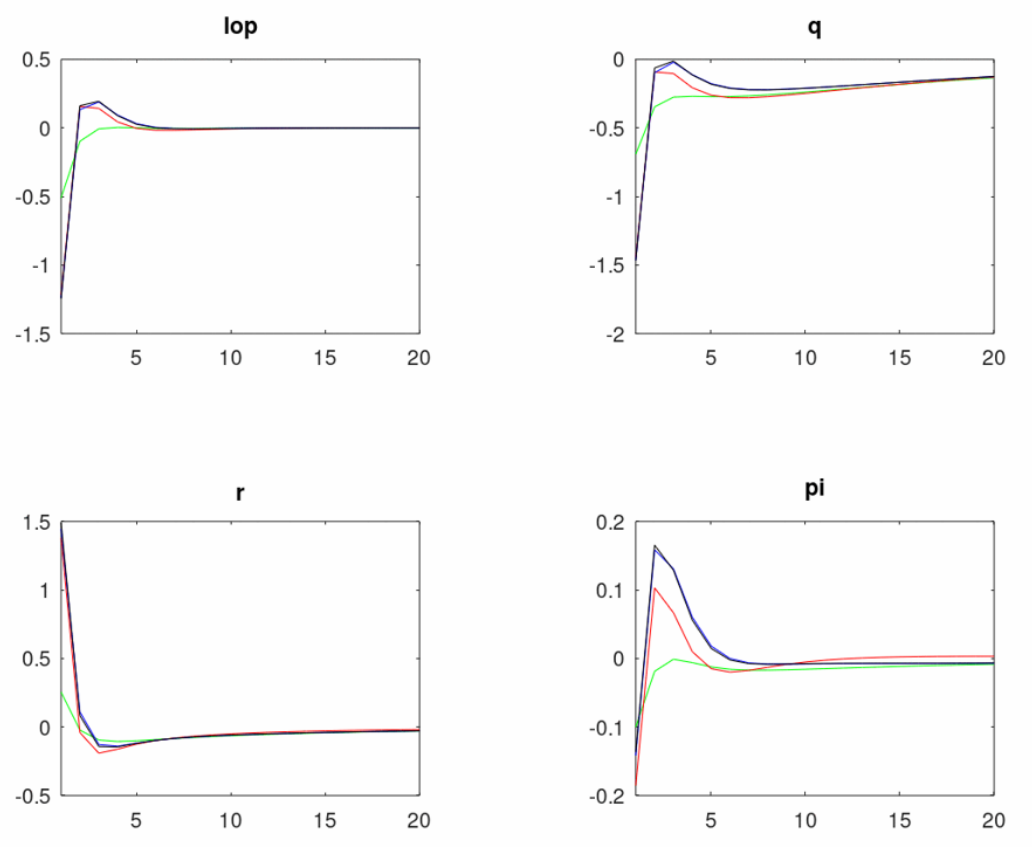


Figure 2b.

Impulse response function of a tourism demand shock in Cabo Verde (%).

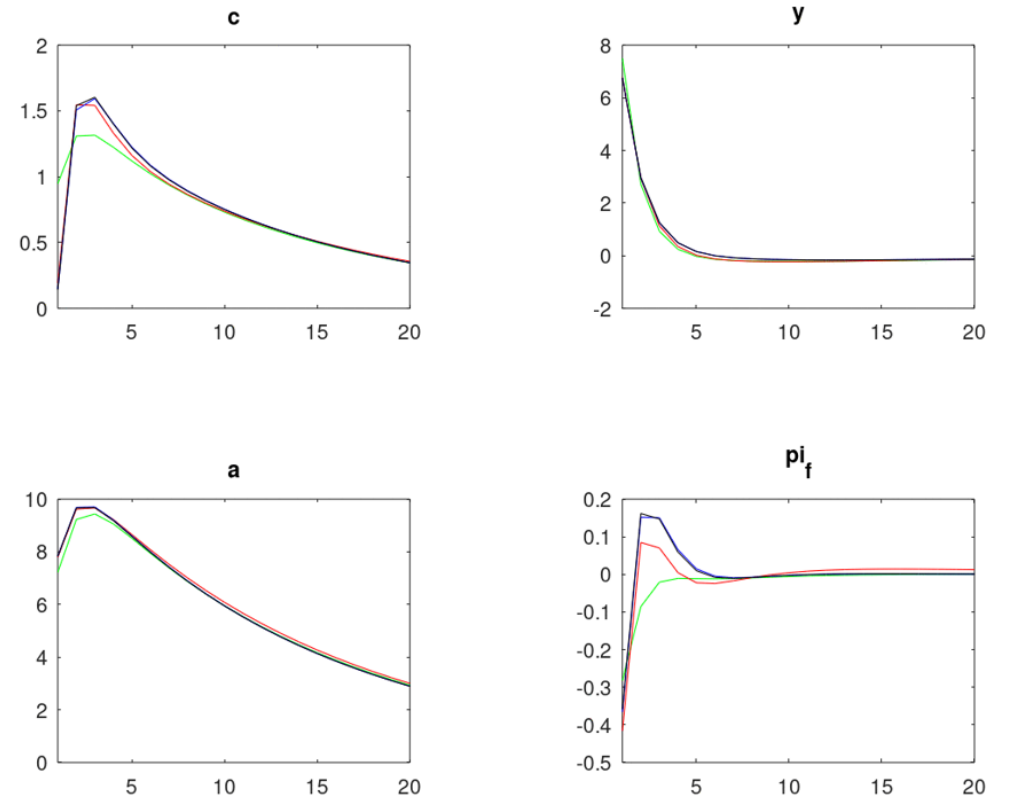


Figure 3.

Impulse response function of a tourism demand shock in Mauritius (%).

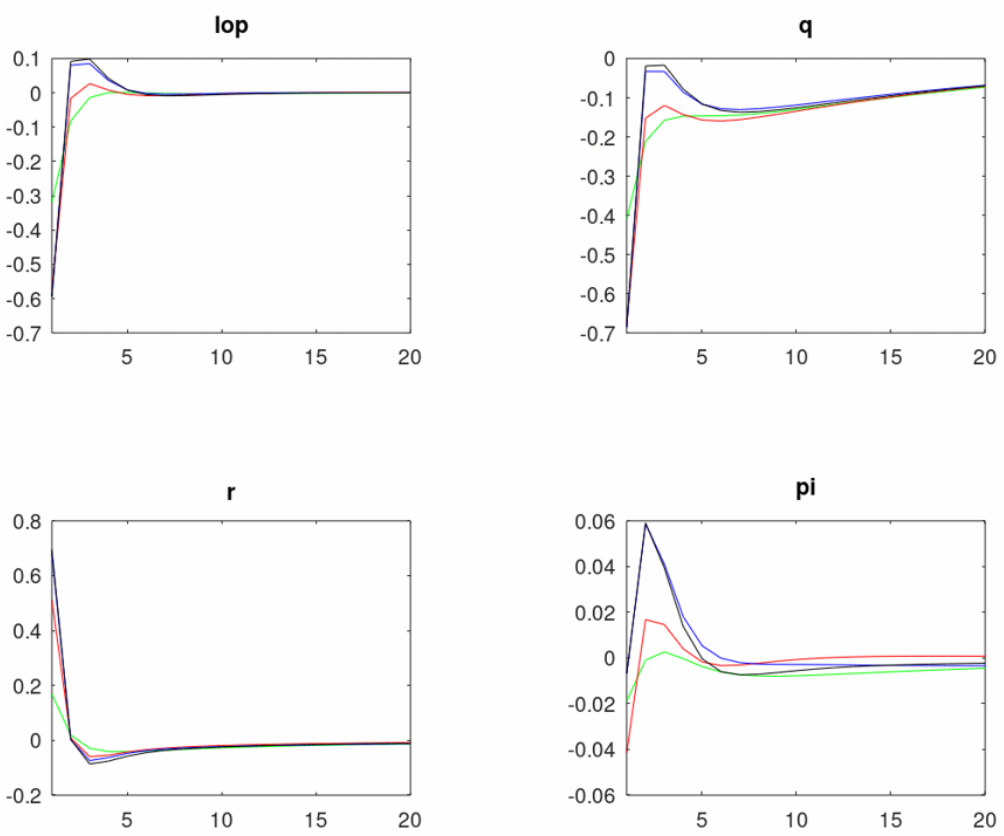


Figure 3b.

Impulse response function of a tourism demand shock in Mauritius (%).

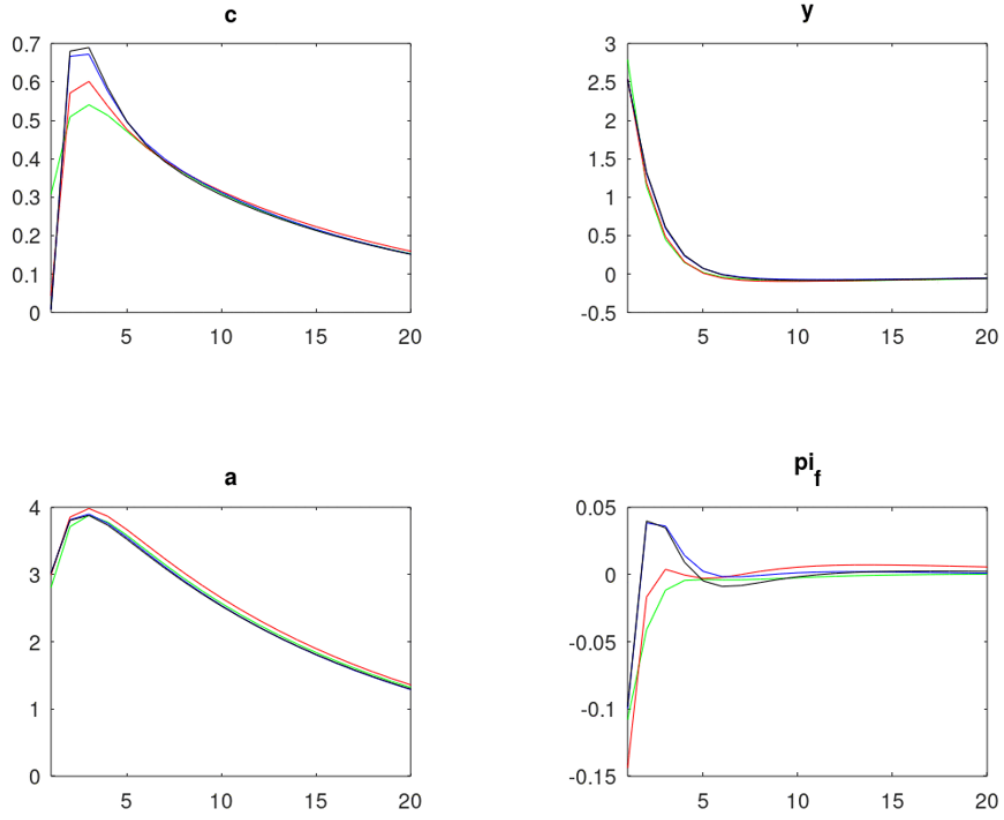


Figure 4.

Impulse response function of a tourism demand shock in Seychelles (%).

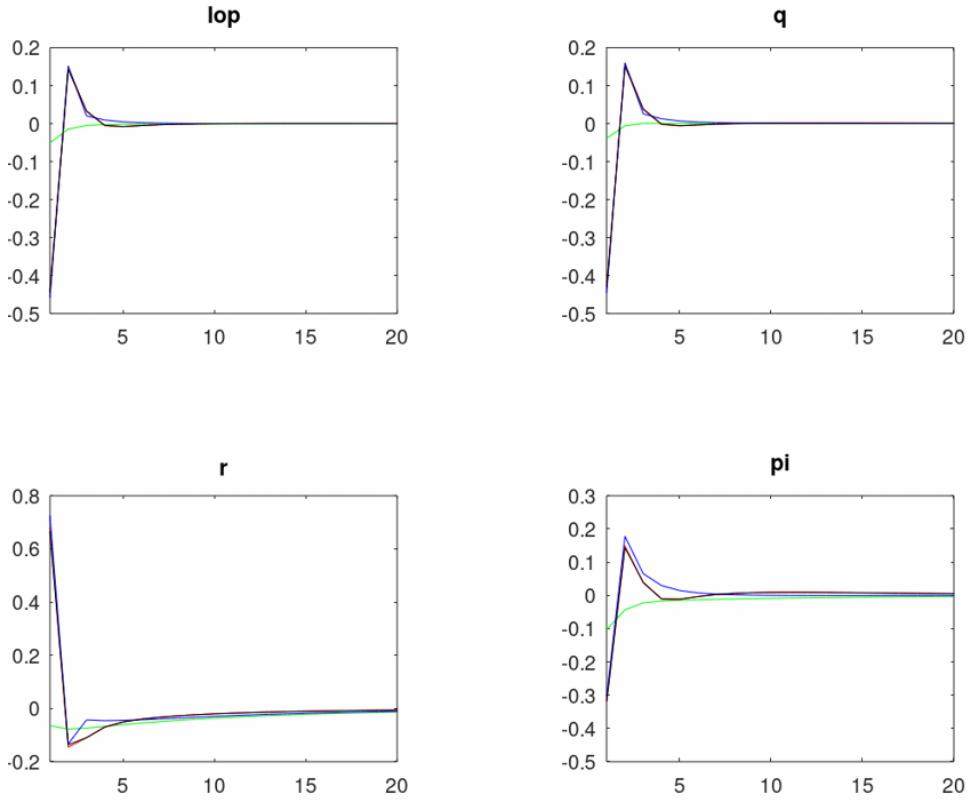
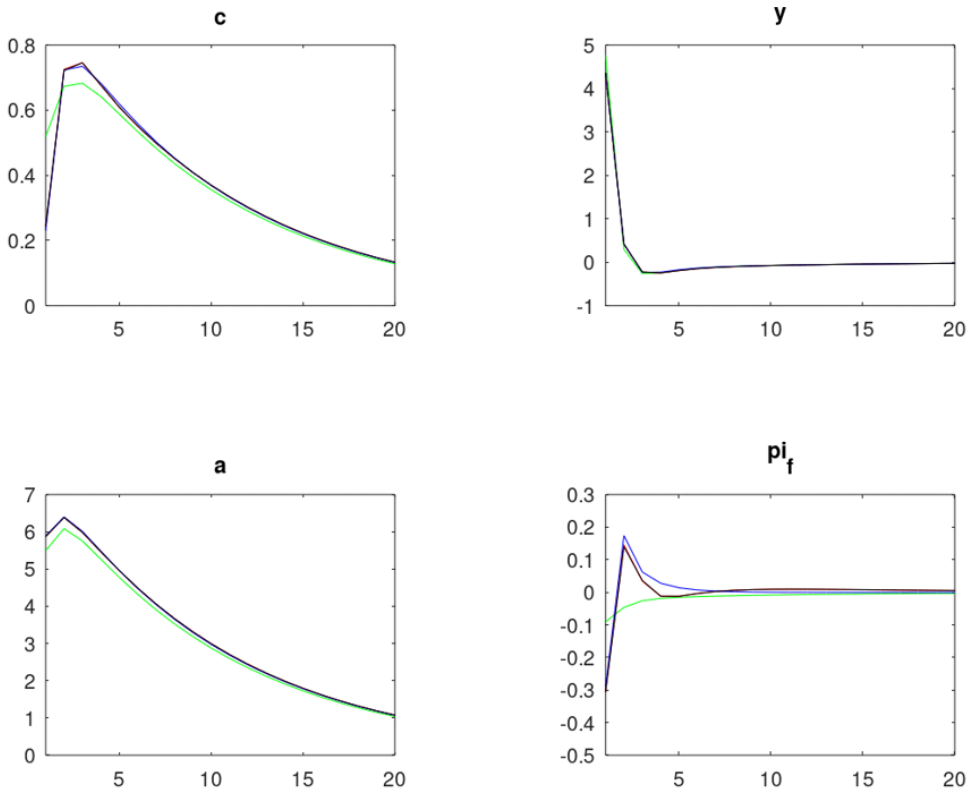


Figure 4b.

Impulse response function of a tourism demand shock in Seychelles



Conclusions and limitations

The aim of this analysis was not to prescribe or recommend an alternative monetary policy in these three economies, but to explore, for the first time, the consequences of adopting different policies under a tourism demand shock. According to the results, either pegged or floating rules cannot avoid the classical tourism economic impact such as real exchange appreciation. But the latter may be reduced under a conventional peg policy.

On the one hand, the four monetary policies yield similar results in terms of production and foreign debt ratio, but the CP policy attains a smoother economic outcome after the tourism demand shock. Moreover, the use of Euribor as a nominal anchor in the conventional peg reduces domestic interest rate volatility significantly, but, at the same time, it restrains larger foreign depreciation.

On the other hand, the inflation-targeting policy provides the closest performance to the latter. However, the rise in inflation is slightly higher, while consumption and the external competitiveness rise more sharply with the others than with the CP. The other two floating policies (IT-ER and M-IT) provide sharper economic improvement in the aforementioned economic variables than in the IT policy, while the inflation is also higher. However, the latter evolves under manageable thresholds. Hence, there is room for adopting alternative sorts of monetary policies capable of providing suitable responses.

Comparing by countries, initially, the tourism demand shock triggers a sharper real exchange rate appreciation that affects more markedly the inflation in Cabo Verde and Seychelles than in Mauritius, showing a higher pass-through in both cases. Nevertheless, the reaction of the interest rate is similar in Mauritius and Seychelles, but significantly higher in Cabo Verde. The improvement in production is also more significant in the latter. Curiously, while the tourism demand shock causes a higher appreciation of the real exchange rate in Mauritius than in Seychelles, the rise in production is higher in the latter. The foreign debt ratio shows a sharp increase followed by higher inertia in the forthcoming periods in all cases, but the rise is higher in Cabo Verde and Seychelles.

The aftermath of this tourism shock implies a depreciation of the real exchange in the three economies. This depreciation is of similar magnitude in Cabo Verde and Mauritius, but considerably higher in Seychelles. The exchange rate flexibility in IT, IT-ER and M-IT allows for a pronounced “foreign” depreciation as observed when analysing the peak in the one-price-law gap. This effect is more marked in Mauritius and Seychelles than in Cabo Verde.

Regarding the optimal response policies, the CP policy achieves the lowest volatility in the main macroeconomics variables in Cabo Verde and Seychelles, while the CP, the IT-ER and the M-IT show similar volatility in Mauritius. It is worth mentioning the sharp response to the exchange rate variation in the floating rules in Seychelles, mainly caused by the higher imports dependence. Except for this last effect in Seychelles, the one-period lagged interest rate shows the highest values in the four monetary policy scenarios and the three economies. The IT-ER and I-IT policies tighten the one-period lagged interest rate, especially in Seychelles, while they soften the importance of inflation.

Finally, we would like to briefly summarise the potential improvements and limitations of the SDGE model. Firstly, the analysis might be enriched by relaxing some assumptions (e.g. allowing wage indexation or unemployment) or including new financial behaviours that affect the conduction of monetary policy such as dollarization. Secondly, the SDGE model

should reconsider the role of the PPP to explain the behaviour of the terms of trade, the real exchange rate or the nominal exchange rate. This would drive the model towards a long-term equilibrium, minimising the influence of the interest rate (uncovered interest rate parity) in the macroeconomic variables and the conduction of monetary policy in the short term.

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Discussion and Conclusions

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This doctoral thesis applies the economic analysis to the tourism field in order to study the impacts and consequences of tourism specialization. Due to the broad topic, different aspects of the economy were studied to uncover the implications of tourism specialization on it. Different methodologies and economic theories are applied along the different research papers included on this doctoral thesis. This work evidence the necessity to consider the particularities of the tourism activity to analyse tourism-led regions and the consequences of this specialization. Several conclusions can be obtained from this work.

The first paper analyses the air transport market of tourism destinations after the LCCs boom providing novel results to the literature. This study showed that the relevance of the LCCs differs among the origin markets and cannot be generalized. While the German market still relies in charter airlines for their leisure travels, the British market changed the previous paradigm. For the British market, two kinds of crowding out effects were observed. On the one hand, FSCs were crowded out in the short run by the entrance of LCCs. On the other hand, while the CCs lost a huge market share, they kept high numbers in the short run. However, the level correlation showed up that LCC is crowding out CCs gradually in the long term. Moreover, the exit of a main incumbent like Monarch airlines was analysed showing that there was a net loss of passengers because some of the passengers did not switch airlines. Nevertheless, further research should be conducted in this line to investigate the role of policies determining the final picture after a relevant exit.

The second paper provides a novel point of view of the total factor productivity which is in fact an incipient research topic in the tourism literature. The study reveals that, in general, labour productivity was modest during the period of study specially in the tourism-led archipelagos. This low productivity gains could damage the gains of the tourism sector in the future given the non-stop growth of competing markets. Thus, productivity gain mechanisms are needed in order to revert the situation. The paper also analyses the impact of the labour market structure on the labour productivity, evidencing that the temporality is a burden for labour productivity. A share of permanent jobs for the two archipelagos similar to the levels of industrial-led regions would close some of the existing gap among those regions. Moreover, the productivity gains could help not only to increase the GDP but also to diminish the negative impacts of tourism and ease sectoral diversification. Further research on this topic can be performed in several aspects. On the one hand, focusing on labour productivity would be desirable in order to include more labour related variables such as salaries and its relationship with the labour productivity. On the other hand, the efficiency literature presents several gaps in the tourism field where newer and more sophisticated models could be employed to solve some of the limitations of the previous literature.

The third paper applies for the first time the DSGE model to the tourism literature. This methodology is widely employed in the field of macroeconomics to analyse the monetary policy. This paper explores the consequences of adopting different monetary policies under a tourism shock. The paper analysed four different monetary policies which showed similar results in terms of production and foreign debt ratio. However, differences arise when analysing other variables. The conventional pegged policy showed, in general, a smoother economic outcome after the tourism demand shock. Additionally, according to the model is also the monetary policy with better results controlling the interest rate volatility. Among the floating policies tested, all of them showed sharped movements in the main economic variables in comparison to the conventional pegged. However, the standard

inflation targeting policy provided smoothed results among the three of them. The analysis of different countries proved that the shape of the impacts was similar for all the countries, however, there were significant differences in terms of scale. Cape Verde, which is the one with a lower level of development, proved to be the most volatile country of the sample with the highest impacts derived from a tourism demand.

The aforementioned studies provided some insights of the particularities of the tourism-led regions in different aspects of the economies. The tourism specialization can impact different aspects of the economy such as the market structure of complementary markets like air transports, the labour productivity and its effects on the economy or effects and efficiency of the monetary policy employed. These results are interesting in the actual context of a global pandemic. With the tourism demand virtually at zero, tourism-led economies are suffering significantly. On the air transport sector, some airlines are relying on the freight transport to have some business. However, several carriers are asking for public funds in order to keep their operations running. As the first paper shows, when an airline falls, there could be a mid to long term loss in terms of passengers. This means that, in the world after Covid-19, the number of tourists could not be at their pre-crisis level for some time. Additionally, as mentioned in section 4, tourism is characterized by a higher level of temporary jobs and this affects negatively to the labour productivity. The actual context could be a significant challenge for tourism-led economies in terms of economic growth. Finally, for SIDS, tourism is the main source of foreign currency. The lack of inflows of foreign currency in addition of the high level of international import dependence could increase the level of external debt in those countries. This could generate macroeconomic instability to those countries.

However, there are still several aspects of the tourism specialization that do not have strong (and sometimes not any) evidence. Tourism economics is a particularly interesting research field with several things to uncover. During the realization of this doctoral thesis, several methodologies were learnt in order to provide relevant answers to the research questions related to tourism economics. These methodologies form the foundations to start a research career and can be employed for different research questions. In fact, taking a look back to the main purposes of this thesis, the two main objectives have been achieved. On the one hand, the knowledge about the tourism economics and its particularities has been improved. On the other hand, several methodologies that can be used in future investigations have been acquired.

The knowledge obtained during the preparation of this doctoral thesis allows for additional research. Some of this research is already finished or is a work in progress, while other ideas are for future research. In conclusion, this doctoral thesis did not only provided the research contained in it, but also planted the seed for additional research. This research could be in the form of an expansion of the previous one or on a completely new topic related with the tourism specialization.

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