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

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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

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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 $\varepsilon_i = v_i + u_i$ where v_i denotes the noise component (the unobserved random component) and u_i 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, $\varepsilon_{it} = v_{it} + u_i$. Additionally, the u_i 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), $G(t)$, and the stochastic individual component (individual-varying), u_i (Kumbhakar et al, 2015). $G(t)$ can adopt any specific functional form. For instance, Battese and Coelli (1992) opt for assuming that $G(t)$ behaves according to the following exponential function: $G(t) = \exp[\gamma(t - T)]$,where γ represents the inefficiency term, t denotes the time and T 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 provinces[4]. Firstly, the group/category of provinces regarded as 'industrialized' are the

[4] 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

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. 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 model[5] following the framework proposed by Kumbhakar and Wang (2005). The model is specified as follows:

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

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

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

$$u_i \sim N^+(u_i, \sigma^2), \tag{4}$$

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

$$\sigma_v^2 = exp(c_v), \qquad \sigma^2 = exp(c_u), \tag{6}$$

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 t 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 made after several trials with other specifications including translog functional forms.

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per working population, labour productivity at constant prices, unemployment rate and tourism beds per working-age population.

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

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 u_i, 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 $\left(k_{i\underline{t}} - l_{i\underline{t}}\right)$, 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 γ parameter, which can be interpreted as "the percentage change in inefficiency over time" (Kumbhakar & Wang, 2005). Because $\gamma = \frac{\partial ln u_{it}}{\partial t}$, if $\gamma < 0$ then efficiency catch-up is observed.

Following Kumbhakar and Wang (2005), the change in total factor productivity[6] ($T\dot{F}P$) 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).

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

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

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

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

Where:

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

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

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

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[7]: 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, respectively[8]), while investment follows a savings-driven rule. The remaining elasticities are obtained from Hertel (1998)[9]. 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

[7] Both Dynamic CGE models have been programmed in GAMS using MPSGE syntax.
[8] The average unemployment rate in both territories during 2002 and 2012.
[9] 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.

from Escribá-Pérez, Murgui-García and Ruiz-Tamarit (2017). Finally the interest rate is obtained endogenously with the other two values.

[Figure 1 about here]

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)[10]. 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[11].

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.

[10] Household income, taxes and tourism income are not depicted in Figure 1.

[11] For an in-depth mathematical description of a CGE model in tourism see Blake, Durbarry, Eugenio-Martín, Gooroochurn, Hay, Lennon, Sinclair, Sugiyarto and Yeoman (2006); or Inchausti-Sintes (2015).

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 γ 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 about here]

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 about here]

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 about here]

[Table 4 about here]

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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Figure 1. CGE structure

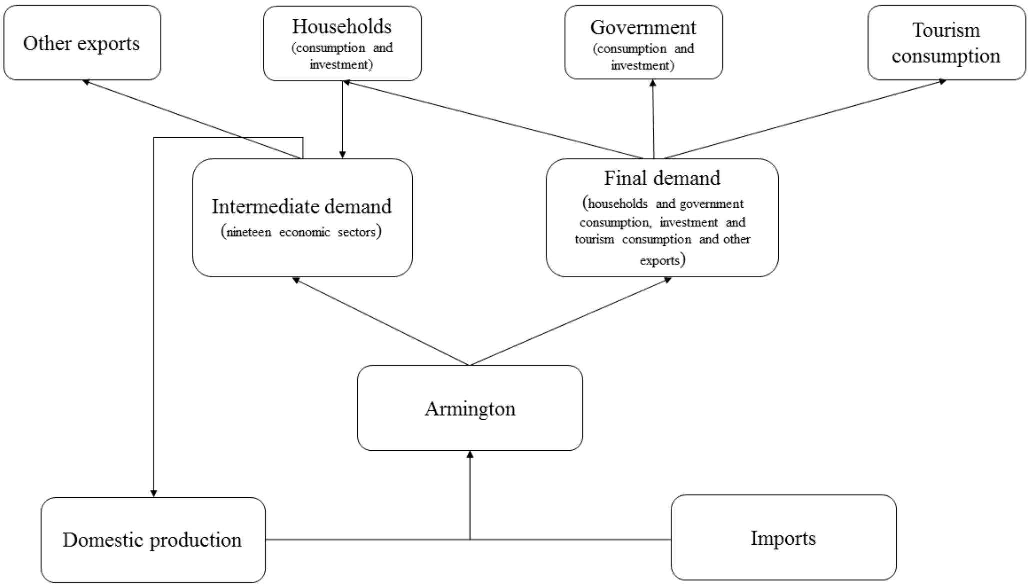

Table 1. Estimation results.

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	0.302***
employment	(0.082)
Constant	-5.977***
	(0.128)
$\boldsymbol{\delta_1}$	0.356***
	(0.056)
$\boldsymbol{\delta_0}$	-0.504
	(0.119)
$\boldsymbol{\gamma}$	-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. 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**

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 and 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 and 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 services	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