Labour market regulations and efficiency in tourism industry

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Abstract

This study examines the effect of the labour market regulations on Greek tourism industry performance. The tourism industry, the steam engine of the Greek economy, always drives to enhance efforts to reach further savings in operating costs. However, the labour regulations that influence the tourism sector's ability to adjust costs have not been thoroughly investigated. We present a novel methodology that permits the evaluation of the effect of labor market regulations on technical and allocative efficiency in one step. The empirical results demonstrate the complexity of the relationship between labour regulations and efficiency. Labour market liberalization is associated with improvements in allocative efficiency but may have opposite effects on technical efficiency. Policymakers should pay attention to these complicated interactions whenplanning reforms on labour market.

Keywords: Labour regulations; tourism; technical efficiency; allocative efficiency; Maximum Likelihood.

JEL: D24, D61, J30, J80, Z30

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Introduction

The focus of the study is to examine the association between labour market and performance of the tourism industry which is characterised by labour intensive underlying production function. The importance of labour market conditions and regulations is, therefore, unequivocal for the tourism industry. However, most prior studies provide evidence of the macroeconomic effects of labour market regulations (Lazear, 1990; Nickell, 1997; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Millan et al, 2013), showing that more labour regulations have a negative impact on output. In this study, we link labour market regulation to tourism performance as measured by duality theory in terms of efficiency, both allocative and technical efficiency. In an empirical application we estimate the dual cost function of the Greek tourism industry, given its importance for the output of the country as the major source of income.

Greece every year attracts millions of international tourists and has a significant brand value in the European and global tourism industry. Greece ranks 13th and 8th in international and European tourism arrivals respectively, while ranks 21st and 8th in international and European tourism receipts, respectively (UNWTO, 2019). During the period 2008-2018 gross output and labour of the tourism industry significantly increased, exhibiting an average growth rate of 5,7% and 8,8%, respectively. It is worth mentioning that for the same period the total GDP of the Greek economy experienced a significant decrease by 2.7%, while unemployment increased by 19.6%[1].

Over the period of economic crisis, on the one hand tourism has been the spearhead of the Greek economy, but on the other hand has lost a lot of its competitiveness. That probably implies the failure of the tourism firms to improve their productivity and efficiency and, the loss of confidence in the Greek economy. According to European Commission (2019), until 2012

Greece faced the higher unit labour cost in EU countries, and this erodes its competitiveness in the global economy. Also, in 2015 the political instability and its financial consequences (capital controls and bank restrictions on withdrawals) in combination with the increasing influx of refugees from Syria and immigrants from Asian countries had a significant negative impact on Greek tourism.

Over the last decade, the Greek firms in the touristic sector have gone through major structural reforms that have been further triggered by the recent economic crisis to enhance their economic performance through a reduction in operating costs. Moreover, the urgency for Greek firms to reduce their costs could also be related to reforms in labour market through the framework of labour regulations. Since 2010, major reforms in labour law have been introduced to regulate the labour market in view of the financial crisis. These reforms that applied under consideration for amendment in line with the EU practices aimed at increasing work flexibility and affecting both individual and collective labour law. The key legislative changes involve the collective agreements (laws 4024/2011 and 4303/2014), compulsory minimum wages (laws 4093/2012 and 4172/2013), more flexible forms of work, including temporary agency work (laws 3846/2010 and 4254/2014), flexible working time (laws 3986/2011 and 4177/2013), flexible collective redundancies (laws 3863/2010, 4336/2015 and 4472/2017), equal treatment of men and women (Law 3896/2010) and more cooperation between employer and employees (laws 3846/2010 and 3986/2011).

There are two ways that firms can be efficient, from success to allocate resources in the most efficient manner, meaning allocative efficiency and from a success to utilize their resources given their allocation, meaning technical efficiency (Anderson et al, 2000). Labour regulations may have major contributions on firm's technical and allocation efficiency. For instance, regulatory constraints on limited wage-setting flexibility and protection on labour mobility may significantly affect the labour allocation (Boeri et al., 2008; Bertola, 2009). Stricter labour

regulations may improve employment conditions (OECD, 2018), enhance the efficiency of industry-specific human capital, and increase a firm's efficiency (Bassanini and Garnero, 2013). On the other hand, these constraints may increase production cost and reduce firm's performance by altering the optimal number of employees or by affecting the labour wages (Almeida and Carneiro, 2009; Mamatzakis et al., 2015). Therefore, tourism firms' ability to reduce labour costs and increase their efficiency could be greatly affected, by labour regulations.

The scope of this study is to extend the literature by examining the association between labour market characteristics and technical and allocative efficiency in the Greek touristic industry over the period 2008-2018. Greece is a useful case to examine these issues because firms operate under a variety of labour regulations. Especially for tourism that is a more labour-intensive industry, firms must usually adjust their labour force because of frequent changes in product designs and a high degree of seasonality. Moreover, we measure the efficiency performance of the tourism industry by providing the technical and allocative efficiency scores and the efficiency ranking among Greek regions. To our knowledge it is the first study that performs such analysis for the tourism industry and offers valuable results for the policymakers on this topic. We employ a model based on Kumbhakar and Tsionas (2005a, 2005b), which estimates both the technical and the allocative efficiency controlling for labour market characteristics in one step. We use the maximum likelihood method to estimate technical and allocative efficiency within a system of equations.

We use three different indexes and their subcomponents as proxies of labour regulation and investigate their effects on technical and allocative efficiency: Fraser Index on Economic Freedom, Global Competitiveness Index, and the OECD indicators. Our analysis provides useful findings of the effect of price-related labour market characteristics and regulations on allocative and technical efficiency.

Overall, the paper attempts to answer the following questions: Do labour regulations impact on tourism industry efficiency? How do the aspects of the three different labour regulation indexes, as captured by the subcomponents, affect tourism industry allocative and technical efficiency? What are the technical and allocative efficiency scores of the tourism industry for Greek regions?

The rest of the paper is organised as follows: Section 2 presents the literature review, while section 3 and 4 presents the methodology and describes the dataset, respectively. Section 5 presents and discusses the empirical results. Finally, section 6 offers some concluding remarks and policy implications.

Literature review

In many countries throughout the world, labour regulations that limit firms' freedom to modify employment are a contentious public policy issue. Prior literature examined primarily the macroeconomic effects of labour market regulations on output and unemployment (Lazear, 1990; Nickell, 1997; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Heckman and Pages, 2003; Botero et al., 2004; Almeida and Carneiro, 2009 and Millan et al, 2013) and showed that labour regulations have a negative impact on output. This literature argues that more labour market regulations would come at the cost of efficiency losses for firms (see also Freeman, 1988; Nickell, 1997; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Besley and Burgess, 2004). The literature argues that higher expenses to hire as a result of stricter employment protection would reduce productivity that, in turn, would have a negative impact on firms' returns with respect to innovation and technology (Malcomson 1997; Bassanini and Ernst 2002; Scarpetta and Tressel, 2004 and Cabalerro et al., 2013).

On the contrary, other research suggests that labour market regulations that put pressure on wages would increase labour productivity as firms shift towards capital-intensive production (Auer et al., 2005; Autor et al. 2007; Deakin and Sarkar, 2008; Storm and Naastepad, 2009 and

Lu, et al., 2010). Also, a high degree of employment protection creates incentives for employees and firms to invest in human capital, as firms with long term employees benefit in terms of higher return due to skilled through training labour force (Bassanini and Garnero, 2013).

Also, our paper is related to the literature on the cost efficiency performance in tourism industry. Pulina et al, (2010) investigated the efficiency of the tourism sector for the Italian regions over the period 2002-2005. Their empirical findings indicate that the hotels in Italia are, on average, operating at 82.28% efficiency level. Benito et al, (2014) examined the efficiency of the tourism industry for the Spanish regions over the period 2002-2010. They found that the average efficiency score is 61.2%. Arbelo et al, (2017) estimated the cost efficiency of 231 hotels from all the regions of Spain over the period 2008-2012. The results indicate that the average efficiency score is 67.56%. Mendieta-Penalver et al (2018) examined the efficiency of 15 international hotels chains for the year 2010. The results indicate that the average efficiency score is 78%. Corne and Peypoch (2020) analysed the tourism efficiency in French regions. They found that the average efficiency score of French regions is 91.82% in the year 2017. Walheer et al, (2020) investigated the cost efficiency of star rated hotels for a sample of 31 Chinese provinces over the period 2005 to 2015. They conclude that the average efficiency score of the Chinese hotel sector is 75%. Perez-Granja and Inchausti-Sintes (2021) examined the efficiency of hotel sector for the Spanish provinces during the period 2001–2016. Their empirical findings indicate that the average efficiency score ranges from 82% to 84%. Alemayehu and Kumbhakar (2021) investigated the efficiency of 94 hotels and restaurants in regions of Norway over the period 2003-2014. They found that excess capacity and location of regions influenced technical efficiency. To sum up, most of the literature that has investigated the case of a single country found high efficiency scores in the tourism industry. In particular, the empirical studies for the European countries showed high levels of efficiency. This is a

significant finding because the destinations in these countries are competitive with those of Greece.

A model of technical and allocative inefficiency

The starting point of our model is Kumbhakar (1997), who opts for a general production function of the form:

$$q_i = f(x_i e^{-u_i}) \tag{1}$$

where q_i notes production and x_i note J inputs in the form of vector and i (i = 1, …, n) is the corresponding firm. f (.) shows the production function, while $u_i \geq 0$ is technical inefficiency based on inputs (see Farrell, 1957).

The production function of the tourism industry as above would be used to estimate the degree of technical inefficiency at touristic firm level. For example, it could reveal that a touristic firm employ excessively all inputs by $u \cdot 100$ percent vis a vis an efficient touristic firm given certain production.

In terms of allocative inefficiency, touristic firms face the choice to allocate inputs from the J vector of inputs. This process of allocation is not error free. In this paper we also measure these errors as they show the allocative inefficiency. To reveal allocative inefficiency, we build on Schmidt and Lovell (1979) and Kumbhakar (1997) as:

$$f_j(x_i e^{-u_i}) / f_1(x_i e^{-u_i}) = w_{j,i} e^{\xi_{j,i}} / w_{1,i},\ j = 2,...,J\ , \tag{2}$$

where f_j (.) notes the marginal product and w_j shows the input price j. If $\xi_{j,i}$ takes a non-zero value it would imply that there is indeed an allocative inefficiency for the input (j,1) at firm level i. At this point it is worth noting that if the production function (1) is homogeneous taking first order conditions would result in dropping the technical inefficiency term (u). Note that as

$\xi_{j,i}$ shows allocative inefficiency for the input (j, 1) and $\xi_{2,i},...,\xi_{J,i}$ represent random variables, indicating allocative inefficiency.

Kumbhakar (1997) measure the actual underlying cost of the production function by:

$$\ln C_i^a = \ln C^*(w_i^*, q_i) + \ln G(w_i, q_i, \xi_i) + u_i \tag{3}$$

where $C_i^a = \sum_j w_{j,i} x_{j,i}$ and $C^*(w_i^*, q_i)$ note the minimum cost as derived from the cost minimisation: $\min_{x_i e^{-u}} w_i^{*'} x_i e^{-u}$ subject to $q_i = f(x_i e^{-u})$.

The $G(w_i, q_i, \xi_i)$ function in (3) takes the form $G(.) = \sum_j S_{j,i}^* e^{-\xi_{j,i}}$, where $S_{j,i}^* = \partial \ln C^*(.) / \partial \ln w_{j,i}^*$. Note that equation (3) is separable in u_i, that is the cost of technical inefficiency given that $u_i \geq 0$. While the allocative inefficiency ξ_j is present in the $C^*(.)$ and the $G(.)$ functions. This provides a complication somewhat because to measure the cost of allocative inefficiency, we should first identify the $C^0(w_i, q_i)$, that is the frontier of cost.

To this end, we reformulate the cost function in (3) as

$$\ln C_i^a = \ln C^0(w_i, q_i) + \ln C^{AL}(w_i, q_i, \xi_i) + u_i \tag{4}$$

where $C^0(w_i, q_i)$ notes the frontier of cost, that we can derive from the cost function (3) using the restriction that the corresponding firm is both technically and allocatively efficient.

We can show that

$$\ln C^0(.) = \ln C^a(. \mid \xi_{j,i} = 0 \,\forall\, j, u_i = 0) = \ln C^*(.) \mid \xi_{j,i=0} \text{ (since } \ln G(.) \mid \xi_{j,i=0} = 0)$$

αnd $\ln C^{AL}(w_i, q_i, \xi_i) = \ln C^a \mid_{u_i=0} - \ln C^0(.) = \ln C^*(w_i^*, q_i) + \ln G(w_i, q_i, \xi_i) - \ln C^0(.)$.

Note that $\ln C_i^{AL}$ is the percentage increase in cost because of the allocative inefficiency.

For a translog functional form we have that the cost function becomes:

$$\ln C^*(w_i^*, q_i) = \alpha_0 + \sum_j \alpha_j \ln w_{j,i}^* + \gamma_q \ln q_i + \tfrac{1}{2}\gamma_{qq}\left(\ln q_i\right)^2 + \tfrac{1}{2}\sum_j\sum_k \beta_{jk} \ln w_{j,i}^* \ln w_{k,i}^* + \sum_j \gamma_{jq} \ln w_{j,i}^* \ln q_i \qquad (5)$$

Based on this parametric translog cost function formulation the underlying shares of inputs are:

$$\ln(C_i^a / w_{1,i}) = \ln C_i^0(\tilde{} \qquad , \qquad (6)$$

$$S_{j,i}^a = S_{j,i}^0(\tilde{} \qquad , \; i = 1,...,n \; ; j = 2, \ldots, J \qquad (7)$$

where $\tilde{} \qquad w_{1,i},...,w_{J,i} / w_{1,i})$, $S_{j,i}^a = w_{j,i} x_{j,i} / C_i^a$ is the cost share of input j that we could observe and measure whereas, $C_i^0(\tilde{}$ is normalized by $w_{1,i}$ and $S_{j,i}^0 = \partial \ln C_i^0(.) / \partial \ln w_{j,i}$.

Note also that the $\ln C_i^0(\tilde{}$ is

$$\ln C_i^0(.) = \alpha_0 + \sum_{j=2}^{J} \alpha_j \ln \tilde{} \qquad + \sum_{j=2}^{J}\sum_{k=2}^{J} \qquad \tilde{} \qquad + \sum_{j=2}^{J} \qquad \tilde{} \qquad (8)$$

$$S_{j,i}^0 = \alpha_j + \sum_{k=2}^{J} \beta_{jk} \ln \tilde{} \qquad + \gamma_{jq} \ln q_i, \quad j = 2,...,J \; , \qquad (9)$$

$$\ln C_i^{AL} = \ln G_i + \sum_{j=2}^{J} \alpha_j \xi_{j,i} + \sum_{j=2}^{J}\sum_{k=2}^{J} \beta_{jk} \xi_{j,i} \ln \tilde{} \qquad + \sum_{j=2}^{J}\sum_{k=2}^{J} \beta_{jk} \xi_{j,i} \xi_{k,i} + \sum_{j=2}^{J} \gamma_{jq} \xi_{j,i} \ln q_i, \qquad (10)$$

$$\eta_{j,i} = \frac{S_{j,i}^0 \left\{1 - G_i \exp(\xi_{j,i})\right\} + a_{j,i}}{G_i \exp(\xi_{j,i})}, \; j = 2,...,J \qquad (11)$$

where $G_i = \sum_{j=2}^{J} (S_{j,i}^0 + a_{j,i}) \exp(-\xi_{j,i})$, (12)

and $a_{j,i} = \sum_{k=2}^{J} \beta_{jk} \xi_{k,i}$. (13)

The above cost function framework (6) and (7) is useful because: it provides a model to measure technical and allocative inefficiencies and provides the link between the two inefficiencies as given in (10). We can measure the underlying components of the overall increase in cost into

the contribution of the technical inefficiency, u_i, and the allocative inefficiency, $\ln C_i^{AL}$. In addition, this process of decomposition presents a direct link between the cost shares' error terms as function of allocative inefficiency (see Mamatzakis et al. 2015; Koutsomanoli-Filippaki & Mamatzakis, 2011; Koutsomanoli et al. 2013; Mamatzakis et al. 2015; Mamamatzakis 2015; Mamatzakis, 2011 and Mamatzakis & Remoundos 2011). This link will be useful during the estimation.

To clarify further this link recall that:

$$\ln C^{AL}(w_i, q_i, \xi_i) = \ln C^{*}(w_i^{*}, q_i) + \ln G(w_i, q_i, \xi_i) - \ln C^{0}(.) .$$

In the case that the underlying production function follows the Cobb-Douglas function, Schmidt and Lovell (1979) show that the link is: $\ln C^{AL} = \sum_{j=2}^{J} \alpha_j \xi_j + \ln\left[\alpha_1 + \sum_{j=2}^{J} \alpha_j e^{-\xi_j}\right] - \ln[\sum_{j=1}^{J} \alpha_j]$.

As in Schmidt and Lovell (1979) employ a production function and cost minimization first-order conditions, we employ this link to estimate the cost of allocative inefficiency.

However, estimating the system of cost function and shares (6) and (7) is by no means an easy task despite using Schmidt and Lovell (1979). This is so because of the underlying linkages between cost/allocative inefficiency and the errors from the cost share equations (12) and (13). It is worth noting that the underlying errors' structure based on *u* and ξ_j in (6) and (7) is rather cumbersome (see Mamatzakis et al. 2015). To address the complications in the estimation we employ a maximum likelihood estimation method.

Maximum likelihood estimation

To facilitate the exposition of estimation method we employ the following system of technical and allocative inefficiency

$$y_i = X_i\beta + \begin{bmatrix} \ln C^{AL}(\xi_i,\beta) + v_i + u_i \\ \eta(\xi_i,\beta) \end{bmatrix} \equiv X_i\beta + \begin{bmatrix} \zeta_i \\ \eta_i \end{bmatrix} \tag{14}$$

where $u_i \sim i.i.d.N(0,\sigma_u^2)$ $(u_i \geq 0)$ is independently distributed from v_i and ξ_i.

Also note that the complication is with the $\omega_i \equiv v_i + u_i$ follows the distribution $f(\omega_i) = \frac{2}{\sigma}\phi\left(\frac{\omega_i}{\sigma}\right)\Phi\left(\frac{\lambda\omega_i}{\sigma}\right)$ as in (see Kumbhakar and Lovell (2000), p. 140),

where $\sigma^2 = \sigma_v^2 + \sigma_u^2$, $\lambda = \sigma_u / \sigma_v$,

and ϕ, Φ note the probability density function (PDF) and cumulative distribution function (CDF) respectively of the standard normal variable.

From the above we have $p(\zeta_i \mid \xi_i) = p_\omega(\omega_i - \ln C^{AL}(\xi_i,\beta))$.

Following Mamatzakis et al. (2015) and Kumbhakar and Lovell (2000) we assume that $\xi_i \sim i.i.d.N_{J-1}(0,\Omega)$, and thereby we get the joint probability density function as

$$p(\zeta_i,\eta_i) = p(\zeta_i \mid \eta_i)\cdot p_\eta(\eta_i) = p(\zeta_i \mid \xi_i(\eta_i,\beta))\cdot p_\xi(\xi_i(\eta_i,\beta)).\mid \det D\xi_i(\eta_i,\beta)\mid$$

$$= \tfrac{2}{\sigma}\Phi(\tfrac{\lambda}{\sigma}[\zeta_i - \ln C^{AL}(\xi_i,\beta])\cdot \mid \det D\xi_i(\eta_i,\beta)\mid \times$$

$$(2\pi)^{-J/2}\det(\Omega)^{-1/2}\exp\left\{-\frac{[\zeta_i - \ln C^{AL}(\xi_i,\beta)]^2}{2\sigma^2} - \tfrac{1}{2}e(\eta_i,\beta)'\Omega^{-1}e(\eta_i,\beta)\right\}.$$

Taking

$$\zeta_i = \ln C_i^a - \ln C_i^0(\beta) - \ln C_i^{AL}(\beta,\xi_i(\eta_i,\beta))$$

$$\eta_{j,i} = S_{j,i}^a - S_{j,i}^0(\beta),\ \ j = 1,...,J-1,$$

the likelihood function takes the form:

$$L(\beta,\sigma_v,\sigma_u,\Omega;y,X)\propto$$

$$\sigma^{-n}\prod_{i=1}^{n}\Phi(-\tfrac{\lambda}{\sigma}[\zeta_i-\ln C^{AL}(\xi_i,\beta])\cdot\prod_{i=1}^{n}|\det D\xi_i(\eta_i,\beta)|\times$$

$$\det(\Omega)^{-n/2}\exp\left\{-\tfrac{1}{2\sigma^2}\sum_{i=1}^{n}[\zeta_i-\ln C^{AL}(\xi_i,\beta)]^2-\tfrac{1}{2}\sum_{i=1}^{n}e_i(\eta_i,\beta)'\Omega^{-1}e_i(\eta_i,\beta)\right\}, \quad (15)$$

where $e_i(\eta_i,\beta)=\xi_i(\eta_i,\beta)-\bar{\xi}(\eta_i,\beta)$, and $\bar{\xi}(\eta_i,\beta)=n^{-1}\sum_{i=1}^{n}\xi_i(\eta_i,\beta)$.

The likelihood function in (15) as in Mamatzakis et al. (2015) will be determined with respect to Ω, and its estimator is:

$$\hat{\Omega}(\beta)=n^{-1}\sum_{i=1}^{n}e_i(\eta_i,\beta)e_i(\eta_i,\beta)'.$$

As a result, the log-likelihood function takes the form:

$$\ln L^C(\beta,\sigma_v,\sigma_u;y,X)=-\tfrac{n}{2}\ln(\sigma^2)+\sum_{i=1}^{n}\ln\Phi(-\tfrac{\lambda}{\sigma}[\zeta_i-\ln C^{AL}(\xi_i,\beta])+\sum_{i=1}^{n}\ln|\det D\xi_i(\eta_i,\beta)|$$

$$-\tfrac{n}{2}\det(\hat{\Omega}(\beta))-\tfrac{1}{2\sigma^2}\sum_{i=1}^{n}[\hat{\zeta}_i-\ln C^{AL}(\xi_i,\beta)]^2. \quad (16)$$

where, σ and λ note the original parameters σ_v and σ_u, while the log-likelihood function is generalized so as the mean μ represents a vector of distortion parameters for allocative efficiency.

This mean vector μ is:

$$\mu_i=\Gamma z_i. \quad (17)$$

where z_i is a vector of exogenous variables and Γ are parameter estimates.

The equation (17) is of importance because it allows studying the effect of exogenous variables on allocative efficiency. This can be done without complications using elasticities once we get the parameter estimates from the maximum likelihood.

The maximisation of the log-likelihood functions shown in (16) is done using the Nelder-Mead simplex approach due to its simplicity not to necessitate the estimation of numerical derivatives. Then the standard errors for the parameter estimates are derived using the Berndt-Hall-Hall-Hausman (BHHH) algorithm. This formula uses first-order derivatives of the log-density with respect to parameter estimates.

The data set

We employ data from all the 13 regions of Greece (namely Attica, Central Greece, Central Macedonia, Crete, Epirus, Ionian Islands, North Aegean, Peloponnese, South Aegean, Thessaly, East Macedonia and Thrace, Western Greece, and Western Macedonia) that cover the period 2008 to 2018. The specification of the time framework is due to the availability of data. This period provides sufficient sample size and comparability between years to allow us to investigate the efficiency for tourism firms. All regional data are annual and were taken from the database of Hellenic Statistical Authority (EL.STAT.), (2021), except the data on the price of capital[2] that were obtained from the Bank of Greece (2021). All, the variables measured at 2010 constant prices. Data include all the units of the tourism sector. Specifically, accommodation services that include hotels and other types of accommodation (camping grounds, recreational vehicle parks, etc.), and food services that include restaurants and other types of catering and food service activities, based on the structural business statistics survey of the EL.STAT.

The frontier model includes data from inputs and outputs variables. We select prices and quantities of three production inputs (physical capital, labour and intermediate inputs). The price and the quantity of labour are defined as the total annual salary of employees and the total number of employees working in the tourism industry, respectively. The price and the quantity of capital are defined as the capital expenses (interest paid) and the capital stock of the firms in

the tourism industry, respectively. The price and the quantity of intermediate inputs are defined as the intermediate inputs costs (including materials and energy costs) and the intermediate inputs of the firms in the tourism industry, respectively. Also, we select the annual gross output of the firms in the tourism industry as output variable. Table 1 presents the descriptive statistics of the variables.

We estimate capital stock by using the perpetual inventory method. After deducting the amount of depreciated capital, capital stock at the end of each year is calculated as the sum of the previous year's capital stock and the current year's capital investment, as shown by the following equation:

$$Capital\ stock_t = capital\ stock_{t-1}\,(1-\delta) + I_t \tag{18}$$

where capital $stock_t$ and capital $stock_{t-1}$ stand for capital stock of the current and the previous year respectively, I_t is the annual capital investment in year t and δ is the annual depreciation rate. In addition, a starting value of capital stock, which is necessary for the application of the perpetual inventory method, is calculated using the following formula:

$$Capital\ stock_{t0} = I_{t0}/(\delta + g) \tag{19}$$

where I_{t0} is the annual capital investment at the time t_0, δ is the annual depreciation rate[3] and g is the average of yearly growth rates of capital investment over the examined period.

[Table 1 here]

Measuring labour market regulation

One of the major European Union (EU) strategy's priorities is to strengthen the functioning of labour markets, particularly in the recent decade. To incorporate labour market regulations in

our empirical analysis, we use three different indexes with their subcomponents. We first use the Fraser Index of Economic Freedom, which represents the liberalization of the labour market. The Index provides the main types of labour regulations that infringe on the economic freedom of employees and employers. The index measures the degree of strictness and distortion related to the existing labour regulations and gives a composite estimate of their anti-competitive implications. We also employ one of the twelve pillars of the Global Competitiveness Index and particularly the labour market efficiency index. The index provides information about the efficiency and flexibility of the labour market. Labour markets must have the flexibility to adjust their economic activity rapidly and at low cost, to ensure strong incentives for employees, to promote meritocracy at the workplace and provide equity in the business environment between women and men. At this point, competitiveness is increasingly driven by a well-functioning labour market. Finally, we use data from the OECD indicators of employment protection related to the synthetic indicators of two main areas: protection of regular workers against dismissal and regulation of temporary contracts of employment.

The indicators of labour regulations developed by the Fraser Index are described below. The index consists of various indicators[4] of labour such as regulations on hiring, on minimum wage, on the negotiation between employers and employees, on hours of work, and on employee dismissal cost. Specifically, the five subcomponents[5] are "hiring regulations and minimum wage", "hiring regulations and minimum wage", "centralized collective bargaining", "hours regulations" and "cost of worker dismissal". Note that the values for labour regulation index and its sub-components range from 0 to 10. A higher value indicates a higher degree of economic freedom and liberalization in the labour market, while a lower value indicates market rigidities.

Figure 1 shows the evolution of the Fraser Index and its sub-components in Greece from 2008 to 2018. We have observed that the trend towards greater liberalization in the Greek labour

market has been somewhat slow, and the overall index and most of the sub-components have exhibited an upward trend during this period. The values of the subcomponents of dismissal costs and regulations on minimum wage show that there is room for more liberalization in these sectors.

[Figure 1 here]

Next, the indicators of labour regulations developed by the Global Competitiveness Index are described below. The index consists of seven indicators[6]: i) Redundancy costs, ii) Hiring and firing practices, iii) Cooperation in labor-employer relations, iv) Flexibility of wage determination, v) Reliance on professional management, vi) Pay and productivity and vii) Ratio of wage and salaried female workers to male workers. Note that the index and indicators are always expressed as scores on a 1–7 scale, with higher values indicating greater labour-market flexibility and more economic freedom.

Figure 2 shows the evolution of labour regulations based on the Global Competitiveness Index and its sub-components in Greece from 2008 to2018. We detect a slow trend towards greater efficiency in Greek labour market according to the overall index. Apart from the subcomponents flexibility of wage determination and hiring and firing practices that exhibited an upward trend over the period, for the other subcomponents seems that required better labour reforms for additional efficiency.

[Figure 2 here]

Finally, the OECD indicators on labour regulation are described below[7]. *Individual and collective dismissals of workers with regular contracts*, incorporating aspects of protection of regular workers against dismissal. The other indicator *Regulation of temporary contracts* refers to aspects on regulation of temporary contracts of employment. Note that the values of the

indicators are converted into a score on a 0–6 scale, with higher values representing stricter regulation.

[Figure 3 here]

Figure 3 shows the evolution of the OECD indicators on labour protection in Greece from 2008 to2018. We observe a clear tendency towards reduction of the degree of stringency of employment protection over the past ten years in Greek labour market. The tendency towards labour deregulation is observable since the onset of the economic crisis and is more intense the countries that had the most stringent legislation before the crisis (OECD, 2013).

Empirical findings

Results of the Translog Cost Function

Table 2 reports the estimated results of the parameters obtained by panel estimation, based on the stochastic frontier analysis. Empirical results indicate that the estimated translog cost function is well behaved, as the signs on the coefficients are consistent with curvature conditions, while the magnitudes of the estimated elasticities are plausible and statistically significant for the most variables. The positive values of the cost inputs variables indicate that an increase in these cost inputs will lead to an increase in cost inefficiency.

[Table 2 here]

Table 3 shows that the average technical efficiency score is 90% and this value indicate that, to operate efficiently, the firms in tourism industry should reduce their input costs by 10% without decreasing their outputs or that around 10% of tourism industry specific inefficiency effects are affecting the production process in achieving the maximum feasible output. The average technical inefficiency ranges from the lowest score of 3.3% in 2014 for the region Western

Greece to the highest score of 28% in 2018 for Attica. Also, the inefficiency scores show that Crete is the most cost-efficient region, while Attica is the most cost inefficient region. The range of inefficiency scores suggests that there is realistic and not considerable, cost inefficiency in the Greek tourism industry.

[Table 3 here]

Table 4 shows that tourism industry exhibits high scores on allocative efficiency in all regions. The average allocative efficiency is 99% and this value indicate that, to operate efficiently, the firms in tourism industry should improve the allocation of production inputs by 1%. The average allocative inefficiency scores show that South Aegean, Ionian Islands and North Aegean are the most efficient regions, while Epirus is the most inefficient region. The range of allocative inefficiency scores suggests that there is negligible cost inefficiency in the Greek tourism industry.

[Table 4 here]

Table 5 summarizes the cost technical and allocative inefficiency scores for each year of the Greek regions and their growth rates. The results reveal that the mean technical inefficiency is increasing over time, but especially in 2016 and 2018 it increased rapidly. The inefficiency scores vary between a low value of 6.6% in 2014 and a high value of 17.3% in 2018. This variation is characterized by an increase of the average annual growth rate to the order of 9.8% during the period 2008-2018. Allocative inefficiency exhibits a similar trend, showing an upward trend over time, especially in 2013 and 2016. The inefficiency scores show the lowest value in 2018 and the highest value in 2016. This variation is characterized by an increase of the average annual growth rate to the order of 8.3% during the period 2008-2018.

[Table 5 here]

The impact of Fraser Index on tourism efficiency

Next, the impact of the aggregate labour regulation of the Fraser Index and its sub-components on technical and allocative efficiency is examined. Table 6 shows the findings for the technical inefficiency. The coefficient of the aggregate labour regulation index is positive at 1% level of significance in all specifications. These findings are further confirmed when looking at the subcomponents where we found that regulations on hiring and firing regulations, on hours of work and on employee dismissal cost have a significant positive impact on technical inefficiency. The subcomponents of regulations on hiring and minimum wage and centralized collective bargaining have an insignificant effect on technical inefficiency. In particular, the results indicate that based on the aggregate labour index and its subcomponents stricter labour regulations in the labour market could foster technical efficiency of the Greek tourism industry.

[Table 6 here]

Table 7 presents the results for the allocative inefficiency. The coefficient of labour regulation index is negative statistically significant at 1% level. For the subcomponents the findings indicate that more flexibility for firms on minimum wage reduces allocative inefficiency. On the other hand, a more liberalised system on collective bargaining and mandated dismissal cost could increase allocative inefficiency. Also, the subcomponents of hiring and firing of workers and restrictions to the work conditions have insignificant effects on allocative efficiency. So, based on the aggregate labour index and some of its components the results indicate that less stringent labour regulations or more liberalization in the labour market enhance allocative efficiency of the Greek tourism industry.

[Table 7 here]

The impact of Global Competitiveness Index on tourism efficiency

Next, we present the findings for the impact of the Global Competitiveness Index and its subcomponents on technical and allocative efficiency. The results of Table 8 indicate a statistically significant positive relationship between technical inefficiency and the aggregate labour regulation index. This positive relationship is confirmed in all cases. Regarding the subcomponents we found mixed results. In particular, the results on the subcomponents reveal that more liberalization on the relationship between employers and employees, and less workplace unionization meaning more flexibility for firms to set the wages could reduce technical inefficiency. On the other hand, more labour market flexibility on the indicators' payments regarding productivity of employees and to women wages as a ratio to men wages may increase technical inefficiency. The subcomponents of the hiring and firing practices, redundancy costs and reliance on professional management show insignificant effects.

[Table 8 here]

Table 9 indicates a statistically significant negative relationship between allocative inefficiency and the aggregate labour regulation index in all specifications. These findings are further confirmed when looking at the subcomponents. In particular, the coefficients of all the subcomponents assert a statistically significant negative effect on allocative inefficiency. We find that more labour market liberalization, meaning more flexibility for firms to set the wages, on the payments related to the employees' productivity, on the women wages as a ratio to men wages and on the redundancy costs reduce the allocative inefficiency. The subcomponents of the hiring and firing practices and reliance on professional management show insignificant effects. The results indicate that based on the aggregate labour index and its subcomponents more liberalization in the labour market boosts allocative efficiency in the tourism industry.

[Table 9 here]

The impact of OECD Indicators on tourism efficiency

Next, we present the findings for the impact of the OECD employment protection indicators on technical and allocative efficiency. Table 10 indicates a statistically significant positive relationship between technical inefficiency and the dismissal protection of employees. Also, the regulation of temporary contracts has insignificant effects on technical inefficiency. In the same direction, the coefficients of the dismissal protection of employees and regulation of temporary contracts assert a statistically significant positive effect on allocative inefficiency. So, the results indicate that stricter labour regulations on the protection of employees reduce technical, as well as allocative efficiency of Greek firms in the tourism industry.

[Table 10 here]

Discussion of the results

The main objective of this study is to investigate the link between regulations on labour market and tourism efficiency. The results reveal that the relationship between tourism efficiency and liberalisation of labour market is complicated. On the one hand, in most cases we find a positive effect of labour market liberalization on technical inefficiency. On the other hand, we observe a negative impact of labour market liberalization on allocative inefficiency. Our findings support the previous literature that provides controversial evidence regarding the effect of labour regulations on firms' economic performance (Bassanini et al., 2009 and Bassanini and Garnero, 2013).

Further, our results confirm that more restrictive labour regulations on hiring and firing, on hours regulations, on workers dismissal cost, on payments regarding productivity of employees

and on women wages as a ratio to men wages assert positive effects on technical efficiency. On the contrary, according to the OECD indicators, we find that more labour liberalization, that is lower individual and collective dismissals protection indicates positive effects on technical efficiency. Also, more labour liberalization on the relationship between employers and employees and on the flexibility for firms to set the wages could improve technical efficiency. For the allocative efficiency, we find that more labour liberalization on hiring and minimum wage, on the flexibility of firms to set the wages, on labour-employer relations, on individual and collective dismissals protection, on payments associated with labour productivity and on the women's wages compared to men wages enhances allocative efficiency. In addition, more restrictive labour regulations on centralized collective bargaining and workers dismissal cost indicate positive effects on allocative efficiency.

The overall results reveal that more labour liberalization for the indicators that affect the labour price and raise the firm's labour cost and those that represent more flexibility for firms to adjust the labour input have positive effects on allocative efficiency. These findings are in line with the literature suggesting that stricter labour market regulations lead to efficiency losses for firms (Freeman, 1988; Nickell, 1997; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Besley and Burgess, 2004). More strict employment protection legislation that raises the adjustment costs of labour may reduce firms' incentives to expand and innovate (Malcomson 1997; Cappelli 2000; Audretsch and Thurik, 2001; Bassanini and Ernst 2002; Scarpetta and Tressel, 2004 and Cabalerro et al., 2013).

In contrary, with some exceptions, we find that stricter labour regulations have positive effects on technical efficiency. This finding is consistent with the prior literature suggesting that more employment protection boosts employees' to invest more in specific knowledge and improve firm's productivity and efficiency (Black and Lynch, 1996; Agell 1999; Bassanini et al., 2009; Bassanini and Garnero, 2013). Moreover, specific to the tourism industry that depends on the

personal interaction between tourism visitors and employees, stricter labour regulations that reduce the labour mobility, may positively affecting technical efficiency as well as on firm's performance. Furthermore, labour regulations that may increase wage pressures could lead to higher levels of labour productivity due to capital deepening and investment in capital-intensive industries (Auer et al., 2005; Autor et al. 2007; Deakin and Sarkar, 2008; Storm and Naastepad, 2009 and Lu, et al., 2010).

Conclusion

The literature on labour economics gives controversial evidence on the effect of labour market regulation on firms' economic performance, whereas the literature on tourism sector performance has thus far ignored the role of labour regulation. Our study aims to fill this gap by examining how labour regulations affect the tourism efficiency, both allocative and technical efficiency. For the empirical application we opt for a sample of Greek tourism sector over the period 2008-2018. Firstly, we find that the Greek tourism industry enjoys high efficiency levels, mainly through allocative efficiency. Also, the degree of cost inefficiency increases over time, implying that Greek firms of the tourism sector continue their production without considerations given mainly to their technical inefficiency. Also, the results of our analysis indicate that, the effects of the labour regulations on cost technical and allocative efficiency are controversial. We find that more liberalization in labour market affects positively tourism industry efficiency mainly through the allocative efficiency channel, supporting the opinion that more liberalisation in labour markets is associated with better economic performance of firms. On the other hand, we find that stricter regulations in labour market may increase technical efficiency. The empirical findings of our paper can also be useful to other countries, especially for these that tourism has a significant contribution to economic growth.

According to the empirical results we clearly demonstrate the complexity of the relationship between efficiency and labour market regulations. When designing labour market reforms, policymakers must examine all these intricate interactions. For instance, more stringent labour regulation that increases the labour cost may foster the informal labour, expanding in this way the shadow economy, and as result more regulation could reduce rather increase employees' protection on average. More effective policies on labour regulations could enhance the efficiency of the Greek tourism industry and improve its position in the global tourism competitiveness.

The empirical findings of this study could be further useful for policy makers as we report that flexibility over setting the wages could improve technical efficiency, whilst regulations that allow adjustments in the labour input have positive effects on allocative efficiency. Our results are in line with the prior macroeconomic studies (Freeman, 1988; Nickell, 1997; Nickell and Layard, 1999; Blanchard and Wolfers, 2000; Besley and Burgess, 2004; Cabalerro et al., 2013) though our focus is on microeconomy as we measure performance in terms of efficiency at the firm level. Our modelling approach offers a new pathway to study the impact of labour market regulation at firm level in the tourism industry that is labour intensive for other economies too. Future research could examine whether the impact of labour regulations across countries, i.e. in countries outside the European Union that Greece is a Member State and where there is a harmonisation in labour market regulations, on efficiency would vary.

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NOTES

[1]The data for Greek economy were taken from AMECO database (AMECO, 2020).

[2] The price of capital depends upon the interest rate, the depreciation rate and the deflator of capital and estimated as the sum of the interest rate and the depreciation rate divided by the deflator of capital. Interest rates are the average annual interest rates for loans (included loans 1-5 years and over 5 years).

[3] The depreciation rate for capital stock was set at 10%. The depreciation rate is in accordance with the Greek Government Law 4110/2013 concerning depreciation of fixed assets.

[4] We exclude from our analysis the subcomponent conscription because its value was stable for Greece during the examined period.

[5] Further details on the methodology of the Fraser Index of Economic Freedom can be found in https://www.fraserinstitute.org/economic-freedom/approach.

[6] Further details on the methodology can be found in the World Economic Forum Reports, http://reports.weforum.org/global-competitiveness-report-2019/.

[7] Further details on the methodology can be found in the OECD indicators on Employment Protection https://www.oecd.org/employment/emp/oecdindicatorsofemploymentprotection-methodology.htm