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Temporary Employment, Technical Efficiency and Productivity: The Hotel Sector in the Canary Islands

Temporalidad, eficiencia técnica y productividad: El sector hotelero en Canarias

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ABSTRACT

This research focuses on analyzing the effect of high employment temporality on technical efficiency and productivity. Previous literature points out a set of benefits and drawbacks related to fixed-term contracts. To ascertain the influence of temporality on efficiency, the critical case of the hotel sector in the Canary Islands is studied where the temporary employment rate (40%). So this paper explores the effect of temporary employment on technical efficiency in the hotel sector of the Canary Islands (a Spanish region). The magnitude of this case study can be clearly checked, given that the Canary Islands is the most popular region in the European Union visited by residents. A production stochastic frontier is estimated by distinguishing between two types of employment: permanent and temporary. Results suggest that high levels of temporality tend to reduce technical efficiency and productivity. A high conversion rate from temporary to permanent jobs seems to increase efficiency. The contribution of this paper is threefold: (i) filling the gap in the literature on the influence of temporary employment on technical efficiency, evaluating its effect for a case study where job temporality is dramatically high, (ii) partial factor productivities for permanent and fixed-term workers are estimated, and (iii) exploring the influence of less studied variables like the level of conversion from fixed-term to permanent employment on efficiency. The findings can be relevant for human resources management for firms where temporary rates are high. Human resource management should consider the type of labor contracts used, as well as the perspectives of conversion into permanent ones for their temporary workers, given their potential influence in technical efficiency, labour productivity, and firm performance.

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Keywords: Hospitality sector; temporality; labor market; technical efficiency; productivity; stochastic frontier.

RESUMEN

Esta investigación se centra en analizar el efecto de la alta temporalidad del empleo sobre la eficiencia técnica y la productividad. La literatura previa señala un conjunto de beneficios e inconvenientes relacionados con los contratos temporales. Para conocer la influencia de la temporalidad sobre la eficiencia, se estudia el caso crítico del sector hotelero en Canarias donde la tasa de temporalidad es del 40%. Así, este trabajo explora el efecto de la temporalidad sobre la eficiencia técnica en el sector hotelero de Canarias (región española). La magnitud de este caso de estudio puede comprobarse claramente, dado que las Islas Canarias es la región de la Unión Europea más visitada por los residentes. Se estima una frontera estocástica de producción distinguiendo entre dos tipos de empleo: permanente y temporal. Los resultados sugieren que altos niveles de temporalidad tienden a reducir la eficiencia técnica y la productividad. Una alta tasa de conversión de empleos temporales a permanentes parece aumentar la eficiencia. La contribución de este trabajo es triple: (i) llenar el vacío en la literatura sobre la influencia del empleo temporal en la eficiencia técnica, evaluando su efecto para un caso de estudio en el que la temporalidad del empleo es dramáticamente alta, (ii) se estiman las productividades parciales de los factores para los trabajadores permanentes y de duración determinada, y (iii) se explora la influencia de variables menos estudiadas como el nivel de conversión de empleo de duración determinada a permanente en la eficiencia. Las conclusiones pueden ser relevantes para la gestión de los recursos humanos de las empresas en las que las tasas de temporalidad son elevadas. La gestión de recursos humanos debería considerar el tipo de contratos laborales utilizados, así como las perspectivas de conversión en indefinidos de sus trabajadores temporales, dada su potencial influencia en la eficiencia técnica, la productividad laboral y el rendimiento de la empresa.

Palabras clave: Sector hostelero; temporalidad; mercado laboral; eficiencia técnica; productividad; frontera estocástica

I. INTRODUCTION

Recent decades have highlighted a changing nature in employment relationships. Temporary employment has increased in many European countries, where labor reforms have been targeted at creating a more flexible labor market. As a consequence, in 2016, temporary employment rates reached 11.2% for OECD countries and 14.2% for the countries belonging to the European Union (EU). From Eurostat data for 2018 (Q4), the proliferation of non-stable employment is particularly noteworthy in the cases of Poland (23.8%) and Spain (27.5%).

In this paper, the literature analyzing the effects of temporary employment is presented. Nowadays, a simple look at Eurostat data (Labor Force Survey) and OECD Employment and Labor Market Statistics show that fixed-term contracts are an important mode of employment¹. One of the main reasons behind the labor reforms in OECD countries

¹ OECD defines temporary employment including “wage and salary workers whose job has a pre-determined termination date. National definitions broadly conform to this generic definition, but may vary depending on national circumstances”.

has been the objective of reducing unemployment. Indeed, employment legislation may have affected the composition of the workforce, promoting a greater use of workers on temporary contracts. Thus, analyses of the consequences of fixed-term contracts have attracted attention with a rapidly growing number of theoretical and empirical studies.

These data on temporary employment have aroused academic interest among researchers. Indeed, a prolific theoretical and empirical literature has emerged focusing on the costs and benefits of the employment protection legislation implemented in several European economies over the last four decades.

Several studies have analyzed the effects of labor market deregulation on Total Factor Productivity (TFP)². Addressi (2014) and Damiani et al. (2016), among others, empirically found that the deregulation of temporary employment negatively affects TFP growth. However, the study of the impact of temporary employment on technical efficiency has received less attention. The analysis of productive efficiency is more precise than the TFP one, given that TFP can also be affected by scale economies, differences in production technology and differences in the environment in which production occurs (Lovell, 1993). Since TFP can be expressed by a weighted average of partial factor productivities, an improvement in technical efficiency may increase TFP *via* improvements in partial factor productivities (Murray, 2016). Specifically, the approach proposed by Battese and Coelli (1995), and followed in this paper, allows us to estimate both, technical efficiency and partial factor productivities. Therefore, the conclusions and recommendations from the analysis of technical efficiency should be more accurate and interpreted in terms of changes of TFP.

Since 1984, Spanish governments have tried to implement significant changes in Employment Protection Legislation by liberalizing temporary contracts to reduce the unemployment rate. Their use soon became extensive, as they entailed much lower dismissal costs than regular permanent contracts (Dolado et al., 2002). As a consequence, the term dual employment protection was coined for the regulation leading to a two-tier segmentation of labor market (Bentolila et al., 2019). Different international organizations warned of the abuse of fixed-term contracts in the Spanish economy, and potential negative effects both, in terms of equity and efficiency (ILO, 2018). These circumstances encourage an academic and political debate beyond the scope of this paper.

As a case study, this paper explores the effect of temporary employment on technical efficiency in the hotel sector of the Canary Islands (a Spanish region). As known, technical efficiency is concerned with obtaining the largest possible level of output for given quantities of inputs, or using the smallest possible quantities of inputs to obtain a given output. The magnitude of this case study can be clearly checked, given that the Canary Islands was the most popular region in the European Union (EU) visited by EU residents in 2017 (EUROSTAT Statistics, 2019). In 2017, the Canary Islands received about 16 million tourists, and the contribution of this sector to the GDP was about 35.2% and over 40% in terms of employment

² Kim (2010) identifies the factors that determine each total factor productivity component, among which are employees with university degrees.

(IMPACTUR, 2017)³. Given the strikingly high temporary employment rate of 40% in 2016, the hotel sector of the Canary Islands is in an ideal case to study temporality and its effects.

Precisely the main hypothesis to be tested is that temporality contracts deteriorate labor productivity and efficiency. Previous literature on this topic does not provide a conclusive relationship between temporary jobs and labor productivity, showing benefits and drawbacks of temporary employment. So the contribution of this paper is threefold: (i) filling the gap in the literature on the influence of temporary employment on technical efficiency, evaluating its effect for a case study where job temporality is dramatically high, (ii) partial factor productivities for permanent and fixed-term workers are estimated, and (iii) exploring the influence of less studied variables like the level of conversion from fixed-term to permanent employment on efficiency.

The rest of the paper is organized as follows. Section 2 presents a literature review on the topic. In Section 3, the hotel sector of the Canary Islands is described as a relevant case study of temporary employment. Section 4 briefly presents the methodology of production frontiers as a framework for the empirical analysis and the dataset used in this paper. In Section 5, the empirical analysis is addressed, and the main results are discussed. Finally, the last section draws some relevant conclusions.

II. LITERATURE REVIEW

The main contributions to this topic reveal inconclusive results about the benefits or drawbacks of temporary employment. Therefore, this literature is presented by first describing contributions shedding light on benefits of temporary jobs and then turning to literature focusing on their drawbacks⁴.

i) Benefits

First, temporary contracts quickly ease labor reallocation in firms in order to deal with technological or demand shocks. The so-called *buffer effect* of fixed-term contracts is commonly argued, given that they protect permanent workers from the risk of unemployment (Polavieja, 2005). In fact, Caggese and Cuñat (2008), for a calibrated model of Italy, found that flexibility during shocks exceeds the lower productivity of fixed-term workers.

Second, temporary contracts can alleviate the moral hazard problem in a principal-agent model (Grossman and Hart, 1983). The uncertainty associated with being fired when a firm's performance deteriorates means a reduction in the future expected wage. In this way, threat of dismissal can promote labor effort, reducing the potential for a moral hazard problem. Related to permanent contracts, Garcia et al. (2018) found that open-ended jobs can promote employee absenteeism, reducing effort and labor productivity. Becker and Engel (2018) confirmed this finding but also their results point out that temporality encourages

³ The convenience of this case study is reinforced by the absence of seasonality, i.e., a noteworthy feature of the Canary Islands as a tourist destination is its low seasonality compared to other European tourist regions.

⁴ For a deep and recent revision of the effects of dual labor markets on different issues, see Bentolila et al. (2019). In addition, Boeri and Garibaldi (2021) focused on the theoretical work on temporary employment, and main empirical findings in terms of job creation and destruction, and unemployment.

fixed-term workers to practice on-site work spite suffering an illness. The latter can be a collateral consequence of the fear of losing job.

Third, temporary contracts can be screening devices for job selection as well as stepping stones to permanent employment (Booth et al., 2002b). Temporary contracts can have an incentive effect, assuming temporary workers aim to obtain open-ended positions (Booth et al., 2002a; Dolado et al., 2002)⁵. Thus, more effort by fixed-term workers compared to permanent workers is expected. In this sense, Engellandt and Riphahn (2005), using indicators for unpaid overtime work and absences taken from the Swiss Labor Force Survey (SLFS), presented evidence that temporary workers make greater effort than permanent employees. Also, Ferreira et al. (2018) found that temporary employees engage in on-the-job learning more intensively than their counterparts in permanent employment. As a regulatory implication, Lisi and Malo (2017) pointed to the need for addressing the design of the use of temporary employment to screen new workers for more stable ways of work.

ii) Costs

The empirical contributions showing the costs associated with fixed-term contracts are mainly focused on the negative impact on attitude and effort of workers and, as a consequence, on their productivity.

First, a relevant finding is that job insecurity appears to be a main source of dissatisfaction associated with fixed-term employment. Chadi and Hestschko (2016) discovered that, for the case study of a panel of German firms, when controlling for the 'honeymoon effect' of a new job, which is more likely to be detected in the case of temporary workers, a clearly negative relationship between working under a temporary contract and job satisfaction emerges. In addition, Blanchard and Landier (2002), for French data, suggested that reforms reducing dismissal costs have the perverse effect of increasing turnover and workers may be worse off. This result was also obtained by Booth et al. (2002b) for a study on British private households. For a sample of 35 European countries, Alekynska (2018) confirmed that temporary employment is indeed shown to negatively affect job satisfaction not only directly, but also indirectly, through generally worse working conditions.

Second, in the tradition of efficiency wage models (Shapiro and Stiglitz, 1984), lower wages can lead to lower labor effort. This can deteriorate labor productivity and firms' performance. In fact, temporary workers are paid less than permanent workers (Booth et al., 2002b). Precisely, in the Spanish case, Mantecón et al. (2023) have confirmed that labor reforms that have promoted temporary employment have caused wage moderation. This wage moderation could deteriorate productivity within the framework of efficiency wage models. Pisa and Sánchez (2016) found empirical evidence in favor of efficiency wage models for the case study of Spanish manufacturing firms. In this sense, Kim and Skott (2016) recognize wage inequality between fixed-term and open-ended contracts and its consequences in terms of labor effort. In fact, Kim and Skott (2016) argue that this wage gap responds to a dual purpose, increasing the effort of both temporary and permanent workers. However, in the absence of prospects of promotion to permanent status, i.e., low conversion rates into permanent jobs, this wage inequality can fail to encourage effort by temporary

⁵ However, Güell and Petrongolo (2007) and Amuedo-Dorantes (2001) found low conversion rates of temporary contracts into permanent positions in the case of Spain.

workers. Dolado et al. (2016) concluded that, all else being equal, up to 13% of the slowdown in TFP growth in Spanish manufacturing firms could be due to how temporary workers reacted to the reduction in conversion rates over the period 1991-2005.

Third, the literature shows that fixed-term contracts provide less work-related training (Arulampalam and Booth, 1998). This fact is consistently demonstrated by empirical evidence. Booth et al. (2002b) found that temporary employees receive less on-the-job training when compared to permanent ones for the case study of UK. Likewise, results from Dolado et al. (2016), in their study of a panel of Spanish manufacturing firms, suggested that temporary workers receive less paid training, thus decreasing TFP. In addition, Damiani et al. (2016) found that the deregulation of temporary employment discourages training and the acquisition of firm-specific skills in the analysis of a sample of ten industries in fourteen European countries.

Fourth, empirical evidence and labor datasets suggest that temporality can deteriorate physical and mental health, reducing labor safety. Virtanen et al. (2005) reviewed 27 studies on temporary jobs and health. In this research, they found that low income, job insecurity, low on-the-job training, lack of prospects for promotion, and exposure to hazardous work conditions have been suggested as potential psychosocial and material pathways through which temporary employment can damage health. They conclude that there is clear evidence of an association between temporary employment and psychological morbidity. Also, temporary workers seem to have a higher risk of occupational injuries, although their sickness absence is lower (presenteeism). Indeed, as showed by López-García et al. (2017) from a Spanish database, temporary jobs have the largest influence on the probability of an accident occurring, except in the industrial sector. More recent works confirm that fixed-term jobs deteriorate psychological health (Bartoll et al., 2019; Carrieri et al., 2014). Moreover, Caroli and Godard (2016), in 22 European countries, found that even when the potential endogeneity of job insecurity is accounted for, the health-damaging effect of job insecurity is still confirmed for a subgroup of health outcomes.

Fifth, attitudes and feelings of workers in the workplace can be affected by the type of labor contract. Less organizational commitment, lower self-efficacy, and less perceived job performance in temporary compared to permanent contracts is shown (Gracia et al., 2011). Following Addessi (2014), the lack of a long-lasting commitment among temporary workers makes it unlikely to expect high degrees of involvement in activities that could generate gains in the future and that are firm-specific (as the TFP is) and not worker-specific.

Sixth, there is evidence that temporary contracts reduce firms' incentives to innovate. The argument is that workers will be prepared to make discretionary efforts and bear the risks involved in innovations only if they have a sense of security in their employment. Results by Storey et al. (2002) also suggested that there was some evidence to support the view that job security is relevant for innovation in their survey of 2,700 firms. Moreover, Malgarini et al. (2013), among others, found a significant increase in the likelihood of hiring permanent workers when the firm innovates.

Summarizing, deregulation of the labor market promoting the use of temporary contracts implies benefits and costs. The empirical literature does not provide a clear recommendation in favor of a particular type of contract. Additionally, the issues reviewed above are not conclusive with respect to labor effort and productivity. Thus, wages, health effects, organizational commitment, satisfaction in the workplace, managerial flexibility

support the potential of a relationship between contract type and productivity. Precisely, this paper focuses on ascertaining the relevance of the link between employment contract type and productivity and efficiency.

III. THE CASE STUDY

In this section, issues related to temporality in the case study of the accommodation sector in the Canary Islands are addressed. Firstly, data on the Spanish labor market are presented according to the main findings on the effects of temporality described in Section 2. Secondly, some features of the hotel sector of the Canary Islands are outlined, highlighting that it can be an ideal 'laboratory case' to study the consequences of high employment temporality.

Since the beginning of the legal status of workers in 1980, about fifty labor reforms have been implemented in the Spanish labor market. The reform of 1984 was the first relevant movement towards labor market flexibilization, promoting the introduction of fixed-term contracts. The objective was the reduction of high rates of unemployment in the decade of the eighties (Mantecón et al, 2023). Although these reforms were designed for the application of this type of contract in specific production circumstances, the Spanish labor market saw a rapid expansion of a flexible segment of temporary contracts (Polavieja, 2005). In the case of the Canary Islands in 2016, only 6.8% of new contracts in the Canary Islands in 2016 were open-ended jobs.

A look at data on the Spanish labor market confirms some findings of the literature on labor temporality. Table 1 shows a comparison between permanent and temporary employment for the Spanish labor market, in terms of some critical issues pointed out in the literature reviewed in Section 2.

Table 1. Comparison between Temporary and Permanent Employments. The Case of Spain

	Permanent employment	Temporary employment
Annual Average Earnings by worker ¹	€24,516	€16,568
Hourly Average Labor Earnings ¹	€15.4	€11.8
Risk of Poverty Rate ²	7.3	23.1
Labor Accidents with Work Leave per 1,000 workers ³	25.3	50.6
Work Leave (health problems related or worsened with the job) ⁴	21%	25%
Main reason of the temporary work: not finding permanent job ²	--	22.4%
Dissatisfaction with labor conditions (not very or not satisfied) ⁴	14.3%	24%
Wage satisfaction ⁴	51.4%	43,7%
Too tired after work ⁴	25%	30.4%
Fear of being fired in the following six months (totally or partially agree) ⁴	14.1%	46.6%
Work-related training paid by employers ⁴	39.6%	29%

Source: (1) National Statistics Institute (INE), 2016. (2) EUROSTAT, 2017. (3) Spanish Labor Ministry, 2017. (4) Spanish Survey on Labor Conditions, 2015.

As can be observed, the earnings of permanent workers in 2016 were noticeably higher compared to fixed-term workers, i.e., about 31% in hourly terms and over 48% in annual

terms. For the case of Spain, Oliver and Sard (2019) precisely found that two identical workers earn different salaries if they have a different type of contract, and this gap is wider for higher wages. More dramatically, the risk of poverty rate of temporary workers is more than three times that of permanent workers. With respect to labor accidents and health, Table 1 shows that labor accidents with work leave for fixed-term workers double those for permanent workers. Other work leave related to health also worsened and were more frequent in the case of fixed-term jobs. Regarding satisfaction and feelings after work, Spanish data confirm the academic findings presented in Section 2, i.e., lower satisfaction and more intense feelings of tiredness in the case of temporary workers. Additionally, in Section 2, labor uncertainty was noted as a factor reducing productivity. In the Spanish case, almost half of temporary workers declare that they feel afraid of being fired in the following six months. Finally, it is noticeable that only 29% of temporary workers received on-the-job training paid by employers, compared to about 40% in the case of permanent workers. Consequently, fixed-term workers declare greater dissatisfaction with their labor conditions.

A comparison between fixed-term and permanent jobs in the hotel sector of the Canary Islands can be observed in Table 2. Online data on labor demand of hotels located in the Canary Islands suggest that offers for fixed-term contracts require lower experience, lower wages, less education, and less opportunity of management positions. Unfortunately, genre data are not available, it being an issue of main interest in the analysis of labor opportunities (Pastore et al., 2020).

Table 2. Some Characteristics of Temporary and Permanent Jobs. Canary Islands

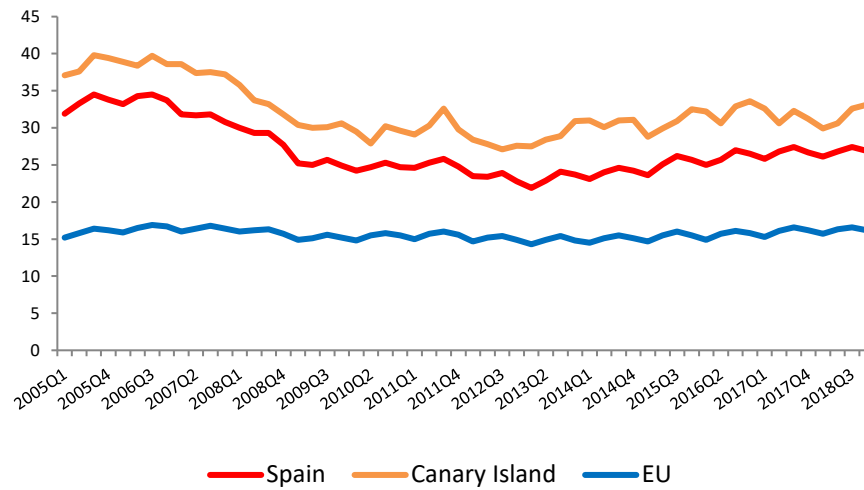
	Permanent Jobs	Temporary Jobs
<u>Minimum experience required</u>		
≥1 year	31.8%	50%
≥5 years	13.6%	0%
<u>Status</u>		
Management positions	14.3%	0%
Intermediate management positions	23.8%	11.8%
Employees	42.9%	70.6%
<u>Education</u>		
Graduate	27.3%	8.3%
Secondary education	9.1%	36.1%
<u>Average wage</u>	€1145.4	€1865.9

Source: online labor demands from self-constructed database by Marrero-Rodríguez et al. (2020).

Figure 1 shows a comparison of temporary employment rates of the European Union, Spain and the Canary Islands. As can be observed, the temporary rates for the Spanish economy over the period 2005-2018 are about 10 percentage points higher than those for the EU. More strikingly, average temporality in the Canary Islands reaches 32.3%, more than doubling the average for the EU. Following ISTAC data “Estadística de Movimiento Laboral Registrado”, only 6.8% of new contracts in the Canary Islands in 2016 were open-ended jobs⁶.

⁶ <https://www.gobiernodecanarias.org/istac/estadisticas/empleo/empleo/actividadeconomica/E59021A.html>

Figure 1. Temporary employment rates. 2005-2018



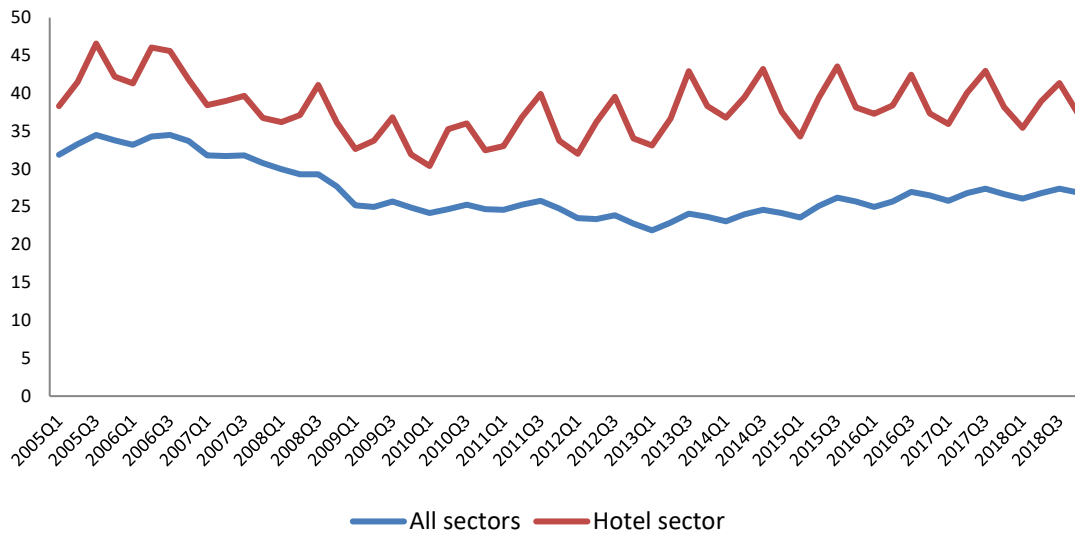
Source: Eurostat and Spanish Statistics Institute (INE, 2019).

Another feature of the Spanish labor market is the low conversion rate of temporary contracts into permanent ones. As pointed out in Section 2, the level of the conversion rate can be a factor that influences labor productivity. Following EUROSTAT data on “Labor Transitions from Temporary to Permanent Contracts” between two consecutive years, in 2018 the conversion rate was about 13.9% for Spain where the average conversion rate for the EU27 reached 24.5%⁷.

Now focusing on the Spanish hotel sector, Figure 2 shows that accommodation sector is clearly characterized by a quite higher temporality rate than the economy as a whole, reaching an average of 38% for the period 2005-2018. The same feature can be observed from Eurostat data, when a comparison between EU hotel sector and EU economy is carried out.

⁷ https://ec.europa.eu/eurostat/databrowser/view/tepsr_wc230/default/table

Figure 2. Spanish temporary employment rates. Hotel sector and all sectors. 2005-2018

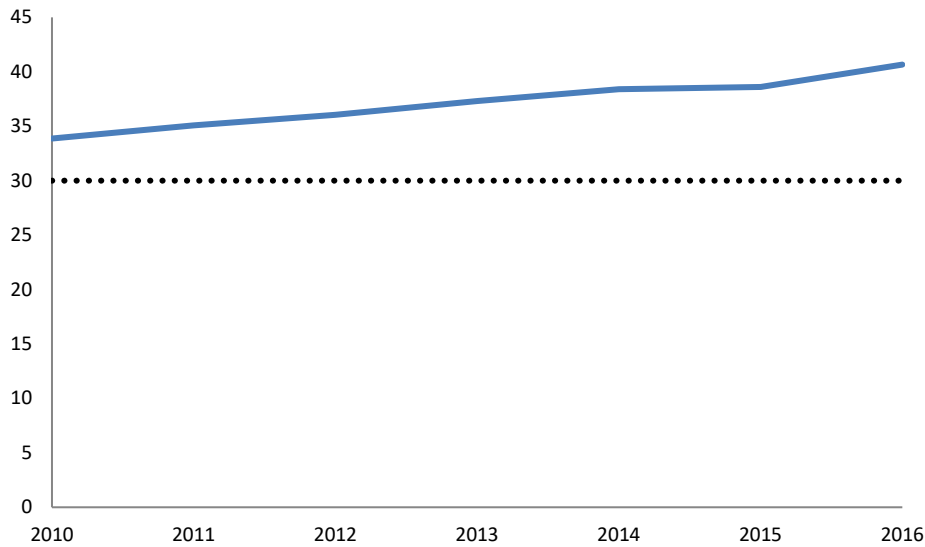


Source: Spanish Statistics Institute (INE, 2019)

Regarding the main features of the hotel sector in the Canary Islands, according to EUROSTAT Statistics (2019), this was the most popular region in the European Union (EU) for EU residents in 2017, with about 110 million overnight stays. This is noticeable since in the second and third most popular regions in the EU, i.e., Catalonia and Jadranska Hrvatska, overnight stays were less than 80 million. The combination of a massive sun-and-sand market segment, the absence of seasonality and the availability of a specific natural heritage may be major reasons behind this popularity. Specifically, in 2017, the Canary Islands received about 16 million tourists, and the contribution of this sector to the Islands' GDP was about 35.2% and over 40% in terms of employment (IMPACTUR, 2017). Thus, a sizeable hotel sector has emerged characterized by more than six hundred hotels with an average size of over four hundred beds. Based on the Spanish Statistics Institute data, this size is notorious, since it is four times greater than the average size for Spain as a whole.

Another relevant feature of the hotel sector of the Canary Islands for this research is the very high temporary employment rate (40% in 2016), almost tripling the average rate for the whole European economy (15%). As mentioned in Section 1, the main objective of this paper is to precisely analyze the effect of high temporality of employment on productivity and efficiency. Figure 3 suggests for the period 2010-2016 two remarkable features: (i) the temporary rate is clearly over 30% and exceeding 40% in 2016, and (ii) an increasing trend in this rate is found. These data make the hotel sector of the Canary Islands an ideal location to study temporality and its effects.

Figure 3. Temporary employment rate. Hotel sector of the Canary Islands. 2010-2016



Source: data compiled and calculated by authors based on the Tourist Accommodation Survey (ISTAC, 2016)

IV. METHODOLOGY AND DATA

In this section, the methodology followed in the empirical analysis is described. In addition, the dataset of the hotels located in the Canary Islands is presented.

With respect to the methodology, one question arises in modelling hotels efficiency, as regards the approach to be adopted in specifying the frontier function. Two main perspectives have been used: The Data Envelopment Analysis (DEA) and the Stochastic Frontier Approach (SFA). DEA is a non-parametric approach that does not require functional specification and can handle multiple inputs and outputs. However, DEA has been strongly criticized in the literature mainly by the fact that all deviations from efficient frontier are considered as technical inefficiency. On the contrary, SFA is a parametric approach assuming the stochastic nature of the production function, as well as compound error. This error term includes a standard statistic error and a term measuring technical inefficiency. In a one-stage procedure, the technical inefficiency can be estimated and explained as a function of the firm-specific factor and other variables. This makes SFA more useful than DEA when the goal is to relate technical inefficiency of hotels to operational decisions by managers or other factors.

In this work, a stochastic production frontier for the hotel sector of the Canary Islands is estimated. Battese and Coelli (1995) proposed a stochastic frontier production function for data of panel firms, in which the non-negative technical inefficiency effects are assumed to be a linear function of firm-specific variables and time. Based in a one-stage procedure, the determinants of the inefficiency are directly incorporated into the estimation by maximum likelihood, improving the estimates of the frontier parameters⁸.

⁸ Also, Tsekerisa and Papaioannou (2018) use stochastic frontier analysis (SFA) to estimate simultaneously the influence of physical capital and labour on regional output and the inefficiency contribution of regional variables. They use data across 13 regions of the Greek economy.

The parametric model followed includes two equations: (i) a production frontier, and (ii) an equation for the technical inefficiency. The functional form for the production frontier is a translog function⁹, expressed by:

$$\ln y_{it} = \alpha + \sum_k \beta_k \ln x_{kit} + \sum_j \sum_{k \geq j} \beta_{jk} \ln x_{jit} \ln x_{kit} + \beta_t t + \beta_{t^2} t^2 + V_{it} - U_{it}$$

$$i = 1, \dots, N; t = 1, \dots, T \quad (1)$$

where \ln indicates natural logarithms, y_{it} is the output variable, i.e., overnight stays in hotel i in year t , x_{kit} is the quantity of input k used in hotel i in year t , where $k = L_P, L_T, K$. In our case, L_P represents the number of permanent workers, L_T the number of fixed-term workers, and K is the capacity variable measured by the number of beds. V_{it} is a statistical error assumed to be $N(0, \sigma^2_v)$ and U_{it} represents technical inefficiency of hotel i in year t and is obtained by truncation (at zero) of the $N(\mu_{it}, \sigma^2_u)$. Finally, t and t^2 denote linear and non-linear trends, respectively.

From the estimates of this equation, also marginal effects for each production factor can be calculated. In this sense, these marginal effects measure elasticities of output with respect to production factors. The production theory shows that these elasticities coincide with the ratio of marginal product over average product for each input. Note that these productivities are partial, different from the TFP. Following, for instance, Murray (2016), TFP can be expressed as the weighted sum of these partial factor productivities where the weights are the inputs' cost-share weights.

From an empirical perspective, a partial productivity measure may be more informative than TFP for particular analytical purposes because partial measures allow an analyst to adjust to the efficiency of specific inputs that are of special interest in a particular context. Furthermore, measurement of TFP requires measures of real output, all the real inputs used by the firm, and the nominal cost shares necessary to compute the weights (Murray, 2016). Specifically, in this research, the analysis is focused on the partial productivity and technical efficiency associated with two specific factors: temporary and permanent work. Additionally, the input prices needed to calculate the weights for TFP were not available for each decision-making unit, i.e., the hotels analyzed¹⁰.

Likelihood function may be expressed in terms of variance parameters. In this way, $\sigma^2_s = \sigma^2_v + \sigma^2_u$ and $\gamma = \sigma^2_u / \sigma^2_s$. When γ ratio increases to the value of one, the study of technical inefficiency becomes more relevant, since it indicates higher variability of the compound error term due to inefficiency.

⁹ Translog specification is more flexible than other alternatives such as the Cobb-Douglas production function, given that it recognizes potential non-linear relationships between outputs and inputs, and it does not impose restrictions such as separability, homotheticity, and unity elasticity of substitution.

¹⁰ Note that our analysis is essentially static, by focusing on the static partial productivities. For the analysis of the effect of the type of contract on the dynamics of TFP, the methodology used by Addessi (2014) and Castellani et al. (2020), among others, provides a suitable empirical framework.

Technical efficiency takes values from zero to one, and it may be calculated from the estimates of inefficiency U_{it} . Therefore

$$TE_{it} = \frac{y_{it}}{\text{Optimal } y_{it}} = \approx \exp(-U_{it})$$

The general specification for technical inefficiency is given by:

$$U_{it} = \delta_0 + \sum_{i=1}^m \delta_i z_{it} + w_{it} \quad (2)$$

where z_{it} denotes a set of m determinants of technical inefficiency and w_{it} is an error term.

Under the assumption that the technical inefficiency of each hotel may be explained from a set of determinants, the variables proposed for the inefficiency equation are the following: (i) the *temporary rate* measured as the ratio of temporary workers over total workers, where the expected effect cannot be previously suggested given the literature revised in Section 2 is inconclusive; in fact, the main hypothesis of this research is that temporary jobs deteriorate efficiency; (ii) the *conversion rate* approximated by the permanent workers expressed in first differences divided by the fixed-term workers corresponding to the previous period¹¹; it could be interpreted as a signal of stepping stones mechanisms to permanent employment, expected to promote labor effort; (iii) the quality of services offered by hotels approximated by the price variable named Average Daily Rate (*ADR*), i.e. the average rental income per paid occupied room, and (iv) *unemployment* in the municipality where the hotel is located.

Our analysis also combines estimates associated with both equations, i.e., the production frontier and the equation for technical inefficiency in order to explore the effects of temporary employment rate on TFP *via* partial productivities. As mentioned above, TFP is a weighted sum of partial productivities estimated from the first equation, so the effects of variables on technical efficiency estimated from the second equation can be interpreted in terms of TFP.

Data used in this paper have been collected mainly from the known as *Encuesta de Alojamiento Turístico del Instituto Canario de Estadística (ISTAC)* for the period 2010-2016. These data are official and cover almost the whole of the hotel sector in the Canary Islands, including hotels belonging to hotel chains¹². Given that the procedure followed needs hotels with both fixed-term and permanent workers, the database of 635 hotels was filtered and a definitive sample size of 407 hotels was used for the empirical analysis.

¹¹ Given that the data corresponding to the type of contract of each worker for each hotel were not available, conversion rate was calculated for each hotel through the variation of permanent workers over fixed-term workers corresponding to the previous year. In this sense, results must be analyzed in terms of changes in the composition of the labor contracts of the hotel.

¹² Most previous research uses extensive accounting databases (e.g., SABI for Spain and Portugal, aida for Italy, and AMADEUS for Europe) with consolidated accounts. However, this does not allow the study of hotels belonging to a chain and presenting consolidated accounts in their country or region of origin. Our dataset incorporates the census of hotels, even those belonging to hotel chains. Unfortunately, data are anonymous and we cannot distinguish if a hotel is currently in a hotel chain.

V.RESULTS

In this section, the main results of the analysis of efficiency and productivity for the case study of the hotel sector of the Canary Islands are presented. Table 3 shows the main descriptive statistics of the variables used in the analysis. As can be observed, the mean of overnight stays for hotels in period 2010 to 2016 is over 138,500. The average size of hotels is about 525 beds, confirming the large size of hotels located in the Canary Islands. The average *temporary rate* for the hotels included in the analysis is about 38% and the average *conversion rate* is negative, indicating a reduction of permanent jobs in average terms, in favor of fixed-term contracts over the period.

Table 3. Descriptive statistics. 2010-2016

	Mean	Median	Maximum	Minimum	SD
Overnight stays	138,539.8	121,305	784,738	1,483	110,638.7
Permanent labor	57.1	46	411	1	51.1
Temporary labor	34.7	24	343	1	37.5
Size (beds)	524.79	472	2,442	10	372.2
Temporary Rate	0.37	0.38	1	0.02	0.1
Conversion Rate	-0.05	0	4	-11	0.48
ADR	69.8	59.6	322.5	10.1	41.3
Unemployment	8,147.1	3,296	54,336	117	13,701.6

As mentioned above, the approach by Battese and Coelli (1995) is used to characterize both a stochastic production frontier and a model for the technical inefficiency. This methodology has the advantage of estimating the frontier function and inefficiency effects function in a single-stage sampling procedure. Firstly, the estimates and main results are analyzed. Secondly, the tests of hypotheses associated with the inefficiency model are studied.

Table 4 shows the maximum likelihood estimates of the production function and the technical inefficiency using NLOGIT 5. In Panel A, the estimated coefficients of the translog production function are presented. As can be observed, coefficients are in general significant.

Turning to Panel B of Table 4, the estimated value for γ suggests that 47.14% of the variability of the compound error is due to technical inefficiency. Thus, it indicates that inefficiency is likely to be significant for the analysis of the outputs of hotels located in the Canary Islands. It is noteworthy that all variables are significant at 1% in the explanation of inefficiency.

As can be observed, the estimated parameter for *temporary rate* seems to indicate the use of this type of contracts tends to increase technical inefficiency, confirming the findings by Díaz-Mayans and Sánchez (2004, 2008) in their analysis for the manufacturing sector. However, the magnitude of our estimated parameter for *temporary rate* suggests a more intense deterioration of technical efficiency in the case of the hotel sector. Several reasons for the negative effect of temporality on technical efficiency and labor productivity are provided by previous literature and they have been presented in Section 2: (i) lower current job satisfaction (Blanchard and Landier, 2002), (ii) lower wage and effort (Kim and Skott, 2016), (iii) less on-the-job training (Damiani et al., 2016), (iv) higher job insecurity and health damage

(Virtanen et al., 2005), (v) less organizational commitment (Gracia et al., 2011), and (vi) less innovation incentives (Malgarini et al., 2013). Therefore, the main hypothesis of this research, i.e. temporary contracts reduce efficiency is confirmed for the case study of the accommodation sector of the Canary Island.

Regarding the *conversion rate*, it shows a positive effect on technical efficiency. Prospects for promotion from fixed-term to permanent jobs can incentivize effort, increasing labor productivity. In this sense, Güell-Rotllan (2000) and Polavieja (2005) also pointed out that the conversion rate can act as an incentive mechanism. Indeed, it can be easier to deal with workers who observe a human resources management promoting permanent positions. Unfortunately, as shown by Boeri and Garibaldi (2021), where share of temporary employment is large, conversion into permanent contracts is mild.

The positive sign of the estimated coefficient for *ADR*, as a proxy of quality of services, suggests that offering quality is expensive in terms of technical efficiency. Indeed, more personalized hotel services require greater labor intensity. This result is consistent with numerous studies analyzing the influence of quality on technical inefficiency. For instance, Corne (2015) found that budget hotels are more technically efficient than other categories for the case study of the French hospitality sector. Arbelo-Pérez et al. (2017) also found that quality has a negative impact on cost efficiency.

Table 4. Deterministic Component of Stochastic Frontier Model

Panel A. Translog production function.				
	Coefficient	Standard Error	z	p-Value
Constant	7.06970***	.12390	57.06	.0000
Log (size)	.14353**	.05977	2.40	.0163
Log (Permanent labor)	.38205***	.06032	6.33	.0000
Log (Temporary labor)	.39859***	.04704	8.47	.0000
Log (size) ²	.10651***	.00935	11.39	.0000
Log (Permanent labor) ²	.00332	.00737	.45	.6529
Log (Temporary labor) ²	.05465***	.00494	11.07	.0000
Log (size)Log (P labor)	-.07087***	.01627	-4.36	.0000
Log (size)Log (T labor)	-.10088***	.01119	-9.02	.0000
Log (P labor)Log (T labor)	.02061*	.01108	1.86	.0628
t	-.05063***	.01834	-2.76	.00058
t ²	.00926***	.00201	4.60	.0000
Panel B. Inefficiency specification.				
	Coefficient	Standard Error	z	p-Value
Temporary Rate	.84502***	.11165	7.57	.0000
Conversion Rate	-.09755***	.01915	-5.09	.0000
ADR	.00513***	.00043	11.88	.0000
Unemployment	.49080D-05***	.1235D-05	3.97	.0001
Υ	0.47136			
σ ²	0.068			
Log likelihood	159.37159			
Number of observations	2849			

Note. ***, **, * represent significance at 1%, 5% and 10% levels, respectively

Finally, based on the theory of efficiency wages, *unemployment* variable exerts a negative influence on labor effort and, therefore, on technical efficiency¹³. This result suggests that hotels located in municipalities with low unemployment show higher levels of labor effort and technical efficiency. Low unemployment provides low bargaining power of hotels and, as a consequence, they pay higher wages; and according with efficiency wages theory, this mechanism reduces shirking when effort is not perfectly observed, which may be promoting higher levels of effort from their workers (Shapiro and Stiglitz, 1984; Akerlof, 1982).

Table 5. Test of hypothesis for the inefficiency Frontier Model

Null Hypothesis	Log (Likelihood)	Critical Value (.95)	Test Statistic
$H_0(i). \gamma = \delta_0 = \delta_1 = \dots = \delta_6 = 0$	-611.56	12.59	1,541.15
$H_0(ii). \gamma = 0$	-580.51	3.81	1,479.85

Regarding the analysis of the specification of the inefficiency model, the results of two hypothesis tests are reported in Table 5: (i) absence of inefficiency effects, and (ii) non-stochastic inefficiency effects. As can be observed, in both cases null hypotheses are rejected. Therefore, it confirms the presence of stochastic inefficiency effects. An additional test on the relationship between inefficiency effects and the regressors has often been carried out in previous research. Given that the intercept is not significant in the inefficiency equation, in our case, this test is not applicable, but an inspection of individual significance tests suggests that inefficiency depends on quality, size, temporary rate and conversion rate.

Let's turn to the analysis of labour productivity. As for the calculation of production elasticities and their interpretation, the results presented in Panel A of Table 4 allow the elasticities for the translog model to be easily calculated. Specifically, the elasticities for permanent and fixed-term labor are 0.047 and 0.2, respectively. Since both elasticities are lower than one, marginal productivity is estimated to be lower than average productivity, i.e., as expected, hotels located in Canary Islands seem to be operating under decreasing average and marginal productivity of production factors¹⁴.

As commonly known, and stated in Section 2, wages of permanent workers are higher than those of temporary workers and, as suggested by microeconomic theory, marginal productivity is higher for permanent workers¹⁵. Therefore, our findings of lower elasticity for permanent workers, i.e., a lower ratio of marginal over average productivity, implies that

¹³ Wages by municipalities would have been a more direct variable dealing with the intuition provided by efficiency wages model. However, they are not available at the level of municipalities.

¹⁴ Furthermore, the average estimation for the parameter of returns to scale, i.e., the sum of production elasticities is 1.1 suggesting the presence of increasing returns to scale. This is an expected finding in the case of the hospitality sector of Canary Islands, where sizeable hotels seem to be achieving the advantages associated with scale economies.

¹⁵ Theoretical differences in real wages may also be affected by the relative negotiating power between workers and firms. In this sense, a higher negotiating power of permanent compared to fixed-term workers could explain the higher real wages of permanent workers. However, in the case of the hotel sector of the Canary Islands, it must be taken into account that the unemployment rate in the islands was fluctuating between 26% and 35% in the sample period. Indeed, negotiating power of workers vanishes in the presence of extremely high unemployment rates.

average productivity must also be higher than that of fixed-term workers¹⁶. This is a relevant conclusion given that temporary jobs seem to reduce the level of partial labor productivity and likewise the performance of hotels located in Canary Islands. This result reinforces those obtained from the inefficiency equation presented in Panel B of Table 4, where the temporary rate reduced technical efficiency. As presented in the methodology section, it implies that TFP decreases when decision-making units use fixed-term workers more intensively. In summary, the negative influence of the temporary rate on technical efficiency seems to be the channel through which TFP declines, validating the hypothesis that temporality deteriorates efficiency and productivity.

Delving deeper into the estimated output elasticities, their differences are analyzed focusing on certain features of hotels: temporary rates, size and quality. Particularly, we are interested to know whether differences in productivities between permanent and fixed-term workers are related to certain variables. Table 6 presents the estimates of the differences in output elasticities of permanent with respect to temporary workers against temporary rates, size and quality of the hotels. All coefficients are significant and with positive sign, suggesting the differences between elasticities of permanent and fixed-term workers are increasing in temporality, size and quality. In other words, the differences in productivity are more sizeable in the case of large hotels with high temporary rate and offering high quality.

Table 6. OLS model of production elasticities differences. Permanent versus temporary

	Coefficient	Standard Error	z	P-Value
Constant	-0.592914	0.00871416	-68.04	<0.0001
Temporary rate	0.261109	0.00592331	44.08	<0.0001
Log(size)	0.0693343	0.000959060	72.29	<0.0001
Log(ADR)	0.0574602	0.00179134	32.08	<0.0001
Dependent variable		mean	s.d.	
		0.149808	0.100493	
R-squared	0.764199			
F(3, 2845)	3,073.412			
Log-likelihood	4,562.080			

The result for the temporary rate variable deserves special attention. Our findings suggest that not only productivity and efficiency are higher in permanent jobs than fixed-term jobs but also this difference is greater for hotels using fixed-term jobs more intensively. This may be because hotels with high temporary rates are characterized by many low-skilled and low-wage temporary workers and few high-skilled and high-wage permanent workers in management positions¹⁷.

Additionally, the majority of large hotels in the Canary Islands belong to hotel chains and they take advantage of more accumulated knowledge and standard management techniques (Chen, 2007). Perhaps permanent workers benefit the most from this qualified on-the-job training. The average size of hotels belonging to chains is about 453 beds, 43% greater

¹⁶ This finding is in line with the results of Rodríguez-Gutiérrez (2007) for the manufacturing sector over the period 1990-1999, where price-cost margin and labour productivity are decreasing in the proportion of temporary workers.

¹⁷ Precisely, Polavieja (2005), among others, found that high-skilled jobs with high monitoring costs promote the use of long-term open-ended contracts.

than hotels that do not belong to chains. This could explain the more sizeable differences in productivity for large hotels.

Related to quality, differences in partial productivities between permanent and fixed-term workers increase with increasing service quality. Thus, the results suggest that hotels offering high quality require highly trained workers and permanent contracts to guarantee quality. Indeed, maintaining a high service quality is quite difficult when workers are less motivated due to uncertainty, lower wages, lower on-the-job training, higher job insecurity and health damage, and less organizational commitment.

VI. CONCLUSIONS

This research focuses on the analysis of the effects of temporary employment on technical efficiency and productivity for the case study of the accommodation sector of the Canary Islands. The main results suggest that the higher the rate of temporary workers, the lower the technical efficiency is. In turn, TFP is reduced *via* low partial labor productivity. Indeed, low motivation derived from fixed-term jobs and reduced conversion rates into permanent can be promoting non-optimum performance in terms of efficiency and productivity.

This case study is of particular interest, since 38% of the workers in hotels located in the Canary Islands are hired under fixed-term conditions. Also, in the database used in this study, negative conversion rates are observed, i.e., changes in the composition of workplaces in favor of temporary jobs. Consequently, this case study can be a suitable “laboratory” to explore the consequences of temporary work.

The main findings in which temporality and low conversion seem to reduce technical efficiency and productivity can be explained by reasons suggested by previous studies: (i) lower current job satisfaction, (ii) lower wage and effort, (iii) less on-the-job training, (iv) higher job insecurity and health damage, (v) less organizational commitment, and (vi) less innovation incentives.

In addition, average productivity is lower for fixed-term labor, reducing TFP as a weighted sum of partial productivities. The differences in productivity between temporary and permanent labor are more sizeable in the case of large hotels with high temporary rates and those hotels offering high quality services.

The findings can be relevant for human resources management in firms where temporary rates are high. Human resource management should consider the type of labor contracts used, as well as the perspectives of conversion into permanent ones for their temporary workers, given their potential influence in technical efficiency, labour productivity, and firm performance.

These results are also of interest in terms of labor policies, to the extent that the labor reforms implemented so far, which have led to the flexibility of the Spanish labor market, have not had the expected effect of a significant reduction in the unemployment rate; and neither in terms of productivity and efficiency. Among their main effects is wage moderation, with job insecurity that reduces the well-being of workers. In fact, there seems to have been a misunderstanding in the use of the figure of the temporary contract. It was designed originally

for its exceptional and provisional use in adjustment contexts, through the *so-called* buffer effect, but it became the almost universal contract in the Spanish labor market.

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Autor 1: la concepción original del trabajo, el análisis, adquisición e interpretación de los datos, la redacción y revisión crítica del contenido y la aprobación final de la versión a publicar.

Autora 2: la concepción original del trabajo, el análisis, adquisición e interpretación de los datos, la redacción y revisión crítica del contenido y la aprobación final de la versión a publicar.

Autora 3: el análisis, adquisición e interpretación de los datos, la redacción y revisión crítica del contenido y la aprobación final de la versión a publicar.