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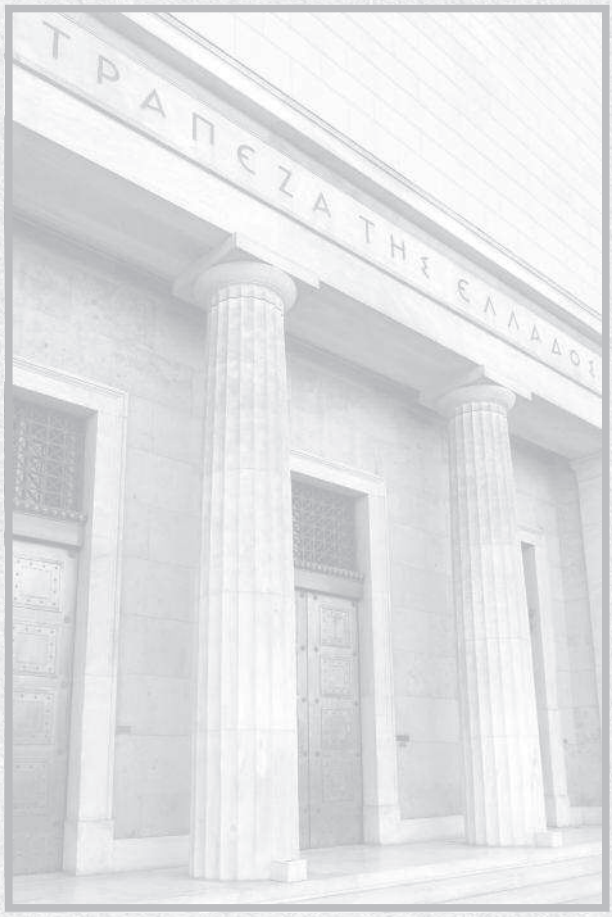

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THE IMPACT OF REFORMS ON THE SECTORS OF TRADABLE GOODS AND SERVICES

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1 INTRODUCTION

Well before the start of the domestic fiscal crisis, the Greek economy had already started to show serious weaknesses in the production process. Many of those weaknesses were due to regulatory restrictions imposed on the functioning of its goods and services sectors, as well as to distortions, which are associated with the role that the public sector was playing in the economy.

The domestic fiscal crisis of 2010 led to the implementation of Economic Adjustment Programmes, which, apart from fiscal adjustment measures, comprised structural reforms in several goods and services sectors, as well as in the labour market, with a view to ensuring the transition of the Greek economy to the economic structure of advanced countries. Within this framework, during the period 2010-2014, a number of regulatory and legal interventions took place in order to restructure the growth model of the Greek economy through the transfer of inputs from non-tradable to tradable sectors.

Given the above, the importance of structural reforms highlights the need not only to enact such reforms but also to monitor their actual implementation and assess their effects. In this context, IOBE (2017)[1] conducted a study to explore the impact of reforms that took place in specific tradable sectors in Greece. In particular, the study estimates, for each sector, the technical efficiency of the firms, that is, their ability to combine available inputs (capital, labour) and the given level of technology, in order to produce maximum output, and compares it with their efficiency under the former regulatory framework. In other words, the study focused on the effects of structural reforms on the level of technical efficiency of those sectors.

In addition, the study estimates the effects on the technical efficiency of these sectors from reforms affecting several other sectors of the Greek economy, i.e. the so-called "horizontal" reforms (e.g. increasing labour market flexibility, starting a business facilitation, etc.). The study also estimates the effects of firm-specific (e.g. firm age, exporting performance) and macroeconomic characteristics (e.g. the impact of recession and of credit expansion or credit shrinkage) on technical efficiency level.

For the assessment of the effects on technical efficiency from "vertical" and "horizontal" reforms and from firm-specific and macroeconomic characteristics, a stochastic frontier model was estimated with the use of a Translog production function.

1 Study entitled "The impact of reforms on the sectors of tradable goods and services", conducted by the Foundation for Economic and Industrial Research (IOBE) on behalf and with the support of the Bank of Greece.

This article is structured as follows: Section 2 outlines the changes in the regulatory framework of each tradable sector under review, as well as the reforms affecting several sectors. Section 3 provides the definition of technical efficiency and provides a literature review on the alternative methodologies that can be used for the estimation of technical efficiency. Section 4 presents the technical efficiency model applied in this study and describes both the variables and the data used. Section 5 discusses the econometric results regarding the evolution of technical efficiency over time and how it has been affected by the recent reforms, the macroeconomic environment and firm-specific characteristics. The last section summarises the findings of the study.

2 STRUCTURAL REFORMS IN TRADABLE SECTORS

2.1 CRUISE AND YACHTING SERVICES

The first sector, for which changes in the legal framework are presented herein, is Cruise and yachting services (class 50.10 "Sea and coastal passenger water transport" according to the Hellenic Statistical Authority's statistical classification of economic activities (STAKOD 2008). This sector is considered as tradable, since it falls under the tourism sector, which in Greece mainly provides tourism services to visitors from abroad.

Regarding the legal framework of the cruise and yachting services sector, under the Code of Public Maritime Law (Legislative Decree 187/1973) only Greek-owned passenger ships were authorised to execute cruises. Legislative Decree 344/2003 extended this right to include passenger ships with European Union (EU) or European Economic Area (EEA) flags, insofar as these ships are registered in the registry of another EU Member State or EEA member country. Under Law 3872/2010 the cruise and yachting services sector was further deregulated, as the right to execute cruises was also expanded to third country ships, under certain conditions. Law 4072/2012 lifted most of the remaining restrictions under Law 3872/2010.

2.2 ROAD PASSENGER TRANSPORT

Road passenger transport (class 49.39 according to STAKOD 2008),[2] similar to the abovementioned sector, is closely linked to the tourism sector, as many non-residents visiting Greece, mainly tourists, use such services for their transfer from the points of entry into the country (airports, sea ports) to their accommodation and vice versa, for their visits to sites of interest, for their transfer to conference venues, for excursions around the country, etc.

With respect to the regulatory framework for tourist coaches, the first relevant law (Law 711/1977)[3] authorised the Secretary General of the Greek National Tourism Ogranisation (EOT) to suspend indefinitely or temporarily the approval of licences for new tourist coaches, which suggests an indirect administrative determination of the number of licences, thereby creating barriers to entry for newcomers and undermining competition. Legislative Decree 346/2001 transferred directives of the Council of the European Union into Greek law. These directives determined the requirements for accessing the profession and are related to the good repute, the financial adequacy and the professional competence of individuals or legal entities wishing to pursue the occupation of road passenger transport operator. Law 4002/2011 abolished the requirements relating to the level of turnover and the proving documents for issuing a tourist coach licence. In addition, the abolition of the EOT Secretary General's power to determine indirectly the number of licences is seen as a major contribution to the deregulation of the sector. Notwithstanding, restrictions on the operation of firms active in this sector continue to exist, as tourist coaches are still not allowed

2 According to STAKOD 2008, this sector comprises scheduled long-distance bus services; charters, excursions and other occasional coach services; operation of school buses and buses for transport of employees; and airport shuttles. City/intercity bus services and taxis are excluded.

3 As amended by Laws 2446/1996 and 3446/2006.

to stop and pick up passengers, as opposed to intercity buses (KTEL). Moreover, KTEL buses may provide tourism services, if no tourist coaches operate in their prefecture.

2.3 ROAD FREIGHT TRANSPORT

Road freight transport (class 49.41 according to STAKOD 2008) is an important sector of the Greek economy, as it plays a key role in the transportation of all kinds of products, thereby contributing to the economy's growth. Road freight transport in Greece involves both domestic and cross-border transport services, with the first category accounting for the bulk of the sector's business. Greece's geographic location enables international transport operations to grow further, as the country is an emerging transit trade hub between European countries and Middle Eastern and Asian countries. Therefore, road freight transport is a sector with great potential for expanding its business.

Turning to the legal framework for road freight transport, until 1967 there was no law or legal provision determining the procedure and criteria for issuing licences. The relevant minister had the authority to grant licences without prior examination of the need to grant them. Emergency Law 183/1967 allowed the granting of road freight transport licences to professional drivers who were registered and insured in the Greek Professional Drivers' Pension Fund. Those new licences were personal and transferable only to professional drivers. Legislative Decree 1060/1971 distinguished road freight transport services into interregional, national and international, and permitted the establishment of firms that provide national and international road freight transport services. At the same time, the minimum gross vehicle weight required for the establishment of a firm that provides national and international road freight transport services was administratively determined. Under Law 383/1976, the Minister for Transport and Communications determined the maximum gross vehicle weight required for the provision of road freight transport services within national borders, which suggests an indirect administrative determination of the number of licences. In addition, by the same Law, the Ministers for Coordination-Planning, Trade, and Transport set the maximum and the minimum freight rates. The easing of the restrictions regarding the road freight transport sector came with Law 3887/2010. Under this law, free access to the occupation was granted under certain qualitative conditions and financial requirements. Furthermore, the administrative determination of both the number of licences and the freight rate limits was abolished.

2.4 ELECTRIC POWER GENERATION, TRANSMISSION AND DISTRIBUTION

The bulk of the output of the Electric power sector (class 35.1 according to STAKOD 2008) is absorbed by the domestic market. Only a small part is transmitted to neighbouring countries in order to meet increased local demand for electricity during peak hours. However, Greece has enormous potential to turn into an energy hub for the broader Southeast Mediterranean region, through interconnections with existing electricity transmission grids in other countries of the region, as well as through any new future grids.

With regard to the regulatory framework governing the Greek electric power sector, its gradual deregulation started earlier, as opposed to the other sectors under review. Specifically, Law 2773/1999 determined the framework for the functioning of the electricity market and established the legal framework of the Greek Regulatory Authority for Energy (RAE). Further, by Legislative Decree 328/2000 the Hellenic Transmission System Operator (DESMIE) was set up, and Ministerial Decision D5/HL/B/F1/7705 granted to DESMIE concession rights to the Greek electricity transmission system. Law 4001/2011 provided for the establishment of the Independent Power Transmission Operator (ADMIE), to which the ownership of the electricity trans-

mission system was transferred, and the Operator of Electricity Market (LAGIE), which carries out daily energy scheduling. The legal acts aimed to foster competition at the sectoral level were Law 4237/2014,[4] which introduced the ownership unbundling of ADMIE from the Public Power Corporation (PPC), with the sale-transfer of 66% of its share capital to an investor, as well as Law 4389/2016, which envisages the reduction of PPC's retail market share below 50% by 2019. An action that further accelerated the deregulation of the energy market was the sale of 25% of ADMIE's share capital to the Chinese firm "State Grid" against €320 million in December 2016.

2.5 GAMBLING ACTIVITIES-CASINOS

The gambling market is rapidly growing at the global level. According to the Hellenic Gaming Commission (HGC), the global industry generates gross profits exceeding €300 billion per year, with 95% of them coming from offline gambling. Nevertheless, a sharp increase in the use of online gambling has been observed over the past few years. This implies the possibility of attracting players both from abroad and from Greece, through the creation of online gambling games, particularly if account is taken of the fact that so far the utilisation of the internet for gambling purposes has been limited at the domestic level. The gambling sector also includes casinos, which also attract foreign players, mostly tourists, and can thus contribute to expanding the provision of services to non-residents. Thus, the Gambling activities-casinos sector is a tradable (services) sector, with great prospects to further enhance its extroversion.

A key law governing gambling activities and casinos (class 92 according to STAKOD 2008) is Law 4002/2011. Under this law, the authority responsible for licensing, certification, supervision, and auditing of gambling activities and casinos is the Hellenic Gaming Commission (HGC). The same law provides for the operation of 35 thousand video lottery terminals (VLTs) in Greece, 16.5 thousand of which will be operated and exploited by the Hellenic Football Prognostics Organisation (OPAP) and the remaining 18.5 thousand by concessionaires. Key actions towards the deregulation of the sector were Law 3986/2011 and Decision 193/2011 by the Interministerial Committee for Restructuring and Privatisation on the transfer of 33% of OPAP shares held by the Greek State to the Hellenic Republic Asset Development Fund (TAIPED). This share was sold on 11 November 2013 to Emma Delta Hellenic Holdings Limited, which thus became the main shareholder of OPAP. With Law 4338/2015, the horse racing betting activities were awarded to Hellas Horse Races S.A. for a period of 20 years. Finally, a structural characteristic of the Gambling activities-casinos sector which showcases competition conditions is that the Aigaio, Achaia, Thessaloniki, Thraki, Corfu, Loutraki, Athens (Mont Parnes), Rodos and Halkidiki casinos are privately owned.

2.6 "HORIZONTAL" REFORMS

As already mentioned in the introduction, for the assessment of the effects of reforms on the technical efficiency of tradable sectors, account must also be taken of reforms affecting several sectors of the Greek economy. Such reforms are often referred to as "horizontal" reforms in the public debate. The reforms examined by this study deal with two crucial issues of entrepreneurship: the procedure for starting a business and the functioning of the labour market.

As far as the procedure for starting a business is concerned, Law 3853/2010 allowed the establishment of new firms through the "one-stop-shop", which significantly reduces the time required to set up a new business. Setting up a new firm was also facilitated by Law 4072/2012, which introduced a new legal form, namely the Private Company (IKE). A Private Company can be established within a much shorter period of time than other legal forms and at a much lower cost, since the minimum

4 Following Cabinet Act 15/24.7.2013.

initial capital required has been set at one euro.

Extensive reforms have taken place in the Greek labour market since 2010. Specifically, under Law 3899/2010, firm-level agreements prevailed over industry-level or occupation-level collective agreements, unconditionally,[5] while the extension of industry-level or occupation-level agreements to firms that did not participate in negotiations was abolished. Subsequently, Law 3986/2011 introduced employment contracts for young people aged 18-25 with minimum wages that are 20% lower than the current minimum wage. At the same time, it provided for the possibility of signing firm-level agreements also by "groups of employees" (associations of persons), where there is no trade union. Under Law 4046/2012, minimum monthly wage was cut by 22% for workers aged 25+ and by 32% for young workers under 25. In addition, this law stipulates that arbitration requires the consent of both employees and employers, and suspends the automatic salary increases, either by law or under collective agreements, due to "seniority". Lastly, Law 4093/2012 introduced lower remunerations in case of dismissal, especially in cases where the employee has been notified in written by the employer at least one month prior to dismissal. The same law specified that in future the minimum wage shall be determined by the government rather than by negotiations between employees and employers.

3 THE CONCEPT OF TECHNICAL EFFICIENCY AND LITERATURE REVIEW

For many years, the economic analysis relied on estimations of production, profit and cost functions, under the assumption that firms operate along those functions. However, experience has shown that very often firms failed to maximise output/profit and minimise cost. The estimation of the distance between the actual point of production/profit/cost and the maximum possible output/profit and the lowest possible cost, respectively, was the driving force for the development of applied econometrics dealing with Stochastic Frontier Analysis (SFA).

The development of this field largely rested upon the theoretical work on productive efficiency, which dates back to the 1950s, with the seminal studies by Debreu (1951), Koopmans (1951), Shephard (1953) and Farrell (1957). More specifically, Farrell (1957), influenced by Koopmans and Debreu, was the first to empirically estimate productive efficiency using a frontier production function. According to Farrell, the activity of each firm should be compared to optimal activity, which is captured by the production function.

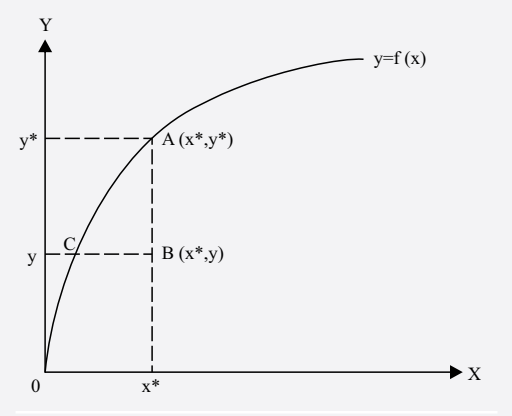
Adopting the approach by Farrell (1957), "technical efficiency" is defined as a firm's ability to produce maximum output, y^*, using a specific quantity of inputs, x^*, and with a given level of technology (point $A(x^*, y^*)$ in Chart 1). In this respect, each combination (x, y) along the frontier production function represents points of maximum technical efficiency. Conversely, the combination $B(x^*, y)$ shows that the firm is technically inefficient, because it fails to produce the maximum possible output (y^*) given the available inputs and the level of technology. Instead, it produces lower output, y.

The estimation of technical efficiency using a stochastic frontier model has already been studied extensively since the 1970s. The studies by Aigner and Chu (1968), Afriat (1972) and Richmond (1974) suggested for the first time the existence of disturbance factors that leads to a deviation of actual output from the maximum possible. This deviation may be captured by a disturbance term.

Then, Schmidt (1976) incorporated into the technical efficiency estimation model a one-sided disturbance term, which follows a strictly positive distribution (exponential or half-nor-

5 E.g. with regard to the minimum size that a firm should have to sign such employment contracts.

Chart 1 Technical efficiency



mal), and estimated it using the maximum likelihood method.

Next, Aigner et al. (1977) suggested a different structure of the disturbance term, adopting a composite error structure, because the difference between actual and maximum feasible output may be due to factors that are under the firm's control, as well as to factors beyond its control.

The major weakness in the above approaches was that they estimated the average technical efficiency of a sample of firms rather than the technical efficiency of each firm. Solution to this estimation issue was given by Jondrow et al. (1982), who developed an appropriate methodology for estimating technical efficiency at the firm level.

Pitt and Lee (1981) extended cross-sectional estimation techniques by developing a technical efficiency estimation model for panel data and assuming that technical efficiency varies across firms, but remains constant over time for each firm (time-invariant technical efficiency).

In the context of such models, the literature developed two separate categories: fixed effects models, in which the technical efficiency term is correlated with the independent variables (regressors) of the production frontier, and random effects models, in which the technical efficiency term is uncorrelated with the regressors.

Moreover, Cornwell et al. (1990) and Kumbhakar (1990) were perhaps the first to develop a stochastic production frontier model for panel data, under which technical efficiency varies over time (time-varying technical efficiency).

In addition, Kumbhakar et al. (1991) developed the first model that incorporates the effects of exogenous factors on technical efficiency level (one-step estimation), while Huang and Liu (1994) developed a model which allows the correlation of exogenous variables with inputs.

In contrast with the above authors who used cross-sectional data to estimate the effects of exogenous factors on technical efficiency, Battese and Coelli (1995) developed a model which they estimated using panel data.

Caudill and Ford (1993) further developed technical efficiency models, assuming the presence of heteroskedasticity in the technical efficiency component, while Hadri (1999) assumed the presence of heteroskedasticity in both the random error and the technical efficiency term.

Finally, Wang (2002) developed a model in which the effect of exogenous factors on technical efficiency may be non-monotonic, i.e. exogenous factors may have a positive effect up to a certain level and a negative effect from that level onwards, or vice versa.

4 DESCRIPTION OF THE TECHNICAL EFFICIENCY ESTIMATION MODEL, VARIABLES AND DATA

In order to estimate the technical efficiency level of the tradable sectors, the study

employed a stochastic frontier model where the production function has a Translog form.

Alternatively, technical efficiency could be estimated with the use of Data Envelopment Analysis (DEA). Yet, this approach has certain disadvantages: it assumes that total deviation from the production frontier is solely due to the firm's inefficiency rather than to random factors beyond the firm's control, while statistical inference is not possible.

In addition, a cost frontier analysis could also be applied. However, in order to employ this methodology, it is important to have data on factor prices, and such data are not available for Greece either at the firm or at the sectoral level.

Another model that could also be used for estimating the impact of reforms is a Total Factor Productivity model. Although, this model provides information about the trend of total factor productivity, it does not provide information on whether firms' performance has (or has not) improved compared with the production frontier.

Besides, the use of a stochastic production frontier model has several advantages. First of all, it does not assume, as other models do, that all firms are efficient. In this respect, it includes an error term which varies across firms. At the same time, it is a parametric method used to estimate technical efficiency and random errors, which means that deviation from the maximum possible output is not exclusively attributable to technical inefficiency. This methodology was also adopted for technical reasons, such as the adequacy of the available data used in the estimations.

With regard to the functional form of the production function, the Translog form has both advantages and disadvantages. The first advantage is that the Translog production function is a second-order Taylor expansion, which incorporates first-order and second-order terms across inputs. Moreover, its functional form ensures the closest proximity to the actual structure of a production process, among alternative production functions. Furthermore, it is linear with respect to parameters and can be estimated using the least squares method. Last but not least, it has a flexible functional form, since it imposes fewer restrictions on output elasticities and elasticities of substitution compared with other functional forms, such as the Cobb-Douglas function. On the other hand, the large number of parameters to be estimated and the difficulty in interpreting them, coupled with the fact that sometimes curvature conditions may be violated, are among the drawbacks of this functional form. Besides, there is a possibility of existence of collinearity among explanatory variables.

In the model used in this study, it was assumed that technical efficiency varies across firms, but remains constant through time for each firm (time-invariant technical efficiency model). Moreover, it was assumed that the technical efficiency term is randomly distributed with constant mean and variance, and is uncorrelated with the regressors and with random error, i.e. the random effects approach was applied.

According to Greene (2005), a major drawback of the random effects model is the fact that firm-specific heterogeneity is not taken into account in the estimation of each firm's technical efficiency. To address this problem, a "true" random effects model was employed, as proposed by Greene (2005). In line with this approach, a random firm-specific effect variable was included in the model to take into account firm-specific heterogeneity in the estimation of technical efficiency.

In addition, the sample used in the estimations includes many firms. In cases where the number of the parameters to be estimated changes with the number of firms, the fixed effects estimators, apart from posing computational challenges, fail to satisfy the necessary statistical properties (large and small sample properties).

As a consequence, the estimations are inconsistent. All the above justify both the choice of the random effects approach and the choice not to perform the Hausman test.

It should be noted that in the estimation of technical efficiency of each firm the approach of Jondrow et al. (1982) to convert the inefficiency score into an efficiency score was employed.

Taking into account the above, it was assumed that each firm of the sample produces output Y, using two inputs, capital K and labour L, while the production is also affected by time trend T, given the quantity of inputs and the level of available technology used by each firm. Thus, the Translog production function has the following form:

$$\ln Y=\beta_0+\beta_L \ln L+\beta_K \ln K+\beta_T T+1/2\beta_{LL}\,(\ln L)^2+1/2\beta_{KK}(\ln K)^2+1/2\beta_{TT}(T)^2+\beta_{LK}(\ln L)(\ln K)+\beta_{LT}\,(\ln L)(T)+\beta_{KT}\,(\ln K)(T)+v-u,$$

which can be written in the following general form:

$$y_{it}=(\alpha+w_i)+x'_{it}\beta+v_{it}-u_{it},$$

where $i=1,\ldots,n$ is the number of firms, $t=1,\ldots,T_i$ is time in years, y_{it} is the logarithm of output (nominal value in euro), α is the constant term, w_i is the random firm-specific effect, x_{it} is the vector of the logarithm of labour (number of firm's employees) and capital (book value of firm's fixed capital in euro) and time trend, and β is the vector of the parameters of the independent variables to be estimated. The term v_{it} is the random error, with $v_{it}\sim N(0,\sigma_v^2)$. Moreover, u_{it} is a non-negative random variable that represents technical inefficiency and is a function of exogenous variables, that include "vertical" reforms, "horizontal" reforms, firm-specific characteristics and the macroeconomic environment characteristics, with $u_{it}\sim N^+(\mu_{it},\sigma_u^2)$ and with $\mu_{it}=z_{it}\delta$, where z_{it} is the vector of exogenous variables affecting the level of technical efficiency of each firm.

The exogenous variables used in the model and representing reforms at the sectoral level ("vertical reforms") are the following:

- **Cruise and yachting services (cruise):** dummy variable equal to 1 over the 2012-2014 period (following the implementation of Law 4072/2012).

- **Road passenger transport (bus):** dummy variable equal to 1 over the 2011-2014 period (following the implementation of Law 4002/2011).

- **Road freight transport (roadfreight):** dummy variable equal to 1 over the 2010-2014 period (following the implementation of Law 3887/2010).

- **Road freight transport (OECDlandtransport):** continuous variable used as an alternative to the dummy variable "roadfreight". Higher values denote stricter market regulation and vice versa.

- **Electric power generation, transmission and distribution (electr):** dummy variable equal to 1 over the 2004-2014 period. 2004 is also the first year of operation of the first private firm that produces electric power in Greece, which benefited from the deregulation of the specific sector.

- **Electric power generation, transmission and distribution (OECDelectr):** continuous variable used as an alternative to the dummy variable "electr". Higher values denote stricter market regulation and vice versa.

- **Gambling activities-casinos (game):** dummy variable equal to 1 over the 2011-2014 period (following the implementation of Law 4002/2011).

The exogenous variables used in the model and representing reforms that affect many sectors ("horizontal" reforms), and not only the tradeable sectors under review, are the following:

- **Increased labour market flexibility (labour):** dummy variable equal to 1 over the 2011-2014

period, during which reforms took place in the labour market.

• **Increased labour market flexibility (OECD-regularlabourindex and OECDtemplabour-index):** continuous variables used as alternatives to the dummy variable "labour". The variable OECDregularlabourindex focuses on the degree of regulation in the labour market with regard to permanent employment contracts. The variable OECDtemplabourindex captures the degree of regulation in the labour market with regard to temporary employment contracts. Higher values of both variables denote stricter regulation and vice versa.

• **Faster procedure for starting a business (ike):** dummy variable equal to 1 over the 2012-2014 period (following the implementation of Law 4072/2012).

The exogenous variables at the firm level and those capturing the macroeconomic environment are the following:

• **Firm age (age):** difference between the year for which there are available data on a firm and its year of establishment, plus one year.

• **Exporting activity (exp):** dummy variable equal to 1 when in a specific year a firm exports goods or services.

• **Location (dtown):** dummy variable equal to 1 if the firm's headquarters are located in one of the two largest regions of Greece, i.e. Attica and Thessaloniki.

• **Credit expansion (credit):** continuous variable which was calculated on the basis of the annual percentage change in outstanding credit to domestic firms by Monetary Financial Institutions (MFIs), excluding the Bank of Greece.

• **Economic crisis (recession):** dummy variable equal to 1 over the 2008-2013 period, during which the Greek economy experienced a decline in Gross Domestic Product (GDP).

The data used in estimations are unbalanced panel data, covering the 2001-2014 period, and refer to 601 firms of all sizes (micro, small, medium-sized, large) in terms of turnover. It should be noted that, where needed, data were distinguished between parent companies and subsidiaries, so as to include in the sample only those firms which are active in the sectors under review. On the other hand, in very few cases, it was not possible to break down turnover by activity, in cases where a firm has revenue not only from its main activity but also from other activities (the same holds for both fixed capital and number of employees).

The data used in the estimations were drawn from various sources. Data on firms' turnover, fixed capital, number of employees, name, year of establishment, location, legal form and tax identification number were drawn from Infobank Hellastat S.A., ICAP S.A. and balance sheets published online. The Bank of Greece is the source of data regarding the rate of change in bank credit to total domestic firms, while the OECD is the source for the time series on regulation indices in the Electric power sector, the Road freight transport sector and the labour market.

5 ESTIMATION RESULTS

Before presenting the estimation results, it should be noted that in the estimation process the "general-to-specific" approach was adopted. Furthermore, in each estimation the combination of dummy variables regarding "vertical" and "horizontal" reforms was carefully chosen, in order to avoid identification issues. The results of each estimation were evaluated using the Akaike and the Bayesian information criteria, as well as the level of statistical significance (p-values). We addressed the problem of the small number of observations in some sectors by using the simulated maximum likelihood method.

Tables 1 and 2 in the Appendix present the estimations results. Table 1 shows the estima-

tions for the Electric power and the Road passenger transport sectors, while Table 2 presents the estimations for the remaining three sectors (Road freight transport, Cruise and yachting services, and Gambling activities-casinos).

Taking into consideration that the model includes a technical inefficiency term (u_{it}) which has a negative sign and is a function of exogenous variables (z_{it}), a negative effect of the exogenous variables on technical inefficiency implies a negative sign of the corresponding estimated coefficients of exogenous variables. For instance, given that "vertical" and "horizontal" reforms are expected to facilitate business establishment and operation, their coefficients are expected to have negative sign. This means that they will reduce technical inefficiency (u_{it}) and as a consequence they will increase technical efficiency.

Starting with firm-level exogenous variables, as the firm ages (variable age), its experience regarding the domestic and international market conditions increases. As a result, the firm adapts its production activity to the prevailing conditions, and thus increases its efficiency. This means that the coefficient of this variable is expected to have a negative sign because, as the firm ages, inefficiency decreases, or in other words efficiency increases.

Through their exporting activity (exp), firms participate in international markets, where competition is usually more intense than in the domestic market. Such conditions put pressure on firms to follow international competition and try to adapt the quality of the goods and services they produce/offer. As a result, exporting activity may reduce their inefficiency level, which means that the coefficient of the variable is expected to have a negative sign.

Location choice depends on factors such as firms' accessibility to resources, proximity to transport hubs/freight centers or to destination markets, etc. In the light of the above, the location of a firm in the regions of Attica or Thessaloniki (dtown) does not affect in the same way the efficiency level of the sectors under review. For example, some sectors, such as the Road passenger transport sector, benefit from choosing these regions as their location, because of the large number of tourists who use these regions as a point of entry into Greece. In such cases, the coefficient of the dummy variable will have a negative sign, i.e. it will negatively affect firms' inefficiency or in other words it will positively affect their technical efficiency.

Credit expansion from the banking system (credit) provides the necessary liquidity to firms to finance their operating needs, the maintenance, upgrading or even replacement of their equipment, etc. Therefore, we expect a positive effect of credit expansion on firms' efficiency, i.e. a negative sign of the corresponding coefficient.

The unexpected recession of the Greek economy (recession), in terms of duration and magnitude, is expected to have negatively affected the efficiency level of most firms. The sharp drop in turnover led to considerable production capacity depreciation as well as to job losses. As a result, the sign of the coefficient of this variable is expected to be positive. Nevertheless, it is also possible that the unfavourable economic environment may have pushed firms to use more efficiently their fixed capital and human resources, with positive effects on their technical efficiency level.

Estimates have shown that the effects of "*vertical*" *reforms* in the efficiency level of the reviewed sectors are not the same and have not always been statistically significant.

In greater detail, the estimation results regarding "vertical" reforms in the sectors of Cruise and yachting services (cruise) and Gambling activities-casinos (game) were statistically insignificant. In the first sector, this result may be due to the fact that reforms were aimed at increasing the number of foreign cruise ships visiting Greece, rather than enhancing the cre-

ation of new firms in the country. In the second sector, the statistically insignificant result may be attributable to the fact that during the period under review reforms had probably not matured yet to affect the efficiency level, because they took place in 2011-2013 and the period reviewed in this study ends in 2014.

In the Road freight transport sector, when a dummy variable was used as a proxy for the effects of structural reforms (roadfreight), the results were also statistically insignificant. However, when this variable was replaced in the estimations with the OECDlandtransport continuous variable, the result became statistically significant. Thus, it was estimated that deregulation, which corresponds to a lower value of the continuous variable, leads to a decline in the sector's technical inefficiency, i.e. to an increase in its technical efficiency level. In this context, initiatives to promote competition seem to have enabled firms to increase their output using a given quantity of inputs and a given level of technology, relative to the past.

The estimations for the Electric power sector show that "vertical" reforms proxied by the dummy variable "electr" have a statistically significant and negative effect on the sector's technical efficiency. This result may be partly explained by the considerable downward adjustments in feed-in tariffs for photovoltaic and other renewable energy source projects. With this reduction the marginal cost of capital became higher than the marginal revenue (price) and, as a result, made production inefficient for several firms. The result with the use of the "OECDelectr" dummy variable was statistically insignificant.

In the case of the Road passenger transport sector, structural reforms had a positive effect on technical efficiency level, as suggested by the negative and statistically significant coefficient of the dummy variable "bus".

Turning to the effects of "*horizontal*" *reforms* on technical efficiency, it was estimated that labour market reforms (labour) positively affected the technical efficiency in three out of the five sectors under review (Electric power generation, transmission and distribution, Road passenger transport, and Road freight transport). Thus, firms active in these sectors were allowed to use their human resources in a more flexible way and thus increased their efficiency. However, in the Cruise and yachting services and Gambling activities-casinos sectors, "horizontal" labour market reforms were estimated to have statistically insignificant effects.[6]

The use the of "OECDregularlabourindex" and "OECDtemplabourindex" dummy variables for the degree of labour market regulation gave statistically insignificant results in most cases.[7] In the Road freight transport sector, the magnitude of the coefficients of these two variables reveals that the combined effect of the various labour market reforms on the efficiency level will have the same direction as that resulting from the use of the dummy variable "labour", i.e. it will positively affect technical efficiency. More specifically, the estimated coefficient of the "OECDregularlabourindex" dummy variable was positive, which means that the easing of labour market regulation for permanent employment contracts has a positive effect on the sector's technical efficiency. Moreover, it was much higher in absolute value than the coefficient of the dummy variable "OECDtemplabourindex", which has a negative sign, thereby indicating a negative effect in efficiency from lifting rigidities in temporary employment contracts. In the Cruise and yachting services sector, a statistically significant and positive effect on efficiency was estimated for the variable "OECDtemplabourindex". This result can be explained by the sector's labour-specific characteristics, because the majority of crews are

6 As it is not possible to include in the Appendix the results of all estimations of the technical efficiency model, the results regarding those two sectors are not presented in the tables and are available upon request.

7 As already mentioned in the previous footnote, the results from both dummy variables are not presented for the Electric power, Road passenger transport and Gambling activities-casinos sectors, but are available upon request.

persons of different nationalities, seasonally employed, with contracts governed by foreign law which usually contain more flexible terms of employment.

The other "horizontal" reform, i.e. faster procedure for starting a business (ike), was estimated to have a positive and statistically significant effect on the technical efficiency of the Road freight transport sector. This can largely be attributed to the extremely low minimum capital requirement for starting a Private Company (1 euro), since it gives newcomers the opportunity to use the funds saved into productive purposes, thereby increasing technical efficiency. Conversely, this reform was found to have a negative effect on the technical efficiency of the Road passenger transport sector. Faster business start-up procedures from 2011 onwards have enabled newcomers to enter the sector, but the economic slowdown that followed, especially during the 2012-2013 period, adversely affected the sector's overall efficiency. The coefficient of the "ike" dummy variable was statistically insignificant in the case of the Electric power sector, because firms in this sector must be either Societes Anonymes (S.A.) or Limited Liability Companies (L.L.C.), with a share capital of at least €600,000 or €60,000, respectively (under Law 4001/2011), and not Private Companies. As a result, they are not affected by this reform.

Estimations with the dummy variable "ike" were not performed for the Cruise and yachting services and Gambling activities-casinos sectors. In the Cruise and yachting services sector, firms usually have the legal form of a Societe Anonyme because of high fixed capital requirements and increased business risk. In the Gambling activities-casinos sector, the operation of a firm mostly depends on obtaining an authorisation from the corresponding authority (Hellenic Gaming Commission), rather than on easier start-up procedures and lower minimum capital required.

As far as *firm-specific variables* is concerned, firm age (age) exerts a positive effect on the technical efficiency of all sectors under review, except for the Cruise and yachting services sector, in which the result for the specific variable was statistically insignificant. As the firm ages, it becomes more experienced in the production process and obtains better knowledge of the market characteristics. As a result, it can properly adjust its output to changes in demand, in technology level and in sectoral conditions.

Exporting activity (exp) was estimated to negatively affect the technical efficiency of the Electric power sector. This negative effect may be due to the fact that a dummy variable rather than a continuous variable was used to approximate exporting activity. We used a dummy variable because there are no such data available at the firm level for the reviewed sectors. In the case of the Road freight transport sector, the result was statistically insignificant, whereas for the remaining three sectors no estimations were performed, as in two of them (Road passenger transport and Gambling activities-casinos) no exporting activity was observed in 2001-2014 period, while in the Cruise and yachting services sector only one firm showed exporting activity during the same period.

The establishment of firms in the regions of Attica and Thessaloniki (dtown) was estimated to have a positive effect on the technical efficiency of the Cruise and yachting services and Road passenger transport sectors. Taking into account that the Greek ports with the largest cruise ship capacity are those of Piraeus and Thessaloniki and that a high share of foreign visitors in Greece usually use those cities as a point of entry into the country, firms from both sectors which are located in, or closer to, those regions minimise distance from their location to their clients' embarkation/disembarkation points. Thus, they can improve their efficiency.

In the other three sectors, the establishment of firms in the regions of Attica and Thessaloniki has a statistically significant and negative effect on the technical efficiency level. In the Electric power sector, if a firm is located close to a large urban area (such as Athens and Thes-

saloniki), it is farther away from the sources of raw materials it uses in the production of electric power (e.g. lignite, water), with negative effects on the technical efficiency level. In the Road freight transport sector, if a firm is located in those two regions (Attica or Thessaloniki), it is away from major transport hubs/freight centres, which are usually located outside large urban areas (e.g. ports of Patras and Igoumenitsa, Astakos hub). As a result, it faces increased operating costs (fuel, cost of warehouse rental, cost of parking spots, etc.), with negative effects on its efficiency. Finally, in the Gambling activities-casinos sector, the negative effect is probably due to the fact that casinos are usually located in tourist areas, outside large urban areas, so that they can attract visitors, both Greeks and foreigners.

As suggested by the estimation results for the credit expansion variable (credit), it positively affects firms' efficiency in three sectors (Electric power generation, transmission and distribution, Road freight transport, and Cruise and yachting services), possibly because it enables firms to finance their investment projects (e.g. construction and/or upgrade of electricity plants, purchase of vehicles, construction of ships) and their liabilities (e.g. distribution, administrative and finance expenses, capital expenditure).

In the case of the Road passenger transport sector, credit expansion was estimated to negatively affect technical efficiency. Perhaps from 2010 onwards, when credit started to shrink in Greece, firms used more rationally the limited available funds from the banking system. Last but not least, in the Gambling activities-casinos sector, credit expansion exerts no statistically significant effect on technical efficiency.[8]

The effect of the economic downturn (recession) on technical efficiency was estimated to be negative in three out of five sectors (Road passenger transport, Road freight transport, and Gambling activities-casinos). However, the economic recession was found to have a positive effect on the Cruise and yachting services sector. Probably, the recession prompted firms to use available inputs more efficiently. In the case of the Electric power generation, transmission and distribution sector, the effect of recession on technical efficiency was statistically insignificant.

If we compare the average technical efficiency level of the sectors under review, we observe that the Road passenger transport sector exhibits the highest score (0.82)[9] over the 2001-2014 period (see the charts in the Appendix). Then, the Cruise and yachting services and Road freight transport sectors follow, with similar average technical efficiency levels (0.77 and 0.76, respectively). Finally, the Electric power and Gambling activities-casinos sectors exhibit the lowest level of average technical efficiency, which are also similar (0.46 and 0.44, respectively).

The annual average technical efficiency by sector over the 2001-2014 period is also presented in the charts in the Appendix. In the Electric power sector, we observe a downward trend in technical efficiency throughout the reviewed period. Its variance is partly explained by the exogenous variables used, because the effects of recession (recession) and of faster business start-up procedures (ike) were statistically insignificant. Furthermore, the effect of sectoral-level reforms (electr) was negative (level of significance 10%) or statistically insignificant (OECDelectr), whereas labour market reforms (labour) had either a positive effect (level of significance 10%) or a statistically insignificant effect (OECDregularlabourindex, OECDtemplabourindex).

In the Road passenger transport sector, the trend of annual average technical efficiency since 2008 is explained from the effects of the

8 This estimation results are not presented in the Appendix, but are available upon request.

9 In other words, the sector's overall technical efficiency during the period under review averaged 82%. This result reveals that firms could increase, on average, their output by 18% of maximum technical efficiency at the sectoral level (=100%-82%), in order to reach 100%, using the same inputs and the same technology. The average values of technical efficiency for the remaining industries can be read in the same way.

exogenous variables. During the 2008-2010 period, efficiency declined, as a result of the recession (recession) and credit expansion (credit), which were estimated to negatively affect technical efficiency. By contrast, efficiency followed an upward trend in 2011-2013, due to structural reforms at the sectoral level (bus), labour market reforms (labour), and firms' experience (age).

In the Road freight transport sector, the evolution of annual average technical efficiency between 2009 and 2014 is explained from the exogenous variables. During the 2008-2010 period, efficiency followed a downward trend, due to recession (recession), which was estimated to negatively affect technical efficiency. During the 2011-2014 period, technical efficiency was positively affected from sectoral-level (OECDlandtransport) and labour market reforms (labour, OECDregularlabourindex), from the opportunity to start a business within a short period of time and at a very low cost (ike) and from the experience acquired by firms over time (age).

In the Cruise and yachting services sector, the trend of annual average technical efficiency, which was downward in 2006-2013 and upward ever since, can be partly explained by the estimated effects of the exogenous variables. Sectoral-level (cruise) and labour market reforms (labour, OECDregularlabourindex) had statistically insignificant effects. Moreover, the effects of the recession (recession) and credit expansion (credit) were positive and statistically significant.

Finally, in the Gambling activities-casinos sector, the trend of technical efficiency, which moves downwards during the 2006-2012 period and increases afterwards, is not explained by the exogenous variables. Reforms in the sector (game) and in the labour market (labour, OECDregularlabourindex, OECDtemplabourindex), as well as credit expansion (credit) had statistically insignificant effects, while the combined effect of all statistically significant variables (positive for age, and negative for location and recession) is inconsistent with the evolution of the sector's technical efficiency.

6 CONCLUSION

The aim of the paper was to estimate the effects of "horizontal" and "vertical" reforms on the technical efficiency level of five internationally tradable sectors of the Greek economy.

As suggested by the econometric estimations, sectoral-level ("vertical") reforms had different effects. In the sectors of Road passenger transport and Road freight transport, the effects were positive for technical efficiency, in contrast with the sector of Electric power generation, transmission and distribution where reforms exert a negative effect on the technical efficiency level. As far as the other two sectors are concerned (Cruise and yachting services, and Gambling activities-casinos), the reforms had statistically insignificant effects on technical efficiency.

Turning to "horizontal" reforms, the effect of labour market reforms on technical efficiency was estimated to be statistically significant for some of the reviewed sectors. In those sectors in which the effect was statistically significant, the reforms positively affect firms' technical efficiency (Electric power, Road passenger transport and Road freight transport). In the case of the procedures for starting a new firm, estimations showed that they positively affect the technical efficiency of the Road freight transport sector but negatively affect that of the Road passenger transport sector.

Regarding the remaining exogenous variables, we should note: the positive effect of age on the technical efficiency level of all sectors but the Cruise and yachting services sector (statistically insignificant effect); the negative effect of the recession in most sectors except the Electric power sector (statistically insignif-

icant effect) and the Cruise and yachting services sector (positive effect); as well as the positive effect of credit expansion on technical efficiency for the Cruise and yachting services, Road freight transport, and Electric power sectors. Turning to exports, estimations show that they exert a negative and statistically significant effect only in the case of the Electric power sector, while location in the regions of Attica and Thessaloniki positively affects the technical efficiency of tourism-related sectors (Cruise and yachting services and Road passenger transport) and negatively affects the technical efficiency of all other sectors.

As far as the ranking of the sectors with respect to technical efficiency is concerned, the Road passenger transport sector has the highest performance (0.82) during the 2001-2014 period, followed by Cruise and yachting services (0.77), Road freight transport (0.76), Electric power generation, transmission and distribution (0.46), and Gambling activities-casinos (0.44).

When assessing the effects of reforms on technical efficiency, it should be emphasised that the time that has elapsed from their implementation to the end of the reviewed period is relatively short and is likely to be insufficient for the reforms to work fully. As a result, a future re-examination of the impact of the reforms, perhaps under better macroeconomic conditions compared with the 2008-2014 period, could produce results that would reflect the full spectrum of their effects. In any case, such a study is of high importance, as structural reforms aiming to promote competition and improve the extroversion of the Greek economy are pivotal for its transition to a new growth model, which will be characterised by stronger competition, production of more tradable goods and services, higher exports and reduced reliance on domestic demand.

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APPENDIX

Table 1 Estimations for firms active in the sectors of Electric power generation, transmission and distribution, and Road passenger transport

	Electric power generation, transmission and distribution				Road passenger transport			
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
β_L	**1.614***** (0.238) [0.000]	**0.815***** (0.283) [0.00397]	**3.422***** (0.475) [0.000]	**2.178***** 0.328 [0.000]	**-0.0324** (0.759) [0.966]	**0.282** (0.603) [0.639]	**-0.0297** (0.715) [0.967]	**0.179** (0.617) [0.771]
β_K	**-0.207** (0.204) [0.309]	**-0.330** (0.218) [0.130]	**-2.290***** (0.332) [0.000]	**-0.795***** 0.275 [0.00383]	**-1.328***** (0.491) [0.00683]	**-0.904**** (0.410) [0.0273]	**-1.354**** (0.537) [0.0116]	**-1.164**** (0.456) [0.0107]
β_T	**0.429***** (0.0952) [6.51e-06]	**0.331***** (0.107) [0.00190]	**0.211** (0.140) [0.132]	**-0.128** 0.131 [0.330]	**0.0631** (0.136) [0.643]	**0.112** (0.0912) [0.219]	**-0.0340** (0.120) [0.777]	**0.0144** (0.105) [0.891]
β_{LK}	**-0.101***** (0.0182) [2.86e-08]	**-0.0626***** (0.0194) [0.00126]	**-0.228***** (0.0322) [0.000]	**-0.141***** 0.0232 [0.000]	**-0.0116** (0.0602) [0.848]	**-0.0489** (0.0487) [0.315]	**-0.0275** (0.0572) [0.631]	**-0.0415** (0.0499) [0.405]
β_{LT}	**0.0186***** (0.00574) [0.00122]	**0.0264***** (0.00621) [2.15e-05]	**0.0155*** (0.00920) [0.0917]	**0.00463** 0.00866 [0.592]	**0.0198** (0.0198) [0.317]	**-0.0179** (0.0124) [0.150]	**-0.0156** (0.0143) [0.273]	**-0.0189** (0.0133) [0.155]
β_{KT}	**-0.0221***** (0.00601) [0.000244]	**-0.0144**** (0.00628) [0.0215]	**-0.00142** (0.00899) [0.875]	**0.0190**** 0.00834 [0.0226]	**-0.00300** (0.0122) [0.806]	**0.00572** (0.00773) [0.459]	**0.0129** (0.00999) [0.197]	**0.00995** (0.00872) [0.254]
β_{LL}	**0.0708**** (0.0307) [0.0211]	**0.141***** (0.0316) [7.7e-06]	**0.270***** (0.0486) [2.90e-08]	**0.243***** 0.0357 [0.000]	**0.183** (0.117) [0.118]	**0.305***** (0.0821) [0.000203]	**0.319***** (0.0950) [0.000784]	**0.315***** (0.0880) [0.000349]
β_{KK}	**0.0636***** (0.0164) [0.000103]	**0.0623***** (0.0165) [0.000163]	**0.202***** (0.0247) [0.000]	**0.0857***** 0.0199 [0.000]	**0.116***** (0.0413) [0.00506]	**0.0895***** (0.0341) [0.00862]	**0.112**** (0.0439) [0.0108]	**0.104***** (0.0369) [0.00481]
β_{TT}	**-0.00380** (0.00407) [0.351]	**-0.00878**** (0.00403) [0.0293]	**-0.0194***** (0.00502) [0.000117]	**-0.0170***** 0.00473 [0.000325]	**-0.0107**** (0.00525) [0.0415]	**-0.0129***** (0.00427) [0.00251]	**-0.0114**** (0.00491) [0.0204]	**-0.00987**** (0.00459) [0.0314]
β_0	**9.612***** (1.254) [0.000]	**11.80***** (1.601) [0.000]	**28.69***** (2.451) [0.000]	**21.78***** 2.449 [0.000]	**24.65***** (3.261) [0.000]	**17.51***** (2.798) [0.000]	**21.83***** (3.638) [0.0001]	**19.83***** (3.137) [0.000]
z_{age}	**-0.0335***** (0.0103) [0.00109]	**-0.0617***** (0.0135) [5.13e-06]	**-1.395***** (0.306) [5.23e-06]	**-0.937***** 0.137 [0.000]	**-0.0972*** (0.0526) [0.0645]	**-0.0146** (0.0474) [0.758]		
z_{exp}				**5.089***** 0.657 [0.000]				
z_{dtown}	**0.863***** (0.220) [8.75e-05]		**0.0128** (1.036) [0.990]		**-2.899***** (0.796) [0.000273]	**-3.109***** (0.923) [0.000759]	**-4.793***** (1.642) [0.00351]	**-4.434*** (2.271) [0.0509]
z_{credit}	**-5.593***** (1.365) [4.16e-05]	**-4.517***** (0.814) [2.85e-08]	**-9.944*** (5.466) [0.0689]	**-5.580** 5.123 [0.276]	**14.03**** (6.619) [0.0340]	**2.826** (3.077) [0.358]	**0.761** (2.404) 0.752	
$z_{recession}$	**-0.152** (0.290) [0.599]			**0.844** 1.171 [0.471]		**2.445***** (0.809) [0.00251]		
z_{bus}							**-1.770**** (0.844) [0.0360]	
z_{electr}		**0.748*** (0.393) [0.0567]						
z_{labour}			**-2.715*** (1.539) [0.0776]					**-1.749*** (1.042) [0.0933]
z_{ike}		**0.216** (0.155) [0.164]			**4.394**** (1.819) [0.0157]			
z_0	**-0.0421** (0.347) [0.903]	**0.0272** (0.406) [0.947]	**6.222***** (1.139) [4.73e-08]	**2.854**** 1.248 [0.0222]	**-1.858*** (1.018) [0.0679]	**-3.170***** (0.996) [0.00145]	**0.150** (0.412) [0.715]	**-1.050***** (0.397) [0.00823]
Vsigma constant	**-4.443**** (1.825) [0.0149]	**-3.053***** (0.271) [0.000]	**-0.655***** (0.0606) [0.000]	**-0.761***** 0.0599 [0.000]	**-3.585***** (0.336) [0.000]	**-3.417***** (0.226) [0.000]	**-3.169***** (0.198) [0.000]	**-3.229***** (0.224) [0.000]

Source: IOBE.
Notes: Standard error in parentheses. Level of statistical significance in square brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table 1 Estimations for firms active in the sectors of Electric power generation, transmission and distribution, and Road passenger transport *(continued)*

	Electric power generation, transmission and distribution				Road passenger transport			
Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(1)**	**(2)**	**(3)**	**(4)**
Theta constant	**1.409***** (0.0575) [0.000]	**1.204***** (0.0421) [0.000]	**0.906***** (0.0791) [0.000]	**0.709***** 0.0512 [0.000]	**0.515***** (0.113) [0.0005]	**0.616***** (0.105) [0.000]	**0.605***** (0.108) [0.000]	**0.618***** (0.106) [0.000]
Mu constant			**4.623** (0)	**6.682***** 1.264 [0.000]	**3.667** (0.0001) [0.000]			
Observations	918	918	918	918	132	132	132	132
Number of firms	221	221	221	221	22	22	22	22
Country FE	NO	NO	NO	NO	NO	NO	NO	NO
Time varying	NO	NO	NO	NO	NO	NO	NO	NO
Simulations	5,000	6,000	5,000	5,000	6,000	6,000	6,000	6,000
Simulations kept	3,000	4,000	3,000	3,000	4,000	4,000	4,000	4,000
AIC	2,345	2,350	2,533	2,489	151.2	131.1	155.1	136.8
BIC	2,427	2,432	2,615	2,576	200.2	180.1	201.3	180.1

Source: IOBE.
Notes: Standard error in parentheses. Level of statistical significance in square brackets. *** p<0.01. ** p<0.05. * p<0.1.

Table 2 Estimations for firms active in the sectors of Road freight transport, Cruise and yachting services, and Gambling activities-casinos

	Road freight transport			Cruise and yachting services		Gambling activities-casinos	
Variables	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(1)**	**(2)**
β_L	**0.106** (0.183) [0.565]	**0.141** (0.172) [0.412]	**0.114** (0.172) [0.508]	**4.684***** (0.730) [0.000]	**1.478***** (0.589) [0.0122]	**3.181***** (0.826) [0.000118]	**8.745***** (0.665) [0.000]
β_K	**-0.988***** (0.178) [0.000]	**-1.374***** (0.128) [0.000]	**-1.197***** (0.142) [0.000]	**-3.493***** (0.505) [0.000]	**-2.153***** (0.219) [0.000]	**-3.184***** (0.254) [0.000]	**-5.349***** (0.172) [0.000]
β_T	**0.161***** (0.0306) [0.000]	**0.227***** (0.034) [0.000]	**0.268***** (0.0405) [0.000]	**-0.173** (0.141) [0.220]	**-0.214**** (0.0931) [0.0215]	**-0.258** (0.184) [0.160]	**0.703***** (0.157) [7.71e-06]
β_{LK}	**0.00156** (0.0167) [0.926]	**0.00418** (0.0162) [0.797]	**0.00351** (0.0165) [0.831]	**-0.389***** (0.0509) [0.000]	**-0.126***** (0.0395) [0.00140]	**-0.0361** (0.078) [0.643]	**-0.572***** (0.0325) [0.000]
β_{LT}	**-0.00105** (0.00406) [0.796]	**0.000349** (0.00461) [0.449]	**0.00739** (0.00503) [0.142]	**0.0350**** (0.0143) [0.0142]	**0.0102** (0.00861) [0.236]	**-0.0354** (0.0239) [0.139]	**0.106***** (0.0305) [0.000516]
β_{KT}	**-0.00580**** (0.00275) [0.0349]	**-0.0114***** (0.00304) [0.000167]	**-0.0128***** (0.00338) [0.000163]	**0.0198**** (0.00861) [0.0213]	**0.0102*** (0.0059) [0.0827]	**0.0304**** (0.0154) [0.0475]	**-0.0751***** (0.0136) [2.93e-08]
β_{LL}	**0.0790**** (0.0309) [0.0107]	**0.0331** (0.0339) [0.329]	**0.0325** (0.0355) [0.361]	**0.733***** (0.124) [0.000]	**0.337***** (0.0710) [0.000]	**-0.431*** (0.252) [0.087]	**0.144** (0.157) [0.360]
β_{KK}	**0.0903***** (0.0161) [0.000]	**0.126***** (0.0118) [0.000]	**0.112***** (0.0125) [0.000]	**0.304***** (0.0372) [0.000]	**0.190***** (0.0183) [0.000]	**0.215***** (0.0386) [0.000]	**0.560***** (0.0221) [0.000]
β_{TT}	**-0.0116***** (0.00133) [0.000]	**-0.0136***** (0.00157) [0.000]	**-0.0189***** (0.00225) [0.000]	**-0.0360***** (0.00717) [0.000]	**0.000606** (0.00502) [0.904]	**-0.0223***** (0.0073) [0.00225]	**-0.00286** (0.00883) [0.746]
β_0	**18.66***** (1.034) [0.000]	**20.73***** (0.795) [0.000]	**19.62***** (0.932) [0.000]	**32.46***** (3.737) [0.000]	**25.16***** (1.578) [0.000]	**33.24***** (2.015) [0.000]	**35.07***** (2.327) [0.000]

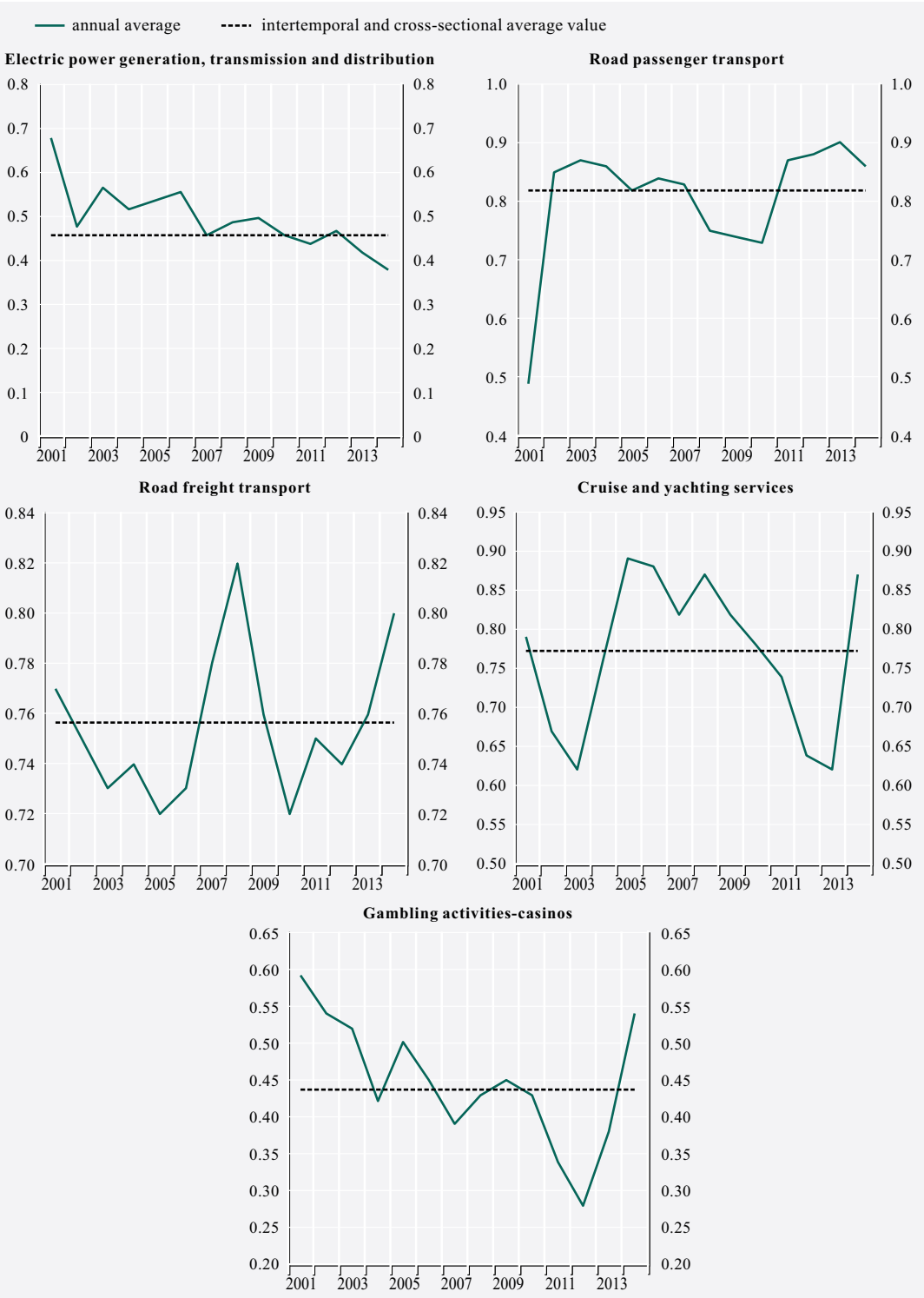
Source: IOBE.
Notes: Standard error in parentheses. Level of statistical significance in square brackets. *** p<0.01. ** p<0.05. * p<0.1.

Table 2 Estimations for firms active in the sectors of Road freight transport, Cruise and yachting services, and Gambling activities-casinos *(continued)*

	Road freight transport			Cruise and yachting services		Gambling activities-casinos	
Variables	**(1)**	**(2)**	**(3)**	**(1)**	**(2)**	**(1)**	**(2)**
z_{age}	**-0.0172**** (0.00742) [0.0207]	**-0.0435***** (0.0123) [0.00042]	**-0.0331***** (0.00918) [0.000314]	**0.0263** (0.226) [0.244]	**0.00242** (0.0186) [0.897]	**-0.0276** (0.0345) [0.422]	**-0.693***** (0.210) [0.000959]
z_{exp}	**-2.384** (2.811) [0.396]	**-2.493** (2.636) [0.344]	**-3.731** (5.495) [0.497]				
z_{dtown}	**1.208***** (0.222) [0.000]	**1.495***** (0.247) [0.000]	**1.824***** (0.335) [0.000]	**-0.866*** (0.495) [0.0803]	**0.360** (0.606) [0.553]	**4.725*** (2.709) [0.0811]	**18.89** (1.278) [0.988]
z_{credit}	**-2.174**** (0.954) [0.0226]	**-0.0576** (1.509) [0.970]	**-1.144** (0.879) [0.193]	**-2.266** (2.828) [0.423]	**-11.65***** (3.404) [0.000619]		
$z_{recession}$		**0.106** (0.148) [0.476]	**0.563***** (0.227) [0.0133]	**-1.311***** (0.453) [0.00377]	**-1.457***** (0.562) [0.0095]	**1.795**** (0.799) [0.0246]	
z_{cruise}				**-0.964** (1.093) [0.378]	**0.322** (0.647) [0.619]		
$z_{roadfreight}$		**0.406** (0.373) [0.276]					
$z_{OECDlandtransport}$			**0.397***** (0.0962) [0.000]				
z_{game}						**0.0578** (1.044) [0.956]	
z_{labour}		**-1.303***** (0.249) [0.000]		**-0.956** (0.865) [0.269]			
$Z_{OECDtemplabourindex}$			**-0.373***** (0.131) [0.00442]		**0.864***** (0.190) [0.000]		
$Z_{OECDregularlabourindex}$			**2.245***** (0.619) [0.000286]		**-0.0879** (1.457) [0.952]		
z_{ike}	**-0.677***** (0.239) [0.00459]		**-0.575*** (0.303) [0.0581]				
z_0	**-2.877***** (0.262) [0.000]	**-1.949***** (0.332) [0.000]	**-9.518***** (1.855) [0.000]	**0.279** (0.786) [0.723]	**-3.219** (4.195) [0.443]	**-6.710***** (2.374) [0.0047]	**-12.50** (1.278) [0.992]
Vsigma constant	**-3.182***** (0.0913) [0.000]	**-2.809***** (0.0997) [0.000]	**-2.866***** (0.120) [0.000]	**-1.698***** (0.205) [0.000]	**-3.530***** (0.265) [0.000]	**-2.287***** (0.743) [0.00208]	**-1.407***** (0.198) [0.000]
Theta constant	**0.676***** (0.0371) [0.000]	**0.671***** (0.0341) [0.000]	**0.699***** (0.0363) [0.000]	**1.007***** (0.149) [0.000]	**0.746***** (0.0831) [0.000]	**0.924***** (0.240) [0.000121]	**0.486***** (0.140) [0.000517]
Mu constant							**4.854***** (1.406) [0.000558]
Observations	1,531	1,531	1,393	320	310	113	113
Number of firms	277	277	252	61	59	16	16
Country FE	NO	NO	NO	NO	NO	NO	NO
Time varying	NO	NO	NO	NO	NO	NO	NO
Simulations	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Simulations kept	4,000	4,000	4,000	4,000	4,000	4,000	4,000
AIC	1,760	2,040	1,865	687.9	473.2	227.1	269.1
BIC	1,856	2,147	1,980	759.5	547.9	268.0	315.4

Source: IOBE.
Notes: Standard error in parentheses. Level of statistical significance in square brackets. *** p<0.01. ** p<0.05. * p<0.1.

Annual average technical efficiency and intertemporal and cross-sectional average value of technical efficiency across sectors (2001-2014)



Source: IOBE.