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Public ownership, entry regulation and TFP growth within a productivity convergence model: Industry level evidence from south European countries

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Athens 10/2013

Η επίδραση του βαθμού της δημόσιας ιδιοκτησίας και των ρυθμίσεων εισόδου στην αύξηση της συνολικής παραγωγικότητας των συντελεστών, μέσα από ένα υπόδειγμα σύγκλισης παραγωγικότητας: Κλαδική ανάλυση σε χώρες της νότιας Ευρώπης

Σοφία Δημέλη & Σωτήρης Παπαϊωάννου

ΠΕΡΙΛΗΨΗ

Στην εργασία αυτή διερευνάται αν ο βαθμός της δημόσιας ιδιοκτησίας και των ρυθμίσεων εισόδου σχετίζεται με την αύξηση της συνολικής παραγωγικότητας των συντελεστών (ΣΠΣ) στους κλάδους οικονομικής δραστηριότητας των νότιο-ευρωπαϊκών χωρών. Αρχικά εκτιμούμε τα σχετικά επίπεδα και τους ρυθμούς μεταβολής της ΣΠΣ σε κλάδους δραστηριότητας της Ελλάδας, της Ιταλίας και της Ισπανίας, με τη χρήση ενός υποδείγματος λογιστικής της οικονομικής μεγέθυνσης. Στη συνέχεια, εκτιμούμε την επίδραση του βαθμού της δημόσιας ιδιοκτησίας και των ρυθμίσεων εισόδου στην ΣΠΣ, μέσα από ένα οικονομετρικό υπόδειγμα σύγκλισης της παραγωγικότητας.

Τα εμπειρικά αποτελέσματα δείχνουν ότι ο υψηλότερος βαθμός ρυθμίσεων εισόδου και δημόσιας ιδιοκτησίας συνδέεται αρνητικά και στατιστικά σημαντικά με το ρυθμό μεταβολής της ΣΠΣ μόνο στους κλάδους της ισπανικής οικονομίας. Αντιθέτως, τα εμπειρικά αποτελέσματα για την Ιταλία και την Ελλάδα, δεν μας παρέχουν ενδείξεις για μια στατιστικά σημαντική επίδραση αυτών των μεταβλητών στο ρυθμό μεταβολής της ΣΠΣ. Επιπλέον, τα ευρήματα αυτής της μελέτης μας παρέχουν ενδείξεις ότι ο παράγοντας της τεχνολογικής σύγκλισης είναι ιδιαίτερα σημαντικός για την αύξηση της παραγωγικότητας των ελληνικών κλάδων, δεδομένου ότι εξακολουθούν να λειτουργούν σημαντικά κάτω από τη σχετική καμπύλη παραγωγικών δυνατοτήτων.

Η ύπαρξη μικτών αποτελεσμάτων αναφορικά με την επίδραση του βαθμού της δημόσιας ιδιοκτησίας και των ρυθμίσεων εισόδου στο ρυθμό μεταβολής της ΣΠΣ αποδίδεται στο γεγονός ότι οι νότιο-ευρωπαϊκές οικονομίες εξακολουθούν να λειτουργούν κάτω από την καμπύλη παραγωγικών δυνατοτήτων και εξακολουθούν να θεωρούνται ως πιο ρυθμισμένες. Σύμφωνα με τους Acemoglu κ.α. (2006), δεν θα πρέπει να περιμένουμε μια άμεση επίδραση του χαμηλότερου βαθμού ρύθμισης σε χώρες που υστερούν, δεδομένου ότι η επίδραση της απελευθέρωσης είναι υψηλότερη σε κλάδους και χώρες που λειτουργούν κοντά στα όρια των παραγωγικών δυνατοτήτων. Θα πρέπει, επίσης, να σημειωθεί ότι οι Van Ark κ.α. (2008) υποστήριξαν ότι, αν και υπάρχει μια σαφής κατεύθυνση προς μεγαλύτερη ευελιξία και απελευθέρωση σε όλες χώρες της Ευρώπης, η έκταση καθώς και η επίδραση της απελευθέρωσης ποικίλλει σημαντικά από χώρα σε χώρα. Στο το ίδιο πνεύμα, οι Alesina κ.α. (2005) υποστήριξαν ότι οι επιπτώσεις της απελευθέρωσης στην αύξηση των επενδύσεων είναι υψηλότερες όταν αυτές ξεκινούν από ήδη χαμηλά επίπεδα κανονιστικών ρυθμίσεων. Θα μπορούσε, επομένως, να υποστηριχθεί ότι οι χώρες της νότιας Ευρώπης, έχοντας ήδη καθυστερήσει στην υιοθέτηση διαρθρωτικών μεταρρυθμίσεων, δεν είναι ακόμη σε θέση να επωφεληθούν από το χαμηλότερο βαθμό ρύθμισης των οικονομιών τους.

Ωστόσο, η ύπαρξη μικτών αποτελεσμάτων αναφορικά με την επίδραση του βαθμού της δημόσιας ιδιοκτησίας και των ρυθμίσεων εισόδου στο ρυθμό μεταβολής της ΣΠΣ, δεν θα πρέπει να θεωρηθεί ως ένδειξη ότι οι χώρες της νότιας Ευρώπης θα πρέπει να εγκαταλείψουν τις προσπάθειές τους για την απελευθέρωση των οικονομιών τους. Αντιθέτως, η ύπαρξη θεσμικών ακαμψιών και στρεβλώσεων θεωρούνται ως μερικοί από τους λόγους για τη σχετική υστέρηση με τις βόρειο-ευρωπαϊκές χώρες.

Public ownership, entry regulation and TFP growth within a productivity convergence model: Industry level evidence from south European countries

Sophia P. Dimelis[a] **and Sotiris K. Papaioannou**[b]

Abstract

In this paper, we investigate whether the degree of entry liberalization and public ownership is associated with higher industry level total factor productivity (TFP) growth of south European economies. We first estimate relative TFP levels and TFP growth rates across manufacturing and service industries of Greece, Italy and Spain, by using a standard growth accounting framework. Then, we estimate the TFP growth impact of entry liberalization and degree of public ownership, within a productivity convergence framework. To this end, we employ panel data econometric techniques. The empirical results indicate that a higher degree of entry regulation and public ownership is significantly associated with lower TFP growth only for Spanish industries. The empirical results for Italy and Greece do not provide us with any evidence for a statistically significant impact of these variables on TFP growth. We attribute the mixed nature of our results to the fact that south European economies still operate below the productivity frontier and are still considered as relatively more regulated.

JEL classification: L5, O43, O50

Keywords: TFP growth, regulatory environment, Southern Europe, panel data.

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1. Introduction

During the 1995-2005 period, there was a significant variation in real GDP growth rates between the US and the EU-15 economy, with the US economy growing on average by 3.3% and the euro area economy growing by 2.1%. Growing divergence between the EU-15 and the US economy has been related, among other factors to the different abilities between the two regions to adopt new technologies, which in turn, depend on the degree of competition, as well as on the nature of institutions affecting the degree of liberalization of the economy (Scarpetta and Tressel, 2002; Gust and Marquez, 2004).

During the same period, a significant change in the regulatory environment of most European countries was observed, towards the direction of greater liberalization in product markets, with lower barriers to entry for new businesses and less presence of public ownership in several sectors of the economy. Although, in general, product market regulation has become less restrictive, this has occurred at different degrees, to different extent and probably with differential impacts across the EU economies.

Recent theoretical models of growth argue that a higher degree of competition is correlated with a higher rate of innovation and higher long run economic growth (Aghion et al., 2005). Furthermore, it has been argued that cross country income divergences are closely related to differences in institutional and policy environment (Acemoglu et al., 2005; Aghion and Griffith, 2005). On the other hand, the existence of substantial degree of regulation may have a negative impact on firms' decisions concerning investments, technology adoption and innovation.

There is evidence in the relevant literature that regulatory reforms have a positive and significant impact on both investment (Alesina et al., 2005) and innovation (Aghion et al., 2005). Furthermore, most of the empirical evidence provided so far has established a positive impact of policies towards liberalization on growth and productivity. However, the existing empirical research has not, yet, provided, evidence among countries that differ on the extent of liberalization and/or their level of economic development.

This paper contributes to the relevant literature by investigating the total factor productivity (TFP) growth impact of regulation in three south European countries. More specifically, we explore the link between entry liberalization, degree of public ownership and measured TFP growth in one digit industries of Greece, Italy and Spain. These countries operate below the productivity frontier, as indicated by their levels of hourly labor productivity, and are considered as more regulated, compared to other EU economies.

In this context, this paper tries to examine a policy related question of whether entry liberalization and degree of public ownership raise productivity. Productivity convergence between north and south European economies remains a priority issue in the economic policy of the EU. Thus, the findings of this study, on whether productivity is affected by changes in the degree of entry liberalization and public ownership, which in turn are influenced by government policies, may prove useful for policy evaluation on the European regional level.

This study is based on a model of TFP convergence, in which Germany is the leader economy and Greece, Italy and Spain are the follower ones. Within this framework, TFP growth of the follower industry is modeled as a function of TFP growth of the leader industry, as well as of technological catch-up and deregulation variables. We justify the choice of Germany as the leader economy in our study, since, aside of a technological leader in the global economy, is also a major trading partner of these three countries.

For the purpose of this study, we first derive industry level measures of TFP growth for Greece, Italy and Spain as well as for Germany, based on a growth accounting framework. Then, within the productivity convergence model described above, we estimate the TFP growth impact of entry regulation and public ownership, for the period 1995-2007, by using several panel data econometric methods.

The empirical results indicate that a higher degree of entry regulation and public ownership is significantly associated with lower TFP growth only in Spanish industries. The empirical results for Italy and Greece do not provide us with any evidence for a statistically significant impact of entry regulation or public ownership on TFP growth. We attribute the mixed nature of our results to the fact that south European economies still operate below the productivity frontier and are still considered as relatively more regulated. Our results are robust to various specifications and econometric estimators.

The paper proceeds as follows: In section 2, we discuss the theoretical impact of regulations and competition on growth. In section 3, the findings of the relevant literature are presented, while in section 4, we derive measures of TFP growth. Section 5 introduces the econometric framework. Section 6 presents the regression results and provides short discussion. Finally, section 7 concludes.

2. Theoretical considerations

Economic theory suggests that competition in product markets results in higher efficiency and productivity. In particular, it is argued that competition increases efficiency, by reallocating markets shares to most productive businesses, by forcing exit of less efficient ones and by allowing more efficient firms to enter the market.

The existing theoretical literature argues that product market regulation can influence productivity by altering the incentives to invest in new technologies. Parente and Prescott (1994) assumed a model of technology adoption, in which the decision of a firm to invest in technology depends on the degree of legal and regulatory barriers, the existence of which increases the cost of technology adoption. Their analysis shows that differences in these barriers among countries account for a major part of observed income disparities across countries. Alesina et al. (2005) support that less regulations lower the cost of expanding capital stocks of firms. They argue that higher competition results in lower profit margins and lower shadow price of capital. They also argue that the cost of reorganizing the production process, which is necessary after adoption of a new technology, is lower in regulatory friendly environments.

On the other hand, the early theoretical arguments in the Schumpeterian spirit stress that innovation and growth are negatively correlated with competition, since the monopoly rents decrease with higher competition. However, recent neo-Schumpeterian analyses have questioned this view by arguing that, as competitive pressures increase then incumbent firms will engage in competition in order to preserve their market shares. Aghion et al. (2005) have attempted to reconcile theory with the existing empirical evidence and showed the existence of an inverted-U relationship between competition and innovation.

Particularly, in their model, both leaders and followers in an industry can innovate, while the incentives to innovate depend upon the difference between post-innovation and pre-innovation rents of incumbent firms. Essentially, at low stages of competition, an increase in competition in the market will increase innovation, since the escape competition effect dominates the Schumpeterian effect and pushes firms in an industry to innovate in order to avoid losing market shares. At higher levels of competition, the Schumpeterian effect is more likely to dominate, so that an increase of competition will result in lower innovation activity.

In other words competition increases the incentives to escape competition of leading firms at low stages of competition and this effect is higher than the Schumpeterian effect of decreasing innovation. However, at higher levels of competition, the Schumpeterian effect is more powerful than the escape competition effect, because the post innovation rents will become very low. According to this view, there exists an inverted-U relationship with too little or too much competition being harmful for innovation.

In this spirit, the recent neo-Schumpeterian models of growth argue that if technology is free to flow across countries and industries, then productivity growth is a positive function of the technology gap between the follower and the leader country or industry, which is often referred to as the catch-up phenomenon. Acemoglu et al. (2006) constructed a simple endogenous growth model to investigate how certain policies that affect positively growth at early stages of development, then become harmful for growth. The main assumption in their analysis is that innovation becomes highly important when a country reaches the world technology frontier. In this context, they argue that institutions and policies that encourage investment and technology adoption in backward economies may not be appropriate for innovation and growth in leader economies. Therefore economies that choose institutions and policies that encourage investment and technology adoption may initially grow faster than others but then may stop converging towards the frontier.

Furthermore, Aghion et al. (2006) argue that the post war catching-up of the European economies to the US slowed down as the relative technology gap narrowed. They argue that policies and institutions which were designed towards technology adoption are not now appropriate for most European economies which are now closer to the technology frontier and, therefore, they stress the need for policies in favour of higher competition in the markets, which in turn will affect positively innovation and growth.

3. Review of empirical literature

Most of the recent empirical literature has established a negative relationship between productivity and regulations on product markets. Nicoletti and Scarpetta (2003) analyzed the impact of product market regulations on multi factor productivity growth across a sample of 23 industries in 18 OECD countries, during 1984-1998. They provided evidence that regulations are negatively correlated with productivity growth, with the negative impact being higher for technological laggard industries and countries, since strict regulations hinder the process of technology adoption. Furthermore, they provided evidence that reforms promoting private governance and competition tend to boost productivity in manufacturing and service industries of OECD countries. In the same spirit, Alesina et al. (2005) found that various measures of product market regulation are negatively linked to investment in OECD countries.

The empirical results of Conway et al. (2006) indicate that the presence of strict product market regulations in several EU countries has stopped the catching-up process between the EU and the US economy. In particular, the authors argue that positive productivity shocks, brought upon by the diffusion of ICT in the 1990s, have been followed by widening productivity gaps between the US and the EU, as well as between southern and northern European countries. Differences in policies and institutions between EU countries and the US seem to have had an important influence in decisions of firms to adopt new technologies, resulting in diverging productivity patterns between the US and the EU, as well as between southern and northern European countries. Also, the results from their simulations indicate that the gains of product market liberalization could be substantially high, especially for countries which are highly regulated. For example, the increase of annual labor productivity in Greece, due to higher catching-up, could be 1.8%.

Arnold et al. (2008) provided industry level evidence that tight product market regulations in service sectors of continental EU countries affect productivity growth by hindering the allocation of resources towards most efficient firms. However, a more recent study of Inklaar et al. (2008) provides evidence in favor of positive effects of competition only in network industries. Bartelsman et al. (2009) investigated the effect of policy distortions on aggregate outcomes. Their key empirical finding is that there is substantial variation in the within-industry productivity dispersion across countries and is affected by the presence of idiosyncratic policy distortions.

Barone and Cingano (2011) studied the effects of anticompetitive regulation on the growth rate of value added, productivity and exports of manufacturing industries that use services more intensively. Their findings indicate that lower regulation increases the growth rate of value added, productivity and exports of manufacturing industries. Importantly, they show that the regulation of professional services and energy has particularly strong negative effects on the outcomes of the above variables. Finally, Bena et al. (2011) investigated whether the liberalization of utilities, transport and telecommunications affected productivity of European network firms, through the period 1998-2007. After having taken account of country, industry and year effects, they showed that liberalization had a positive impact on TFP growth, with the gains amounting to an increase on TFP by 38%.

4. TFP growth estimates

4.1. Growth accounting framework

We first built upon growth accounting, a technique which is based on the seminal work of Solow (1956) and, then, we compute the implied series of TFP for each industry in each country by using a standard constant returns to scale production function, We assume the following neoclassical Cobb Douglas production function:

$$Y_{i,j,t} = A_{i,j,t}(K_{i,j,t})^{a}(L_{i,j,t})^{(1-a)} \qquad (4.1)$$

where $Y_{i,j,t}$ represents value added for each industry i in each country j, K is the capital stock of each industry in each country and L is the labor input, measured in total hours worked. Furthermore, A is a labor and capital neutral technology parameter, associated with TFP growth, t is a time index and a is the elasticity of capital with respect to output, which varies across industries, countries and time. After taking logarithms, differentiating both sides of equation (4.1) and accepting the hypothesis of constant returns to scale[2], we obtain:

$$\ln\left(\frac{Y_{i,j,t}}{Y_{i,j,t-1}}\right) = \ln\left(\frac{A_{i,j,t}}{A_{i,j,t-1}}\right) + a\ln\left(\frac{K_{i,j,t}}{K_{i,j,t-1}}\right) + (1-a)\ln\left(\frac{L_{i,j,t}}{L_{i,j,t-1}}\right) \qquad (4.2)$$

Equation (4.2) indicates the main sources of growth of an economy. In particular, the growth rate of output, $\ln(\frac{Y_{i,j,t}}{Y_{i,j,t-1}})$, is comprised of three main components: the growth rate of labor, $\ln(\frac{L_{i,j,t}}{L_{i,j,t-1}})$, multiplied by its income share *(1-a),* the growth rate of capital, $\ln(\frac{K_{i,j,t}}{K_{i,j,t-1}})$, multiplied by its income share *(a)* and TFP growth, $\ln(\frac{A_{i,j,t}}{A_{i,j,t-1}})$.

[2]We have assumed that inputs are paid according to their marginal products, so that the income shares of labor and capital income sum up to 1.

With this framework, changes in output growth can be decomposed into the contributions of physical capital, labor and measured TFP growth. Each input's contribution is measured by its growth rate weighted by its income share, which, in turn reflects its output elasticity. The part of output growth not attributable to inputs is the TFP residual and includes technological change, the efficiency with which the inputs are used, deviation from competitive equilibrium, as well as measurement errors and unmeasured inputs:

$$\ln(\frac{A_{i,j,t}}{A_{i,j,t-1}}) = \ln(\frac{Y_{i,j,t}}{Y_{i,j,t-1}}) - a\ln(\frac{K_{i,j,t}}{K_{i,j,t-1}}) - (1-a)\ln(\frac{L_{i,j,t}}{L_{i,j,t-1}}) \quad (4.3)$$

In this empirical study, Germany is considered the frontier economy, while Greece, Italy and Spain are considered as the follower ones. Therefore, TFP gap for each industry *i* in each country *j* (Greece, Italy, Spain) is expressed as the level of TFP in each German industry *i* relative to the level of TFP in the same industry of the follower country *j*:

$$\text{TFP gap} = \ln(\frac{A_{i,GER,t}}{A_{i,j,t}}) = \ln(\frac{Y_{i,GER,t}}{Y_{i,j,t}}) - a_K \ln(\frac{K_{i,GER,t}}{K_{i,j,t}}) - (1-a_K)\ln(\frac{L_{i,GER,t}}{L_{i,j,t}}) \quad (4.4)$$

A low value of technology gap indicates that the industry operates close to the frontier, while a high value indicates that this industry is further away from the frontier.

4.2. Data and real capital stocks

The data used for the estimates cover the period between 1995 and 2007 and are expressed on an annual basis. The data for value added in each industry (expressed in 2000 prices), for hours worked and for physical capital stocks in each industry and country were taken from the OECD STAN Industrial Database (2012).

However, data for physical capital in Greek industries were not officially available. Therefore, we constructed the series of capital stock, by following the procedure of Conesa et al. (2007), based on the perpetual inventory method. Therefore, capital stock in each period is expressed as:

$$K_{t+1} = I_{t+1} + (1-\delta)\,K_t \qquad (4.5)$$

In order to calculate the series of capital stock for each industry in Greece, we were provided with data for real gross fixed capital formation *I*, which have been provided by the OECD STAN Industrial Database (2012). We also needed a value for the depreciation rate of capital, δ, as well as an initial value of real capital stock at time 0, K_0. The value of δ was chosen to be consistent with the observed data of consumption of fixed capital to value added, so that across the whole period, for each industry In Greece, it holds that:

$$\frac{1}{n}\sum_{t=1}^{n}\frac{\delta K_t}{Y_t} = D \ (4.6)$$

where $\frac{\delta K_t}{Y_t}$ in each period *t* is the amount of consumption of fixed capital over gross value added, while *D* is the amount of consumption of fixed capital, averaged over the whole period 1995-2007. The capital output ratio for each Greek industry in the initial period was chosen to be equal to the average capital output ratio for years 2000 and 2005, with physical capital data provided by Skountzos and Stroblos (2011).

4.3. Input shares

The income shares of capital and labor, *a* and *1-a*, respectively, can be measured directly with the use of National Accounts' data. Since in some countries (e.g. Greece), the amount of self employment is very high, computing the income share of labor as the ratio of the compensation of employees to value added in each industry, would introduce a bias in our estimates (Gogos et al., 2012). Therefore, we preferred to proxy for the compensation of self employment and then calculate a labor share of total employment (dependent employees plus self employed).

In order to proxy for income of self employed, we first constructed a compensation rate per employee by dividing total compensation of employees with total dependent employment. Then, we multiplied this with the number of self employed persons and thus obtained an imputed income of self employed. In order to compute the share of labor (dependent employees plus self employed) in output, we added total compensation of employees and total compensation of self employed and divided this sum with the value added at factor prices (total value added minus indirect taxes).

The income share of capital is the calculated as 1 minus the income share of labor. These income shares, combined with the available data on the growth rates of capital, labor and output, allow us to estimate the relative growth contribution of each factor of production, as well as TFP growth.

4.4. Growth accounting results

The growth accounting estimates shown in Table 1 indicate that during the period 1995-2007, output growth was mainly driven by the high contribution of TFP growth in most German industries, with TFP growth being negative only in hotels and restaurants and being higher than the growth of output in manufacturing, electricity, gas and water supply, post and telecommunications and financial intermediation. In Greece (Table 2), we observe a relatively high value added growth contribution of TFP growth in hotels and restaurants, as well as in transport and storage (which is accompanied, at the same time, with high TFP growth rates) and relatively lower ones in most of the remaining industries. We, also, observe a negative TFP contribution in construction, as well as in real estate, renting and business activities.

In Italy (Table 3), we observe a relatively low growth contribution of TFP and, at the same time, low TFP growth rates in most of the industries (with the exception of financial intermediation). We can also distinguish negative growth rates of TFP in three out of the eight industries. Finally, in Spain (Table 4), we observe negative TFP growth rates in most of the industries and low TFP growth contributions, with output growth mainly driven by the contribution of capital.

Overall, these estimates indicate that output growth in Germany was mainly driven by the high contribution of TFP growth. On the other hand, we observe a moderate contribution of TFP growth in Greece, while in Italy and Spain, we can distinguish low and negative, respectively, contributions of TFP on output growth.

Our growth analysis for Germany confirms the findings of Jones and Olken (2005) which show that shifts in the growth process are largely due to changes in productivity growth and do not rely on changes in the factors of production. Comparable evidence has been offered by Kehoe and Prescott (2002), indicating that the rate of TFP can adequately explain long periods of economic crisis across economies of many developed countries (e.g. USA, UK, Germany). Prescott (1998) has, also, argued that TFP is the basic determinant of income differences across the world economy.

However, when considering the economies of southern Europe, the results of the growth accounting analysis differentiate, with the growth contribution of TFP being, either comparatively lower, or even negative. Kollintzas et al. (2012) have offered evidence for the Greek economy, which show that the great difference between Greece and other euro area countries, during the 1975-2010 period, is the growth contribution of TFP. In particular, they showed that while the contribution of TFP growth in Germany was close, or even exceeded 100% of output growth, in Greece it accounted only for 55%. In general, it seems that despite joining the euro area, no TFP convergence seems to have been realized in south European countries.

Table 1: TFP Growth in German industries

	GY*	GK*	GL*	CAPITAL CONTRIBUTION	LABOR CONTRIBUTION	TFP GROWTH	CAPITAL CONTRIBUTION (%)	LABOR CONTRIBUTION (%)	TFP CONTRIBUTION (%)
Manufacturing	1.60%	-0.42%	-1.30%	-0.11%	-1.02%	2.72%	-7.00%	-63.66%	170.66%
Electricity, gas and water supply	2.53%	0.98%	-2.81%	0.57%	-1.19%	3.15%	22.67%	-47.22%	124.56%
Construction	-3.11%	-0.53%	-2.61%	-0.11%	-2.10%	-0.90%	3.64%	67.46%	28.90%
Wholesale and retail trade - repairs	1.90%	2.62%	-0.27%	0.54%	-0.22%	1.59%	28.40%	-11.72%	83.32%
Hotels and restaurants	0.87%	1.13%	1.30%	0.07%	1.18%	-0.38%	8.33%	135.50%	-43.84%
Transport and storage	3.22%	2.52%	-0.31%	0.72%	-0.26%	2.75%	22.32%	-7.94%	85.62%
Post and telecommunications	4.38%	-0.85%	-2.88%	-0.54%	-1.35%	6.27%	-12.24%	-30.91%	143.15%
Financial intermediation	0.44%	2.01%	-0.93%	0.61%	-0.67%	0.50%	137.98%	-151.92%	113.94%
Real estate, renting and business activities	3.21%	2.82%	4.12%	2.01%	1.19%	0.02%	62.55%	36.97%	0.48%

* GY: Growth rate of value added, GK: Growth rate of capital, GL: Growth rate of total hours worked.

Table 2: TFP Growth in Greek industries

	GY*	GK*	GL*	CAPITAL CONTRIBUTION	LABOR CONTRIBUTION	TFP GROWTH	CAPITAL CONTRIBUTION (%)	LABOR CONTRIBUTION (%)	TFP CONTRIBUTION (%)
Manufacturing	1.88%	1.96%	-0.32%	0.80%	-0.19%	1.28%	42.34%	-10.36%	68.01%
Electricity, gas and water supply	1.16%	1.76%	-1.17%	1.17%	-0.37%	0.35%	101.43%	-31.66%	3 0.24%
Construction	2.20%	5.00%	2.32%	2.55%	1.09%	-1.44%	115.98%	49.52%	-65.49%
Wholesale and retail trade - repairs	4.73%	4.17%	1.66%	1.63%	0.99%	2.11%	34.53%	20.88%	44.59%
Hotels and restaurants	3.45%	-0.42%	0.90%	-0.34%	0.31%	3.48%	-9.88%	9.01%	100.87%
Transport and storage	9.35%	14.34%	-3.02%	2.74%	-1.68%	8.29%	29.32%	-17.96%	88.64%
Post and telecommunications	7.89%	11.11%	-1.44%	6.83%	-0.44%	1.50%	86.51%	-5.57%	19.06%
Financial intermediation	5.06%	2.83%	1.85%	1.26%	1.00%	2.81%	24.81%	19.72%	55.47%
Real estate, renting and business activities	1.05%	1.74%	4.98%	1.22%	1.38%	-1.55%	116.24%	132.09%	-148.32%

* GY: Growth rate of value added, GK: Growth rate of capital, GL: Growth rate of total hours worked.

Table 3: TFP Growth in Italian industries

	GY*	GK*	GL*	CAPITAL CONTRIBUTION	LABOR CONTRIBUTION	TFP GROWTH	CAPITAL CONTRIBUTION (%)	LABOR CONTRIBUTION (%)	TFP CONTRIBUTION (%)
Manufacturing	0.63%	1.57%	-0.12%	0.50%	-0.08%	0.21%	79.91%	-13.20%	33.29%
Electricity, gas and water supply	1.19%	1.88%	-1.88%	1.33%	-0.56%	0.42%	111.73%	-47.44%	35.71%
Construction	1.76%	3.44%	2.62%	1.17%	1.73%	-1.14%	66.32%	98.70%	-65.01%
Wholesale and retail trade - repairs	0.61%	4.03%	0.14%	1.42%	0.09%	-0.90%	232.50%	15.12%	-147.62%
Hotels and restaurants	1.62%	3.97%	2.21%	1.17%	1.57%	-1.12%	72.46%	97.04%	-69.50%
Transport, storage, post and communications	3.43%	3.33%	1.28%	1.42%	0.74%	1.27%	41.51%	21.52%	36.96%
Financial intermediation	3.04%	0.77%	0.24%	0.23%	0.14%	2.67%	7.52%	4.70%	87.78%
Real estate, renting and business activities	1.94%	1.96%	5.07%	1.38%	1.49%	-0.92%	70.93%	76.59%	-47.52%

* GY: Growth rate of value added, GK: Growth rate of capital, GL: Growth rate of total hours worked.

Table 4: TFP Growth in Spanish industries

	GY*	GK*	GL*	CAPITAL CONTRIBUTION	LABOR CONTRIBUTION	TFP GROWTH	CAPITAL CONTRIBUTION (%)	LABOR CONTRIBUTION (%)	TFP CONTRIBUTION (%)
Manufacturing	0.90%	3.17%	0.03%	1.13%	0.00%	-0.22%	124.36%	0.48%	-24.85%
Electricity, gas and water supply	3.77%	2.95%	0.01%	2.25%	-0.07%	1.59%	59.73%	-1.91%	42.18%
Construction	3.69%	6.01%	3.36%	1.78%	2.65%	-0.75%	48.40%	71.82%	-20.22%
Wholesale and retail trade - repairs	2.82%	5.32%	2.23%	1.81%	1.45%	-0.44%	63.99%	51.52%	-15.52%
Hotels and restaurants	1.86%	5.92%	3.16%	2.42%	1.93%	-2.49%	130.44%	103.68%	-134.12%
Transport, storage, post and communications	3.27%	6.34%	2.66%	3.00%	1.40%	-1.12%	91.57%	42.72%	-34.29%
Financial intermediation	4.94%	3.17%	0.94%	1.56%	0.53%	2.86%	31.47%	10.69%	57.84%
Real estate, renting and business activities	3.41%	3.48%	4.57%	2.06%	1.81%	-0.46%	60.43%	52.98%	-13.41%

* GY: Growth rate of value added, GK: Growth rate of capital, GL: Growth rate of total hours worked.

5. Econometric framework and data

5.1. Econometric framework

Our model is based on Aghion and Howitt (2006) in which productivity growth of a country depends on its ability to keep pace with the technological frontier. It also depends on the size of the technology gap between the follower and the leader. Therefore, for each country *j* we assume a model of TFP growth in the following form:

$$TFP_{i,j,t} = \alpha TFP_{i,GER,t} + \beta TG_{i,j,t} + \gamma REG_{i,j,t} + \delta\, REG_{i,j,t} * TG_{i,j,t} + \rho_i + d_t + e_{i,j,t} \quad (5.1)$$

where indices *i* and *t* denote industry and year, respectively. $TFP_{i,j,t}$ is total factor productivity growth of industry *j* of the follower country (Greece, Italy, Spain) and $TFP_{i,GER,t}$ is TFP growth of industry *j* of the leader country (Germany). In this manner, productivity growth of the leader industry may influence productivity growth of the follower industry.

The term of technology gap ($TG_{i,j,t}$) is calculated by equation (4.4) and is the ratio of the level of TFP in each industry *j* of the leader country, relative to the level of TFP in the same industry of the follower country *i*. If coefficient β is positive and statistically significant, this implies the existence of high potential for technological catching-up with the leader industry.

By considering the *REG* indicator, we wish to search for the existence of any effects of economy wide regulation on TFP growth. In our regressions, we consider separately two different regulation variables, related to entry barriers (*ENT*) in the market and degree of public ownership (*PUB*). The impact of regulations can be measured, also, indirectly be including in the regression the term *REG * TG*, allowing for these two regulation variables to interact with the level of technology gap. A positive coefficient on δ implies the existence of indirect negative effects on TFP growth by slowing down the catching-up process of laggard industries.

Industry effects (ρ_i) and year effects (d_t) are also considered in this model to account for unobserved industry specific effects and common productivity shocks, respectively.

5.2. Data

To analyze the impact of regulation on TFP growth, we use two different time varying regulation indices of the product market regulation index of OECD. These are analytically described in Conway and Nicoletti (2006) and are available in the OECD product market regulation database.

We use the entry regulation index, as well as, an index showing the degree of public ownership. The entry regulation index covers the extent of legal limitations on the number of companies, as well as rules on vertical integration of network industries. When entry is free, this indicator takes the value of 0. On the contrary, this index takes the value of 6 in cases where entry is heavily regulated. Similarly, the public ownership indicator takes the value of 0 in cases that there is no public ownership, and 6 in the case of full public ownership.

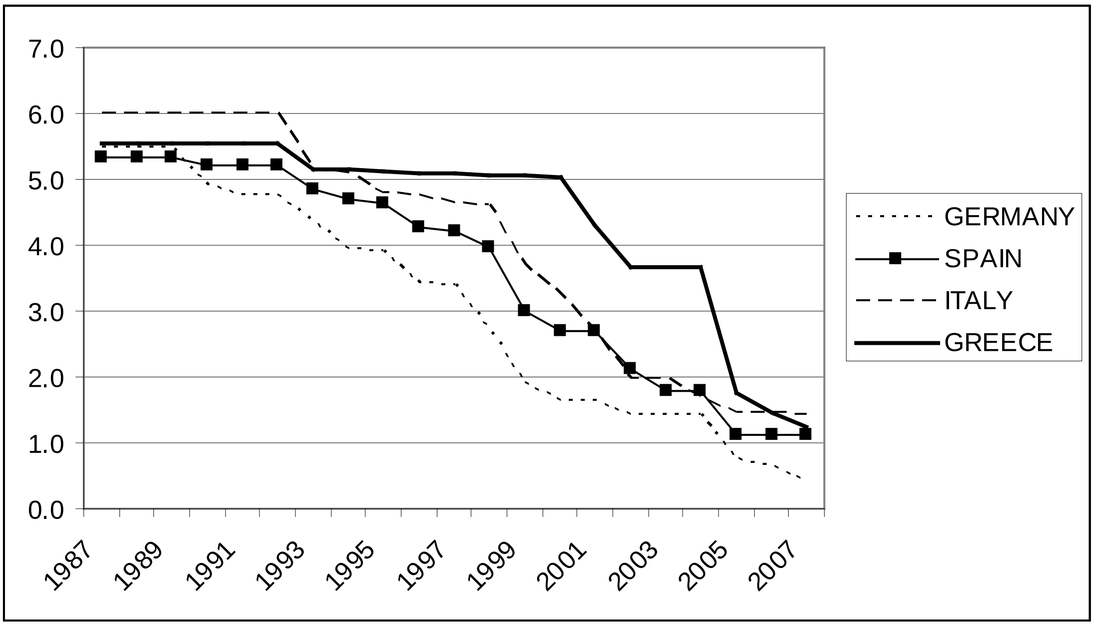
The advantage of using these regulation indices is their time dimension, covering a long period of time for each OECD country, and, therefore, allowing for time series and panel data analysis. Although they cover certain industries, they can be used as proxies for assessing the impact of the economy wide regulatory environment, since they include sectors in which much anti-competitive regulation is concentrated for most OECD countries (see Scarpetta and Tressel, 2002; Conway et al., 2006). In addition, it should be noted that these indices are highly correlated with the cross section economy wide product market regulation in the years in which they overlap (Conway et al., 2006). A further advantage of these indices is that they can be treated as exogenous measures of regulation, which are not affected by productivity outcomes[3].

In Figure 1, we show the evolution of the indice of entry barriers across time for the countries under examination. Entry barriers have been reduced significantly over time, with different rates, however, for individual countries. In particular, Germany has managed to reduce more quickly and to a greater extent entry barriers for businesses, with Spain following and Greece and Italy lagging behind.

The degree of public ownership has, also, been reduced, as shown in Figure 2. However, it still remains high for Italy and Greece, unlike Spain and Germany, which started privatizations earlier and have already significantly reduced the degree of public ownership. It is also worth noting that the degree of public ownership was already much lower in Spain and Germany, at the beginning of the period, as compared to Italy and Greece.

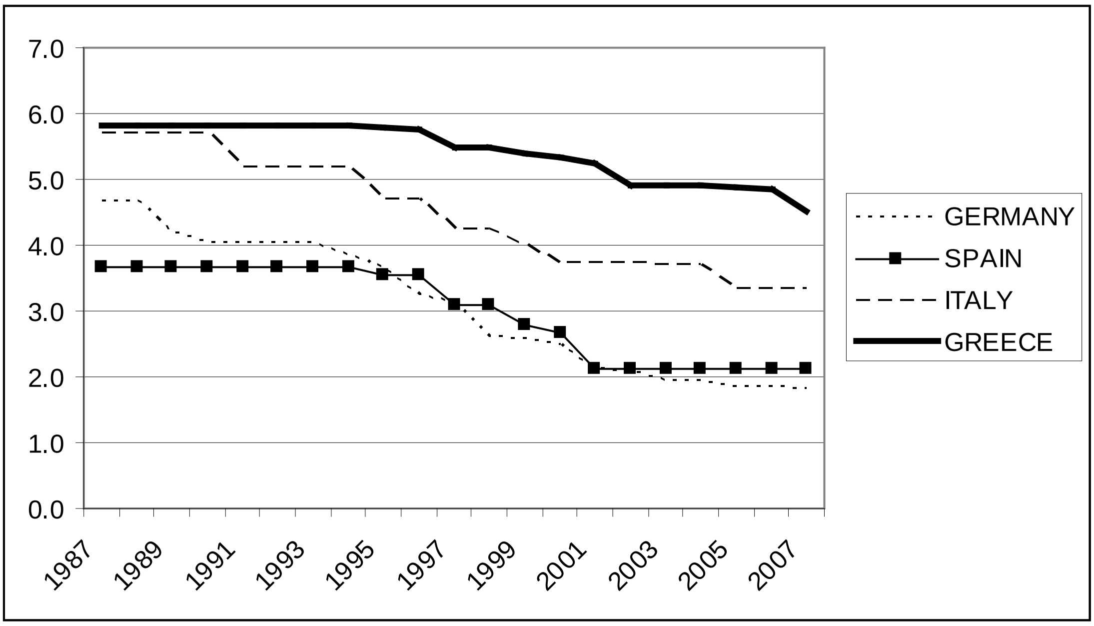
[3] A part of past literature used traditional indicators of mark-ups or industry concentration rates to analyze the impact of competition on productivity. However, such indicators cannot be treated as exogenous, since higher productivity of firms in an industry could lead to higher concentration in the market or higher prices.

Figure 1: Entry barriers across time



Source: Conway and Nicoletti (2006)

Figure 2: Degree of public ownership across time



Source: Conway and Nicoletti (2006)

6. Econometric Estimates

6.1. Regression results

In our econometric estimates, we test whether the degree of entry barriers (*ENT*) or public ownership (*PUB*) has a direct impact on TFP growth of the follower industry. The basic regression of our model includes also as explanatory variables, TFP growth in the leader industry and the term of the technology gap (*TG)*. In all regressions, we use year dummies to control for common aggregate productivity shocks. Furthermore, we have assumed the existence of industry specific effects across industries, to avoid obtaining spurious correlation estimates, which could be caused by endogeneity.

Equation (5.1) is a fixed effects (FE) specification which can be estimated with least squares after having included industry dummies in our regression. However, since fixed industry effects can be correlated with the explanatory variables and therefore, obtain biased estimates, we prefer the FE panel data estimator, which eliminates the fixed industry effects, by expressing all variables in their deviations from their means. We should note, that in panels with the time dimension higher than the number of cross sections (T>N) the FE estimator performs better than the generalized moments' estimator (Judson and Owen, 1999). In our case, the number of years ($T = 13$), is higher than the number of cross sections ($N = 9$).

Table 5 presents the regression results obtained for industries in Spain. As shown in Column 1, TFP growth of the leader industry is found to have a positive and significant effect on TFP growth of Spanish industries. The estimated parameter on TFP growth in Column 1 indicates that a 1% rise on TFP growth in German industries results in an increase by 0.12% on TFP growth of Spanish industries. Therefore, from the results provided in this column, it seems that outward shifts in the technological frontier influence the productivity of the follower industries in Spain.

Table 5: Fixed Effects Econometric Estimates-Spanish industries

Dependent variable: TFP growth								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
c	0.040* (3.22)†	0.040* (3.22)	0.039* (3.09)	0.068* (2.77)	0.021* (3.42)	0.021* (3.19)	0.021* (3.16)	0.033* (2.77)
TFP GER	0.122** (1.88)	0.123** (1.90)	0.124** (1.90)	0.119** (1.72)	0.114** (1.76)	0.115** (1.76)	0.120** (1.82)	0.124** (1.80)
TG	0.098* (5.03)	0.097* (4.99)	0.077* (2.48)	0.077* (2.44)	0.098* (4.97)	0.098* (4.94)	0.093* (4.61)	0.094* (4.64)
PUB	-0.012* (-2.57)	-0.013* (-2.63)	-0.012* (-2.44)	-0.023* (-2.80)				
ΔPUB		-0.008 (-0.68)	-0.008 (-0.68)					
TG*PUB			0.010 (0.86)	0.011 (0.93)				
ENT					-0.005* (-2.25)	-0.004* (-2.25)	-0.004* (-2.03)	-0.012* (-3.01)
ΔENT						-0.001 (-0.14)	-0.001 (-0.16)	
TFP GAP*ENT							0.005 (1.12)	0.006 (1.22)
R^2	0.268	0.272	0.279	0.335	0.256	0.256	0.267	0.340
Obs.	96	96	96	96	96	96	96	96
F-stat	10.40	7.86	6.42	2.66	9.76	7.24	6.07	2.72

† t-statistics included in parentheses.
* Significant at 5%.
** Significant at 10%.

Furthermore, the *TG* variable term enters positively and significantly, suggesting that industries that are lagging behind the technological frontier experience higher rates of productivity growth. As noted in Bournakis (2011), this variable captures the effects of technology transfer and is expected to be higher, the higher is the distance of an industry from the frontier. On the contrary, the lower is the value of the coefficient, the lower is the scope for further growth of the follower countries, since any capabilities of imitation have been exhausted and growth should lie now on innovation. The recent neo-Schumpeterian models of growth argue that if technology is free to flow across countries and industries, then productivity growth is a positive function of the technology gap between the follower country or industry and technological frontier.

In Columns 1-4 of Table 5, we estimate whether the degree of public ownership (*PUB*) has a direct impact on TFP growth, while in Columns 5-8, we estimate the TFP growth impact of entry barriers (*ENT*). Since these two measures of regulation are highly correlated, we preferred to estimate separately their individual effects. The results with respect to *PUB* indicate a significantly negative direct effect of public ownership on TFP growth and imply that a unit decrease of the degree of public ownership results in a 1.2% increase of TFP growth, ceteris paribus.

In Column 2, we extend our model to include any effects of the changes on the degree of public ownership (*ΔPUB*) on TFP growth. The results with respect to this variable are not statistically significant, however the estimated coefficient on the level of public ownership (*PUB*) retains its sign and statistical significance.

In Columns 3 and 4, we test whether the degree of public ownership has a indirect impact on TFP growth, through its influence on technological catching-up, by including as a regressor the interaction term *TG*PUB*. In this way, we aim to test the predictions of the neo-Schumpeterian growth model (Aghion et al., 2005), according to which a higher degree of regulation should have an indirect negative impact, by slowing down the catching-up process and reducing the ability of industries far from the technological frontier to adopt new technologies. The results with respect to this term are not statistically significant and do not provide us with any evidence that public ownership has an indirect negative impact on TFP growth.

In Columns 5-8 of Table 5, we estimate the TFP growth impact of entry barriers (*ENT*) on Spanish industries. The results with respect to this variable indicate the existence of a significantly negative relationship between entry barriers and TFP, as shown in Column 5. With respect to the remaining regressors included in the model, the results of Column 5 still indicate that higher TFP growth of German industries has a positive and significant effect on TFP growth of Spanish industries. Furthermore, the variable of the technology gap (*TG*) term enters positively and significantly, suggesting that industries that are lagging behind the technological frontier experience higher rates of productivity growth.

When extending our model to search for any effects of the changes on entry regulation (*ΔENT*), the results continue to confirm a significantly negative effect of entry barriers on TFP growth (Column 6). The results with respect to *ΔENT* do not provide us with any evidence for a statistically significant impact of changes on entry regulation on TFP growth. In Columns 7 and 8, we also test for the existence of indirect effects of entry regulation on TFP growth, by including as a regressor the interaction term *TG*ENT*. The results with respect to this term are not statistically significant, however, the results of these columns still indicate a significantly negative direct effect of entry barriers on TFP growth.

Table 6 presents the regression results obtained for industries in Italy. In Columns 1-4 of Table 6, we test whether the degree of public ownership (*PUB*) has any direct impact on TFP growth of Italian industries. The regression results with respect to this variable indicate non existence of any significant impact of this variable on TFP growth, a result which is confirmed in all regression estimates of Columns 1-4.

Also, the regression results of Columns 1-3, indicate that higher TFP growth of leader industries exert a positive and statistically significant (at 10%) effect on TFP growth of Italian industries. The magnitude of the estimated coefficient implies that

1% rise on TFP growth in German industries results in an increase by 0.13% on TFP growth of Italian industries.

Table 6: Fixed Effects Econometric Estimates – Italian industries

Dependent variable: TFP growth								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
c	0.010 (0.39) †	0.009 (0.35)	0.005 (0.20)	0.018 (0.48)	-0.002 (-0.32)	-0.002 (-0.36)	-0.003 (-0.45)	0.009 (0.67)
TFP GER	0 .137** (1.84)	0.142** (1.92)	0.140** (1.88)	0.104 (1.36)	0.135** (1.81)	0.135** (1.80)	0.134** (1.78)	0.105 (1.38)
TG	0.020 (0.93)	0.021 (0.98)	-0.032 (-0.28)	-0.021 (-0.19)	0.017 (0.79)	0.017 (0.79)	0.006 (0.25)	0.009 (0.35)
PUB	-0.002 (-0.37)	-0.002 (-0.43)	-0.001 (-0.26)	-0.003 (-0.35)				
ΔPUB		-0.024 (-1.53)	-0.024 (-1.51)					
TG*PUB			0.015 (0.48)	0.012 (0.38)				
ENT					0.0009 (0.47)	0 .0009 (0.47)	0.001 (0.67)	-0.001 (-0.32)
ΔENT						-0.001 (-0.19)	-0.002 (-0.23)	
TG*ENT							0.007 (0.70)	0.007 (0.72)
R^2	0.043	0.069	0.071	0.219	0.044	0.044	0.050	0.223
Obs.	96	96	96	96	96	96	96	96
F-stat	1.28	1.56	1.28	1.49	1.31	0.98	0.87	1.52

† t-statistics included in parentheses.
* Significant at 5%.
** Significant at 10%.

Furthermore, the estimated coefficient on the variable of the technology gap (*TG*) term is not statistically significant in all specifications. If this relationship holds, this suggests that the scope for further growth of Italian industries, through technological catch-up, has been exhausted. It may be possible, however, that there still remain obstacles for free flow of technology and, therefore, Italian industries cannot fully benefit by technology adoption from frontier industries and countries.

We have also included in our regressions the variables of *ΔPUB* and *TG*PUB*, to search either for any effects of changes on the degree of public ownership, or for the existence of an indirect impact of public ownership on TFP growth, respectively. However, the results with respect to both variables are not statistically significant and do not provide us with any evidence either that the change on the degree of public ownership has any effect on TFP growth, or that there exist indirect effects of public ownership through technological catch-up.

In Columns 5-8 of Table 6, we have estimated the TFP growth impact of entry barriers (*ENT*) on Italian industries. The results with respect to this variable do not indicate the existence of any statistically significant relationship between entry barriers and TFP. With respect to the remaining regressors included in the model, the results confirm that higher TFP growth in German industries has a positive and significant (at 10% level) effect on TFP growth of Italian industries. Furthermore, the coefficient on the variable of the technology gap (*TG*) is not statistically significant in all specifications. Finally, no significant results have been obtained with respect to the coefficients of the variables *ΔENT* and *TG**ENT*.

Table 7 presents the regression results obtained for industries in Greece. In Columns 1-4 of Table 7, we test whether the degree of public ownership (*PUB*) has any direct impact on TFP growth of Greek industries. The regression results are similar to those obtained for Italy and indicate non existence of any significant impact of the degree of public ownership on TFP growth, a result which is confirmed in all regression estimates of Columns 1-4.

The regression coefficient on TFP growth of the leader industry is not statistically significant and this indicates that Greek industries cannot benefit from technological progress and outward shifts in the technological frontier. Furthermore, the variable of the technology gap (*TG*) term enters positively and significantly, suggesting that industries that are lagging behind the technological frontier benefit from technological catch-up and experience higher rates of productivity growth.

Table 7: Fixed Effects Econometric Estimates – Greek industries

Dependent variable: TFP growth								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
c	-0.127 (-0.94)[†]	-0.175 (-1.22)	-0.173 (-1.18)	-0.032 (-0.17)	-0.029 (-1.14)	-0.023 (-0.72)	-0.023 (-0.71)	-0.005 (-0.11)
TFP GER	0.232 (1.08)	0.214 (0.99)	0.217 (0.99)	0.203 (0.88)	0.229 (1.08)	0.216 (0.99)	0.215 (0.98)	0.204 (0.89)
TG	0.140* (3.88)	0.145* (3.97)	0.120 (0.42)	0.168 (0.57)	0.149* (4.17)	0.149* (4.15)	0.150* (2.45)	0.153* (2.41)
PUB	0.027 (1.06)	0.035 (1.29)	0.035 (1.26)	0.006 (0.17)				
ΔPUB		-0.069 (-0.95)	-0.068 (-0.95)					
TG*PUB			0.004 (0.09)	-0.003 (-0.06)				
ENT					0.011** (1.86)	0.010 (1.47)	0 .010 (1.45)	0.001 (0.15)
ΔENT						0.005 (0.31)	0.005 (0.31)	
TG*ENT							-0.0004 (-0.03)	-0.0008 (-0.07)
R^2	0.141	0.150	0.150	0.201	0.162	0.163	0.163	0.201
Obs.	108	108	108	108	108	108	108	108
F-stat	5.29	4.19	3.32	1.53	6.20	4.63	3.66	1.53

[†] t-statistics included in parentheses.
* Significant at 5%.
** Significant at 10%.

The regression results with respect to *ΔPUB* (Columns 2-3) are not statistically significant and do not provide us with any evidence that the change on the degree of public ownership has any effect on TFP growth of Greek industries. Furthermore, the coefficient on the interaction term *TG*PUB* (Columns 3-4) is not, also, statistically significant.

In Columns 5-8 of Table 7, we have estimated the TFP growth impact of entry barriers (*ENT*) on Greek industries. The results with respect to this variable indicate non existence of any statistically significant relationship between entry barriers and TFP growth. Regression results with respect to the remaining terms included in the model do not change significantly in terms of sign and statistical significance.

At this point, it should be noted that competition and innovation are mutually endogenous (Aghion et al., 2005). In this context, it may be possible that regulation is endogenous and correlated with an idiosyncratic shock to aggregate productivity. To control for the presence of endogeneity between TFP growth and regulation variables of public ownership and entry regulation, we use instrumental variable regression by using as instruments the lagged values of these variables. The results with respect to public ownership and entry regulation presented in Table 8 confirm the results shown in Tables 5-7 and indicate that the degree of public ownership and entry regulation have a significantly negative effect on TFP growth only of Spanish industries.

Table 8: Instrumental variable estimates

Dependent variable: TFP growth									
	SPAIN			**ITALY**			**GREECE**		
c	0.027 (1.48)†	0.033* (2.77)	0.068* (2.77)	-0.006 (-0.37)	0.009 (0.67)	0.018 (0.48)	-0.013 (-0.16)	-0.005 (-0.11)	-0.032 (-0.17)
TG	0.079* (2.81)	0.094* (4.64)	0.077* (2.44)	0.009 (0.26)	0.009 (0.35)	-0.021 (-0.19)	0.153 (1.33)	0.153 (2.41)*	0.168 (0.57)
TFP GER	0.039 (0.55)	0.124** (1.80)	0.119** (1.72)	0.106 (1.39)	0.105 (1.38)	0.104 (1.35)	0.205 (0.89)	0.204 (0.89)	0.203 (0.88)
ENT		-0.012* (-3.01)			-0.001 (-0.32)			0.001 (0.15)	
TG*ENT		0.006 (1.22)			0.007 (0.72)			-0.0008 (-0.07)	
PUB			-0.023* (-2.80)			-0.003 (-0.35)			0.006 (0.17)
TG*PUB			0.011 (0.93)			0.012 (0.38)			-0.003 (-0.06)
R^2	0.318	0.340	0.334	0.219	0.223	0.219	0.201	0.201	0.201
Obs.	72	96	96	96	96	96	108	108	108
F-stat	27.45	38.57	37.66	20.87	21.33	20.86	31.42	31.43	31.43

† z-statistics included in parentheses.
* Significant at 5%.
** Significant at 10%.

6.2. Discussion

Overall, the regression results of this study indicate that entry regulation and public ownership have a direct negative effect only on TFP growth of Spanish industries. For Greece and Italy, the regression results do not provide us with any evidence that entry regulation and degree of public ownership exert a significant impact on TFP growth. It should be noted, however, that mixed or insignificant results, with respect to the impact of regulation, have, also, been obtained by Conway et al. (2006) and Inklaar et al. (2008).

Furthermore, we have been provided with preliminary evidence that technological catch-up is significant for productivity growth of Greek and Spanish industries, suggesting a large potential for catching-up with the frontier. Also, the regression results show that TFP growth of leader industries in Germany has a positive and significant effect on TFP growth of Spanish and Italian industries.

Overall, the results of this study show that entry regulation and/or the degree of public ownership are not associated with higher TFP growth of industries in southern Europe. We should note that Van Ark et al. (2008) have argued that, although there is a direction towards higher flexibility and liberalization in EU countries, the extent, as well as the impact of regulatory reforms, varies greatly across countries, a stylized fact that seems to be verified in this study[4].

In the same spirit, Alesina et al. (2005) have argued that the timing, extent and impact of liberalization differ across countries. They discuss that there is evidence that the marginal effects of deregulation on investment are higher when the policy reform is large or when changes start from already low levels of regulation. It could be argued, therefore, that southern European countries, having already delayed the adoption of structural reforms, are not yet in the position to benefit from lower degree of regulation in their economies.

[4] Convergence between Europe and the US, after the Second World War, has been mostly linked to the existence of institutions that favored imitation of foreign technology. In this context, Aghion et al. (2006) suggest that policies and institutions that facilitated imitation of technologies, are not suitable any more for further convergence and growth, since Europe now operates close to the productivity frontier. Therefore, the European economy should now build new institutions, which favor competition and are directed towards more integration within a single European market, which will, in turn, affect innovation and long run growth.

Industries of southern European countries still operate below the frontier, as indicated by the estimated significant effect of the technology gap on TFP growth. According to Acemoglu et al. (2006) we should not expect an immediate impact of lower regulation in such industries, since the effect of higher competition is stronger for industries operating close to the frontier, which rely more on innovation, rather than imitation, to achieve higher rates of productivity.

Mixed results, with respect to the impact of regulation variables on productivity, should not be viewed as evidence that countries of southern Europe should abandon their efforts to liberalize their economies. On the contrary, as indicated in the case of Greece, the existence of several institutional rigidities and public sector distortions are some of the reasons for lagging behind northern European countries (Angelopoulos and Philippopoulos, 2007; Angelopoulos et al., 2010).

7. Conclusions

The main purpose of this study was to assess the impact of entry liberalization, as well as of public ownership on TFP growth across industries of south European countries. The study was based on an econometric model of TFP convergence, in which Germany is the leader economy and Italy, Spain and Greece are the follower economies. Within this framework, TFP growth of the follower was modeled as a function of TFP growth of the leader, as well as of technological catch-up and deregulation variables.

We first, derived industry level measures of TFP growth for Italy, Spain and Greece as well as for Germany, based on growth accounting. Then, we estimated the impact of entry regulation and public ownership on industry level TFP growth, for the period 1995-2007, by using several panel data econometric methods.

The empirical results indicated that a higher degree of entry regulation and public ownership is significantly associated with lower TFP growth only in Spanish industries. The empirical results for Italy and Greece did not provide us with any evidence for a statistically significant impact of these variables on TFP growth. We attribute the mixed nature of our results to the fact that south European economies still operate below the productivity frontier and are still considered as highly regulated.

In this spirit, we may conclude that the long term costs of anti-competitive regulations are higher in countries that are lagging behind the technological frontier and are, relatively more regulated. This issue deserves more empirical attention, as to the differential impacts of deregulation depending on proximity to the productivity frontier and degree of regulatory restrictions.

References

Acemoglu, D., Aghion, P., Zillibotti, F., (2006), Distance to Frontier, Selection and Economic Growth, *Journal of the European Economic Association*, 4, 37-74.

Acemoglu, D., Johnson, S., Robinson, J., (2005), The rise of Europe: Atlantic Trade, Institutional Change and Economic Growth, *American Economic Review*, 95, 546-579.

Aghion, P., Bloom, N., Blundell, R., Griffith, R., Howitt, P., (2005), Competition and Innovation: An Inverted U Relationship, *Quarterly Journal of Economics*, 120, 701-728.

Aghion, P., Comin, D., Howitt, P., (2006), When does Domestic Saving Matter for Economic Growth?, *NBER Working Paper*, No.12275, Cambridge, MA: National Bureau of Economic Research.

Aghion, P., Griffith, R., (2005), *Competition and Growth: Reconciling Theory and Evidence*, MIT Press.

Aghion, P., Howitt, P., (2006), Joseph Schumpeter Lecture Appropriate Growth Policy: A Unifying Framework, *Journal of the European Economic Association*, 4, 269-314.

Alesina A., Ardagna, S., Nicoletti, G., Schiatarelli, F., (2005), Regulation and Investment, *Journal of the European Economic Association*, 3, 791-825.

Angelopoulos, K., Dimeli, S., Philippopoulos, A., Vassilatos, V., (2010), Rent Seeking Competition from State Coffers in Greece: A Calibrated DSGE Model, *Bank of Greece Working Paper*, No. 120, Athens, Greece: Bank of Greece.

Angelopoulos, K., Philippopoulos, A., (2007), The Growth Effects of Fiscal Policy in Greece, *Public Choice*, 131, 157-175.

Arnold, J., Nicoletti, G., Scarpetta, S., (2008), Regulation, Allocative Efficiency and Productivity in OECD Countries: Industry and Firm Level *Evidence, OECD Economics Department Working Paper*, No. 616, Paris: Organisation for Economic Cooperation and Development.

Barone, G., Cingano, F., (2011), Service Regulation and Growth: Evidence from OECD countries, *Economic Journal*, 121, 931-957.

Bartelsman, E., Haltiwanger, J., Scarpetta, S., (2009), Cross Country Differences in Productivity: The role of Allocation and Selection, *NBER Working Paper*, No.15490, Cambridge, MA: National Bureau of Economic Research.

Bena, J., Ondko, P., Vourvachaki, E., (2011), Productivity Gains from Services Liberalization in Europe, *CERGE-EI Working Paper*, No. 452.

Bournakis, I., (2011), Sources of TFP Growth in a Framework of Convergence-Evidence from Greece, *International Review of Applied Economics*, 26, 47-72.

Conesa, J., Kehoe, T., Ruhl, K., (2007), Modeling Great Depressions: The Depression in Finland in the 1990s, *Federal Reserve Bank of Minneapolis Quarterly Review*, 31, 16-44.

Conway, P., Nicoletti, G., (2006), Product Market Regulation in the Non-Manufacturing Sectors of OECD Countries: Measurement and Highlights, *OECD Economics Department Working Paper*, No. 530, Paris: Organisation for Economic Cooperation and Development.

.Conway P., Rosa, D., Nicoletti, G., Steiner, F., (2006), Product Market Regulation and Productivity Convergence, *OECD Economic Studies*, No. 43, Paris: Organisation for Economic Cooperation and Development.

Gogos, S., Mylonidis, N., Papageorgiou, D., Vassilatos, V., (2012), Greece 1979-2001: A (First) Great Depression Seen from the Basic RBC Model, *Economics*

Department Working paper, No. 01-2012, Athens: Athens University of Economics and Business.

Gust, C., Marquez, J., (2004), International Comparisons of Productivity Growth: The Role of Information Technology and Regulatory Practices, *Labour Economics*, 11, 33-58.

Inklaar, R., Timmer, M. P., Van Ark, B., (2008), Market Services Productivity across Europe and the US, *Economic Policy*, 23, 139-194.

Jones, B., Olken, B., (2005), The Anatomy of One Stop Growth, *NBER Working Paper*, No.11528, Cambridge, MA: National Bureau of Economic Research.

Judson, A., Owen, L., (1999), Estimating Dynamic Panel Data Models: A Guide for Macroeconomists, *Economics Letters*, 65, 9-15.

Kehoe, T., Prescott, E., (2002), Great Depressions of the Twentieth Century, *Review of Economic Dynamics*, 5, 1-18.

Kollintzas, T., Papageorgiou, D., Vassiltaos, V., (2012), An Explanation of the Greek Crisis: The "Insiders – Outsiders Society", Paper presented in the 11th Conference on Research on Economic Theory and Econometrics, 1-15-July 2012, Milos, Greece.

Nicoletti, G., Scarpetta, S., (2003), Regulation, Productivity and Growth: OECD Evidence, *Economic Policy*, 18, 9-72.

OECD (2012), STAN Industrial Database, Paris: Organization for Economic Cooperation and Development.

Parente, S., Prescott, E., (1994), Barriers to Technology Adoption and Development, *Journal of Political Economy,* 102, 298-321.

Prescott, E., (1998), Needed: A Theory of Total Factor Productivity, *International Economic Review*, 39, 525-551.

Scarpetta, S., Tressel, T., (2002), Productivity and Convergence in a Panel of OECD Industries: Do Regulations and Institutions Matter?, *OECD Economics Department Working Paper*, No. 342, Paris: Organisation for Economic Cooperation and Development.

Skountzos, T., Stromplos, N., (2011), Sectoral Capital-Output Ratios and Capital Intensity in the Greek Economy, in Balfoussias, S., Hatzipanayotou, P., Kanellopoulos, C., (Eds), *Essays in Economics*, Athens, Greece: Centre of Planning & Economic Research.

Solow, R., (1956), A Contribution to the Theory of Economic Growth, *Quarterly Journal of Economics*, 70, 65-94.

Van Ark, B., O' Mahony, M., Timmer, M., (2008), The Productivity Gap between Europe and the United States: Trends and Causes, *Journal of Economic Perspectives*, 22, 25-44.

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No 82 P. Baltzakis, “The Need for Industrial Policy and its Modern Form”. Athens, 2006 (in Greek).

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No 3 J. Dutta and H. Polemarchakis, “Credit Constraints and Investment Finance: No Evidence from Greece”. Athens, 1990, in M. Monti (ed.), *Fiscal Policy, Economic Adjustment and Financial Markets*, International Monetary Fund, (1989).

No 2 L. Athanassiou, “Adjustments to the Gini Coefficient for Measuring Economic Inequality”. Athens, 1990.

No 1 G. Alogoskoufis, “Competitiveness, Wage Rate Adjustment and Macroeconomic Policy in Greece”. Athens, 1990 (in Greek). Published in: *Applied Economics*, vol. 29, 1997.