Market Structure, Education and growth

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Abstract

In a modern globalised economic environment, firms and national economies alike seek for growth and competitiveness advantages through specialized knowledge and innovation. In this context, human capital accumulation plays an exceptionally important role. The positive effects of human capital on economic growth have long been recognized and tested, but mostly at the macroeconomic level, while limited emphasis has been placed on the microeconomic side. In this study we will investigate the influence of human capital on growth rates at the firm level. Using data from Greek manufacturing and panel data techniques, we =estimate an empirical model where human capital appears as one of the independent variables. Our results suggest that, after controlling for other variables such as firm size, physical investment, efficiency, human capital has a positive and significant impact on the growth rates of firms.

Keywords: Education; Human Capital; Growth

JEL Classification: D21, J24, L6

1. Introduction

"Knowledge is power", this is a motto widely used in western nations during the last decades, based on the fact that the creation of new knowledge and the implementation of innovative methods in production generate competitive advantages thus becoming the main source of economic growth and development.

In the highly competitive environment of the global market, the role of education became more important since it has been proved that personnel with high level of education is a determining factor of the research and innovation process, thus facilitating improvements in productivity and competitiveness.

Our research focuses on the relationship between the growth of companies and the educational level of their employees. Nowadays, in the era of the so called knowledge based society, this relationship needs to be explored and exploited as much as possible.

In the international literature, studies conducted so far focusing on the relationship between education and economic growth, verify a positive long-term relationship and tend to recommend an increase in the investment of human capital.

This paper focuses on the microeconomic level, investigating the relationship between the educational level of employees and the growth rates of Greek manufacturing firms, as reflected by their profitability indicators (with the use of a random sample for the 2004-2008 period).

The paper is structured as follows: The literature review in Section 2 describes the impact of education on economic performance. In Section 3, the description of the methodology and data used is provided. In Section 4, we present an empirical model of firm profitability and estimate it with the use of panel data econometric techniques. In Section 5 we analyze the education – growth relationship conditioned on the level of industry competition. Finally, Section 6 concludes the paper.

2. Literature Review

The interest of economists in economic growth increased during the late 1950s. Growth accounting experts, such as Abramovitz (1956) and Solow (1957), found that improvements in the quality of the labour force may be an important part of the explanation in order to account for growth residuals. Other empirical observations validate that part of organizations' growth during the post-war period was due to increases in the educational level of their labour force (Denison, 1967, Griliches 1970). All the above influenced the perception about the role of education and actually, after World War II, at almost all western economies, an exceptional role was assigned to education, based on the belief that it could be used as a tool to balance social inequalities and improve economic potential along with giving a boost to the growth of living standards Mincer, 1958, Ben-Porath, 1967). Under the influence of this trend, which was characterized as the "social paradigm of education" (Neave, 1989), economists studying the educational field focused on the study of human capital and the research for the benefits of investing in knowledge.

Studies from the early 1960's (Schultz, 1961, Becker 1962) that investigate the economic effects of investment in knowledge, pointed to the significant influence of human capital on country growth and confirmed that economies with well educated employees exhibited higher growth than those with lower levels of education. Denison (1966) tried to determine the impact of factor productivity on industry growth of post-war America and concluded that the quality of human resources was more significant than its quantity. Mincer (1962), investigating at a microeconomic level, pointed out that investment in learning by doing (on-the-job training) was equally important as formal education.

These observations laid down the theoretical background for subsequent research. However, in the 1970's the educational system was highly criticized, mostly due to the low growth rates of economies with highly educated employees. Phenomena like the deceleration in growth rates in economies where the number of graduates from educational institutions increased ("over-education"), as well as the high unemployment which was observed in western economies associated with the highly educated employees, limited the interest in human capital theory. According to this view, education leads to a number of economic problems (screening or signaling theories, Stiglitz, 1975, Spence, 1974) and the educational system is being managed selectively (Arrow, 1973) without supporting the lower social classes, and as a result, the system itself is producing social discrimination (segmented labor market theories, Cain, 1976).

This dispute of the 1970's ended up with the appearance of new technologies which were afterwards used in the production process in the beginning of 1980's. The theory of endogenous growth which appeared during this period (Romer, 1986, 1990, Lucas, 1988 and Scott, 1989) examines the interaction of technological progress and human capital. According to this theory, investment in technological research as well as in education and professional training strengthens growth endogenously by increasing labor quality and productivity (Romer, 1994). Observations based on endogenous growth theory, found that higher labor specialization facilitates technology adoption (Benhabib and Spiegel 1994) and is associated with higher rates of growth in competitiveness and productivity (Blundell, 1999). Schultz (1993) pointed out that evolution of knowledge contributed decisively in the growth rates of organizations.

Nevertheless, during the late 1990's other researchers, with the use of different econometric models (panel data instead of cross-section data), produced new disappointing conclusions about the impact of education in total growth. Thus, new doubts were raised concerning investment in human capital and brought new skepticism concerning this issue (Caselli et al, 1996, Pritchett, 2001). Subsequent studies attributed the negative correlations to the insufficient data that were used, mainly at the microeconomic level (Temple, 1999, Cohen and Soto, 2007) and pointed out the importance of using qualitative data (Apergis *et al*, 2009). Studies that managed to collect their data more carefully and used modern econometric and sampling methods (taking also into consideration the possibility of errors), suggested that the high level of education of employees significantly affects the development of organizations and the economy as a whole (Fuente and Domenech, 2006).

Recent empirical studies (Agiomirgianakis *et al*., 2002, Psacharopoulos and Patrinos, 2004) verify the positive relationship between education and firm performance. Employees with specialized knowledge possess particular capabilities such as communication and decision making, problem solving and team working skills, as well as the ability to adapt to continuously changing environments, thus tending to behave more professionally in their daily tasks.

In addition, it is now broadly accepted in the relevant literature that human capital may even outweigh physical capital in creating competitive advantage. Youndt *et al.* (2004), using data from 208 organizations, found that investment in human capital is more effective than investment in other forms of capital. Griffith *et al.* (2004), examining the determinants of productivity growth in a panel of industries across twelve OECD countries, found that human capital stimulates growth directly through innovation and, also, indirectly through technology transfer.

Lewis (2005) provides support for the link between human capital and technology adoption using data on human capital and levels of automation in manufacturing across U.S. cities. He shows that cities with lower human capital (due to low-skilled immigration) have lower levels of automation, even within narrowly defined industries.

Chen et al. (2005), using data for Taiwan stock exchange listed companies, showed that intellectual capital (i.e. human capital plus structural capital) contributes significantly to firm profitability. Similar results were also obtained by Switzer and Huang (2007) for a sample of mutual funds in Canada. They found that the performance of mutual funds is directly related to managerial human capital characteristics. On the other hand, Bollen *et al.* (2005) point out that the strongest association of human capital to organizations' performance is depicted in industries which are characterized by extremely competitive conditions.

3. Data and Methodology

The empirical analysis in this paper is based on a panel of 400 manufacturing firms that were active in years 2004, 2006 and 2008. The database used is provided by ICAP Hellas which collects balance sheet and demographic data for S.A. and Ltd companies in Greece.

The data used include:

- Demographic Statistics (Foundation year, Location of the Head office, Legal status, size and sector).
- Economic Statistics (sales, profits, capital, exports, R&D expenditure).
- Employment Statistics (number of employees in full-time equivalent units - FTE)

The above data were combined with information about the employees' education level, obtained through a telephone questionnaire survey.

The final dataset includes 287 companies for the years 2004 and 2006 (a total of 574 observations) for which all necessary information was acquired[1]. The variables which have been taken into account are:

- Deflated sales growth.
- Age (year t minus establishment year, in logarithmic form)
- Firm Size (natural logarithm of sales).
- Investment (the growth rate of gross fixed capital formation)
- Firm profitability (ROI, net profits before tax divided by sales)
- Export Performance (X, exports as a percentage of sales)
- Assets turnover (Sales divided by total assets)
- Leverage (Debt divided by total liabilities)
- Human Capital (number of employees with university degree as a ratio to total employment)
- R&D intensity (R&D expenditure divided by sales)
- Industry concentration (Herfindahl index of the relevant 4-digit industry)
- Athens dummy (Dummy variable taking the value 1 if the firm is located in Athens, 0 otherwise)
- Thessaloniki dummy (Dummy variable taking the value 1 if the firm is located in Thessaloniki, 0 otherwise)

[1] Regarding the Sales variable we collected also data for 2008, in order to calculate the Growth variable.

4. The Empirical Model

The empirical model developed draws from the resource-based view of the firm. According to this approach (see for example Jovanovic, 1982, and Wernerfelt, 1984), the fundamental determinants of company performance are specific firm-level resources and capabilities. Firms follow heterogeneous historical development paths and, as a result, they generate different skills and competences, which are expected to affect their performance more than the characteristics of the environment where they operate.

This approach underlines that success is not a result of a simple investigation of the external environment for market needs and opportunities, but results mainly from the creation and development of certain advantages of the enterprise. Consequently, success is connected to specific resources that are unique for the enterprise and difficult to be imitated by other enterprises. Such measurable characteristics include financial resources (own funds, borrowed funds), natural resources (size of the enterprise, capitalization) and intangible resources (human capital, innovation, which is approximated by R&D expenditures, and commercial resources such as trademarks, reputation etc. which are approximated by advertising expenses and export activities).

Based on the theory and empirical findings in the relevant literature, we endeavoured to include in the empirical model indicators (proxies) for all the above mentioned three categories of resources, given our data limitations. We also included the industry concentration variable in order to test for the effect of competition on growth rates. The empirical model we estimated (with the panel data cross-sectional weights technique) is specified as follows:

GROWTH = F(Size, Age, Investment, Human Capital, Assets Turnover, Leverage, Exports, Profitability, R&D, Concentration, Athens dummy, Thessaloniki dummy)

Table 1 shows the regression results for this model:

Table 1: Determinants of growth

	No. of observations: 574	**No. of observations: 574**
	(a)	**(b)**
SIZE	-0.0004***	-0.0004***
	(2.633)	(2.824)
AGE	-0.0031***	-0.0039***
	(3.025)	(3.442)
INVESTMENT	0.0002***	0.0028***
	(7.602)	(7.514)
HUMAN CAPITAL	0.8164***	0.8734***
	(6.108)	(6.832)
ASSETS TURNOVER	0.0003***	0.0004***
	(4.914)	(5.235)
LEVERAGE	-0.0502	-0.0433
	(1.023)	(0.982)
EXPORTS	0.2323***	0.2545***
	(3.435)	(3.811)
PROFITABILITY	0.4921***	0.5625***
	(4.359)	(4.755)
R&D	0.1004***	0.0906***
	(3.296)	(3.692)
CONCENTRATION	0.1204	0.0936
	(0.958)	(1.293)
DUMATH	0.2423***	-
	(7.581)	-
DUMSAL	0.0682	-
	(1.135)	-
Adj. R^2	**0.807**	**0.753**

* Significant at the 10% level (two-tailed test).
** Significant at the 5% level (two-tailed test).
*** Significant at the 1% level (two-tailed test).
t ratios are in parentheses. Standard errors are White heteroskedasticity consistent.
All equations include 2-digit sectoral dummies to control for heterogeneity among 2-digit industrial sectors.

The above results are in line with other studies, either for the Greek economy or internationally (Voulgaris *et al.* 2005, Agiomirgianakis *et al.* 2006, Heshmati 2001, Fu *et al.* 2002). The estimated coefficients have the expected signs and the overall explanatory power of the model is high. We discuss below the results for each variable:

- The size of enterprises: as we see in Table 1, the size of enterprises affects their growth negatively. This means that small enterprises grow faster than larger ones, contrary to the Gibrat's law of proportionate effect but in accordance with the empirical literature.
- The age of enterprises: age is found to be a significant determinant of growth with a negative sign. It seems that young firms are more dynamic than the older ones since the latter, being in the market for a longer time period, are closer to their long-run equilibrium scale of operation.
- New investment positively affects the growth of enterprises. This result confirms that investing in new capital is one of the most reliable options for firms aiming at increasing their growth performance.
- The assets turnover variable, which is a proxy for managerial efficiency, is a significant positive determinant of firm growth. This result validates the Jovanovic theory, according to which efficient firms grow and survive while inefficient firms decline and fail.
- Exports: the effect of the export activity on the growth of enterprises is positive and significant. Export orientation is a strategy which gives firms opportunities to expand (and take advantage of scale economies) through the penetration into large international markets.
- Profitability also affects significantly the growth rates. Internally generated funds allow firms to invest in capital equipment and R&D activities, thus leading to higher growth.
- The regional dummies: the information from the estimation of equation (a) shows that the location in the broader Athens area offers larger growth opportunities than any other region in Greece. This could be attributed to the concentration of activities and public and other services in Athens and the positive external economies that this fact implies.
- The concentration variable is insignificant. This is an indication in favor of the resource-based view of the firm, since it shows that, after properly controlling for the individual resources of firms, industry characteristics (such as the degree of competition), may not be significant in determining firm performance.
- Last but not least, human capital, which is the focal point of our study; moreover, its role has not been investigated up to now in other relevant studies of firm growth (at least for Greece). Human capital has a positive and particularly significant effect on the growth rates of firms, after controlling for the effect of all other relevant variables. This result stresses the importance of the highly specialized personnel (and the high levels of productivity that it implies) for the successful performance of an enterprise.

5. Human Capital, Concentration and Growth

As noted earlier, some researchers argue (e.g. Bollen et al., 2005) that the relationship between human capital and firm performance is complicated and depends on the degree of competition of an industry. While it has been found that human capital has a significant impact on performance in highly competitive industries, this relationship has not been investigated for less competitive industries so far.

In order to test the above argument empirically we proceeded as follows: We assumed that the degree of competition of an industry can be approximated by the corresponding concentration index. Using data for sales for all enterprises that are included in the ICAP database we constructed Herfindahl indices of concentration for all manufacturing industries. We then proceeded to divide our sample to two subsamples of 125 firms belonging to high-concentration industries and low-concentration industries respectively (excluding 37 firms in the medium concentration category) and estimated our empirical model separately for each subsample. The results are presented in Table 2 below:

Table 2: Determinants of growth by industry concentration group

	Low-concentration industries (Equation 2a)	**High-concentration industries (Equation 2b)**
	No. of observations: 250	**No. of observations: 250**
SIZE	-0.0002***	-0.0002***
	(3.829)	(6.3652)
AGE	-0.0019***	-0.0027***
	(4.788)	(5.644)
INVESTMENT	0.0002	0.0004***
	(1.182)	(4.545)
HUMAN CAPITAL	0.6689***	0.8644
	(6.857)	(1.165)
ASSETS TURNOVER	0.0002***	0.0002**
	(3.863)	(2.486)
LEVERAGE	-0.0313	-0.0274
	(0.504)	(0.644)
EXPORTS	0.0754***	0.3133
	(3.5171)	(1.144)
PROFITABILITY	0.0108	0.8606***
	(0.475)	(9.245)
DUMATH	0.2036***	0.2029***
	(8.555)	(15.091)
DUMTHESS	0.0524	0.5808
	(1.078)	(1.065)
Adj. R^2	**0.673**	**0.709**

* Significant at the 10% level (two-tailed test).
** Significant at the 5% level (two-tailed test).
*** Significant at the 1% level (two-tailed test).
t ratios are in parentheses. Standard errors are White heteroskedasticity consistent. All equations include 2-digit sectoral dummies to control for heterogeneity among 2-digit industrial sectors.

The above results reveal some interesting differentiations: investment in physical capital leads to a significant increase in profitability in less competitive (high concentration) industries (equation 2b), while their effect is insignificant for the more competitive (low concentration) industries (equation 2a). *Exactly the opposite is true for the human capital variable* (thus confirming the hypothesis expressed before). It seems that in less competitive industries (i.e. oligopolistic or monopolistic), large firm sizes (which imply large market share), investment in physical capital and managerial efficiency are sufficient for a firm to be profitable while human capital (and the innovations that it generates) is not necessary, since firms have already well established market shares. On the other hand, in competitive industries the human capital variable is very important for firms in order to gain competitive advantages through new and innovative ideas created by the highly skilled staff, while investment in physical capital is less productive, probably because they require a considerable time lag in order to be operational.

In a similar manner, exporting firms grow faster in competitive industries, since these firms have been more exposed to the highly competitive international environment and their managers have learned how to operate successfully under the specific circumstances. No impact of the export variable on firm growth has been registered in non-competitive industries.

6. Conclusions

In this study we attempted to investigate the relationship between the educational level of human resources and the economic performance of enterprises as (the latter being proxied by growth rates). We developed and estimated an empirical model based on a random sample of 287 Greek enterprises. The econometric results showed the positive and significant effect of human capital on the growth path of Greek enterprises, on top of confirming the importance of certain factors already investigated by other researchers. The above conclusions are valid mainly for those industries which are more competitive, while the impact of human capital on firm growth in less competitive industries is not found to be significant.

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