World Academy of Science, Engineering and Technology
International Journal of Industrial and Manufacturing Engineering
Vol:9, No:4, 2015

Innovative Activity and Firm Performance: The Case of Eurozone Periphery

Ilias A. Makris

***Abstract*—**In this work, we attempt to analyze the contribution of innovative activities to firm performance and growth. We examine economic data from some of the economies that were heavily affected by current economic crisis: the countries of southern Europe (Portugal, Italy, Greece and Spain) and Ireland. Following literature, an appropriate econometric model is developed and several indicators are tested in order to disclose possible relation with innovative activity. Findings confirm the crucial effect of innovative process in economic activity, in firm and country level.

***Keywords*—**Eurozone Periphery, Firm Performance, Innovative activity, R&D.

I. Theoretical Background

THE countries of southern Europe (Portugal, Italy, Greece and Spain) and Ireland were heavily affected by the global financial crisis. Their economies, are also called as PIIGS (or GIIPS), acronyms that were firstly introduced in the 90s' and even though not 'politically correct' are broadly used by the majority of analysts describing the inability of those countries to confront successfully sovereign debt. The result of the debt crisis was the implication of very 'hard' austerity measures and cut-offs in public spending leading to a large reduction in GDP and in a violent burst in unemployment. The vicious circle of recession is generally admitted to be the most crucial problem, for those economies and specific policy measures and reforms are necessary in order to spur development and growth.

In this paper, we focus on one of the factors that are considered to be directly related with growth, the innovative process. Active Research and Development appeared to be a major factor for technological and economic progress. Various surveys from previous decade highlight already the strong positive relation with financial performance, along with fast rates of growth [1]. As a result, focused policies should be established in order to encourage and support innovative firms (especially Start-ups and NTBFS), as they seem to contribute to economic prosperity directly (in terms of turnover, profitability, etc.), and indirectly (employment, establishment of new technologies etc.).

In a more recent work, [2], following OECD view, underline that, "the interest in innovation spans from the firm level to the national level... as countries can achieve higher rates of growth and favorable terms of trade by specializing in knowledge intensive products with higher added value [and because of that,] policy makers across the globe have been struggling to develop policies which would stimulate spending on R&D activities and increase the efficiency of the innovation process" (p.353). In their survey, they found that investment in innovation activities, affect positively the innovation output (sales of new products) resulting also in better productivity. In the line of that, [3] claimed that R&D increases the level of sector's performance and national economic performance, diffusing innovative products (p.990), while [4] found that R&D process is correlated positively with productivity growth and sales, especially in high-tech sectors (p.492). Analyzing European enterprises, [5], concludes that innovative firms are more likely to grow than non-innovative firms. However, no clear relation with profitability seems to exist.

The contribution of innovative firms (mainly SMEs) to economic growth has been also underlined by [6], while [7] conclude that innovative firms, even during economic recessions, seem to increase their employment and sales (p.120). In a survey for Chinese firms [8] finds that R&D performers are more concentrated among capital-intensive firms with large sales' volumes. Research works for Greece [9], [10] also find that firms performing innovative activities enjoy higher rate of growth in turnover and employment, than sector's average.

Apart from sales and revenue, innovative activity seems also to affect positively exports' volume, another very crucial factor of growth in firm and country level. [11], [12], conclude in a positive relation between innovative activity and exporting performance, underlining that, firms, wishing to export, should first reach an initial level of R&D. A survey for Japan [13] shows that international R&D activities (enhanced by the existing research capabilities) increase performance and growth of the (pharmaceutical) firms. Using various statistical models and interpreters on measuring exporting activity in food products' sector, [14] also finds that in all calculations, innovative activity has the larger and stronger contribution in the volume of exports.

Even though the contribution of R&D in economic growth seems to be more than obvious, most of the countries of euro periphery that we are focused on, present poor performance. More specific, Portugal Italy Greece and Spain present lower R&D expenditures and high-tech exports, than most of the other Euro zone countries-members, while two of them (Portugal and Greece) are in the last place. Only Ireland's high-tech exports are more than 20% of its total exports, however a reduction of almost 50% is appeared too in the last

I. A. Makris is with the Accounting and Finance Department, Technological Educational Institute of Peloponnese, Antikalamos Messinias, 24100, Kalamata, Greece (phone: +30-27210-45256, e-mail: elimak@teikal.gr, elimak99@yahoo.com).

decade.

Figs. 1 and 2 presents the average percentage of high-tech exports and R&D expenses accordingly, for the last 25 years, among several group of countries: i) Southern European countries and Ireland (PIIGS), ii) Euro-12 countries[1] and iii) a random group, including Euro-12 countries along with selected large developed countries (Japan, USA, Australia, Canada and UK). The data are collected and analyzed, from world data bank.

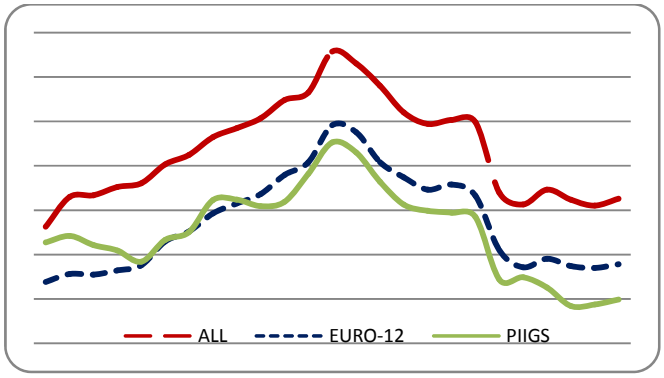

Fig. 1 High-tech exports (% of manufactured exports)

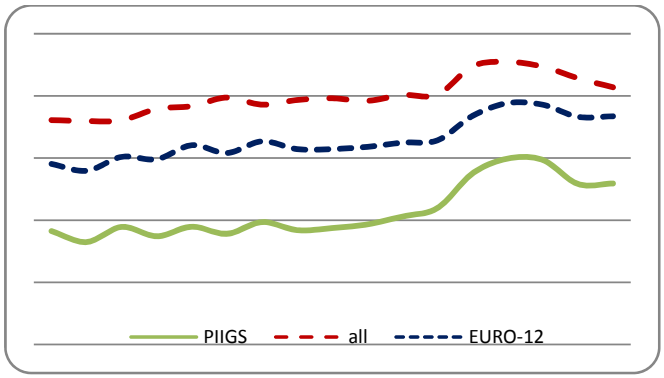

Fig. 2 R&D expenses (% of GDP)

As it is clear, Innovative activity is rather low in countries of European periphery. Figs. 3-5 show the relation between high-tech exports, GDP and unemployment. Confirming literature, a clear positive relation seem to exist, as the higher the exports of highly innovative products, the higher the GDP ratio, and the lower the rate of unemployment and vice versa. Thus, economies investing in innovation, appear higher exporting activity and as a result, higher productivity and employment.

II. Data and Methodology

In this work, we attempt to examine the effect of innovative activity in Euro periphery countries, highlighting the need for policy measures to spur such activities. Economic data of listed firms from various sectors from Portugal, Italy, Ireland, Greece and Spain are analyzed, in order to examine the relation (if any) between innovative activity and firm performance. The period examined is between 2002 and 2012, including both periods of prosperity and recession (current economic crisis).

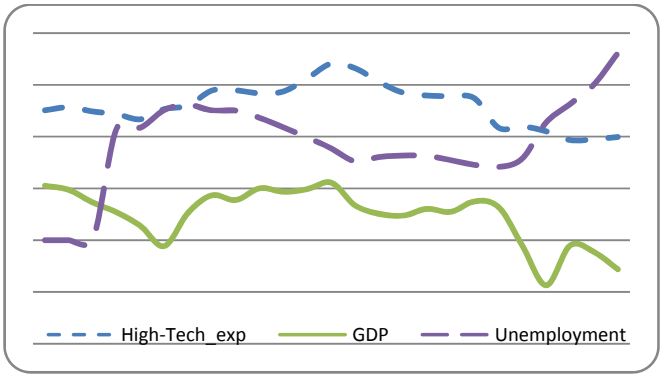

Fig. 3 High-Tech Exports (S. Europe and Ireland-PIIGS)

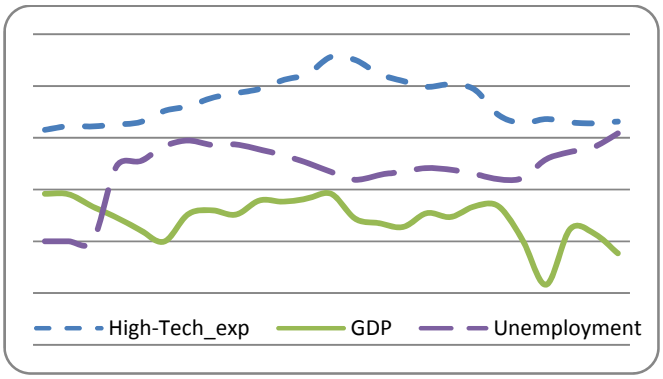

Fig. 4 High-Tech Exports (Euro-12 countries)

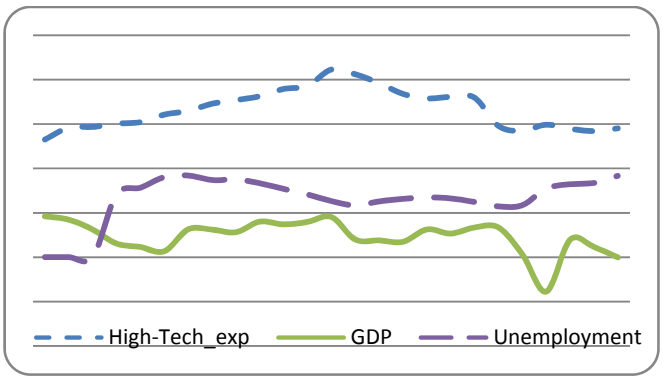

Fig. 5 High-Tech Exports (All countries)

From an initial sample of 390 listed firms from the five countries, after excluding missing cases, 200 were randomly selected and analyzed: 100 non innovative and 100 that was presented active R&D activity. The criteria were the continuous R&D expenses for the period examined and whether firms use and/or introduced patents in those years.

A binary variable was created in order to classify innovative (1) and non-innovative (0) firms. That classification will be the dependent variable in the empirical model (INV). As [5] underlings (see also [15]), numerous financial and non-

[1]We focus on Euro-12, as all those countries were members of Euro zone for the whole period examined.

financial variables exist in literature, as reliable measures of performance (such as profits, sales, market share, debt ratios and stock prices). Thus, for the next step of the analysis, several widely used economic and financial characteristics are selected, analyzed and tested, in order to disclose possible relation with innovative activity. The calculation used for all explanatory variables is the following[2]:

$$Change(i)_{02-012} = \frac{\text{Average(i)}_{09-012} - \text{Average(i)}_{02-05}}{\text{Average(i)}_{02-05}} \quad (1)$$

where i = the variables included in the analysis

As analyzed previously, innovative activity appears in various surveys to be positively correlated with economic performance and/or growth. In order to test whether that is the case for our sample of firms from southern Europe and Ireland, we use some of the most popular financial indicators that are broadly accepted as reliable measures of performance. A brief theoretical justification for each interpreter is presented in the rest of this section, along with their codification for the empirical analysis.

Fixed Assets (FA): Net capital growth (measured by the yearly volume of net fixed assets) is considered to be a source of motive power for firms, increasing long-run growth and employment [16] and affecting positively cash flow and profitability [17], [18].

Basic Earning Power (BEP): It is calculated as the EBIT-to-Total Assets, and it reveals the true economic strength of a company. The BEP ratio is included in several surveys [for a synopsis of some of them, see for example Pastor and Veronesi 2003, in [19], p.1570, [20], [18]. A large value indicates that its assets are used effectively, generating profits and contributing to firms performance.

EBITDA: It is one of the most popular and broadly used indicators of financial performance. Even though some theoretical problems are underlined by few analysts, it is used in numerous surveys and reports, as an indication of profitability (see for example [21], [22]).

Return On Invested Capital (ROIC): Indicates the efficiency and profitability of a company's capital investments. Reveals the effective use of capital in profitable investments, providing a sense of how well a company is using its money to generate returns. It is crucial for a firm to be able to generate profits, using its capital.

Total Debt to total Equity (LEV 1): It is the most well known financial leverage ratio, indicating firm's capital structure. It reveals firm's ability to repay all creditors, and the degree to which a business is utilizing borrowed money [23], [18].

Total Debt to total Assets (LEV 2): A financial indicator, implying firm's ability to serve its loan, through the assets. It is also used as a financial leverage ratio [24], [19], although it is not a clear one. It reflects debt ratio, relative to firm assets, and it is a strong indicator of survival and growth prospects.

[2]All financial data comes from officially published data in firms' financial statements (yearly) and they have been collected from Worldscope data bank

Finally, as we examine listed firms, two stock performance indicators will be included in the analysis, i) Stock Return: The average change in stock return for the period examined, and ii) Earnings Per Share (EPS): Indicates the available return that a company (stock) offers to its shareholders.

III. Model Specification and Findings

In order to examine the effect of innovative activity on firm performance we use Binary Logistic regression model, an appropriate method for binary dependent variables. The software used for the analysis is IBM SPSS, v.18 and v.20. In Tables I-III, model's performance is presented. As output indicates, the significance is at 1% level, and scores of R square (Cox and Snell and Negelkerke) rather adequate, with more than 40% of the cases examined to be explained by the model. That is higher than other research work with similar datasets (see indicatively [25], [26], [19]). Furthermore, the predictability of the model is very high for group -0- (non-innovative firms) and rather adequate for group -1- (innovative firms), providing an overall percentage of correct predictions, of 85%.

TABLE I
Model Performance

		Chi-square	df	Sig.
Step 1	Step	73.555	8	.000
	Block	73.555	8	.000
	Model	73.555	8	.000

TABLE II
Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Negelkerke R Square
1	167.306[a]	.308	.440

a. Estimation terminated at iteration number 9 because parameter estimates changed by less than .001

TABLE III
Classification Table [a]

			Predicted		
	Observed		INV		Percentage Correct
			0	**1**	
Step 1	**INV**	**0**	138	4	97.2
		1	26	32	55.2
	Overall Percentage				85.0

a. The cut value is .500

Findings presented in Table IV, indicate that innovative firms present better profitability (EBITDA and BEP). Basic Earning Power appears to be strongly associated with innovation, relative to all other interpreters, as Exp(B) score highlights. Thus, it seems to be confirmed that innovative activity leads in productivity growth and higher profitability. Another truly crucial point is the negative relation between innovative activity and debt accumulation. Leverage appeared to be reduced in innovative firms for the period examined, which means that those firms, even during a severe recession, not only generate profits, but also, they manage to deleverage their Balance Sheets, reducing debt.

Finally, innovative firms seem to offer higher return (stock

return) than non-innovative, which could be a slight but interesting indication of market performance of those firms, even during severe financial crisis, making those stocks (and firms), more secure for potential investors.

TABLE IV
REGRESSION'S OUTPUT [a]

	B	S.E.	Wald	df	Sig.	Exp(B)
FA	-.224	.230	.946	1	.331	.799
LEV_2	.110	.164	.446	1	.504	1.116
EBITDA	.295	.129	5.182	1	.023	1.343
ROIC	-.006	.010	.309	1	.578	.994
RET	.255	.095	7.268	1	.007	1.291
BEP	.819	.242	11.485	1	.001	2.268
EPS	-.011	.015	.559	1	.455	.989
LEV_1	-.264	.079	11.054	1	.001	.768
Constant	.331	.325	1.037	1	.308	1.393

a. Variable(s) entered on step 1: TA, LEV_2, EBITDA, ROIC, RET, BEP, EPS, LEV_1

IV. CONCLUSIONS

In the present paper, we attempt to examine and highlight the positive effects of innovative activity in firm performance, focusing on the countries of southern Europe (and Ireland), that are mostly affected by current financial crisis. After recorded an analyzed several performance indicators of innovative and non-innovative listed firms, we find that innovative firms appear to be more profitable, provide investors with higher market returns and they have manage even during current sovereign debt crisis to reduce their liabilities. The latter strongly indicates the crucial role of innovative activity in economic growth, in firm and country level. Thus, the continuous cut-offs in spending to that direction the last years, should be stop, and specific policy measures and motives should be established in order to spur firms to develop innovative products or processes.

REFERENCES

[1] D. J. Storey and B. S. Tether, "New technology-based firms in the European Union: an introduction," Research Policy, Vol. 26, pp.933–946, 1998.
[2] I. Hashi and N. Stojcicc, "The impact of innovation activities on firm performance using a multi-stage model: Evidence from the Community Innovation Survey 4," Research Policy, vol. 42, pp. 353– 366, 2013.
[3] M. Delapierre, B. Madeuf, and A. Savoy, "NTBFs: the French case," Research Policy, vol. 26, pp.989–1003, 1998.
[4] M. Kafouros, "R&D and productivity growth: evidence from the UK," Economics of Innovation and New Technology, Vol. 14, No. 6, pp.479–497, 2005.
[5] P. Koellinger, "The relationship between technology, innovation, and firm performance—Empirical evidence from e-business in Europe," Research Policy, Vol.37, pp. 1317–1328, 2008.
[6] R. Ferguson and C. Olofsson, "Science parks and the development of NTBFs: location, survival and growth," Journal of Technology Transfer, vol. 29, pp.5–17, 2004.
[7] E. Autio and A. Parhankangas, "Employment generation potential of new, technology-based firms during a recessionary period: the case of Finland," Small Business Economics, vol. 11, pp.113–123, 1988.
[8] G. Jefferson, B. Huamao, G. Xiaojing, and Y. Xiaoyun, "R&D performance in Chinese industry," Economics of Innovation and New Technology, vol. 15, No. 4–5, pp.345–366, 2006.
[9] G. Tselekidis, R. Rafailidis, I. Makris, and N. Vernardakis, "Globalization, technological flows and employment" (in Greek), Globalization and Modern Society, Special volume of National Centre for Social Research, Athens, pp.199–218, 2003.
[10] I. A. Makris, "The factors affecting firms' growth: investment in tangible versus intangible assets in the Greek pharmaceutical industry," International Journal of Behavioural and Healthcare Research, Vol. 1, No. 1, pp.91–104, 2008.
[11] M. Bleaney, and K. Wakelin, "Efficiency, innovation and exports," Oxford Bulletin of Economics and Statistics, vol. 64, No. 3, pp.3–15, 2002.
[12] I. Filatotchev, X. Liu, T. Buck, and M. Wright, "The export orientation and export performance of high-technology SMEs in emerging markets: the effects of knowledge transfer by returnee entrepreneurs," Journal of International Business Studies, vol. 40, No. 6, pp.1005–1021, 2009.
[13] J. P. Hahn, and M. J. Shaver, "Does international research and development increase patent output? An analysis of Japanese pharmaceutical firms," Strategic Management Journal, vol. 26, pp.121–140, 2005.
[14] I. A. Makris, V. N. Nikolaidis, and S. Stavroyiannis, "Identifying factors affecting firm performance: the role of exporting activity on Greek industry," International Journal of Business and Globalisation, vol. 9, No. 1, pp.59–69, 2012.
[15] S. Tangen, "An overview of frequently used performance measures," International Journal of Productivity and Performance Management, Vol. 52, No. 7, pp.347–354, 2003.
[16] S. R. Chirinko, "Business fixed investment spending: modeling strategies, empirical results, and policy implications," Journal of Economic Literature, vol. 31, pp.1875–1911, 1993.
[17] N. Eriotis, P. Frangouli, and Z. Ventoura-Neokosmides, (2002) "Profit margin and capital structure: an empirical relationship", Journal of Applied Business Research, Vol. 18, No. 2, pp.85–88.
[18] I. A. Makris, "What drives firm growth? Evidence from the Greek industry," Int. J. Economics and Business Research, vol. 7, No. 1, pp.17–27, 2014.
[19] J. Wang, G. Meric, Z. Liu, and I. Meric, "Stock market crashes, firm characteristics and stock returns," Journal of Banking and Finance, vol. 33, No. 9, pp.1563–1574, 2009.
[20] I. A. Makris, V. N. Nikolaidis, and S. Stavroyiannis, "Identifying stocks' characteristics before market crashes: the case of the Athens stock exchange," Global Business and Economics Review, vol. 15, No. 1, pp.76–87, 2013.
[21] J. M. Sahut and J. S. Lantz, "Value creation in high-tech: the case of the telecommunication sector," International Journal of Business, Vol. 8, No. 4, pp.409–424, 2003.
[22] J. Jung, "The bigger, the better? Measuring the financial health of media firms," The International Journal on Media Management, vol. 5, No. IV, pp.237–250, 2003.
[23] A. Ng and A. Yuce, "Risk and returns in mergers and acquisitions: efficient or agent motivations", Journal of International Finance and Economics, vol. 4, no. 1, pp. 103-115, 2006.
[24] S. Lee and S. Y. Park, "Financial impacts of socially responsible activities on airline companies," Journal of Hospitality & Tourism Research, Vol. 34, No. 2, pp.185–203, 2010.
[25] J. N. Variyam and D. S. Kraybill, "Empirical evidence on determinants of firm growth," Economics Letters, vol. 38, No. 1, pp.31–36, 1992.
[26] D. S. Evans, "The relationship between firm growth, size and age: estimates for 100 manufacturing industries," The Journal of Industrial Economics, Vol. 35, No. 4, pp.567–581, 1987.