The role of financial statements in the prediction of innovative firms

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Abstract

This study was undertaken on the basis of reports in the international research literature that investments in innovation have a higher return compared to conventional investments, on the one hand and on the fact, on the other, that the corresponding information is not distinguisly reported on the financial statements.

Given however the absence of information regarding such investments on the financial statements these findings underline the inadequacy of the financial reporting and the negative effects on market efficiency from the apparent substitution of the financial statements for other non official and probably unsafe sources of financial information. The consequence could be more serious to those investors who are not in the position to seek and use efficiently alternative information sources. The purpose of this study is to investigate the efficiency of Electre Tri method in developing models for indentifying innovative firms.

Keywrds: Innovative firms, multicriteria decision making

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1. Introduction

Prior literature provides evidence that investments in innovation have a higher return compared to conventional investments. Svein (1997) states that innovative investments of firms are positively correlated with the significant increase of their sales. Also, Geroski et al., (1993), Ho et al. (2005) and Canibano et al. (2000) have found that innovative investments of firms are strongly associated with such their performance competitive position in the market as their future earnings and profit margins. So, innovative firms could attract more investors and funds, provided that they disclose reliable information for their innovative investments. Financial statements, nowadays, still remain the more systematic audited at least annually reliable and free accessible source of information for the investors. As Leauanae et al. (2002) stated "*to investors financial statements, are the last line of defense in protecting their investments and very often are the only opportunity that investors are given to assess both organizations viability and its life expectancy*".

On the other hand there are many researchers who believe that financial statements have lost a lot of their relevance either because of the conservatism of accounting principles which have been adopted by IFRS or because of the agency problem. As a result of this, investors are looking for other sources of information to cover the gap of information which is not included in financial statements. These sources are not audited or validated and sometimes are expensive and not free accessible to the investors. For the innovation investments, we know that relevant information is available in the websites of firms, in unofficial reports for their goals and their performance or in high cost executive studies and reports which are composed by financial analysts or business consultants.

In the periods of financial crisis many national organizations, financial and business consultants and analyst advise the enterprises to invest in innovation and develop an innovative profile. Innovation was characterized as a special tool for entrepreneurs which creates wealth[1] (1985). During the decade of 1960, the expenses

[1] Drucker P. F., *"Innovation and Entrepreneurship"*, Harper & Row, New York, 1985

in Research and Development (R&D) were considered as the only investments in innovation. In the recent years although R&D expenses are still correlated with the innovative activities of firms, they are not the only criterion for the recognition of firms' innovation.

In the European Commission and Eurostat guideline for collecting and interpreting Technological innovation data for firms, known as Oslo Manual[2], innovation is defined at the level of product and the level of process. As a technological product innovation has been considered the implementation/commercialization of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment, human resources, working methods or complication of these.

According to Oslo Manual the innovation expenditures may be tangibles and intangibles. Tangible are these for the:

- Acquisition of embodied technologies,
- land and buildings for innovation activities,
- instruments and equipment acquired for use in the innovation activities of the firm.

In the intangible expenditures are included:

- the R&D investments,
- computer software development or purchased software for innovation activities,
- acquisition of disembodied technology and know how,
- industrial design, industrial engineering, pilot plants and prototypes (not included R&D),
- training linked to innovation activities,
- marketing for technologically new or improved products.

[2] Oslo Manual, *"Proposed Guidelines for collecting and interpreting Technological innovation date"*, European Commission, Eurostat, 2006

The accounting treatment for tangible innovative investments doesn't provide any information to the investors for these investments. Specifically, although land and buildings and instruments and equipment are capitalized and reported in the balance sheet and financial notes of firms as fixed assets accounts, the part of these expenses which concerns innovation activities is not distinguishly reported on their financial statements.

The intangible innovation expenditures for training linked to innovation activities and marketing for technologically new or improved product are not reported distinguishly and capitalized. Also they are reported in the same accounts with the total operational and administrative expenses of the profit and loss statement. IAS 38 states that no intangible asset arising from research. Expenditure on research shall be recognized as expenses when it is incurred. Intangible asset can be arised only from development if it satisfies the appropriate conditions for generating future economic benefits for the firm. Finally, computer software expenditure, disembodied technology, industrial design patents, prototypes or pilot plant are recognized as intangible assets.

Observing this accounting treatment for both tangible an intangible innovation expenditure, we see that it is not possible to distinguish it in the financial statements of enterprises. The fact that the majority of intangible innovative investment recognized as expenses and are included in accounts with non innovative expenses and the non disclosure of tangible innovative investments distinguishly as innovative assets in financial statements seem to be borders for the provision of adequate information to the investors concerning the innovation activities of firms.

The main purpose of this study is to investigate if financial reporting can provide adequate information to investors for recognizing the innovative firms. In other words we examine whether the accounting treatment of innovative investments affects the value relevance of financial statements.

If investors cannot identify the innovative firms using the reported accounting information, they will ask for this information in unsafe financial or in non financial resources, and the value relevance of financial reporting for the investors will be decreased more. There are many researchers who found that a lot of relevance of the

financial statements has been lost since the industrial economy was charged to acknowledge based economy and the accounting cannot reflect this change. Less reliable accounting information may have negative effect to market's efficiency and to the optimum allocation of financial recourses of the society.

The rest of paper is as follows: Section 2 discusses prior literature related to the present study. Section 3 outlines the research design, while section 4 presents the empirical results. Finally, the last section conclude the paper and highlights future research directions.

2. Literature review

Disclosure in financial reporting is the presentation of necessary information for the optimum operation of efficient capital markets. All investors need information to evaluate the relative risks of individual firms in order to obtain the optimum investment (Hendriksen, 1977). The lack of quality in accounting information provided by financial reporting is positively correlated with the variation in the market price of the corporation's stock (Singhn and Desal, 1971). In this section we will examine empirical studies and the literature to explore if the disclosed information of financial reporting, under the current legal framework[3], is useful and adequate for the investors.

Cantzos (1991) stated that although it is a widely held view that financial information contributes to the better allocation of resources in society there are inefficiencies preventing it optimal production and equitable distribution so that there is at least theoretical justification for regulation. In their empirical study Lev and Zarowin (1999) indicated that the usefulness of reported earnings, cash flows and book values has been deteriorating over the decades of 1980 and 1990 and they identified, as major reason for the usefulness decline of financial information, the increasing rate and impact of business change and the inadequacy of the present accounting treatment to follow this change. Wallman (1995) has also demonstrated that financial accounting and corporate disclosure are not keeping pace with changes

[3] IFRS, IAS

in business world and he proposed that we have to evaluate and make forward looking changes in the reporting system that will make available to investors the most relevant and useful information. Similar evidence was found by Brown et al. (1999) and Lo and Lys (2000). Specifically, they found, as stated accounting cannot follow the rapid changes of the business environment, and the available accounting information doesn't fully reflect the economic reality of firm activities. In a more recent empirical study Pire and Smith (2008) studying Malaisian firms due to estimate the incremental explanation power of the available accounting information. They found that almost the 30% of the variation in share prices remains unexplained.

As it seems from the above studies the provided accounting information in the financial statements is not adequate to explain the gap between the market and book value of firms. The degree of informativeness of financial statements varies systematically with firm and economy characteristics (Healy et al 2001). The last two decades, there are many studies in which it is panted out that investments in innovation are highly correlated with profitability of firms. The number of innovations produced by a firm has a positive effect on its profitability according to Geroski et al. (1993) who focused on UK firms. Also in other studies in other countries, USA, France, Norway and Japan researchers found that firms which invest in innovation succeed in decreasing their production cost, enlarge their profit margins, have bigger profitability and competiveness, sales increase and they are more resistable in periods of financial crisis (Coombs, 1991; Svein, 1997; Barlet et al., 1995; Geroski, 1995).

Hsien et al. (2003) reported positive correlation between firms' innovative investment and their market value. The effects of R&D investment on firm's value were examined by Ho et al. (2005) who observed that innovative investments may have effect for three years to industrial firms' value. Also, positive correlation between R&D intensity and future market returns was found by Chan et al. (2007). Canibano et al. (2002) in their empirical research found significant difference on market to book value between innovative and non innovative firms and the wonder why these investments are not reported in financial statements.

According to the referred studies there is evidence that innovative investments affect the financial performance of enterprises. If there is not available, direct or indirect, accounting information regarding these investments the investors, especially the non sophisticated, cannot evaluate these firms based on official and audited data and they will ask for them to unofficial and sometimes unknown for them information sources. Lev et al. (1999) found that the increasing relevance of innovation as a determinant of the value of companies is not appropriately reflected in the financial statements. As a result of this investors' attention shifts from published accounting numbers to other financial and non financial indicators of the future financial position of business companies.

Lev (1999), also wondered "*How ironic that accounting is the last vestige of those who believe that things are assets and ideas are expendable"*, according to him and other researchers Canibano et al., (2002) and Abdolmohammadi, (2005). It is necessary innovative investments to be reported in financial statements. For this purpose there is need either for new accounting standards or at least for less conservatism to the existed standards so as the innovative investments, especially the intangibles, could be capitalized and reported as assets.

3. Research design

3.1 Sample

The data for the present study were obtained from ICAP[4] and in the Athens Stock Exchange. Our sample is consisted of 257 firms which are all the listed firms (except banks and insurance companies) of the Athens Stock Exchange for the period 2005 – 2009. Almost hale of them are manufacturing and rest become from the trade and services sector (Table 1). The classification of firms in innovative and non innovative was mainly based on the criteria of Oslo Manual. In addition we used empirical approaches for mapping and measuring the innovativeness of firms such as this of the evaluation of firms' innovation through their innovative activities and innovative result (Brusoni et al., 1998) and those of the innovation assessment through patent

[4] ICAP is the largest business information and consulting services firm in Greece

analysis (Abraham and Moitra, 2000) or through investments in research and development (Frascati, 2002). In any case the above classification of companies was based on process, product and process management, which are the three components of innovation.

Insert Table 1 approximately here

3.2 Variables

We selected, for the purpose of our study financial variables which consisted of ratios which can be calculated using the available accounting information in financial statements and of ratios for which more information is demanded which is not reported in them (table 2). Specifically we collected for each of the 257 firms for the five year period, financial variables which are used according to the literature, for the evaluation of firms performance such as profitability, liquidity, solvency, size and managerial activity (Courtis 1978) in addition to financial ration we examined market to book ratio as Canibano et al. (2000) have done due to evaluate the market reaction to the innovative companies and we also imported in the variables list the firm size as previous studies have found evidence that big companies can fund easier their innovative activities than small on medium enterprises do (Makris, 2005). The final set of variables is selected on the basis of 1% significant a Kruskal Wallis test. The results of the above test have shown that there are significant differences between the two groups in seven financial indicators (significant at the 1% level) and also for market value to book value ratio.

Insert Table 2 approximately here

Specifically INVEC/TA, CA/TA, SAL/TA, CL/TA, GP/TA, SAL/EQ, SAL/TD are the variables with significant differences in an 1% level of significance. Four of them are profitability rations. Empirical studies have shown that innovative

companies seem to be more efficient and more profitable than non innovative are, as we studied in the introduction of this paper.

3.3 Multicriteria classification methods

The problem considered in this case study falls within the classification problematic. In particular, the problem under consideration is to assign a finite set of $\mathbf{x}$ alternatives $X = x_1, x_2, ...x_n$ into q predefined groups $C_1 \succ C_2 \succ \cdots \succ C_q$, let us assume from the worst C_1 to the best C_q. Each alternative is described by m criteria and consequently it can be considered as a multivariate vector $\mathbf{x}_i = (x_{i1}, x_{i2}, ..., x_{im})$, where x_{ij} is the description of alternative *i* on criterion *j*.

In this study, the alternatives involve the 257 firms, the criteria correspond to the seven variables for the first model and eleven variables for the second models. The ELECTRE TRI method employs the outranking relations approach of multicriteria decision aiding (Roy and Bouyssou, 1993).

3.3.1 Electre Tri

The Electre Tri is a procedure based on the construction of a set of embedded outranking relations. Each category must be characterized by a lower and upper profil. The outranking relation is used to estimate the outranking degree of an alternative $\mathbf{x}_i$ over a reference profile $\mathbf{r}_k$, which distinguishes the classes C_k and C_{k+1}. Each reference profile $\mathbf{r}_k$ is defined as a vector of individual profiles for each criterion, i.e., $\mathbf{r}_k=(r_{k1}, r_{k2}, \ldots r_{km})$.

In order to determine whether an alternative $\mathbf{x}_i$ outranks a reference profile $\mathbf{r}_k$, all paired comparisons (x_{ij}, r_{kj}) and (r_{kj}, x_{ij}) should be performed for each criterion *j*. The former comparison enables the assessment of the strength $\sigma(\mathbf{x}_i, \mathbf{r}_k)$ of the affirmation "alternative $\mathbf{x}_i$ is at least as good as profile $\mathbf{r}_k$", while the latter comparison leads to the assessment of the strength $\sigma(\mathbf{r}_k, \mathbf{x}_i)$ of the affirmation "profile $\mathbf{r}_k$ is at least as good as alternative $\mathbf{x}_i$". An alternative $\mathbf{x}_i$ is preferred to a profile $\mathbf{r}_k$ ($\mathbf{x}_i$ P $\mathbf{r}_k$) if $\sigma(\mathbf{x}_i,$

$\mathbf{r}_k)\geq\lambda$ and $\sigma(\mathbf{r}_k, \mathbf{x}_i)<\lambda$ (λ is a pre-specified cut-off point). If $\sigma(\mathbf{x}_i, \mathbf{r}_k)\geq\lambda$ and $\sigma(\mathbf{r}_k, \mathbf{x}_i)\geq\lambda$, then $\mathbf{x}_i$ and $\mathbf{r}_k$ are considered as indifferent ($\mathbf{x}_i$ I $\mathbf{r}_k$). Finally, if $\sigma(\mathbf{x}_i, \mathbf{r}_k)<\lambda$ and $\sigma(\mathbf{r}_k, \mathbf{x}_i)<\lambda$, then $\mathbf{x}_i$ and $\mathbf{r}_k$ are considered incomparable ($\mathbf{x}_i$ R $\mathbf{r}_k$). The estimation of the credibility index $\sigma(\mathbf{x}_i, \mathbf{r}_k)$ is performed in two stages (Roy and Bouyssou, 1993). The first stage involves the concordance test, which considers the criteria for which $\mathbf{x}_i$ is at least as good as $\mathbf{r}_k$. The second stage considers the veto conditions, which may arise if $\mathbf{x}_i$ is significantly worse than $\mathbf{r}_k$ in some criteria.

Once the outranking relation is developed, the classification of the alternatives is performed through heuristic assignment procedures. The two procedures are pessimistic rule and optimistic rule. Under the pessimistic assignment, in a classification problem with q classes, each alternative $\mathbf{x}_i$ is compared successively to the profiles $\mathbf{r}_1, \mathbf{r}_2, \ldots, \mathbf{r}_{q-1}$. Let $\mathbf{r}_k$ be the first profile such that $\sigma(\mathbf{x}_i, \mathbf{r}_k)\geq\lambda$. Then, $\mathbf{x}_i$ is assigned to group C_k (if there is no profile such that $\sigma(\mathbf{x}_i, \mathbf{r}_k)\geq\lambda$, then $\mathbf{x}_i$ is assigned to group C_q). In the case of the optimistic assignment each alternative $\mathbf{x}_i$ is compared successively to the profiles $\mathbf{r}_{q-1}, \mathbf{r}_{q-2}, \ldots, \mathbf{r}_1$. Let $\mathbf{r}_k$ be the first profile such that $\mathbf{r}_k$ P $\mathbf{x}_i$. Then, $\mathbf{x}_i$ is assigned to group C_{k+1} (if the there is no profile satisfying the above condition, then $\mathbf{x}_i$ is assigned to group C_1). The differences between the two procedures appear in the presence of the incomparability relation. For instance, in a two-group case an alternative that is incomparable to the profile $\mathbf{r}_1$ will be assigned to group C_1 with the optimistic procedure and to group C_2 with the pessimistic procedure. Consequently, the differences between the two rules facilitate the identification of alternatives with special attributes, which make the comparison of the alternatives to the profiles difficult.

In the present study we use the optimistic assignment procedure while all the parameters of the ELECTRE TRI model (e.g. weights of the criteria, thresholds, etc.) are estimated using the evolutionary optimization approach that was proposed by Doumpos et al. (2009).

3.4 Discriminant analysis

Discriminant analysis seeks to obtain a linear combination of the independent ariables. The objective is to classify observations into mutually exclusive groups as accurately as possible by maximizing the ratio of among-groups to within-groups variance. The discriminant function is of the following form:

$$Z = b_0 + b_1 x_1 + b_2 x_2 + ... + b_m x_m$$

where x_j is the *j*th independent variable, b_0 is the coefficient for the *j*th independent variable, and Z is the discriminant score that maximizes the distinction between the two groups. A given financial statement will be classified as qualified if Z > Zc (the critical Z), and as unqualified if Z < Zc.

4. Empirical results

We first used Electre Tri mutlicriteria method for the above financial rations which were considered as criteria for classification. Table 3 presents the average weights of the criteria. The most important criteria were CA/TA and CL/TA which are not profitability rations. The weights changed when we applied Electre Tri using, in addition to financial, non financial criteria such as Market to Book Ratio (ME), the sector and the size of firms GP/TA and MB become the most important criteria. This is the relevant with the studies of Canibano et al. (2002), Ho et al. (2001), Lev and Zarowin (1995) who found either significant difference in Market Value to Book Value ratio or to profil margins ratio between innovative and non innovative firms.

Insert Table 3 approximately here

Table 4 presents the average classification accuracies over the 10 replication. Panel A corresponds to the training sample and Panel B the validation sample. Additional, for testing the accuracy of Electre Tri method, we also developed for benchmarking reasons an additional model through DA using the same input variables in order to test the Electre Tri model.

Insert Table 4 approximately here

The highest average classification accuracy in the training sample was obtained with Electre Tri for both financial variables model (63,89%) and all variables (73,59%). On the other hand using discriminant analysis we obtained accuracy level of 59,40% and 60,70% respectively. The poor performance in terms of classified firms can be explained as a result of non distinguished reporting of innovative investments in financial statements. As in the case of training sample the classification accuracy validation sample, is also characterized poor, though Electre Tri obtain higher proportion of correct classification of firms, in innovative and non innovative group, as we see in Panel B. One more important finding which is presented in Table 4 is that the classification using all variables is more accurate than this of financial variables only.

5. Conclusion

The main purpose of this study was to investigate if the available accounting information, which is reported in financial statements is adequate for the investors, especially the non sophisticated, to recognize the innovative companies which, according to the literature, are more profitable and effective than non innovative. There are studies in which is mentioned the usefulness decline of financial information during the last decades. So we can also expect a decrease to the rate of markets efficiency. In other words if there is not available to the investors the appropriate financial information for the innovative investments of firms, then they on the one hand can’t get the optimum result investment choices, and on the other hand

they will consider that financial statements provide useful information for companies and they will search for it in other sources.

In this paper we examined, using the classification milticriteria methods Electre Tri and the statistical discriminant analysis, if we can classify firms to innovative and non innovative groups using the available financial information in financial statements. Then we tested if the enrichment, of our classification model, with variables which are not reported in financial statements will increase its accuracy. We observed in our results that the probability of correct classification which is based on financial data is not more than 60% or 70% if we use additionally validated data which are not included in financial statements.

This is not surprising because as we observed the innovative investments of firms either they are tangibles or intangibles are not reported distinguished in financial statements. In fact they are merged with other assets of the same category or they are not capitalized and they reports as expenses. In that way the investments in research, training and marketing of innovative products as it is defined in IFRS have the same accounting treatment with other expenses which can't create future income for more than one year. We propose the distinguished reporting, of tangible and intangible innovative investments, in notes of firms which are audited annually. In this way there will not be any inconsistency with the present legal framework (IFRS) especially if indicators such as Total Innovative Investments/Total Assets, Total Innovative Investments/Equity, Total R&D Investments/Total Assets, will be input in financial statements (notes).

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Table 1: Observations by industrial sector

	2005	2006	2007	2008	2009	Total
Manufacturing						
non innovative firms	78	78	78	77	76	387
innovative firms	48	48	48	48	47	239
Trade						
non innovative firms	36	36	35	35	34	176
innovative firms	15	15	15	15	15	75
Service						
non innovative firms	46	46	46	46	45	229
innovative firms	21	21	21	20	20	103
Total						
non innovative firms	160	160	159	158	155	792
innovative firms	84	84	84	83	82	417

Table 2: Descriptive univariate statistic (training sample)

Variable	non innovative firms		innovative firms		
	Mean	SD	Mean	SD	Kruskal-Wallis
INVREC / TA	0.32	0.22	0.37	0.20	10.55*
REC / SAL	1.92	11.95	0.59	0.78	0.21
CA / CL	5.05	18.13	1.82	1.12	0.02
CA / TA	0.42	0.24	0.48	0.20	13.55*
CASH / CL	2.04	13.49	0.24	0.50	0.01
CASH / TA	0.05	0.10	0.05	0.07	3.74***
ROA	0.03	0.11	0.04	0.08	3.32***
RBT / FA	1.93	16.20	0.09	0.21	6.09**
INV / SAL	0.50	3.87	0.21	0.46	5.95**
SAL\TA	0.50	0.51	0.81	1.00	38.49*
TD / TA	0.45	0.24	0.52	0.54	4.30**
RBT / CL	1.02	9.01	0.19	0.37	0.24
CL / TA	0.28	0.21	0.36	0.54	14.49*
WC / TA	0.14	0.25	0.12	0.53	3.49***
EBIT Margin	8.13	125.00	0.23	3.74	1.56
GP / SAL	0.29	0.24	0.28	0.21	0.67
GP / TA	0.12	0.13	0.19	0.24	33.59*
(CA - ST) / CL	4.54	17.80	1.43	1.00	0.55
365 * AREC / SAL	864.76	5313.47	400.44	1517.69	1.55
365 * ST / CS	280.68	1895.93	107.48	205.17	4.72**
SAL / EQ	1.02	5.17	4.64	32.19	30.09*
SAL / TD	1.47	1.93	1.82	1.74	23.94*
365*AP / SAL	340.88	3027.97	120.72	375.44	0.52
LOGTA	7.93	0.52	7.95	0.63	0.09
LOGDEPT	7.46	0.67	7.58	0.67	3.09***
INV / SAL	0.11	0.11	0.11	0.10	1.57
SAL/EMP	849145.48	2966414.50	563430.98	1062777.02	2.27
MB	1.78	2.42	2.75	7.81	36.51*

Notes: INVREC / TA: (Inventories + Receivable) / Total Assets, REC / SAL: Receivable / Sales, CA / CL: Current Assets / Current Liabilities, CA / TA: Current Assets / Total Assets, CASH / CL: Cash / Current Liabilities, CASH / TA: Cash / Total Assets, ROA: Profit before tax×100 / Total assets, RBT / FA: Profit (Loos) before tax×100 / Fixed Assets, INV / SAL: Inventories/Sales, SAL\TA: Sales / Total Assets, TD / TA: Total Dept / Total Assets, RBT / CL: Profit (Loos) before tax x 100 / Current Liabilities, CL / TA: Current Liabilities / Total Assets, WC / TA: Working Capital / Total Assets, EBIT Margin: Profits before interest and taxes×100 / Turnover, GP / SAL: Gross Profit / Sales, GP / TA: Gross Profit / Total Assets, (CA - ST) / CL: (Current assets – Stock) / Current liabilities, 365 * AREC / SAL:365 Accounts Receivable / Sales, 365 * ST / CS: 365 * Stock / Cost of Sales, SAL / EQ: Sales / equity, SAL / TD: Sales / Total Dept, 365*AP / SAL: 365* Accounts Payable / Sales, LOGTA: Logarithm of total assets, LOGDEPT: Logarithm of Dept, INV / SAL: Inventories / Total Assets, SAL/EMP: Sales per employee, MB: Median Market to book.
The Kruskal-Wallis test indicates whether there are statistically significant differences between the two groups, * Significant at the 1% level, ** Significant at the 5% level, *** Significant at the 10% level.

Table 3: Weights of criteria (variables) in the Electre Tri

	Financial variables	All variables
INVREC / TA.	2.30%	4.68%
CA / TA	38.84%	12.29%
SAL\TA	14.60%	4.97%
CL / TA	20.48%	10.07%
GP / TA	17.80%	22.32%
SAL / EQ	5.08%	8.80%
SAL / TD	0.92%	2.55%
MB		18.67%
Trade		1.69%
Manufacturing		0.11%
Medium Capitalization		2.13%
Large Capitalization		11.72%

Table 4: Classification results (accuracies in %)

Methods	Financial Variables			All Variables		
	non innovative firms	innovative firms	**Average**	non innovative firms	innovative firms	**Average**
Panel A: training sample						
Electre tri	63.88%	63.89%	63.89%	70.98%	76.19%	73.59%
DA	70.80%	48.00%	59.40%	63.90%	57.50%	60.70%
Panel B: validation sample						
Electre tri	69.01%	50.30%	59.66%	78.91%	61.21%	70.06%
DA	70.30%	43.00%	56.65%	66.10%	57.60%	61.85%