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Can One Discriminate between High-Growth Firms in Terms of Their Technology Specificity? An Empirical Verification

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Abstract: The authors aim to address two issues relating to the asset specificity of firms with respect to their technology. By applying discriminant analysis to a sample of fast-growing firms, they attempt to develop simple and robust prediction equations. These equations would in turn utilise a few items of circumstantial information regarding firms to predict whether they are likely to invest relatively more in the R&D of new products or services or if they are likely to possess more or less specific technology.

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Introduction

The authors seek to address two issues relating to the asset specificity of firms with respect to their technology. First, firms that attribute greater importance and devote relatively more resources to the R&D development of new products will on average introduce more innovations and more knowledge to markets and the economy. Second, the higher level of own involvement in the development of technology increases the technology specificity of a firm. The authors contend that the contrasting options of either developing one's own technology or buying technology from the market lead to different business models and possibly also differences in firm performance. To enable a differentiation between firms according to the abovementioned criteria, the authors set out to develop two straightforward and robust discrimination functions. They should enable one to predict a firm's character

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with respect to its technology specificity and efforts to research and develop new products.

Theoretical Background

Once again, the perennial question arises: why do firms grow? Drawing from the very foundations of microeconomics, a firm's growth is linked with the interests of its owners to realise the maximum possible increase in assets (Napuk, 1993, Pearce, Robinson, 1991) in the sense of efforts to approach the optimal size of the firm (You, 1995), which in classic microeconomics is characterised as the point of maximised profit. These days, attention is being given to the field of firm growth from many areas of research, especially economics and strategic management studies (Penrose 1959, Greiner 1972, Evans 1987, Hendrickson 1998, O'Farell and Hitchens 1998, Garnsey 2002 and 2004) and entrepreneurship (Smallbone et al. 1995, Glancey 1998, Welbourne et al. 1998, Hitt et al. 2002). The size or growth of firms is most frequently discussed in terms of operating income or sales, assets, employees, equity or profits (Delmar et al.., 2002; Smallbone et al., 1995; Glancey, 1998). To contrast these quantitative measures, authors point to the need to deal with growth in terms of progress. If we choose to view growth as a change in quality as a result of the process of development, no single numerical measurable variable can be expected to sufficiently contain such information. A complex multidimensional measure of this kind would be more applicable across a range of sectors (Glancey, 1998) and relate to various characteristics of firms.

Yet, this is not the only practical predicament that emerges when one chooses to study growth. The assets firms accumulate have no intrinsic value if they are idle and unutilised. They only release their value when they are used in the firm's activities to render services (Penrose, 1959). Indeed, in keeping with the resource-based view of the firm, every firm is a unique bundle of resources in the sense that if we compare even very similar firms we find they do not possess identical ranges and amounts of resources nor will they combine and utilise them in the production process in exactly the same way. Within this logic, firms also grow because not all resources can be optimally utilised by the firm at all times since they are not perfectly substitutable and divisible. Excess resources are those that drive firms to seek out new opportunities so as to employ them, utilise them and transform their value into cash flow.

A firm's growth thus depends not just on the type and amounts of resources used since for what purpose their value is being released is also important. They can be channelled in two ways; either to enable future growth through the accumulation of more valuable assets or to generate current profits through sales. Growth predominantly originates in the opportunity to grow. This opportunity is a promise of

an improvement whereby a firm will change in a positive way, and it can occur at any time or place and is less tangible in terms of the form in which it may present itself (Shane, 2003). Stevenson and Jarillo (1990) explained that growth is achieved through entrepreneurial behaviour, which is the quest for growth through innovation. Innovation can simply be regarded as the creation of newness.

Innovation pertains to more than just the development of new products and production methods. Innovation can be related to all aspects of a firm's operations. Schumpeter's (1942) innovations as sources of new competition are new commodity, product, source of supply, technology, and type of organisation. Kirzner (1973, 1985) characterised as entrepreneurial any action that enables arbitrage in imperfect markets, for example the unmet demand in a certain niche. If we choose to broadly differentiate between technological innovations (new products, services and production methods) and managerial innovations (new organisations, markets, financing solutions, managerial methods, sales methods, distribution channels etc.), it is usually seen that in the early stages of a firm's life technological innovation dominates over managerial innovation. However, as a firm grows it will run into constraints imposed by its current organisation, by the abilities and workloads of the founders, by the size of the niche market or availability of own financing. Without introducing change, it will cease to grow or even fall into turmoil. Managerial innovations in the sense we use may often be the only source of a firm's competitive advantage.

In this respect, the authors derive their research interest from the two assumptions. First, the authors point to the link between the efforts put into the R&D of new products and services and the innovative performance of firms. Following a straightforward logic, firms that attribute greater importance and relatively more resources to the R&D development of new products will, on average, introduce more innovations and more knowledge to markets and the economy. This is interesting in terms of their performance, the regulators and those that sell new technologies.

Second, they maintain that an increased level of own involvement in the development of technology increases the technology specificity of a firm. In other words, a firm that develops its own technological processes will develop them to be more specific and inimitable. On the other hand, a firm that bought technology in the market will have technology that is more easily comparable to the technology of other firms that also buy this or similar technology rather than developing a proprietary one. Within this logic, the authors contend that this difference will lead to significant differences in the business models of firms and possibly also in their performance.

The authors set out to develop straightforward and robust discrimination functions that will enable the prediction of a firm's character with respect to its technology specificity and efforts to research and develop new products.

Research Design

This paper is based on an ongoing 10-year research project that is designed to gain insights into the characteristics of growth in relation to Slovenia's fastest-growing companies according to sales turnover. The sample frame of data used in this analysis consists of the 500 fastest-growing firms in the 1998 to 2002 period as published by Gospodarski vestnik, a leading Slovenian business magazine. Data collection entails self-administered postal surveys, accounting data and other facts regarding these 500 fastest-growing companies. The breadth of the questionnaire reveals, among other things, the origin and importance of technology and the importance of R&D; in most cases directly or otherwise inferred from a series of questions. The unit of analysis in these datasets is the firm. The nature of the questions included in the questionnaires was mostly categorical (in the form of closed-end questions) and in the form of 5-step Likert scales. Data is supplemented by certain demographical and accounting data (e.g. number of employees, total profit, operating income, assets, financial leverage, share of exports in income) obtained from the Slovenian Agency for Payments (APPNI). The questionnaire includes questions relating to the main areas of the research project that often supersede the scope of this analysis: growth strategy, marketing, product, organisation, life cycle, finance, ownership and harvesting. The response rate for the survey was 27.8% (139 units). Due to the absence of any systematic connection between the observed variables and non-responding firms, or any self-selection due to communication between the respondents, there should not be a concern about any systematic bias in the obtained sample. For example, the relative bias due to non-response (Biemer, Lyberg, 2003) in the second survey's average rate of growth variable is -0.83 percent. There is a 0.83 percent relative bias as a result of the 72.2 percent non-response rate.

The analysis consists of two sections. First, the relative propensity to invest in the R&D of new products and services is examined. The authors model a discriminant function to single out those firms that invest heavily in new product development. Second, the authors attempt to form a discrimination function to measure or point to technology specificity. The authors estimate technology specificity as a complex multidimensional measure. A cluster analysis of sample firms according to an array of technology and R&D related variables render a taxonomy of two fundamental approaches to the technology specificity. Cluster membership in these two groups is then used as a dependent variable in a discriminant function. The discriminant is in this case a function set up to find those discriminators/predictors that can best predict a firm's membership in either of the two possible clusters.

Results

The results are presented first for the discrimination function pointing out those firms that invest heavily in the R&D of new products and services, then for a function predicting technology specificity.

Discriminating between Firms According to the Relative Level of Investment in the R&D of New Products and Services

Based on responses to the question of how much a firm invests in the R&D of new products and services a sub-sample of 125 fast-growing firms was divided into two groups. Since the variable measured the relative importance of this type of investment on a 1 to 5 Likert scale, each firm was classified in the 'lower importance' group if it chose to answer with a 1, 2 or 3; whereas firms that responded with a 4 or 5 were classified in the 'high importance' group.

The discriminant model in this case therefore aims to point out those firms that attribute great importance to product or service innovation, regardless of whether they also innovate in other areas of business and regardless of whether they rely on their own research efforts or outsource these activities. Based on preliminary analyses of variance, an array of variables was identified that pointed to significant differences in the arithmetic means between the two clusters and these are the variables that were included in the analysis to discriminate firms between the clusters:

'a firm more inclined to introduce novelties in its business operations' – the overall inclination of a firm to novelties may be a result of a dynamic strategy, an ability to adapt to environment dynamics, competition, or a superior ability to innovate. Though there are important differences between these positions, they all produce a common indicator that should also point to the placing of more efforts into new product R&D;

- 'a foreign trademark upon entering the market' – introducing a foreign trademark quite unequivocally suggests a passive generic strategy and, in this case, the absence of own production capabilities also supports expectations that this strategy would reduce the firm's inclination and ability to innovate on its own;
- 'high obsolescence rate of products and services' –a high obsolescence rate due either to intensive competitive forces, the characteristics of the product or the customers all lead to increased efforts to improve and develop now products

and services to increase the competitive edge of a firm. This indicator is therefore industry-, rather than firm-specific;
- 'access to markets through foreign partners' –collaboration with another firm suggests that the firm may also benefit through a knowledge exchange and pooling and spill-over effects;
- 'market taken from disintegrating incumbent firms': this was a typical generic market entry strategy in the times of economic transition. This type of entry is characterised by a low-price strategy only. It would be expected that this strategy type would correspond to lower R&D for new product development; and
- 'a firm better able to recognise new business opportunities' – a higher level of market orientation due either to intensive competitive rivalry or innate superior ability of strategic orientation all lead to higher involvement in new product development. A firm that has access to superior information concerning customers, products and competitors will attempt to pour this information into new products and services.

All of the abovementioned variables (except for the binomial variable measuring the presence of a foreign trademark) were measured on a 5-step Likert scale and treated as numerical variables. The stepwise discriminant analysis was performed on 125 firms for which all of the necessary data could be obtained. The correlations between all variables are relatively low which suggests that each variable could add significantly to the explanatory power of the model. The lowest correlation coefficient is between foreign trademark upon entering the market and the variable that measures whether the market was taken from disintegrating incumbent firms (0.027), while the highest correlation coefficient is between the former variable and the variable of high obsolescence rate of products and services (0.25). Discriminant analysis assumes that data come from a multivariate normal distribution and that the covariance matrices of the clusters are equal. The first assumption is not totally fulfilled so, as a result, the estimated mean and standard deviation measures could be poor estimates of location and spread. The value of Box's M statistic is 45.770 and its significance probability, based on F transformation, is 0.003. The null hypothesis of equal group covariance matrices is rejected. Even though the results of the discriminant function are presented in the following text, it would be recommended to verify them with a logistic regression to thus obtain more accurate results.

Table 1: Variables entered in the discriminant model for the level of investment in the R&D of new products and services

Entered (by steps)	Wilks' Lambda							
	Statistic	df1	df2	df3	Exact F			
					Statistic	df1	df2	Sig.
firm more inclined to introduce novelties in its business operations	0.897	1	1	123	14.054	1	123	0.000
foreign trademark upon entering the market	0.84	2	1	123	11.593	2	122	0.000
high obsolescence rate of products and services	0.799	3	1	123	10.134	3	121	0.000
access to markets through foreign partners	0.766	4	1	123	9.146	4	120	0.000
market taken from disintegrating incumbent firms	0.736	5	1	123	8.554	5	119	0.000
firm better able to recognise new business opportunities	0.707	6	1	123	8.138	6	118	0.000

As in the previous analysis, we only have two clusters and one discriminant function is estimated. Wilks' Lambda for the function is 0.541 and is significant at the 0.000 level. We can write classification functions that are used to assign firms into those that invest more in the R&D of new products and services or not. Each firm is predicted as being a member of a cluster where its score is highest. The estimates of the classification function for a 'low level' and 'high level' of R&D in new products and services are:

Low-level investment = -16.372
+ 4.098 * score a firm better able to recognise new business opportunities
+ 1.226 * score market taken from disintegrating incumbent firms
+ 1.79 * score high obsolescence rate of products and services
+ 2.818 * score a firm more inclined to introduce novelties in its business operations
- 0.425 * score foreign trademark upon entering the market
+ 0.189 * score access to markets through foreign partners

High-level investment = -21.325
+ 4.736 * score a firm better able to recognise new business opportunities
+ 0.774 * score market taken from disintegrating incumbent firms
+ 2.117 * score high obsolescence rate of products and services
+ 3.407 * score a firm more inclined to introduce novelties in its business operations
- 2.264 * score foreign trademark upon entering the market
+ 0.582 * score access to markets through foreign partners

Table 2: Classification results for the discriminant function classifying firms according to the relative level of investment in the R&D of new products and services

			Predicted Group Membership		Total
			low investment	high investment	
Original	Count	low investment	46	18	64
		high investment	17	46	63
		Ungrouped cases	1	0	1
	%	low investment	71.9	28.1	100
		high investment	27	73	100
		Ungrouped cases	100	0	100
Cross-validated(a)	Count	low investment	44	20	64
		high investment	18	45	63
	%	low investment	68.8	31.3	100
		high investment	28.6	71.4	100

The model's prediction of firms in the high-level investment group is 73% correct while the prediction into commoners is 71.9% correct. The overall success of this three-variable model for classifying firms in one of the two clusters is 72.4% and when cross validation is used 70.1% firms are correctly classified. If we randomly assigned the cases into clusters we might expect to classify half of the firms correctly. With our method we classified 92 firms correctly and the practical significance of classification shows that when using our discriminant method a 22.4% reduction in error over chance is obtained.

Using a Multivariate Measure to Discriminate between Firms According to Their Technology Specificity

A cluster analysis of the fast-growing firms sample provides the following typology with respect to the values of an array of variables pertaining to technology and R&D (see Table 3):

experts (65 firms, 52% of cases): they demonstrate a higher level of technology specificity. They invest relatively more in technology, which is an important element of the business model as well as of competition. Their product base is subject to high obsolescence. To sustain their competitive advantage, these firms make great efforts to study the market, their competitors and also invest heavily in new product development;

commoners (59 firms, 48% of the sample): relative to experts these firms put less emphasis on their technology and especially on upgrading it. The obsolescence rate in their market is lower, in spite of the indication that their actions can be easily imitated by their competitors. Since their technology is relatively accessible this

apparently is not a crucial element of a sustained competitive advantage for these firms.

Table 3: Technology and R&D characteristics of clustered firms (final cluster centres)

	Cluster		Sig.
	Experts	Commoners	
large investment in the technology***	4.35	2.42	0.000
technology easily accessible	3.82	3.56	0.239
technology does not make a great impact on the business**	2.26	2.75	0.028
large investment into a new product R&D***	4.26	2.53	0.000
R&D is based on good knowledge of the buyers and the market**	4.12	3.71	0.029
high obsolescence rate of products/services**	3.17	2.51	0.005
everything done is easily imitable by competitors**	2.98	3.49	0.028

Note: values represent the responses on the degree of intensity of a particular phenomenon presented to the respondents in the form of a 5-step Likert scale.

** statistically significant at $p < 0.05$

*** statistically significant at $p < 0.001$

In the continuation of this discussion, a new question should also be addressed. Is distinguishing between firms with respect to their technology specificity important and useful? By checking for significant differences between the average characteristics of firms that belong to the different cluster groups (in Table 4), we can create a rough sketch of these firms in terms of the aspects that make them different. First, those that belong to the expert cluster more often started as a classical start-up firm over 13 years ago and are older than the commoners. This apparent longevity may be attributed to a better market performance or simply certain environmental factors. In any case, if we observe the employment figures from the beginning and end of the period the experts started off at the start of the period larger than the commoners and have on average kept their supremacy in this respect. However, the average growth rate of employment, although apparently not significantly different, points to the fact that in the four years observed the commoners have been catching-up. Combining the findings that experts are on average bigger firms, score higher on excess capacity and large-scale production orientation may to some extent merely be attributed to the structure of the groups by industry – there may be more manufacturing firms in the experts group. What is important though is differences in performance. Experts manifest higher levels of export orientation, lower levels of debt financing and were on average able to exceed their investors' expectations with regard to their returns. They are more optimistic as regards the future and more often believe that their profitability is sufficient to also enable the firm's future growth. To conclude, technological dedication leads to significantly higher levels of innovative products and supports the development of own proprietary trademarks. In connection

with this, empirical findings also suggest a positive link between technology specificity and relative financial performance. Possibly, asset-specificity also relates to greater longevity and consequentially the bigger size of firms.

Table 4: Significant differences in business characteristics of firms with different technology specificity

	Cluster average	
Variable	Experts	Commoners
developed from a start-up to an SME*	*73.0%*	*58.0%*
years in operation*	13.26	10.58
growth induced by changes in technology***	3.7	2.53
outlook for the future of the firm*	3.29	3.14
satisfying customers' needs is primary goal of the company**	4.63	4.31
product assortment has remained the same**	2.47	3.03
superior production methods than competitors**	3.22	2.7
firm more inclined to introduce novelties in its business operations**	3.92	3.56
more successful in realising its long-term strategy than competitors**	3.89	3.42
orientation to large-scale production*	2.74	2.27
excess capacity**	2.91	2.36
profitability sufficient to ensure future growth**	3.66	3.27
investors' perception of firm's returns (break-off value of meeting expectations	1.11	0.96
exports in 1998 (000 SIT)*	294,015	50,853
number of employees in 2002*	93	37
number of employees in 1998*	45	19
share of exports in sales in 2002**	28.5%	14.9%
share of debt financing in 2002*	66.2%	72.3%
presence of original products and services*	65.0%	48.0%
own trademark when entering the market**	46.0%	29.0%

* statistically significant at $p < 0.1$

** statistically significant at $p < 0.05$

Moving now from the clustering to the discriminant analysis, the main objective of the following discriminant analysis is to identify differences between previously empirically identified groups of firms. These groups are in our case based on the results of a clustering analysis and divide the firms into those that put great significance on their technology and R&D (experts) and those that do not (commoners). With the clustering method we separated two clusters of fast-growing firms which are distinguished based on significant differences in variables relating to technology specificity and scope of investment in the R&D of new products and services. Consequently, the purpose of the discriminant analysis is to identify other characteristics of firms in each cluster in such a way that they will explain the differences between the clusters. As a result of the discriminant analysis, one would be able to predict whether a firm is an expert or a commoner based on the values of these other discriminating characteristics of the firm.

Based on preliminary analyses of variance an array of variables was identified that pointed to significant differences in the arithmetic means between the two clusters

and these are the variables that were included in the analysis to discriminate firms between the clusters:

- 'high switching costs for buyers to cross over to competitors' – if a firm is able to retain its buyers by imposing switching costs on them if they decide to move to competitors it can assure a relatively more stable base. On one hand, it then has more incentive to invest in research into specific assets. On the other hand, this research is inevitable as it can only put up switching costs by developing a distinctive and differentiated product or a service. Regardless of the perspective, a differentiated product or service that imposes switching costs suggests a greater propensity to invest in specific assets and in research;
- 'presence of excess unmet demand upon entering the market' –if customers are asking for more goods that can be delivered by the incumbent firms in the market, market entrants do not have to be very innovative to gain market share. Rather, the pressure of excess demand in the market shifts a great deal of market power into the hands of suppliers –the firms. They will focus on harvesting the present profits from the market and focus less on the future. In other words, excess demand relieves the pressure of competition which also drives efforts to improve products or technology;
- 'the firm is in the investment cycle; if a firm is currently investing heavily' –this expresses overall optimism for the future. if a firm is investing in new capacities, this will also be positively related to investment in new technologies and products. If nothing less, new production capabilities are always built based on the latest technology available;
- 'the firm is more attentive to the advantages and weaknesses of its competitors' –if a firm is facing greater competition this will stimulate it towards following the actions and strategies of its competitors. As this points to the tightening of market forces, it also relates to greater efforts to achieve market supremacy, including in the form of product or technology innovations.

All of the abovementioned variables are measured on a 5-step Likert scale and treated as numerical variables. The stepwise discriminant analysis was performed on 75 firms that had data available for all of the necessary variables. The correlations between all variables are relatively low, as desired. The lowest correlation coefficient is between high switching costs for buyers to cross over to competitors and the variable that measures whether a firm is attentive to the advantages and weaknesses of its competitors (0.05), while the highest correlation coefficient is between the latter variable and the variable of the presence of excess unmet demand upon entering the market (0.41).

Discriminant analysis assumes that data come from a multivariate normal distribution and that the covariance matrices of clusters are equal. This assumption seems to be satisfied as the value of Box's M statistic is 9.123 and its significance probability, based on an F transformation, is 0.572. The null hypothesis of equal cluster covariance matrices cannot be rejected and this enables us to proceed with the analysis. Results of the analysis are shown (Table 5) and described below.

Table 5: Variables entered in the discriminant model according to firms' technology specificity

Entered (by steps)	Wilks' Lambda							
	Statistic	df1	df2	df3	Exact F			
					Statistic	df1	df2	Sig.
high switching costs for buyers to cross over to competitors	0.868	1	1	73	11.098	1	73	0.001
presence of excess unmet demand upon entering the market	0.779	2	1	73	10.186	2	72	0.000
firm is in the investment cycle	0.705	3	1	73	9.887	3	71	0.000
firm is more attentive to the advantages and weaknesses of its competitors	0.666	4	1	73	8.787	4	70	0.000

As we only have two clusters, one sole discriminant function is estimated. Wilks' Lambda for the function is 0.666 and is significant at the 0.000 level. Each firm is predicted as being a member of a cluster where its score is highest. We can write classification functions that are used to assign firms into either experts or commoners. The estimate of the classification function for the first cluster is:

experts = -14.987
+ 2.249 * score high switching costs for buyers to cross over to competitors
+ 0.077 * score presence of excess unmet demand upon entering the market
+ 3.074 * score firm is in the investment cycle
+ 2.134 * score firm is more attentive to the advantages and weaknesses of its competitors

The estimate of the classification function for the second cluster is:

commoners = -11.092
+ 1.479 * score high switching costs for buyers to cross over to competitors
+ 0.929 * score presence of excess unmet demand upon entering the market
+ 2.486 * score firm is in the investment cycle
+ 1.558 * score firm is more attentive to the advantages and weaknesses of its competitors

Table 6: Classification results for the discriminant function classifying firms according to technology specificity

			Predicted Group Membership		Total
			experts	commoners	
Original	Count	experts	42	21	63
		commoners	16	42	58
		Ungrouped cases	2	12	14
	%	experts	66.7	33.3	100
		commoners	27.6	72.4	100
		Ungrouped cases	14.3	85.7	100
Cross-validated(a)	Count	experts	40	23	63
		commoners	17	41	58
	%	experts	63.5	36.5	100
		commoners	29.3	70.7	100

The model's prediction of firms into experts is 72.4% correct and the prediction into commoners is 66.7% correct. The overall success of this three-variable model for classifying firms into one of the two clusters is 69.4% and when cross validation is used 66.9% firms are correctly classified. If we randomly assigned the case into clusters we might expect to classify half of the firms correctly. With our method we classified 84 firms correctly (69.4%) and the practical significance of the classification shows us that in the case of using our discriminant method a 19.4% reduction in error over chance is obtained.

Conclusion

The aim of the paper was to check whether one can empirically develop a prediction function to distinguish between firms with regard to the importance of technology and R&D for their business model, and with regard to their technology specificity. The authors regard technological specificity as the result of an own innovation processes and suggest that a greater propensity to invest in R&D and to develop one's own technology lead to the greatest technology specificity as a competitive advantage of a firm.

The purpose of the first discriminant analysis was to find a function which would single out firms that put a greater relative emphasis on the R&D of new products and services. The function is 73% correct when it predicts a firm investing heavily in the R&D of new products and services, while overall the function is 70.1% correct when using cross-validation. A firm will be likely to invest heavily in the R&D of new products if it is better able to recognise new business opportunities, if it is facing a high obsolescence rate of products and services, if it is more inclined to introduce

novelties in its business operations, if it has access to markets also by using foreign partners and if has the possibility of taking market share from a disintegrating incumbent firm. It will be less likely to invest in R&D if it initially used a foreign trademark to enter the market. Since intermediate results suggest that the assumption of the homogeneity of variances between the groups may be violated, it is suggested to further verify these findings by using other methodology. These results could provide useful indicators for policy-makers and investors seeking prospective firms that not only grow but accumulate further potential for growth by investing in innovation. All of the indicators are firm-specific since they point to the specific traits of firms that can be found in any industry or type of market.

In the second part of the analysis, the authors attempt to identify a prediction model to point out firms with higher technology specificity. Based on four indicators a model was formed to predict technology specificity with a 69.4% success rate. Combining knowledge on a wide array of technology-related variables, clustering analysis provided a division of sample firms into experts and commoners. Experts exhibited high levels of technology specificity. Indicators pointing to this were the presence of high switching costs for buyers, stronger intentions to invest heavily in future opportunities and superior attentiveness to the strengths and weaknesses of competitors, and only to a small extent, excess demand in the market.

Identifying those firms prepared to invest in technology-specific assets could be useful for governments, policy-makers, experts, the suppliers of specialised technologies, financiers and anyone else who finds it hard to identify firms that have an above-average propensity to innovate, are more export-oriented, less indebted and on average able to exceed their investors' expectations with regard to returns. They are also more optimistic as regards the future and more often believe that their profitability is sufficient to also enable the future growth of the firm.

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