

**University - Industry collaboration in Turkish SMEs: Investigation of a U-shaped relationship**

Temel, S; Scholten, VE; Cengiz, R; Fortuin, F; Omta, SWF

**DOI**

[10.5367/ije.2013.0109](https://doi.org/10.5367/ije.2013.0109)

**Publication date**

2013

**Document Version**

Final published version

**Published in**

International Journal of Entrepreneurship and Innovation

**Citation (APA)**

Temel, S., Scholten, VE., Cengiz, R., Fortuin, F., & Omta, SWF. (2013). University - Industry collaboration in Turkish SMEs: Investigation of a U-shaped relationship. *International Journal of Entrepreneurship and Innovation*, 14(2), 103-115. <https://doi.org/10.5367/ije.2013.0109>

**Important note**

To cite this publication, please use the final published version (if applicable). Please check the document version above.

**Copyright**

Other than for strictly personal use, it is not permitted to download, forward or distribute the text or part of it, without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license such as Creative Commons.

**Takedown policy**

Please contact us and provide details if you believe this document breaches copyrights. We will remove access to the work immediately and investigate your claim.

# University–industry collaboration in Turkish SMEs

## Investigation of a U-shaped relationship

Serdal Temel, Victor Scholten, R. Cengiz Akdeniz, Frances Fortuin and Onno Omta

**Abstract:** *University–industry collaboration and innovation are popular topics in emerging countries. Although the main premise is that such collaboration and innovation increase firm performance, the empirical evidence is inconclusive. Drawing on a sample of 79 Turkish small and medium-sized enterprises (SMEs), the authors find negative direct effects of innovation-based strategy and university collaboration on the profit growth of firms. However, where there is fierce market competition, they find that an innovation-based strategy increases profit growth and that collaboration with universities needs to exceed a certain level before the benefits are manifested in profit growth. These results contribute to the debate on the role of innovation and university collaboration in the profit growth of SMEs in emerging countries. For managers, the implications are that an innovation-based strategy is important in competitive markets in emerging countries, and that university collaboration needs to be taken more seriously and must involve higher levels of effort and commitment if benefits are to emerge; otherwise, companies may decide against working with universities.*

**Keywords:** *university–industry collaboration; innovation-based strategy; business performance; profit margin growth; market competition*

Serdal Temel and R. Cengiz Akdeniz are with Ege University Science and Technology Centre, 35100 Bornova, Izmir, Turkey. Victor Scholten (corresponding author) is with the Department of Technology, Strategy and Entrepreneurship, Faculty of Technology, Policy and Management, Delft University of Technology, Jaffalaan 5, 2628 BX Delft, The Netherlands. E-mail: v.e.scholten@tudelft.nl. Frances Fortuin and Onno Omta are with the Department of Business Administration, Wageningen University, Hollandseweg 1, 6707 KN Wageningen, The Netherlands.

Currently, the impact of innovation strategy and university collaboration on the performance of SMEs is a major concern of technology and innovation policies in emerging economies. The underlying assumption is that a greater focus on an innovation-based strategy and university collaboration will contribute to the knowledge assets of SMEs, which will in turn make them more competitive in a global economy. As a result, emerging

economies such as Turkey have invested in policy programmes to nurture the innovative competitiveness of SMEs and provide incentives for them to collaborate with university institutes. However, innovation and university collaboration are highly complex, systemic and context-related matters (Autio, 1997) that involve significant tacit and non-codified knowledge components (Agrawal, 2006). One of the things that makes

them so complex is the fact that academics and businesses have divergent goals and scopes (Dasgupta and David, 1994).

In this paper, we examine the effects of innovation strategy and university collaboration on the performance of Turkish SMEs. Innovative initiatives have become increasingly important to firms that want to grow and become more competitive (Maldonado *et al*, 2009; Verhees *et al*, 2010). Generally speaking, external sources of knowledge are considered important when it comes to speeding up organizational learning and innovation processes (Powell *et al*, 1996) because they provide complementary capabilities (Hargadorn and Sutton, 1997) and drive product innovation (Nieto and Santamaria, 2007). In particular, collaboration with universities is believed to be beneficial to SMEs because it provides them with access to new knowledge and technologies (Adams, 2002; Lee and Win, 2004) and can increase their legitimacy and prestige (Baum and Oliver, 1991; Podolny, 1994).

Although policy makers increasingly encourage this kind of collaboration to increase local economic development (Packham *et al*, 2010), research has yielded ambiguous results concerning the effect of collaboration with universities. Lee *et al* (2001) found no direct connection between working together with universities and sales growth, although their findings indicate that SMEs with high levels of technological capabilities can benefit from such collaboration. Lawton Smith and Bagchi-Sen (2006) and Pickernell *et al* (2010) argue that the impact of universities on the development of industries needs to be interpreted more carefully. Similarly, at the moment, the effects of having an innovation-based strategy on firm performance are largely unclear, with some scholars finding a positive relationship between the two (Dowling and McGee, 1994), while others argue that the effects are negative (Bloodgood *et al*, 1996) or that there is no effect at all (Zahra and Bogner, 2000). In an extensive review, Capon *et al* (1990) and Song *et al* (2008) found inconclusive evidence for both positive and negative effects concerning the relationship between product innovation and firm performance, and they proposed including more interaction terms, which prompted Li and Atuahene-Gima (2001) to examine the moderating effect of environmental factors on the relationship between having an innovation-based strategy and business performance. In their research on Chinese new ventures, they found negative effects of strategic alliances and dysfunctional competition on the relationship between having an innovation-based strategy and firm performance, and a positive effect with regard to environmental turbulence and institutional support. They suggested that environment-based and relationship-based factors moderated the effect of

having an innovation-based strategy on firm performance. These mixed results indicate that the relationship between having an innovation-based strategy, university collaboration and SME performance warrants further research.

In this paper, we examine the role of innovation-based strategy and university collaboration on firm performance among SMEs in Turkey's emerging economy by looking at the effects of market competition, innovation-based strategy and university collaboration on firm performance. Drawing on innovation literature, we empirically test a number of hypotheses, using a sample of small and medium-sized enterprises in the Aegean region. Turkey is an emerging country that, since the liberalization of its economy in the early 1980s, has placed great emphasis on innovation and university–industry collaboration, with the aim of increasing the competitiveness of the country's SMEs (Pamukcu, 2003; Cetindamar and Ulusoy, 2008).

We begin, in the next section, by analysing the structure of innovation and university–industry collaboration in Turkish SMEs, and in the subsequent section we develop six hypotheses on innovation-based strategy and university collaboration and how they affect firm performance. In the last three sections, we discuss our research methods and data collection; test the hypotheses through multivariate data analysis; and finally, present our findings and discuss their managerial implications.

## **Innovation and university collaboration in Turkey**

Turkey is one of the emerging countries that have been trying to establish a bridge between universities and industry, with the aim of increasing the competitiveness of SMEs. Since the liberalization of the economy in the 1980s, Turkish firms have faced increasing international competition, which has made innovation and university–industry collaboration more important (Pamukcu, 2003), and several institutions, including the Directorate for Small and Medium-Sized Enterprises (KOSGEB), Directorate for Technology and Innovation Assessment (TEYDEB) and Technology Development Foundation of Turkey (TTGV), were established in the mid-1990s to facilitate innovation (Beba and Saatcioglu, 2009; Turkoglu and Celikkaya, 2011). After 1994, consecutive Turkish governments launched programmes, introduced incentives and founded organizations to support and encourage firms (mostly SMEs) to become more innovative (Yaniktepe and Cavus, 2011). These institutions are designed to help and guide firms in developing their own innovation projects, providing financial support through

various programmes. They also encourage firms to collaborate with universities and research centres in order to be eligible for further subsidies. The ultimate aim of these support programmes is to enhance the firms' innovative capacity and thus increase their business performance. Although, compared with most European countries, Turkey implemented support programmes relatively late, the development of its innovation infrastructures has been remarkable. The recently introduced financial innovation support schemes encourage companies to collaborate with universities in their innovation, and this cooperation model is almost the only way that firms can gain access to most of the financial grants. For instance, the 'Industrial Theses-SanTez' innovation support scheme requires the development of joint research projects leading to postgraduate degrees. Since universities are among the major organizations in the Turkish National Innovation System (Chung, 2002; Arikan *et al.*, 2003), more firms are looking for opportunities to create sustainable links with academia to gain access to various support schemes and other innovation-related financial incentives. This is reflected by the rate of R&D-oriented companies, which gradually grew from around 1% to 1.4% in 1995, and public R&D support funds increased substantially, to 2.1% in 1997 and 2.5% in 2000 (Taymaz, 2009).

Although most Turkish SMEs are still labour-intensive and produce low-value-added products, their focus on innovation is increasing (Cetindamar and Ulusoy, 2008). Turkey is one of the fastest growing economies when it comes to R&D and innovation, and the number of SMEs that have the potential to collaborate with academia is increasing continually, which is why the Turkish situation provides us with an opportunity to examine the early effects of innovation-based strategy and university cooperation on firm performance.

Previous international studies have identified a positive effect of university collaboration on the innovative capabilities and performance of SMEs (Bleaney *et al.*, 1992; Love and McNicoll, 1998; Wright *et al.*, 2008). However, as yet no study has examined Turkish SMEs and very little is known about the impact of universities on the innovative focus and performance of SMEs, which is why we examine, among other things, whether or not university collaboration has an impact on the profit growth of SMEs.

## Theory and hypotheses

Innovation performance is considered to be a major driver for firms wanting to enhance their business performance (van de Vrande *et al.*, 2008; Elmquist *et al.*, 2009). Compared with large firms, SMEs often lack a

sophisticated resource base, including financial capital, to invest in research and development and recruit talented engineers, who are crucial to successful innovation (Caputo *et al.*, 2002). They can compensate for this lack of resources by initiating and exploiting connections with external sources of knowledge (Chesbrough, 2003). Research has shown that a firm's search strategy for new technologies can influence its innovation performance considerably (Katila and Ahuja, 2002). Universities and research institutions in particular are accumulators of specific knowledge, and firms that work together with universities can improve their knowledge base and thereby increase their innovation performance. More specifically, various studies have shown that, when they work together with universities, SMEs can benefit from increasing their access to useful knowledge and skilled graduates and increase their technological problem-solving capacity (Cohen and Levinthal, 1990; Salter and Martin, 2001; Azagra-Caro *et al.*, 2006; Kodama, 2008) and innovative capability (Kaufmann and Tödtling, 2001; Balconi and Laboranti, 2006). Although these studies suggest that having an innovation-based strategy and being linked to universities will improve firm performance, other researchers found inconclusive evidence with regard to the existence of such a causal connection (for example, Capon *et al.*, 1990; Lee *et al.*, 2001; Song *et al.*, 2008), which may be due to the complex, systemic, context-related, tacit and non-codified nature of innovation (Autio, 1997) and of the knowledge that is transferred from universities to SMEs (Agrawal, 2006), which often requires more detail than can be obtained through traditional publications such as conferences, journals and patents (Mowery *et al.*, 1996; Almeida and Kogut, 1999; Owen-Smith and Powell, 2003). As a result, different systems and processes are required that can enable the conversion of scientific knowledge into products (Zahra and George, 2002) and overcome the diverging goals and scopes that exist between scientists and engineers in industry (Dasgupta and David, 1994). Zahra *et al.* (2007) emphasize the importance of having a knowledge conversion capability when university-based start-ups try to exploit scientific knowledge in the market. Similarly, we believe that such a knowledge conversion capability is essential to the transfer of scientific knowledge to SMEs. Particularly in emerging countries, where more and more SMEs adopt an innovation-based strategy and work together with universities, this conversion capability may be underdeveloped and it will take time before best practices emerge. Taking this into account, we develop hypotheses and argue that the benefits of having an innovation strategy and working together with universities may vary depending on environmental factors and the effort that is put in.

### Hypotheses

In innovation literature, the main premise is that a firm's innovation-based strategy has an important impact on its competitive position. By engaging in an innovation-based strategy, firms can develop new products and services or introduce new features to existing products and services that add value for customers. Investments aimed at improving existing products and services or developing new ones can strengthen the loyalty of existing customers and help recruit new ones. Offering greater value to customers may help prevent firms from having to compete on prices and protect them from declining sales. However, Turkey is an emerging economy with significant economic growth (Pamukcu, 2003). Emerging economies provide SMEs with significant scale or first-mover advantages where experience effects and network externalities are important to building a dominant position for themselves (Lieberman and Montgomery, 1988). In emerging markets, an initial strategy focusing on growth rather than on profitability is more important in gaining a substantial market share (Katz and Shapiro, 1985; Steffens *et al.*, 2009). In an emerging country such as Turkey, where more and more SMEs focus on innovation (Cetindamar and Ulusoy, 2008), large investments are needed, which will reduce the immediate profitability of the firm, while a focus on market growth is likely to provide higher profits (Steffens *et al.*, 2009). Hence, we argue that having an innovation-based strategy may not translate into large profit margins. As a result, we posit that having a greater focus on innovation has a negative effect on the short-term profit growth of Turkish firms.

*Hypothesis 1:* SMEs in Turkey with a greater focus on innovation-based strategy are more likely to have lower short-term profit margin growth.

A greater focus on innovation and R&D is not only capital-intensive, it also involves higher risk levels. Because the outcome of innovation projects often depends on recent technological developments that have not yet been proved in practice and are based on assumptions concerning future market demands, the risks involved are considerable. For successful innovation, well equipped labs and experienced researchers are needed, which are often capital-intensive, especially for firms in emerging countries such as Turkey, where such equipment is rarer and relatively speaking more expensive. By working together with universities, firms can partly outsource their investments and share equipment. A number of researchers have examined the importance of university collaboration for the innovative capacity of firms (Belderbos *et al.*, 2004; Liefner *et al.*, 2006), which is assumed to reduce costs and increase their productivity (Pekkarinen and Harmaakorpi, 2006). However, the

contribution of research carried out in universities to the creation of new profitable goods and processes in part depends on how well firms are able to utilize and commercialize the research findings (Mansfield, 1998). Collaboration with universities is characterized by the transfer of non-codified information and experience (Agrawal, 2006), which requires a common language and often involves face-to-face interaction between university researchers and industry researchers (Balconi and Laboranti, 2006). Particularly in Turkey, with its strong growth in public funds for R&D support (Taymaz, 2009), the learning experience for university and industry researchers alike with regard to their collaboration needs to mature and SMEs need to learn the best practices to benefit fully from the support available. This requires time and may have a negative effect on the immediate profit ratio. As a result, it may take more effort and time before the benefits of university collaboration manifest themselves in terms of profit margin growth. Consequently, we present the following hypothesis:

*Hypothesis 2:* SMEs in Turkey with a high level of university collaboration are more likely to have lower short-term profit margin growth.

Generally speaking, in emerging countries, markets are growing and firms often follow a strategy aimed at market share growth (Steffens *et al.*, 2009). When specific industries mature and market growth diminishes, competition will put a greater strain on SMEs. Buyers in such markets have access to a greater variety, due to the larger number of firms. They can switch more easily to other firms, giving them a stronger position when it comes to price negotiations (Porter, 1980). Similarly, when more firms enter the market, variety increases and the buyers' negotiating position improves even more. To remain attractive, SMEs need to put greater effort into accommodating their buyers, which increases the transaction costs (Williamson, 1991), putting pressure on the prices they can charge for their products and services, which in turn will affect profit margins. Consequently, we posit that, when SMEs face greater market competition, their short-term profit margin growth will be lower.

*Hypothesis 3:* SMEs in Turkey operating in a more competitive environment are more likely to have lower short-term profit margin growth.

Researchers increasingly argue that the relationship between firm-level capabilities and firm performance depends on environmental factors (Li and Atuahene-Gima, 2001; Goedhuys and Srholec, 2010). The effects of technological capabilities on firm performance are nested in national framework conditions (Goedhuys and



Srholec, 2010), such as the level of competition, the availability of a labour force and institutional support. Particularly in industries with high levels of competition, buyers have a larger variety of products and services from which to choose, allowing them to switch to other products and services more easily (Williamson, 1991). To reduce switching opportunities for buyers, SMEs need to make buyers more dependent on their products and services by distinguishing themselves from the competition, for instance by adopting an innovation-based strategy. Therefore, we argue that firms with a strong focus on innovation can better bind buyers to their products and services and, as a result, can charge higher prices and thus increase their profit margins. Consequently, the competitive environment will have a positive effect on the relationship between having an innovation-based strategy and immediate profit margin growth, which is formulated in the following hypothesis:

*Hypothesis 4:* The relationship between having an innovation-based strategy and the short-term profit margin growth of SMEs in Turkey is moderated positively by competitive strength.

University collaboration reflects the extent to which academic researchers collaborate with SMEs in the development of new innovative products and services. They can provide the SMEs with specific knowledge for future products and services that would be more costly to develop in-house (Belderbos *et al*, 2004; Pekkarinen and Harmaakorpi, 2006). In particular, SMEs that emphasize innovation as a strategy can benefit from direct collaboration with a university (Baum *et al*, 2000) and firms that can draw on their technological knowledge are better at absorbing the technologies and knowledge that they develop together with universities (Cohen and Levinthal, 1990; Hitt *et al*, 2000). Drawing on their technological knowledge and focus on innovation, they are more experienced in conducting R&D and are more open to acquiring new competencies, knowledge and capabilities that may increase their understanding of the processes used by such organizations to define problems and create solutions (Cohen and Levinthal, 1990). As a result, their knowledge conversion capability (Zahra *et al*, 2007) will help improve their performance (Lee *et al*, 2001). Hence, we argue that firms can benefit more from their collaboration with a university when they adopt an innovation-based strategy, and hypothesize the following:

*Hypothesis 5:* The relationship between having an innovation-based strategy and short-term profit margin growth of SMEs in Turkey is moderated positively by university collaboration.

Collaboration with universities can range from short-

term direct contract research and services and temporal contract research, to long-term in-depth collaboration and knowledge exchange. In the case of short-term direct contract research, we argue that the costs are likely to outweigh the immediate benefits. Under such circumstances, firms may not take enough time to understand the non-codified elements of the knowledge that is produced in collaboration with universities (Agrawal, 2006) and may find it difficult to reap the rewards of the commercial application. In other words, it is only beyond a certain level of effort and commitment that scientists and practitioners will be able to understand each other better and bridge their diverging goals and scopes (Dasgupta and David, 1994). More intense collaboration helps SMEs understand the details of scientific research (Owen-Smith and Powell, 2003) and increases their knowledge conversion capability, which is important to the commercial development of scientific knowledge (Zahra *et al*, 2007). For this reason, we propose that the relationship between university collaboration and short-term profit margin growth will be negative at low levels of university collaboration and positive at high levels of university collaboration. We hypothesize the following:

*Hypothesis 6:* The relationship between university collaboration and the short-term profit margin growth of SMEs in Turkey will be non-linear, with the relationship being negative at low levels of university collaboration and positive at high levels of university collaboration.

The hypothesized relationships are presented in Figure 1.

## Data and methods

### Sample

The sample of SMEs we examined was drawn from the regional technology transfer database at Ege University Science and Technology Centre (EBILTEM), which has been working as an interface organization between

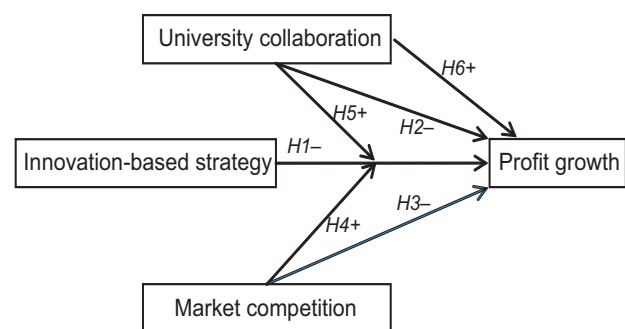


Figure 1. The hypothesized relationships.

academia and industry since 1994 and aims at enhancing the competitiveness of SMEs via technology transfer, innovation and university–industry partnerships in the region. SMEs operating in different sectors in the Aegean region were included to examine the role of universities in R&D and innovation in different sectors. The sample represents the agricultural, plastics, chemicals, machinery and electronics sectors, the four largest sectors in the region. From each sector, we selected SMEs with an R&D department. A final sample of 100 SMEs were asked if they would be willing to take part in the research, and 86 SMEs filled out the questionnaire, representing an initial response rate of 86%. Of the 86 firms, seven were unwilling to share their financial data, bringing the total sample to 79.

To assess the university–industry collaboration in Turkish SMEs, we used the Wageningen Innovation Assessment Tool (WIAT) which was developed by Fortuin *et al* (2007) based on earlier studies in the field of innovation (Cooper, 1985; Jamrog, 2006). The design of WIAT is based on the well established NewProd model (for example, see Cooper, 1985; Cooper *et al*, 2001; Cooper and Kleinschmidt, 1995), which has been used extensively to measure the success and/or failure of product development projects. The original WIAT questionnaire covers several company–external dimensions and has a strong focus on market orientation and competition. We extended the WIAT questionnaire by including questions on university collaboration, following the work by Hanel and St-Pierre (2006).

First, we translated and adapted the questionnaire to the needs of Turkish SMEs and conducted a pilot study among seven firms in order to adapt the WIAT questions to the context of Turkish firms where needed. Second, the data were collected through a survey between May and August 2009. Third, we conducted interviews to validate the answers and ask follow-up questions, with the aim of improving our interpretation of how firms responded. Meetings were held with at least two representatives of each company. Among the representatives were directors (45%), managers (37%) and staff members (18%) with a good insight into the firms' practices, including their university–industry network and innovation. The areas in which the respondents were active were divided as follows: R&D (39%), marketing (37%), quality control (9%) and other (15%). We subjected the answers to non-parametric Kruskal Wallis tests and found no significant differences, indicating that the sample was homogeneous.

### Measures

The measurement items were based on existing 7-point Likert scales (1 = strongly disagree to 7 = strongly agree). A complete list of the questions is provided in the appendix.

We measured firm performance on the basis of profit margin growth, a commonly used indicator for firm performance in regressing the effect of innovation-based strategy (Li and Atuahene-Gima, 2001). Profit margin growth was measured as relative profit margin growth: for example  $(\text{Profit Margin}_{2008} - \text{Profit Margin}_{2007}) / \text{Profit Margin}_{2007}$ .

The innovation-based strategies of the firms were measured using three items concerning how much emphasis firms placed on keeping track of their innovations, capturing what they learnt during the process and providing clear incentives to stimulate innovation. These three types of innovation are considered important to the success of technology-oriented firms (Boer and Duing, 2001) and their performance. Market competition was measured using three items that reflected threats in the business environment and opportunities for growth. University–industry collaboration was measured by looking at the extent to which the firms collaborated with universities and research centres in their innovation process. For all the dependent variables in our model, we examined the unidimensionality and convergent validity of the constructs with principal components factor analysis. All items loaded on their respective constructs, and each loading was large ( $> 0.50$ ). As shown in the appendix, the constructs have high reliability, with alphas over 0.60.

We included several control variables that are commonly used in studies on the connection between innovation-based strategy and firm performance, as well as control variables that are more specific to Turkish firms. Firm size is a control variable that measures the number of employees, which we subsequently log-transformed. We also included the relative share of export sales in total sales, since the firms in the Aegean region are located close to Izmir's harbour and provide a better export infrastructure than other regions in Turkey (TÜİK, 2010). We included these control variables because there is some theoretical basis for expecting the variables to have a systematic relationship with the independent variables or with the dependent variable. For instance, larger firms may have stronger relationships with universities (Mansfield, 1998). Furthermore, we analysed the models including sector-specific dummy variables for the four main sectors involved in this study. These sector-specific control variables were excluded from further analyses because we found no significant differences with regard to the main variables between the four main sectors.

## Results

Table 1 provides the means, standard deviations and correlations for the variables used in the regression

analysis. The average relative profit margin growth between 2007 and 2008 was  $-0.07$ , with a standard deviation of  $0.35$ . In 2007, profit margin growth ranged between  $0\%$  and  $78\%$ , with a mean of  $21\%$ , while in 2008 it was between  $0\%$  and  $50\%$ , with a mean of  $18.5\%$ . The average firm’s focus on innovation-based strategy was  $3.17$  ( $SD = 0.83$ ) on a 7-point Likert scale, indicating that the firms in our sample have a relatively moderate focus on innovation. Average market competition is  $3.30$ , which is also moderate, although the standard deviation is  $1.14$ , indicating that firms perceive different levels of competition in their markets. At the same time, we found that, on average, university collaboration scored  $3.19$ , with a relatively large standard deviation of  $2.05$ , which suggests that some firms are engaged in minor collaboration with universities, while others maintain a closer relationship. With regard to export sales, the data show that, on average,  $13.7\%$  of the total sales are export-related. Furthermore, we found that firms on average employed  $60$  people. With regard to the correlations, we see that having an innovation-based strategy and competition strength are both negatively associated with profit margin growth. Among the independent variables, we observe low levels of correlation, indicating that there are no problems with multicollinearity. We included the Cronbach alphas in brackets for the multi-item constructs.

The estimated Ordinary Least Squares (OLS) regression models are presented in Table 2. Model 1 includes the control variables and the main effects. Model 2 contains the interaction effects of innovation-based strategy with university collaboration and with market competition. In Model 3, we examined the inverse U-shaped relationship by adding the squared term of university collaboration. In all models, the relative profit margin growth between 2007 and 2008 is the dependent variable. We centred the innovation-based strategy, the market competition and the university collaboration variables prior to multiplication and creation of the interaction terms (Aiken and West, 1991). For each of the predictor variables, we calculated the maximum Variation Inflation Factor (VIF), which was below  $1.40$ , suggesting no serious multicollinearity problems (Hair *et al.*, 1998). Table 2 presents the standardized coefficients of the independent variables for each model, as well as the  $R^2$ ,  $\Delta R^2$ , the adjusted  $R^2$ , the  $F$  and  $\Delta F$ .

Model 1 assesses the contribution of the main effects and the control variables to the relative profit margin growth between 2007 and 2008. These variables explain about  $15\%$  of the variance in the dependent variable. Model 1 shows that having a focus on innovation is statistically significant but negatively related ( $b = -0.327$ ,  $p < 0.01$ ) to profit margin growth. This provides support for Hypothesis 1: Firms that have a strategy

**Table 1. Description and correlations.**

	Mean	SD	1	2	3	4	5
1 Profit growth	-0.07	0.35					
2 Innovation-based strategy	3.17	0.83	-0.312**	(0.68)			
3 University collaboration	3.19	2.05	-0.019	0.202*			
4 Market competition	3.30	1.14	-0.305**	-0.035	-0.225*	(0.63)	
5 Firm size	60.00	107.3	-0.004	0.143	0.198*	-0.084	
6 Export sales	13.40	24.3	0.070	0.144	-0.004	-0.180***	0.297**

Note:  $N = 79$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; \*\*\* $p < 0.10$ . Cronbach’s alpha is in parentheses.

**Table 2. OLS regression analyses.**

	Model 1 Profit growth	Model 2 Profit growth	Model 3 Profit growth
Innovation-based strategy (H1)	-0.327**	-0.245*	-0.226
University collaboration (H2)	-0.023	-0.065	-0.828*
Market competition (H3)	-0.311**	-0.248*	-0.230*
Firm size	0.003	0.008	-0.005
Export sales	0.059	-0.004	-0.002
Innovation-based strategy x market competition (H4)		0.263*	0.240*
Innovation-based strategy x university collaboration (H5)		0.134	-0.125
University collaboration square (H6)			0.810*
$R^2$	0.201	0.251	0.316
Adj $R^2$	0.146	0.176	0.236
Delta $R$		0.060	0.059
$F$	3.633**	3.349**	3.981**
Delta $F$		2.307***	6.549*

Note:  $N = 79$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; \*\*\* $p < 0.10$ .



focusing on innovation have on average lower profit margin growth than firms that pay little attention to innovation. Hypothesis 2, which posited that university collaboration had a negative effect on profit margin growth, is not supported. The findings of Model 1 do not show a statistically significant effect of university collaboration on profit margin growth. When analysing the role of market competition, the results indicate a statistically significant and negative effect ( $b = -0.311, p < 0.01$ ) on profit margin growth, providing support for Hypothesis 3: SMEs that operate in more competitive environments will have lower profit margins. These findings show that, in an emerging economy such as Turkey, firms that focus more on an innovation-based strategy generally speaking have lower profit margin growth. This can be due to the labour-intensive and relatively low-value-added character of most firms in emerging countries. Their competition is often based on price and speed of production (Temel *et al*, 2012) rather than on innovation, and by focusing on efficiency and the exploitation of existing production capital, they may reach higher levels of profit margin and can gain a larger market share (Steffens *et al*, 2009). The results of the regression in Model 2 provide information related to the hypothesized interaction effects. The results from Model 2 should be used to interpret the interaction effects when Model 2 significantly increases the variance explained in the dependent variable compared with Model 1 (Aiken and West, 1991). Table 2 shows that the variance explained by Model 2 is about 18%, compared with the 14.6% of variance explained by the first model (with the addition of the interaction terms,  $\Delta R^2 = 0.06, \Delta F = 2.307, p < 0.10$ ). Model 2 depicts a statistically significant and positive effect of market competition ( $b = 0.263, p < 0.05$ ) on the relationship between having an innovation-based strategy and profit margin growth, which supports Hypothesis 4.

With respect to Hypothesis 5, which states that university collaboration positively moderates the relationship between innovation-based strategy and profit margin growth, we found no statistically significant effect and the hypothesis cannot be supported. It would appear that, in an emerging economy such as Turkey, where labour-intensive and low-cost production is more common, firms benefit more from innovation when competition is fierce. The focus on innovation may help them distinguish their products and services from those of their competitors. The relatively recent focus on university–industry collaboration in Turkey (Pamukcu, 2003) may explain why the effect of collaboration with a university on the relationship between an innovation-based strategy and profit margin is not significant. It is only recently that the Turkish government, universities and SMEs have started to explore the

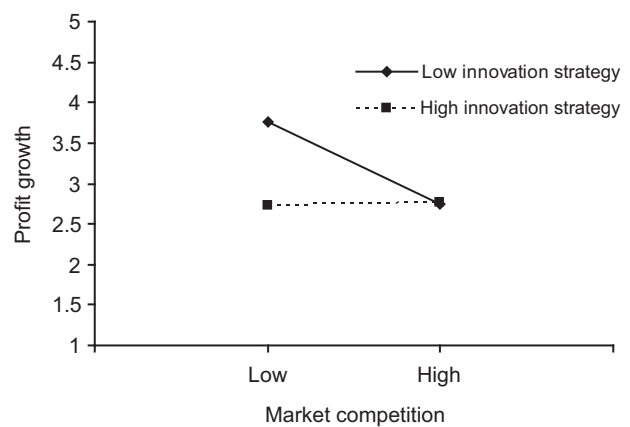


Figure 2. Effects of interaction on profit margin growth.

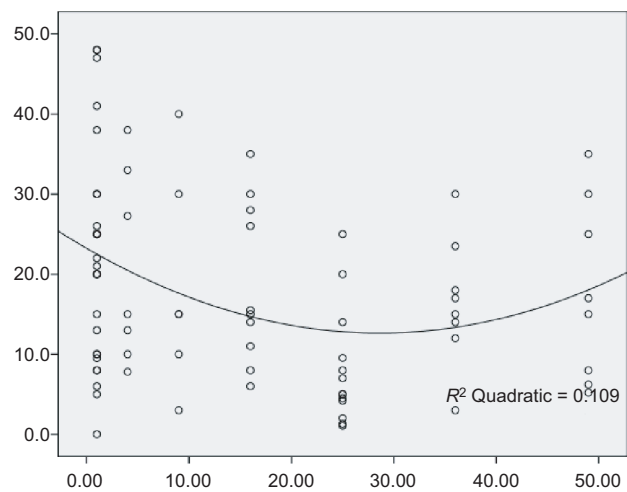


Figure 3. The relationship between profit margin growth and university collaboration.

benefits and best practices of university–industry collaboration and, as a result, their knowledge conversion capability (Zahra *et al*, 2007) is not yet well developed and the potential gains of collaboration may not be fully realized.

Finally, in Model 3 we included the squared term of university collaboration, which is statistically significant and positively related to profit margin growth ( $b = 0.810, p < 0.05$ ), supporting Hypothesis 6.

To interpret the interaction effects, we followed the standard procedures for interpreting interaction effects (Aiken and West, 1991) and plotted the simple slope of the interaction and the curvilinear model for university collaboration, as shown in Figures 2 and 3. The plots in Figure 2 show the effects on profit margin growth for two levels of market competition, low – minus one standard deviation from the mean – and high – plus one standard deviation from the mean. Figure 2 shows that profit margin growth decreases for firms with a low

innovation-based strategy when market competition becomes fiercer, while firms with more innovative strategies can maintain their profit margin growth in more competitive environments.

In Figure 3, the relationship between profit margin growth and the squared term of university collaboration is plotted. This figure shows a U-curve. The plotted line is produced using the quadratic fit method and informs us that, at low levels of university collaboration, profit margin growth is high, and decreases when there is more collaboration, but at a certain point, profit margin growth increases again, which indicates that firms need to exceed a certain level of university collaboration to reap the rewards. A minimum level of collaboration is needed to understand the details of scientific research (Owen-Smith and Powell, 2003) and to be able to convert scientific knowledge into commercial applications (Zahra *et al.*, 2007).

## Discussion and conclusion

Using a sample of 79 small and medium-sized enterprises located in the Aegean region of Turkey, we examined the relationship between having an innovation-based strategy, university collaboration, market competition and firm profit margin growth. The aim of the study was to investigate whether or not university collaboration has an impact on the profit growth of SMEs. The findings revealed that Turkish firms have lower profit margin growth when they focus more on innovation or operate in more competitive markets. This would suggest that Turkish firms that have a more innovative strategy on average perform less well than other firms. With regard to the effects of having an innovation-based strategy or university collaboration on profit margin growth, we found negative or no statistically significant effects. This may indicate that, in general, firms in Turkey can realize higher profit margins if they focus on production efficiency rather than innovation, which corresponds with the work of Forsman and Temel (2011), who found that non-innovative SMEs performed better in terms of profit margins and return on investments, but also with Katz and Shapiro (1985) and Steffens *et al.* (2009), who argued that, in emerging countries such as Turkey, firms focus on growth in order to obtain market share, and on realizing a dominant position rather than on innovation.

However, the findings also show that, when there is more intense market competition, having an innovation-based strategy does contribute to profit margin growth, which may imply that, when competition is fierce, a focus on innovation is needed to allow firms to distinguish themselves from their competitors and maintain their profitability.

A remarkable finding is the U-shaped effect of university collaboration on profit margin growth. When the intensity of university collaboration is relatively low, it has a negative effect on the profit margin growth of the firm, whereas if the university collaboration exceeds a certain threshold, the effect of the collaboration is positive, which provides evidence in favour of our claim that it takes time to learn how to benefit from university collaboration. The scientific information that is transferred from the university to the SME often requires more detail than is available in a publication (Agrawal, 2006; Owen-Smith and Powell, 2003). Direct interaction between scientists and practitioners can make the transfer smoother, and SMEs enjoy the benefits more if both scientists and practitioners understand each other better and can bridge their diverging goals and scopes (Dasgupta and David, 1994). Therefore, we argue that low levels of collaboration are not enough for scientists and practitioners in SMEs to understand each other fully and benefit from their collaboration. As a result, the collaboration will have a negative effect on the firms' profit margin growth. However, as our findings suggest, it takes a certain threshold of university collaboration intensity. When both scientists and practitioners put more effort and commitment into their collaboration, they are better able to understand each other's goals and scopes, and this understanding improves their knowledge conversion capability (Zahra *et al.*, 2007). A more intense collaboration between SMEs and universities improves the scientists' perceptions of what the SMEs need and how they create value for their customers. Similarly, the SMEs can better translate the scientific knowledge from the universities and apply and develop that knowledge in products and service improvements.

These findings contribute to the discussion on why previous studies provided inconclusive evidence and found both negative and positive results with regard to the effect of having an innovation-based strategy on business performance (Capon *et al.*, 1990). While some researchers argue that, in emerging countries, partnerships aimed at developing innovations are very important to the innovation performance of SMEs (Liefner *et al.*, 2006; Biggs and Shah, 2006; Kaminski *et al.*, 2008), our findings show that the effect on profit margin growth depends on the level of competition and on the SME's ability to understand the scientific knowledge. Our results provide evidence that, particularly in emerging countries, the explanation for inconclusive findings may lie in the interaction between the innovation drivers and environmental factors (Li and Atuahene-Gima, 2001). This also corresponds with Lee *et al.* (2001), who found no positive direct effect of university collaboration on sales growth, but for SMEs that had more technological capabilities, the

relationship between university collaboration and sales growth was positive. As a result, we provide evidence that the impact on the development of industries of having an innovation-based strategy and working together with universities needs to be interpreted carefully (Lawton Smith and Bagchi-Sen, 2006; Pickernell *et al.*, 2010).

However, working together with universities seems to have benefits that do not become manifest immediately. Our findings show that the effect depends on the intensity of collaboration. To understand better the role of university collaboration in product development, we used the Wageningen Innovation Assessment Tool (WIAT), which is based on earlier studies of innovation (Cooper, 1985; Jamrog, 2006; Fortuin *et al.*, 2007), and our survey included several questions based on Hanel and St-Pierre (2006) with regard to university collaboration. By including the role of university collaboration in innovation and product development, we contribute to the WIAT questionnaire and also its usability in emerging economies. In both areas, there are interesting avenues for further research that will increase our insight into the role of universities and other external factors that affect the innovation and product development of SMEs in emerging economies.

#### Managerial implications

The findings of this study show that SMEs in emerging countries may have lower immediate profit growth when they invest in an innovation-based strategy and collaborate with universities. When they experience lower profit growth, SMEs in emerging countries may turn away from an innovation-based strategy and university collaboration, while it could be argued that having an innovation-based strategy is more important and provides more benefits when there is greater market competition. Also, collaboration with universities will provide benefits, but only if it exceeds a certain threshold. A more intense collaboration between universities and SMEs will contribute to knowledge transfer and conversion capability and eventually to the financial performance of the SMEs involved. As a result, we would advise managers in SMEs that want to work together with universities to increase their level of collaboration.

Similarly, we would like to express the fact that Turkish universities can support and contribute to small firms and the Turkish economy through the transfer of their scientific knowledge. Turkish universities and Turkish policy makers should be aware that it requires a minimum level of engagement with SMEs before the expected benefits of their collaboration with SMEs will become manifest and provide profit growth for SMEs and regional economic welfare.

#### Limitations and future research

There are some limitations to this research that should be mentioned, two of which are the small number of SMEs and the focus on the Aegean region in Turkey. Because the findings may be specific to the region, future research should increase the number of firms in the sample by including other regions and other emerging countries. Although such an expanded research project may yield results that are closer to the dominant literature in the field, it may also be worthwhile for the Aegean region itself to examine these external circumstances in greater detail. Research into these specific circumstances may lead to fruitful discussions, which in turn may lead to concrete actions that allow the circumstances to be changed over time, thus creating an environment that embraces innovative culture and university–industry collaboration. Furthermore, we measured university collaboration based on a single indicator and realize that a more sophisticated measure may provide greater insight. Despite these limitations, our research has made several contributions to existing literature concerning innovation in SMEs and university–industry cooperation, particularly in emerging countries.

#### Acknowledgments

The authors would like to thank Ege University Science and Technology Centre, Enterprise Europe Network (EBIC-Ege)-Izmir and Professor Dr Fazilet Vardar Sukan for their support and assistance during the interviews with companies. Without their help, we would not have been able to collect reliable data in such a short time frame. We also appreciate the comments and suggestions provided by two anonymous reviewers.

#### References

- Adams, J.D. (2002), 'Comparative localization of academic and industrial spillovers', *Journal of Economic Geography*, Vol 2, No 3, pp 253–278.
- Agrawal, A. (2006), 'Engaging the inventor: exploring licensing strategies for university inventions and the role of latent knowledge', *Strategic Management Journal*, Vol 27, No 1, pp 63–79.
- Aiken, L.S., and West, S.G. (1991), *Multiple Regression: Testing and Interpreting Interactions*, Sage, Newbury Park, CA.
- Almeida, P., and Kogut, B. (1999), 'Localization of knowledge and the mobility of engineers in regional networks', *Management Science*, Vol 45, No 7, pp 905–917.
- Arikan, C., Akyos, M., Durgut, M., and Goker, A. (2003), *National Innovation System*, TUSIAD-T/2003/10/362, TUSIAD, Istanbul.
- Autio, E. (1997), 'New, technology-based firms in innovation networks: symplectic and generative impacts', *Research Policy*, Vol 26, No 3, pp 263–281.
- Azagra-Caro, J.M., Archontakis, F., Gutiérrez-Gracia, A., and Fernández-de-Lucio, I. (2006), 'Faculty support for the

- objectives of university–industry relations versus degree of R&D cooperation: the importance of regional absorptive capacity', *Research Policy*, Vol 35, No 1, pp 37–55.
- Balconi, M., and Laboranti, A. (2006), 'University–industry interactions in applied research: the case of microelectronics', *Research Policy*, Vol 35, No 10, pp 1616–1630.
- Baum, J.A.C., Calabrese, T., and Silverman, B.S. (2000), 'Don't go it alone: alliance network composition and startups' performance in Canadian biotechnology', *Strategic Management Journal*, Vol 21, No 3, pp 267–294.
- Baum, J.A.C., and Oliver, C. (1991), 'Institutional linkages and organizational mortality', *Administrative Science Quarterly*, Vol 36, No 2, pp 187–218.
- Beba, A., and Saaticioglu, K. (2009), 'Financing R&D projects of innovative SMEs: national and international funds', in Katrinli, A., ed, *Proceedings of the International Entrepreneurship Congress 2009: SMEs and Entrepreneurship*, University of Izmir, ISBN: 978-975-8789-32-0, pp 70–80.
- Belderbos, R., Carree, M., and Lokshin, B. (2004), 'Cooperative R&D and firm performance', *Research Policy*, Vol 33, No 10, pp 1477–1492.
- Biggs, T., and Shah, M.K. (2006), 'African SMEs, networks, and manufacturing performance', *Journal of Banking and Finance*, Vol 30, No 11, pp 3043–3066.
- Bleaney, M., Binks, M., Greenaway, D., Reed, G., and Whynes, D. (1992), 'What does a university add to its local economy?' *Applied Economics*, Vol 24, pp 305–311.
- Bloodgood, J., Sapienza, H.J., and Almeida, J.G. (1996), 'The internationalization of new high-potential U.S. ventures: antecedents and outcomes', *Entrepreneurship Theory and Practice*, Vol 20, No 4, pp 61–76.
- Boer, H., and During, W.E. (2001), 'Innovation, what innovation? A comparison between product, process and organizational innovation', *International Journal of Technology Management*, Vol 22, Nos 1/2/3, pp 83–107.
- Capon, N., Farly, J.U., and Hoenig, S.M. (1990), 'A meta-analysis of financial performance', *Management Science*, Vol 16, pp 1143–1159.
- Caputo, A.C., Cucchiella, F., Fratocchi, L., Pelagagge, P.M., and Scacchia, F. (2002), 'A methodological framework for innovation transfer to SMEs', *Industrial Management & Data Systems*, Vol 102, No 5, pp 271–283.
- Cetindamar, D., and Ulusoy, G. (2008), 'Innovation performance and partnership in manufacturing firms in Turkey', *Journal of Manufacturing Technology Management*, Vol 19, No 3, pp 332–348.
- Chesbrough, H. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press, Boston, MA.
- Chung, S. (2002), 'Building a national innovation system through regional innovation systems', *Technovation*, Vol 22, No 8, pp 485–491.
- Cohen, W., and Levinthal, D. (1990), 'Absorptive capacity: a new perspective on learning and innovation', *Administrative Science Quarterly*, Vol 35, No 1, pp 128–152.
- Cooper, R.G. (1985), 'Selecting winning new product projects – using the newprod system', *Journal of Product Innovation Management*, Vol 2, No 1, pp 34–44.
- Cooper, R.G., and Kleinschmidt, E.J. (1995), 'Benchmarking firms' new product performance and practices', *Engineering Management Review*, Vol 23, No 3, pp 112–120.
- Cooper, R.G., Edgett, S., and Kleinschmidt (2001), 'Portfolio management for new product development: results of an industry practices study', *R&D Management*, Vol 31, No 4, pp 361–380.
- Dasgupta, P., and David, P.A. (1994), 'Toward a new economics of science', *Research Policy*, Vol 23, No 5, pp 487–521.
- Dowling, M.J., and McGee, J.E. (1994), 'Business and technology strategies and new venture performance: a study of the telecommunications equipment industry', *Management Science*, Vol 40, No 2, pp 1663–1677.
- Elmquist, M., Fredberg, T., and Ollila, S. (2009), 'Exploring the field of open innovation', *European Journal of Innovation Management*, Vol 12, No 3, pp 326–345.
- Forsman, H., and Temel, S. (2011), 'Innovation and business performance in small enterprises. An enterprise-level analysis', *International Journal of Innovation Management*, Vol 15, No 3, pp 641–665.
- Fortuin, F., Batterink, M., and Omta, O. (2007), 'Key success factors of innovation in multinational agrifood prospector companies', *International Food and Agribusiness Management Review*, Vol 10, No 4, pp 1–24.
- Goedhuys, M., and Srholec, M. (2010), *Understanding Multilevel Interactions in Economic Development*, UNU-MERIT Working Paper Series 003, Maastricht.
- Hair, J.F. Jr, Black, W.C., Babin, B.J., and Anderson, E.E. (1998), *Multivariate Data Analysis*, 7 ed, Pearson, London.
- Hanel, P., and St-Pierre, M. (2006), 'Industry–university collaboration by Canadian manufacturing firms', *Journal of Technology Transfer*, Vol 31, No 4, pp 485–499.
- Hargadorn, A.B., and Sutton, R.I. (1997), 'Technology brokering and innovation in a product development firm', *Administrative Science Quarterly*, Vol 42, No 4, pp 716–749.
- Hitt, M.A., Dacin, M.T., Levitas, E., Arregle, J.L., and Borza, A. (2000), 'Partner selection in emerging and development market contexts: resource-based and organizational learning perspectives', *Academy of Management Journal*, Vol 43, No 3, pp 449–467.
- Jamrog, J.J. (2006), *The Quest for Innovation: A Global Study of Innovation Management 2006–2016*, Human Resource Institute, University of Tampa, FL.
- Kaminski, P.C., de Oliverira, A.C., and Lopes, T.M. (2008), 'Knowledge transfer in product development processes: a case study in small and medium enterprises (SMEs) of the metal-mechanic sector from Sao Paulo, Brazil', *Technovation*, Vol 28, No 1/2, pp 29–36.
- Katila, R., and Ahuja, G. (2002), 'Something old, something new: a longitudinal study of search behavior and new product introduction', *Academy of Management Journal*, Vol 45, No 6, pp 1183–1194.
- Katz, M.L., and Shapiro, C. (1985), 'Network externalities, competition, and compatibility', *American Economic Review*, Vol 75, pp 424–440.
- Katz, R., and Alen, T. (1982), 'Investigating the not invented here (NIH) syndrome: a look at the performance, tenure, and communication patterns of 50 R&D projects', *R&D Management*, Vol 12, No 1, pp 7–19.
- Kaufmann, A., and Tödtling, F. (2001), 'Science–industry interaction in the process of innovation: the importance of boundary-crossing between systems', *Research Policy*, Vol 30, No 5, pp 791–804.
- Kodama, T. (2008), 'The role of intermediation and absorptive capacity in facilitating university–industry linkages – an empirical study of TAMA in Japan', *Research Policy*, Vol 37, No 8, pp 1224–1240.
- Lawton Smith, H., and Bagchi-Sen, S. (2006), 'University industry interactions: the case of the UK biotech industry', *Industry and Innovation*, Vol 13, pp 371–392.
- Lee, C., Lee, K., and Pennings, J.M. (2001), 'Internal capabilities, external networks, and performance: a study on technology-based ventures', *Strategic Management Journal*, Vol 22, pp 615–640.
- Lee, J., and Win, H.N. (2004), 'Technology transfer between university research centers and industry in Singapore', *Technovation*, Vol 24, No 5, pp 433–442.
- Li, H., and Atuahene-Gima, K. (2001), 'Product innovation strategy and the performance of new technology ventures in China', *Academy of Management Journal*, Vol 44, No 6, pp 1123–1134.
- Lieberman, M.B., and Montgomery, D.B. (1988), 'First-mover advantages', *Strategic Management Journal*, Vol 9, Special Issue: Strategy Content Research, pp 41–58.
- Liefner, I., Hennemann, S., and Xin, L. (2006), 'Cooperation in the innovation process in developing countries: empirical



- evidence from Zhongguancun, Beijing', *Environment and Planning*, A38, pp 111–130.
- Love, J., and McNicoll, L. (1998), 'The regional economic impact of overseas students in the UK: a case study of three Scottish universities', *Regional Studies*, Vol 22, No 1, pp 11–18.
- Maldonado, M.U., Dias, N., and Varvakis, G. (2009), 'Managing innovation in small high-technology firms: a case study in Brazil', *Journal of Technology Management & Innovation*, Vol 4, pp 131–132.
- Mansfield, E. (1998), 'Academic research and industrial innovation: an update of empirical findings', *Research Policy*, Vol 26, No 7/8, pp 773–776.
- Mowery, D., Oxley, J., and Silverman, B. (1996), 'Strategic alliances and interfirm knowledge transfer', *Strategic Management Journal*, Winter Special Issue, Vol 17, pp 77–91.
- Nieto, M.J., and Santamaria, L. (2007), 'The importance of diverse collaborative networks for the novelty of product innovation', *Technovation*, Vol 27, Nos 6–7, pp 367–377.
- Owen-Smith, J., and Powell, W. (2003), 'The expanding role of university patenting in the life sciences: assessing the importance of experience and connectivity', *Research Policy*, Vol 32, No 9, pp 1695–1711.
- Packham, G., Pickernell, D., and Brooksbank, D. (2010), 'Introduction: The changing role of universities in knowledge generation, dissemination and commercialization', *International Journal of Entrepreneurship and Innovation*, Vol 11, No 4, pp 261–263.
- Pamukcu, T. (2003), 'Trade liberalization and innovation decisions of firms: lessons from post-1980 Turkey', *World Development*, Vol 31, No 8, pp 1443–1458.
- Pekkarinen, S., and Harmaakorpi, V. (2006), 'Building regional innovation networks: the definition of an age business core process in a regional innovation system', *Regional Studies*, Vol 40, No 4, pp 401–413.
- Pickernell, D., Packham, G., Brooksbank, D., and Jones, P. (2010), 'A recipe for what? UK universities, enterprise and knowledge transfer: evidence from the Federation of Small Businesses 2008 survey', *International Journal of Entrepreneurship and Innovation*, Vol 11, No 4, pp 265–272.
- Podolny, J.M. (1994), 'Market uncertainty and the social character of economic exchange', *Administrative Science Quarterly*, Vol 39, No 3, pp 458–483.
- Porter, M.E. (1980), *Competitive Strategy*, Free Press, New York.
- Powell, W.W., Koput, K.W., and Smith-Doerr, L. (1996), 'Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology', *Administrative Science Quarterly*, Vol 41, No 1, pp 116–145.
- Salter, A., and Martin, B.R. (2001), 'The economic benefits of publicly funded basic research: a critical review', *Research Policy*, Vol 30, No 3, pp 509–532.
- Song, M., Podoyntsyna, K., Van Der Bij, H., and Halman, J.I.M. (2008), 'Success factors in new ventures: a meta-analysis', *Journal of Product Innovation Management*, Vol 25, No 1, pp 7–27.
- Steffens, P., Davidsson, P., and Fitzsimmons, J. (2009), 'Performance configurations over time: implications for growth and profit-oriented strategies', *Entrepreneurship, Theory and Practice*, Vol 33, No 1, pp 125–148.
- Taymaz, E. (2009), 'Development strategy and evolution of Turkey's innovation system', in Suh, J.H., ed, *Models for National Technology and Innovation Capacity Development in Turkey*, Korea Development Institute, Seoul, pp 63–104.
- Temel, S., Vardar-Sukan, F., Asarkaya, T., et al (2012), *Izmir Regional Innovation Strategy Report*, Izmir Development Agency (IZKA), Izmir, ISBN: 978-605-5826-07-9.
- Trapp, R. (1997), '3M: back to the future', *MBA: The Magazine for Business Matters*, Vol 1, pp 40–44.
- TÜİK (2010), Statistical database, website: <http://www.turkstat.gov.tr>.
- Turkoglu, M., and Celikkaya, S. (2011), 'R&D support for small and medium size enterprises', *International Journal of Alanya Faculty of Business*, Vol 3, No 2, pp 56–71.
- Verhees, F., Meulenbergh, M., and Pennings, J. (2010), 'Performance expectations of small firms considering radical product innovation', *Journal of Business Research*, Vol 63, pp 772–777.
- van de Vrande, V., de Jong, J., and Rochemont, M. (2008), 'Open innovation in SMEs: trends, motives and management challenges', *Technovation*, Vol 29, pp 423–437.
- Williamson, O.E. (1991), 'Strategizing, economizing and economic organization', *Strategic Management Journal*, Winter Special Issue, Vol 12, pp 75–94.
- Wright, M., Clarysee, B., Lockett, A., and Knockaert, M. (2008), 'Mid-range universities' linkages with industry: knowledge types and role of intermediaries', *Research Policy*, Vol 37, No 8, pp 1205–1223.
- Yaniktepe, B., and Cavus, M.F. (2011), 'Investigation of policy and incentives on the industrial research and development in Turkey', *African Journal of Business Management*, Vol 5, No 22, pp 9214–9223.
- Zahra, S.A., and Bogner, W.C. (2000), 'Technology strategy and software new ventures' performance: exploring the moderating effect of the competitive environment', *Journal of Business Venturing*, Vol 15, No 2, pp 135–173.
- Zahra, S.A., and George, G. (2002), 'Absorptive capacity: a review, reconceptualization and extension', *Academy of Management Review*, Vol 27, No 2, pp 185–203.
- Zahra, S.A., Van de Velde, E., and Larrañeta, B. (2007), 'Knowledge conversion capability and the performance of corporate and university spin-offs', *Industrial Corporate Change*, Vol 21, No 3, pp 569–608.



# Appendix

## Variables

### *Dependent variable:*

#### *Profit margin growth*

Can you indicate your profit margin in the year 2008?

Can you indicate your profit margin in the year 2009?

### *Independent variables:*

#### *Innovation strategy, Cronbach's alpha 0.61*

Key performance indicators are used to monitor the innovation process.

We consistently codify the 'lessons learned' at the end of innovation projects.

There are efficient reward procedures and motivation drivers to stimulate innovation.

#### *University collaboration*

How intensively do you collaborate with universities and/or research institutes?

#### *Market competition, Cronbach's alpha 0.71*

The business environment is safe and provides little threat for the survival and well-being of our company.

The sector is rich in investments and marketing opportunities.

We expect the sales volume of our current products in the coming three years to increase.