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Internationalization and innovation profitability: the case of Tunisian service firms

Abstract

Innovation has always been a key element in improving the performance of service firms. In this context, the majority of the studies on innovation have afforded a particular attention to analyze firms' internal resources and their impact on promoting innovation. Conversely, they do not deeply investigate the role other relevant features can play such as the external environment firms act in. This paper, using a sample of 108 Tunisian value-added service firms, explores the extent to which internationalization affects innovation profitability. The paper shows that internationalization increases firms' innovation profitability. This result may embody the fact that the access to external knowledge can determine the innovation performance of service firms. In addition, the authors show that export is the internationalization modality that is more adopted by Tunisian service firms.

Keywords: innovation profitability, internationalization, R&D, service sector.
JEL Classification: O33, F23, L80.

Introduction

The innovation plays a relevant role in the economic performance of service firms. Indeed, most of them has always tendency to invest more so as to develop new technologies, to adopt new production techniques and, also, to launch new services in both domestic and tier-foreign markets.

According to the innovation literature, most empirical studies have focused on the development of firms' internal factors such as size, R&D and technological opportunities. However, these studies have not examined the role of other important firm's features such as its external environment (Kobrin, 1991; Kotabe, 1990; Kafouros et al., 2008). Indeed, the accelerated evolution of the R&D costs, access to foreign technology resources and the establishment of an information system allow the emergence of new mechanisms of synergy and exchange of ideas. Therefore, the internationalization, i.e. the extent to which the firm operates beyond its national borders (Kotabe et al., 2002), has been regarded to be one of the firm's characteristics that can optimize the return to innovation.

However, due to the intense competition and the uncertain economic environment a firm faces, its capacity to innovate is based on its ability to acquire (or to learn from) the external knowledge being available. Actually, the international orientation can help firms to increase the effectiveness of their knowledge for the innovation know-how. In this setting, numerous are the service firms that have found the opportunities to internationalize their trade activities. This internationalization strategy allows them to gain in terms of productivity and even in terms of extending the size of the markets they act in. With the purpose to encourage firms internationalizing and, therefore, promoting their innovation ability, some public authorities intervene by adopting policies that aim at growing up the international operations.

As a result of the adhesion of Tunisia to the World Trade Organization (WTO), the internationalization has known an important role during the recent decades. According to statistics from the Tunisian Central Bank, the internationalization investments have increased from 9 million dinars in 2002 to 104 million dinars in 2009. The reason behind this increase is due to the noteworthy support the Tunisian government gives while seeking for openness and encouraging exportation.

The literature dealing with the relationship between innovation and internationalization embodies the fact that the majority of the empirical frameworks have been mainly focused on the manufacturing sector. Among others, Kafouros et al. (2008) analyze the effect of the internationalization on the economic performance of the UK manufacturing sector. These authors have shown that there exists a positive correlation between internationalization and innovation performance of manufacturers. In this same manufacturing context, Tsang (1999) has pointed out that since 1990 manufacturing companies in Singapore have decided to invest more in China in order to create research joint ventures. Further, he has shown that internationalization is a learning process that brings about a sort of technological spillovers running between China and Singapore.

Although there exists a large body of the literature on innovation, the analysis of the relationship between innovation and internationalization remains limited for emerging countries and in particular for Tunisia. In order to complete the rare existed frameworks studying this interesting topic, we aim in this paper to

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investigate the extent to which internationalization affects the innovation profitability of Tunisian value-added service firms. Furthermore, we are interested in identifying the major internationalization modalities the Tunisian service firms adopt.

The paper is organized as follows. Section 1 presents a brief literature review on the relationship between internationalization and innovation. Section 2 presents the method and the data set. The results are presented in section 3. The final section concludes.

1. Analysis of the relationship between innovation and internationalization

In this section, we present the main frameworks that have concentrated on the impact of internationalization on the innovation profitability of service firms. According to Hitt et al. (1994) and Hitt et al. (1997), internationalization or international diversification can be defined as "*expanding across country borders into geographic locations that are new to the firm*"[1]. In fact, internationalization is not a new phenomenon in the economic globalization process (OECD, 2007). However, it has just recently become an important business strategy firms adopt (for instance the internationalization of the R&D network).

The empirical works dealing with service innovation have shown that service firms (notably the SME) cannot acquire a great ability to innovate alone without reaping a lot from the technological externalities that the economic environment brings. Moreover, the multiplicity and the diversity of the links firms develop with their domestic or foreign environment are important determinants of their capabilities to innovate. Thus, firms have to well position by adapting their products or services and finding new ways to serve customers across borders.

The relationship between internationalization and service innovation has been widely studied in the economic literature. Kobrin (1991) shows that international firms have a strategic advantage from international business and from the cross border integration markets. The author reveals that internationalization can improve the firm's innovative capacity while using various and substantial resources, notably R&D. In addition, Castellacci (2010) shows that the internationalization activities of Norwegian service firms are seen as a strategy to compete in foreign markets.

However, Hitt et al. (1997) indicate that the access to foreign markets encourages firms to invest more in innovation projects and therefore they make better off their innovation performance. Furthermore, these authors point out that internationalization allows firms not only to extend their knowledge resources but also to capture new ideas from other markets. Accordingly, they can increasingly enhance their innovation intensity. In the same context, Kotabe (1990) shows that internationalization offers to firms further market opportunities. First, firms can benefit a lot from the new ideas arising from servicing several different markets. Second, they can gain in terms of good exploitation of the inter-firm and inter-region interrelationships. These latter come about through the establishment of alliances and cooperation agreements with suppliers, customers, universities and research centers (Santos et al., 2004). Finally, they can also benefit from sharing skills, learning from experiences and economies of scale (Hitt et al., 1997).

Miozzo and Soete (2001) show that multinational firms are considered as an important source for the development of service innovations and skills. These multinationals can transfer physical and organizational technologies of the company between countries and regions (Kogut and Zander, 1993; and Tsang, 1999).

2. Method and data

2.1. Models. In order to analyze the relationship between internationalization and profitability of innovation, we specify two econometric models. The aim of the first model (M1) is to study the direct effect of the internationalization on firms' return on innovation. The second model (M2) completes the first one insofar as it deals with the fact that a firm can enhance its innovation profitability through the exploitation of inter-firm relationships. These latter are manifested in the establishment of alliances and cooperation agreements with various economic actors.

2.1.1. First model (M1). To estimate the equation representing the direct effect of internationalization on the service innovation profitability, we model innovation output following a modified *knowledge production function (hereafter KPF)* approach (see Geroski, 1990; Love and Roper, 1999; and Freel, 2005). We consider that the firm' profitability innovation depends not only on its internal resources such as size, firm vintage and R&D but also on its degree of internationalization.

In our context, the KPF is expressed as follows:

$$PfInn_i = \beta_0 + \beta_1 R\&D_i + \gamma R_i + \rho I_i + \varepsilon_i, \quad (1)$$

[1] For more details, see Hitt et al. (1994, p. 298).

where $PfInn_i$ represents the innovation profitability of firm i, $R\&D_i$ is a measure of the R&D of each firm i, I_i is a set of indicators measuring the internationalization and R_i is a vector of other explanatory variables that can affect the innovation profitability. ε_i is the error term of firm i. The coefficients β, γ and ρ are the vectors of the parameters to be estimated.

A preliminary test confirms the presence of endogeneity bias (Hausman, 1978). The main source of endogeneity is justified by the causality relationship between profitability of innovation and R&D while using the method of ordinary least squares (OLS). For instance, in the KPF, the determinants of innovation may be endogenous because firms that produce innovations are also those that invest more in innovation project (OCED, 2008). In this paper, we use the Instrumental Variable method in order to solve the endogeneity problem. This procedure expresses the endogenous variable (in our case R&D), using a set of explanatory variables (instruments) that are not correlated with the residues. Indeed, we choose *R&Dper*, *R&Dnat*, *R&Ddev* and *R&Dinv* as instruments of the R&D variable. This can be written as follows:

$$R\&D_i = \alpha_0 + \alpha_1 R\&Dper_i + \alpha_2 R\&Dnat_i +$$

$$+ \alpha_3 R\&Ddev_i + \alpha_4 R\&Dinv_i + \gamma' R_i + v_i. \quad (2)$$

The coefficients α and γ' are the vectors of the parameters to be estimated by the maximum likelihood method.

2.1.2. Second model (M2). In this model, we attempt to identify the major internationalization modalities the Tunisian service firms adopt. To do so, we propose to estimate the impact of these modalities, through their interactions with the internationalization decision. Here, we clarify the interaction of each variable I_i^k; k = 1,2,3 with the five internationalization modalities Z_i^j: (1) outsourcing agreement, (2) representative office, (3) subsidiary or establishment, (4) export[1] and (5) foreign direct investment (FDI) (see equation (3)). Thus, for k = = 1,2,3 the basic model is modified as follows:

$$PfInn_i = \beta_0 + \beta_1 R\&D_i + \gamma R_i + \rho I_i + I_i^k \left(\sum_{j=1}^{5} \theta_k^k Z_i^j\right) + \mu_i \quad (3)$$

2.2. Data. In this paper, we use data from a survey of 108 Tunisian services firms. Data were collected through a questionnaire which has been distributed to some Tunisian service firms. Although our analysis is about the issue of innovation in the service sector, our sample consists of firms that mainly provide value-added service:

- The ICT-based services according to the nomenclature published in "The directory of ICT in Tunisia" that is edited by *Symbols Média* (2005).
- The Banks listed in the "Tunisia's professional association of banks and financial institutions (APTBEF)".
- Insurance Companies that are listed in the "Tunisian Federation of Insurance Companies (FTUSA)".

Of the 200 questionnaires distributed, only 108 usable responses were obtained, representing a response rate of 54%. The questionnaire is a modified version of the third community innovation survey CIS 3 and the second European survey on innovation 1997. The survey involves information about the firms' features such as their size, their firm vintage and skills and the expenditures they devote to R&D. Furthermore, the same survey includes information about the percentage increase in a firm's turnover due to the introduction of a new service over the period of 2005-2007. With regard to the commitment in the strategy of internationalization, the survey also provides information about (1) the percentage of foreign sales over total sales, (2) the degree of the importance of the internationalization process and (3) the main internationalization modalities.

Our sample has been stratified by NAT[2] size (7 classes by number of employees: 1-6, 7-9, 10-19, 20-49, 50-90, 100-199, 200 and over). For each class, we associate a weight pondering each bracket at the national level in order to obtain a more representative sample of the global population.

Table 1 below summarizes the determinants of this operation and shows that 21.30% of respondents come from small firms (number of employees is lower than 6). Furthermore, this table reveals that 52.78% of interviewed firms claim that they engaged at international markets during the period of 2005-2007. Around 20% of innovators report that they have internationalized their services during the survey period. Further, the statistical analysis shows that 58 of respondents give high importance to the internationalization process.

[1] Among numerous examples of exporting services, we cite the broadcasting satellite TV, transmission of a lawyer consultation execution to a customer located abroad by mail, fax or e-mail, currencies transactions, etc.

[2] List of activities: distribution of companies by activity and by number of employees in 2007.

Table 1. Distribution and weighting of firms in our sample

Size	Total firms				Internationalization		Innovation	
	Number	INS' firms	Corrected weight	%	Number	%	Number	%
1-6	23	12649	549,95	21,30	9	15,8	7	13,4
7-9	17	785	46,17	15,74	9	15,8	9	17,3
10-19	18	713	39,61	16,67	10	17,5	8	15,3
20-49	13	509	93,15	12,04	9	15,8	9	17,3
50-90	10	230	23	9,26	6	10,5	5	0,96
100-199	10	167	16,7	9,26	4	0,7	4	0,76
≥ 200	17	215	12,64	15,74	10	17,5	10	19,2
Total	108	15268	781,24	100	57	100	52	100

2.3. Variables. *2.3.1. Dependent variables. 2.3.1.1. Profitability on innovation.* Most of the past researches have used various approaches so as to measure innovation. For instance, Mairesse and Mohnen (2003) measure it by the number of patents a firm hold. Others, such as Freel (2005) and Castellani and Zanfei (2007) among others, use measures that indicate whether or not a firm has launched new products or services on the market it acts in. Love and Roper (2001) have, however, measured innovation while interrogated firms' managers about the number of the new products or services they offer in a market. In addition, Kafouros et al. (2008) state that a firm's innovation profitability can be measured by the ratio of the R&D investment to the total sales. In our service innovation context, we measure the firms' innovation profitability (*PfInn*) by the percentage increase in their turnover due to the introduction of a new service during the period of 2005-2007.

2.3.1.2. R&D activities and their instruments. The R&D activities have longtime presented in the literature as a powerful determinant of innovation (Crépon et al., 1998). In this paper, we use a dummy variable as a measure of the R&D activities (*R&D*). This indicator takes one if the interviewed firm is engaged in intramural R&D activities and zero otherwise. Our sample shows that 50% of surveyed firms reveal that they engage in R&D. This proportion is higher for the small firms (60.87%) than for the large ones (52.94%).

To carry out the regression using instrumental variables, we choose to instrument the variable R&D by the following four instruments:

- *R&Dper*: it represents the number of employees involved in the internal R&D including those inside and outside the R&D department.
- *R&Dnat*: this measure stands for the nature of the R&D activities. In fact, firms are asked to answer a question that concerns the way by which their R&D activities are undertaken: whether continuously or occasionally.
- *R&Ddev*: this variable indicates how the R&D activities have been developed. Actually, firms are asked to precise how they develop innovative activities including their in-house R&D and with whom they undertake these activities (with ownerships or with other enterprises and institutions).
- *R&Dinv*: this measure indicates the total expenditure in 2007 devoted by each firm to the development of the R&D activities.

2.3.2. Independent variables. 2.3.2.1. Internationalization. It is recognized that firms can increase their degree of internationalization by different ways. For example, it can be active in many international markets (subsidiaries or representative offices). It also can collaborate with other foreign firms and can also export its new products. To measure this variable, several studies use foreign direct investment (FDI) and/or exports as indicators of international operations. In particular, in the first model, we measure internationalization by three different indicators:

- A binary variable that takes 1 if the firm indicates that it has internationalized its service activities over the period of 2005-2007 and 0 otherwise (I_i^1).
- The ratio of foreign sales to total sales (I_i^2). The variable is discreet so that it takes values from one to seven; 1 = less than 10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60% and 7 = greater than 60% (Hsu and Pereira, 2008).
- A discrete variable with four outcomes indicating the level (score) of the importance that each firm attributes to the internationalization strategy (I_i^3): 1 = high, 2 = medium, 3 = low and 4 = not used.

In the second model and in order to analyze the role of different internationalization modalities in promoting returns to innovation, we use an indicator that represents the interaction between internationalization and five modalities of international external links: (1) outsourcing agreement, (2) representative office, (3) subsidiary and establishment, (4) export and (5) foreign direct investment (FDI).

2.3.2.2. Size and age of the firm. The relationship between innovation and firm size has been the subject of many empirical studies. In this paper, we measure size (*size*) by the total number of employees in 2007 (in log form). The age of the firm (*age*) is determined by the date of its creation. More precisely, this measure represents the experiences and knowledge accumulated throughout the history of the firm. Thus, age is a source of creating innovation and providing more absorptive capacity.

2.3.2.3. Education level. We notice that the skills play a crucial role in promoting the innovation efforts of any service firm. These well-skilled staffs are, actually, necessary notably in enhancing the way by which external sources are used and optimally exploited. Indeed, on the one hand, the education level of employees is a measure of the level of knowledge and the qualification of the employees within the company. On the other hand, it represents a major determinant for innovation activities. In this paper, we measure the education level (*NivSc*) by the number of workforce qualified[1] divided by the total number of employees in the firm.

2.3.2.4. Innovation experience. Firms that participated during the period of 2005-2007 in innovation projects with the purpose to develop or to introduce new services (or even new methods) have certainly acquired technical knowledge, experience and new ideas. So, even if the enterprise has not innovated, the experience it captures from the projects enables it to heighten its innovation profitability. In this analysis, we measure innovation experience (*ExpInn*) by a binary variable taking the value 1 if the firm answered that it was involved in innovation projects and 0 otherwise.

2.3.2.5. Demand pull and cost push. According to the economic literature on the innovation, Crépon et al. (1998) show that the demand pull and cost push are two key factors that promote innovation. To implement these two indicators, we use a measure adopted by Lopes and Godinho (2005). The demand pull (*Dpull*) is a binary variable that takes the value 1 when, on average, the firm gave a score greater than 2 (very or moderately important) to the set of four objectives "replacing the products being phased out", "improving service quality", "extending service range" and "opening new markets or increasing market share", and 0 otherwise.

Similarly, cost push (*Cpush*) is a binary variable that takes the value 1 when, on average, the firm gave a score greater than 2 (very or moderately important) to the set of three objectives "reducing production costs", "increasing the firm payoff" and "increasing the firm's productivity", and 0 otherwise.

3. Empirical results

The estimation results of both models with the instrumental variables method are reported in Tables 3 and 4. Our results provide insight about the analysis of the role of internationalization in promoting the profitability of innovation in the Tunisian service sector.

3.1. Empirical validation. Table 2 presents the mean, the standard deviation and the correlations between variables used in this study. To test for multicollinearity, the variance inflation factor (hereafter VIF) was also given in Table 2 (column 4). According to Neter et al. (1989), the values of the individual VIF are greater than 10 and the values of average VIF are greater than 6 indicating, hence, a multicollinearity problem. However, in our context, one can easily check that the values presented in table 2 do not reach the levels that make multicollinearity problem to matter.

Other preliminary tests confirm the absence of omission explanatory variables and heteroscedasticity problems. The application of the Pesaran Taylor Ramsey RESET test indicates a *p*-value of 0.7875 for the first model, 0.5305 for the model M2a, 0.4041 for the model M2b and 0.9924 for the last one. This test allows us to accept the hypothesis of no omitted variables. In addition, the test of Pagan-Hall (1983) states that the distribution is homoscedastic (*p-value* = 0.50)[2]. However, the use of the Hausman (1978) specification test permits us to prove that there is an endogeneity problem. The residual of the first stage equation is significantly correlated with the innovation profitability; a matter that brings about the acceptance of the R&D-endogeneity hypothesis.

With the goal to solve the endogeneity problem, we use the instrumental variables estimators. In fact, the main difficulty we encounter in the implementation of the estimation procedure is the choice of the instruments. These latter must be correlated with the endogenous variable and uncorrelated with the error term. The first condition can be tested considering the regression in its reduced form (the first stage regression). Based on the R^2 and the *Fisher* statistic, our results show that the probability of the test is statistically significant indicating that the instruments chosen in these models are relevant. As for the second condition, the overidentifying restrictions assumption can be tested by the Sargan (1958) statistic (or the validity of instruments test). As

[1] We consider as qualified, the percentage of the service firms' workforce with a bachelor's degree.

[2] It is equal to 0.8213 for model M2a, 0.8184 for model M2b and 0.7608 for the latest model.

shown in Table 3, we find that the probability of the Sargan statistic for model (M1) is not significant (0.249) suggesting that the model is correctly specified. Therefore, we conclude that the instruments chosen to explain the R&D are all valid. Table 4 also shows that the *Wald* statistic is statistically significant indicating the absence of the endogeneity problem for the second model (M2).

3.2. The economic returns to innovation. In this paper, we test how the internationalization of services does affect the innovation profitability of Tunisian service firms. We obtain that the variable (I_i^3) has a positive and statistically significant effect on the service firms' innovation profitability. In this setting, we argue that the higher the investment level a firm devotes to international operations, the higher will be its absorption capacity in terms of innovation. In this context, we can argue that internationalization allows Tunisian service firms to enhance their performance through learning the way according to which they develop new services. Actually, this result embodies the fact that internationalization can increase the firm innovation profitability either by the improvement of the process of knowledge accumulation or by the capture of innovative ideas from other service firms. This outcome goes in line with that obtained by Kafouros et al. (2008). These authors reveal that internationalization enhances a firm's capacity to improve its performance through innovation. Moreover, when we use the ratio of foreign sales over total sales I_i^2 as an indicator of internationalization, we find no significant effect of such a variable on innovation. Actually, this outcome contradicts the Kafouros et al.'s (2008) results. This result has been obtained while taking into consideration the ratio of foreign sales to total sales as a proxy. However, our result arises due to the fact that we have adopted a qualitative character.

The service firm that introduces new services may benefit not only from the international activities but also from accessing to new external knowledge in terms of efforts that are devoted to promote innovation. Indeed, this new knowledge can be either created within the firm (internal R&D) for its innovation activities or bought from other organizations (external R&D). In this analysis, we find that the implementation of the R&D activities positively affects the service firms' innovation profitability. This result is consistent with earlier findings on innovation (Crépon et al., 2000; Mairesse and Mohnen, 2005). In this context, the R&D effort and the importance attributed to the research activities allow the service firms to strengthen their ability to absorb and to use all kinds of new knowledge.

Table 4 presents the estimation results of the second model (M2). Although R&D has always been a key element in the process of innovation, it is far away from being the only factor used for driving any innovation. The management of the innovation-making in a firm can be also based upon the utilization of other factors. For instance, it should also take account of the workers qualification role, the interactions with other firms, as well as an organizational structure conducive to learning and to the exploitation of knowledge (OCDE, 2005). In this situation, it is important to note that, among all inputs and determinants of innovation (education level, demand pull, technology push and innovation experiences), only the technology push is significant (Table 4). We observe a positive and statistically significant coefficient at 10% for both models. We state that the growing of the technological dynamics enables organizations to reap productivity gains in many services. Similar results are found by Crépon et al. (2000). These authors show that the technologies dynamics incite and encourage companies to develop new services. As it has been shown in Salkintzis (2004), the mobile telecommunication industry has quickly evolved. In this context, mobile operators are going to cover higher market share. Accordingly, this successful business field is being known as a source of innovative business ideas relative to the communication products and service.

So, the interaction is between a binary variable indicating whether or not the company has internationalized its services (I_i^1) with five different internationalization patterns that can be adopted by the firm (Z_i^j). In this case, our empirical results show that only the coefficient relative to the interaction between internationalization and export (I_i^1 Z_i^4) is significant and positive. This implies that the internationalization via exports has a positive and statistically significant effect on innovation profitability. The higher a service firm's exporting intensity, the greater its innovation profitability. This is consistent with the *Learning-by-Exporting* theory according to which the firm that integrates foreign markets enhances knowledge and experiences enabling it to enlarge its innovation effectiveness (De Loecker, 2007). Similarly, we also show that "export" is the most-adopted internationalization modality. This result is obtained while using the ratio of foreign sales to total sales (I_i^2) and the perception of the internationalization strategy (I_i^3) as indicators of internationalization rather than using the binary variable (I_i^1). Also, we find that the coefficient relative to the interaction of internationalization-FDI (I_i^3 Z_i^5) has a positive and statistically significant effect on innovation profitability only for model M2c. This embodies the fact that when a firm invests abroad can increase its ability to innovate.

Table 2. Descriptive statistics and correlations between variables

Variables	Mean	SD	VIF	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
(1) *R&D*	0.5	0.502	1.24	1.00														
(2) *Size*	3.380	2.004	2.23	-0.13	1.00													
(3) *Age*	12.932	19.250	2.39	-0.12	0.6*	1.00												
(4) *NivSc*	0.748	0.243	1.48	0.09	-0.2*	-0.39*	1.00											
(5) *ExpInn*	0.703	0.458	1.33	0.20*	0.13	0.02	0.17	1.00										
(6) *Cpush*	0.796	0.404	2.05	0.27*	0.12	0.06	0.08	0.37*	1.00									
(7) *Dpull*	0.731	0.445	1.91	0.18	0.15	-0.06	0.20*	0.29*	0.62*	1.00								
(8) I_i^3	2.037	1.281	1.92	-0.24*	-0.03	0.16	-0.21*	-0.15	-0.21*	-0.2*	1.00							
(9) I_i^1	0.527	0.501	3.77	0.16	0.09	-0.00	0.17	0.11	0.21*	0.2*	-0.62*	1.00						
(10) I_i^2	1.888	2.503	3.15	0.23*	0.04	-0.13	0.17	0.07	0.15	0.17	-0.49*	0.71*	1.00					
(11) $I_i^1 Z_i^1$	0.064	0.247	1.48	0.03	-0.07	-0.00	-0.01	0.17	0.13	0.15	-0.15	0.24*	-0.00	1.00				
(12) $I_i^1 Z_i^2$	0.129	0.337	1.73	0.22*	0.2*	-0.08	0.01	0.19*	0.12	0.10	-0.24*	0.36*	0.45*	-0.10	1.00			
(13) $I_i^1 Z_i^3$	0.185	0.390	2.43	0.23*	0.2*	-0.08	0.02	0.15	0.24*	0.2*	-0.36*	0.45*	0.59*	0.16	0.5*	1.00		
(14) $I_i^1 Z_i^4$	0.25	0.435	1.95	0.02	0.00	0.08	0.15	0.09	-0.07	0.06	-0.30*	0.54*	0.46*	0.1*	0.15	0.16	1.00	
(15) $I_i^1 Z_i^5$	0.055	0.230	1.95	0.16	0.05	-0.02	-0.07	0.06	0.12	0.14	-0.19*	0.22*	0.33*	0.26*	0.38*	0.50*	0.23*	1.0

Table 3. Estimation results of the first model (M1)

Variables	Innovation profitability (M1)	
	Coefficient	(R. std. E)
Constant	**-18.873***	(10.822)
R&D activity (*R&D*)	**25.840***	(14.604)
Firm size (*size*)	4.183	(3.327)
Age of the firm (*age*)	0.303	(0.332)
Education level (*NivSc*)	4.722	(14.671)
Innovation experience (*ExpInn*)	-13.323	(12.865)
Cost push (*Cpush*)	19.679	(12.442)
Demand pull (*Dpull*)	-3.618	(6.871)
Internationalization		
Elaboration (I_i^1)	-3.086	(10.451)
Foreign sales (I_i^2)	0.075	(2.674)
Perception (I_i^3)	**5.850****	(2.417)
N	90	
R^2	0.329	
Wald $\chi_{(10)}^2$	49.143	
prob > χ^2	[0.000]	
Sargan test	4.115	
p-value	0.249	

Note: Significance levels: * 10% ** 5% *** 1%.

Table 4. Estimation results of the second model (M2)

Variables	(M2a)		(M2b)		(M2c)	
	Coef.	R. std. E	Coef.	R. std. E	Coef.	R. std. E
R&D activity (*R&D*)	**27.338****	(12.250)	**26.413****	(13.530)	**25.984****	(13.091)
Firm size (*size*)	**5.048***	(2.980)	4.237	(3.250)	4.798	(3.254)
Age of the firm (*age*)	-0.010	(0.339)	0.231	(0.316)	-0.007	(0.432)
Education level (*NivSc*)	-3.066	(13.109)	1.506	(13.872)	-2.324	(13.702)
Innovation experience (*ExpInn*)	-16.757	(11.265)	-17.426	(12.442)	-15.388	(12.545)
Cost push (*Cpush*)	**33.105*****	(12.155)	**26.976****	(13.595)	**28.697****	(13.255)
Demand pull (*Dpull*)	-6.724	(6.698)	-6.943	(7.386)	-4.768	(7.449)
Internationalization						
Elaboration (I_i^1)	-13.019	(11.500)	-9.198	(12.334)	-9.357	(13.249)
Foreign sales (I_i^2)	0.014	(2.171)	0.717	(3.202)	0.687	(2.135)
Perception (I_i^3)	**5.306****	(2.313)	**5.142****	(2.371)	**4.860****	(2.494)
I_i^1 Z_i^1	-25.683	(15.207)				
I_i^1 Z_i^2	5.009	(17.409)				
I_i^1 Z_i^3	-14.190	(10.360)				
I_i^1 Z_i^4	**33.518*****	(11.464)				
I_i^1 Z_i^5	2.316	(14.443)				
I_i^2 Z_i^1			3.670	(6.151)		
I_i^2 Z_i^2			5.466	(3.563)		
I_i^2 Z_i^3			-3.265	(2.865)		
I_i^2 Z_i^4			**4.079*****	(2.458)		
I_i^2 Z_i^5			-4.567	(3.208)		
I_i^3 Z_i^1					-17.125	(9.213)
I_i^3 Z_i^2					3.983	(10.609)
I_i^3 Z_i^3					-17.488***	(6.750)
I_i^3 Z_i^4					**17.840****	(9.246)
I_i^3 Z_i^5					**6.932***	(11.884)
N	90		90		90	
R^2	0.455		0.403		0.413	

Table 4 (cont.). Estimation results of the second model (M2)

Variables	(M2a)		(M2b)		(M2c)	
	Coef.	R. std. E	Coef.	R. std. E	Coef.	R. std. E
Wald $\chi_{(15)}^2$	79.13***		73.38***		48.38***	
Prob > χ^2	[0.000]		[0.000]		[0.000]	
Sargan test	1.184		3.450		2.646	
p-value	0.756		0.327		0.449	

Conclusions, implications and future research

In this paper, we have used a sample of 108 Tunisian service firms in order to explain the role of internationalization in promoting innovation profitability. Besides, we have analyzed the direct effect of internationalization on firms' innovation returns. We have also focused on the interna-tionalization modalities firms adopt.

To do so, we have used the KPF relating innovation to its various determinants. Using the instrumental variables procedure, the results of the estimation show that internationalization improves the firms' innovation profitability. This result suggests that the access to external knowledge justifies the increase in firms' returns on innovation. Moreover, the econometric results show that internationalization through exports remains the main modality the Tunisian service firms used to adopt while seeking for enlarging their capability to innovate.

Further, it follows from our analysis some other interesting results relative to the literature that deals with the topic of service innovation. Indeed, these results suggest some policy implications:

- Firstly, enabling the internationalization of firms could improve their ability to "steer" further innovation opportunities. For example, promoting relationship across borders is an important way to *extract* source of knowledge and therefore it helps generating innovation. In fact, internationalization could be considered as an important channel for exchanging the prospective innovation opportunities running between countries.
- Secondly, the internal R&D activities of a service firm are not the sole to provide innovation. Dealing with the Tunisian service firms, it appears that the access to the international markets plays a key role in performing their innovation efforts. For instance, the R&D cooperation with service foreign firms could give a Tunisian service firm the capability to learn from their innovation know-how. As reported by the *Learning-by-Exporting* theory, the firm that integrates foreign markets enhances knowledge and experience enabling it to increase its innovation effectiveness (De Loecker, 2007).
- Finally, our results suggest that the public authorities caring on innovation in the service sector have to take into consideration the extent to which service firms are heterogeneous with respect to the way by which they manage their innovation behavior. The reason behind this finding is that the diversification of the innovation procedures could accentuate the technological externalities and soften the eviction behavior.

However, our study has a number of limitations. First, in this paper we have focused particularly on the service sector, taken alone. Indeed, future research should also take into account both the manufacturing and the service sectors. In this context, it will be important to see how these two complementary sectors learn from each other in terms of innovation. Second, due to the limited data availability, we have used a qualitative variable as an internationalization indicator. To generalize the results, future research should use other measures such as the ratio of foreign sales to total sales. Third, we should note that the dynamic feature of the innovation process could be an important topic to deal with in a further research. At last, it could be also recommended to re-estimate the model using panel data rather than cross-sectional data.

References

1. Castellacci F. (2010). The internationalization of firms in the service industries: Channels, determinants and sectoral patterns, *Technological Forecasting and Social Change*, 77, pp. 500-513.
2. Castellani D., Zanfei A. (2007). Internationalization, innovation and productivity: How do firms differ in Italy? *The World Economy*, 30, pp. 156-176.
3. Crépon J., Duguet E., Mairesse J. (2000). Mesurer le rendement de l'innovation, *Economie et statistique*, 334, pp. 65-78.
4. Crépon J., Duguet E., Mairesse J. (1998). Research, Innovation and Productivity: An Econometric Analysis at the Firm Level, *Economics of Innovation and New Technology*, 7, pp. 115-158.
5. De Loecker J. (2007). Do exports generate higher productivity? Evidence from Slovenia, *Journal of International Economics*, 73, pp. 69-98.

6. Freel M.S. (2005). Patterns of innovation and skills in small firms, *Technovation*, 25, pp. 123-134.
7. Geroski P.A. (1990). Innovation, technological opportunity, and market structure, *Oxford Economic Papers*, 42, pp. 586-602.
8. Greene W.H. (2003). *Econometric analysis*, 4th ed., Prentice Hall.
9. Hausman J.A. (1978). Specification tests in econometrics. Econometrica, *Journal of the Econometric Society*, pp. 1251-1271.
10. Hitt M.A., Hoskisson R.D., Robert E. (1994). A mid-range theory of the interactive effects of international and product diversification on innovation and performance, *Journal of Management*, 20, pp. 297-326.
11. Hitt M.A., Hoskisson R.E., Kim H. (1997). International diversification: Effects on innovation and firm performance in product-diversified firms, *The Academy of Management Journal*, 40, pp. 767-798.
12. Hsu C.C., Pereira A. (2008). Internationalization and performance: The moderating effects of organizational learning, *Omega*, 36, pp. 188-205.
13. Kafouros M.I., Buckley P.J., Sharp J.A., Wang C. (2008). The role of internationalization in explaining innovation performance, *Technovation*, 28, pp. 63-74.
14. Kobrin S.J. (1991). An empirical analysis of the determinants of global integration, *Strategic Management Journal*, 12, pp.17-31.
15. Kogut B., Zander U. (1993). Knowledge of the firm and the evolutionary theory of the multinational corporation, *Journal of International Business Studies*, 24, pp. 625-645.
16. Kotabe M. (1990). The relationship between offshore sourcing and innovativeness of US multinational firms: an empirical investigation, *Journal of International Business Studies*, 21, pp. 623-638.
17. Kotabe M., Srinivasan S.S., Aulakh P.S. (2002). Multinationality and firm performance: The moderating role of R&D and marketing capabilities, *Journal of International Business Studies*, 33, pp. 79-97.
18. Lopes L.F., Godinho M.M. (2005). Services Innovation and Economic Performance: An analysis at the firm level, *Danish Research Unit for Industrial Dynamics Working Paper*, 05-08.
19. Love J.H., Roper S. (1999). The determinants of innovation: R&D, technology transfer and networking effects, *Review of Industrial Organization*, 15, pp. 43-64.
20. Love J., Roper S. (2001). Location and network effects on innovation success: evidence for UK, German and Irish manufacturing plants, *Research Policy*, 30, pp. 643-661.
21. Mairesse J., Mohnen P. (2003). R&D and productivity: a reexamination in light of the innovation surveys, in DRUID Summer Conference, pp.12-14.
22. Mairesse J., Mohnen P. (2005). The importance of R&D for innovation: A reassessment using French survey data, *Essays in Honor of Edwin Mansfield*, pp. 129-143.
23. Miozzo M., Soete L. (2001). Internationalization of Services: A Technological Perspective, *Technological Forecasting and Social Change*, 67, pp. 159-185.
24. Neter J. Wasserman, W. Kutner M.H. (1989). *Applied Linear regression Models*, 2nd ed., Irwin Homewood IL.
25. OCDE (2005). La mesure des activités scientifiques et technologiques, Manuel d'Oslo, Principes directeurs pour le recueil et l'interprétation des données sur l'innovation.
26. OCDE (2007). Tendances récentes de l'internationalisation de la R&D du secteur des entreprises.
27. OCDE (2008). Science, technologie et industrie : Perspectives de l'OCDE 2008.
28. Pagan A.R., Hall A.D. (1983). Diagnostic tests as residual analysis, *Econometric Reviews*, 2, pp. 159-218.
29. Salkintzis A.K. (2004). *Mobile internet: enabling technologies and services*, New York: CRC Press.
30. Santos J., Doz Y., Williamson P. (2004). Is your innovation process global? MIT Sloan, *Management Review*, 45, pp. 31-37.
31. Sargan J.D. (1958). The estimation of economic relationships using instrumental variables, *Econometrica*, 26, pp. 393-415.
32. Tsang EWK (1999). Internationalization as a learning process: Singapore MNCs in China, *The Academy of Management Executive*, 13, pp. 91-101.

Appendix

Table 1A. List of variables

Variable code	Proxy
Innovation profitability	The percentage increase in the firm's turnover due to the introduction of a new service during the period of 2005-2007.
Internationalization	♦ A binary variable that takes 1 if the firm indicates that it has internationalized its service activities over the period 2005-2007 and 0 otherwise (I^1). ♦ The ratio of foreign sales to total sales (I^2). The variable is discreet so that it takes values from one to seven; 1 = less than 10%, 2 = 11-20%, 3 = 21-30%, 4 = 31-40%, 5 = 41-50%, 6 = 51-60% and 7 = greater than 60%. ♦ A discrete variable with four outcomes indicating the level (score) of the importance that each firm attributes to the internationalization strategy (I^3): 1 = high, 2 = medium, 3 = low and 4 = not used.
R&D activities	Dummy variable that takes 1 if the firm is engaged in internal R&D activities and zero otherwise.
Size and age of the firm	Size: The total number of employees in 2007 (in log form). Age: The date of its creation until 2007.
Education level	The number of workforce qualified divided by the total number of employees in the firm.
Innovation experience	Binary variable taking the value 1 if the firm answered that it was involved in innovation projects and 0 otherwise.
Demand pull	Binary variable that takes the value 1 when, on average, the firm gave a score greater than 2 (very or moderately important) to the set of four objectives "replacing the products being phased out", "improving service quality", "extending service range" and "opening new markets or increasing market share", and 0 otherwise
Cost push	Binary variable that takes the value 1 when, on average, the firm gave a score greater than 2 (very or moderately important) to the set of three objectives "reducing production costs", "increasing the firm payoff" and "increasing the firm's productivity", and 0 otherwise.