# ECONOMICS
## & Sociology

# BARRIERS TO PRODUCT INNOVATION: AN EMPIRICAL STUDY IN PORTUGUESE SERVICES SME

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**ABSTRACT.** This study aims to explore the relations between financial, knowledge and market barriers to innovation and the innovation propensity of the Portuguese SMEs services sector, specifically at the product level. Utilizing data from the Community Innovation Survey (CIS) covering the years 2018-2020, the analysis focuses on a sample of 9238 companies within the service sector, each employing between 10 and 249 individuals. The research employs a logistic regression model to assess these relationships. The findings highlight that some obstacles, such as insufficient credit or private investment and restricted access to external knowledge, are perceived as hindrances to product innovation. Interestingly, some barriers to innovation, such as the lack of skilled personnel and elevated costs, can paradoxically serve as catalysts for innovation.

## Introduction

Given the relevance and importance of business innovation for the economic development of countries and the enhancement of people's quality of life, the study of barriers to innovation in the context of Small and Medium Enterprises (SMEs) becomes essential to support companies in identifying these limiting factors and overcome them successfully

(Ribeiro-Soriano, 2017; Saunila, 2020). According to statistical data from Pordata (2020), SMEs represent 99.9% of the total number of companies in Portugal, employ approximately 79% of the active population and record a turnover of 56% of the total national production. On the other hand, the services sector is vital for the Portuguese economy since it employs close to 70% of the active population, i.e. seven out of ten people work in this sector, according to Eurostat data (2019). Therefore, it is important to develop research that helps SMEs in the services sector to achieve higher levels of innovation, productivity and competitiveness.

Attending to the relevance of innovation for companies and the economic development of countries, it is therefore crucial to develop studies on the factors that promote and inhibit innovation (Kim, Park & Paik, 2018). Thus, the general objective of this work is to identify the relationship between barriers to innovation and product innovation in SMEs in the service sector. The specific objectives that are intended to be achieved in this research are presented below: (i) identify and analyse the types of barriers to innovation; (ii) identify and describe the financial, knowledge and market variables that limit innovation in Portuguese SMEs in the service sector.

This research employs data derived from the 2020 edition of the Community Innovation Survey, investigating the correlation between obstacles to innovation and the development of new products among small and medium-sized enterprises (SMEs) in the Portuguese service sector from 2018 to 2020. The sample encompasses 9238 companies falling under sections G to S of the CAE (Classification of Economic Activity), all of which have a workforce ranging from 10 to 249 employees – classifying them as Small and Medium Enterprises. It is hoped that the results obtained can contribute to a deeper knowledge of the subject and fill some existing gaps in terms of both theoretical and empirical contributions. In addition, it aims to generate knowledge and propose guidelines to guide public and private entities in formulating measures to overcome the barriers to innovation in SMEs.

This paper begins by presenting the theoretical framework based on relevant literature on barriers to innovation as conditioning factors of the innovation process and, consequently, the result of this process at the level of product innovation. Then, it introduces the methodology and describes and characterises the variables used in the empirical study. The following section presents the logistic regression model to study the barriers to product innovation and discusses the results. Finally, the conclusions and implications for the design and future adoption of public policies aimed at overcoming the factors conditioning the innovative capacity of service sector firms in Portugal are presented.

## 1. Literature review

### 1.1. Innovation in services

Over the past few decades, there has been a transformative shift in the significance of the services sector within the economy. Its role has expanded, gaining greater importance in driving innovation, fostering competitiveness, generating employment, and contributing to overall economic growth (Madeira, Simões, Souza, Moreira & Marinardes, 2014; Santos-Vijande, Santos-Vijande; Pascual-Fernández & Rudd, 2021). Increasingly, service industries are the source of new growth, emphasising the potential importance of innovation in services in increasing regional productivity (Love, Roper & Hewitt-Dundas, 2010).

The definition of services is ambiguous and heterogeneous since it encompasses diverse economic activities, all those not included in the primary and secondary sectors (Jacob, Tintoré & Torres, 2001). The services sector, also known as the third sector, comprises a wide range of different activities with different characteristics, ranging from personal service companies such

as hairdressers who use basic technologies to companies that are intensive in the use of advanced information technologies, such as companies in the communications, IT, financial, insurance and real estate sub-sectors (Jacob et al., 2001; Miles, 2005). The term service innovation refers to innovation that occurs in various service contexts and includes the introduction of new services or gradual improvements in existing services (Pires, Sarkar & Carvalho, 2008; Durst, Mention & Poutanen, 2015).

## 1.2. Barriers to innovation

The majority of empirical research literature on innovation tends to concentrate on unraveling the intricacies and features of technological innovation, as well as discerning the forces propelling innovation activities within firms and sectors. In contrast, relatively less attention is afforded to examining the factors that could obstruct or defer the progression of the innovation process. (D'Este, Iammarino, Savona & Von Tunzelmann, 2012; Garcia-Quevedo, Pellegrino & Savona, 2017; Pellegrino, 2018).

For Hadjimanolis (1999), the barriers to innovation act as inhibiting factors and can arise in one or more phases of the innovation process. Once the inhibitors of innovation when identified, classified, their effect will be understood, and measures will be taken to eliminate them, the natural flow of innovation will be restored, and the barriers can even act as stimulants of innovation in some cases, instead of inhibitors (Hadjimanolis, 1999; Cordeiro, 2011; Shojaei & Burgess, 2022).There are several classifications and approaches in the study of barriers to innovation, a usual classification is that of internal or endogenous barriers, related to people, structure or knowledge and external or exogenous barriers, related to the market context, policy or environment (Hadjimanolis, 1999; Madrid-Guijarro et al., 2009; Cordeiro, 2011; Moraes Silva, Lucas & Vonortas, 2020).

Another categorization explored in the literature on innovation economics involves the classification of barriers into financial, knowledge, and market categories. (Costa-Campi, Duch-Brown & García-Quevedo, 2014). Financial constraints are related to characteristics of innovation projects such as the high degree of uncertainty or the existence of information asymmetries (García-Quevedo, Segarra- Blasco & Teruel, 2018; Costa-Campi et al., 2014).

Market failures play a pivotal role in elucidating the presence of market barriers, particularly the challenges associated with securing external financing. Additionally, factors aligned with a systemic perspective on innovation, such as the scarcity of qualified personnel or a market heavily dominated by established firms, can also pose impediments to innovation activities. (D'Este et al., 2012; Costa- Campi et al., 2014). This will be the classification used in this study.

Over the recent years, researchers exploring barriers to innovation have embraced two empirical approaches. The first delves into the examination of the predominantly financial barriers and their impact on the inclination and intensity of innovation activities within firms. The second approach investigates the characteristics of both firms and markets that could shape firms' perspectives on the significance of various barrier types. (Garcia-Quevedo et al., 2017; Pellegrino, 2018; Ortiz & Fernandez, 2022).

There is a third approach based on a more detailed observation of non-innovative companies to obtain a better understanding of how barriers to innovation are perceived by different types of companies (D'este et al., 2012; Pellegrino & Savona, 2013; Ortiz & Fernandez, 2022). According to D'este et al. (2012), companies face two types of barriers to innovation, which can arise at different times of the innovation process: deterrent barriers (obstacles that prevent companies from engaging in innovation processes) and revealed barriers (obstacles that arise when the company has already started an innovation process).

### 1.3. Financial barriers

A significant portion of studies in the field of barriers to innovation has concentrated on scrutinizing the ramifications of financial limitations. Specifically, these studies delve into the analysis of how constraints in finances impact a firm's ability to invest in research and development (R&D) and the subsequent development of innovation processes. (Garcia-Quevedo et al., 2017; Radicic, 2021).Savignac (2008) examined the impact of financial constraints on innovation activities in firms established in France. The results of his investigation showed that the perception of financial barriers considerably reduces the propensity of firms to engage in innovation activities. Canepa & Stoneman (2008) explored the role of financial factors as limiting the innovation process in the UK. The results showed that financial barriers negatively impact innovative activity and that the impact is more severe in firms in the high technology sector and in smaller firms.

According to Kim et al. (2018), internal human and financial resources are essential to pursue innovation, and their lack increases the propensity of failure and low performance in the firm. For Hadjimanolis (1999), SMEs face relatively more barriers to innovation than large companies due to insufficient internal financial resources.

Silva, Leitão & Raposo's (2008) study delved into the impact of barriers to innovation on the innovative capacity of Portuguese manufacturing firms in product or process development. The findings revealed that increased innovation costs and a dearth of internal financing sources emerged as the most significant perceived hindrances to innovation, exerting a negative and noteworthy influence on the inclination to innovate. Consequently, companies grappling with the perception of exorbitant innovation costs and a shortfall in financing options demonstrate a reduced propensity for innovation.

The intricacies of financial uncertainty and information asymmetries further compound the challenges for firms seeking external financing, particularly in the realm of innovative projects. The unique characteristics of such projects, marked by high monitoring costs and the intricacy of assessing innovation viability, intensify risks and exacerbate information issues with external investors (Savignac, 2008; Madrid-Guijarro et al., 2009; Garcia-Quevedo et al., 2017; Radicic, 2021).The literature reviewed indicates that lack of internal financial resources, lack of private capital and high costs are perceived by firms as financial barriers and reduce their propensity to engage in product-level innovation processes, so the following hypotheses are formulated:

> $H_1$. Lack of internal financing for innovation is negatively related to SMEs' propensity to innovate at the product level.
>
> $H_2$. Lack of credit or private capital for innovation is negatively related to SMEs' propensity to innovate at the product level.
>
> $H_3$. The difficulty in obtaining public support or subsidies is negatively related to the propensity of SMEs to innovate at the product level.
>
> $H_4$. Too high innovation costs are negatively related to SMEs' propensity to innovate at the product level.

### 1.4. Knowledge barriers

During the innovation process, companies encounter several obstacles. Galia & Legros (2004) analysed the obstacles to innovation faced by French manufacturing companies in postponed projects and in abandoned projects. Results indicated that the lack of qualified

personnel is a significant barrier for firms that decide to postpone their involvement in innovative activities.

As outlined in the study conducted by Silva et al. (2008) within the context of Portuguese manufacturing companies, the absence of qualified personnel is identified as a notable impediment to innovation. This is attributed to the crucial role of highly skilled human capital, as a deficiency in this area deprives the company of a requisite reservoir of creative ideas and knowledge essential for successful commercial negotiation of innovations.

Segarra-Blasco, Garcia-Quevedo and Teruel-Carrizosa (2008) explored the relationship between the propensity to innovate and barriers to innovation encountered by Catalan manufacturing and service firms. The study concludes that difficulty in finding highly skilled employees and partners to collaborate with are factors that limit innovation. The difficulty of finding a partner to collaborate with is a barrier for both innovative and non-innovative firms, but non-innovative firms perceive this barrier more. More recent studies allows to understand that open innovation practices can be used to mitigate existing barriers (Torres de Oliveira et al, 2022)

The existing literature seems to agree that firms face significant difficulties in developing innovation activities, both due to lack of skilled employees and lack of collaborative partners, and these difficulties are likely to persist as barriers to innovation. Therefore, it is proposed to test the following hypotheses:

> $H_5$. *The lack of skilled employees within the firm is negatively related to SMEs' propensity to innovate at the product level.*
> $H_6$. *The lack of partners to collaborate is negatively related to the propensity of SMEs to innovate at the product level.*
> $H_7$. *The lack of access to external knowledge is negatively related to the propensity of SMEs to innovate at the product level.*

### *1.5. Market barriers*

The literature on barriers to innovation has traditionally focused on the study of financial barriers and constraints faced by firms and gives less importance to the study of the lack and uncertainty around demand, lack of adequate information about technologies and market or the lack of skills and knowledge by employees as factors that hinder decisions to invest in innovation (Pellegrino & Savona, 2013; Garcia-Quevedo et al., 2017; Ortiz & Fernandez, 2022).

Garcia-Vega & Lopez's (2010) empirical analysis focused on scrutinizing the impact of barriers to innovation on the likelihood of abandoning innovation projects within Spanish innovative firms during the period 2005-2007. The study's outcomes underscore the prominence of market-related factors as the primary influencers of innovation failure. Additionally, a key observation is the divergence in the perception of barriers based on company size. Small and medium-sized enterprises (SMEs) primarily face challenges leading to the abandonment of innovative projects such as competition from established companies and market uncertainty. In contrast, larger companies identify the lack of qualified personnel and the accessibility of external financing as the foremost barriers to sustaining innovation projects.

Costa-Campi et al. (2014) explored the main factors driving investment in R&D and the barriers to innovation in the energy sector in the context of Spanish companies, period 2004-2010. The results showed that the main barriers hindering innovation in the energy sector are related to market factors, and the main barrier preventing innovation activities in the energy industry is the market dominance of established firms.

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Pellegrino and Savona's (2017) comparative assessment delved into the factors impeding firms' capacity to transform investments into product or process innovation activities. The study utilized unbalanced panel data from "potentially innovative" firms in the UK during the period 2002-2010. The findings indicate that demand-side factors, specifically a concentrated market structure and insufficient demand, wield a significance akin to financial constraints in influencing firms' innovation failures. In line with existing literature, the study formulates the following hypotheses:

$H_8$. *Uncertain market demand for their innovative ideas is negatively related to SMEs' propensity to innovate at the product level.*

$H_9$. *Too much competition in their market is negatively related to SMEs' propensity to innovate at the product level.*

$H_{10}$. *Different priorities within the firm are negatively related to SMEs' propensity to innovate at the product level.*

## 2. Methodological approach

To assess the hypotheses proposed in this study, a quantitative investigation will be conducted. The focus of this research is confined to Portuguese companies within the services sector employing between 10 and 249 individuals. Consequently, the most suitable method for data collection has been identified as the utilization of secondary data.

According to Silva (2003), the use of secondary data presents multiple advantages such as quick access to the information needed for the investigation, low cost, and eliminates the problem of low response rate associated with traditional questionnaires.

Data were collected between July and December 2019 through the Community Innovation Survey, a publication that reports on innovation activities carried out by companies during the period 2018-2020 in the Portuguese territory. The target population includes companies belonging to Sections A to S of CAE - Rev. 3, with the exception of Section O.

The survey was implemented by the Directorate-General for Education and Science Statistics and the National Statistical Institute under the guidance of Eurostat. The CIS 2018 - 2020, regulated by the European Union, measures innovation activities in enterprises based on the principles defined in the Oslo Manual (OECD, 2018).

In this research, it is considered as independent or explanatory variables ten barriers to innovation considered in the CIS 2020, which are: Lack of internal funding for innovation, lack of credit or private capital, difficulty in obtaining public support or subsidies, innovation costs too high, lack of qualified employees within the company, lack of partners to collaborate, lack of access to external knowledge, uncertain market demand for innovative ideas, too much competition in the market and different priorities within the company.

The dependent or response variables are those that depend on the values or variation of the independent variables. In this research, the dependent variable is the propensity to innovate at the product innovation level. To measure these dimensions of innovation it was used dichotomous variables based on binary data, the variable assumes the value of 0 for companies that have not innovated and 1 for companies that have innovated.

This study aims to explore the influence that barriers to innovation have on the types of innovation carried out by service SMEs. To find this relationship, and after a review of the literature, it was decided to use the Logistic Regression Model (Logit Model).

The logistic regression model has been a model used in several empirical studies and presents itself as a suitable analytical technique since it includes a dependent variable (binary

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or dichotomous) and several independent variables (Silva, 2003; Silva et al., 2008; Madeira et al., 2014; Duarte et al., 2017).

Equation of the logistic regression model for product innovation

$$\text{Logit (Ipd)} = \beta_0 + \beta_1 BX_1 + \beta_2 BX_2 + \beta_3 BX_3 + \beta_4 BX_4 + \beta_5 BX_5 + \beta_6 BX_6 + \beta_7 BX_7 + \beta_8 BX_8 + \beta_9 BX_9 + \beta_{10} BX_{10}$$

Where: Ipd = Product Innovation;

$\beta_0$ = Ln value (Ipd) when all $X_i = 0$ (i = 1, ..., p)

$\beta_1, \beta_2, ..., \beta_p$ = Logit Coefficients, Logit variation (Ipd) per unit of variation BX.

$BX_1$ = Lack of internal finance for innovation.

$BX_2$ = Lack of credit or private equity.

$BX_3$ = Difficulties in obtaining public grants or subsidies

$BX_4$ = Costs too high.

$BX_5$ = Lack of skilled employees within your enterprise.

$BX_6$ = Lack of collaboration partners.

$BX_7$ = Lack of access to external knowledge.

$BX_8$ = Uncertain market demand for your ideas.

$BX_9$ = Too much competition in your market.

$BX_{10}$ = Different priorities within your enterprise.

## 3. Conducting research and results

This section presents the product innovation model and the results obtained from this model. We sought to analyse the relationship between barriers to innovation and product innovation in Portuguese SMEs in the services sector.

The sampled companies were considered to be product innovators if they answered affirmatively on at least one of the two questions in block B, question B1 of the CIS 2020. Firms were asked whether, during the period 2018-2020, they introduced: (1) new or improved goods, (2) new or improved services.

The following table summarises the variables included in the model and which serve to empirically test the hypotheses formulated.

Table 1. Variables of the product innovation model and associated hypotheses

| | Variables | Code | Measures | Hip. |
|---|---|---|---|---|
| **Var. dep.** | Product Innovation | IPROD | Dichotomous <br> 0 = Did not innovate <br> 1 = Innovated | |
| **Independent variables** | Lack of internal finance for innovation | $BX_1$ | | $H_1$ |
| | Lack of credit or private equity | $BX_2$ | | $H_2$ |
| | Difficulties in obtaining public grants or subsidies | $BX_3$ | | $H_3$ |
| | Costs too high | $BX_4$ | 0 = Not a constraint | $H_4$ |
| | Lack of skilled employees within your enterprise | $BX_5$ | 1 = Low | $H_5$ |
| | Lack of collaboration partners | $BX_6$ | 2 = Medium | $H_6$ |
| | Lack of access to external knowledge | $BX_7$ | 3 = High | $H_7$ |
| | Uncertain market demand for your ideas | $BX_8$ | | $H_8$ |
| | Too much competition in your market | $BX_9$ | | $H_9$ |
| | Different priorities within your enterprise | $BX_{10}$ | | $H_{10}$ |

*Source*: own calculation

In this study, a sample of 9238 service companies with a number of employees between 10 and 249 was considered. Of the total number of companies, 2665 (28.8%) made innovations at the product level in that period (IPRO =1 Innovated), and consequently, 6573 (71.2%) did not innovate (IPRO =0 Did not innovate).

Based on the information presented above and using the SPSS Statistics 27 software, the logistic regression model for product level innovation was built, obtaining the following results.

Table 2. Logit regression for product innovation model

| Barriers to Innovation | Model A | | Final Model | | |
|---|---|---|---|---|---|
| | Estimated Coefficients | Sig. | Estimated Coefficients | Sig. | EXP (B) |
| Lack of internal finance for innovation (BX1) | 0,266 | 0,005 | 0,243 | 0,010 | 1,275 |
| Lack of credit or private equity (BX2) | -0,652 | 0,000 | -0,718 | 0,000 | 0,488 |
| Difficulties in obtaining public grants or subsidies (BX3) | -0,161 | 0,064 | | | |
| Costs too high (BX4) | 0,630 | 0,000 | 0,639 | 0,000 | 1,895 |
| Lack of skilled employees within your enterprise (BX5) | 0,383 | 0,000 | 0,413 | 0,000 | 1,511 |
| Lack of collaboration partners (BX6) | 0,070 | 0,455 | | | |
| Lack of access to external knowledge (BX7) | -0,614 | 0,000 | -0,593 | 0,000 | 0,553 |
| Uncertain market demand for your ideas (BX8) | 0,439 | 0,000 | 0,485 | 0,000 | 1,624 |
| Too much competition in your market (BX9) | 0,127 | 0,112 | | | |
| Different priorities within your enterprise (BX10) | 0,464 | 0,000 | 0,478 | 0,000 | 1,613 |
| Constant | -1,615 | 0,000 | -1,605 | 0,000 | 0,201 |
| Model Summary | | | | | |
| Correct Predict (%) | 71,5% | | 71,8% | | |
| Chi-square | 547,893 | 0,000 | 541,693 | 0,000 | |
| Log-likelihood | 10552,252 | | 10558,451 | | |
| Number of cases (n) | 9238 | | 9238 | | |

*Source*: own calculation

The model explains the relationship between the propensity to innovate at the product level and the barriers to innovation. In Model A, the ten independent variables considered in this study were included, hypotheses $H_3$ ($BX_3$), $H_6$ ($BX_6$) and $H_9$ ($BX_9$) were not empirically tested for not being statistically significant at the 5% level. Then, the final model was estimated without considering these variables. Considering the quality of fit of the Final Model, it can be seen that the model's predictive ability is 71,8% on what 97,6% the 0 to 0 and 8% the 1 to 1 assignments. This percentage indicates that the model is able to correctly predict 71,8% of the

cases, therefore the independent variables are good predictors of the dependent variable, and the model is valid.

The chi-square test, another indicator of the quality of the model adjustment, has the value of 541,693 with a significance level less than 0,05, this shows that the independent variables included in the model significantly improve the prediction of the occurrence of the dependent variable (innovate, not innovate). The log-verosimilarity statistic has the value of 10558,451 and also corroborates the overall significance of the model.

Wald's statistic was used as test statistic, therefore the regression parameter estimates are statistically significant at 5% level. It can be verified that of the ten independent variables considered in Model A, seven variables are statistically significant in the Final Model: $BX_1$, $BX_2$, $BX_4$, $BX_5$, $BX_7$, $BX_8$, $BX_{10}$.

The lack of internal financing for innovation ($BX_1$) is statistically significant at the 10% level, $H_1$ is confirmed. This variable shows a significant and positive effect on product innovation and is therefore considered a driver of innovation at the product level rather than a barrier. It is possible that the lack of internal financing stimulates SMEs in the services sector to seek alternative financings such as credit or private investment. This result contradicts the studies of Hadjimanolis (1999) and Silva et al. (2008), thus, it becomes a potential line of research to develop in the future to know the reason why the lack of internal financing for innovation stimulates the propensity to innovate at the product level.

With regard to the lack of credit or private investment ($BX_2$), it is found to have a significant and negative effect on product innovation, therefore the null hypothesis of no relationship between the variables is rejected, and hypothesis $H_2$ is corroborated, meaning that SMEs in the service sector that perceive a lack of credit or private investment have less propensity to innovate at the product level. The coefficient of the variable is -0.718, and its advantage ratio Exp(B) is 0.488, so this is the most limiting factor in the model. This result is in line with previous studies (Hadjimanolis, 1999; Nunes, 2008; Canepa & Stoneman, 2008; Silva et al., 2008; Savignac, 2008; Madrid-Guijarro, 2009; Kim et al., 2018).

The high costs ($BX_4$) are statistically significant at the 1% level, $H_4$ is confirmed. This variable presents a significant and positive effect, appearing not as a barrier but as a driver variable of product innovation. This result agrees with the result obtained by Nunes (2008) and contradicts the results of Savignac (2008), Silva et al. (2008) and Madrid-Guijarro et al. (2009). The variable $BX_4$ has the highest advantage ratio of the final model (1.511), which means that it is the factor that most drives innovation in this model and that SMEs that perceive high costs as a barrier to innovation have 1.511 times more propensity to innovate at the product level, compared to SMEs that do not perceive this barrier. The study of Fonseca (2010) corroborates these results by showing that the high costs of innovation stimulate the development of the innovation process in the company since companies to cope with these high costs create partnerships with entities of the technological system in order to obtain resources that allow them to face this difficulty. This leads to an involvement in joint innovation processes and, consequently, boosts innovation.

The lack of qualified employees ($BX_5$) is statistically significant at the 1% level, $H_5$ is confirmed. This variable shows a significant and positive effect on product innovation, therefore, it is a driver of innovation. A possible explanation for this result could be that the lack of qualified personnel stimulates to SMEs to seek external knowledge and thus reduce their deficiencies in this area. This result contradicts some previous studies (Galia & Legros, 2004; Silva et al., 2008; Segarra- Blasco et al., 2008; Madrid-Guijarro et al., 2009). Although the reason for this result is unknown, it is a future line of research to be analysed in further studies.

The variable lack of access to external knowledge ($BX_7$) has a significant and negative effect on product innovation, so the null hypothesis of no relationship between the variables is

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rejected, and the hypothesis $H_7$ is corroborated, which means that SMEs in the service sector that perceive lack of access to external knowledge have less propensity to innovate at the product level. This variable was recently included in the CIS 2020, so it was not possible to find other studies that analysed it previously and make a comparison of the results. Thus, it constitutes a future line of research to be analysed in further studies.

The uncertainty regarding the market and the demand for new goods or services ($BX_8$) is statistically significant at the 1% level, $H_8$ is confirmed. This variable presents a significant and positive effect on product innovation, therefore, it is a driver of innovation. This result contradicts some previous studies (Garcia-Vega & Lopez, 2010; Pelegrino & Savona, 2017) and coincides with the study developed by Nunes (2008), which revealed that uncertainty regarding the market is a driver of innovation since not knowing what to expect can favour the development of innovative activities, thus entrepreneurs take risks in the search for greater profit.

The different variable priorities within the company ($BX_{10}$) are statistically significant at the 1% level, $H_{10}$ is confirmed. This variable shows a significant and positive effect on product innovation, so it is a driver of innovation. This variable was recently included in the CIS 2020, so it was not possible to find other studies that analysed it previously and compare the results. Unknown the reason for this result, it is constituted as a future line of research to be analysed in further studies.

The following table presents the summary of results of the hypotheses related to the final model of product innovation.

Table 3. Result of the hypotheses of the product innovation model

| Hypotheses | Variables | Results | Product Innovation |
|---|---|---|---|
| $H_1$ | Lack of internal finance for innovation ($BX_1$) | Confirmed | Positive effect |
| $H_2$ | Lack of credit or private equity ($BX_2$) | Confirmed | Negative effect |
| $H_3$ | Difficulties in obtaining public grants or subsidies ($BX_3$) | Not confirmed | |
| $H_4$ | Costs too high ($BX_4$) | Confirmed | Positive effect |
| $H_5$ | Lack of skilled employees within your enterprise ($BX_5$) | Confirmed | Positive effect |
| $H_6$ | Lack of collaboration partners ($BX_6$) | Not confirmed | |
| $H_7$ | Lack of access to external knowledge ($BX_7$) | Confirmed | Negative effect |
| $H_8$ | Uncertain market demand for your ideas ($BX_8$) | Confirmed | Positive effect |
| $H_9$ | Too much competition in your market ($BX_9$) | Not confirmed | |
| $H_{10}$ | Different priorities within your enterprise ($BX_{10}$) | Confirmed | Positive effect |

*Source*: own calculation

Hypotheses $H_2$ and $H_7$ were confirmed and presents a significant and negative effect on product innovation. For hypothesis $H_2$, these results agree with those obtained by Savignac (2008), Canepa & Stoneman (2008), Garcia-Vega & Lopez (2010) and Garcia-Quevedo et al. (2018). In the case of hypothesis H7, because it is a barrier recently considered in the CIS 2020, no studies were found that previously analysed it and compared results.

Hypotheses $H_1$, $H_4$, $H_5$, $H_8$ and $H_{10}$ were confirmed and presents a significant and positive effect on product innovation. In the case of hypotheses $H_1$ and $H_4$, the results differ from those obtained by Silva et al. (2008), Kim et al. (2018) and Garcia-Quevedo et al. (2018). In the case of hypothesis $H_5$, the result disagrees with Galia & Legros (2004), Silva et al. (2008), Segarra-Blasco et al. (2008) and Kim et al. (2018). The result of hypothesis $H_8$ agrees with the result obtained by Garcia-Vega & Lopez (2010), Costa-Campi et al. (2014), Pellegrino & Savona (2017) and Garcia-Quevedo et al. (2017). Finally, in the case of hypothesis $H_{10}$, it was

not possible to make a comparison of results because it is a barrier recently considered in the CIS 2020.

## Conclusion

This study aimed to determine the relationship between barriers to innovation and the propensity to innovate in terms of product innovation in service SMEs in Portugal. The logistic regression model of product innovation has two sections: model A and final model. In model, A ten independent variables were included, of which three (difficulty in obtaining public grants, lack of partners for collaboration and too much competition in their market) were not statistically significant. For the calculation of the final model, the three non-significant variables were removed, and only seven independent variables were considered.

The results of the final model revealed that most of the variables considered barriers proved to be drivers of product innovation. The variables lack internal funding for innovation $(BX_1)$, high costs $(BX_4)$, lack of qualified employees in the company $(BX_5)$, market with uncertain demand for their ideas $(BX_8)$, and different priorities within the company $(BX_{10})$ show a positive sign so that they are drivers of product innovation, not barriers.

On the other hand, the variable lack of credit or private investment $(BX_2)$ and lack of access to external knowledge $(BX_7)$ had a negative sign, so that they are considered factors that hinder the development of innovative activities and therefore make SMEs in the services sector less likely to innovate at the product level. Thus, through the results obtained, it was only possible to confirm the hypotheses $H_2$ and $H_7$.

Given the results obtained, the design of public policies aimed at strengthening innovation and enabling the barriers to innovation associated with the lack of access to external knowledge and the lack of credit and private investment is proposed. These measures are particularly important, to the extent that the Portuguese business fabric is composed, in the main, of micro, small and medium-sized enterprises, sparse in resources and knowledge, which deeply limits the company's innovative process.

To continue this research, it is proposed to carry out a future work that derives from the limitations found, which will consist of repeating the empirical study now carried out by using new data concerning the CIS in order to obtain information that allows assessing evolutionary trends within the scope of the barriers to innovation. From this perspective, it is considered that the repetition of the research in space, more specifically in the countries that responded to the same questionnaires, could also enrich the study of the phenomenon of business innovation and specifically in the approach to barriers to innovation.

It would also be interesting to carry out case studies in which it would be possible to corroborate the data obtained in this study and to deepen knowledge about the effects of barriers to innovation in service SMEs. These case studies should also be carried out over time to gain a better understanding of the phenomenon and its evolution.

Another research proposal would be to further analyse why some barriers can act as drivers of innovation, as are the cases of high costs and lack of qualified personnel in this study.

There are some new factors that have emerged as barriers to innovation that were recently considered in the last CIS 2020, such as lack of access to external knowledge and different priorities within the company. It is suggested to develop studies that analyse in depth the origin and impact of these new barriers.

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