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Financial and Non-Financial Obstacles to Innovation: Empirical Evidence at the Firm Level in the MENA Region

Mohamed Oudgou [ID]

ENCG Béni Mellal, Laboratory L.E.R.S.E.G, University Sultane Moulay Slimane, Béni Mellal 23000, Morocco; m.oudgou@usms.ma

Abstract: Innovation, in all its forms, has become a central activity in companies. Moreover, innovation is considered as the engine of growth in several countries. The main objective of this paper is to study the determinants of innovation (product and process) in firms in the Middle East and North Africa (MENA) region via concentrating on the impact of financial and non-financial obstacles. The empirical study refers to row data collected by the World Bank's Survey of Enterprises (WBES) between 2013 and 2020 in 10 MENA countries. The empirical results of the probit model estimation show that international quality certification, women's participation in ownership, and investment in research and development (R&D) have a positive impact on all types of innovation. Nevertheless, small firms, sole proprietorships, and firms managed by women are found to be less innovative. The problem of endogeneity between innovation and financial obstacles is controlled thanks to the use of the instrumental regression method (IV-probit). The results confirm that the variable measuring the financial obstacles is endogenous, and it impacts all types of innovation negatively. The results of the IV-probit regression show that the non-financial obstacles related to the business environment which negatively affect innovation are: business licensing and permits, corruption, access to electricity, labor regulations, political instability, and the practices of competitors in the informal sector.

Keywords: innovation; product and process innovation; obstacles; determinants; MENA; IV-probit

1. Introduction

Innovation has become vital to economic growth through job creation and income generation [1]. In the last two decades, developing economies have focused increasingly on innovation to enhance economic growth and competitiveness, which aims to bridge these countries' gap and become integrated into a global economy [2]. Innovation is seen as a core activity in companies as they face increasing competition not only in the domestic market but also in the international market. Therefore, a successful company must engage and maintain its innovation activities while contributing to the sustainable development of the country.

When they want to innovate, companies face many obstacles that represent rational reasons to limit the decision to invest and engage in an innovation activity as well as reducing their capacity to introduce a new product or process. In this line of thought, it is believed that the presence of obstacles to innovation is not only associated with particular characteristics of the companies, but it is also related to the result of market or business environment failures, which can be difficult to overcome and can be seriously detrimental to their productivity coupled with the translation of the innovation effort into an effective result.

The majority of empirical research concentrates on the study and analysis of financial obstacles to innovation [3–7]. Non-financial obstacles are generally treated as control variables [8]. However, no contribution, as far as we know, provides a detailed and comparative analysis on non-financial obstacles to innovation at a broad level. Moreover, the non-financial obstacles studied are only related to factors that are internal or specific to the characteristic of companies [8,9].

In the contemporary context of international economic, social and political transformations, the present paper reckons that particular attention should be given to factors related specifically to the business environment of companies. The study argues that firms may encounter other types of non-financial obstacles, which, despite the availability of financial resources to invest in innovative activities, may constitute conditions that are not conducive to innovation. These obstacles can lead to a persistent systematic inability on the part of companies, which limits their willingness to engage in innovation activities and/or direct financial efforts towards R&D as well as extending the innovation activity to the introduction of new products, services, and processes [10]. This makes this matter of significant political importance for each country. It is, therefore, more important for policymakers to extend the analysis to non-financial barriers. This will help to determine whether firms do not innovate because of failures in the business environment (external factors) or because of their characteristics (internal factors) per se.

In the last decade, studies have focused on the relevance of innovation to companies and economic development in developing countries, but limited work, as far as we know, has been devoted to this topic in the Middle East and North Africa (MENA region). The MENA region is experiencing huge economic, geopolitical and social transformations under the pressure of the 2011 Arab Spring movements. This has enabled this region to become a center of entrepreneurship and innovation with the potential for transformation, growth and competitiveness [2,11,12]. These profound transformations and challenges serve as a background for this empirical research, which focuses mainly on analyzing the new MENA business environment's effect on innovation behavior of companies along with financial and non-financial obstacles.

This current empirical study fills the gap by offering a deep investigation by estimating the effects induced by different obstacles (financial and non-financial) on firms' innovation behavior and providing a global image of this issue in the MENA region. This paper aims, precisely, to shed light on:

- The determinants of innovation in the MENA region;
- To determine the impact of financing on the companies' commitment to innovation activity in the MENA region;
- To identify the main non-financial obstacles to innovation that are related to the business environment in the MENA region.

The empirical study expects that a high perception of obstacles is going to prevent firms from investing and engaging in product or process innovation or both.

This study uses one database, namely the World Bank Enterprise Surveys (WBES), to the extent that it provides a set of indicators on business innovation in 144 countries. Our key dependent variables include (i) the number of firms that have introduced a product or service innovation and (ii) the number of firms that have introduced a process innovation. The independent variables of interest are financial and non-financial obstacles related to the MENA business environment.

The paper also contributes to the literature review by taking into account the fixed effect of MENA countries, sectors of activity, and the year of the survey to control firm heterogeneity and to control unobserved characteristics that are specific to each country as well as the sector that could influence the innovation behavior of firms. Moreover, taking these parameters into account in the different estimates would allow the correction of sample selection bias and/or differences in survey methods across countries. This problem generally marks empirical contributions and leads to counter-intuitive conclusions of a positive relationship between innovation behavior and the perception of obstacles to innovation [3,8,13,14] argue that sources of bias that distort results, and interpretations include the presence of unobserved firm-specific heterogeneous factors and a particular source related to questionnaire design and inappropriate sample selection.

The second section is devoted to present the literature review, including an overview of the MENA region and the obstacles to innovation. The third section encompasses the methodology where data sources will be provided while the definition of variables and

specification of econometric models will be stated. The fourth section will be devoted to the presentation of the results and discussion, and the last Section 5 will be dedicated to the conclusion and implications of the research.

2. Literature Review

2.1. Overview of the MENA Region and Innovation

The MENA region has witnessed profound political and economic upheavals, which started with the Tunisian revolution in 2011 which has swept across several other Arab countries, including Egypt, Sudan, Yemen, Syria, Libya and Algeria. However, the MENA region is in a great period of political, economic, and social transformation; this has enabled it to become a hub of innovation and entrepreneurship in the full expansion [11,12,15]. In addition, the MENA countries have the potential to leapfrog into the digital economy and benefit from its geographical location, with access to large markets in America, Europe and Asia.

Economically, the MENA region has a gross domestic product (GDP) of US$3.65 billion in 2019 (Accessed 18 December 2020: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=ZQ). According to the 2018 Global Competitiveness Index Report [16] (p. 32), MENA has improved its average performance because lower oil and gas prices force many countries to implement structural reforms to increase resource diversification. The fall in oil prices has negatively affected the macroeconomic environment and performance in the region. On the positive side, significant investments have enhanced technological and digital infrastructure. Still, they have not yet led to a turnaround in innovation [16]. This region has improved its competitiveness performances in 2019 (Figure 1), and it has shown a faster score (2.77%) between 2018 and 2019 than Sub-Saharan Africa's score (2.35%), while East Asia and the Pacific (1.78%) are close behind, continuing its upward trend. Meanwhile, Europe and North America (0.14%) and South Asia (0.08%) registered the lowest scores [17].
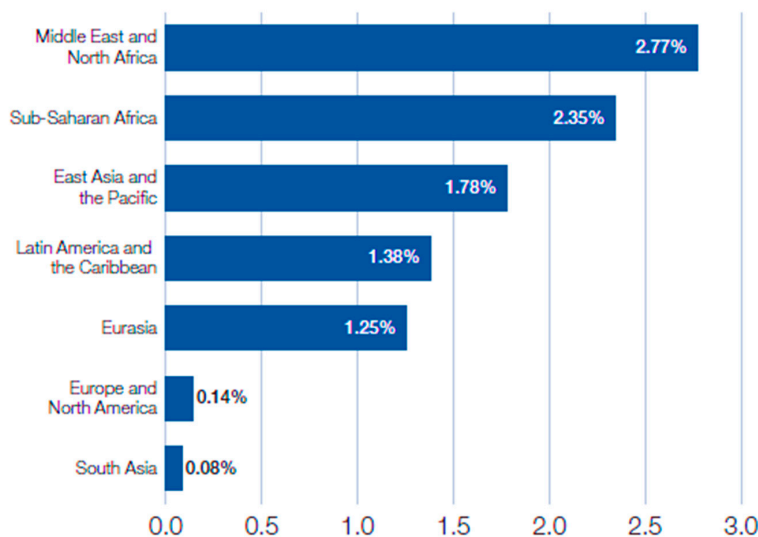

Figure 1. Change in median competitiveness performance, by region (percentage change 2018–2019). Source: The Global Competitiveness Report (2019). Page 28.

Figure 2 below provides a list of 15 MENA countries for which the global innovation index (GII), innovation input and output index, and the efficiency ratio rank in 2020. Regarding the GII, Israel, Malta, United Arab Emirates (UAE), Tunisia, and Saudi Arabia (KSA) fall above the median value (30.94) for the entire world economies [18]. The UAE is the unique country that ranks within the first 50 countries worldwide in 2020 and 2018, while two countries (UAE and Qatar) were in the GII 2017 and three countries (UAE, Qatar and KSA) were in the GII 2016 [2]. Regarding innovation efficiency ratio, Tunisia (49) and Morocco (57) leads the Arab MENA countries, followed by Egypt,

Qatar and UAE. However, the UAE (22) and KSA (50) lead the Arab MENA countries in regard to innovation input in 2020 and 2018. Regarding innovation output capabilities, UAE (55), Tunisia (59), and Morocco (69) lead Arab MENA countries.
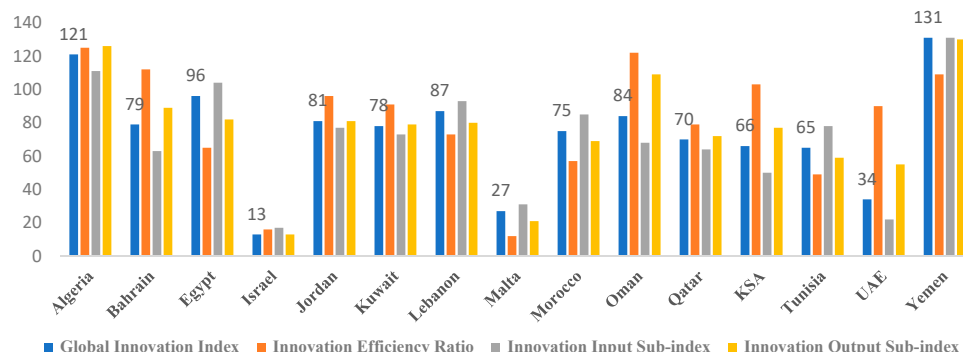

Figure 2. Innovation index for Middle East and North Africa (MENA) region based on GII 2020. Source: author calculations, from GII database (2020) (retired 18/12/2020 from https://www.globalinnovationindex.org/analysis-indicator).

From this analysis, we can conclude that there is great concern about translating the effort of inputs and investments into real innovations (output). Thus, there is a weakness of innovation in many MENA countries. These weaknesses result from, among other factors, the quality of the innovation ecosystem, the absence of strong government policies, regulatory barriers, inadequate economic structures, and the gap between the strategies of education systems and the labor market needs [16,19,20]. In addition to weak government support for innovation, the 2019 World Bank Report notes, "*The MENA region's financial ecosystem is underdeveloped*" [19]. Figure 3 below shows that political instability, tax rates and access to finance are the top three biggest obstacles to the business activities of MENA companies.
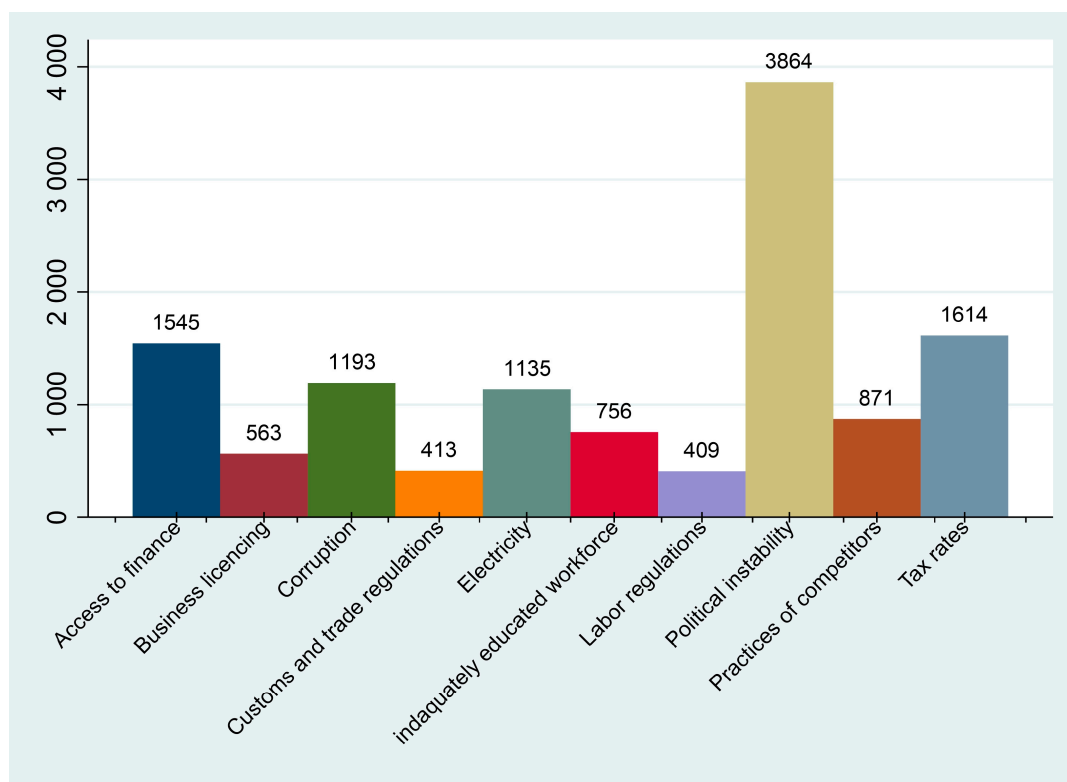

Figure 3. Major barriers for MENA firms. Source: author calculations WBES database (2020).

The countries of the region will have to tackle some substantial obstacles, including inadequate finance, restrictive regulation and the institutional framework, to scale the success stories of the region and to sustain a new innovation ecosystem for enterprises [19].

2.2. Theory and Hypothesis Development

The factors that significantly affect innovation have been widely investigated by several researchers. The existing literature review shows that investment in research and development (R&D), employee training and access to finance generally play a determining role in innovation in most organizations [3,6,21–25]. In the majority of empirical works, two groups of explanatory factors are often put forward [8]. The first reflects the inputs of the innovation implemented (R&D expenditures, cooperation with research centers). The second group represents the characteristics of the firm (size, age, ownership structure, ..., etc.) and its environment (sector of activity, geographical location, degree of openness, ..., etc.) [8,9,26–29]. The results of the empirical work seem to be converging and in conformity with theoretical predictions. In general, we find that firms' propensity to innovate increases with the number of inputs implemented, R&D investment, and firm size [3,8,26,28]. However, researchers' interest in the obstacle to innovation was only developed in 1997 by Ref. [30].

The recent literature review has focused on the determinants of firms' perceptions of obstacles to innovation and their dissuasive impact on the decision on investment and commitment to innovation activity [7,9,10,22,31–33]. Hence, far, quasi-all research has adopted a quantitative method by using international or national surveys on innovation. This work falls within two groups. In the first group, the most adopted approach, the obstacles are considered by the authors as explanatory variables of the propensity of firms to initiate an innovation activity [3,22,25,30,31,34,35]. In the second group, obstacles to innovation are considered as explained variables in which authors study the action of other factors on their level [10,14,36–38]. In fact, scholars that have included the obstacles faced by companies trying to develop innovations as explanatory variables have obtained non-significant or positive results [3,8,39]. In most empirical papers, a special interest has been given to the impact of financial obstacles on the innovative behavior of enterprises.

Financial obstacles occur due to the lack of access to financing in the credit market, which can restrict investment and innovation activities. Consequently, many enterprises are discouraged from engaging in innovation efforts owing to a lack of sufficient and adequate financial resources. It is widely recognized that investments in innovation are intangible, which leads to a strong unwillingness among credit institutions to finance these unsecured investments that undergo a long and complex process [4,7]. Therefore, enterprises that are active in innovation may encounter difficulties in getting external finance. Moreover, by its particular aspect, innovation activities are not necessarily dependent on time. They also include a high-risk of information asymmetries (moral hazard) [40]. This increases the cost of external capital, urging firms to use their own internal resources to finance innovation projects [41,42]. For this reason, in economies where a considerable number of enterprises are exposed to high financing obstacles, innovation is rendered meaningless and economic growth can be negatively affected. Strong financial markets and institutions can play a key role in firms' innovation efforts; providing access to external funds can reduce financing costs, optimally allocate resources, and contribute to the assessment of innovation projects and risk management [7,43].

Extensive empirical studies have demonstrated that access to finance is the most constraining obstacle to innovation. It is argued by some researchers that the higher the funding obstacles, the more efficient a firm's innovation will be [9,24]. Nevertheless, the results of recent empirical studies tend to confirm that the encountering of financial obstacles significantly reduces the likelihood that a firm will engage in innovation activity [3,7,22,28,44]. In light of what has been discussed in the literature review, the first assumption about financial obstacles can be stated as follows:

Hypothesis 1 (H1). *The likelihood of introducing a new innovation decreases considerably whenever firms encounter financial obstacles.*

While financial resources are fundamental, it has recently been demonstrated that there are other non-financial important factors that significantly constrain enterprises' innovation behavior [7,10,26,33]. In fact, no exhaustive literature review exists on the non-financial obstacles that affect, directly or indirectly, firms' innovation. The most identified obstacles to innovation in recent studies [6,7,9,23,24,29,45,46], include competition, corruption, access to electricity, infrastructure, business regulation and property rights. Indeed, most studies consider these factors as indicators of the global governance or external factors representing the business environment. The results of this research tend to confirm that the introduction of one type of innovation is negatively impacted by these factors. Following the same line of thought, excessive bureaucracy [47], a corrupt and unfair judicial system [46,48], weak intellectual property rights [49], national political stability [50] undermine business confidence and can create obstacles to the innovation process, especially the registration behavior of innovation licenses. Hence, the second assumption about non-financial obstacles can be stated as follows:

Hypothesis 2 (H2). *The likelihood of introducing a new innovation decreases considerably whenever firms encounter non-financial obstacles.*

3. Data and Methodology

3.1. The Data

In an endeavor to examine the link between financial and non-financial obstacles and innovation, this empirical study uses individual firm data from the World Bank's Business Enterprise Survey (WBES).

The objective of this survey is to identify the biggest obstacles to business performance and growth in both developed and developing countries. It focuses particularly on the following aspects: firm characteristics, access to finance, innovation, cost of inputs, labor, corruption, business licensing and permits, infrastructure, trade, crime, competition, tax rates, the relationship between government and performance measures. These data relate to non-agricultural private sector enterprises, and they are collected through stratified random sampling methodology on representative samples in each country.

The World Bank's Survey has covered 144 countries so far, and it has adopted a standard methodology since 2006, which ensures that comparisons between countries can be made. Surveys conducted on some African and MENA countries before 2011 do not include questions related to innovation. Because of this inconsistency, the study discards data for MENA countries conducted before 2011 (Iraq in 2011 and Yemen in 2010) and includes only surveys conducted after 2011. This paper will eventually cover 10 countries and a starting sample of 14,291 MENA firms between 2013 and 2020. In each estimate, firms with missing information on a variable are excluded.

3.2. Definition of Variables

3.2.1. Dependent Variables

Previous empirical studies have used input or output indicators to measure the innovation activity of firms. R&D investments are an important measure of innovation performance and are used in a significant number of empirical studies [43]. The use of a single measure can ignore the complex process of innovation before market introduction, which can produce non-robust results [22,50].

Like ref [22,23,25], the current study adopts direct measures of the outcome of product or service or process innovation. First, for product/service (*Product*) innovation, firms are asked whether: "*during the last three years, has this establishment introduced new or significantly improved products or services*?" If the answer is "yes", the company is considered innovative

regarding products or services. For process innovation (*Process*), companies are asked if: "*during the last three years, has this establishment introduced any new or significantly improved process (including methods of manufacturing products or offering services, logistics, delivery, or distribution methods for inputs, products, or services, or supporting activities for processes)*". If the answer is "yes" it indicates that the company has introduced a process innovation in the last three years at the time of the WBES survey. In addition, a company may introduce one type of innovation or both. Therefore, the third measure of innovation is constructed and measures fundamental innovation if the firm has introduced a product or process innovation in the last three years at the time of the survey (inov). All types of innovation are recoded as 1 if the answer is "yes" and 0 otherwise.

3.2.2. Measuring Obstacles to Innovation

To analyze the effect of financial barriers on innovation, the first empirical studies [51–53] have used mainly the degree of sensitivity of cash flow on R&D investments. However, it has been argued by [54] that cash flow is an indicator that can predict the expected profits that motivate companies to invest, and it does not, therefore, reflect financial constraints. As a result, recent studies encourage the use of direct or qualitative measures of financial constraints [3,7,25,55].

In accordance with the previous studies [7,56], the present study exploits the data provided by the WBES survey; this allows us to construct a direct measure of the financial obstacles to innovation. A firm is considered financially constrained (obstfin) and takes value 1 if (i) it has applied for credit, and its application is rejected, and (ii) if it has not applied for credit because the application procedure is complex, the interest rates are not favorable, the requested collateral too high, the size and maturity of loan are insufficient, did not think that the application could be approved or other causes. In otherwise, the variable (obstfin) would take value 0 if a firm did not apply for a loan in the last fiscal year because they did not need a loan.

Non-financial barriers related to the business environment of companies can impact their innovation behavior. The most recent studies have identified the variables characterizing the business environment: corruption, bureaucracy, access to electricity, competition, inadequately educated workforce, labor regulations, business licensing and permits, regulation of land access and use, transportation, customs and trade regulations, the court's system, and security [22,23,46,57]. The aim of the majority of these works is far from studying the direct impact of non-financial obstacles on innovation. However, these indicators are, for this study, a reference for the selection of the most relevant indicators to characterize the business environment. These research findings agree that the failure of the business environment may hinder the innovation behavior of companies and their level of growth [15,32].

In line with previous studies, the WBES survey provides data on how companies experience and perceive the business environment. The companies asked about the biggest obstacles they face in their current operations and the realization of their projects and objectives. This paper focuses on the obstacles that are mostly identified in previous studies, which are most cited as major obstacles for MENA firms, and that can characterize the business climate dimension (Figure 1). More specifically, these biggest obstacles incorporate political instability, tax rates, access to electricity, corruption, inadequately educated workforce, practices of competitors in the informal sector, labor regulations, business licensing and permits, customs and trade regulations. Each variable is dichotomous, takes value 1 to indicate the extent to which a firm considers an element of the business environment as the biggest obstacle faced by the firm in their current operation, 0 otherwise.

3.2.3. Control Variables

We use a set of control variables at the enterprise level. The age (age) of the company, the size (size) measured by the number of permanent employees that makes a distinction between small (small) less than 20 employees, medium (medium) between 20 and

99 employees and large (large) companies with 100+ employees. The ownership structure is measured by the percentage of the firm's capital held by domestic private owners (domestic) and by foreign private owners (foreign). The openness of the firm is measured by the percentage of turnover directly exported (export) and by a binary variable that takes the value 1 if the firm has an internationally recognized quality certification (ISO9000, 9002, or 14000). The legal status of the company is identified by two variables: value 1 is taken if the company is owned by a single person (individual), 0 otherwise; value 1 is also taken if the company is a limited liability company (sarl), and 0 otherwise. Gender (Gend-owner) takes 1 if at least one of the owners is a female and 1 if at least one female is the top manager in the firm (gend-manag), 0 otherwise. The experience (exper) in terms of years of the manager in the sector of activity of the enterprise. Innovation inputs take 1 if the firm has invested in R&D, 0 otherwise. Table 1 below provides detailed definitions of the variables selected.

Table 1. Variables definition and measurement.

Variables	Definition and Measure
Dependent variables	
Product	Takes value 1 if the firm introduced new or significantly improved products or services during the last three years of the survey, 0 otherwise
Process	Takes value 1 if the firm introduced new or significantly improved methods of manufacturing products or offering service during the last three years of the survey, 0 otherwise
Inov	Takes value 1 if the firm introduced at least one type of innovation, 0 otherwise
Independent, control variables	
Size	Indicate the size of the firm and takes value 1 if Small (5–19 employees), medium (20–99 employees) and large (100 or more permanent employees), 0 otherwise
Age	The number of years in which the firm began operations to date of the survey
Log (Age)	Logarithm of the number of years in which the firm began operations
domestic	Percentage (%) of the firm's capital held by domestic private owners
foreign	Percentage (%) of the firm's capital held by foreign private owners
Sarl	Takes value 1 if the company is a limited liability company, 0 otherwise
individual	Takes value 1 if the company is owned by a single person, 0 otherwise
Quality	Takes value 1 if the firm has an internationally recognized quality certification (ISO9000, 9002, or 14000), 0 otherwise
export	Percentage (%) of turnover directly exported
Gend-owner	Takes 1 if at least one female among the owners in the firm, 0 otherwise
Gend-manag	Takes 1 if at least one female is the top manager in the firm, 0 otherwise
Exper	Years of the manager in the sector of activity of the enterprise
R and D	Innovation inputs take 1 if the firm has invested in R&D, 0 otherwise
Independent obstacles to innovation	
Obstfin	Indicate financial obstacle and takes value 1 if: it has applied for credit and its application is rejected; and if it has not applied for credit because the application procedure is complex, the interest is not favorable, the requested guarantees are high, the size and maturity of the credit are insufficient, did not think that the application could be approved or other causes
Bus. licens	Takes value 1 if firms choose Business licensing and permits as the biggest obstacle to their current operation
Corruption	Takes value 1 if firms choose corruption as the biggest obstacle to their current operation
C.T. regulat	Takes value 1 if firms choose Customs and trade regulations as the biggest obstacle to their current operation
Electricity	Takes value 1 if firms choose electricity as the biggest obstacle to their current operation
Workforce	Takes value 1 if firms choose inadequately educated workforce as the biggest obstacle to their current operation
Labor regul	Takes value 1 if firms consider labor regulations as the biggest obstacle to their current operation
Policy	Takes value 1 if firms consider political instability as the biggest obstacle to their current operation
Competition	Takes value 1 if firms consider practices of competitors in the informal sector as the biggest obstacle to their current operation
Tax rates	Takes value 1 if firms consider tax rates as the biggest obstacle to their current operation.
Industry	According to the international industry codification (isic), a dummy variable is included to take into account their fixed effect
Overdraft	Takes value 1 if a firm has an overdraft facility

3.3. Model Specification

Since the dependent variable is binary, we begin our analysis of the relationship between barriers (financial and non-financial) and the innovation behavior of MENA firms using a probit model. The basic model is presented as follows:

$$Pr(innov_{i,j,t} = 1) = \Phi(\alpha + \beta obst_{i,j,t} + \beta X_{i,j,t} + \mu_{i,j,t}) \qquad (1)$$

innov is a binary variable take 1 if the firm has introduced an innovation (product/service or process); otherwise, 0. The indexes *i*, *j*, *and t* indicate the company, country, and time, respectively. Φ the cumulative standard normal distribution. *obst* indicates the variables of financial and non-financial barriers. *X* the vector of control variables indicated above (Section 3.2.3).

The study's model is estimated in three steps. First, the determinants of innovation of MENA firms are estimated, while the second model is devoted to estimating the impact of financial obstacles; the last model focuses on estimating non-financial obstacles. Since several studies report the endogeneity of the financing obstacle variable, an instrumental estimation is also performed (IV-probit) to circumvent this endogeneity problem. Depending on the result of the *Wald* test of endogeneity, the estimate to be preset is going to be a probit or IV-probit model.

Finally, in all specifications, the study includes the date of the survey and the industry sector according to the international industry codification (isic) as dummy variables to take into account their fixed effect. The countries are also retained in each estimate to control the existence of possible heterogeneity among MENA countries [10]. To take into account a possible correlation of error terms between the firms interviewed in each survey, standard errors are clustered at the level of each country.

4. Results and Discussion

4.1. Descriptive Statistics

Table 2 shows descriptive statistics of the sample (columns 4–5) and the distribution of innovative firms by size, sector, and country (columns 1–3).

Table 2. Sample characteristics.

Type of Innovation Size/Sector/Country	Product (1)	Process (2)	Inov (3)	obs (4)	% (5)
Small (<20)	33.45	35.20	36.21	6741	47.17
Medium (20–99)	36.82	37.64	36.70	4774	33.41
Large (100 +)	29.73	27.16	27.10	2776	19.42
Total number of employees	2371	2213	3292	14,291	100
Manufacturing	65.46	61.36	61.63	8043	56.28
Retail	10.21	11.12	11.03	1551	10.85
Other Services	24.34	27.52	27.34	4697	32.87
Total number of employees	2371	2213	3292	14,291	100
Djibouti	3.84	5.47	4.10	266	1.86
Egypt	37.66	34.39	37.76	7786	54.48
Israel	4.93	3.75	4.43	483	3.38
Jordan	8.86	7.77	8.54	1174	8.21
Lebanon	12.99	12.29	12.12	1093	7.65
Malta	4.77	2.21	3.86	242	1.69
Morocco	7.42	9.76	8.66	1503	10.52
Tunisia	6.79	10.17	8.11	592	4.14
W.B and Gaza	6.66	7.23	6.83	799	5.59
Yemen	6.07	6.96	5.59	353	2.47
Total number of employees	2371	2213	3292	14,291	100
Year of survey	2013	2016	2019	2020	Total
N. obs	6566	1814	2836	2075	14,291
%	45.95	12.69	19.84	21.52	100

The classification of companies by size indicates that 47% are small companies (small < 20 employees), 34% are medium companies, and 20% are large companies with 100 or more employees. 57% of the companies in the sample have an industrial activity, and 43% are commercial and service companies. Regarding the distribution of firms by country, 65% of the sample firms are located in Egypt and Morocco, given the large size of

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the economies of these two countries compared to the other MENA countries covered by the survey. Column 3 of the table shows that small (36%) and medium (36%) firms have achieved product or process innovation compared to only 27% of large firms. It can be, therefore, assumed that there is a negative relationship between size and engagement in innovation activity, i.e., small firms are more innovative than large firms. On the other hand, the majority of innovations are initiated by firms in the industrial sector (+61%) and more precise product innovation (65% of firms). Egypt accounts for 37.76% of innovations (product and process) due to its over-representation in the sample, followed by Lebanon (12%) and Morocco (8.66%).

Table 3 below shows the descriptive statistics of the variables selected for analysis. As for the nature of innovation, 16.7% of the companies have carried out a product (product) innovation in the last three years at the date of the survey, 15.7% have carried out a process (process) innovation, and 23% have carried out a product or process (inov) innovation. MENA companies are relatively young and, on average, are 21 years old. The ownership structure indicates the pervasiveness of national ownership on average since 90% of the capital of MENA companies is held by domestic (domestic) individuals or companies (86.94 of the companies are 100% owned by domestic owners.), and only 5% is held by foreign (foreign) investors; the remaining 5% is distributed between state participation and other types of organizations. In terms of legal status, 22% are private limited liability companies (sarl), and 40% are sole proprietorships (individual). In terms of company openness, only 20% of the companies have an internationally recognized quality certification (quality), and the percentage of turnover directly exported abroad (export) does not exceed 10% on average. Firms with at least one female owner represent only 20% of the sample (Gend-owner), and 5% of the firms are run by a woman (Gend-manag), with a small difference between the firms in the sample. The average number of years of experience of the firm's manager in the sector of activity (exper) is 21.5 years, with a large difference between the firms. On the other hand, MENA firms are characterized by a lack of investment in R&D, with only 8% having invested in R&D in the last three years at the time of the survey in each country.

Table 3. Descriptive statistics.

Variable	Obs	Mean	std. Dev	Min	Max
Small	14,291	0.471	0.5000	0	1
Medium	14,291	0.334	0.471	0	1
Large	14,291	0.194	0.395	0	1
Product	14,194	0.167	0.373	0	1
Process	14,114	0.157	0.364	0	1
Inov	14,235	0.231	0.422	0	1
Age	14,023	21,736	16.51	1	162.000
Log (Age)	14,023	2.781	0.843	0	5.088
domestic	14,046	90.865	26.136	0	100.000
foreign	14,046	5.062	19.503	0	100.000
Sarl	14,291	0.219	0.413	0	1
individual	14,291	0.394	0.489	0	1
Quality	13,915	0.207	0.405	0	1
export	14,036	9.071	23.745	0	100.000
Gend-owner	14,158	0.202	0.402	0	1
Gend-manag	14,253	0.052	0.222	0	1
Exper	13,952	21.586	11.757	1	60.000
R and D	14,177	0.088	0.284	0	1
obstfin	14,291	0.288	0.453	0	1
Bus. licens	13,718	0.041	0.198	0	1
Corruption	13,718	0.087	0.282	0	1
C.T. regulat	13,718	0.030	0.171	0	1
Electricity	13,718	0.083	0.275	0	1
Workforce	13,718	0.055	0.228	0	1
Labor regul	13,718	0.030	0.170	0	1
Policy	13,718	0.282	0.450	0	1
Competition	13,718	0.063	0.244	0	1
Tax rates	13,718	0.118	0.322	0	1

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For the variable that assesses financial obstacles, +28% of enterprises consider access to financing as the biggest obstacle (obstfin). For non-financial obstacles, among all barriers, political instability (policy) is the largest barrier faced by MENA firms. In fact, 28 percent of surveyed firms consider political instability as a major obstacle. In second and third place successively, 11 percent of firms consider the tax rates (tax rates) and access to finance as the biggest obstacle to their current operation. These first three obstacles account for 51% of all obstacles encountered by companies. As a result, the development of public policies to improve the business environment must focus on these three biggest obstacles for MENA enterprises. Moreover, corruption (corruption) and access to electricity (electricity) are also the biggest obstacles for 8.70% and 8.27% of MENA companies, respectively.

4.2. Regression Results and Discussion

The results of the estimation of Equation (1) are presented in three successive steps. First, the study attempts to analyze the determinants of innovation based solely on the control variables. Subsequently, the paper integrates the financing barriers into the equation. At this level, it is according to the results of Wald's test for each type of innovation that the study estimates a probit or IV-probit. The last estimate is devoted to the integration of non-financial barriers.

4.2.1. Determinants of Innovation

Table 4 presents the marginal effects of the results of the probit estimation of Equation (1). Standard errors are adjusted and clustered at the country level. Size (small), legal status (individual), and management of a firm by a female (gend-mang) negatively affect firm innovation. The probability of introducing a product innovation (product) or a product and process innovation (inov) as a small firm (small), compared to large firms, decreases successively by 3.8% and 3.5%. This probability for individual companies (individuals) is 2% and 2.7%. The variable gend-manag is negative and significant at the level of process innovation, which means that firms managed by women do not introduce process innovations. The coefficient of this variable is not significant for product innovation or fundamental innovation (inov). Firms with international quality certification (quality), women's participation in ownership (Gend-owner), managers' experience in the firm's sector (exper), and investment in research and development (R&D) positively affect all the categories of innovation analyzed (product, process and inov). The empirical results are similar to those of Ref. [22,29,46,58]. The other variables in the estimated model are not significant so far.

Table 4. Probit regression: the determinants of innovation.

Variables	Product	Process	Inov
small	−0.038	−0.020	−0.035
	(0.039) ***	(0.094)	(0.048) ***
medium	−0.014	0.007	−0.007
	(0.066)	(0.044)	(0.052)
age	0.006	0.005	0.005
	(0.026)	(0.023)	(0.022)
domestic	0.000	−0.000	0.000
	(0.002)	(0.001)	(0.002)
Foreign	0.000	0.000	0.000
	(0.003)	(0.002)	(0.002)
Sarl	−0.016	−0.009	−0.019
	(0.061)	(0.078)	(0.062)
individual	−0.020	−0.008	−0.027
	(0.052) **	(0.070)	(0.055) **
Quality	0.061	0.043	0.072
	(0.058) ***	(0.033) ***	(0.046) ***

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Table 4. *Cont.*

Variables	Product	Process	Inov
Gend-owner	0.043	0.029	0.050
	(0.026) ***	(0.026) ***	(0.020) ***
Gend-manag	−0.009	−0.016	−0.015
	(0.064)	(0.036) ***	(0.055)
Exper	0.000	0.000	0.000
	(0.001) *	(0.001)	(0.002)
R and D	0.176	0.174	0.234
	(0.061) ***	(0.097) ***	(0.081) ***
Export	0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
_cons	(1.157)	(0.312) **	(1.161)
Isic FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Pseudo R^2	0.205	0.270	0.227
Lroc	0.804	0.846	0.811
N	13,014	12,965	13,037

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4.2.2. Financing Obstacles to Innovation

To correct the endogeneity bias reported earlier, we propose to use an instrumental variable that affects financing barriers but does not (directly) influence firms' innovation activity. Like Ref. [7,28,55] the paper uses the overdraft facility, which takes value 1 if a firm has a facility with a financial institution, 0 otherwise. To be a valid instrumental variable, it must satisfy two conditions: relevance and exogeneity. The first condition implies the existence of a correlation between the instrumental variable and the endogenous variable, while the second condition, exogeneity, refers to the absence of a direct relationship with the dependent variable. In this empirical study, an overdraft facility is considered as a valid instrumental variable since it is related to firms' access to finance (first condition) [7] since credit institutions are reluctant to grant credit to finance innovation activities. Moreover, it is still difficult to finance an innovation activity, the outcome of which is uncertain, with an overdraft that is granted only to finance very short-term activities (second condition). Furthermore, for each estimate, we will use Wald's exogeneity test for the financing obstacle variable. If the result of the test confirms the hypothesis of the existence of endogeneity in the study's model, the results of the IV-probit estimation will be presented; otherwise, a simple probit model will be estimated.

Table 5 presents the results of estimating Equation (1) using the probit instrumental variable (IV-probit) methodology. For all three models, the *p*-value of the Wald test of exogeneity is less than 5%, confirming that the variable "financing obstacles" is endogenous.

As in the previous empirical studies, after controlling endogeneity bias, the coefficient of the variable of interest, financing obstacles, is negative and significant at the 1% threshold for the three variables measuring innovation activity (product, process and inov). These results indicate that firms facing financing obstacles are less likely to introduce products, processes, or both innovations than firms without financing barriers. *Consequently, the first formulated hypothesis (H1) is statistically verified through the estimation of the IV-probit model.* This result is consistent with the findings of Ref. [3,7,22,28,55]. It rejects, however, the findings of Ref. [7], which shows that financing obstacles do not have an impact on business innovation in the MENA region.

The coefficients of the other variables (quality, Gend-owner, and R&D) remain unchanged. Nevertheless, the coefficients of the medium-sized enterprises (medium) become positive and significant, indicating that these firms are more likely to introduce process innovations compared to other types of firms (small or large). This indicates the existence of a nonlinear relationship between innovation and firm size. Further investigation can

be carried out on this matter. The paper's results are consistent with those of ref [32]. The increase in the share of capital held by domestic owners (domestic) becomes significant and negatively impacts innovation activities. Similarly, foreign ownership of capital (foreign) has a negative impact on product innovation. These results are consistent with those of de Ref. [32], and those of Ref. [7] in case of government support. Refs. [22,23,48] finds that foreign participation positively impacts innovation, while domestic participation negatively impacts it. Private limited liability companies (limited liability companies) are less likely to be innovative compared to other companies.

Table 5. IV-probit regression of financial barriers to innovation.

Variables	Product	Process	Inov
Obstfin	−1.888	−1.576	−1.705
	(0.254) ***	(0.523) ***	(0.320) ***
Small	0.067	0.077	0.066
	(0.051)	(0.096)	(0.059)
Medium	0.058	0.133	0.081
	(0.049)	(0.032) ***	(0.053)
Age	−0.031	−0.023	−0.029
	(0.046)	(0.031)	(0.039)
Domestic	−0.005	−0.005	−0.004
	(0.002) **	(0.002) **	(0.002) **
Foreign	−0.004	−0.004	−0.003
	(0.002) *	(0.003)	(0.002)
Sarl	−0.138	−0.107	−0.136
	(0.045) ***	(0.051) **	(0.039) ***
Individual	−0.043	−0.015	−0.064
	(0.037)	(0.047)	(0.034) *
Quality	0.195	0.187	0.224
	(0.064) ***	(0.048) ***	(0.058) ***
Gend-owner	0.158	0.136	0.172
	(0.031) ***	(0.031) ***	(0.024) ***
Gend-manag	−0.002	−0.045	−0.015
	(0.031)	(0.047)	(0.042)
Exper	0.002	0.001	0.001
	(0.002)	(0.002)	(0.003)
R and D	0.530	0.742	0.700
	(0.138) ***	(0.236) ***	(0.166) ***
Export	0.000	0.000	0.001
	(0.001)	(0.001)	(0.001)
_cons	0.550	0.023	1.404
	(0.383)	(0.417)	(1.489)
Isic FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Lroc	0.807	0.847	0.813
N	12,810	12,769	12,830
Wald (P > x^2)	0.000	0.039	0.001

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

4.2.3. Non-Financial Obstacles to Innovation

Table 6 presents the results of estimating Equation (1) using the probit instrumental variable (IV-probit) methodology. For all three models, the *p*-value of the Wald test of exogeneity is less than 5%, confirming that the variable "financing obstacles" is endogenous.

After controlling the endogeneity bias, the coefficient of the funding barrier variable is negative and significant in all three models (product, process, and inov). The model results also indicate that seven non-financial obstacles in the business environment negatively impact the innovation activities of MENA firms. These obstacles are considered as biggest for the firms surveyed. They include particularly: business licensing and permitting,

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corruption, access to electricity, inadequately educated workforce, labor regulations, political instability, and the practices of competitors in the informal sector. *Consequently, our second* hypothesis (H2) formulated is statistically confirmed using the IV-probit model estimation.

The paper's results are consistent with those of Ref. [29] in a study on industrial enterprises in Bangladesh. Their main results show that corruption, access to energy, and competitor practices in the informal sector negatively impact firms' innovation activities in Bangladesh. Indeed, the paper's results are consistent with the findings of Ref. [46] in the context of Latin America and the Caribbean (LAC) countries, and the findings of [45] in the context of Turkey. According to Ref. [45] results, business licensing and permitting, corruption, access to electricity, inadequately educated workforce, labor regulations, political instability, and the practices of competitors in the informal sector are the biggest obstacles for Turkey's enterprises and negatively impact innovation activities. Ref. [8] also has shown that financial and non-financial barriers negatively impact firms involved in innovation in France.

For the other control variables, the results remain unchanged. In fact, small and medium enterprises (size), quality certification, women's participation in ownership (Gend-owner), and investment in R&D positively impact innovation. The increase in the share held by domestic owners (domestic), the legal status of limited liability companies (sarl) negatively impacts business innovation.

Table 6. IV-probit regression of non-financial barriers to innovation.

Variables	Product	Process	Inov
Obstfin	−1.978	−1.679	−1.836
	(0.313) ***	(0.526) ***	(0.377) ***
Small	0.108	0.114	0.108
	(0.057) *	(0.101)	(0.064) *
Medium	0.092	0.153	0.107
	(0.041) **	(0.037) ***	(0.042) **
Age	−0.040	−0.030	−0.039
	(0.050)	(0.035)	(0.043)
Domestic	−0.004	−0.005	−0.004
	(0.002) **	(0.002) **	(0.002) *
Foreign	−0.004	−0.004	−0.003
	(0.002)	(0.003)	(0.002)
Sarl	−0.129	−0.103	−0.130
	(0.041) ***	(0.041) **	(0.035) ***
Individual	−0.040	0.002	−0.053
	(0.034)	(0.038)	(0.031) *
Quality	0.206	0.206	0.234
	(0.077) ***	(0.050) ***	(0.073) ***
Gend-owner	0.153	0.134	0.165
	(0.050) ***	(0.035) ***	(0.041) ***
Gend-manag	0.007	−0.048	−0.009
	(0.032)	(0.051)	(0.036)
Exper	0.002	0.001	0.002
	(0.002)	(0.002)	(0.002)
R and D	0.473	0.706	0.627
	(0.187) **	(0.251) ***	(0.211) ***
Export	−0.000	0.000	0.000
	(0.001)	(0.001)	(0.001)
Bus. licens	−0.209	−0.233	−0.231
	(0.089) **	(0.071) ***	(0.081) ***
Corruption	−0.040	−0.098	−0.068
	(0.039)	(0.054) *	(0.045)
C.T. regulat	0.017	−0.060	0.022
	(0.092)	(0.105)	(0.105)
Electricity	−0.141	−0.146	−0.144
	(0.048) ***	(0.070) **	(0.058) **

Table 6. *Cont.*

Variables	Product	Process	Inov
Workforce	−0.279	−0.135	−0.234
	(0.095) ***	(0.085)	(0.106) **
Labor regul	−0.195	−0.119	−0.212
	(0.060) ***	(0.136)	(0.078) ***
Policy	−0.248	−0.266	−0.253
	(0.065) ***	(0.070) ***	(0.068) ***
Competition	−0.141	−0.177	−0.138
	(0.075) *	(0.098) *	(0.084)
Tax rates	−0.016	−0.063	−0.049
	(0.084)	(0.127)	(0.106)
_cons	1.648	0.108	1.572
	(1.378)	(0.438)	(1.433)
Isic FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Lroc	0.808	0.847	0.813
N	12,352	12,314	12,372
Wald (P > x^2)	0.0037	0.0424	0.0075

$* p < 0.1; ** p < 0.05; *** p < 0.0.$

5. Conclusions and Research Implications

The firms that are involved in innovation are considered as a factor of job creation, added value and economic growth. Policymakers are very conscious of the importance of innovation, and they are trying to implement various programs and policies to encourage enterprises to be more innovative. Against this background, the purpose of this study is to provide an analytical overview of the factors that affect innovation in MENA enterprises. The study of financial and non-financial obstacles to business innovation in the MENA region is the main goal of this contribution. To accomplish this aim, the World Bank's Enterprise Survey (WBES) is used to draw a sample of 14,291 firms in 10 countries.

The definition of innovation allows for to identification and construction of three dependent variables: product or service innovation, process innovation, and fundamental innovation. In this framework, the simple probit regression model with binary variables and the IV-probit model is used to overcome the issue of the endogeneity bias of the variable financing obstacles. The main empirical results finally led to reflect synthetic results findings on innovation determinants and obstacles in MENA firms. It has been argued that the main determinants of product, process, or both product and process innovation are firm sizes, ownership structure, legal status, quality certification, gender, and R&D investment. Furthermore, it has been found that the innovativeness of MENA firms is hindered by the characteristics of the business environment. The main identified obstacles that have proven/proved to be hampering the involvement of the region's companies in innovation are business licensing permits, inadequately educated workforce, access to electricity, labor regulations, political instability and the practices of competitors in the informal sector. In addition, corruption is also reported to reduce the ability of firms to introduce process innovations.

Therefore, creating an enabling environment for innovation in the MENA region requires multi-pillar support. Moreover, any policy to encourage innovativeness cannot ignore the main obstacles encountered by firms. Hence, the implications of this study can be analyzed at two levels. At the company level, the results imply that any company wishing to introduce a product or process innovation should pay close attention to R&D investments and have an international outlook; the participation of women in ownership is strongly encouraged as well. Likewise, the company should strive to minimize obstacles. At the level of public policy, any policy aiming at encouraging innovation should focus on the major obstacles encountered by companies.

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This research can thus be developed in two points. The first is to distinguish between internal and external obstacles. The second point is to take into account macroeconomic factors in particular: gross domestic product (GDP), the development of the financial system and global governance indicators.

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