Alexeeva-Alexeev Inna,
Ph D, Associate Professor, Assistant Lecturer,
Department of Business Organization;
University of Cantabria,
Member of Santander Financial Institute SANFI (Santander, Spain);
Mazas-Pérez-Oleaga Cristina,
Ph D in Econometrics,
Lecturer and Researcher in Business Administration;
European University of the Atlantics,
Director of the Observatory of Students Employability UNEATLANTICO

IS IT EASY TO FIND FEMALE CEOS AND (CO)OWNERS IN INNOVATIVE FIRMS? EVIDENCE FROM INTERNATIONAL-BASED SAMPLE OF ENTERPRISES

Abstract. The objective of this empirical study is to measure the likelihood of finding women as CEOs or shareholders considering corporate investment in innovation. The analysis, made with logistic regression, uses 154,682 data from a large number of companies in 142 countries during 2007-2023 extracted from the World Bank Enterprise Surveys (WBES). The results of the study suggest that female CEOs and shareholders are more likely to be found in companies with high support to innovation via new product development, improved processes and expenditure in research and development (R&D). The socio-economic context is also very important in terms of women's inclusion.

Introduction. In spite of an increasing number of women involved in business, their presence in top management positions worldwide is still very low. Similarly, the participation of women in corporate boards remains an issue. Increased female presence in business decision-making is more noticeable in those countries that by law oblige companies to comply with gender quotas, as shown in the report on the global perspective on the visibility of women in business presented by Deloitte [1]. Interestingly, there has been a greater inclusion of women in senior management positions when boards had women. The industries with the highest presence of women on boards belong to the Service Sector, mainly in Life Sciences and Health Care and Financial Services as well as Consumer Business. Regarding the regional distribution, the highest number of female board members is found in companies situated in North America (37%). European companies represent 19% of the total, but with quite a high female presence on boards, above 30%. All regions show an increased inclusion of

women in senior management and on boards, except in the Caribbean, where there were 37% fewer female CEOs in 2021 than in 2018, and in the Middle East and North Africa (MENA), with a reduction of up to 24% of women's participation in corporate governance and management in 2021 compared to previous years. This goes in line with the fact that in developing countries, in general, fewer women's participation is observed due to women's double burden (home and work) being heavier than in developed countries and due to the culture itself favouring men, making women see their role in the society and business as of the minor contributor [2].

The integration of women in business management appears to have a significant effect on the development and performance of organisations. The literature provides evidence that this relationship is positive [3; 2]. Other studies show that the presence of women on boards of directors is related to less volatile corporate performance [4], which is associated with greater stability. In this regard, it is necessary to highlight some of the most prominent characteristics of women's management and leadership skills in managerial positions or as board members.

Firstly, it is risk and loss aversion which tends to be higher among women than men [5]. Even when applying incentives equally between men and women, which in some ways helps to tolerate risk better, the presence of women in senior management ultimately favours fewer decisions involving risk [6]. A priori, women managers are less inclined to introduce innovation in companies because this activity involves high risk due to the uncertainty about the results [7]. However, we need to consider that in many countries and, especially in big companies, to be promoted to top management positions, women are forced to outperform their male counterparts [8]. Finally, female managers apparently are less likely than female co-owners to introduce innovation [9]. Secondly, it is the technical and specific nature of the skills related to the manager's role, although it highly depends on the type of sector. Women were often seen as less suitable candidates for science and STEM, which comprises technology, engineering, and mathematics [10]. This social behaviour still prevails in some countries or regions, which contrasts with other territories where the gender gap in this regard is narrowing significantly. Curiously, women seem to apply greater rigour and effort to supervisory tasks and accounting management [11]. Thirdly, it is the interpersonal characteristics and leadership skills of women that influence business development. Women have stronger soft skills than men, which is why companies often turn to women and even promote them to top management positions in critical periods, like crises. Apparently, the leadership style of female CEOs, which is rather transformational, helps to solve personnel-related problems and creates a climate of trust in the organization [12].

We also need to consider some theoretical approaches, such as classical agency theory, which says that typically managers are more risk-averse than owners and, in spite of monetary incentives offered additionally, women-managers avoid taking more risk than usual in decision-making [13]. Similar results are obtained from the perspective of the behavioural agency model [6]. Another approach is the institutional theory [14], according to which organisations behave according to the institutional norms adopted by society, so this behaviour is what influences decision-making. For

example, gender quotas on company boards introduced as mandatory in many countries put pressure on organisations to behave differently [15]. At this point, the macro environment is important.

In view of the above, this paper aims to measure and analyse the probability of finding a female CEO or shareholder in innovative companies based on a broad international sample and taking into account different firm-level variables and the macro environmental context.

Methodology, Sample, and Variables. This study is carried out on the World Bank Enterprise Surveys (WBES), a database already used in the literature to measure the performance of a woman at the head of a company or to determine the gender gap in entrepreneurship [16; 17]. Our sample includes 154,682 data during 2007 and 2023, involving a large number of companies from 142 countries. The percentage of female CEOs and co-owners in the sample is 34%. The breakdown between female CEOs and co-owners is as follows: the percentage of companies that have only female shareholders and no female CEO is 19% of the total, which is more than half of all women in top management and on boards. In contrast, there is slightly less than 4% of companies which do have a female CEO but no female shareholders. In 12% of the sampled companies, women CEOs and shareholders coexist. Regarding the distribution by sector, while the majority of male CEOs and shareholders are concentrated more in manufacturing industries, female business leaders have a more balanced representation between manufacturing (17.5%) and service sectors (16.5%). Considering the geographical areas included in the study, the region with the highest percentage of women CEOs and/or co-owners is East Asia and Pacific (EAP), with 52%, followed by Latin America and Caribbean (LAC), with 45%. The region with the lowest participation of women in business management is South Asia (SAR), with 15%.

To determine the probability of finding a woman in top management, two probabilistic models were used. The first model shows the probability of finding a woman as Chief Executive Officer (CEO) or a shareholder according to the innovation management in a company. To capture the presence of a woman in business, we define the variable Y_i, which is binary and takes a value of 1 if there is a woman CEO/shareholder and a value of 0, otherwise. Therefore, considering the qualitative nature of the dependent variable, the construction of a logistic regression model is proposed [18], as defined in equation (1):

$$Y_i = \alpha + \beta_1 New\_product_i + \beta_2 New\_product\_nm_i + \beta_3 Improved\_process_i + \beta_4 RD\_Invest_i + \beta_5 GGGI_i + \beta_6 GDP_i + \beta_7 Size_i + Sector_i \ (1),$$

Where Y_i is the dependent variable which reflects the presence of a woman in a company (CEO or shareholder) and α is the constant term. The explanatory variables of the model (1), related to different types of innovation, are qualitative and codified as binary. They include the following ones: *Improved_process* refers to the introduction of new or improved business processes and takes the value of 1 if such introduction is done and 0 otherwise; *New_product* takes the value 1 if the company introduced new products or services or improved them and 0 otherwise;

New_product_nm is 1 if the new or improved product or service are introduced by the company in a new market and 0 otherwise; *RD_Invest* has a value of 1 if the company invested in R&D activities directly or subcontracting other companies for that and 0 otherwise. The control variables are used to reflect the micro- and macro context in which the company operates: *Size*, as the size of the company, with value 1 if the firm is a small or medium-sized (with less than 100 full-time permanent workers) and 0 otherwise; *Sector* is a dichotomous variable showing the belonging of the sampled companies to manufacturing or service industries (in this case, it is used as a dummy with a fixed effect, which may cause a change in the constant term α due to the company's belonging to a certain sector); *GDP* as logarithm of the total volume in USD, showing the economic level of a country; *GGGI*, the Global Gender Index Gap, published by the World Economic Forum (WEF), which reflects the index of equality between men and women in a country ranging from 0 to 1. β_1-β_7 are the coefficients that relate the explanatory variables to the dependent variables. In addition, to validate and check the robustness of the estimations, we included the test of goodness of fit of the model through pseudo McFadden R^2, which values from 0.2 to 0.4 indicate a good model fit. Finally, due to the great difference in the inclusion of women in business leading positions across the different regions, we included clustered standard errors done by countries. By doing so, we meet the following important purposes: first, to reflect eventual differences and, second, to address dependency among the observations within countries [19].

The estimation of model as per equation (1) was carried out using version 4.3.2. of the free software R.

Findings. The general model for analysing the likelihood of finding female managers or co-owners is presented in Table 1, which also includes results of the additional estimations done according to classification of sampled companies by female CEO and female shareholders.

Table 1

Estimations: models (a) and (b)

	(a) General model			Model (b) Female CEO versus Female Co-owner				
				(b1) CEO			(b2) Co-owner	
New_product	0.2107	(3.6051)	***	-0.0476	(-0.6447)		0.2501 (3.9710)	***
New_product_nm	0.0178	(0.5403)		0.0823	(1.7657)	*	0.0026 (0.0741)	
Improved process	0.1425	(3.3223)	***	-0.0770	(-1.1887)		0.1735 (3.8131)	***
RD_Invest	0.0737	(1.7683)	*	-0.1164	(-1.1580)		0.0194 (0.4878)	
GGGI	7.3291	(5.0277)	***	7.0707	(4.9309)	***	6.9117 (4.0988)	***
GDP	0.0694	(0.4691)		-0.1820	(-1.2664)		0.1629 (1.0421)	
Size	-0.1452	(-2.6815)	***	0.1953	(1.4449)		-0.0898 (-1.6561)	*
Intercept	-6.1011	(-5.2779)	***	-6.2179	(-6.9345)	***	-6.3690 (-4.7231)	***
Fixed Effects	Sector			Sector			Sector	
Clustered errors	Country			Country			Country	
Pseudo R^2	0.2875			0.2779			0.2914	

*Note: for each variable its coefficient and Z-value is shown in brackets; *** means a significance level of 1 %, ** means a significance level of 5 %, * means a significance level of 10 %.*

In model (a), of the explanatory variables, *Improved_process*, *New_product*, and *RD_Invest* are significant with a positive associated coefficient. Regarding the control variables, *GGGI* is significant and positive and *Size* is significant and negative. This means that the companies which support greatly innovation through new product development, improved processes and R&D investment are likely to have female CEOs. Another important characteristic of these firms is that they mainly of SME-type and located in countries with a reduced gender gap. According to the results of model (b1), finding a female CEO is more frequent in countries with a narrow gender gap and in companies which invest in the development and introduction of new products in new markets. The results of model (b2) contain more significant variables, according to which the innovative context for women shareholders is different from what we observed of women CEOs. For women co-owners it is mainly through development and commercialization of new products (avoiding addressing new markets) as well as improved processes. As in model (b1), female co-owners are more likely to lead SMEs located in more gender-balanced countries.

Additionally, we carried out two estimations classifying the sampled firms by sector (models c1 and c2) and firm size (models d1 and d2), which results are shown in Table 2. The results of the estimations of models c1 and c2 reveal that, regardless the sector, greater innovation in new products and productive processes apparently attract more female CEOs and co-owners. Like in the previous models, socio-economic development favouring greater inclusion of women in all spheres of society is related to higher probability to find female CEOs and shareholders. Only in the Service industry we observe that increased investment in R&D is directly related to the presence of women in leading business positions.

The results of the estimations of models d1 and d2 are very similar: *New_product*, *Improved_process*, and *GGGI* as significant and positive. So, in companies, regardless their size, greater support to new products development as well as updated processes creates a favourable context for women to occupy leading business positions. As in the previous models, the likelihood to find females CEOs or co-owners is higher in countries with reduced gender gap, since *GGGI* is significant and positive.

Table 2

Estimations: models (c) and (d)

Variables	Model (c) Sector				Model (d) Firm Size			
	(c1) Manufacturing		(c2) Service		(d1) SME		(d2) Large	
New_product	0.2700	(3.5417) ***	0.1900	(2.7934) ***	0.2239	(4.0463) ***	0.1613	(1.7357) *
New_product_nm	0.0111	(0.3032)	0.0245	(0.4681)	0.0128	(0.3529)	0.0388	(0.7047)
Improved process	0.1431	(2.7960) ***	0.1491	(3.4160) ***	0.0962	(2.2707) **	0.3217	(4.7567) ***
RD_Invest	0.0542	(1.0963)	0.0918	(1.7346) *	0.0581	(1.2549)	0.0934	(1.2264)
GGGI	7.2249	(4.6808) ***	7.4023	(4.9371) ***	7.6444	(4.9638) ***	5.9647	(3.9194) ***
GDP	0.1293	(0.7414)	0.0096	(0.0751)	0.0646	(0.4230)	0.0871	(0.5270)
Size	-0.1667	(1.4449)	-0.1036	(-1.5740)	No		No	
Intercept	-6.2367	(-2.7462) ***	-5.7784	(-5.0065) ***	-6.4351	(-5.2992) ***	-5.2911	(-4.7763) ***

Продовження таблиці 2

Fixed Effects	No	No	Sector	Sector
Clustered errors	Country	Country	Country	Country
Pseudo R²	0.2468	0.3324	0.2459	0.2413

Note: for each variable its coefficient and Z-value is shown in brackets; *** means a significance level of 1 %, ** means a significance level of 5 %, * means a significance level of 10 %

In all models, pseudo R^2 are rather high, between 0.2 and 0.4, showing a good model fit.

Discussion and Conclusions. In this study, we identified some relevant factors that influence the probability of finding a woman in the position of CEO and a shareholder of innovative companies from a large sample extracted from the database of the World Bank Enterprise Surveys. The analysis was done on 154,682 data of a large number of companies from 142 countries which belong to six large regions, during the period between 2007 and 2023. The model used in the analysis is logistic regression with robust clustered standard errors. The study shows a general model and three additional models built according to the classification of the sample by the role of women as company leaders (CEO *versus* shareholder), sector (manufacturing *versus* service), and firm size (SMEs *versus* large companies). The main findings suggest that women-led companies are characterized by being small- or medium-sized, being highly involved in innovation in a broad sense, and located in regions with more equality between genders.

Regarding the support for innovation, apparently, the predominant type of innovation is incremental, which is when, according to [20], new products are designed for commercialization in a known market. Besides that, in women-led companies, we observe greater adoption of innovation and, more specifically, in the service sector through investments in R&D. This is what creates a favourable context for increased inclusion of women in top business positions. Interestingly, innovative activities are related to high risk and women are more risk-averse. So, our findings contradict this idea, expressed in one way or another in the literature [13; 5]. However, our results might be in line with the idea that the decision to assume more or less risk in business is more associated with the availability of resources for innovation than with gender [21].

Finally, we would like to stress that, based on the additional analysis done between female CEOs and female shareholders, female CEOs are more likely to be found in larger companies, while female co-owners are more present in SME-type firms. Apparently, women CEOs assume more risk than female co-owners supporting innovation not only through new product development, but also through exploration of new sales destinations for these new products. Curiously, this is somewhat different from what agency theory predicts: in our case, the agent ("female CEO") assumes more risk than the principal ("female owner").

Last but not least reflection is that increasing women's participation in business is the key to a strong development of society. However, there are many peculiarities in the incorporation of a woman in the top management of a company, which generates

much heterogeneity depending on the country in which it operates. Therefore, it is necessary to keep on analysing and identifying the tools and mechanisms which promote the inclusion of women in leading managerial positions and on boards.

References

1. Deloitte (2022). *Women in the boardroom: A global perspective* (7th ed.). Deloitte Global Center for Corporate Governance.

2. Mohsni, S., Otchere, I., & Shahriar, S. (2021). Board gender diversity, firm performance and risk-taking in developing countries: The moderating effect of culture. *Journal of International Financial Markets*, Institutions and Money, 73, 101360.

3. Havran, D., Primecz, H., & Lakatos, Z. (2020). *Does female presence on corporate boards impact firm performance? Evidence from listed firms in Central Eastern Europe. Women in Management in Central and Eastern European Countries*. Baden-Baden: Nomos, 37-68.

4. Bernile, G., Bhagwat, V., & Yonker, S. (2018). Board diversity, firm risk, and corporate policies. *Journal of financial economics*, 127(3), 588-612.

5. Faccio, M., Marchica, M.-T., & Mura, R. (2016). CEO gender, corporate risk-taking, and the efficiency of capital allocation. *Journal of Corporate Finance*, 39, 193-209.

6. Baixauli-Soler, J. S., Belda-Ruiz, M., & Sanchez-Marin, G. (2015). Executive stock options, gender diversity in the top management team, and firm risk taking. *Journal of Business Research*, 68(2), 451-463.

7. Tian, X., & Wang, T. Y. (2014). Tolerance for failure and corporate innovation. *The Review of Financial Studies*, 27(1), 211-255.

8. Prabowo, R., & Setiawan, D. (2021). Female CEOs and corporate innovation. *International Journal of Social Economics*, 48(5), 709-723.

9. Dohse, D., Goel, R. K., & Nelson, M. A. (2019). Female owners versus female managers: Who is better at introducing innovations? *The Journal of Technology Transfer*, 44, 520-539.

10. Reuben, E., Sapienza, P., & Zingales, L. (2014). How stereotypes impair women's careers in science. *Proceedings of the National Academy of Sciences*, 111(12), 4403-4408.

11. Triana, M. D. C., Miller, T. L., & Trzebiatowski, T. M. (2014). The double-edged nature of board gender diversity: Diversity, firm performance, and the power of women directors as predictors of strategic change. *Organization Science*, 25(2), 609-632.

12. Bruckmüller, S., Ryan, M. K., Rink, F., & Haslam, S. A. (2014). Beyond the glass ceiling: The glass cliff and its lessons for organizational policy. *Social issues and policy review*, 8(1), 202-232.

13. Albanesi, S., Olivetti, C., & Prados, M. J. (2015). Gender and Dynamic Agency: Theory and Evidence on the Compensation of Top Executives. In *Gender in the Labor Market* (pp. 1-59). Emerald Group Publishing Limited.

14. Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340-363.

15. Carrasco, A., Francoeur, C., Labelle, R., Laffarga, J., & Ruiz-Barbadillo, E. (2015). Appointing women to boards: is there a cultural bias? *Journal of Business Ethics*, 129(2), 429-444.

16. Fang, S., Goh, C., Roberts, M., Xu, L. C., & Zeufack, A. (2020). Female business leaders, business and cultural environment, and productivity around the world. *World Bank Policy Research Working Paper*, (9275).

17. Bertrand, J., Burietz, A., & Perrin, C. (2022). Just the two of us, we can ('t) make it if we try: Owner-CEO gender and discouragement. *Economics Letters*, 216, 110596.

18. Agresti, A. (2012). *Categorical data analysis* (Vol. 792). John Wiley & Sons.

19. eileis, A., Köll, S., & Graham, N. (2020). Various Versatile Variances: An Object-Oriented Implementation of Clustered Covariances in R. *Journal of Statistical Software*, 95(1), 1-36.

20. Varma, R., Bommaraju, R., & Singh, S. S. (2023). Female Chief Marketing Officers: When and Why Do Their Marketing Decisions Differ from Their Male Counterparts'? *Journal of Marketing Research*, 00222437231156902.

21. Audretsch, D. B., Belitski, M., & Brush, C. (2022). Innovation in women-led firms: an empirical analysis. *Economics of Innovation and New Technology*, 31(1-2), 90-110.