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THE EARLY-STAGE ENTREPRENEURIAL ACTIVITY OF WOMEN IN INDIVIDUALISTIC VERSUS COLLECTIVIST COUNTRIES: MOTIVES, DRIVERS AND INHIBITORS

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ABSTRACT. The purpose of this paper is to investigate whether differences in female entrepreneurial rates are explained by inherited cultural, societal, and technological factors. Women's early-stage entrepreneurial activity in two groups of countries is examined in this study. As part of the analysis, we used data from the Global Entrepreneurship Monitor and employed Logistic Regression, the Synthetic Minority Oversampling Technique, and Firth logistics for rare events. Collectivist countries have higher rates of early-stage entrepreneurial activity among women, but these occur in less technologically advanced sectors. Women's primary motivation for entrepreneurship in countries with lower disposable personal income is necessity. New technology adoption rates in early-stage entrepreneurial activity are significantly higher in collectivist countries. Young women's entrepreneurial rates are slightly affected by the loneliness phenomenon. study's weaknesses are the overconfidence of interviewees in their ability to self-assess their skills, the low rate of women entrepreneurs, and the omission of essential variables due to missing data. This study tests the adage that individualistic behavior promotes entrepreneurship and examines the impact of societal variables on women's entrepreneurship, contrary to certain assumptions made in the GEM report. The study contributes to the body of knowledge regarding female entrepreneurship.

JEL Classification: L26, C40, J16

Keywords: entrepreneurship, women, gender, collectivism, individualism, technology, logistic regression, SMOTE, Firth, Global Entrepreneurship Monitor

Introduction

Entrepreneurship has become a critical, if not primary process for bringing innovative ideas to market. It is the process by which technologies are repurposed from military to individual and societal use. Furthermore, this may explain why eastern European countries were

unable to develop new revolutionary technologies following the dissolution of the Soviet Union. Thus, in most countries, establishing new businesses has become a priority for economists, academics, and policymakers (Rubio-Bañón and Esteban-Lloret, 2016). With the transition to a market-based economy, the world started viewing differently not only entrepreneurship but also the way new innovative technologies are generated. However, if all humans respond similarly to the incentives associated with entrepreneurship, why are not there more people initiating economic activities or attempting to provide any form of entrepreneurship?

Previous studies mention that to achieve high levels of economic growth, a country needs a large number of individual entrepreneurs (Pinillos and Reyes, 2011). Meanwhile, Stam and Stel (2011) contend that entrepreneurship, particularly high-growth entrepreneurs, can be the critical link in economic growth. It has been observed that growth is slowed when female labour participation or entrepreneurship is low (Kumar et al., 2018). However, Dautzenberg (2012) argued that what fuels growth is not small businesses but technology firms. People are believed to respond not only to monetary incentives but also to individual, societal, emotional, and cognitive influences; these directly impact how they engage in innovative thinking and create value (George and Zahra, 2002). Then, the entrepreneurial process can only be fully understood by considering both the individual and societal contexts in which it occurs (Acs et al., 2011). There is a frequently observed significant disparity in economic performance between individualistic and collectivist countries. In light of the fact that female entrepreneurship is lower than male entrepreneurship in these countries due to stereotypes and roles, this work intends to compare the factors affecting female entrepreneurship in various environments. Because researchers focus exclusively on individual-level aspects, this research will focus on macroscopically examining the societal factors accumulated over history is critical. The necessity of comparing country groups' cultures, values, and incentives is also demonstrated by the paper of (Rubio-Bañón and Esteban-Lloret, 2016).

The importance of women's entrepreneurship as a driver of economic growth cannot be overstated. Throughout the history of scientific entrepreneurship, studies have focused primarily on the entrepreneurial rate disparity between males and females. Despite the recommendation, no policies aim to expand the entrepreneurial environment for women (Foss et al., 2019). The purpose of this paper is to compare women's intentions, strategic choices, and entrepreneurial activities in individualistic and collectivist countries while also considering their economic development level, aligning with the identified potential research questions from (Bastian, Sidani and El Amine, 2018). Because previous research has been largely theoretical and has included personal characteristics as female entrepreneurship drivers and inhibitors (Hattab, 2012). Women's motivations and factors driving entrepreneurship will be examined in relation to systemic factors such as loneliness, gender inequality, and disposable income because each factor has a different impact on women's motivation to become entrepreneurs (Martínez-Rodríguez et al., 2022).

1. Literature review

1.1. Women's entrepreneurial activity

Since, throughout history, entrepreneurial activity has been primarily initiated and led by men, societies have suppressed the role of women in entrepreneurship through the division of gender responsibilities. Even when they succeed, their successes are obliterated from society and the media in some way. Nonetheless, institutions, business education, legislation, and entrepreneurial literature were primarily shaped by and for men at the time. In her work, Ahl

(2006) performs a study on existent entrepreneurial literature. It is mentioned that most of the terms describing the entrepreneur are also highly correlated with the words describing masculinity, like "Independent", "Detached", "Achievement-oriented" "Strong-willed", and "Resolute" (p.5). Additionally, she notes that most studies compare men's and women's entrepreneurial activity using descriptive statistics. Likewise, it is mentioned that journals devoted to entrepreneurship research rarely publish critical or feminist work.

One could argue that when a country promotes masculine, individualistic behaviour and independent thought, risk-taking, rewards, and entrepreneurial activity increase. A philosophical lens could be used to view it. The greater the rewards associated with individualistic, masculine, and risky entrepreneurial activity, the more societies promote and value these characteristics while simultaneously excluding collectivist and cooperative cultures. To conduct a cross-country comparison of women entrepreneurs, one must consider attitudes toward women, culture, religion, the roles that women have, their willingness to pursue available opportunities, as well as the assistance they receive from their in-groups The motivation to start a business entails combining knowledge, psychological characteristics, attributes, personal values, and attitudes; all of these must be examined at the individual level and integrated into the context to allow for more accurate cross-country comparisons (Thomas and Mueller, 2000). The media should reinforce women's leadership positions as having elite education, supportive partners, strong leaders, and the ability to overcome entrepreneurial challenges. However, we must determine the extent to which women rely on the media as motivators for starting a new business, as the woman leader is constructed through media representation (Drake, 2018). Exemplary mentors and networks are regarded as a success factor in women's work leadership (Socratous, 2018).

H1. There is no significant relationship for women between seeing stories in the public media and/or internet about successful new businesses and engaging in entrepreneurial activity.

1.2. Individualistic-collectivist societies

Hofstede developed the Individualistic-Collectivist scale in 1980. The study was initially focused on the IBM culture but was later expanded to the country level. Originally, there was no explicit definition of individualist and collectivist societies. In Hofstede and Minkov (2010) and Hofstede (2011), he defines an individualistic society as one in which individuals prioritise their own and closely related family members' interests. While a collectivist society is defined as a culture in which people are connected to solid and unified groups through much of their lives, going beyond the first-level family circle and promoting values such as loyalty, these groupings strongly oppose other groups.

There is a widespread belief that individualist countries with a premium on achievement have a greater proclivity or tendency toward entrepreneurship than collectivist countries (Pinillos and Reyes, 2011). This fallacy is facilitated by the risk-taking attitude of individuals in those countries and the security cushion provided by collectivist societies. This idea of security in a collectivist society is described as a "lose-win" situation by Minkov et al. (2017), classifying it as a "lose for the individual, win for society" (p.16). On the other hand, entrepreneurship activity does not always conform to this assumption, as business creation in collectivist countries is motivated by the need for affiliation among groups of people (Pinillos and Reyes, 2011).

H2a. Women's total early-stage entrepreneurial activity (TEAW) is more prevalent in countries with a high level of collectivism than in countries with a culture characterised by high levels of individualism.

H2b. However, in individualistic countries, women's entrepreneurial activity (TEAW) is characterised by higher technology levels than in collectivist countries.

Collectivism can encourage women entrepreneurs to succeed by providing guidance and security but also limit their activity through rigid values, gender roles, and group loyalty (Bullough, Renko and Abdelzaher, 2014). These merely define what is considered good and bad in society and what actions are considered moral or immoral. As noted, entrepreneurial activity in individualistic countries is primarily determined by knowledge generation and creativity, whereas in collectivist countries, it is characterised by leveraging existing resources. Despite numerous studies on the differences between men and women, where women are believed to be more motivated by market opportunities and demand, while men are motivated by growth and new technologies, few cross-country studies have been conducted (Dautzenberg, 2012). Gender disparities are a social construct formed by a country's or region's culture and history and evolve during political regimens.

H3. The rate of new technology in women's entrepreneurial activity is higher in individualistic countries than in women's entrepreneurial activity in collectivist countries.

Likewise, the desire to establish a unique identity or stand out in their community is one of the reasons people pursue entrepreneurial endeavours (Shepherd and Haynie, 2009). This motive can be a constraint in collectivist countries, where the desire to belong may outweigh the desire to be distinct.

1.3. Gender inequalities

How gender inequalities are perceived and addressed affects one's ability to start a business or be a business owner (Thébaud, 2015). Also, Thébaud (2015) mentions that in countries with higher inequality, a more significant gender gap was seen in nascent entrepreneurship rates (Klyver, Nielsen and Evald, 2013). The current body of knowledge focuses primarily on income and entrepreneurial engagement disparities between men and women. Nonetheless, these studies are limited in examining how entrepreneurial women are disproportionately represented in laws, institutions, regulations, entrepreneurship literature, and culture. For instance, the decision to start or manage a business can be influenced by network behaviour, funding availability for female entrepreneurs, and social and institutional support. Nevertheless, previous rigorous studies reveal that women's businesses are usually smaller and less rewarding and involve more routine tasks than men-owned businesses (Loscocco and Bird, 2012). According to the same authors, as long as women are not exempt from rooted responsibilities for the home, family, and community and also dismantle traditional gender roles, their business performance will always lag behind men's, and disparities will continue to widen. While women may have a higher level of education than men in innovative countries, this does not translate into more significant early-stage entrepreneurial activity (TEA) than men, this lacuna between male and female entrepreneurship and behavioural factors influencing it was also observed by (Yadav et al., 2022).

Additionally, men are credited with laying the groundwork for highly technological firms (Dautzenberg, 2012). This disparity may not be robustly significant, but it can reveal factors impeding women's entrepreneurial activity, such as work-family life imbalance and the opportunities offered by governments to address it, a lack of resources, scarce financial support for female entrepreneurs, a lack of business knowledge and opportunities or a not favourable business environment (Panda, 2018). The same author notes that government programs may

favour men-owned businesses over women-owned businesses. Women may struggle to obtain startup financing due to their limited employment history. These and other gender-based stereotyping raise imperative questions about how society views women and their capacities (Godwin, Stevens and Brenner, 2006).

H4. Women's entrepreneurial activity is positively associated with higher levels of education in collectivist countries, while there is no significant relationship between these two in individualistic countries.

H5. Women's entrepreneurial activity rates are higher in countries with lower levels of gender inequality than in countries with higher inequalities.

H6. There should be a significant positive relationship between skills perception and women's entrepreneurial activity.

1.4. Alone, untouched, unspoken-the effect of loneliness on women's entrepreneurship

Along with numerous studies on how entrepreneurship affects growth, it is exciting to see how several studies examine how entrepreneurship affects psychological needs and vice versa. Shepherd and Haynie (2009) make a worthy viewpoint about the psychological need for belonging and how it can result in isolation and have a detrimental effect on psychological health. This topic leads to the paper's argument that loneliness has a detrimental effect on women's entrepreneurial activity, regardless of possible reverse causality.

However, loneliness does not occur consistently throughout a lifetime. According to Barreto et al. (2020), young people experience the most loneliness, which diminishes with age, both in males and females. The same article notes that individuals in individualistic societies experience greater loneliness than those in collectivist cultures. However, Heu, van Zomeren and Hansen (2019) found that collectivist regions had a higher level of loneliness. Not only are young people isolated, but they are also eager to accomplish more and make a difference in the world. However, some countries with a family-oriented culture may encourage entrepreneurialism only after a certain age, implying that the rate of elderly entrepreneurs may be higher in those countries. Due to the apparent differences in the motivations of younger and older entrepreneurs, the age variables must be examined (Global Entrepreneurship Monitor Report , 2021/2022).

H7. In countries with higher levels of loneliness, the rate of women's entrepreneurial activity of 18-30 is lower than those in countries with lower feelings of loneliness.

1.5. The role of income in female entrepreneurship

Often, we observe individuals who invest or are willing to invest only after accumulating sufficient capital. In this case, the argument is not that income growth increases entrepreneurial activity. However, having a higher personal income reduces risk aversion, as the individual investor's own capital is perceived as less risky (Hartog, Ferrer-i-Carbonell and Jonker, 2002). Future entrepreneurs determine the amount of capital required to start a business. As Lerner, Brush and Hisrich(1997) noted, the amount of net income also has an effect on the motivation for entrepreneurial activity. Another intriguing finding is that women in low-income countries engage in entrepreneurial activities at a higher rate than women in high-income countries (Malach Pines, Lerner and Schwartz, 2010).

H8. The influence of the interaction between income category and attitude towards risk will be positively associated with women's TEA for the last income category.

H9. The proportion of women initiating entrepreneurial activity as a necessity is higher for women in the low-income category than those in the high-income category.

H10. There should be a negative relationship between fear of failure and women's entrepreneurial activity.

Table 1. Social indicators used for country grouping and comparison

Country	Indiv-Collectiv.	Loneliness	Gender Inequality	Disposable Income
Netherlands	182	1	0.043	24969
France	86	4	0.049	24923
United Kingdom	93	2	0.118	23836
Sweden	133	2	0.039	24240
Poland	-15	4	0.115	15706
Slovakia	52	3	0.191	14545
Bulgaria	-19	4	0.206	10875
Croatia	30	3	0.116	13861

Notes: "Indiv-Collectiv"=Individualism-collectivism index. A lower score indicates a higher level of collectivism. A higher value in loneliness indicates a greater proportion of people experiencing loneliness. "Gender Inequality"=UNDP Gender Inequality Index. Disposable income, as of OECD, is the income available to households.

Source: *own compilation*

Social indicators are critical to the analysis, represented in (Table 1). Individualism and collectivism indicators are derived from Hofstede and Minkov (2010), Hofstede (2011), and Minkov et al. (2017) papers. A higher score indicates a greater degree of individualism, whereas a lower score indicates a greater degree of collectivism. Loneliness data were derived from the European Social Survey, and a higher number indicates a more significant percentage of the population experiencing loneliness. Then it was gathered data on gender inequality from the United Nations Development Programme (UNDP). A lower number indicates less inequality and, thus, greater gender equality. Finally, there is the indicator of household disposable income.

2. Methodological approach

2.1. Data and variables

The above-mentioned hypothesis was tested using the Global Entrepreneurship Monitor (GEM) database. The Adult Population Survey (APS) was used in each country to collect data on individual and social attitudes toward entrepreneurial activities, as well as individual motivations and ambitions to start a business. The data extraction took place in November 2022, as the GEM consortium made the dataset available three years after it was created in 2018. The sample of states chosen for this cross-country comparison is predicated on the assumption that socialist states, also known as "Eastern Bloc Satellites," were influenced by the Soviet Union and communist ideology. That is why these countries are classified as collectivist in this study.

On the other hand, during the Cold War (1947–1991), the so-called "First World" or "Western Bloc" countries backed the U.S. and NATO against the Soviet Union, adhering to US capitalist ideology and an individualist attitude toward entrepreneurship. The sample for this study is divided into Collectivist countries (Poland, Slovakia, Croatia, Bulgaria) and Individualistic countries (United Kingdom, Netherlands, Sweden, France). The dependent variable used to examine the differences in entrepreneurial motivations and attitudes across

countries is Total early-stage entrepreneurial activity (TEA) for women, defined as those women in the sample who have been an entrepreneur or owner-manager of a new business for less than three and a half years. In Table 2, the variables are described in terms of how they were created and their types.

Table 2. GEM APS variables used in the women entrepreneurship models

Variable	Description	Type
TEA Women	Are involved in early-stage entrepreneurial activity: 0: No 1: Yes	*Dummy*
Know Entrepreneur	0: Do not know anyone who started a business in the last two years 1: Know someone who started a business in the last two years	*Dummy*
Fear Failure	0: Fear of failure does not prevent her from starting a new business 1: Fear of failure does prevent from starting a new business	*Dummy*
Skills Perception	0: Does not feel that she possesses the knowledge and skills to start a business 1: Does feel that she possesses the knowledge and skills to start a business	*Dummy*
Education Level	1: Secondary and less than secondary, 2: post-secondary, 3: graduate	*Categorical*
Income category	Household income in 3 categories 1: Lowest 1/3, 2: Middle 1/3, 3: Highest 1/3	*Categorical*
Age	Age when the person was interviewed: From 18 to 65 and up	*Discrete*
Media	In their country, do they see stories in the public media and/or internet about successful new businesses: 0: No 1: Yes	*Dummy*
Proportion comparison		
New Technology	Percentage of Women TEA businesses using new technology that is less than 5 years old	*Proportion*
Technology level	Percentage of Women TEA businesses that are active in high or medium technology sectors	*Proportion*
High growth firms	Percentage of Women TEA businesses that have high employment expectations	*Proportion*
Notes: The variables were build based on the GEM Adult Population Survey (APS) from the next source: https://www.gemconsortium.org/data/sets?id=aps		

2.2. Missingness of data

Our empirical research is inextricably linked to missing data. However, few articles address the issue of missing data. As a result, despite the significant results, numerous factors are overlooked, potentially biasing the results. Though, caution must be exercised, as incorrect data imputation can result in bias insertion into data. Researchers can address this issue by imputing data using a variety of algorithms. For instance, Batista and Monard (2003) propose several methods for dealing with missing data, including "Case Substitution", "Mean or Mode Imputation", "Hot Deck and Cold Deck", "Prediction Models" but also the k-NEAREST NEIGHBOR and C4.5 and CN2 algorithms. Each of these methods has its advantages and disadvantages.

However, these types of imputations are most effective when we are dealing with continuous or scale data. Using these algorithms on categorical data is complicated because they employ qualitative and quantitative dimensions of values and the Euclidian Distance. Additionally, they can be used for data that is missing completely at random (MCAR), but applying them to data that is not missing at random (MAR) is not trivial and using missing not at random is nearly impossible (MNAR).

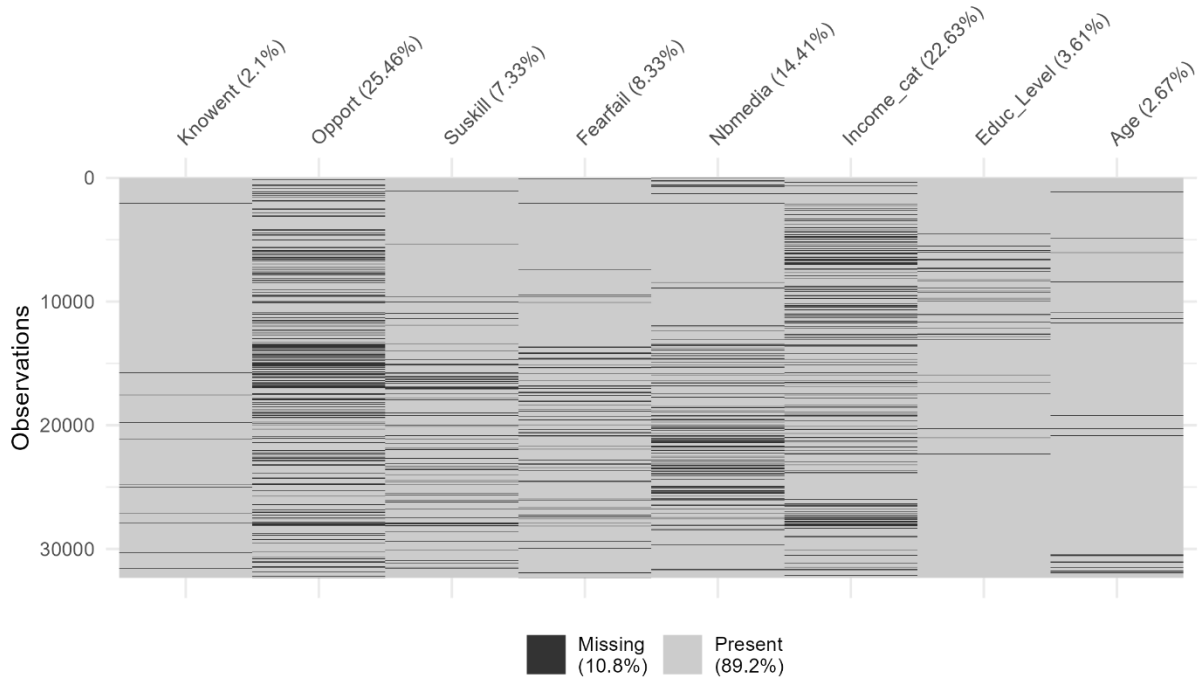

Figure 1. Missing data patterns
Source: *own data*

In their book, Little and Rubin (1987) define different patterns of data missingness. According to MCAR, the missingness value of a variable is independent of other matters in the dataset or missing values within the data. Different types of imputations can be performed at these levels without increasing bias. The missing value for MAR is determined by other values in the dataset but not by the data itself. MNAR values depend on the attribute's missing or exiting values and the values of other variables in the dataset.

Although 'Seeing Opportunities' is a critical, independent variable in our model, we must exclude it from our analysis because Little‘s (1988) MCAR test indicated that the values are not completely missing at random. Despite high levels of missingness, we kept other variables in the model, and we did not make any imputations as the majority of variables are categorical and essential for our prediction.

2.3. Logistic regression

The decision to perform a logistic regression is frequently motivated by the data type. When the dependent variable is binary, it is used binary logistic regression. A binary outcome variable “Y” can take two values (1 = Yes, 0 = No). We are looking for the success probability modelling, P (TEA = 1). Let us take $\pi(x)$to the value of P (TEA = 1). Logistic regression makes the assumption that the observation is binomial and that it varies with the parameter $\pi(x)$, which likewise alters with the values of x.

As it is revealed in the book of Agresti (2019), logistic regression has the following formula:

$$\pi(x) = \frac{e^{\alpha+\beta x}}{1+e^{\alpha+\beta x}} \quad (1)$$

Additionally, it has a linear form for the logit of the success probability, which we can obtain by calculating the log of the odds:

$$\text{Logit}[\pi(x)] = \log\left[\frac{\pi(x)}{1-\pi(x)}\right] = \alpha + \beta x \quad (2)$$

This formula indicates that the logit increases by β for every 1-unit increase in x. The following is the model equation in our case:

$$\log\left[\frac{P(\text{ TEAyyFEM })}{1-P(\text{ TEAyyFEM })}\right] = \alpha + \beta_1(\text{ Skill Perception }) + \beta_2(\text{ Fear of failure }) + \beta_3(\text{ Know entrep. }) + \beta_4(\text{ age }) + \beta_5((\text{ EducLevel })_2) + \beta_6((\text{ EducLevel })_3) + \beta_7((\text{ Income Cat. })_2) + \beta_8((\text{ Income Cat. })_3) + \beta_9(\text{ SkillPercep} \times \text{Knowentr }) + \beta_{10}(\text{SkillPercep} \times (\text{ EducLevel })_2) + \beta_{11}(\text{ SkillPercep} \times (\text{ EducLevel })_3) \quad (3)$$

2.4. Pitfalls of logistic regression for small samples and SMOTE algorithm

While performing a logistic regression (LR) may initially appear straightforward, certain pitfalls must be considered. One issue may be unequal data, specifically a lack of positive responses in the dependent variable or a minority positive class, referred to as rare events or rare class problems. Here, we can see that our predicted variable does indeed have a structure resembling a rare event, as visible in Table 3:

Table 3. Total early-stage entrepreneurial activity (TEA) of women and non-entrepreneurship proportions

TEA Women	Country								Total
	BG	FR	HR	NL	PL	SE	SK	UK	
0	931 (6%/94%)	997 (6%/96%)	948 (6%/92%)	1050 (7%/92%)	3830 (24%/96%)	2458 (16%/97%)	898 (6%/91%)	4562 (29%/96%)	15674 (95%)
1	55 (7%/6%)	40 (5%/4%)	78 (10%/8%)	86 (11%/8%)	179 (23%/4%)	84 (11%/3%)	86 (11%/9%)	183 (23%/4%)	791 (5%)
Total	2000 (6%)	2002 (6%)	2000 (6%)	2258 (7%)	8000 (25%)	5078 (16%)	2000 (6%)	9002 (28%)	32340 (100%)

Source: *own compilation of GEM data*

This difficulty also influences the imbalanced classification, as a dataset with 98% being the majority negative class can also achieve high accuracy (ACC) at classification such as based on Figure 2:

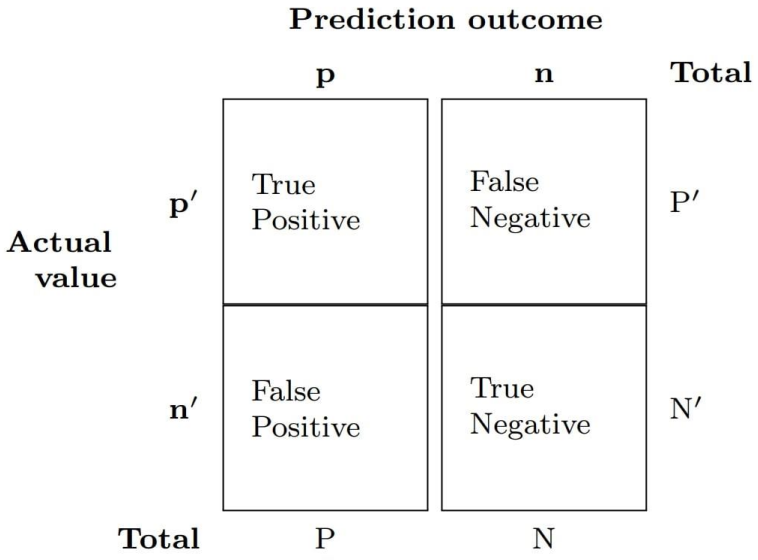

Figure 2. The confusion matrix structure
Source: *own conceptualisation*

$$ACC=(TP+TN)/(TP+FP+TN+FN) \quad (4)$$

The problem will affect the classification information regarding accuracy, sensitivity and specificity. Such an issue will also influence the odds ratio as it arranges the documents corresponding to the positive class (minority class). Numerous techniques address this issue, including algorithms that over-or under-sample the minority class. The primary objective of such methodologies is to increase recall without forfeiting precision (Chawla *et al.*, 2003). It can be recognised from looking at a confusion matrix.

To deal with such minority class imbalances, a method widely accepted by researchers and data scientists is SMOTE (Synthetic Minority Oversampling Technique). The concept behind this approach is to over-sample the minority group by creating "synthetic" instances (Chawla *et al.*, 2002). This algorithm uses the Value Distance Metric to generate the so-called synthetic values, including Euclidian assumptions (Chawla *et al.*, 2003). It is generated by taking the difference between the sample vector and its K nearest neighbour. We add a random figure between 0 and 1 to the difference and summate it to the particular vector to create the synthetic sample (Luengo *et al.*, 2011).

In Figure 3, we can observe how the operating point on the curve moves towards the upper left in the Receiver Operating Characteristic (ROC). This effect is triggered by the augmented oversampling of the minority positive class. The closer it is to one, the higher the performance. If we applied an under-sampling of the majority class, the operating point would tend to move towards the upper right. In addition, we can observe that the accuracy and sensitivity also improved.

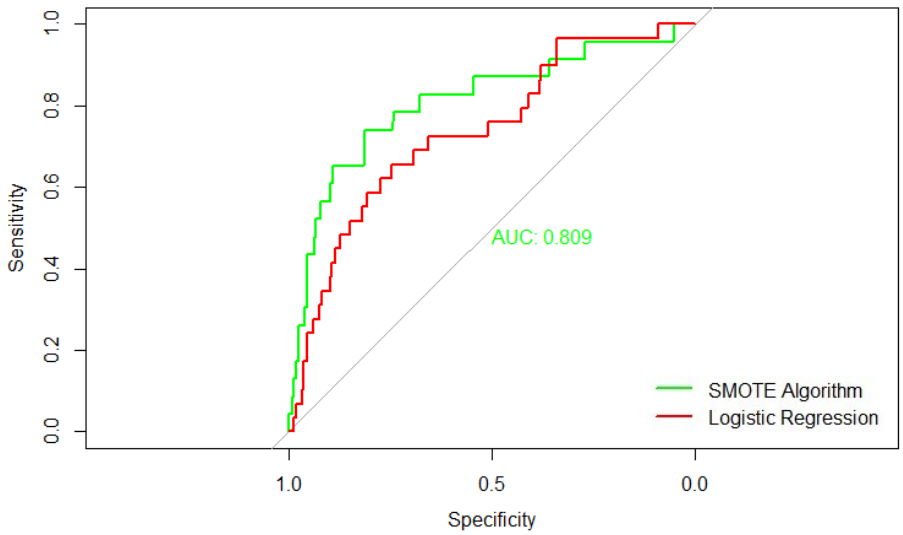

Figure 3. Improved sensitivity in the ROC curve after using LR and SMOTE
Source: *own compilation on GEM Poland data*

2.5. Firth logistics or "A logistic regression for rare events"

Despite significant improvements in the accuracy or capacity to identify true positives and true negatives for the prediction under evaluation, SMOTE is not a perfect method. One of the weaknesses is that when SMOTE oversamples the minority sample, it does so randomly and with equal probability while also considering only between-class imbalance and not within-class imbalance, or when a small minority sample is replicated numerous times, significant information is lost (Douzas, Bacao and Last, 2018).

This paper will also employ Firth logistics and compare the results to those obtained using the other two methods to address small minority shortcomings identified in the previously described methodologies. This methodology is primarily used in the case of extremely rare events. In rare instances, the substance of the ones is more informative and significant for analysis than the value of the zeros. Rare events probability most of the time is underestimated by simple logistic regression (King and Zeng, 2001). Moreover, the bigger the imbalance of the values of the outcome variable, the more serious is the bias in the probabilities at prediction (Puhr *et al.*, 2017). Firth logistic, also called the penalised likelihood method, was introduced in 1993 in the paper (Firth, 1993).

As previously stated, the log odds ratio estimates are calculated by maximising the conditional likelihood. In order to calculate the estimate values, we apply logarithm to the likelihood function and have the following equation:

$$\log L(\beta \mid y) = \sum_{i=1}^{n} \left[y_i \log \left(\frac{1}{1+e^{-X_i\beta}} \right) + (1-y_i) \log \left(1 - \frac{1}{1+e^{-X_i\beta}} \right) \right] \quad (5)$$

However, the estimates obtained with a simple logit model have a bias substantial different from zero (Rainey and McCaskey, 2017).To solve this is relatively easy by adding a penalty to the log-likelihood function. In this case, 0.5log[detI(β)] is Jeffrey's Invariant prior from (Hartigan, 1964), where [I(β)] is the information matrix, and "det" is the determinant of the matrix:

$$\log L^{*}(\beta \mid y) = \sum_{i=1}^{n} \left[y_i \log \left(\frac{1}{1+e^{-X_i\beta}} \right) + (1-y_i) \log \left(1 - \frac{1}{1+e^{-X_i\beta}} \right) \right] + \frac{1}{2} \log |I(\beta)| \quad (6)$$

They mention that "bias may be removed from the maximum likelihood estimator by the introduction of an appropriate bias term into the score function" it "simply penalises the

likelihood by the Jeffreys invariant prior" (Firth, 1993, p. 36). This bias-reduction method will enhance the accuracy in individual predicted probabilities for small sample-size datasets.

3. Results and discussion

The first section of the analysis of the results will examine the general characteristics of the countries and people sampled. We can see that, despite the small sample size of the other countries, the United Kingdom and Poland have higher rates of Women's Early-Stage Entrepreneurial Activity, which includes both women willing to start a business and those who have recently started or are currently managing a business. Additionally, we can observe a high level of passivity among female entrepreneurs in countries such as Bulgaria and France. When we compare entrepreneurial activity to educational attainment, we notice an interesting phenomenon. Countries with a higher rate of female entrepreneurship have significantly larger proportions of people with some secondary education or only post-secondary education.

In contrast, countries with a lower rate of female entrepreneurship have a more balanced population distribution in education. We can observe this phenomenon in countries such as France and the Netherlands, where education levels are higher but entrepreneurial activity is not as substantial. Let us compare males and females on the basis of their educational attainment. We observe no significant disparities in educational attainment, which supports previous theories that women and men are educated equally. However, the disparity persists in STEM subjects linked with innovation and entrepreneurship, where women are more likely to hold degrees in social sciences, education, and health (Li *et al.*, 2021). It cannot be provided a rigorous opinion without conducting an in-depth analysis of the differences between Individualist countries (Netherlands, United Kingdom, France, and Sweden) and Collectivist countries (Slovakia, Poland, Croatia, and Bulgaria) in terms of TEA activity.

Table 4. Proportion comparison between country groups and hypothesis testing

	Sample 1	Sample 2	Prop.1	Prop.2	p-value	Conf. low	Conf. high	Alternative	p.signif
Hypothesis 2a	9067	6607	0.04	0.06	<0.001	-1.00	-0.01	two-sided	****
Hypothesis 2a	9067	6607	0.04	0.06	<0.001	-1.00	-0.01	less	****
Hypothesis 2b	1038	926	0.11	0.06	<0.001	0.03	1.00	greater	****
Hypothesis 5	2173	1970	0.06	0.07	0.08	-0.02	0.01	two-sided	*
Hypothesis 7	1459	1325	0.06	0.06	0.5	-1.00	0.01	two-sided	ns
Hypothesis 9	350	380	0.14	0.20	<0.04	-0.11	-0.01	two-sided	**
Hypothesis 9	350	380	0.14	0.20	<0.04	-0.11	-0.01	less	**
Firm Growth	392	398	0.06	0.09	0.31	-0.06	0.01	two-sided	ns
New Tech	393	398	0.27	0.32	0.11	-0.12	-0.01	two-sided	*

Notes: Prop.2 is associated with less developed, low-income, collectivist countries, as indicated by the proportions in each case. The alternative was tested for each hypothesis using the R environment's Z-test for proportions and is included in the current table. $^{ns}p > 0.1$ *p<0.1 **p<0.05 ***p<0.01 ****p<0.001

Source: *own calculations on GEM data*

A proportion analysis was conducted to address the previous issue of country differences. As shown in Table 4, the proportion of women engaged in total entrepreneurial activity is significantly higher in collectivist countries than in individualist countries. This leads us to accept Hypothesis 2a. Simultaneously, the technology level of businesses run and initiated by women is higher in individualist countries than in collectivist countries. This supports

Hypothesis 2b, which states that the two country groups are technologically distinct, and individualist countries account for a greater share of high-technology businesses. However, this hypothesis needs to be complemented by a ROA study as presented in (Zolin, Stuetzer and Watson, 2013).

Figure 4. Women's TEA by Country
Source: *own compilation*

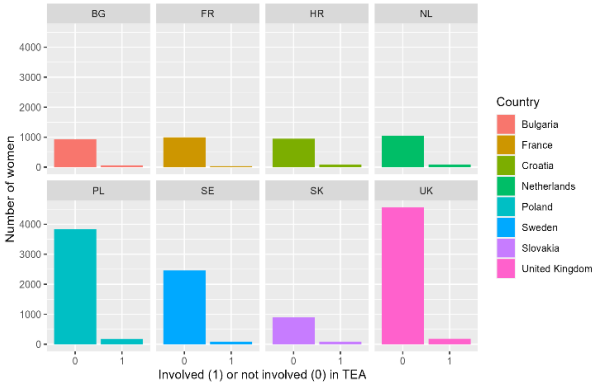

Figure 5. Education levels by gender and country
Source: *own compilation*

As illustrated in Figure 7, women's early-stage entrepreneurial activity is slightly more concentrated in the medium or high-tech sector in individualistic, high-income countries than in collectivist countries. On the other hand, when we look at countries such as Poland, Bulgaria, and Slovakia, we see a modest proportion of women operating in medium and high-tech sectors. This led to accepting Hypothesis 2b, as the proportional comparison corroborated the findings. However, as illustrated in Figure 6, the age of technology used in women's business varies significantly across the samples. We can see that collectivist countries have a higher proportion of new and remarkably new technology than individualistic countries. This is also confirmed by the proportion comparison, which is significant at the 10% significance level, indicating that the difference in newness of technology between the two analysed samples is not zero. This leads us to reject Hypothesis 3, as collectivist countries are the most advanced in terms of new technology adoption. We must emphasise that new technology is defined as any technology used that is less than five years old.

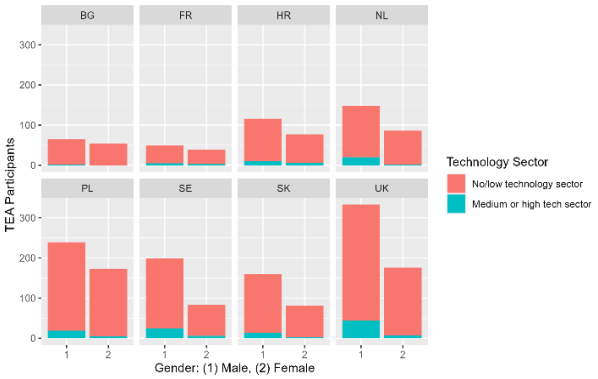

Figure 6. TEA by gender using new technology
Source: *own compilation*

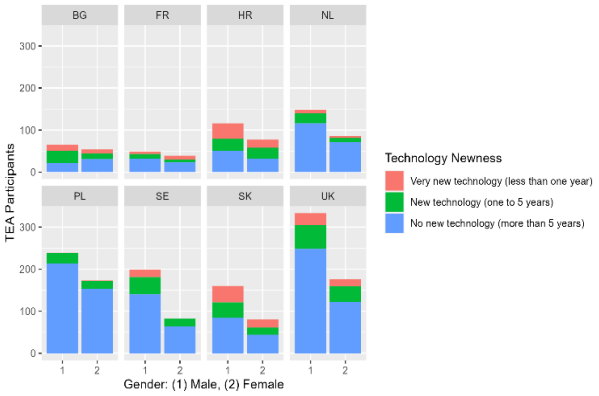

Figure 7. Technology sector intensity
Source: *own compilation*

Generally, there is a perception that women are involved in less industrialised business than men, mainly because of technological complexity. A similar trend can also be observed in our analysed sample. Looking closely at Figure 8, we can see that women make up a much smaller proportion of those involved in extractive and transformative entrepreneurship, which

men primarily dominate. However, we can observe that women entrepreneurs are more detached than men in consumer-oriented entrepreneurship, but there is also a sizable proportion of women in business services. This is due to the high level of technological complexity, but also to the dangers and risks inherent in these extractive and transforming activities. Another reason could be the educational disparity in STEM disciplines, and it may be premature to expect women to enter more technologically complex industries until this disparity is closed.

In the subsequent session, logistic regression was performed. Concerned about the low rate of positive responses in the dependent variable, two additional modelling techniques were implemented. Simple logistic regression, SMOTE (Synthetic Minority Over-sampling Technique), and a penalised likelihood (Firth logistic) algorithm are applied. The latter method is primarily used for rare events; 15% positive responses constitute a rare event, while less than 5% constitute an extremely rare event.

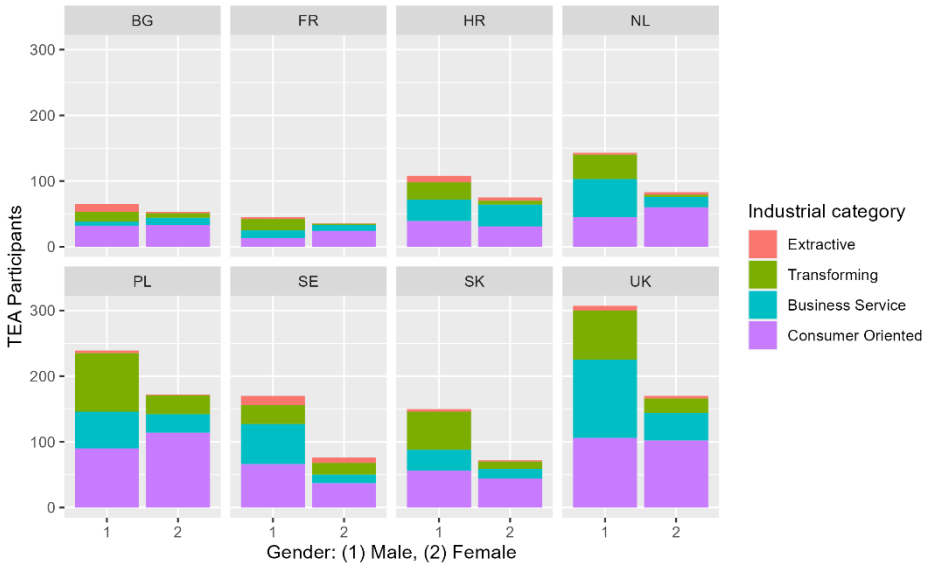

Figure 8. TEA by type of activity and gender
Source: *own compilation*

The fourth hypothesis is that education relates strongly with women's entrepreneurial activity in collectivist countries but not in individualistic countries. We find no evidence to support this. Despite the fact that the Global Entrepreneurship Monitor Report (2021/2022) assumes that graduates have a higher rate of entrepreneurship, the research finds that bachelor's degree graduates have a higher chance of becoming entrepreneurs when compared to those with no degree at all. However, we find that post-secondary education positively affects women's entrepreneurial activity in Sweden, as demonstrated by simple and Firth logistic. Consider Hypothesis 5, which states that women have a higher rate of entrepreneurial activity in countries with lower levels of gender inequality than in countries with higher levels of inequality. We find that when countries are divided into groups according to their gender inequality scores is little significant difference in female entrepreneurship proportions for these countries.

As expected, perceptions of skill, knowledge, and experience, which can also be referred to as self-confidence in one's abilities, have an effect on women's entrepreneurial activity. However, in Poland and Bulgaria, this dimension is not statistically significant despite testimony from Godwin, Stevens and Brenner (2006) mentioning that women are not viewed as having the necessary abilities to perform management tasks efficiently. As a result, we conclude that Hypothesis 6 is correctly predicted and partially proved.

The fact that people may not want to meet other people in countries with higher levels of loneliness or may find meeting other people engaging has been mentioned in previous studies. In this way, their desire to start or run a successful business diminishes; however, according to the literature, this phenomenon is most prevalent among rows of young people under the age of thirty. As a result of this, the research ought to compare the proportion of women who engage in entrepreneurial activity in so-called lonely countries and non-lonely countries until they reach the age of 30. The results of the proportion test show that the difference in rates of female entrepreneurship is not statistically significant, and as a result, the seventh hypothesis must be rejected.

According to the literature review findings, individuals who have a risk-averse attitude toward life also have a risk-averse attitude toward starting and managing a business. This can be explained by the high financial risk involved and the fact that being known as an entrepreneur was not one of history's most favoured occupations. It implied financial inequality from other people or even small acts of deception to grow the business. Today is not the same, but many people experience numerous risks when engaging in entrepreneurial activity, and fear of risk can act as a barrier to starting a new business. However, as people earn more money, their fear of risk diminishes, and they invest more in starting new businesses. We hypothesised that as income increases, fear of failure decreases, and income exceeds fear, implying a positive relationship between women's entrepreneurial activity and income. However, we must reject the eighth hypothesis because no positive relationship between fear of failure and income and female entrepreneurship was discovered, indicating that even as income increases, fear of failure remains stronger and dominates the financial security feeling.

Entrepreneurship is viewed as a different type of employment that pays more than simple jobs. If successful, it is a significantly more rewarding type of activity, which is why it is appealing to start a new business in countries where employment opportunities are scarce. Additionally, it can be a means of escaping financial dependence on other family members. In their paper, Stam and Stel (2011) mention that self-employed people are less satisfied than employees in low-income countries, but the opposite is true in high-income countries. Typically, in low-income countries, women will start a business because they have no other economic option or are irritated by the continued absence of progress in the workplace.

Furthermore, women are more severely punished than men for the same errors at work (Kirkwood, 2009; Fluharty-Jaidee *et al.*, 2018). It is believed that entrepreneurship occurs more due to an opportunity in high-income countries and more result of necessity in low-income countries. Hypothesis 9 takes on this assertion, indicating that female entrepreneurship rates from necessity are significantly higher in collectivist, less economically developed countries than in individualistic countries. As a result of the Covid 19 pandemic, the number of necessity entrepreneurship cases increased, and this type of entrepreneurship is expected to increase among females in the future (Martínez-Rodríguez et al., 2022). This is confirmed by Kirkwood (2009) article, which asserts that women are motivated more by push factors such as poverty, flexibility, and the desire for financial independence than by pull factors. We found no evidence, however, that individualistic countries would introduce more business as a result of opportunity. As additional evidence, Quak & Barenboim (2022) mention that much of women's entrepreneurship in low-developed countries is informal.

When we examine the effect of fear of failure on entrepreneurial activity, we discover that Hypothesis 10 is true only for the Croatian and Polish models (Table 5). An exciting finding is that knowing other entrepreneurs positively affects women's overall early-stage entrepreneurial activity in the majority of countries except for Bulgaria and Poland, which also have the highest levels of collectivism. However, this finding about the importance of knowing other entrepreneurs holds true for the entire sample of individualistic countries. With the

expectation that developed countries would use newer technologies, we discover that the less economically developed countries use significantly more new technologies that are less than five years old in the sample, which is significant at 10% significance levels. However, the significance is weak.

Table 5. Determining the factors impacting TEAW in collectivist countries using binary logistic and the SMOTE algorithm

	Dependent variable: Women's Total Early-Stage Entrepreneurial Activity											
	Slovakia			Poland			Bulgaria			Croatia		
	(Logit)	(SMOTE)	(Firth)	(Logit)	(SMOTE)	(Firth)	(Logit)	(SMOTE)	(Firth)	(Logit)	(SMOTE)	(Firth)
Skill Perception	0.952*	1.404**	0.902*	-0.547	-0.615***	-0.533	18.991	18.586	2.459**	1.709***	2.249***	1.611***
Fear of failure	-0.608	0.101	-0.573	-1.336**	-1.253***	-1.258**	0.112	-17.452	0.034	-0.727	-1.627***	-0.623
Know other entrepreneurs	0.692**	1.247**	0.667**	1.077***	0.926***	1.05***	1.606	19.871	1.142	1.221***	1.307***	1.17***
Media	0.192	-0.174	0.181	0.308	0.629***	0.302	0.202	0.642	0.195	-0.43	-0.750***	-0.411
Age	-0.026	0.145*	-0.033	0.328***	0.326***	0.31***	0.26	0.955***	0.168	-0.006	-0.063	-0.012
Age Squared	0.0002	-0.002**	0.001	-0.005***	-0.005***	-0.004***	-0.004	-0.012***	-0.003	-0.0003	0.0005	0.001
Education level 2	1.202	1.987**	1.286	-0.597	-0.642**	-0.548	-0.95	-0.861	1.086	-0.204	0.911*	-0.083
Education level 3	0.487	1.009*	0.513	-0.744	-0.918***	-0.669	0.289	22.311	1.64	-13.116	-13.474	0.289
Income category 2	no data	18.728	no data	0.293	0.520**	0.279	0.159	1.491	0.154	0.111	0.073	0.097
Income category 3	0.228	0.638*	0.225	0.085	-0.201	0.064	0.57	1.738*	0.444	0.096	-1.248***	0.075
Fear Fail*Income Cat. 2	no data	-0.607	no data	-1.176	-0.316	-1.051	-18.883	-2.686	-1.69	-0.472	0.363	-0.447
Fear Fail*Income Cat. 3	-0.476	-1.899**	-0.403	1.128*	1.134**	1.064*	-1.865	-4.088	-1.385	0.524	1.905***	0.442
Have skills*Educ. level 2	-1.087	-0.591	-1.116	1.348**	1.555***	1.287**	1.676	2.394	-0.462	0.576	-0.379	0.445
Have skills *Educ. level 3	0.419	0.086	0.355	0.981	1.649***	0.912	0.371	-19.905	-1.065	13.581	12.717	0.218
Constant	-2.65	-4.67***	-2.38	-8.59***	-6.38***	-8.18***	-26.21	-58.98	-7.47**	-3.24**	-0.43	-2.95**
Nagelkerke pseudo-R-squared	0.16	0.5	-	0.19	0.33	-	0.5	0.85	-	0.27	0.42	-
Cox&Snell pseudo-R-squared	0.07	0.38	-	0.06	0.22	-	0.14	0.55	-	0.11	0.3	-
Observations	517	419	517	1,756	1,258	1,756	317	222	317	756	590	756
Log Likelihood	-142.29	-187.77	-	-275.82	-546.49	-	-27.718	-27.203	-	-162.005	-271.575	-
AIC	310.579	405.541	-	581.641	1,122.98	-	85.436	84.406	-	354.01	573.15	-

Notes: AIC: Akaike's information criterion. Observations = Obs. used in the model. Nagelkerke: a measurement of the goodness of fit for logistic regression model using the classification table. Cox&Snell measurement for model goodness of fit. All the models contain the same variables just the minority class changes in case of SMOTE. SMOTE: Synthetic Minority Over-sampling Technique. Firth: Firth's penalised logistic regression method. Logit: the logistic regression model. Have skills is the skill perception variable, one meaning that the person possesses the skills to start a business. *p < 0.1; **p < 0.05; ***p < 0.01

Source: *own calculation*

Table 6. Determining the factors impacting TEAW in individualistic countries using binary logistic and the SMOTE algorithm

	Dependent variable: Women's Total Early-Stage Entrepreneurial Activity											
	Netherlands			France			United Kingdom			Sweden		
	(Logit)	(SMOTE)	(Firth)	(Logit)	(SMOTE)	(Firth)	(Logit)	(SMOTE)	(Firth)	(Logit)	(SMOTE)	(Firth)
Skill Perception	2.719***	2.527***	2.557***	1.710***	2.342***	2.089***	2.290***	3.324***	2.627***	2.773***	2.968***	1.625***
Fear of failure	-0.827*	-0.012	-0.766*	-1.174	-3.018***	-0.623	-0.732	-0.261	-0.48	-0.502	-0.619**	-1.068*
Know other entrepreneurs	0.959***	0.713***	0.922***	1.203***	0.844***	0.758*	0.796*	1.362***	1.569***	1.594***	1.581***	1.141***
Media	0.142	0.225	0.128	-0.01	0.089	-0.205	-0.225	-0.542*	-0.043	-0.04	-0.222	-0.026
Age	0.09	0.245**	0.081	-0.046	-0.03	0.136	0.161*	0.221**	-0.02	-0.016	-0.013	-0.053
Age Squared	-0.001**	-0.003**	-0.001**	0.00003	-0.00002	-0.002*	-0.002*	-0.003**	0.001	-0.0001	-0.0002	0.001
Education level 2	0.472	1.201**	0.475	-0.419	0.13	0.604	0.747	1.294**	1.471***	1.594**	1.787***	-0.364
Education level 3	1.588**	1.748**	1.54**	2.744**	-11.338	0.308	0.305	0.555	1.605**	1.650**	1.987***	2.903**
Income category 2	-0.645	-0.176	-0.608	-0.266	-0.596	0.135	0.145	0.343	-0.037	-0.041	-0.19	-0.274
Income category 3	0.169	-0.292	0.171	-0.275	-0.399	-0.423	-0.492	-0.634	-0.094	-0.091	-0.214	-0.281
Fear Fail*Income Cat. 2	-0.389	-0.838*	-0.263	-0.539	1.428	-0.44	-0.468	-0.708	-0.048	-0.05	0.386	-0.43
Fear Fail*Income Cat. 3	-0.16	-1.647**	-0.137	0.215	0.878	-1.103	-14.961	-16.368	-0.614	-0.63	-1.127***	0.205
Have skills*Educ. level 2	-0.472	-0.704	-0.471	0.783	0.141	-1.701*	-1.936*	-2.539**	-1.205**	-1.318*	-1.522**	0.703
Have skills *Educ. level 3	-1.292	-1.242*	-1.246	-16.178	-4.373	-0.352	-0.329	-1.093	-1.238	-1.284	-1.642**	-3.047*
Constant	-5.333***	-7.084***	-4.96***	-2.307*	-0.994	-6.022***	-6.798***	-6.238***	4.613***	-4.875***	-2.845**	-1.99
Nagelkerke pseudo-Rsquared	0.33	0.42	-	0.3	0.52	-	0.22	0.5	-	0.25	0.44	-
Cox&Snell pseudo-Rsquared	0.15	0.31	-	0.09	0.36	-	0.06	0.36	-	0.08	0.3	-
Observations	845	660	845	1,140	597	1,140	751	634	751	2,494	1,771	2,494
Log Likelihood	-180.789	-321.237	-	-148.606	-225.583	-	-104.164	-259.574	-	-373.641	-684.608	-
AIC	391.578	672.474	-	327.211	481.166	-	238.327	549.149	-	777.281	1,399.22	-

Notes: AIC: Akaike's information criterion. Observations = Obs. used in the model. Nagelkerke: a measurement of the goodness of fit for logistic regression model using the classification table. Cox&Snell measurement for model goodness of fit. All the models contain the same variables just the minority class changes in case of SMOTE. SMOTE: Synthetic Minority Over-sampling Technique. Firth: Firth's penalised logistic regression method. Logit: the logistic regression model. Have skills is the skill perception variable, one meaning that the person possesses the skills to start a business. *p < 0.1; **p < 0.05; ***p < 0.01

Source: *own calculation*

Conclusion

We used three methods to estimate the planned model in the current study. We observed no significant improvement in terms of significance between logistic regression and firth logistic, which is understandable given that Firth is applied to rare events and is not intended to improve the strength of the variable relationship. However, the SMOTE algorithm strengthened the relationship for a large number of variables by transforming the dataset and generating synthetic examples. Skill perception was found to have a significant relationship with women's total early-stage entrepreneurial activity (TEA) in all countries except Poland. Fear of failure has a significant negative relationship with TEA in Croatia, and it was discovered to have a significant negative relationship with TEA in the Netherlands and Sweden using the SMOTE algorithm. Knowing other entrepreneurs appears to have a significant positive influence on women's early-stage entrepreneurial activity in the majority of countries except for Bulgaria, which has some of the lowest collectivism scores. Media was not found to be significant in the majority of cases and was only rarely significant when using the SMOTE algorithm. When we look at the effect of age, we see that as women's ages increase, their odds of becoming involved in TEA increase as well. However, when we look at age squared, we see that this odds decreases after a certain age. France and the United Kingdom exhibit a similar effect.

As anticipated, income growth has a positive relationship with women's entrepreneurship in countries such as Poland and Bulgaria across various income categories. The positive relationship between income and women's TEA is also evident in the Netherlands sample studied. There is a significant positive relationship between the interaction of skill perception and education levels in the United Kingdom and Sweden. That is, as education and skills improve, the likelihood of women getting involved in TEA increases. It was discovered that in collectivist countries, the proportion of women engaged in total entrepreneurial activity is significantly higher than in individualist countries. However, entrepreneurial activity is concentrated in collectivist, lower-income countries in low-tech sectors.

Collectivist country groups are the most advanced in terms of new technology adoption. We must emphasise that new technology is defined as anything less than five years old. Women are more likely to engage in consumer-oriented entrepreneurship than men in both samples of countries. New digital technologies will increase the number of businesses and opportunities for women in these consumer-oriented entrepreneurship fields (Eneh Ojo et al., 2022). In Sweden, we find that post-secondary education positively influences women's entrepreneurial activity, proven by both simple logistic and firth logistic. By dividing countries into two samples based on their level of gender inequality, we discover no evidence that this has an effect on the TEA rates in these countries. Comparing entrepreneurial rates in so-called lonely countries and non-lonely countries until the age of 30, we found weak evidence that loneliness negatively affects women's early-stage entrepreneurial rates in these country groups.

Female entrepreneurship rates from necessity are significantly higher in collectivist and less economically developed countries than in individualistic, developed countries. There was no significant difference in the rates of Women's TEA with high employment expectations or so-called "high growth" firms between collectivist and individualist countries. The purpose of this paper is to debunk the myth that individualistic countries have a higher rate of female entrepreneurship. It is worth noting that collectivist countries were also considered to have a low economic development. The current findings can be used to demonstrate the importance of improving the ability of people in low-developed countries to absorb technology. The primary distinction between male and female entrepreneurial activity continues to be that women activate in less technologically sophisticated industries. They are, however, utilising a variety of new technologies. This evidence can be used to inform policymakers about the development

of a women-focused entrepreneurial environment. Further research comparing these two country groups would be most efficient if it compared men's and women's return on assets and investment, as well as cross-country comparisons of the same gender. A time analysis would shed light on the effectiveness of female entrepreneurs in growing their businesses, not just their entry. It was essential to understand the cultural and socio-political factors affecting women's entrepreneurship rates in order to understand the differences in entrepreneurship between countries, and this dispels the myth that entrepreneurship is the same across countries.

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