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## Comparative Analysis of X-Y-Z Generation Entrepreneurs in a Semi-Peripheral EU Member Country: Insights from Regularized Regression Techniques

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**Abstract:**

**Purpose:** The aim of our research is to deeply analyze entrepreneurial dynamics across generations X, Y, and Z, enhancing understanding of generational shifts and offering insights for future tailored entrepreneurship policies and development programs. This study serves as a foundation for stakeholders to address the unique challenges and opportunities presented by each generational cohort.

**Design/Methodology/Approach:** In our paper, we conduct a nuanced comparative analysis of entrepreneurs from Generation X, Y, and Z within a semi-peripheral European Union member state, employing Ridge, Lasso, and Elastic Net regression techniques. Utilizing a sophisticated system-level approach, we devised a quint-segment model capable of encapsulating the generational disparities in a comprehensive manner.

**Findings:** Our findings delineate a pronounced polarization within the sector, highlighting a notable intergenerational coexistence particularly between Generations Y and Z. Despite the distinct socio-economic backgrounds and entrepreneurial approaches prevalent amongst these generational cohorts, there emerges a remarkable alignment in self-perception and economic trust between Generation Y and Z entrepreneurs. Conversely, this shared perspective markedly diverges from that held by Generation X individuals, spotlighting a significant generational schism in the appraisal of the business environment and the evolving role of education and training across these generations.

**Practical Implications:** In light of emergent entrepreneurial paradigms, it is imperative for policymakers and educational institutions to recalibrate, cognizant of Generations Y and Z's proclivity for informal pedagogical modalities and networking. Business support mechanisms, notably incubators, are enjoined to refine their approaches, accentuating Gen Z's predilection for trust-anchored mentorship. Concurrently, investors and governmental entities must reconfigure strategies, attentive to dynamic sectoral and capital sourcing shifts. As workplace ethos undergoes transformation, enterprises should champion inclusivity, with advisory services emphasizing bespoke, trust-centric advisement.

**Originality/Value:** The paper presents a novel systemic analysis of entrepreneurial dynamics across generations offering fresh insights particularly on the economic and self-perception dimensions of Generations Y and Z in juxtaposition with Generation X. Through a quint-segment model and five predictive models, the study not only corroborates existing literature but also unveils unique intergenerational discrepancies and convergences, thereby enriching

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*the understanding of generational shifts in entrepreneurial realms. This research holds significant implications for shaping future entrepreneurship policies and tailoring business development programs, emphasizing the importance of recognizing generational nuances in the entrepreneurial ecosystem.*

**Keywords:** *XYZ generation, entrepreneurs, complex system, regularized regression.*

**JEL Classification:** *L26, C3, O52.*

**Paper type:** *Research article.*

## **1. Introduction**

Generational shifts profoundly affect business dynamics, a focal topic in academic circles over recent decades (Marquina-Jones, 2015; Parry, 2014). Our research fortifies this conversation, addressing the existing knowledge gaps in understanding generational variations through a complex system approach and examining the evolving role of education and training across generations. We further augment the discourse with fresh insights on Generation Z entrepreneurs.

Employing Ridge, Lasso, and Elastic Net Regression analyses within a nuanced framework of five sub-models, our research scrutinizes these aspects based on data from a sizable cohort of entrepreneurs in a semi-peripheral European Union nation, surveyed in 2022.

Generational groups significantly influence the entrepreneurial ecosystem, a research focus persisting for numerous decades (Strauss and Howe, 1991; Inglehart, 1997). This scrutiny is grounded in generational theory, a pivotal narrative in business, social science, and entrepreneurship discourse since the 1950s (Mannheim, 1952; Ortega, 1961; Mead, 1970; Howe-Strauss, 1992; Twenge, 2014).

The theory posits that individuals born and schooled during similar periods exhibit analogous habits and values due to shared experiences in economic, technological, and sociocultural contexts (Twenge, 2014; Hudson *et al.*, 2003; Delahoyde, 2009; Chen, 2010). These contexts, being dynamic, foster distinct patterns of behavior and cognition across generations (Mannheim, 1952).

Recent generational research predominantly examines the distinctive perspectives of X, Y, and Z generation entrepreneurs. Literature suggests that Generation X entrepreneurs (1965-1980) hold a distinctive position in the entrepreneurial landscape, skillfully leveraging available resources (Arkorful *et al.*, 2022) and exhibiting a preference for solitary problem-solving strategies over collaborative approaches (Khor, 2017; Tulgan, 2000).

Furthermore, they demonstrate significant adaptability and resilience (Coupland, 1991), blending traditional and innovative business practices (Schalk et al., 2010). Despite being the first generation to experience a lower standard of living than their parents (Harper, 1993), they exhibit a strong inclination towards enhancing their work skills and demonstrating professional loyalty rather than allegiance to their employers (Jurkiewicz and Brown, 1998; Yu and Miller, 2005). These entrepreneurs, molded by economic downturns and the nascent stage of technology, often favor stability and risk aversion in their business ventures (Light and Rosenstein, 1995), showcasing a pragmatic and resilient approach over time.

Generation Y entrepreneurs (1981-1996) demonstrate a pronounced shift towards technology-centric enterprises, a byproduct of their digital upbringing (Twenge, 2010). This cohort, technologically adept and driven by social change, prominently values community engagement and collaboration (Eisenbeiss *et al.*, 2015). Consequently, they gravitate towards business models that are inclusive and flexible, with a preference for horizontal organizational structures and a focus on work-life harmony (Mihalcea *et al.*, 2012; Slade, 2018; Smith, 2010).

Characterized by multitasking abilities, high self-assurance, and a penchant for autonomy, they seek flexible work schedules and swift career advancements (Sessa *et al.*, 2007). Generation Z entrepreneurs (1997-2012), recognized as digital natives (Hernandez-de-Menendez *et al.*, 2020), are currently infiltrating the entrepreneurial realm, introducing innovative perspectives and strategies.

Early studies indicate their entrepreneurial endeavors are marked by innovation, inclusivity, and a global mindset (Seemiller and Grace, 2019), often aligning with digital platforms and emphasizing sustainability and social responsibility, heralding a more interconnected and conscientious business environment (Lifintsev *et al.*, 2019). Furthermore, research by Gimbergsson and Lundberg (2016) reveals a notable gender disparity in the work values of Generation Z, albeit with no significant variation among different academic majors.

Over a substantial period of scholarly research spanning several decades clearly demonstrate that distinct generational groups have profoundly shaped the entrepreneurial landscape, each imprinting it with their unique socio-economic status, perspectives, and future visions.

Presently, the entrepreneurial sphere manifests as a generationally diverse and complex system, synergizing the resource-based orientation of Generation X, the collaborative stance of Generation Y, and Generation Z's globally conscious approach to delineate the current entrepreneurial ecosystem.

Despite the extensive studies, several aspects demand further scrutiny to deepen the understanding of inter-generational entrepreneurship nuances. Factors such as socio-economic status (Cao-Shi, 2021), diverse business attributes (Spigel-Harrison,

2018), contextual influences, and the entrepreneurs' self-perceptions and futuristic outlooks (Guerrero *et al.* 2021; Malecki, 2018) have been acknowledged as potent drivers explaining the peculiarities of inter-generational entrepreneurship.

However, the intricate interplay of these elements has been relatively underexplored in existing literature. Additionally, a significant research gap persists concerning the evolving needs for entrepreneurial training across different generations, raising questions about the role of varied educational approaches in crafting entrepreneurial mindsets and skills across generations.

Notably, the nascent entrance of Generation Z into the workforce signifies a dearth of empirical data delineating their entrepreneurial attributes and impacts on the business sector. Our research endeavors to bridge these gaps, offering a meticulous analysis of socio-economic statuses, divergent entrepreneurial characteristics, contexts, and individual perceptions and future visions, while emphasizing their mutual influences.

Concurrently, we aim to illuminate the shifts in education and training between generations, supplemented by novel empirical insights into Generation Z's entrepreneurial characteristics.

Our research adopts a focused approach (Kreimer, 2022), concentrating on an economically semi-peripheral European Union member country, rather than a global analysis.

The nuanced economic and social dynamics of such semi-peripheral nations have garnered increasing scholarly attention, given their transitional role bridging central and peripheral economies and their concomitant economic resources and challenges (Terk, 2019).

Understanding entrepreneurship within these nations not only facilitates insight into the synchronous development of economic divergence and convergence (Mayer *et al.*, 2015), but also can potentially forecasts long-term economic trends, especially regarding technological adaptation and innovation, which are vital factors influencing competitiveness and growth prospects in the regions (Chong-Zanforlin, 2001).

However, the diverse socio-cultural dynamics inherent to these countries indicate that the present study serves as a precursor to broader generational comparative research encompassing central or peripheral nations.

The entrepreneurial ecosystem constitutes a multifaceted dynamic system, wherein a solitary examination of individual explanatory variables proves insufficient; rather, an integral analysis at the system level is requisite.

Entrepreneurial ecosystem is a non-linear (Nicolis 2012), third-order systems (Deacon 2007)<sup>2</sup>; that are far from equilibrium (Reed–Harvey 1996) and have multiphase correlations (DeLanda 2005)<sup>3</sup>, which can be described by autopoiesis (Maturana–Varela 1980), structure, hierarchy, and control parameters (Cilliers 2001)<sup>4</sup>. In our study, we adhere to this systems-based analytical approach.

In conclusion, entrepreneurial activity remains a central determinant of a country's economic growth and stability (Rasool et al., 2012). Our research endeavors to deepen the understanding of this aspect by thoroughly investigating the intergenerational disparities present within it from multifaceted viewpoints.

## 2. Research Hypothesis

In our study, we formulated five analytical models grounded in existing literature to delineate intra-generational entrepreneurial activities: 1) socioeconomic status, 2) business variables, 3) economic perception and trust, 4) entrepreneurs' self-perception, and 5) business initiation planning (Cao-Shi, 2021; Spigel-Harrison, 2018; Guerrero *et al.*, 2021; Malecki, 2018).

These models facilitate a comprehensive examination of the varying economic, social, and psychological landscapes entrepreneurs from distinct generations navigate in a semi-peripheral country context (Terk, 2019; Mayer *et al.*, 2015).

These models illuminate how the shifting socio-economic status of entrepreneurs can significantly affect business outcomes, with generational analysis elucidating evolving entrepreneurial opportunities and limitations (Arkorful *et al.*, 2022). Moreover, considering business variables in tandem with generational distinctions enhances our grasp on adaptive strategies in fluctuating business environments.

Analyzing economic perception and trust, pivotal for business expansion (Kolnhofer *et al.*, 2017), we discern the progression of economic understanding and trust across generations, pinpointing resultant opportunities and challenges. Furthermore, investigating entrepreneurs' self-perception, we deepen our insights into the

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<sup>2</sup>Deacon's (2007) theory delineates complex systems into three hierarchical tiers, facilitating nuanced analysis of system dynamics. The first-order level facilitates the statistical or stochastic capture of higher-order system attributes, the second-order enables the localized and periodic assessment of system self-organization (autopoiesis), and the third caters to the analysis of fundamental shifts inherent to the system's nature.

<sup>3</sup>DeLanda's (2005) multiphase correlation theory articulates the nuanced causality within complex systems, where traditional linear cause-and-effect relationships are supplanted by dynamic interrelations that resist simple binary categorization.

<sup>4</sup>Cilliers (2001) highlights that the analysis of a complex system extends beyond its periodic structural properties and hierarchy, incorporating crucial control parameters like the boundary parameter, which modulates the system's changes and interactions, and the crisis parameter, influencing the potential onset or prevention of a system crisis state.

formation of entrepreneurial identities across the X, Y, and Z generations and its impact on businesses (Ensari, 2017).

Lastly, by exploring variations in business planning processes between generations, we uncover the divergent strategies employed during business inception, identifying those that have stood the test of time (Sreih *et al.*, 2019).

In summary, these models and intergenerational analyses facilitate a nuanced understanding of entrepreneurial practices in a semi-peripheral EU nation, illuminating the impact of generational shifts on business and economic landscapes. Furthermore, they offer insights into evolving educational and training roles across generations while introducing fresh empirical data on Generation Z's entrepreneurial traits. Our research hypotheses are delineated below:

H<sub>1.1</sub>: The socio-economic profiles of entrepreneurs vary across generations X, Y, and Z, with a gradual increase in female representation and generation Y exhibiting the highest income levels.

H<sub>1.2</sub>: There is a discernible shift from formal education to informal. Network-based learning in entrepreneurial knowledge acquisition from generation X to Z.

H<sub>2</sub>: Entrepreneurs from generations X, Y, and Z gravitate towards distinct business sectors; the former two preferring capital-intensive sectors, while the latter opts for industries with lesser capital demands.

H<sub>2.1</sub>: A trend of diminishing business sizes is observable from generation X to Z, with a pronounced community-focused approach to business management prevalent among generation Y entrepreneurs.

H<sub>3</sub>: While both Gen Y and Z demonstrate similar levels of mistrust towards local institutions and perceive a favorable economic situation, their trust in international firms contrasts with the distinct perspective of Gen X.

H<sub>4</sub>: Despite variations in other aspects, all generations share a common self-perception of being open, innovative, and possessing strong local success and leadership skills, albeit coupled with a general dissatisfaction with their personal lives.

H<sub>5</sub>: Future business endeavors are not on the horizon for any of the generations. Initial business ventures were predominantly grant-funded across all generations, with generational differences in supplementary financing; self-financing for Gen X and Y, and loans from acquaintances observed for Gen Z. Advice from close relatives was universally sought, supplemented by workplace connections for Gen X, and international contacts for Gen Y and Z.

### 3. Research Data and Methodology

Our research leverages representative data acquired from a structured questionnaire administered in person during a methodical data collection process in 2022. This dataset represents a cross-section of Hungarian entrepreneurs, encapsulating variations in age, enterprise sector, gender, settlement type, education, and income.

Despite the substantial presence of missing data (59.63%) within the 98 variables examined in our 1089-participant sample, each variable maintained a data void below the critical 5% threshold (Little – Su 1987), thereby allowing for the application of data implementation and dimension reduction techniques on the database.

The data imputation was executed using the Classification and Regression Trees (CART) method, an artificial intelligence and machine learning-based imputation algorithm, which fills in missing values using patterns identified in existing data samples (Wray – Byers, 2020). Utilizing 1000 substitution models, this algorithm facilitates optimized imputation or variance reduction at each stage of the recursive data split process inherent to CART, making it particularly suited for datasets of smaller scale.

We employed Exploratory Factor Analysis (EFA), a prominent multivariate statistical method, to delineate the underlying structure within a large set of variables and to discern latent constructs or factors influencing observed correlations or covariances among these variables (Pruzek, 2005). This technique facilitated the formation of theoretical categories vital to our five models.

We constructed four EFA models and assessed each using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (ranging between 0.70 and 0.80, indicating satisfactory sampling adequacy) and Bartlett's Test of Sphericity, which encompassed analysis of Chi-square ( $\chi^2$ ), p-value, and degrees of freedom (DF) (Braeken - Van Assen 2017; Bai, 2009). The minuscule p-values observed suggest significant relationships between variables, warranting further exploration through factor analysis in every model.

The factor number in each model was determined through parallel analysis and minimum residual method with varimax rotation, implementing a 0.3 cut-off for substantial variable loading on diverse factors, indicative of distinct underlying dimensions (Lateh, 2008). While some items exhibited complexity above 0.8, suggesting a potential multifaceted nature, the models encapsulated approximately 50% of the total variance, representing a significant proportion of the dataset variance (Peterson, 2000).

Models' fitness was ascertained through RMSR values and the Tucker-Lewis Index (TLI), with both indicating satisfactory model fits (Peterson, 2000; Kapfhammer -

Soffa 2003). The consequent factor scores displayed moderate to substantial reliability, substantiating the statistical accuracy of each EFA model.

In our refined EFA models, we identify critical factors influencing entrepreneurial attitudes and individual perspectives on business through four distinct lenses: Studies, Trust, Self-Perspective, and Advice. Under the Studies dimension, we discern two streams: Studies\_ Formal, representing structured educational engagements, and Studies\_ Informal, denoting active participation in events and networking platforms fostering extensive knowledge and networking opportunities.

The Trust facet encapsulates attitudes towards local and international institutions (Trust\_ Local Institutions and Trust\_ Foreign Companies), portraying the contemporary preferences and concerns in entrepreneurial pursuits. Delving into Self-Perspective, we analyze individual tendencies through Self\_ Openness and Creativity and Self\_ Life Satisfaction and Work-Life Balance factors, offering insights into personal openness and satisfactory work-life balance, supplemented by ambitions reflected in Self\_ Local Success Aspirations and Self\_ Leadership Aspirations dimensions.

Lastly, the Advice sector underscores the significance of professional counsel (Advice\_ Professional Sources) and local entrepreneur (Advice\_ Local Individuals), accentuating the integration of global viewpoints through Advice\_ International Experts and the reinforcement of familial and workplace networks, represented by Advice\_ Personal and Family Networks and Advice\_ Workplace Networks respectively. This streamlined approach presents a multifaceted analysis of prevailing entrepreneurial attitudes and tendencies.

Within the entrepreneurial sectors, enterprises were categorized using the Global Industry Classification Standard (GICS) framework, a standardized method developed by MSCI and SandP Dow Jones Indices for delineating companies according to their primary business activities (Bhojraj et al., 2003). Utilizing birth year as a criterion, we classified entrepreneurs into Generation X, Y, or Z groups, designating this as our primary research variable.

Following data cleaning, categorization, and dimension reduction procedures, we utilized the mini-max algorithm to normalize the data (Cai – Zhou, 2012). Consequently, we analyzed 43 variables, the descriptive statistics of which are detailed in Appendix Table 1.

Our model analysis employed regularized regression techniques, specifically utilizing Ridge, Lasso (least absolute shrinkage and selection operator), and Elastic Net regressions as key tools for predictive modeling in the contemporary data landscape, characterized by high-dimensional data. We conducted the computations using the R programming environment (version 4.2.2) complemented by RStudio (version 2023.06.1+524) (R Core Team, 2022), utilizing the glmnet (Tay *et al.*,



2023) and caTools (Tuszynski- Dietze, 2022) packages for constructing, validating, and testing the regression models.

Regularized regression techniques, which have been extensively researched and documented for their theoretical properties and practical applications, introduce regularization terms to the objective function, aiding in alleviating multicollinearity and overfitting issues, and potentially enhancing prediction accuracy (James *et al.*, 2013; Friedman *et al.*, 2010; Zou and Hastie, 2005).

Introduced by Hoerl and Kennard (1970), Ridge Regression is an L2-regularized method that imposes a penalty equal to the square of the coefficient magnitudes, aiding in the diminution of model complexity and the mitigation of multicollinearity issues. The equation is formulated as follows:

$$\hat{\beta}^{\text{ridge}} = \arg \min_{\beta} \left\{ \sum_{i=1}^n (y_i - x_i' \beta)^2 + \lambda \sum_{j=1}^p \beta_j^2 \right\}$$

Lasso regression, formulated by Tibshirani (1996), incorporates an L1 regularization term, fostering coefficient estimate sparsity and enabling feature selection. The corresponding equation is delineated below:

$$\hat{\beta}^{\text{lasso}} = \arg \min_{\beta} \left\{ \sum_{i=1}^n (y_i - x_i' \beta)^2 + \lambda \sum_{j=1}^p |\beta_j| \right\}$$

The Elastic Net regression, devised by Zou and Hastie (2005), integrates the penalties of both Ridge and Lasso regressions, seeking to leverage the advantages of both approaches. The equation is presented as follows:

$$\hat{\beta}^{\text{elastic}} = \arg \min_{\beta} \left\{ \sum_{i=1}^n (y_i - x_i' \beta)^2 + \lambda \left( \alpha \sum_{j=1}^p |\beta_j| + (1 - \alpha) \sum_{j=1}^p \beta_j^2 \right) \right\}$$

The Ridge regression, proposed by Hoerl and Kennard (1970), stands out for its stability and ability to moderate complexity, often providing superior generalization, particularly in the presence of Gaussian noise. Nonetheless, it falls short in facilitating feature selection, as it fails to nullify coefficients completely, potentially introducing bias in estimations by trading reduced variance for increased bias.

In contrast, Lasso regression, introduced by Tibshirani (1996), is proficient in feature selection, offering sparse models by potentially nullifying some coefficients,

and often surpasses other techniques in predictive accuracy, especially in high-dimensional spaces with a few significant predictors. Its drawback lies in possibly exhibiting arbitrary feature selection and inconsistencies in variable selection in cases of multicollinearity or when variables outnumber observations (Hastie *et al.*, 2009).

Superseding, the Elastic Net regression, crafted by Zou and Hastie (2005), skillfully integrates Ridge and Lasso's strengths, presenting a potential equilibrium between bias and variance, especially excelling where predictors are highly correlated. It avoids the abrupt elimination of correlated variables, a common Lasso shortfall, but increases computational complexity and risks overfitting with improperly tuned regularization parameters (Friedman *et al.*, 2010).

In our study, the adoption of regularized regression methods emerged as fundamentally crucial, as these techniques adeptly curtail the potential for overfitting. The application of cross-validation techniques further fortified model robustness, establishing a reliable benchmark for evaluating the predictive precision of the models scrutinized.

In our analysis to pinpoint the optimal regression model for each scenario, we embarked on rigorous hyperparameter tuning to enhance the performance and prediction reliability of our models. We rigorously examined several metrics including the Root Mean Square Error (RMSE), Adjusted R-squared, Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC) as pivotal evaluative tools (Cavanaugh - Neath, 2019). This methodological rigor facilitated the selection of a model that embodies both goodness-of-fit and parsimony, guaranteeing not only statistical robustness but also the capacity to yield insightful and accurate real-world predictions.

The final models were evaluated through coefficient analysis, a proven method in regression analyses that elucidates the impact of fluctuations in one or more independent predictor variables on the dependent variable (Clogg *et al.*, 1995).

Notably, in the realm of regularized regression, the analysis hinges not on p-values, owing to the regularization term, but on interpreting the coefficients in terms of their convergence to zero and by comparing the magnitude of the optimal coefficients (Emmert-Streib - Dehmer, 2019).

## **4. Research Results**

### **4.1 Identifying the Optimal Models**

In our study, we established five distinct models: 1) socioeconomic status, 2) business variables, 3) perceptions of economic climate and trust, 4) entrepreneurial self-perception, and 5) business initiation planning. We then scrutinized which

among the Ridge, Lasso, or Elastic Net regressions aptly suited the data for each category, including socio-economic factors, existing business conditions, business startup intentions, contemporary economic outlook, trust, self-view, and future prospects, applying these regressions to the comprehensive sample.

In each model, we partitioned the data into training (80%) and testing (20%) sets, formulating Ridge, Lasso, and Elastic Net regression models. We then scrutinized the coefficient trajectory to discern variations with fluctuating lambda values and executed cross-validation to pinpoint the lambda value minimizing the mean cross-validated error. Utilizing the optimal lambda values, we crafted the final models and conducted predictions on the test set.

To assess the efficacy of each regression model, we computed the RMSE by deriving the square root of the mean squared discrepancies between the predicted and actual values, alongside calculating the R-squared value, indicative of the variance in the dependent variable predictable from the independent variables.

Furthermore, we evaluated the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) to ascertain the model's goodness of fit. These analyses guided our selection of the most appropriate regression model for each analytical theme.

**Table 1.** Evaluation Metrics for the Various Regulated Regression Models

Model	Regression Models	RMSE	R squared	AIC	BIC
Socio-economic model	Ridge	0.3175	0.0069	132.42	156.11
	Lasso	0.3182	0.0023	133.44	157.13
	Elastic Net	0.3187	-0.0005	134.07	157.76
Business model	Ridge	0.3167	0.0117	141.38	181.99
	Lasso	0.3166	0.0120	141.31	181.93
	Elastic Net	0.3166	0.0119	141.34	181.95
Economic perception and Trust model	Ridge	0.3167	0.0117	141.38	181.99
	Lasso	0.3167	0.0120	141.31	181.93
	Elastic Net	0.3167	0.0119	141.34	181.95
Self-perception model	Ridge	0.3201	-0.0094	130.01	143.54
	Lasso	0.3213	-0.0171	131.65	145.19
	Elastic Net	0.3213	-0.0171	131.65	145.19
Starting a business model	Ridge	0.2973	0.1292	109.79	143.63
	Lasso	0.2998	0.1144	113.45	147.29
	Elastic Net	0.3001	0.1129	113.82	147.67

*Source: Own study.*

The initial model, centered on socioeconomic status variables, displays nearly identical RMSE (.3175 - .3187) values across all three regularized regression models, with the Ridge regression marginally outperforming in prediction error. Notably, the R-squared values are significantly low for the Ridge, Lasso, and

Elastic Net models, denoting a minimal explanatory power over the variance in the dependent variable, albeit the Ridge model (.0069) fares slightly better.

Evaluating through the lens of AIC and BIC metrics, the Ridge model demonstrates the lowest values (132.42, 156.11), subtly edging out the Lasso and Elastic Net models, thereby establishing it as the superior model for this specific set of variables. Consequently, the socioeconomic status variables were analyzed utilizing the Ridge regression model.

In the evaluation of the second model, which focuses on business variables, the Lasso regression model distinctly surpasses its Ridge and Elastic Net counterparts, boasting the minimum RMSE (.3166), AIC (141.31), and BIC (181.93) values, alongside the highest R-squared value. For the economic perception and trust model, the Elastic Net model demonstrates a marginally superior fit and increased explanatory prowess compared to the Ridge and Lasso models.

Regarding the fourth and fifth model on entrepreneurs' self-perception and the business start-up model, the Ridge regression model slightly outperforms the Lasso and Elastic Net models, manifesting lower values in RMSE (.3201 and .2973), AIC (130.01 and 109.79), and BIC (143.54 and 143.63) metrics.

#### **4.2 Generational Cohort Analysis: Dissecting the Nuances of X, Y, and Z Generations**

Proceeding to the subsequent phase of our research, we categorized the data into generations X-Y and Z to analyze it in accordance with the most effective models identified earlier.

This involved a repeated cycle of model fitting, cross-validation, and hyperparameter optimization across all five models. Our analysis delineates two distinct categories: firstly, the trajectory of model coefficients at various regularization parameter levels, and secondly, the coefficient values at the optimal level of regularization.

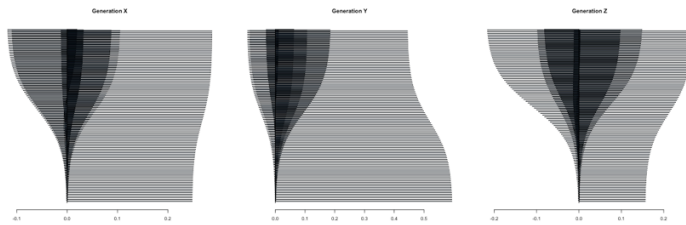
The trajectory of coefficient development across varying levels of regularization parameters is illustrated vertically from s0 to s99 in Figure 1, diverging from the traditional horizontal representation (Lipovetsky, 2021) to vertical representation.

Figure 1 reveals an expected enhancement in the prediction reliability concerning the interrelation between the variable set and the dependent variables as the models' progress. Notably, the regression coefficient matrix across disparate  $\lambda$  values delineates distinctly varied patterns followed by the X, Y, and Z generations for each model.

**Figure 1.** Variation in Coefficients Across Regularization Parameters: A Comparative Analysis of Optimal Regularization Regression Models across Generations X, Y, and Z

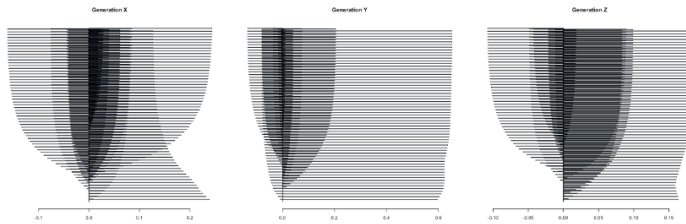
Model 1:

Ridge model of socio-economic status



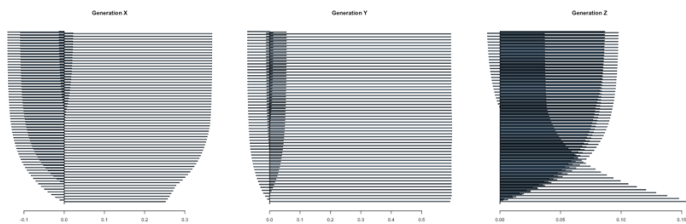
Model 2:

Lasso Regression Model estimations of Business



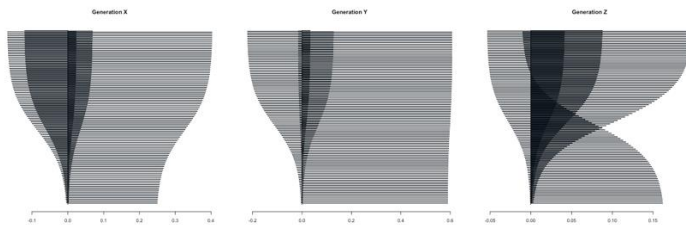
Model 3:

Elastic Regression Model of perspective on the economy and Trust



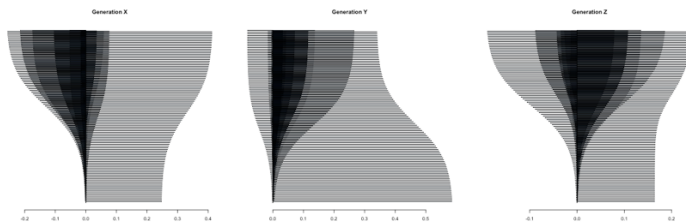
Model 4:

Ridge Regression Model of Self-perspective



Model 5:

Ridge Regression Model of Starting a Business



*Source: Own study.*

The regression coefficient visual analysis delineates distinct patterns across all five models for each generation, indicating that entrepreneurs from different generations exhibit varied socio-economic statuses, business strategies, and perceptions.

To precisely pinpoint the discrepancies, we conducted a deeper analysis of the data based on the optimal  $\lambda$  values for the regression coefficients. The initial table (Table 2) presents the optimal coefficients for the preeminent ridge regression model encapsulating socio-economic status variables.

**Table 2.** Optimal Coefficient Values for the Ridge Regression Model Analyzing Socio-economic model across Generations X, Y, and Z

	GenX	GenY	GenZ
Sex	1.1204	-7.4154	-3.7894
Studies Informal	-2.6795	-2.2667	4.9462
Studies Formal	8.3768	-7.2246	-7.6543
Education	1.5040	1.5704	-1.7208
Settlement Type	-1.2302	9.6087	-2.6939
Income Subjective	-1.3788	4.5847	9.2039
Income	-4.2169	8.8157	-4.5987

*Source:* Own study.

Drawing upon data from Table 2, we observe a declining gender gap in entrepreneurship across generations Y ( $\beta$  -7.4154) and Z ( $\beta$  -3.7894) compared to generation X ( $\beta$  1.1204), which is predominantly male. Interestingly, informal business learning approaches (Studies Informal), typified by networking events and social interactions, exhibit a negative correlation for generations X ( $\beta$  -2.6795) and Y ( $\beta$  -2.2667) but a positive one for generation Z ( $\beta$  4.9462).

Conversely, the uptake of formal education avenues (Studies Formal), encapsulated by institutional learning and mentorship programs, presents an inverse trend for GenZ and Gen Y. The generational delineation in entrepreneurial education pathways presents a complex landscape. GenY has demonstrated a limited engagement in both formal and informal business learning, whereas GenX primarily adopted formal methods, and GenZ favored informal avenues.

This scenario is further nuanced by the education variable (Education), indicating that while high education levels are prevalent amongst GenX and Y entrepreneurs, GenZ, possibly due to their younger age, exhibit incomplete higher education trajectories ( $\beta$  1.5040, 1.5704 and -1.7208). Examining the core variables, residential patterns emerge as a significant factor. Notably, both GenX and Z predominantly inhabit urban settings, contrasting with GenY, who are chiefly found in smaller cities and agglomerations.

Finally, analysis of the primary model's variables centering on income perceptions and realities (Income Subjective and Income), significant generational disparities emerge. GenX perceives and objectively possesses lower income levels compared to the other cohorts. In contrast, GenY entrepreneurs report and exhibit higher incomes both subjectively and objectively. Interestingly, GenZ demonstrates a dichotomy in income perception, harboring a subjective sense of high income,

despite objective evaluations indicating lower earnings relative to other generations.

In summation, utilizing the ridge method, the model highlights pronounced generational variations in socio-economic status. A notable shift in gender imbalance is observed, transitioning from male to female predominance in younger demographics. This transition accompanies a marked increase in the significance of informal learning, concurrently with a decrease in formal educational avenues. Noteworthy, GenY entrepreneurs, based in semi-peripheral nations, manifest a superior income structure compared to their older (GenX) and younger (GenZ) counterparts, transcending settlement types.

In our second model, we meticulously examine the intergenerational differences in enterprise characteristics, utilizing Lasso regression as a foundation. Optimal coefficients are presented, with median values for non-critical variables enclosed in parentheses to delineate variable trends, thereby enriching the analysis (Table 3).

**Table 3.** *Optimal Coefficient values of the Lasso Regression Model Analyzing Business model across Generations X, Y, and Z*

	<b>GenX</b>	<b>GenY</b>	<b>GenZ</b>
Sole Founder of Entrep	0,0689	-0,0679	0,007
Sector_ Comm Services	-0,0342	-0,0027	0,069
Sector_ Consumer	...	...	...
	(-0,0011)	(0,0317)	(0,0003)
Sector_ Financials	...	...	...
	(0,01419)	(0,0003)	(0,0137)
Sector_ HealthCare	0,0494	-0,0015	-0,0171
Sector_ Industrials	0,0309	0,0082	-0,0093
Sector_ IT	-0,0357	-0,0124	0,0811
Sector_ Real Estate	...	...	...
	(0,0207)	(-0,0629)	(0,0725)
Enterp. How Many Employee	-0,1309	0,1662	-0,0323
Business Old Year	0,1965	-0,1057	-0,0876
Enterp. Currently Sell Abroad	-0,0619	0,0002	0,0602
New Product or Service	0,0669	-0,0286	-0,0397

**Source:** *Own study.*

Table 3 illustrates that the model, encompassing a diverse set of variables, exhibits low coefficient values, and the Lasso model negates the significance of three sectoral variables (Consumer, Financials, Real Estate).

An analysis of Lasso regression estimates reveals distinct entrepreneurial patterns across generations. GenX and GenZ entrepreneurs predominantly establish businesses singly ( $\beta$  0,0689 and 0,007), whereas GenY entrepreneurs often collaborate with multiple partners ( $\beta$  -0,0679).

Sectoral preferences vary substantially among the groups: GenZ gravitates towards customer service, financial, real estate, and IT sectors; GenX maintains a moderate presence in these and additionally in healthcare and industrial sectors; GenY occupies an intermediary position.

Furthermore, GenY entrepreneurs typically helm larger businesses, contrasted with the smaller establishments of the other generations, with GenX firms boasting the longest market tenure. A progressive increase in foreign relations and sales is observable in younger entrepreneurial cohorts. Notably, innovation trends reverse across generations: while GenX entrepreneurs perceive their offerings as consistent, younger generations exhibit a tendency towards diversification and innovation in their products or services.

In conclusion, our findings resonate with existing literature concerning business operations across generations. A distinct sectoral gap is discernible: GenX and GenZ predominantly operate businesses individually, favoring capital-intensive sectors and lower entry threshold sectors respectively, while GenY embodies a transitional phase, frequently establishing larger, collective enterprises.

Moreover, GenY and younger cohorts exhibit increased international market engagement, facilitating a more critical evaluation of their products or services' innovation within a global context.

Our third model, optimally estimated using Elastic Net regression, retained all variables, albeit exhibiting low optimal coefficients owing to variable heterogeneity (Table 4).

**Table 4.** Optimal Coefficient values of the Elastic Net Regression Model Analyzing of Trust and perspective on the contemporary economic landscape model across Generations X, Y, and Z

	<b>GenX</b>	<b>GenY</b>	<b>GenZ</b>
Trust in Local Institutions	0.0216	-0.0112	-0.0104
Trust in Foreign Companies	-0.1092	0.0110	0.0977
Majority of the successful Entrepreneurs did not flow straight line	-0.1411	0.0552	0.0857
Satisfied with the economic situation of the country	-0.0131	0.0731	0.0866

**Source:** Own study.

The data illustrates significant generational shifts in several perceptual realms. Gen X entrepreneurs exhibit greater trust in local institutions ( $\beta$  0.0216) compared to their Gen Y and Gen Z counterparts ( $\beta$  -0.0112 and -0.0104), albeit harboring skepticism towards foreign companies ( $\beta$  -0.1092) and a negative view of Hungary's economic climate ( $\beta$  -0.0131).



They also tend to reject the notion that successful entrepreneurship often involves corrupt practices ( $\beta$  -0.1411). Conversely, Gen Y and Z manifest a pronounced trust in foreign enterprises, a propensity to associate success with unethical methods in a semi-peripheral setting and maintain a positive outlook on the economic situation.

In conclusion, there is a notable alignment in the economic perspectives of Gen Y and Z entrepreneurs, which starkly contrasts with the viewpoints prevalent in the Gen X cohort.

In our fourth model focusing on the entrepreneurial self-image, ridge regression yielded the most precise predictions, as displayed in Table 5.

**Table 5.** *Optimal Coefficient values of the Ridge Regression Model Analyzing of self-perspective model across Generations X, Y, and Z*

	<b>GenX</b>	<b>GenY</b>	<b>GenZ</b>
Openness Creativity	-0.1685	0.0695	0.6071
Satisfaction with Life and Work Life Balance	0.0232	-0.1207	-0.0149
Aspirations for Local Success	0.0684	-0.0081	-0.2210
Leadership Aspirations	0.1206	0.0179	0.0328

*Source: Own study.*

The data highlights a notable agreement in the self-perceptions of Gen Y and Z, distinctly differing from Gen X's self-view. Gen X entrepreneurs regard themselves as less open and innovative ( $\beta$  -0.1685), a contrast to the significant value placed on these traits by the younger generations ( $\beta$  0.0695 and 0.607).

Despite this, Gen Y and Z report less life satisfaction and work-life balance ( $\beta$  -0.1207 and -0.0149), not prioritizing success within the country ( $\beta$  -0.0081 and -0.2210), unlike their Gen X counterparts who portray a positive stance on these aspects. Notwithstanding these differences, entrepreneurs across all generations perceive themselves as competent leaders with aspirations towards leadership roles.

In conclusion, a distinct divergence is evident between the self-perceptions of Gen X and the younger generations (Y and Z), barring leadership skills which are uniformly regarded as a significant self-defining aspect across all cohorts.

This bifurcation extends to facets such as creativity, openness, life satisfaction, and aspirations for success, with the latter notably aligning with pronounced regional and international connections, indicating a broader entrepreneurial success vision harbored by Gen Y and Z compared to their predecessors.

Lastly, our fifth model intricately analyzes generational trends concerning past and forthcoming entrepreneurial practices in business initiation (Table 6).

**Table 6.** Optimal Coefficient values of the Ridge Regression Model Analyzing of starting a business model across Generations X, Y, and Z

		GenX	GenY	GenZ
Future	Currently Working on Creating New Business	0.0049	-0.0048	-0.0023
	Planning To Start New Business in 3Y	-0.0513	0.0253	0.0348
Past	Where Capital_ Financed by Myself	-0.0082	0.0141	0.0015
	Where Capital_ From Grant	0.0227	0.0392	-0.0372
	Where Capital_ Loan Friend Family	-0.0253	-0.0032	0.0244
	Advice_ Professional Sources	-0.0003	0.0022	-0.0014
	Advice_ Local Individual/Entrepreneur	-0.0015	0.0147	-0.0054
	Advice_ Foreign Individual /Entrepreneur	-0.0441	0.1063	-0.0079
	Advice_ Workplace Connections	-0.0456	0.0540	0.0166
	Advice_ Personal Connections Family and Friends	-0.0217	-0.0404	0.0388

*Source:* Own study.

The analysis of the coefficients reveals that while all generations intend to initiate new businesses, Gen X anticipates doing so imminently ( $\beta$  0.0049), whereas Gen Y and Z foresee a more deferred realization ( $\beta$  0.0253 and 0.0348). Historically, distinctive funding avenues were harnessed to establish their enterprises: Gen X predominantly utilized grants ( $\beta$  0.0227), Gen Y leaned on personal and grant funds ( $\beta$  0.0392 and 0.0141), whereas Gen Z capitalized on personal savings and familial or friendly financial assistance ( $\beta$  0.0015 and 0.0244).

Advisory preferences diverged significantly, with Gen X typically eschewing counsel, contrasting with the extensive consultancy sought by Gen Y, albeit excluding personal networks. Conversely, Gen Z entrepreneurs prominently sought guidance from workplace connections and close personal circles.

In summation, the data delineates distinct business strategies and ambitions across generations. Gen X is inclined to venture into businesses in the near term, a contrast to the deferred aspirations of Gen Y and Z, a variance stemming not only from age differences but also disparate perceptions of the economic milieu. Initial funding methodologies also evolved over generations: whereas Gen X and Y utilized grants, a transition towards personal and familial resources is noticeable in Gen Z.

Furthermore, generational shifts are evident in advisory preferences during business inception, with Gen X generally forgoing external counsel, Gen Y seeking widespread advice excluding personal networks, and Gen Z valuing guidance from personal relationships predominantly.

## 5. Discussion and Conclusion

In our paper, we scrutinized the entrepreneurial dynamics of generations X, Y, and Z in a semi-peripheral European Union member nation, utilizing a comprehensive system approach on a representative 2022 sample.

Addressing the gaps in existing literature, our research furnished an in-depth analysis of various factors including socioeconomic status, business attributes, economic and self-perceptions, trust levels, as well as past and prospective business initiatives, simultaneously offering fresh insights on Gen Z entrepreneurs. We engineered five predictive models to facilitate our analysis, employing the most suitable regularization regressions (Ridge, Lasso, and Elastic Net) to meticulously examine the variable set across the aforementioned generations within each respective model.

Our study elucidates several nuanced findings concerning inter-generational discrepancies. Through a systemic analysis, we affirmed substantial variations across generations in numerous dimensions, corroborating several previous studies (Cao - Shi, 2021; Spigel - Harrison, 2018; Guerrero *et al.* 2021; Malecki, 2018), albeit not universally across all segments. Particularly, we pinpointed a significant concordance in perceptions of economic context and trust variables between generations Y and Z entrepreneurs, juxtaposed with distinct contrasts observed in the X generation counterparts.

Upon scrutinizing individual models, we substantiated hypotheses H<sub>1.1</sub> and H<sub>1.2</sub> pertaining to the socioeconomic status paradigm. Hypothesis H<sub>1.1</sub> posited a diverging socio-economic profile across generations X, Y, and Z entrepreneurs, with a noticeable increment in female representation and peak income within the Y generation; this assertion was confirmed by our analysis. Concurrently, hypothesis H<sub>1.2</sub>, which hypothesized a diminishing reliance on formal education from generation X to Y, favoring network-centric knowledge assimilation, was also corroborated.

Our findings highlight a prominent shift towards informal and online learning avenues, underscoring a discernible transformation in knowledge acquisition dynamics amongst contemporary entrepreneurs.

Our second model, which encompasses hypotheses H<sub>2.1</sub> and H<sub>2.2</sub>, effectively substantiated the anticipated divergences in business operations across the X, Y, and Z generations. Hypothesis H<sub>2.1</sub> asserted that these generations gravitate towards distinct sectors, a claim reinforced by our data. Specifically, GenX entrepreneurs predominate in capital-intensive sectors like industrial and healthcare, while GenZ opts for sectors with lower capital demands and entry barriers, establishing GenY as a transitional phase between these trends.

Moreover, hypothesis H2.2 found empirical support, highlighting a consistent reduction in business size from GenX to GenZ, coupled with a pronounced communal orientation in GenY's business management strategies, distinguishing them through a preference for collaborative business ownership, in contrast to the more solitary approaches of GenX and GenZ.

Our hypothesis H<sub>3</sub> demonstrates that entrepreneurs from generations Y and Z share a similarly pessimistic view of the economic situation, expressing low trust in national institutions and perceiving widespread corruption. In contrast, their Generation X counterparts maintain an opposing stance on these issues. Despite these differences, a general satisfaction with the economic state is observed across all generations. It should be acknowledged, however, that this data precedes the recent spike in inflation, potentially altering current positive perceptions of the local economy.

We have dismissed hypothesis H<sub>4</sub>, as significant divergences in self-perception among the generations are apparent. Apart from leadership skills where a consensus exists, a distinct separation is observed between Generation X and the combined perspectives of Generations Y and Z. The latter two generations prioritize creativity and openness as central to their self-identity, albeit coupled with a level of dissatisfaction concerning their life and success ambitions. This contrasts markedly with the viewpoints held by Generation X.

Hypothesis H<sub>5</sub> was also rejected. The data illustrates a pervasive optimism across all generations towards initiating new ventures, albeit with differing timelines; Generation X leans towards the immediate future, whereas Generations Y and Z envision a more distant onset. This delineates a distinct division in startup approaches among the generations.

Generation X traditionally opted not to seek advice during startup, a trend which shifted dramatically with Generation Y, who embraced widespread counsel. In contrast, Generation Z favored advice from close acquaintances. Moreover, there is a noticeable transition in startup capital sources, moving from grant reliance in Generation X to a predominant use of personal savings and familial loans in Generation Z. This shift potentially signifies a budding social polarization within the entrepreneurial domain, with a leaning towards capital-rich individuals, thereby necessitating further investigation.

In revisiting the systemic context of our study, it is evident that our research significantly enhances the existing literature on intergenerational entrepreneurs. We corroborate existing studies highlighting significant disparities in socio-economic variables (Cao - Shi, 2021), business nature (Spigel - Harrison, 2018), and entrepreneurial approaches and aspirations (Guerrero et al., 2021), as well as individual and group behaviors (Malecki, 2018) among generations X, Y, and Z.

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Furthermore, our investigation unveils fresh insights particularly in terms of economic and self-perception dimensions, revealing a notable harmony between generations Y and Z, which starkly contrasts with the perspectives of Generation X. Notably, our research also underscores a rising prominence of formal and informal network-based education across successive generations.

These findings significantly contribute to a nuanced understanding of generational shifts in entrepreneurial realms, offering vital insights for shaping future entrepreneurship policies and precisely tailoring business development programs for distinct generations. Despite its contributions, our study has limitations stemming from its focus on a semi-peripheral nation - a critical standpoint considering their transitional state which encapsulates concurrent social challenges and economic resources, facilitating critical analysis and prediction of long-term economic trends across generations X, Y, and Z, both in central and peripheral regions.

Our study's emphasis on qualitative data may overlook certain quantitative aspects crucial for a holistic view of generational entrepreneurial behaviors. Additionally, inherent cultural and regional biases in our sample limit its generalizability to wider global contexts, urging caution in applying these findings universally.

Nevertheless, given the unique socio-cultural dynamics in semi-peripheral nations, future research should expand to incorporate data from central and peripheral countries to foster a comprehensive understanding. Moreover, a longitudinal assessment of these results is pivotal for a deeper insight into evolving intergenerational discrepancies. Additionally, exploring intergenerational collaborations promises to cast new light on our findings, unveiling fresh perspectives on this dynamic landscape.

Furthermore, delving into the interplay between technological advancements and intergenerational interactions might elucidate subtler dimensions of these dynamics. And finally, a cross-cultural examination of how educational systems influence these socio-cultural interactions across generations could yield critical insights, paving the way for targeted interventions and informed policy-making.

In our paper, we undertook a meticulous systemic analysis examining entrepreneurs from generations X, Y, and Z. Our findings delineate not only marked distinctions among the generations but also highlight areas of considerable convergence, particularly between the Y and Z generations in terms of their perceptions and approaches.

This divergence in viewpoints and approaches across the generations points to a heightened degree of polarization within the entrepreneurial ecosystem. Interestingly, this polarization seems to be a catalyst for continuous rejuvenation

and a heightened level of dynamism within the sector, thereby promoting a robust resilience that is vital for its ongoing evolution and growth.

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**Appendix:**

*Table 1. Descriptive Statistics of the Variables*

Category	Subcategory	Variables	n_miss	Completion rate	mean	sd	histogram
Socio-economic variables	Studies	Sex	0	1	0.5371	0.4988	
		Education	0	1	0.7607	0.2615	
		Studies_ Informal	0	1	0.3420	0.2827	
		Studies_ Formal	0	1	0.5147	0.2448	
		Income_ Subjective	0	1	0.7927	0.2191	
		Income	0	1	0.5456	0.2406	
		Settlement Type	0	1	0.6914	0.3817	
		International Experience	0	1	0.9494	0.2190	
		GenerationXYZ	0	1	0.4591	0.3178	
	Generation	GenX	0	1	0.2460	0.4309	
		GenY	0	1	0.5895	0.4921	
		GenZ	0	1	0.1643	0.3707	
Own Business	Sector_GICS	Sole Founder of Entrep	0	1	0.8420	0.3648	
		Sector_ Comm Services	0	1	0.1138	0.3177	
		Sector_ Consumer	0	1	0.4481	0.4975	
		Sector_ Financials	0	1	0.0486	0.2152	
		Sector_ HealthCare	0	1	0.0789	0.2698	
		Sector_ Industrials	0	1	0.2323	0.4225	

Category	Subcategory	Variables	n_mis	Completion rate	mean	sd	histogram	
		Sector_ IT	0	1	0.0596	0.2370	█-----	
		Sector_ Real Estate	0	1	0.0183	0.1343	█-----	
		Enterp. How Many Employee	0	1	0.0255	0.0914	█-----	
		Enterp. Currently Sell Abroad	0	1	0.1303	0.3368	█-----	
		New Product or Service	0	1	0.4833	0.2973	██-█	
		Business Old Y	0	1	0.0694	0.0998	█-----	
		Trust and Perspective on the contemporary economic landscape	Trust	Trust_ Local Institutions	0	1	0.5597	0.1853
Trust_ Foreign Companies	0			1	0.5401	0.2014	-███	
Perspective on the economic landscape	Majority Succ Entrep Did Not follow Straight Line		0	1	0.4851	0.2911	██-█	
	Economic Situation Satisfied		0	1	0.4508	0.2884	████	
Perception on self	Self - Context	Self_ Openness Creativity	0	1	0.7887	0.1085	----██	
		Self_ Life Satisfaction Work-Life Balance	0	1	0.5912	0.1415	-███-	
		Self_ Local Success Aspirations	0	1	0.6404	0.1721	---██	
		Self_ Leadership Aspirations	0	1	0.6753	0.1376	---██	
		Starting a business	Future	PlanningToStartNewBusiness3Y	0	1	0.4658	0.2701
Currently Working on Creating New Business	0			1	0.7107	0.4536	█-----█	
Past Initial Capital Future	WhereCapital_ Financed by Myself		0	1	0.5546	0.4972	█-----█	
	WhereCapital_ From Grant		0	1	0.8806	0.3243	-----█	
Advice	Advice Sources		WhereCapital_ Loan Friend Family	0	1	0.0918	0.2889	█-----
			Advice_ Professional	0	1	0.2736	0.1411	██----
			Advice_ Local	0	1	0.5145	0.2517	-███
			Advice_ Individ	0	1	0.5145	0.2517	-███

Category	Subcategory	Variables	n_mi ss	Compl .rate	mean	sd	histogram
		Advice_ Foreign Individ	0	1	0.1656	0.1154	█-----
		Advice_ Workplace Connections	0	1	0.4477	0.2036	███
		Advice_ Personal Family Connections	0	1	0.2405	0.1198	█-----