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 **ERF** | 32nd
Annual Conference
June 14-16 | Cairo, Egypt

2026

Oil Income and Entrepreneurial Activity in MENA:

A Panel Analysis of Six Countries using GEM Data (2016-2022)

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**Oil Income and Entrepreneurial Activity in MENA:
A Panel Analysis of Six Countries using GEM Data (2016-2022)**

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Abstract

This paper examines whether oil income influences entrepreneurial activity in Middle Eastern rentier states, and whether institutional quality or digital connectivity condition this relationship. Using a multi-country panel dataset covering six MENA economies - Egypt, Israel, Iran, Qatar, Saudi Arabia, and the United Arab Emirates - between 2016 and 2022, the study links Global Entrepreneurship Monitor (GEM) indicators with an updated measure of oil income per capita constructed following Ross. Fixed- and random-effects panel models, supported by Hausman tests and cluster-robust standard errors, reveal no statistically significant relationship between oil income and total early-stage entrepreneurial activity (TEA). Moderation analyses likewise show that neither government effectiveness nor mobile connectivity alters this null effect. Robustness checks using alternative indicators (Nbgood, Nbstat, and New Business Density) confirm that the absence of an oil-entrepreneurship link is consistent across behavioral, perceptual, and firm-creation outcomes.

Complementing the panel analysis, a comparative assessment of Saudi Arabia and the UAE demonstrates that divergent entrepreneurial trajectories arise not from resource-income fluctuations but from differences in institutional maturity, policy coherence, and ecosystem development. Overall, the findings challenge conventional resource-curse expectations and suggest that entrepreneurship in rentier economies is driven primarily by institutional and socio-cultural conditions rather than hydrocarbon rents. The results underscore the need for policies that strengthen governance quality, improve ecosystem coordination, and address behavioral barriers in order to foster innovation-led growth in resource-rich MENA economies.

Key words: *Entrepreneurship; Innovation; Oil rent; GEM data*

JEL: *L26; O13; O53; Q33*

1. Introduction

1.1. Background and Motivation

Entrepreneurship is widely viewed as a key driver of innovation and economic diversification (Audretsch 2006). Yet in the Middle East and North Africa (MENA), entrepreneurial activity remains limited despite substantial hydrocarbon wealth. This paradox aligns with the resource-curse and rentier-state hypotheses, which argue that large resource revenues can weaken institutional quality, reduce incentives for private-sector activity, and suppress entrepreneurship (Ross 2012; Ploeg 2011). Although these frameworks have shaped much of the existing debate, recent transformations in the region suggest the need for renewed empirical analysis.

Over the past decade, several MENA economies - including the United Arab Emirates and Saudi Arabia - have undertaken significant governance reforms, digital transformation initiatives, and policy efforts aimed at stimulating innovation-led growth. Expanding digital infrastructure and diversification programs, such as the UAE's entrepreneurship initiatives and Saudi Arabia's Vision 2030, have begun to reshape national entrepreneurial environments. These developments raise an important question: does oil income still influence entrepreneurial activity in contemporary rentier states, or have institutional and technological changes altered this relationship?

Despite its policy relevance, empirical evidence remains limited. Most prior studies rely on long historical panels or macro-growth indicators, whereas micro-level measures of entrepreneurship, such as those provided by the Global Entrepreneurship Monitor (GEM), have seldom been incorporated into resource-curse analyses. Moreover, little is known about whether governance quality or digital connectivity can moderate the oil-entrepreneurship linkage in the modern era.

This study addresses these gaps by analyzing the relationship between oil income per capita and early-stage entrepreneurial activity (TEA) across six MENA countries - Egypt, Israel, Qatar, Saudi Arabia, UAE, Iran - between 2016 and 2022, a period marked by intensified reform efforts and rapid digitalization. By examining not only the direct association between oil income and entrepreneurship, but also the potential moderating roles of institutional quality

and digital connectivity, the study seeks to reassess the resource-curse hypothesis within the contemporary entrepreneurship landscape of the MENA region

1.2. Research Questions

This study is guided by three interrelated research questions that seek to clarify the role of natural-resource wealth in shaping entrepreneurial outcomes in MENA rentier states. The first question examines whether oil income per capita exerts a measurable influence on early-stage entrepreneurial activity. The second question explores whether this relationship is conditioned by national institutional and technological environments. Specifically, it asks whether higher levels of institutional quality or digital connectivity can transform oil rents into an enabling factor for entrepreneurship, thereby moderating or even offsetting potential resource-curse effects. The third question undertakes a comparative perspective by asking how Saudi Arabia and the UAE - two economies with similar levels of hydrocarbon dependence - exhibit divergent entrepreneurial trajectories. This last question probes the institutional and ecosystem-based mechanisms that may account for these differences.

1.3. Contributions of this study

This study makes three substantive contributions to the literature on resource wealth and entrepreneurship. First, it provides new empirical evidence by constructing a multi-country panel dataset that links Global Entrepreneurship Monitor (GEM) indicators with oil income per capita calculated following Ross (2014) and updated through 2022. This allows one of the first systematic assessments of the oil–entrepreneurship relationship during the recent period of digital and institutional transformation in the MENA region.

Second, the analysis advances methodological practice by applying fixed- and random-effects models, moderation tests, and multiple robustness checks using alternative entrepreneurship indicators (Nbgood, Nbstat, New Business Density). The consistent null results across specifications challenge the common expectation in resource-curse research that oil rents inherently depress entrepreneurial activity.

Third, the study contributes conceptually by showing that entrepreneurship in resource-rich economies is driven less by oil-income fluctuations than by institutional and ecosystem conditions. The comparative analysis of Saudi Arabia and the UAE highlights how differences in regulatory quality, digital readiness, and human-capital environments shape divergent entrepreneurial trajectories despite similar hydrocarbon dependence, offering policy-relevant insights for innovation-led diversification.

1.4. Structure of the paper

The remainder of this paper proceeds as follows. Section 2 reviews the literature on the resource curse, and the determinants of entrepreneurship in resource-dependent economies. Section 3 describes the data sources, the construction of oil-income and entrepreneurship variable, and the empirical strategy underlying the panel regression models. Section 4 presents the baseline results and the moderating models examining the roles of institutional quality and digital connectivity. Section 5 provides robustness checks using alternative entrepreneurial indicators to assess the stability of the findings. Section 6 complements the panel analysis with a comparative examination of Saudi Arabia and the United Arab Emirates, highlighting the institutional and ecosystem factors that shape their divergent entrepreneurial trajectories. Section 7 concludes by summarizing the key findings and discussing their implications for policy and future research.

2. Literature Review

2.1. Resource Curse and Rentier State Theory

The literature on the resource curse broadly examines the political, economic, and social consequences of large natural-resource revenues. Politically, a substantial body of work argues that dependence on resource rents weakens democratic accountability, entrenches authoritarian governance, and erodes institutional quality—a central theme in the rentier state tradition (Beblawi and Luciani 1987; Ross 2001, 2014). Empirical studies show that resource-rich states, particularly in the Middle East, often experience diminished political participation,

higher corruption, and greater vulnerability to political instability and conflict (Fearon and Laitin 2003; Basedau and Lay 2009). Economically, early contributions by Auty (1990) and Sachs and Warner (2001) demonstrate that resource-dependent economies tend to suffer from slow diversification, stagnation in non-resource sectors, and heightened macroeconomic volatility. These effects have been especially pronounced in hydrocarbon-dependent Gulf economies, where oil revenues historically inhibited the development of competitive non-oil industries and private-sector productivity.

The social dimensions of the resource curse further highlight its multifaceted impact. Studies find that resource dependence is associated with lower female labor-force participation, weaker civic engagement, and pervasive patronage structures that constrain human-capital development (Ross 2001, 2014; Karl 1997). Importantly, the conclusions of resource-curse research vary depending on how “resource wealth” is defined: while Sachs and Warner (2001) include oil, minerals, and agricultural commodities, other studies focus solely on hydrocarbons, leading to different empirical outcomes. In the Middle Eastern context, however, oil wealth is consistently associated with institutional weaknesses and limited economic diversification. Yet recent work notes that several Gulf economies—having experienced the adverse effects of the 1980s oil-price collapse—have since adopted sovereign wealth funds, diversification strategies, and innovation-oriented reforms that differentiate their contemporary trajectories from earlier decades (Hertog 2010). As technological change, digitalization, and new industrial policies reshape the region’s economic landscape, reassessing the relationship between oil wealth, development, and entrepreneurial dynamism becomes increasingly necessary.

2.2. Entrepreneurship in MENA Rentier States

Research on entrepreneurship in Middle Eastern rentier states has expanded over the past decade, but it remains fragmented and highly country-specific. Empirical studies on Saudi Arabia, for instance, often focus on micro-level behavioral constraints or gender-specific dynamics: Abubakar (2017) shows that strong entrepreneurial intentions coexist with administrative and regulatory barriers, while Basaffar (2018) highlight persistent structural and cultural constraints facing women entrepreneurs. Other Saudi-focused studies emphasize fragmented ecosystem coordination and weak university - industry linkages (Khan 2016;

Kayed 2010). In the UAE, existing work documents a comparatively mature entrepreneurial ecosystem, supported by regulatory efficiency, openness, and cultural diversity (Tong 2012; Facchini 2019), while recent scholarship points to psychological barriers - such as fear of failure - that persist despite favorable institutional conditions (Alnassi 2023). Comparative research remains limited: Balawi (2021) compares TEA levels in the UAE, Saudi Arabia, and Qatar but relies on a single-year GEM dataset, while Aminova (2020) analyzes ecosystem components across selected Arab states without assessing longitudinal dynamics.

Although a small number of studies have explicitly examined the relationship between resource rents and entrepreneurship, these analyses are typically cross-sectional and not focused on the MENA region as a whole (Majbouri 2016; Farzanegan 2014). Thus, across the broader literature, oil rent is rarely incorporated as a systematic explanatory factor within multi-country empirical designs, and existing research largely treats rentier structures as background conditions rather than testable variables. In light of these gaps—and given recent policy transformations such as Saudi Arabia’s Vision 2030 and the UAE’s expansion of digital and innovation strategies—comprehensive panel evidence covering multiple hydrocarbon economies remains limited. Consequently, empirical research using multi-year GEM data to analyze entrepreneurship across several MENA rentier states is notably scarce, underscoring the contribution of the present study.

2.3. Hypotheses

The central research question of this study is: Under what conditions does oil income per capita support or hinder entrepreneurship in MENA rentier states? The main hypotheses to be tested are: (1) Higher oil income per capita is associated with weaker entrepreneurial outcomes; (2) Good governance quality and advanced digital infrastructure moderate this negative relationship, potentially turning resource rents into an enabling factor for entrepreneurship.

3. Data

3.1. Data Description

This section outlines the data sources adopted in this study. The number of entrepreneurship-related statistics for MENA countries was limited, so a panel dataset was constructed and used. All data are national level. Table 1 provides an overview of the variables employed in the analysis, along with their respective data sources.

Table 1: Summary of Data Description

Category	Variable	Source	Range	Sample
IV	Oil income per capita*	EIU, World Bank Commodity Price/ Ross and Mahdavi(2015)	2016 - 2022 (Balanced)	6 nations
DVs	Total early-stage entrepreneurial activity (TEA)	GEM	2016 - 2022 (Unbalanced)	6 nations
MVs	Government Effectiveness	World Bank WGI	2016 - 2022 (Balance)	6 nations
	Mobile Connectivity Index	GSMA	2016 - 2022 (Balanced)	6 nations
CVs	GDP per Capita	World Bank	2016 - 2022 (Balanced)	6 nations
	Population	World Bank		
	Unemployment	World Bank		
	Education (Higher education enrollment rate)	EIU		
	Political stability and absence of violence/terrorism	World Bank		

To address these questions, the study uses an unbalanced multi-level panel dataset covering up to six MENA oil-rich countries from 2016 to 2022. GEM offers a limited and unbalanced dataset covering MENA countries. The data is not continuous except for six countries from 2016 to 2022: Egypt, Israel, Qatar, Saudi Arabia, UAE, and Iran. Core dependent variables include the Global Entrepreneurship Monitor (GEM) indicators (total early-stage entrepreneurial activity, TEA). The key independent variable is oil income per capita, calculated following Ross (2014) using production and price data from the EIU and World Bank, adjusted to constant USD. Control variables include GDP per capita, population, education, unemployment, and political stability. Governance quality and digital readiness

indices are incorporated as moderators.

3.2. Dependent Variables

The dependent variable is TEA, which is a behavior-based indicator derived from the GEM Adult Population Survey (API). This is measured as the percentage of the adult population (ages 18–64) who are either actively involved in starting a new business or managing a business less than 42 months old.

3.3. Independent Variables

The independent variable is oil income per capita, which was constructed to more accurately reflect the distribution of oil wealth across countries. While previous studies often used the share of oil exports in GDP as a proxy for a country’s resource dependence—commonly referred to as a “rentier score”—this measure has notable limitations. As Ross points out that GDP-based export ratios fail to account for domestic oil consumption, thereby underestimating the total value of resource income available to the state and society (Ross, 2014). To address this limitation, this study adopts Ross’s method for calculating oil income per capita, which offers a more comprehensive measure by incorporating both oil and gas production values. The formula is expressed as follows:

$$\text{Oil Income per Capita}_{it} = \frac{\text{Oil Production}_{it} \cdot P_{\text{oil},t}^{\text{real}} + \text{Gas Production}_{it} \cdot P_{\text{gas},t}^{\text{real}}}{\text{Population}_{it}}$$

In this specification, a country’s annual oil and gas production is multiplied by the corresponding real international market prices (deflated to a constant base year), and the result is divided by the total population. In Ross’s original study, prices were adjusted to constant 2000 U.S. dollars to ensure comparability over time. Following this approach, the present study constructs a panel dataset of oil income per capita using real international prices and production data sourced from EIU and the World Bank. This measure is employed as the primary independent variable in all subsequent regression analyses.

Given that GEM data for MENA countries is available only for the period 2016–2022, it was necessary to update the oil income per capita variable accordingly. The dataset provided by Ross and Mahdavi extends only up to 2014 and contains several limitations: its gas production data are reported in ambiguous units (e.g., MOBE or BCF), suffer from a high degree of missingness, and rely on conservative estimation methods (Ross and Mahdavi, 2015). To improve reliability, a new dataset was constructed using data from EIU, which offers regularly updated and consistent country-level figures for oil and gas production, export volumes, and prices. For both nominal and real price indices, World Bank commodity price data were utilized, along with population figures drawn from the same source. Crude oil prices are based on Brent benchmarks, and natural gas prices follow Henry Hub standards, in alignment with Ross’s original methodology.

$$\text{Oil Income per Capita}_{it} = \frac{\text{Oil Production}_{it} \times P_{\text{oil},t}^{\text{real } 2010} + \text{Gas Production}_{it} \times P_{\text{gas},t}^{\text{real } 2010}}{\text{Population}_{it}}$$

To control for inflation and ensure temporal comparability, oil income per capita values were converted into constant 2010 U.S. dollars using GDP deflators provided by the World Bank. The selection of 2010 as the base year adheres to international conventions and facilitates cross-country comparison. Accordingly, the key independent variable is defined as the natural logarithm of oil income per capita in 2010 constant U.S. dollars, denoted as `log_oil_income_pc2010real`. This transformation not only ensures consistency across countries and periods but also mitigates the skewness introduced by outliers in small, resource-rich states.

3.4. Control Variables and Moderating Variables

In addition to the main variables, several controls are included to account for macro-economic and structural factors that may affect entrepreneurial activity. Specifically, GDP per capita controls for overall economic development, unemployment captures labor market conditions, education reflects human capital, and political stability accounts for broader governance and risk environments. Population size is also included to adjust for scale effects across countries. To address potential endogeneity between oil income and GDP per capita, a

two-way fixed-effects model is employed to net out unobserved country characteristics and common time shocks. GDP per capita enters only as a control, and multicollinearity diagnostics(VIF) confirm that the estimates are stable. Robustness checks with alternative dependent variables yield consistent null results, further reducing concerns about residual endogeneity.

Two moderating variables are introduced to examine whether the relationship between oil income and entrepreneurship is conditioned by institutional or technological contexts. Institutional quality is measured using the Government Effectiveness indicator from the World Bank’s Worldwide Governance Indicators (WGI), as it provides a widely used, conceptually clear measure of state capacity and the quality of public services—factors closely linked to the enabling environment for entrepreneurship. Digital connectivity is captured using the GSMA Mobile Connectivity Index rather than the more conventional ITU Internet Access indicator, because the GSMA index offers a more comprehensive, multidimensional assessment of digital readiness—including infrastructure, affordability, consumer readiness, and network performance—reflecting mobile-first digital ecosystems in MENA economies more accurately.

3.5. Descriptive Statistics

Table 2. Descriptive Statistics

Variable	N	Mean	SD	Min	Max	Skewness	Kurtosis
tea	45	12.285733	4.0341168	5.6572533	25.52	0.8425499	4.2340427
log_oil_income_pc2010	48	7.4519649	1.9978935	4.4324477	10.409955	0.1654473	1.4559288
log_gdp_per_capita	48	9.8049864	1.1580484	8.002621	11.181028	0.4490472	1.4334747
log_population	48	16.793042	1.3877197	14.58179	18.539514	0.1432744	1.5887283
unemploy	48	5.6880625	4.0996939	0.1	13.052	0.2305519	1.9180301
edu	48	49.596473	18.386521	14.8	79.6	0.4276526	2.1053315
pol_stabl	48	34.253612	27.339181	5.6603775	82.380951	0.6607885	1.6124565
wgi_gov_eff	48	0.4296539	0.8002343	1.0175947	1.4263396	0.2503153	1.5291989
gsma_mobile	48	70.421535	12.298136	40.759128	90.522516	0.4628652	2.3442583

Source: Authors' Elaboration using R

Although TEA has a kurtosis above 3, it remains below the conventional thresholds (kurtosis < 7) typically considered acceptable in regression and panel-data analysis. Thus, while some outliers may exist, the distribution does not threaten the validity of our regression estimates.

4. Methodology & Models

4.1. Empirical Strategy Overview

This study employs a series of panel regression models to examine the relationship between oil income per capita and early-stage entrepreneurial activity across six MENA countries. Given the structure of the dataset, which combines temporal variation with unobserved country-specific characteristics, panel estimators are more appropriate than pooled OLS. The analysis begins with a baseline model regressing TEA on oil income and standard macro-structural controls, followed by moderation models that incorporate institutional quality and digital connectivity to test for conditional effects. All models are estimated in R using the *plm* package, which provides standard estimators for fixed-effects and random-effects panel models. Cluster-robust standard errors are applied at the country level. The choice between fixed-effects and random-effects estimators is determined using the Hausman test to ensure consistency and efficiency.

As a robustness check, the empirical framework is extended to alternative entrepreneurship indicators - Nbgood, Nbstat, and New Business Density Rate - to assess whether the estimated null relationship between oil income and entrepreneurship holds across different outcome measures. Nbstat refers to the high status of successful entrepreneurs, reflecting the percentage of respondents who believe successful entrepreneurs are highly regarded in their country. Nbgood reflects entrepreneurship as a good career choice, capturing the proportion of individuals who perceive starting a business as a desirable career path. New Business Density Rate, obtained from World Bank's Entrepreneurship Database, is defined as the number of newly registered limited liability firms per 1,000 working-age individuals (ages 15–64) per calendar year, offering a standardized and internationally comparable measure of

entrepreneurial activity. Together, these modeling strategies provide a transparent and rigorous approach for identifying the role of oil income while accounting for country heterogeneity and small-sample constraints.

4.2. Models

In this study, the main hypotheses are: (1) Higher oil income per capita is associated with weaker entrepreneurial outcomes; (2) Good governance quality and advanced digital infrastructure moderate this negative relationship, potentially turning resource rents into an enabling factor for entrepreneurship. Model 1 tests Hypothesis 1 using oil income per capita as the independent variable. Models 2 and 3 cover Hypothesis 2 by applying two moderating variables, institutional quality (government effectiveness) and digital connectivity (GSMA Mobile Connectivity Index). Model 2-1 examines whether institutional quality conditions the relationship between oil income and entrepreneurial activity. In this specification, government effectiveness (*wgi_gov_eff*) is added to the baseline model along with an interaction term between oil income and institutional quality. Model 2-2 evaluates whether digital connectivity alters the impact of oil income on entrepreneurship, the GSMA mobile connectivity index (*gsma_mobile*) is included as a moderator.

All models have the same dependent variable (TEA) and control variables, and cover a panel of six countries - Egypt, Israel, Iran, Qatar, Saudi Arabia, and UAE - over the period from 2016 to 2022. The equations of all models are below.

Equation

$$\text{Model 1: } TEA_{it} = \alpha + \beta_1 \ln(OilIncome_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

$$\text{Model 2-1: } TEA_{it} = \alpha + \beta_1 \ln(OilIncome_{it}) + \beta_2 GovEff_{it} + \beta_3 (\ln(OilIncome_{it}) * GovEff_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

$$\text{Model 2-2: } TEA_{it} = \alpha + \beta_1 \ln(OilIncome_{it}) + \beta_2 GSMA_{it} + \beta_3 (\ln(OilIncome_{it}) * GSMA_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

$$\text{Model 3: } TEA_{it} = \alpha + \beta_1 \ln(\text{OilIncome}_{it}) + \beta_2 \text{GovEff}_{it} + \beta_3 \text{GSMA}_{it} + \beta_4 (\ln(\text{OilIncome}_{it}) * \text{GovEff}_{it}) + \beta_5 (\ln(\text{OilIncome}_{it}) * \text{GSMA}_{it}) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

In these equations, i denotes the country index, t denotes the time(year) index. TEA_{it} refers to the dependent variable. $\ln(\text{OilIncome}_{it})$ represents the log of oil income per capita (2010 constant prices), which is the main independent variable. As for moderating variables, GovEff_{it} is the government effectiveness, $\beta_2 \text{GSMA}_{it}$ is GSMA Mobile Connectivity Index. X_{it} is a vector of control variables, including GDP per capita, population, unemployment rate, education (higher or tertiary education enrolment rate), and political stability. μ_i is the country fixed effects, λ_t is the year fixed effect, and ε_{it} is the error term, capturing unobserved factors.

4.3. Correlation

Table 3: Correlation result

tea	log_oil_income pc2010	log_gdp per capita	log population	unemploy	edu	pol stabl	wgi gov eff	gsma mobile
1	0.340257178	0.2261071	-0.125918	-0.083294	0.314434	0.245921	0.2053009	0.255874
0.3403	1	0.55946904	-0.5385921	-0.577862	-0.18931	0.812244	0.3073144	0.460343
0.2261	0.559469044	1	-0.9536526	-0.919675	-0.18309	0.749797	0.9130609	0.839468
-0.126	-0.538592148	0.95365261	1	0.934773	0.422342	-0.80343	-0.839467	-0.76125
-0.083	-0.577862486	0.91967527	0.9347734	1	0.420535	0.820863	-0.811215	-0.80829
0.3144	-0.189314122	0.18309057	0.4223422	0.420535	1	0.510797	-0.065421	-0.05119
0.2459	0.812244488	0.74979692	-0.8034298	-0.820863	-0.5108	1	0.6265731	0.622376
0.2053	0.307314381	0.91306086	-0.8394675	-0.811215	-0.06542	0.626573	1	0.819835
0.2559	0.460343252	0.83946795	-0.7612506	-0.808294	-0.05119	0.622376	0.8198355	1

Source: Authors' Elaboration using R

Notes: $p < 0.1$ (*), $p < 0.05$ (**), $p < 0.01$ (***)

Correlation analysis shows that TEA exhibits only modest correlations with key national-level variables. Oil income per capita ($r = 0.34$), education ($r = 0.31$), political stability ($r = 0.25$), and digital connectivity as measured by GSMA Mobile Connectivity Index ($r = 0.26$) are positively associated with TEA, although the magnitudes remain moderate. Government

effectiveness also shows a weak positive correlation ($r = 0.21$). These results suggest that simple bivariate relationships cannot fully explain cross-country differences in entrepreneurship, supporting the need for a multivariate panel regression framework with institutional and digital moderators.

Several control variables, particularly population, unemployment, and GDP per capita, exhibit relatively high correlations with institutional and digital indicators. While some multicollinearity is expected, especially in socio-economic panel datasets, VIF diagnostics remain within acceptable thresholds, from 1.30 to 3.05, and the use of fixed-effects models with cluster-robust standard errors mitigates potential estimation concerns.

5. Empirical Results

5.1. Panel Analysis of Model 1

Table 4: Model 1 panel analysis result (RE model)

Variable	Estimate	Std Error	z_value	p_value
(Intercept)	61.47326915	80.10801176	0.767379789	0.447597795
log_oil_income_pc2010	0.689567893	0.610082481	-1.130286338	0.265439518
log_gdp_per_capita	-2.22497148	3.654853709	-0.608771693	0.546298059
log_population	2.870653561	3.222779543	-0.890738421	0.378674716
unemploy	0.86782675	0.215631711	4.024578509	0.000262511***
edu	0.263450474	0.128482411	2.05047891	0.047261573**
pol_stabl	0.226490229	0.078281915	2.893263767	0.006280189***

Source: Authors' Elaboration using R

Notes: $p < 0.1$ (*), $p < 0.05$ (**), $p < 0.01$ (***)

The random-effects estimates presented in Table 4 indicate that oil income per capita has no statistically significant association with TEA in the six MENA countries examined. The coefficient on log_oil_income_pc2010 is negative but insignificant ($p = 0.265$), suggesting that variations in oil-derived revenue do not directly influence entrepreneurial engagement once macroeconomic factors and between-country variation are accounted for. Similarly, GDP per capita, population size, and unemployment do not display significant effects.

In contrast, education and political stability emerge as the only consistently significant predictors in the baseline specification. Higher levels of education are associated with increased TEA ($p = 0.047$), reflecting the role of human capital in facilitating entrepreneurial capabilities, while political stability ($p = 0.006$) appears to enhance the environment for business creation. The positive coefficient on unemployment ($p < 0.001$) suggests the presence of necessity-driven entrepreneurship, a pattern commonly observed in emerging economies where labor-market constraints may push individuals toward self-employment.

Overall, the baseline model confirms that the direct effect of oil income on entrepreneurship is weak, motivating the need to examine how institutional quality and digital connectivity condition this relationship in subsequent models.

5.2. Moderation Analysis of Models 2 and 3

To ensure a theoretically consistent and statistically valid identification strategy, the moderating variables in this study are introduced sequentially rather than simultaneously. Because the two moderators—government effectiveness and mobile connectivity—are substantially correlated in the data ($r = 0.82$), estimating a model with multiple interaction terms at once may inflate multicollinearity and produce unstable or uninterpretable coefficients. This modeling strategy aligns with established methodological guidance: moderating effects should first be examined independently before estimating a model that includes all moderators concurrently. Such a stepwise approach is particularly important when moderators are conceptually related or empirically correlated, as simultaneous inclusion may obscure each moderator’s unique conditional effect. Therefore, this paper estimates Model 2-1 and Model 2-2 separately before introducing both moderators jointly in Model 3.

Table 5: Model 2-1 panel analysis result (RE model)

Variable	Estimate	Std Error	z value	p value
(Intercept)	21.088085	59.974697	0.3516164	0.72717578
log_oil_income_pc2010	1.6705722	1.3517041	1.2359009	0.224499339

wgi_gov_eff	-7.122369	8.7958019	0.8097464	0.423406133
log_gdp_per_capita	1.1407255	3.2765303	0.3481505	0.72975487
log_population	2.0016515	2.6837506	0.7458411	0.460606027
unemploy	0.8379803	0.1550873	5.4032825	4.36124E-06
edu	0.2772606	0.1594188	1.7391964	0.090545846*
pol_stabl	0.2391974	0.0989159	2.4181903	0.020784033**
<u>log_oil_income_pc2010:wgi_gov_eff</u>	<u>0.6044578</u>	<u>0.7892562</u>	<u>0.7658576</u>	<u>0.448753609</u>

Source: Authors' Elaboration using R
Notes: p < 0.1 (*), p < 0.05 (**), p < 0.01 (***)

In the Model 2-1, the RE estimator provides more reliable estimates in this setting, and the Hausman test confirms that RE is appropriate ($p = 0.976$). The interaction term between oil income and institutional quality is statistically insignificant ($p = 0.44$), indicating that government effectiveness does not condition the effect of oil income on TEA (Table 5). Moreover, the main effect of oil income remains non-significant across specifications, suggesting that resource rents do not directly influence early-stage entrepreneurship in this sample. Overall, these results imply that institutional quality—at least as captured by government effectiveness—does not alter the oil–entrepreneurship linkage in the countries analyzed.

Table 6: Model 2-2 panel analysis result (RE model)

Variable	Estimate	Std Error	z value	p value
(Intercept)	23.85853474	87.25993277	0.273419128	0.786093608
log_oil_income_pc2010	-4.11942355	4.208932125	-0.978733661	0.334243354
gsma_mobile	-0.27544073	0.400398742	-0.687916072	0.495914496
log_gdp_per_capita	0.26158827	4.210217101	0.062131777	0.950801576
log_population	-0.62010021	4.001412179	-0.154970341	0.877710325
unemploy	0.832901377	0.363015925	2.294393495	0.027707071**
edu	0.196008877	0.093585386	2.094438942	0.043322352**
pol_stabl	0.207348618	0.056408319	3.675851758	0.00076719***
<u>log_oil_income_pc2010:gsma_mobile</u>	<u>0.045824047</u>	<u>0.055642394</u>	<u>0.823545559</u>	<u>0.415620446</u>

Source: Authors' Elaboration using R
Notes: p < 0.1 (*), p < 0.05 (**), p < 0.01 (***)

Model 2-2 incorporates mobile connectivity as a potential moderator of the oil–

entrepreneurship relationship. The Hausman test strongly favors the random-effects specification ($p = 0.999$), indicating that RE estimates are consistent. The results show that neither oil income nor the interaction term between oil income and mobile connectivity is statistically significant, suggesting that digital connectivity does not condition the impact of oil rents on early-stage entrepreneurial activity (Table 6). Among the control variables, unemployment and education remain positively associated with TEA, consistent with the baseline model. Overall, the findings provide the lack of evidence that mobile connectivity alters the relationship between oil income and entrepreneurship in the sampled countries.

The lack of a moderating effect may reflect the limited within-country variation in institutional indicator such as government effectiveness, which are relatively stable over time. Given the small number of countries and the structural nature of both oil rents and institutional quality, digital connectivity interaction effects may be difficult to detect statistically. The interaction term between oil income and digital connectivity is statistically insignificant as well. This suggests that higher levels of digital readiness—measured by the GSMA Mobile Connectivity Index—do not alter the relationship between oil wealth and entrepreneurial activity. In other words, even in digitally advanced environments, such as Saudi Arabia and the UAE, oil rents do not translate into higher levels of early-stage entrepreneurship. This result is consistent with the idea that digital infrastructure is a necessary but not sufficient condition for entrepreneurial dynamism in rentier economies.

Table 7: Model 3 panel analysis result (RE model)

Variable	Estimate	Std Error	z_value	p_value
(Intercept)	-17.291797	61.310028	-0.2820386	0.7796236
log_oil_income_pc2010	-5.9762424	5.4871716	-1.0891299	0.2837564
wgi_gov_eff	-4.0926259	6.1654732	-0.6637975	0.5112963
gsma_mobile	-0.4092623	0.4751913	-0.861258	0.3951294
log_gdp_per_capita	4.1513952	4.4001749	0.9434614	0.3521012
log_population	0.4741501	3.3705231	0.1406755	0.8889564
unemploy	0.7456028	0.290758	2.5643414	0.014926**
edu	0.2039395	0.1048842	1.9444244	0.0601552*
pol_stabl	0.2288727	0.0875116	2.6153406	0.0131957**

log_oil_income_pc2010:wgi_gov_eff	0.0105811	0.7327962	0.0144393	0.9885639
log_oil_income_pc2010:gsma_mobile	0.0626943	0.0694758	0.9023903	0.3731983

Source: Authors' Elaboration using R

Notes: $p < 0.1$ (*), $p < 0.05$ (**), $p < 0.01$ (***)

Model 3 includes both institutional quality and mobile connectivity as moderators. The Hausman test again favors the random-effects estimator ($p = 0.999$). The results indicate that neither oil income nor either interaction term is statistically significant, suggesting that neither institutional quality nor digital connectivity conditions the relationship between oil rents and entrepreneurial activity (Table 7). The coefficients of the main variables remain broadly consistent with Models 2-1 and 2-2, reinforcing the conclusion that no meaningful moderating effects are present in this sample.

A comparison of Models 2 and 3 shows several numerical shifts in p-values; however, none of these movements carry substantive statistical meaning. For example, the coefficient of oil income moves from a p-value of 0.33 in Model 2-2 to 0.28 in Model 3, and the interaction term with mobile connectivity declines modestly from 0.41 to 0.37. Although these movements might appear to suggest a slight strengthening of the estimated associations, they remain far above the conventional 0.05 significance threshold and therefore do not imply any emerging effect. Rather, such minor fluctuations are typical when additional covariates or interaction terms are introduced, as the underlying variance–covariance structure of the estimator is reallocated across regressors.

Conversely, the interaction term involving institutional quality (*wgi_gov_eff*) exhibits an increase in its p-value—rising from 0.72 in Model 2-1 to 0.98 in Model 3—which further weakens any potential moderating influence of institutional quality on the oil–entrepreneurship relationship. This upward shift indicates that, once both moderators are jointly modeled, the data provide even less support for any conditioning role of governance quality. Taken together, the observed fluctuations across Models 2 and 3 should therefore be interpreted as statistical noise rather than substantively meaningful changes. All key variables - including oil income and both interaction terms - remain firmly non-significant, reinforcing the conclusion that neither institutional quality nor digital connectivity moderates the relationship between oil rents and early-stage entrepreneurial activity in this sample.

6. Robustness Checks

To assess the stability of the main results and address potential concerns about indicator-specific measurement effects, several robustness checks are conducted using alternative dependent variables that capture different dimensions of entrepreneurial activity. In addition to TEA, the analysis incorporates two GEM-based indicators—Nbgood (perceived opportunity, Model 4-1) and Nbstat (entrepreneurial status, Model 4-2)—as well as the World Bank’s New Business Density measure (Model 4-3). The sample of Model 4-1 and Model 4-2 cover the same countries (Egypt, Israel, Iran, Qatar, Saudi Arabia, UAE) and the same time-range (2016-2022). Because New Business Density is only available for Iran in 2020, Iran is excluded from this particular specification. These additional models provide an important validation step by testing whether the absence of an oil - entrepreneurship relationship persists across multiple outcome variables.

Table 8: Model 4 panel analysis result (RE model)

Variable	Model 4-1: Nbgood	Model 4-2: Nbstat	Model 4-3: New Business Density
log_oil_income_pc2010	-2.837 (2.677)	-0.028 (1.359)	0.710 (0.448)
log_gdp_per_capita	-4.157 (5.011)	-31.582 (7.688) ***	-3.578 (1.789) *
log_population	40.493 (33.449)	19.679 (20.637)	7.898 (2.439) ***
edu	-0.057 (0.273)	-0.006 (0.186)	0.014 (0.015)
pol_stabl	0.856 (0.410) **	0.634 (0.176) ***	-0.083 (0.038) *
unemploy	1.817 (1.229)	1.032 (0.861)	-0.046 (0.089)
Estimator	RE	RE	FE
Hausman p-value	0.8448	0.1857	1.73e-05

Source: Authors' Elaboration using R

Notes: $p < 0.1$ (*), $p < 0.05$ (**), $p < 0.01$ (***)

Model 4-1 shows no statistically significant relationship between oil income and opportunity perception. The oil-income coefficient remains insignificant in both the FE model ($p = 0.29699$) and the RE model ($p = 0.31166$), and the Hausman test ($p = 0.8448$) clearly favors the random-effects estimator. This indicates that fluctuations in oil income do not materially shape individuals’ perceived entrepreneurial opportunities. Model 4-2 likewise reveals no substantive association between oil income and entrepreneurial self-identification. The FE coefficient is entirely insignificant ($p = 0.98385$), as is the RE estimate ($p = 0.27431$),

and the Hausman test again supports the RE model ($p = 0.1857$). These findings reinforce the conclusion that resource rents do not influence whether individuals perceive themselves as potential entrepreneurs.

A similar pattern emerges when using the World Bank's New Business Density measure. Model 4-3 produces a more mixed pattern, though ultimately still non-supportive of a meaningful effect. The Hausman test strongly rejects the RE model ($p = 1.73 \times 10^{-5}$), indicating that the FE estimator is more appropriate. The FE model suggests a weak, marginally positive association between oil income and new business creation, but this estimate does not reach statistical significance ($p = 0.129089$). Although the fixed-effects model produces a marginally positive coefficient, the estimate is statistically insignificant and highly sensitive to sample size and model specification, suggesting that it does not represent a stable or meaningful effect. Taken together, these findings demonstrate that the absence of an oil–entrepreneurship relationship is not driven by the choice of indicator, model specification, or estimation method. Rather, the null results are consistent across behavioral, perceptual, and firm-creation measures, reinforcing the conclusion that resource rents neither systematically suppress nor stimulate entrepreneurial activity in the MENA region.

7. Comparative analysis: Saudi Arabia and the UAE

7.1. Time-Series Trends: Saudi Arabia and the UAE

To supplement the panel analysis, this subsection examines within-country trends in entrepreneurial activity for Saudi Arabia and the United Arab Emirates over the period 2016 - 2022. Because the time-series dimension is short, the objective is not to establish causal effects but to assess whether the key indicators - TEA, Nbgood, Nbstat, and new business density - exhibit discernible temporal patterns. As illustrated in Appendix Figure A1, Saudi Arabia shows a clear upward trajectory across all four indicators. TEA increases steadily from 2016 onwards, and both Nbgood and Nbstat rise substantially after 2019, while new business density also trends upward. These consistent improvements suggest that structural reforms under Vision 2030, rather than annual variation in oil revenues, have contributed to the strengthening of Saudi Arabia's entrepreneurial ecosystem.

In contrast, the UAE displays a markedly different pattern. As shown in Appendix Figure A2, entrepreneurship indicators remain relatively stable over time, with high but only moderately fluctuating levels of TEA, Nbgood, Nbstat, and new business density. The absence of clear upward or downward trends likely reflects the UAE's already mature ecosystem, where the baseline level of entrepreneurial activity is high and year-to-year variation is limited. Taken together, the descriptive evidence indicates that oil income does not appear to shape within-country changes in entrepreneurship for either economy, while the direction and magnitude of trends differ substantially. These contrasting patterns highlight the importance of country-specific institutional and policy environments, which are explored further in the next subsection.

7.2. Qualitative Assessment: Institutional and Ecosystem Differences Between Saudi Arabia and the UAE

Building on the time-series patterns described in Section 7.1, this subsection provides a qualitative explanation for the divergent entrepreneurial trajectories observed in Saudi Arabia and the United Arab Emirates (UAE). While oil income does not influence year-to-year variation in entrepreneurship in either country, the underlying institutional and ecosystem conditions differ markedly. These differences align with broader arguments in the rentier-state literature, which emphasizes that entrepreneurship in resource-dependent economies is shaped primarily by institutional quality, regulatory governance, human-capital structures, and socio-cultural norms rather than by fluctuations in hydrocarbon rents (Acemoglu and Robinson 2013; Hertog 2010; Naudé 2009). Within this theoretical framework, Saudi Arabia represents an ecosystem in institutional transition, whereas the UAE reflects a mature and stable entrepreneurial environment.

In Saudi Arabia, empirical studies portray an ecosystem undergoing rapid reform but still characterized by institutional fragmentation and procedural constraints. Using GEM microdata, Abubakar (2017) finds that although Saudi respondents display high levels of opportunity perception and entrepreneurial intentions, new-business activity is dampened by administrative inefficiencies, regulatory opacity, and gaps in procedural transparency. Ecosystem studies similarly document weak coordination among universities, financial institutions, incubators, and public agencies, limiting knowledge spillovers and slowing

ecosystem consolidation (Khan 2013, 2016). Socio-cultural constraints—especially gender norms—remain another structural barrier. Basaffar (2018) shows that Saudi women face substantial obstacles in entrepreneurial entry. Scientific and technology-based entrepreneurship also continues to suffer from underdeveloped R&D linkages and commercialization pathways (Alshumaimri 2012). However, most of the previous literature on Saudi Arabia was conducted before the launch of Saudi Reform, including Vision 2030. It might be argued that Vision 2030 has accelerated regulatory modernization, SME support, and financial-access reforms, which help explain the upward trends in TEA, perceived capabilities, and new-business density observed in Section 7.1. Saudi Arabia, therefore, reflects a reform-driven trajectory in which institutional improvements—though incomplete—are translating into measurable entrepreneurial gains.

By contrast, the UAE exhibits institutional maturity and long-standing ecosystem coherence, which account for its stable but consistently high entrepreneurial outcomes. Studies identify the UAE's regulatory efficiency, digital-government infrastructure, and free-zone governance models as central pillars supporting entrepreneurial performance (Hamdan 2019; Aminova 2020). GEM-based analyses show that the UAE outperforms Saudi Arabia and Qatar in both TEA levels and the share of opportunity-motivated entrepreneurs, reflecting a more advanced innovation ecosystem (Balawi 2021). Socio-culturally, the UAE benefits from a diverse expatriate population, internationally oriented networks, and open labor-market policies, all of which strengthen opportunity recognition and entrepreneurial capability (Facchini 2020). At the same time, recent micro-level studies highlight persistent behavioral constraints. Alnassi (2023) demonstrates that fear of failure and perceived lack of resources continue to exert significant negative effects on entrepreneurial activity among Emirati nationals, even within a supportive institutional environment. These findings suggest that the UAE's ecosystem has reached a high-performance equilibrium, where institutional conditions are strong but behavioral barriers limit further upward expansion.

Taken together, the contrasting institutional landscapes of Saudi Arabia and the UAE help explain the divergent patterns observed in the time-series analysis. Saudi Arabia's upward trajectory reflects an ecosystem in transition, driven by reforms under Vision 2030 but still shaped by structural and cultural constraints. The UAE's high and stable levels of entrepreneurship reflect institutional maturity, regulatory coherence, and diversified human-

capital networks. The absence of oil-income effects in both countries further reinforces the conclusion that entrepreneurial dynamics in GCC rentier economies are mediated primarily through institutional, socio-cultural, and behavioral mechanisms rather than by resource-rent fluctuations. These qualitative insights thus complement the empirical findings by situating cross-country differences within broader institutional and ecosystem contexts.

8. Discussion and Conclusion

8.1. Main Findings

This study examined the relationship between oil income and entrepreneurial activity in six Middle Eastern countries using GEM indicators and country-level panel data from 2016–2022. Across all model specifications, including moderation models incorporating institutional quality and digital connectivity, oil income does not exhibit a statistically significant effect on TEA or related entrepreneurial outcomes. These findings are reinforced by robustness checks using alternative indicators such as perceived opportunities (Nbgood), entrepreneurial status (Nbstat), and new-business density. Taken together, the empirical results suggest that resource rents neither promote nor hinder entrepreneurship in the short run, challenging conventional assumptions that hydrocarbon wealth systematically depresses entrepreneurial incentives in rentier economies.

Furthermore, the comparative time-series assessment of Saudi Arabia and the United Arab Emirates highlights divergent within-country patterns that are independent of oil-income fluctuations. Saudi Arabia exhibits a reform-driven upward trajectory across multiple entrepreneurship indicators, while the UAE maintains consistently high but relatively stable levels. These patterns demonstrate that institutional maturity, policy coherence, and socio-cultural dynamics play more prominent roles in shaping entrepreneurial ecosystems than oil-income variations.

8.2. Policy Recommendations

The findings offer several recommendations for policymakers in resource-rich

economies. First, entrepreneurship cannot be stimulated through resource-revenue channels alone; instead, targeted institutional reforms are required to strengthen regulatory quality, reduce administrative burdens, and improve access to finance. The Saudi experience suggests that large-scale reform agendas - such as SME - support initiatives, licensing simplification can produce measurable gains in entrepreneurial activity even when resource revenues remain volatile. Second, the UAE case underscores the importance of ecosystem maturity: sustained investment in digital government, human-capital development, and global connectivity allows entrepreneurial activity to remain resilient despite external shocks. Third, the persistence of behavioral barriers, particularly fear of failure, indicates that policy interventions must address psychological constraints through education, mentorship, and cultural-change initiatives. Overall, the results highlight that resource-dependent countries should prioritize institutional strengthening and ecosystem development rather than relying on resource windfalls to stimulate entrepreneurship.

8.3. Limitations and Future Research

This study faces several data limitations that constrain the scope of empirical inference. The analysis relies on GEM indicators for a limited set of MENA countries, and the short time span of available observations restricts both the temporal depth and the size of the panel. As a result, the models are less able to capture long-run adjustments or dynamic responses in entrepreneurial behavior. Future research would benefit from the inclusion of longer time-series or alternative entrepreneurship datasets - such as business registration records, labor-force microdata, or innovation and startup indicators from the World Bank or OECD - which would allow for a more granular and comprehensive assessment of entrepreneurial dynamics.

Moreover, the empirical focus on MENA oil exporters limits the generalizability of the findings. Comparative research incorporating additional resource-rich economies, such as Norway, or contrasting resource-poor but entrepreneurship-intensive East Asian economies like Korea, Japan, and Taiwan, would help determine whether the patterns identified in this study are specific to MENA rentier states or reflect broader relationships between resource structures, institutions, and entrepreneurial outcomes. Finally, several non-oil MENA economies - such as Lebanon, Morocco, and Tunisia - were excluded due to missing post-2015

oil-income data. As more consistent data become available, expanding the sample to include both oil and non-oil MENA countries will permit a more balanced and heterogeneous regional analysis. These extensions would enhance the robustness and external validity of future studies on entrepreneurship in resource-dependent contexts.

Appendix.

Figure A1. Time-Series of Entrepreneurial Indicators in Saudi Arabia, 2016–2022

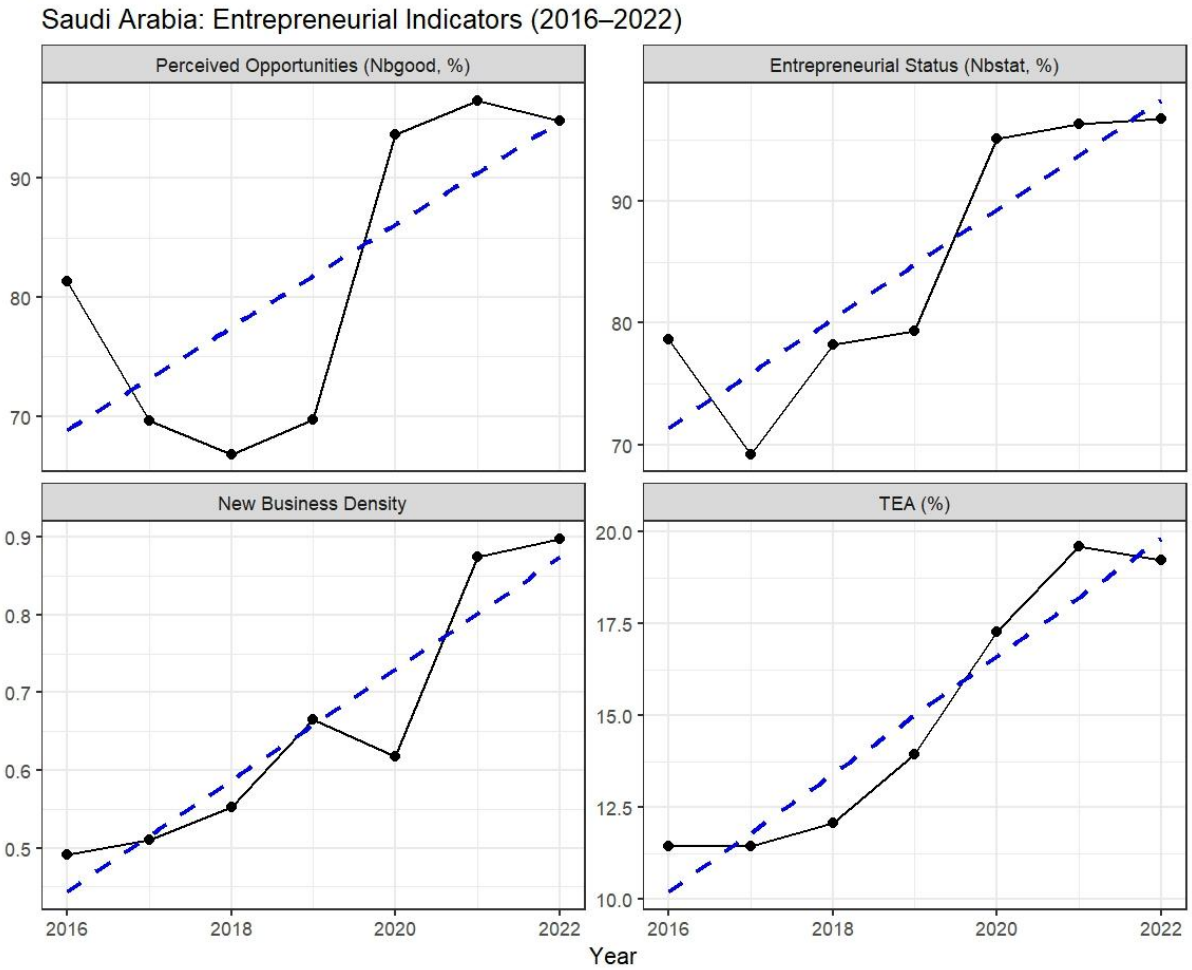
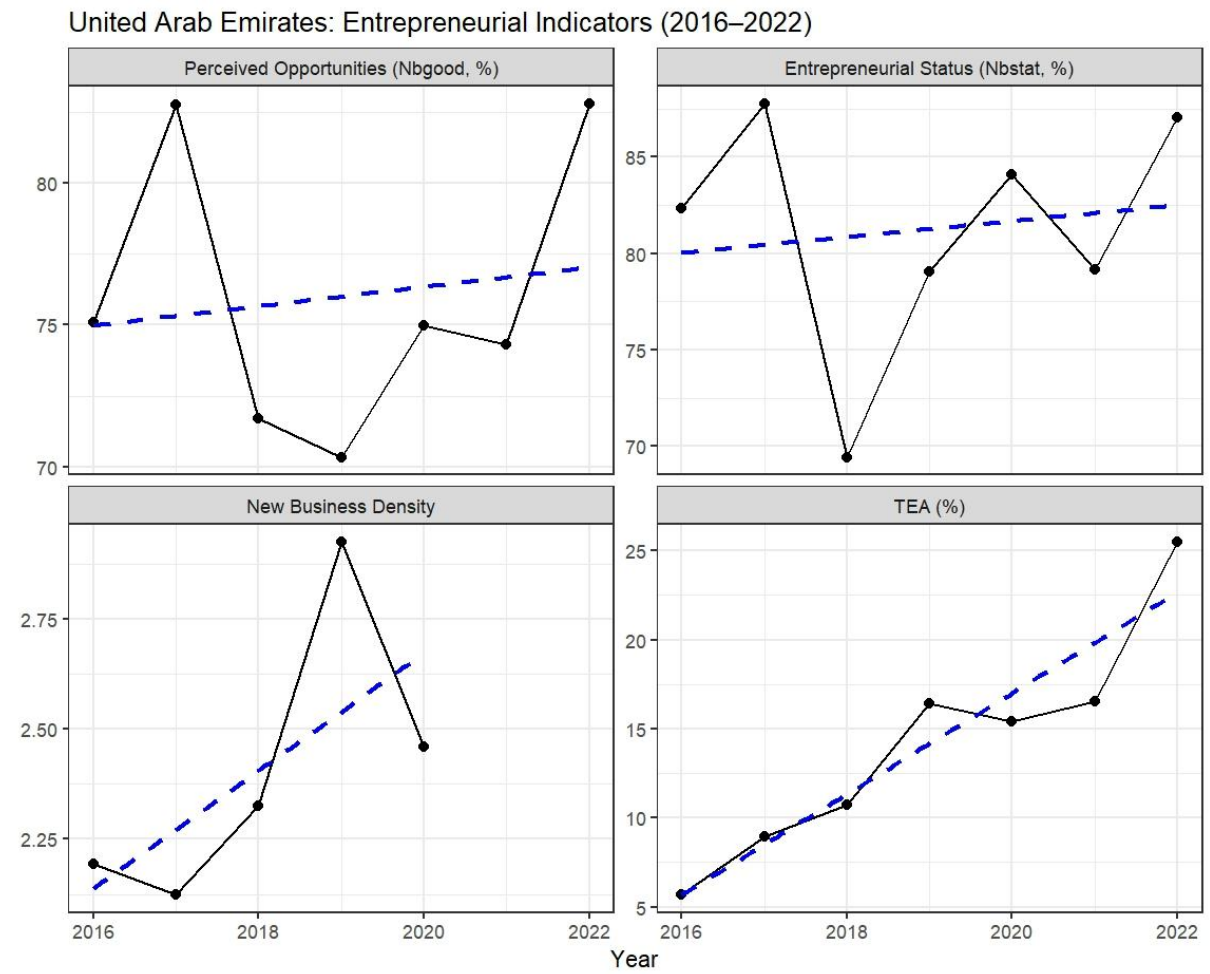


Figure A2. Time-Series of Entrepreneurial Indicators in the UAE, 2016–2022



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