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Institutional Quality and Sustainable Firm Growth: Evidence From North African Countries

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ABSTRACT

This study investigates the relationship between institutional quality (IQ) and sustainable firm growth (SFG) in North African countries, focusing on Egypt, Morocco, and Tunisia. Utilizing panel data from 155 non-financial firms over the period 2007–2020, we employ a system generalized method of moments (GMM) approach to analyze this relationship. Our findings reveal a significant U-shaped relationship between IQ and SFG, indicating that both very low and very high levels of IQ are associated with limited firm growth, while an optimal level of IQ promotes substantial growth. This suggests that firms in low-IQ environments struggle due to weak regulatory frameworks and corruption, whereas those in high-IQ environments benefit from better governance and transparency, leading to enhanced growth. The study makes several contributions by providing empirical evidence from an underexplored region, highlighting the complex dynamics between institutional quality and firm growth, and offering robust methodological insights. Policy implications underscore the need for balanced regulation and long-term investment in institutional quality, education, and infrastructure.

JEL Classification: C23, G38, Q56

1 | Introduction

Institutional quality (IQ) in North African countries, particularly Egypt, Tunisia, and Morocco, has garnered significant attention from policymakers and development experts (Antwi, Kong, and Donkor 2024; Elamer, Ntim, and Abdou 2016; Elamer et al. 2019; Onifade et al. 2024). These countries consistently score below the global average in terms of government effectiveness (GE), rule of law (RL), and control of corruption (CC) (World Bank 2022). Despite efforts by these governments to improve IQ through legal and administrative reforms, corruption remains a significant challenge, with Transparency International (2022) ranking Egypt 130th, Morocco 94th, and Tunisia 85th out of 180 countries. These rankings underscore the persistent issues that these countries face in fostering a robust institutional framework capable of promoting sustainable economic and business growth (Elamer, Ntim, and Abdou 2020a; Elamer et al. 2020b; Jahanger, Usman, and Balsalobre-Lorente 2022; Kpegba et al. 2024). The aim of this study is to investigate the relationship between IQ and sustainable firm growth (SFG) in North African countries. Specifically, we examine whether a U-shaped relationship exists between IQ and SFG, wherein both very low and very high levels of IQ may limit firm growth, while an optimal level of IQ promotes substantial growth.

The concept of IQ signifies the government's capability to secure property rights and enforce contracts (Addai, Amegavi, and Robinson 2024; Asongu and Odhiambo 2019; Diallo and Ouoba 2023; North 1981). According to North (1990), institutions are the "rules of the game" in a society, encompassing formal laws, informal norms, and other social structures regulating interactions between individuals and organizations. These institutions are crucial for economic development, providing a framework for individuals and companies to engage in the exchange of goods and services and productive activities. IQ affects various economic outcomes, including investment, innovation, and overall economic performance (Acemoglu, Johnson, and Robinson 2002; Alshbili, Elamer, and Beddewela 2018; Alshbili, Elamer, and Moustafa 2021; Hall and Jones 1999; Sethi, Behera, and Sethi 2024; Wang et al. 2024; Yeyouomo and Asongu 2024).

In recent years, the Egyptian government has initiated several legal and administrative reforms aimed at enhancing IQ. These efforts include the establishment of specialized courts to address commercial disputes and the adoption of a new investment law in 2017, which aims to create a more favorable business environment (El-Dyasty and Elamer 2021, 2022, 2023a). Similarly, the Tunisian government has pursued increased transparency and accountability, particularly in the wake of the 2011 revolution. This revolution catalyzed significant political changes, emphasizing the need for stronger institutional frameworks to support economic stability and growth. The Moroccan government has also implemented reforms, including the adoption of a new constitution in 2011 that strengthened the powers of parliament and the judiciary, aiming to improve governance and accountability. Despite these efforts, the effectiveness of these reforms remains limited due to deep-seated structural issues and persistent corruption (El-Dyasty and Elamer 2023a, 2023b). For instance, Transparency International (2022) reports that corruption remains a significant barrier to effective governance in all three countries. These challenges highlight the complex interplay between institutional reforms and their actual implementation and impact on economic activities.

The literature on IQ can be categorized into two primary perspectives: macroeconomic and microeconomic. From a macroeconomic standpoint, numerous studies have explored IQ's impact on economic growth (e.g., Shleifer and Vishny 1993; Mauro 1995; Hall and Jones 1999; Acemoglu, Johnson, and Robinson 2002), investment (e.g., Knack and Keefer 1995; Mo 2001), and total factor productivity (e.g., Ng and Yu 2014; Shirokova et al. 2021), suggesting that high IQ supports these economic factors. For example, Acemoglu, Johnson, and Robinson (2002) demonstrated that countries with better institutions tend to have higher levels of income per capita and more robust economic growth trajectories. Their research underscored the importance of IQ in shaping long-term economic outcomes. On the microeconomic side, research has primarily focused on IQ's effect on firm performance, demonstrating a significant impact (e.g., Yasar, Paul, and Ward 2011; Faruq and Weidner 2018; Baumöhl, Iwasaki, and Kočenda 2019; Chang 2023). For instance, Chang (2023) found that firms operating in environments with higher IQ tend to have better performance metrics, including higher profitability and growth rates. However, few studies have examined IQ's impact on firm growth specifically, creating a notable gap in the literature (e.g., Boubakri, El Ghoul, and Saffar 2015).

This study aims to fill this research gap by investigating the potential connection between IQ and SFG. SFG refers to a firm's ability to grow continuously without exhausting its resources or compromising its long-term viability. We posit that there may be a U-shaped relationship between IQ and SFG. Specifically, Low IQ initially generates a decline in SFG until it reaches a certain inflection point, beyond which regulatory efforts to promote good governance, transparency, and accountability begin to support SFG. This suggests that at lower levels of national governance, North African companies struggle to grow. However, once this inflection point is crossed, improvements in national governance can foster development in these firms. Thus, our research question is: Does IQ have a U-shaped effect on SFG?

To address this research question, we utilize a system generalized method of moments (GMM) approach and a sample of publicly listed companies in North Africa. The GMM methodology is particularly suited for this analysis as it helps address potential endogeneity issues and provides robust estimates in the presence of dynamic panel data. This methodological approach allows us to rigorously test the hypothesized U-shaped relationship between IQ and SFG, considering potential regulatory responses to different IQ levels.

The main result reveals that the relationship between IQ and SFG is nonlinear (U-shaped). Specifically, there is an inflection point beyond which improvements in IQ enhance SFG. This finding contributes to the existing literature by challenging the common assumption of linearity in this relationship. Additionally, these insights have practical implications for policymakers and firms, indicating that targeted reforms can generate substantial long-term growth benefits. Future research could examine how this nonlinearity varies across different sectors and regions.

Our study provides several key contributions to the existing literature. First, it expands the understanding of the relationship between IQ and firm growth by introducing and empirically testing the U-shaped hypothesis. Previous studies have predominantly focused on the linear effects of IQ on various economic outcomes, often overlooking the potential for non-linear relationships. By demonstrating a U-shaped relationship, this study offers a more nuanced understanding of how IQ impacts firm growth, particularly in developing economies with varying levels of institutional development. Second, the study provides empirical evidence from North African countries, a region that has been relatively underrepresented in the literature on IQ and firm growth. By focusing on Egypt, Tunisia, and Morocco, we offer insights into how firms in these countries navigate their unique institutional landscapes. This regional focus allows for a deeper understanding of the specific challenges and opportunities that firms face in environments characterized by transitional and often fragile institutional frameworks.

Third, our findings have important policy implications. The U-shaped relationship suggests that while very low levels of IQ hinder firm growth due to inadequate governance and lack of transparency, there exists an optimal level of IQ beyond which further improvements can significantly enhance SFG. This implies that policymakers in North African countries should focus on achieving and maintaining this optimal level of IQ to foster sustainable economic growth. Efforts to enhance governance,

transparency, and accountability should be prioritized to create an environment conducive to SFG. Furthermore, our results indicate that at the initial stages of improving IQ, firms may experience a decline in growth as they adapt to new regulations and governance structures. However, as these institutions become more effective, firms can leverage the benefits of a stable and predictable business environment, leading to enhanced growth prospects. This underscores the importance of sustained and consistent policy efforts to improve IQ as short-term disruptions are likely to be outweighed by long-term benefits.

The study also highlights the importance of considering both macroeconomic and microeconomic perspectives when analyzing the impact of IQ on firm growth. While macroeconomic studies provide valuable insights into the broad economic implications of IQ, microeconomic analyses are crucial for understanding the firm-level dynamics and specific mechanisms through which IQ affects business operations and growth.

The remainder of this paper is organized as follows: Section 2 outlines the theoretical background and hypotheses; Section 3 discusses the methodology adopted in the study; Section 4 presents the analysis of the outcomes; and Section 5 concludes the paper with policy implications and suggestions for future research.

2 | Theoretical Framework and Hypothesis Development

Institutional quality (IQ) plays a critical role in economic development by establishing the framework of laws, regulations, and customs that govern economic activity (Makurumidze et al. 2024; Pata and Karlilar Pata 2024; Noth 1990). High-quality institutions can increase the volume of transactions and reduce transaction costs, which are essential for economic growth. Moreover, IQ influences the behavior of economic agents by providing incentives, reducing uncertainty, and enforcing contracts. However, IQ is not solely determined by economic factors; it is also shaped by historical, political, and cultural contexts. As Noth (1990) emphasizes, institutions are fundamental to fostering economic growth, highlighting the need for governments to prioritize institutional development.

Several institutional theories provide further insights into the relationship between IQ and firm growth. For instance, the Institutional Theory posits that institutions provide the rules and norms that shape economic and social interactions (Scott 2001). This theory underscores the importance of stable and effective institutions in creating a conducive environment for economic activities. According to this perspective, high-quality institutions reduce transaction costs, enhance predictability, and facilitate long-term planning, which are critical for firm growth.

Additionally, the Resource-Based View (RBV) of the firm highlights the importance of accessing and leveraging valuable resources for competitive advantage (Barney 1991). In contexts with high IQ, firms can more effectively utilize their resources due to better protection of property rights and more efficient regulatory frameworks. This access to resources, combined with the ability to innovate and adapt, can significantly enhance firm growth.

The Dynamic Capabilities Theory further complements this understanding by emphasizing the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments (Teece et al. 1997). Firms in high IQ environments are better positioned to develop dynamic capabilities, leveraging stable institutions to innovate and adapt to market changes, thereby driving sustainable growth.

2.1 | Macroeconomic Perspective

From a macroeconomic perspective, several studies have investigated the impact of IQ on economic growth rates. The structure of government institutions and the political process significantly influence the level of corruption, which is more disruptive and expensive than taxation because it is illegal and requires secrecy. Shleifer and Vishny (1993) argue that corruption is particularly damaging to development in less developed countries. Corruption reduces investment, leading to a decline in economic growth (Mauro 1995). Additionally, the involvement of Europeans in certain societies led to an institutional reversal, where institutions that promoted investment were more likely to be introduced in previously underdeveloped regions (Acemoglu, Johnson, and Robinson 2002). Other studies have examined the impact of IQ on investment. Property rights have a more substantial influence on investment than previously believed, surpassing the impact of proxies such as the Gastil indices of liberties or the frequency of political upheavals like revolutions, coups, and political assassinations (Knack and Keefer 1995). Corruption decreases the share of private investment, indicating that it is detrimental to economic development (Mauro 1995; Mo 2001).

Furthermore, studies have analyzed the effect of IQ on total factor productivity. Corruption can reduce the effectiveness of capital productivity through various means, such as x-inefficiency, wasteful rent-seeking, or biased public decisions, rendering governments incapable or unwilling to promote public welfare (Lambsdorff 2003). Bureaucracy negatively influences corporate productivity through the misallocation of resources and its effect on company productivity (Augier, Dovis, and Gasiorek 2012). Economic freedom positively influences total factor productivity (Alexandrakis and Livanis 2013). Companies' productivity progress is impeded by the fragility of property rights protection (Ng and Yu 2014). When the legal environment in which a company operates is weak and unstable, the company may face greater uncertainty and risk regarding issues such as intellectual property theft, unfair competition, and the possibility that customers and suppliers may not fulfill their contractual obligations (Shirokova et al. 2021).

2.2 | Microeconomic Perspective

From a microeconomic perspective, studies have focused on the impact of IQ on firm performance. Property rights protection has a positive effect on firm performance (Yasar, Paul, and Ward 2011). Although institutions are crucial for a company's

performance, their effectiveness is shaped by various cultural attributes. For instance, the cultural context in which firms operate can significantly influence how institutional frameworks are perceived and utilized (Faruq and Weidner 2018). Moreover, the influence of institutions varies across industries; improvements in IQ tend to benefit manufacturing and construction firms but not necessarily those in the service or agriculture sectors. Additionally, institutions can have different effects in different regions (Faruq and Weidner 2018). IQ is an important factor in preventing firm failure, but its impact decreases as the effect is greatest in countries with lower levels of IQ and smallest in those with higher levels of IQ (Baumöhl, Iwasaki, and Kočenda 2019). Improving the quality of institutions can lead to an increase in firm value. Among diverse types of institutions, IQ has the most significant positive impact on firm value (Chang 2023).

2.3 | IQ and SFG

Despite the extensive research on IQ's impact on firm performance, few studies have examined the effect of IQ on firm growth specifically. Effective political institutions are often linked to greater transparency and reduced agency problems in business (Bushman, Piotroski, and Smith 2004; Pagano and Volpin 2005). Political institutions influence firm growth indirectly by impacting market imperfections (Boubakri, El Ghoul, and Saffar 2015). However, the literature has not thoroughly investigated the effect of IQ on SFG.

The relationship between IQ and firm growth can be complex. On the one hand, high IQ provides a stable and predictable environment conducive to business operations and growth. High-quality institutions reduce uncertainties, provide better enforcement of contracts, and ensure property rights, all of which can enhance investment and innovation (Noth 1990). On the other hand, in environments with low IQ, firms may find ways to adapt and innovate despite the challenges. This adaptation may include developing informal networks and relying on personal relationships to mitigate the risks associated with weak formal institutions. This dual nature suggests that the connection between IQ and SFG is likely to follow a U-shaped trend. At very low levels of IQ, firms struggle due to inadequate governance and lack of transparency. As IQ improves, firms initially face increased regulatory burdens but eventually benefit from better governance and reduced corruption, leading to sustainable growth.

Our theoretical framework is grounded in institutional theory (Scott 2001), which is appropriate given that IQ is widely recognized as a fundamental determinant of economic performance. High-quality institutions create an attractive environment for foreign investment and enhance firm profitability by fostering stability, encouraging innovation, and promoting value for money. This theoretical approach reflects our objective (Chang 2023). Building on this, we posit that SFG initially decreases with increasing IQ, as firms face regulatory adjustments and compliance costs. However, beyond a certain threshold, further improvements in IQ yield significant gains in SFG, as firms can capitalize on a stable and transparent business environment. This U-shaped relationship captures the nuanced effects of IQ on firm growth, underscoring the importance of understanding IQ's complex impact on business performance across different contexts. This perspective enriches our theoretical framework and aligns with Lind and Mehlum's (2010) recommendation for rigorously testing U-shaped relationships in economic research.

Based on this theoretical and empirical foundation, we propose the following hypothesis:

Hypothesis 1. *The association between institutional quality (IQ) and sustainable firm growth (SFG) is U-shaped.*

3 | Methodology

3.1 | Data and Sample

This study examines the relationship between IQ and SFG using a sample of 155 non-financial firms listed on three stock markets in North African countries—Egypt, Morocco, and Tunisia—representing 11 distinct industries as classified by Campbell (1996). The analysis covers the period from 2007 to 2020, utilizing financial data sourced from DataStream. This extended timeframe is particularly valuable as it captures significant economic and political events that have shaped the region, including the 2007 subprime crisis, the Arab Spring beginning in 2010, and the COVID-19 pandemic. Each of these events has had substantial impacts on North African economies and business dynamics.

The exclusion of financial institutions from the sample is intentional, due to their unique accounting practices, corporate governance structures, and financial frameworks, which differ considerably from those of non-financial firms (Alshbili and Elamer 2020; Elamer, Boulhaga, and Ibrahim 2024; Elamer and Boulhaga 2024). This approach ensures a more homogeneous sample, enhancing the accuracy of the analysis and interpretation (Elamer and Kato 2025; Selmey and Elamer 2023). The distribution of the sample across each country is provided in Table 1.

3.2 | Econometric Model

The primary aim of this study is to evaluate both the linear and nonlinear relationships between IQ and SFG of listed firms in North African countries. Specifically, the study tests the hypothesis of a U-shaped relationship between IQ and SFG. To

TABLE 1 | Distribution of firms.

Countries	Number of companies	Observations	Percentage
Egypt	91	1274	58.71%
Morocco	39	546	25.16%
Tunisia	25	350	16.13%
Total	155	2170	100%

achieve this, we employ the system GMM approach proposed by Blundell and Bond (1998). The system GMM is suitable for addressing potential endogeneity issues and provides robust estimates in the presence of dynamic panel data.

The empirical model for SFG is formulated as follows:

$$SFG_{cit} = \alpha_i + \beta_1 SFG_{cit-1} + \beta_2 IQ_{ct} + \beta_3 IQ_{ct}^2 + \sum_{n=4}^{11} \beta_n X_{cit} + \mu_t + \varepsilon_{it} \quad (1)$$

where FSG_{cit} is the firm sustainable growth for country c, firm i at time t, IQ_{ct} is the IQ for country c at time t, IQ_{ct}^2 is the quadratic term of IQ to capture the non-linear relationship, X_{cit} is a vector of control variables, μ represents firm-specific fixed effects, ε_{it} is the error term.

3.3 | Definition of Variables

3.3.1 | Dependent Variable

SFG reflects a firm's ability to finance its growth using its own resources instead of relying on external loans. It is frequently used to predict investment in assets, project cash flow, formulate borrowing plans, assess long-term sustainability and profitability, and gauge the durability of extended growth. Following Akhtar et al. (2022), we use the Higgins model (Higgins 1977) to calculate SFG, defined as follows:

$$\text{SFG} = \text{NP} \times \text{AT} \times \text{RR} \times \text{EM} \quad (2)$$

where NT = net profit ratio (post-tax profit to net sales). AT = asset turnover ratio (net sales to total assets). RR = retention ratio (retained earnings to net profit). EM = equity multiplier (total assets to total equity).

3.3.2 | Independent Variables

To measure IQ, we use an arithmetic average method that incorporates all six indicators of the worldwide governance indicators (WGI): voice and accountability (VA), political stability (PS), GE, regulatory quality (RQ), RL, and CC. Higher scores indicate stronger governance within a country. As noted by Kaufmann, Kraay, and Mastruzzi (2011), there is a high correlation among these IQ dimensions, supporting the validity of using an averaged composite measure.

3.3.3 | Control Variables

To assess the impact of IQ on SFG, we consider several control variables that have been mentioned in previous studies. These variables include debt, firm size, asset tangibility, risk, non-debt tax shields, liquidity, inflation, and GDP growth.

Previous studies have indicated that credit access can lower agency costs and enhance growth. Nevertheless, the impact of debt on firm growth may differ based on the specific situation and context. In line with agency theory, debt can have a favorable effect on growth by serving as a means of discipline that resolves conflicts of interest between stakeholders, such as managers and shareholders. In certain situations, having debt can limit growth opportunities (Jensen and Meckling 1976 and Jensen 1986). However, according to the trade-off theory, debt can also have a negative impact on growth in some cases because it creates a conflict of interest between borrowers (managers) and lenders (creditors) (Bradley, Jarrell, and Kim 1984). In summary, the leverage effect can have both positive and negative outcomes on corporate investments depending on the situation and the stakes involved. Financial health is often measured by the ratio of long-term debt's book value to total assets at a given time (Khémiri and Noubbigh 2021).

To ensure that our analysis is accurate, we check for the effect of size, as larger companies typically face fewer financial constraints, as demonstrated by previous research. We measure size by taking the natural logarithm of the company's total assets. We also include tangibility as a control variable, which reflects a firm's capacity to secure external financing. Tangibility is calculated by dividing tangible assets by total assets, as stated by Khémiri and Noubbigh (2021).

Overall, these control variables allow us to better understand the determinants of SFG. We have incorporated the AZ variable into our model, following the works of Altman (1983) and Akhtar et al. (2022). This variable is measured by Altman's Z-score, which is calculated using the following formula: 1.2*(working capital/total assets) + 1.4*(net income/total assets) + 3.3*(earnings before interest and taxes/total assets) + 0.6*(book value of equity/total book value of liabilities) + 0.999*(sales/total assets). The Z-score allows us to evaluate the level of financial distress of the firm. Indeed, Akhtar et al. (2022) have highlighted the positive and significant effects of risk on firm growth. Therefore, it is necessary to include another variable in our model, namely the variable of non-debt tax shields (NDTS), determined by the ratio of depreciation to total assets (as indicated by Akhtar et al. 2022). They also showed that NDTS had a positive and significant impact on firm growth. We have also included the Liquidity variable in our model to evaluate the company's ability to meet its short-term commitments. To do this, we used the current assets to current liabilities ratio, following the previous works of Rahaman (2011), Khémiri and Noubbigh (2021), and Akhtar et al. (2022). Additionally, we introduced inflation and GDP growth as control variables in our model to respectively control for macroeconomic stability and economic conditions (Akhtar et al. 2022 and Khémiri and Noubbigh 2021). All variables are presented in Table 2.

4 | Findings and Discussions

4.1 | Diagnostic Test

To ensure the reliability and validity of our regression results, we performed several diagnostic tests. Table 3 displays the results of the variance inflation factor (VIF) test, which indicates the absence of multicollinearity among the independent variables. Additionally, the Pearson correlation results corroborate this finding, showing no significant multicollinearity between the variables, as suggested by Gujarati.

TABLE 2 | Variable definition.

Variables	Acronyms	Definition	Source
Dependent variable			
Sustainable firm growth	SFG	NP *AT * RR * EM	Refinitiv Eikon (datastream)
Independent variable			
IQ	FI	Composite variable. PCA is used for calculating the composite variable. IQ represents FI indicator using min-max normalization.	IMF FAS and authors' own calculation
Control variables			
Debt long term	DEBT	Total debt total assets	Refinitiv Eikon (Datastream)
Firm size	SIZE	The natural logarithm of total assets	
Asset tangibility	TAN	Fixed assets to total assets	
AZ	AZ	Altman's Z-score	
Non-debt tax shields	NDTS	Depreciation to total assets	
Liquidity	LIQI	Current assets to current liabilities	
Inflation	INF	Consumer prices index (annual %)	WDI
GDP growth	GDP	GDP growth rate (annual %)	WDI

Note: WDI is World Development Indicators and FAS is International Monetary Fund Financial Access Survey.

4.2 | Descriptive Statistics

Table 4 presents the descriptive statistics for all variables from 2007 to 2020. The mean SFG of 0.301, with a standard deviation of 1.745, highlights considerable heterogeneity in SFG. This variability suggests that growth rates among firms are highly variable and can even be negative, indicating that SFG is likely influenced by factors such as leverage, size, and risk. The mean and standard deviation for IQ are negative and low, at −0.560 and 0.275, respectively, suggesting generally low levels of IQ within the sample, which could restrict SFG, as IQ is widely recognized as beneficial for firm performance.

The debt ratio (DEBT) has a mean of 0.231 and a standard deviation of 0.206, reflecting moderate dispersion and a generally conservative approach to debt across firms. In contrast, firm size (SIZE) is highly dispersed, with a mean of 12.273 and values ranging from 7.713 to 18.25, indicating substantial differences in resource availability and risk tolerance among firms. The average tangibility ratio is 0.275, suggesting a low reliance on tangible assets, which may hinder firms' borrowing capacity but provide flexibility in asset management. Firm risk exhibits relatively high dispersion, with a mean of 1.748 and a standard deviation of 2.291, indicating varying levels of risk across firms. This variation could present greater growth opportunities for some firms, albeit with increased volatility. Non-debt tax shields (NDTS) show low and relatively stable values, with a mean of 0.033, potentially limiting the attractiveness of debt financing.

Liquidity (LIQI) has an average of 0.520, although some firms maintain very low liquidity levels (with a minimum of 0.005). This variability may limit firms' ability to increase liquidity in volatile conditions. Finally, the inflation rate (INF) and GDP growth (GDP) have means of 0.086 and 0.018, respectively, indicating moderate inflation and slow economic growth. This economic context suggests a tempering effect on growth opportunities, aligning with cyclical economic conditions. Collectively, these variables depict a complex environment where firm growth is influenced by multiple, often interdependent, factors.

4.3 | The Impact of IQ and SFG

The primary goal of this section is to assess the effect of IQ on SFG using the system GMM estimator. The J-Hansen test results, reported in Table 5, confirm the validity of the instrumental variables, and the AR (2) test results show no second-order autocorrelation, further validating the use of the system GMM estimator.

The results presented in Columns (1) and (2) of Table 5 indicate that the lagged SFG variable SFG_{t-1} is positive and statistically significant at the 1% level. This suggests that current growth is positively influenced by past growth, although the rate of growth is declining, reflecting the presence of weak growth dynamics among North African businesses. These findings are consistent with Akhtar et al. (2022) but contradict previous studies such as Molinari (2013) and Khémiri and Noubbigh (2021).

IQ exhibits a negative impact on SFG at the 1% significance level. Specifically, a one standard deviation decrease in IQ is associated with a 0.196 (-1.388×0.141) decrease in SFG, representing 29.148% of its mean ($-1.388/0.210$). This implies that higher IQ does not necessarily enhance firm growth, which aligns with Noth's (1990) argument that more regulations

TABLE 3 | Correlation matrix.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	VIF
(1) SFG	1.000											
(2) SFGS	0.141*	1.000										
(3) IQ	−0.041*	−0.002	1.000									1.03
(4) DEBT	0.060*	0.023	0.014	1.000								1.11
(5) SIZE	0.063*	0.086*	0.038	0.061*	1.000							1.02
(6) TANG	0.040	−0.024	−0.060*	0.121*	0.019	1.000						1.38
(7) VOL	−0.055*	0.007	−0.016	−0.244*	−0.057*	−0.243*	1.000					1.22
(8) NDTS	0.065*	0.063*	−0.096*	0.190*	0.070*	0.396*	−0.069*	1.000				1.35
(9) LIQ	0.006	0.045*	−0.027	−0.001	0.036	−0.211*	−0.062*	−0.047*	1.000			1.09
(10) INF	0.005	0.011	−0.063*	−0.019	−0.068*	0.039	0.216*	−0.221*	−0.161*	1.000		1.21
(11) GDP	−0.138*	−0.077*	0.047*	−0.090*	−0.035	0.011	0.088*	−0.056*	−0.072*	0.126*	1.000	1.04
Mean VIF												1.32

*Significance at the 5% level.

TABLE 4 | Descriptive statistics.

Variable	Obs.	Mean	SD	Min	Max
SFG	2170	0.301	1.745	−48.938	18.785
SFGS	2170	0.069	0.408	−1.151	9.495
IQ	2170	−0.560	0.275	−0.947	−0.143
DEBT	2170	0.231	0.206	0	1.059
SIZE	2170	12.273	2.155	7.713	18.25
TAN	2154	0.275	0.212	0	0.896
Risk	2170	1.748	2.291	−2.713	12.609
NDTS	2170	0.033	0.031	0	0.174
LIQI	2170	0.520	0.270	0.005	0.929
INF	2170	0.086	0.064	−0.007	0.229
GDP	2170	0.018	0.024	−0.097	0.056

and restrictions can limit growth potential. Additionally, stronger enforcement of property rights in high-IQ countries may create barriers for firms to acquire necessary resources for growth. Firms in low-IQ countries, conversely, tend to be more innovative and flexible, adapting to changing market conditions more effectively.

4.3.1 | U-Shaped Relationship Between IQ and SFG

Column (2) of Table 5 indicates a significant negative impact of IQ on SFG, and a positive effect of the quadratic term (IQ^2). To confirm the U-shaped relationship, we follow the methodology by Lind and Mehlum (2010), which requires analyzing the lower and upper bounds, as well as the extreme point. The lower bound slope needs to be negative and significant, while the upper bound slope must be positive and significant. Furthermore, the extreme point must be located between the extreme values of the curve. The conditions are met, confirming the U-shaped relationship between IQ and SFG as presented in Figure 1 and Table 6. This indicates that firms on the left side of the curve experience a decrease in SFG as IQ levels rise, while firms on the right side see increased SFG beyond the inflection point (0.289).

All variables retained their sign and level of significance. In short, at the level of Column (1), the positive relationship between the GDP growth rate and SFG of listed firms in North Africa indicate that the region's sustained economic growth encourages firm growth. This is due to the fact that vigorous economic growth boosts demand for goods and services, leading to more sales and profit margins for firms listed on the stock exchange.

The analysis of firm-level variables in Column (1) of Table 5 reveals several significant findings. A positive correlation between debt and SFG suggests that leveraging debt promotes firm continuity by reducing equity capital costs and benefiting from tax advantages, enabling timely investments and growth, consistent with Akhtar et al. (2022). Firm size also positively

TABLE 5 | Main outcomes.

Dependent variable: SFG	(1)	(2)
Variables	**Linear**	**Curvilinear**
L.SFG	0.213***	0.185***
	(0.031)	(0.032)
IQI	−0.142***	−2.501***
	(0.045)	(0.312)
IQI^2		2.354***
		(0.278)
DEBT	0.333***	0.387***
	(0.068)	(0.054)
SIZE	0.017*	0.014
	(0.009)	(0.009)
TAN	0.017	0.050
	(0.063)	(0.074)
Risk	−0.010**	−0.010**
	(0.005)	(0.005)
NDTS	1.710**	1.438**
	(0.689)	(0.654)
LIQI	0.013	−0.002
	(0.038)	(0.038)
INF	0.694***	0.774***
	(0.114)	(0.122)
GDP	−2.564***	−1.602***
	(0.317)	(0.264)
Constant	−0.146	0.438***
	(0.121)	(0.129)
Observations	1688	1688
Number of firms	155	155
Firm fixed effect	YES	YES
Number of instruments	57	57
AR (2) test (*p*-value)	0.156	0.117
Hansen test (*p*-value)	0.408	0.105

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are displayed in parentheses.

correlates with SFG, indicating that larger firms grow faster than smaller ones, supporting Gibrat's law. Conversely, the negative coefficient for asset tangibility (TANG) highlights that North African firms' lack of tangible assets hampers their growth and access to external funding, aligning with findings by Khémiri and Noubbigh (2021). The AZ variable's negative coefficient indicates high financial distress and risk of bankruptcy, contradicting Akhtar et al. (2022). The positive and significant non-debt tax shields (NDTS) coefficient suggests

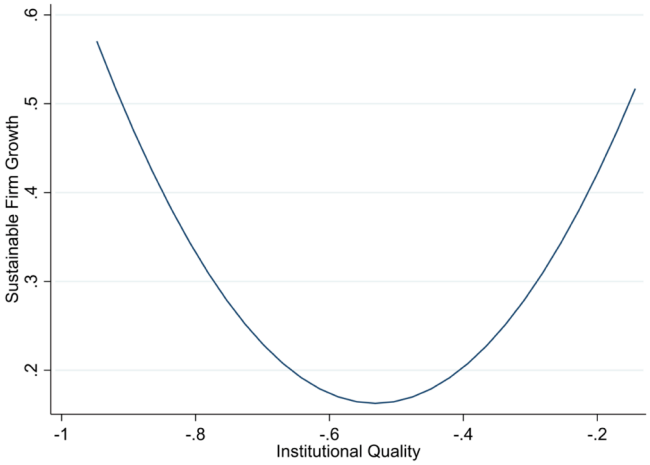

FIGURE 1 | Inverted U-shaped relationship between IQ and SFG.

TABLE 6 | Test for the U-shaped curve.

Group	Lower bound	Upper bound
Interval	−0.947	−0.143
Slope	−1.959***	1.826**
	(−4.583)	(1.662)
Overall test		
t-value	7.82	
p-value	0.000	
Extreme point	−0.531	

Note: t-values are in parentheses. **, *** denote significance at 5% and 1% levels respectively.

that investment in long-term assets, such as buildings and machinery, enhances firm growth by maximizing tax benefits. Additionally, the negative impact of inflation on SFG reflects reduced consumer purchasing power, affecting sales and demand. Overall, these findings underscore the complex interplay between firm-specific and macroeconomic variables in influencing SFG in North Africa.

4.4 | Robustness Checks

To ensure the robustness of our findings, we performed additional tests by changing the SFG indicator to Van Horne's static model (SFGS) as suggested by Zhang and Chen (2017) and Akhtar et al. (2022) measured by the following equation:

$$\text{SFGS} = \text{Retained Profits} \times \text{Net Profit Rate} \times \left(1 + \frac{\text{Debt}}{\text{Equity}}\right) \times \left\{\frac{1}{\left(\frac{\text{Total Assets}}{\text{Total Sales}}\right)} - 1\right\} \quad (3)$$

The results, presented in Table 7, also indicate a U-shaped relationship between IQ and SFGS.

To further validate the robustness, we employed static methods (fixed and random effects) with robust standard errors, using

TABLE 7 | Robustness checks (change of dependent variable).

Dependent variable: SFGS	(1)	(2)
Variables	**Linear**	**Curvilinear**
L.SFGS	1.090***	0.714***
	(0.003)	(0.014)
IQI	−0.013***	−0.075***
	(0.002)	(0.018)
IQI^2		0.065***
		(0.014)
DEBT	−0.001	−0.008
	(0.002)	(0.007)
SIZE	0.000	0.001
	(0.000)	(0.001)
TAN	0.000	−0.014*
	(0.005)	(0.007)
Risk	−0.002***	0.001
	(0.000)	(0.001)
NDTS	−0.196***	0.363***
	(0.030)	(0.056)
LIQI	−0.000	0.004
	(0.002)	(0.005)
INF	0.013***	0.056***
	(0.004)	(0.010)
GDP	−0.243***	−0.441***
	(0.017)	(0.047)
Constant	0.027***	0.014
	(0.006)	(0.010)
Observations	1688	1688
Number of firms	155	155
Firm fixed effect	YES	YES
Number of instruments	92	84
AR (2) test (*p*-value)	0.084	0.091
Hansen test (*p*-value)	0.296	0.310

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are displayed in parentheses.

TABLE 8 | Robustness checks (change of econometric technique: FGLS).

	(1)	(2)
Variables	**SFG**	**SFG**
IQ	−0.121***	−1.704***
	(0.028)	(0.209)
IQ^2		1.543***
		(0.187)
DEBT	0.107**	0.178***
	(0.046)	(0.052)
SIZE	0.026***	0.021***
	(0.004)	(0.004)
TAN	0.080*	0.061
	(0.044)	(0.048)
VOL	−0.021***	−0.018***
	(0.004)	(0.004)
NDTS	2.406***	2.138***
	(0.356)	(0.390)
LIQI	0.051*	0.086**
	(0.031)	(0.034)
INF	0.322**	0.464***
	(0.132)	(0.153)
GDP	−4.230***	−3.283***
	(0.322)	(0.354)
Constant	−0.176***	0.244***
	(0.060)	(0.074)
Observations	1820	1820
Number of firms	155	155
Wald test	0.000	0.000
Hausman test	0.040	0.045
Heteroscedasticity test	0.000	0.000
Autocorrelation test	0.000	0.000

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively. Standard errors are displayed in parentheses.

the SFG measure examined in Table 5. The outcomes of the Hausman specification test (Hausman 1978) show that random effect model is more appropriate than fixed effect. In addition, we applied Feasible generalized least squares (FGLS) to address the possible heteroskedasticity and autocorrelations.

The results, shown in Table 8, confirm the U-shaped relationship between IQ and SFG, consistent with previous findings.

4.5 | Discussion

The findings of this study reveal a complex relationship between IQ and SFG in North African countries. The significant U-shaped relationship suggests that both very low and very high levels of IQ are associated with limited firm growth, while an optimal level of IQ promotes substantial growth. This result indicates that firms in countries with poor IQ struggle due to inadequate governance and lack of transparency. As IQ improves, firms initially face increased

regulatory burdens but eventually benefit from better governance, leading to enhanced sustainable growth.

The negative impact of IQ on SFG at low levels can be attributed to excessive regulatory burdens and enforcement mechanisms that stifle innovation and flexibility. Conversely, the positive impact at higher levels of IQ reflects the benefits of a stable and predictable business environment, where firms can leverage better governance and transparency to achieve sustainable growth.

From an economic perspective, these results can be attributed to the distinct institutional frameworks and economic environments in North African countries, which differ significantly from those in developed economies. In recent years, Egypt has enacted several institutional reforms aimed at improving its regulatory and business environment. However, cumbersome regulations and persistent corruption remain major barriers to development. The World Bank has repeatedly highlighted Egypt's slow progress in reducing bureaucratic inefficiencies and enhancing governance. These challenges create high compliance costs for companies navigating complex regulations, which hampers their capacity for stable growth. For many Egyptian companies, especially smaller ones, overcoming such regulatory hurdles is daunting, potentially explaining why quality institutions have a limited impact on sustainable growth.

In contrast, Morocco has pursued a different trajectory, implementing governance and institutional reforms to improve the business climate and bolster corporate resilience. Compared to Egypt, Morocco has relatively effective policies for enhancing regulatory transparency and facilitating business operations, which helps firms achieve higher sustainable growth. However, rigidities in the labor market and limited access to financing for small businesses remain significant challenges. Despite these issues, Morocco's more enabling institutional framework—though not without its own limitations—offers a comparatively stable environment for business growth relative to other North African countries.

Tunisia, on the other hand, has experienced mixed operating conditions amid ongoing institutional volatility since its governmental transition. Firms face risks from shifting regulatory frameworks, and political instability impedes sustainable business growth by creating uncertainty around institutional reliability, which deters investment and hinders long-term planning. With the slow pace of reform and ongoing corruption issues, Tunisia's business climate remains unpredictable, limiting companies' capacity to capitalize on opportunities for sustainable growth.

From a regional and global comparative perspective, businesses in these North African economies operate in an institutional environment markedly different from those in developed markets. While IQ is widely recognized as a key determinant of corporate growth globally, its impact in these emerging markets is less predictable due to higher regulatory burdens and frequent political instability. Unlike in developed economies—where stable and transparent institutions support business growth—companies in North African countries often encounter inconsistencies and obstacles that hinder their pursuit of sustainable growth.

5 | Conclusion and Policy Implications

This study explores the relationship between IQ and SFG through an econometric analysis using panel data from 2007 to 2020, covering 155 non-financial firms in Egypt, Morocco, and Tunisia. The findings reveal a U-shaped relationship between IQ and SFG, indicating that low IQ levels constrain firm growth due to weak regulatory frameworks, corruption, and inadequate property rights protection, while high IQ levels facilitate significant growth due to improved IQ. An optimal level of IQ allows firms to maximize their growth potential, highlighting the critical role of institutions in economic development. Additionally, financial and macroeconomic variables were found to significantly impact SFG.

This study makes several significant contributions to the existing literature. First, it advances our understanding of the non-linear relationship between IQ and firm growth, a topic that has been relatively underexplored. By demonstrating the U-shaped relationship, the study provides a nuanced perspective on how different levels of IQ affect firm growth, particularly in developing economies. Second, the research offers empirical evidence from North Africa, a region that has not been extensively studied in the context of IQ and firm growth. This regional focus provides valuable insights into the specific challenges and opportunities that firms face in these countries. Third, the study's methodological approach, utilizing the system GMM, addresses potential endogeneity issues and provides robust estimates, contributing to the rigor of empirical analyses in this field.

These findings carry important managerial and policy implications for firms and policymakers in North Africa. For firms operating in environments characterized by low IQ, it is essential to develop robust internal governance structures, foster relationships with local authorities, and implement effective risk management practices to navigate institutional weaknesses. Managers should establish mechanisms to monitor institutional changes, identify potential risks, and capitalize on opportunities arising from shifts in the institutional landscape.

Policymakers, on the other hand, must strike a delicate balance between regulation and market flexibility. Over-regulation can stifle growth, while under-regulation can lead to market inefficiencies and adverse outcomes. Achieving SFG requires a long-term commitment to improving IQ, investing in education, and developing infrastructure. Governments should be prepared to allocate resources consistently to enhance IQ and create an enabling environment for firms to thrive.

These findings have significant policy implications. Policymakers in North African countries should aim to achieve and maintain an optimal level of IQ to foster a conducive environment for business growth. This requires a balanced approach that combines regulatory reforms, anti-corruption measures, and efforts to enhance transparency and accountability. Improving IQ to

an optimal level can significantly enhance SFG, contributing to broader economic development goals.

Despite its contributions, this study has several limitations. First, the sample is limited to non-financial firms in three North African countries, which may not fully capture the diversity of institutional environments across different regions and sectors. Future research should consider expanding the sample to include a broader range of countries and industries. Second, the study covers a period up to 2020, and the dynamic nature of institutional changes means that more recent data could provide additional insights. Third, while the study focuses on formal IQ, it does not account for informal institutions and cultural factors that could also influence firm growth. Incorporating these dimensions could offer a more comprehensive understanding of the institutional context. Finally, the study primarily uses secondary data sources, and future research could benefit from primary data collection to capture firm-specific strategies and responses to institutional challenges.

Future research could expand this study to other African countries to further explore the relationship between IQ and SFG. Additionally, prospective studies could focus on the specific strategies firms should adopt to cultivate and leverage IQ for strengthening their growth processes. This would provide deeper insights into how firms can effectively operate and grow in varying institutional contexts. Further research could also examine the role of informal institutions and cultural factors in shaping firm growth, providing a more holistic view of the institutional environment.

Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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