The Impact of AI and technology to measure impact of Internet usage & mobile cellular subscriptions on Stock market capitalization rate for Arab Countries

تأثير الذكاء الاصطناعي والتكنولوجيا لقياس اثر استخدام الإنترنت واشتراكات الهاتف المحمول على معدل القيمة السوقية للأسهم في الدول العربية

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Abstract:

Artificial intelligence (AI) and technology approaches have been increasingly used in financial markets. The global technology revolution has had a profound and lasting effect on the world. The stock market capitalization in Arab countries has also witnessed these changes. This thesis attempted to investigate the impact of artificial intelligence and technology on the stock market capitalization rate in Arab countries. Econometric and statistical analysis using panel regression has been adopted to test this impact, especially for Middle Eastern countries, such as Bahrain, Kuwait, Egypt, Qatar, Oman, Morocco, Tunisia, Lebanon, Saudi Arabia, Jordan, and the United Arab Emirates from 2010 until 2022. Middle Eastern countries were selected according to the availability of data, and they represent the majority of Arab countries, which adapt quickly to the use of AI and technology. The model includes the dependent variable, the stock market capitalization rate, as an indicator for stock market capitalization. While concerned, the

independent variables are Internet usage and mobile cellular subscriptions as indicators for AI and technology.Then, we extended the model with other macroeconomic control variables (gross domestic product, inflation rate, number of traded stocks, trade, high technological trade, and foreign direct investment). The findings illustrate that internet usage and the number of traded stocks have a significantly positive impact. In contrast, mobile cellular subscriptions, high technological exports, and the inflation rate significantly negatively impact Middle Eastern countries' stock market capitalization rates.

المستخلص:

تم استخدام أساليب الذكاء الاصطناعي والتكنولوجيا بشكل متزايد في الأسواق المالية. لقد كان للثورة التكنولوجية العالمية تأثير عميق ودائم على العالم. كما شهدت القيمة السوقية للأسهم في الدول العربية هذه التغييرات. ولهذا السبب جذبت مناهج الذكاء الاصطناعي والتكنولوجيا اهتمامًا بحثيًا واسع النطاق منذ التسعينيات.

لذلك، حاولت هذه الرسالة التحقيق في تأثير الذكاء الاصطناعي والتكنولوجيا على معدل القيمة السوقية للأسهم في الدول العربية. تم اعتماد التحليل القياسي والإحصائي باستخدام الانحدار اللوحي لاختبار هذا التأثير، وخاصة بالنسبة لدول الشرق الأوسط، مثل البحرين والكويت ومصر وقطر وعمان والمغرب وتونس ولبنان والمملكة العربية السعودية والأردن والإمارات العربية المتحدة. الفترة التي تركز عليها الورقة هي من عام 2010 حتى عام 2022. وتم اختيار دول الشرق الأوسط وفقاً لتوافر البيانات، وهي تمثل غالبية الدول العربية، التي تتكيف بسرعة مع استخدام الذكاء الاصطناعي والتكنولوجيا. تم استخدام نموذجً أساسي يتضمن المتغير التابع، معدل القيمة السوقية للأسهم، كمؤشر لقيمة سوق الأسهم. المتغيرات المستقلة الرئيسية المعنية هي استخدام الإنترنت واشتراكات الهاتف الخلوي المحمول كمؤشرات للذكاء الاصطناعي والتكنولوجيا. بعد ذلك، تم تطبيق النموذج بمتغيرات التحكم الاقتصادي الكلي القياسية الأخرى (الناتج المحلي الإجمالي، ومعدل التضخم، وعدد الأسهم المتداولة، والتجارة، والتجارة التكنولوجية العالية، والاستثمار الأجنبي المباشر). توضح النتائج أن استخدام الإنترنت وعدد الأسهم المتداولة لهما تأثير إيجابي كبير على معدل القيمة السوقية للأسهم. في حين أن اشتراكات الهاتف الخلوي المحمول والصادرات التكنولوجية العالية ومعدل التضخم لها تأثير سلبي كبير على معدلات القيمة السوقية للأسهم لدول الشرق الأوسط.

الكلـمات المفتـاحية: الذكاء الاصطناعي، استخدام الإنترنت، اشتراكات الهاتف المحمول، عدد الأسهم المتداولة، الناتج المحلي الإجمالي، معدل التضخم، التجارة، التجارة التكنولوجية العالية، الاستثمار الأجنبي المباشر، ومعدل القيمة السوقية للأوراق المالية.

1. Introduction

Technology is a stock of specie, which tosses into head-tail outcomes. Irrespective of its win-loss situation that makes current investment obsolete, proponents view technology as a giant catalyst that irrevocably lowers costs. Many firms have saved money on staff and paperwork through electronic order processing, billing, and e-mail (Strauss et al. 2003).

The definition of artificial intelligence, according to (McCarthy, 2004), is "the science and engineering of making intelligent machines and computer programs.". It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to biologically observable methods".

A study by Singh (2024) shows that fintech players are using technologies like blockchain and artificial intelligence to offer new solutions to meet several financial needs. Blockchain technology opens up new opportunities for business finance, from facilitating digital identity to improving supply chain management. The Internet now makes it possible for people to browse the stock market information available to make instant decisions about their investments, such as which company to buy or sell shares of. These factors have influenced recent stock market development. Therefore, technology is the primary factor that significantly influences stock market growth.

According to (Bogan, 2008), the Internet in the past decade has significantly altered how investors trade stocks. The Internet has mitigated three proposed causes for low stock market participation: transaction costs, information costs, and limited access. Moreover, they mentioned that the stock markets introduced Internet trading (online trading) in February 2002, which has brought a tremendous change in trading. With the growth of Internet trading, businesses can reduce costs by more readily providing goods and services to

several markets. They defined online trading as buying and selling assets through a broker's internet-based proprietary trading platform, e-trading, or self-directed investing. (Jaiswal, Joge, and Saw 2018).

To fully achieve the potential of this revolution, issues like cybersecurity risks, complicated regulations, and gaps in digital literacy must be resolved. Furthermore, it is still crucial to make sure that the advantages of digitalization are available to all aspects of society.(Singh and Ranjan, 2024).

Stock market development lacks an indicator for measuring. The market capitalization ratio, which is calculated by dividing market capitalization by GDP, is the most widely used measurement of stock market size. This ratio indicates the market's ability for risk diversification and capital mobilization, as well as its relationship to the size of the economy.(Ezirim, Adebajo, Elike, and Muoghalu, 2009).

2.Research problem

The rapid development of artificial intelligence (AI) and technology has altered several industries, including financial markets, as it is a critical indicator for economic growth and development. Despite extensive research in AI and technology, there is still a need to identify the impact of AI and technology on stock market capitalization rates.**Therefore,** the research problem could be "What is the impact of AI and technology on the stock market capitalization rate, especially in Middle Eastern countries? The study will implement all econometric tools needed to investigate the effect of AI and technology on the stock market capitalization rate in Middle Eastern countries.

3 .Literature review

The term artificial intelligence appeared for the first time in the proposal for the Dartmouth Summer Research Project on Artificial Intelligence, which was held in 1956 (McCarthy et al., 1955). Later

the same year, the Logic Theorist was introduced, becoming the first fully functional AI capable of self-improvement (McCorduck 2004, p. 170), starting a technological revolution that would affect the world of finance among many other business sectors.

According to OECD (OECD, 2016) and UNTD (UNTD, 2017), AI was defined as the ability of machine systems to acquire and apply knowledge and to carry out intelligent behavior. This included a variety of cognitive tasks (e.g., sensing, processing oral languages, reasoning, learning, and making decisions) and the ability to move and manipulate objects accordingly. Intelligent systems use a combination of big data analytics, machine-to-machine communication, and the Internet of Things (IoT) to operate and learn.

Today, due to Internet access and the use of information technology in all human societies, the world is rapidly becoming an information society, as the internet is growing fast in all aspects of human life. Nowadays, citizens must be prepared in intellectual and cultural fields of information technology development because there is a direct relationship between the nation's economic health and skills. Creating information technology systems, especially in the capital market, is the essential factor that facilitates work and achieves the goals easily. This will be possible with the growth in online trading and assuring investors about their safety and property information. (Jaiswal, Joge, and Saw, 2018).

The objective of the other study was to explore the impact of Internet growth/IT on stock trading in India. In India, corporations used the online trading system to create a completely automated screen-based bidding system that allows trade members to place bids on behalf of their clients. The steps taken by the government of India through IT policy have paid a rich dividend in the form of an increase in the share of IT in GDP, foreign exchange reserves, and foreign direct investment from multinationals in the IT sector

(Bajwa 2003). Results show that India is emerging as the fastest hub in the world, as IT's contribution to the country's GDP has increased from 1.2% in 1997-98 to 5.2%in 2006-07 and approximately 60 million internet users in India, nearly one-third of this number are doing financial transactions over the internet like online banking, stock trading, and e-commerce. (Jaiswal, Joge, and Saw, 2018)   .

(Brad M. Barber and Terrance Odean, 2002) Surveyed 1,607 investors who switched from phone to online trading in the 1990s. Before switching to online trading, they were online, generating more than 2% of their business every year. After they got online, their business increased. Its annual turnover is over 3%. Reduced trade (lower prices, faster trade, and easier access). They found that investors who chose to invest online performed better than those who did not. The idea is that overconfidence causes them to switch, but then the over-switch trade eats into their profits. (Singh, 2024).

A study (Bogan, 2008) examined the relationship between internet usage and stock market participation for individuals. He used the Health and Retirement Survey (HRS) to answer questions about internet usage. Due to the Internet, participation costs may have declined more for computer/Internet users than non-users. If this is the case, we should expect a significant rise in stock market participation among computer users to test for changes in individual participation .

In addition, similar models were used by (Hong, Kubik, and Stein, 2004), (Blume and Zeldes,1994), and (Bertaut,1998). The results conclusively support the idea that households that use computers/Internet increased participation substantially more than households that do not use computers/Internet.

According to the Health and Retirement Survey (HRS), internet usage was defined as the regular use of the World Wide Web, or the Internet, for sending and receiving e-mail or for any other purpose,

such as making purchases, searching for information, or making travel reservations.(Glaser and Klos,2013).

(Glaser and Klos, 2013) Examined whether Internet usage has a positive and causal effect on stock market participation rates by analyzing data from three representative household panel surveys from Germany and the US and Retirement Study (HRS). The results show a positive and causal effect of internet use on stock market participation.

Reviews of industry websites also indicate that 65% of financial services firms provide online investment tools via mobile platforms (Roper, 2014).

(Barber and Odean,2001) Examined the effect of Internet connectivity on trading activity for investors and evidence that Internet access increases stock market activity.(Barber and Odean,2001) Attribute much of this improvement to the ease of trading and breadth of information available to Internet investors.

Investors are increasingly using mobile devices to gather information and make investments. (Miller and Skinner, 2015; Agarwal and Chua, 2020).

In addition, a study in China proves a significant growth rate of mobile trading and a continuous increase in the mobile trading ratio. Mobile trading has increased gradually since 2010 and accounts for a large share of the total trading amount (from 2.88% in 2010 to 42.68% in 2018). (Li, Diao, and Wu,2022).

However, (Brown et al., 2020) suggested that mobile-induced distractions could cause market participants to neglect information pertinent to the market or the need/desire to trade, which, in turn, impedes overall stock market activity.

(Brown, Elliott, Wermers, and White, 2022), investigated the impact of mobile internet technology on stock market activity, especially examining whether it enhances information gathering or serves as a distraction for investors. They discovered that when

mobile internet systems are unavailable, trading volume and frequency increase by roughly 5%. This indicates that when devices are inaccessible, they have a significant impact on distracting investors' limited attention away from trading and information gathering   .

According to (McKenzie and Faff,2003), the condition correlation of stock returns is highly dependent on trading volume for individual stocks but not for the index, reflecting that liquidity disparity for stocks has a significant impact at the individual level but not at the aggregate level.

Moreover, (Norton,1992) examined cross-sectional data from 47 countries over the 1957-1977 period and concluded that "the telephones provide substantial growth- and investment-enhancing activity and thus facilitate economic development".

Another study investigated how the deployment of broadband lines affected economic growth among 22 OECD countries between 2002 and 2007 while controlling for two-way causal relationships between economic growth and telecommunications infrastructure. The results suggested a significant and positive impact on the economic development of broadband infrastructure.(Koutroumpis, 2009).

(Gardner, Lee, Alford, Cresson, & Gardner, 2017) used FDIit / GDPit is the net inflow of foreign direct investment (FDI) as a percent of the country's GDP and is included to control for the level of openness or globalization of a country's financial sector. In addition, the gross domestic product growth rate is a measure of economic activity. The inflation rate is measured by the price increase index and its correlation with the stock market. (Yang, 2023) .

An empirical analysis examined the relationship between technological performance and export for nine developing countries in 1985–1998: Argentina, Brazil, China, Colombia, India,

Malaysia, Mexico, 9 Singapore, and Thailand and export shares. (Montobbio, & Rampa,2005) The results showed that in countries like China, Malaysia, Singapore, and Thailand, the share of medium and high-tech products in total exports improved substantially. Therefore, there is an important relation between stock market return and macroeconomic variables for understanding the financial performance in the capital market (Ouma and Muriu, 2014) .

Stock market capitalization is identified as the measure of the corporate size of a country. It shows the current stock price multiplied by the number of outstanding shares. It is commonly referred to as Market cap. This term is often confused with capitalization, which is the total amount of funds used to finance a firm's balance sheet and is calculated as market capitalization plus debt (book or market value) plus preferred stock. While there are no strong definitions for market cap categorizations, a few terms are frequently used to group companies based on their capitalization. (Jaiswal,Joge, & Saw, 2018).

(Gardner, Lee, Alford, Cresson, and Gardner, 2017) estimate a model by using the market capitalization as the dependent variable of listed domestic companies, as a percent of GDP in the country. Information communication technology within the country at the time is ICTit. Three specifications for ICTit are considered the number of mobile cell subscriptions per 100 people, the number of internet users per 100 people, and the number of fixed broadband subscriptions per 100 people as independent variables. The results show that the number of mobile cell subscriptions, internet users, and fixed broadband subscriptions per 100 people each have a positive and statistically strong effect on stock market capitalization.

Arab stock exchanges have grown substantially in recent decades, with more listed companies and larger stock market capitalizations. In light of this tremendous rise, this study seeks to

identify the most important variables and economic factors influencing this development from 2006 to 2017. Using panel data models, the results show that trade openness, market liquidity, money supply, and economic growth all have positive effects on stock market development Based on these findings, efforts should be implemented to boost market liquidity, limit the money supply, and maintain a balanced economic growth rate to encourage the development of Arab stock exchanges. (Chiad et al., 2021).

Finally, Simulations show that by 2030, AI will contribute approximately \$13 trillion to the world economy, which indicates an increased GDP growth of 1.2% yearly.70% of companies will have implemented AI in their business to some degree by 2030 .

Moreover, simulations show that companies that fully adopt AI into their business are estimated to gain a 50% boost in cash flow by 2030. Meanwhile, non-adopters may gain a 20% decline in cash flow from today's levels if considering the same cost and revenue models as today (Bughin et al., 2018) .

According to the abovementioned literature, this study aims to investigate the relationship between the use of AI and technology on the stock market capitalization in Middle Eastern countries.

4. Research Objectives

The objective of this research is to gain a deeper insight into the impact of Artificial intelligence and technology on the stock market capitalization rate in Arab countries through:

- Investigate the impact of AI (internet usage and mobile subscriptions), on control variables (FDI, inflows, inflation rate, GDP Growth rate, no of stocks traded, Trade, and High-Tech exports)
- Investigate the impact of control variables (FDI, inflows, inflation rate, GDP Growth rate, no of stocks traded, Trade, and High-Tech exports) on the stock market capitalization rate.

- Examine the impact of internet usage and mobile subscriptions on the stock market capitalization in Arab countries.

5. Research importance:

The impact of the AI and technology on the stock market capitlization has important implications for trading, portfolio management, and risk assessment. Understanding the impact will empower investors to execute trades in real-time, access a wealth of market data and analysis tools, and manage their portfolios with unprecedented convenience. AI algorithms have also been utilized to automate trading processes, bringing speed and efficiency to the market and reducing transaction costs for investors.

6. Research Methodology

The research utilizes the cause-and-effect method in investigating the impact of AI and technology on stock market capitalization by using panel data analysis. Panel data is a combination of time series data and cross-section data. This study employs panel data analysis techniques like pooled OLS, fixed effect, and random-effect methods. The Hausman test is used to identify which method is more appropriate for this research. Moreover, data is processed using Stata software. Data are collected for all variables from the World Bank and Fred Louis. The data was collected for Middle Eastern countries, such as Bahrain, Kuwait, Egypt, Qatar, Oman, Morocco, Tunisia, Lebanon, Saudi Arabia, Jordan, and the United Arab Emirates, between 2010 and 2022. The statistical analysis was conducted to test hypotheses and draw conclusions.

7. Research sample

The targeted sample included 11 countries in the Middle East, which are Bahrain, Kuwait, Egypt, Qatar, Oman, Morocco, Tunisia, Lebanon, Saudi Arabia, Jordan, and the United Arab Emirates from 2010 to 2022. Middle Eastern countries were selected according to

the availability of data, and they represent the majority of Arab countries, which adapt quickly to the use of AI and technology.

8. Research Data

The study comprises of three components, namely the dependent independent variables , and control variables as described below:

Variables	Name /symbol	Measurement
Stock Market Capitalization: (Dependent Variable):	Stock market capitalization rate (% of GDP)	(STOCKit/GDPit) is the market capitalization of listed domestic companies, as a percent of GDP. (Gardner et al., 2017)
(Independent Variable):	Internet usage % of the population	Measurement for technology use. (Gardner et al., 2017(INTERNETit)
(Independent Variable):	Mobile cellular subscriptions Per 100	Measurement for technology use. (Gardner et al., 2017) (MOBILEit)
Control Variable:	Gross domestic product growth rate(GDPGR)%	measure the level of economic activity and is closely linked to the stock market. (Yang,2023)
Control Variable:	Inflation rate (INFR%)	Annual percentage changes in consumer prices (Lawal,2016)& (Babarinde&Abdulmajeed,2020).
Control Variable:	Number of traded stocks	The value of shares traded is the total number of shares traded, both domestic and foreign, multiplied by their respective matching prices. (World Bank Open Data, n.d.) Measure stock market liquidity (Ramirez,2018).
Control Variable:	Trade (% of GDP)	Measure market activity("News or Noise: Mobile Internet Technology and Stock Market Activity," 2021)
Control Variable:	High tech exports(% of GDP)	ability to enter innovative sectors with high technological opportunities (Montobbio & Rampa, 2005)
Control Variable:	Foreign direct investment (FDI% of GDP)	Used FDIit / GDPit is the net inflow of foreign direct investment (FDI) to control for the level of openness or globalization of a country's financial sector. (Gardner et al., 2017)

9. Model and proposed hypotheses

Given the previous research problem and the previous studies indicating that there is a significant Impact of AI and technology on stock market capitalization rate, it is possible to formulate the following research hypotheses and model:

H1: There is a significant effect between the growth of the internet and technology on the stock market capitalization rate

H2: There is no significant effect between the number of stocks traded and stock market capitalization rate

H3: Improvements in technological activities positively affect trade performance, especially for high-tech exports for developed countries.

H4: There is a negative significant effect between the inflation rate and the stock market capitalization rate.

H5: There is a positive and statistically strong impact between the number of mobile cell subscriptions and internet users on the Stock market capitalization rate.

Model:
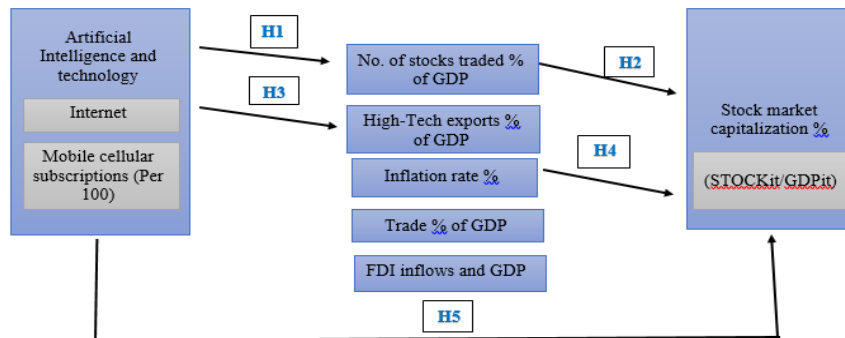
10. Data results and analysis

The main aim of the following section is to determine and examine all the statistical and econometric methods needed to investigate the impact of AI and technology on the stock market

capitalization rate. The paper used panel data analysis which is better than time series in terms of biasedness, variability, and accuracy. The software used to examine all the econometric tools needed was Stata.

10.1 Table 1: Descriptive Analysis

The upcoming table demonstrates the nature of all the observations across all the selected countries. This is a very important point to be considered and examined before running the model   used.

	Stock market capitalization %	No.of stocks traded % of gdp	Trade % of gdp	FDI, inflows % of gdp	GDP Growth rate %	High-Tech exports % of gdp	Inflation rate %	Internet usage %	Mobile cellular subscriptions Per 100
Mean	60.99	11.64	92.13	2.58	2.60	34.10	6.00	72.65	134.59
Maximum	330.55	78.1	191.87	11.46	19.6	74	171.2	100	221
Minimum	6.512	0.1	0	-2.76	-21.4	1	-3.7	15.9	57
Standard Deviation	52.63	15.85	38.97	2.25	4.14	15.70	20.35	22.47	38.33

Source: Conducted by the researcher

The above table displayed the nature of the dependent variable and all the main independent variables along with the controlled variables: trade, stocks traded, GDP growth, FDI, high-tech exports, and inflation rate. The stock market capitalization rate demonstrated huge variation across the selected countries throughout the period 2010-2022.

This was displayed through the huge gap between the minimum and maximum values of stock market capitalization rates. The low values of stock market capitalization rates indicate various small to medium enterprises with a small market value compared to other gigantic companies.

On the other hand, the maximum value, which was almost 331%, reflected the existence of well-established companies in some of the selected countries that have a high market value and market share that exceeds 10 billion dollars (Merrill, 2024).

Moreover, the same reasons can explain the huge variation in the values of the stocks traded across the chosen countries. In addition, the low number of stocks traded in some countries in some years can mean the existence of an oversupply of stocks with low demand (Nickolas, 2023) .

Moving to the trade, all the countries globally witness a recognizable shift towards trading and exporting to other countries, such as the US and China. On the other hand, there are still some countries in the MENA region that did not adapt to these drastic changes. The decline or non-existence of enough trading in the MENA countries can be attributed to the lack of variety in the goods to be exported, the lack of infrastructure, and the existence of high trade barriers (Saidi & Prasad, 2023).

Regarding the FDI inflows, which turned out to be negative at some point in some of the selected countries, this can be following the Great Recession and Arab Spring that happened in the MENA region. So, the FDI sharply declined due to the political instability following the Arab Spring (Caccia, Paniagua, & Caccia, n.d.). Due to this political instability accompanied by several economic reforms, high fiscal deficits, and the COVID-19 pandemic, the GDP growth deteriorated heavily at some point in several MENA countries (Dabrowski & Jiménez, 2021).

Recently, due to rapid innovation in the technological sector and the high reliability of industrialization, the majority of the chosen MENA countries started to promote the use of technology in the production process. Investments in high-tech industries and exporting them played a major role in some selected countries, such as Saudi Arabia and the United Arab Emirates. These countries invested in artificial intelligence, blockchain, & cyber security, especially in the previous few years (Base, 2024).

Lastly, the last controlled variable, which is the inflation rate, did vary across the countries and the years. Some of MENA

countries have suffered from deflation in some years. This can be mainly due to government interventions to control the increase in the price levels of tradable goods. This type of government intervention can be in the form of price controls or subsidies.

On the other hand, some other MENA countries did experience very high rates of inflation compared to previous years, mainly due to the rise in oil prices. This hurt the GCC countries such as Kuwait, Qatar, & Bahrain (Boxshall, Ashkar, & Anderson, 2022). Concerning the internet usage and mobile cellular subscriptions, it rose tremendously in the previous couple of years across all selected countries. This change happened especially after the pandemic since people became highly dependent on mobile networks to deal with and sustain economic, financial, and social activities (Rose, 2022).

10.2 Figure 2: Correlation Analysis

The following table demonstrates the level of dependence and relationship between the variables whether the main independent ones or the controlling variables.

Correlation Probability	Stock market capitalization	No. of stocks traded % of GDP	Trade % of GDP	FDI, inflow % of GDP	GDP Growth rate %	High-Tech exports % of GDP	Inflation rate %	Internet usage %	Mobile cellular subscriptions
Stock market Capitalization	1.000								
No.of stocks traded % of gdp	0.4734	1.000							
Trade % of GDP	-0.0884	-0.1823	1.000						
FDI inflows % of GDP	-0.2159	-0.1754	0.2086	1.000					
GDP growth rate %	0.0497	0.1325	0.0737	0.0527	1.000				
High-tech exports % of GDP	0.025	-0.0639	-0.255	-0.0752	-0.125	1.000			
Inflation rate %	-0.1718	-0.1053	-0.075	0.0354	-0.3118	-0.0138	1.000		
Internet usage %	0.3396	0.0581	0.2030	-0.1794	-0.1716	-0.2390	0.0038	1.000	
Mobile Cellular Subscriptions	0.2558	0.3598	0.3867	-0.2311	0.1876	-0.4061	-0.2530	0.3867	1.000

Source: Conducted by the researcher

As seen from the above figure, it was clear that the variables did not suffer from high multi-collinearity, which ensures the non-existence of biasedness in the model that will be examined. On the other hand, there was a moderately positive correlation between the number of stocks traded and market capitalization. This is completely normal, as the market capitalization is measured by multiplying the number of stocks traded by the price of each share. Therefore, as the number of stocks traded in the market increases, the market value, or capitalization, will also rise (Kramer, 2024).

There was a slight negative relationship between mobile cellular subscriptions and high-tech exports in the selected MENA countries, with a coefficient of -0.40. This suggests a lack of effective policies aimed at leveraging digitalization to boost the export of high-tech goods (Handoyo et al., 2024)

10.3 Figure 3: Unit root test

The following figure will display the level of stationarity of all the variables examined across all the selected countries. If the stationarity doesn't exist for one of the variables, this means that the lagged effect or first difference needs to be taken. This is very important to consider before running the regression model to avoid any inconsistencies in any of the variables. Several methods can be used to examine the level of fluctuations across all of the variables. These methods are Phillips Perron, Breitung, Im Peasaran Shin, Harris Tzavalis, and Levin Lin Chu unit root tests.

$$H_0: Panels\ contain\ unit\ root$$
$$H_1: Panels\ are\ stationary$$

Variables	PP		Breitung		LLC		IPS	HT
	Level	1st difference	Level	1st difference	Level	1st difference	Level	Level
Stock market capitalization %	69.066***	66.4943***	-0.2684	-0.5271	-0.2393	1.9052	-0.7835	0.4518
Number of stocks traded %	253.61	N.A	N.A	N.A	N.A	N.A	-3.4796***	N.A
Trade % of GDP	16.78	18.945	-1.8286**	-1.79**	-1.99**	-5.925**	-0.4240	0.5954
High-tech exports %	42.249***	44.589***	1.4062	-0.0806	-3.9119***	-3.9119***	-1.862*	0.0557***
Inflation %	27.8062	25.7806	-1.7242**	-2.3763***	-3.9065***	-3.9065***	0.4229	0.9172
GDP Growth %	90.143***	93.48***	-3.0069***	-2.255**	-4.1223***	-4.1223***	-3.5267***	-0.0322***
FDI inflows %	70.330***	73.7817**	-1.198	-0.8809	-3.2943***	-3.2943***	-2.6062***	0.100***
Mobile cellular subscriptions	44.157***	42.843***	0.599	-1.077	-2.6892***	-2.6892***	-1.660	0.5785
Internet usage %	149.17***	130.14***	4.255	0.5277	-2.6713***	-2.6713***	0.090	0.5356

Source: Conducted by the researcher

(* significant at 10%- ** significant at 5%- *** significant at 1%)

Referenced to figure 3, illustrates the level of stationarity of all of the dependent, independent, and controlling variables throughout the selected period. It was completely clear that the majority of the variables were highly significant at the level and at 1st difference also. This means variables did not suffer from huge volatility since there was stationarity without taking any lagged effect. On the other hand, the main dependent variable did suffer from high insignificance across the majority of the unit root methods whether at level or at 1st difference. This means that the stock market capitalization suffered from huge fluctuations across the selected countries.

10.4 Figure 4: Regression Model:

The upcoming section will use various regression and econometric models needed to examine the panel data analysis used in such a paper. This is very crucial to examine to display which of

the independent and controlling variables had a significant impact on the stock market capitalization in the selected Middle Eastern Countries

Variable	Pooled OLS	Fixed Effect Model	Random Effect Model
C	-14.944	116.987	-10.111
No.ofStocksTraded	1.443***	-1.0508**	1.1008***
Trade% of GDP	-0.0539	-0.4288***	-0.1159
High-techexports%	0.3854	0.9038**	0.4553
Inflation rate %	-0.3123	0.0743	-0.2489
GDP Growth%	0.5348	-0.1564	0.5474
FDI inflows %	-1.485	2.421	-1.110
Mobilecellular subscriptions	-0.0408	-0.3035*	-0.00197
Internet usage %	0.839***	0.00128	0.78066***
Prob(FStatistic)	0.0000	0.0002	0.0000
R-Squared	0.3623	0.0766	0.3570

Source: Conducted by the researcher

(* significant at 10%- ** significant at 5%- *** significant at 1%)

Concerning the above figure, three econometric methods were used to examine the panel data analysis and to study the impact of AI and technology on the stock market capitalization rate. First, the pooled OLS model assumes the non-existence of any cross-sectional or time effects on the model .

This model concluded that as the number of stocks traded increases by 1%, the stock market capitalization increases significantly by 1.443%. This can be explained as mentioned before in terms of reflecting the size, reputation, and share of such a market when the number of traded stocks rises. Moreover, when internet usage increases by 1%, the stock market capitalization rate increases by 0.839% at a 1% significance level. Regarding the

probability of f-statistic, it ensured the significance of the whole model. The R-squared meant that 36% of the variations in the stock market capitalization are explained by the mentioned independent and controlling variables .

Moving on to the fixed effect model, which is similar to the pooled OLS since it assumes that any specific or external forces are constant across the observations. According to the fixed effects model, the number of stocks traded did have a significant negative impact on the stock market capitalization rate. This means that as the number of stocks traded increases by 1%, the stock market capitalization rate will decrease by 1.05% .

This can be mainly due to the sharp decline in the prices of the shares. Also, this can happen when the investor agrees to use warrants that raised the number of outstanding shares but weakens the market capitalization (Curry, 2024). Then, regarding the trade that indicated that as the trade increased by 1%, the market capitalization declined by 0.428%. This can explain why when the country did suffer from trade deficit throughout several consecutive years, this means that imports exceeded the exports hence reflecting the existence of debt in the economy.

Moreover, a trade deficit can exist during the growth and expansion phase of the country. So, this deficit will adversely affect the domestic spending hence hurting the local companies and their position in the market. Accordingly, this causes a drastic fall in the stock prices of such companies. On the contrary, as the high-tech exports increase by 1%, the stock market capitalization rises by 0.9038% at a 5% significance level. This demonstrates that as the high-technological exports rose, the companies exporting such goods will drive more economic growth, therefore, raising their market value and capitalization.

Lastly, mobile cellular subscriptions rose by 1 unit, and the stock market capitalization deteriorated by 0.3035% at a 10%

significance level. This can discuss the level of distraction that internet usage causes to the stock market performance (Brown, Elliott, Wermers, & White, 2020). The significance of the whole model was ensured through the probability of f-statistic. Also, the R-squared was approximately 8% which is very low ensuring the existence of other external forces affecting the stock market capitalization in the chosen countries including time and non-time forces.

Last but not least, the random effect model takes into consideration any differences or variations across the observations within a larger group. Regarding the number of traded stocks and internet usage, they had a positive significant impact on the stock market capitalization rate for the same reasons discussed before. The R-squared explained around 36% of the explanatory variables explaining the stock market capitalization rate.

10.5 Figure5: Hausman test:

The main aim of running the Hausman test is to understand whether the variables or regressors are predicted from each other or not. This will conclude whether the fixed or random effect was better.

$$H_0: Random\ Effect\ is\ better$$
$$H_1: Fixed\ effect\ is\ better$$

Chi-Squared	Probability
44.36	0.0000

Source: Conducted by the researcher

Since the probability of the Hausman test examined was less than 5%, this means that the null hypothesis cannot be accepted and the fixed effect model is better.

10.6 Diagnostic tests:

This section will display all the diagnostic tests needed to ensure the validity and accuracy of the econometric models used.

1. Figure 6: VIF Test (Variance Inflation factor)

The VIF test indicates the level of multicollinearity in any of the independent or controlling variables by examining the inflation in its variance.

Variables	VIF
Number of stocks traded %	1.35
Trade % of GDP	1.53
High-tech exports %	1.30
Inflation rate %	1.19
GDP Growth rate %	1.22
FDI inflows %	1.25
Mobile cellular subscriptions per 100	2.24
Internet usage %	1.31

Source: Conducted by the researcher

According to the above figure that demonstrated the level of multicollinearity, it concluded that all of the explanatory variables had a VIF less than 5. This means that the variables don't suffer from high collinearity problem.

2. Figure 7: Cross-section dependence test

This test determines whether the explanatory variables suffers from heteroscedasticity or not. This means that the test examines whether the variables are correlated with the residual or not.

$$H_0: No\ Cross\ sectional\ Dependence$$
$$H_1: There\ is\ cross\ sectional\ Dependence$$

Chi-Squared	Probability
195.866	0.0000

Source: Conducted by the researcher

Referenced to the above figure, the probability is less than 5% which means that the null hypothesis cannot be accepted the model suffers from cross-sectional dependence.

3. **Figure 8: Heteroscedasticity test**

This test examines whether the variables used in the model did suffer from having an unequal variance or not which can therefore affect the biasedness of the model.

$$H_0: Residuals\ are\ homoscedastic$$
$$H_1: Residuals\ are\ heteroscedastic$$

Chi-Squared	Probability
49975.02	0.0000

Source: Conducted by the researcher

As seen in the above table, the probability was less than 5% which means that the model suffered from heteroscedasticity problem.

4. **Figure 9: GLS model (Generalized linear squares model)**

The GLS is similar to the OLS regression model but the main difference is that the GLS model deals with the data where the residuals are not independent. So, this model solves the problem of heteroscedasticity.

Variables	Coefficients
C	-14.944
Number of stocks traded %	1.443***
Trade % of GDP	-0.05399
High-tech exports %	0.3854
Inflation rate %	-0.3123*
GDP Growth rate %	0.5348
FDI inflows %	-1.4850
Mobile cellular subscriptions per 100	-0.0408
Internet usage %	0.8395***
Prob f-statistic	0.000

Source: Conducted by the researcher

(* significant at 10%- ** significant at 5%- *** significant at 1%)

After running the GLS model, the only positive significant variables were the number of stocks traded and internet usage which was similar to the pooled OLS model results but the heteroskedasticity problem was solved. On the other hand, the inflation rate did adversely affect the stock market capitalization rates. This occurred due to the fact that high rates of inflation may cause high uncertainty in the economy and people's behavior generally. Accordingly, the high rates of inflation will affect the investor confidence that affects their ability to take risks especially in the stock market (Zucchi, 2023).

5. **Figure 10: Serial Correlation test (Wooldridge test)**

This test detects the existence of first-order autocorrelation in the residuals for the panel data analysis.

$$H_0: No\ Serial\ Correlation$$
$$H_1: Serial\ Correlation\ exists$$

Chi-Squared	Probability
660.159	0.0000

Source: Conducted by the researcher

The above table ensured the existence of the serial correlation since the probability is less than 5%.

6. **Figure 11: GMM Model (Generalized Methods of Moments)**

This model aims to resolve the issue of correlation since this may affect the reliability of the model. Generally, it is widely used to deal with any model with measurement errors.

Variables	Coefficients
Number of stocks traded %	1.443***
Trade % of GDP	-0.05399
High-tech exports %	0.3854
Inflation rate %	-0.3123***
GDP Growth rate %	0.5348
FDI inflows %	-1.485
Mobile cellular subscriptions per 100	-0.0408
Internet usage %	0.8393***

Source: Conducted by the researcher

(* significant at 10%- ** significant at 5%- *** significant at 1%)

The results of the GMM model did ensure having the same results like the GLS model and the same level of significance for the number of stocks traded, inflation rate and internet usage.

11. Summary and Concluded Remarks

The results show that several variables have significant effects on the stock market capitaliation rate. The internet usage and the number of traded stocks have a significantly positive impact. In contrast, mobile cellular subscriptions, high technological exports, and the inflation rate significantly negatively impact Middle Eastern countries' stock market capitalization rates .

After that, some diagnosing tests were implemented to ensure the validity and accuracy of the econometric models used. Results indicate that the model suffered from heteroscedasticity problems. Thus, GlS and GMM were implemented to solve heteroscedasticity and serial correlation .

To conclude, these findings suggest that policymakers and regulators should consider the use and promote the benefits of the Internet and technology and its impact on the Stock market capitalization rate. This will impact the whole economy for all countries.

12. Recommendations

Based on the results of the article, there are several recommendations that can be made to enhance and facilitate the use AI and technology on stock market capitlization rate.First, policymakers and regulators should Pay attention to Countries that are actively investing in AI technologies because their market capitalization has a tendency to rise significantly.

Second, Monitor market reactions and news attention to know how investors will behave and hence decrease the level of distraction that internet usage cause to the stock market performance.Third, Keep an eye on macroeconomic factors that can affect stock market capitalisation such as inflation , GDP, and FDI. Countries that used AI and technology may react to economic shift differently that those without.Fourth, engage the use of technology in stock market in a right way to decrease the level of distraction that internet usage cause to the stock market.

Overall, these recommendations can help and promote countries development and their economy as a whole.

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