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The Role of Trade Policies and Digitalization in Enhancing Export Resilience to External Shocks: Evidence from Selected Oil-Exporting Countries

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دور سياسات التجارة والرقمنة في تعزيز مرونة الصادرات في مواجهة الصدمات الخارجية: أدلة من دول مختارة مصدرة للنفط

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Abstract

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The resilience to export is important in economic sustainability particularly to the oil-dependent economies. Although the majority of the countries depend on the oil revenues, the export activity is often unstable because of external factors such as price fluctuations or geopolitical conflicts. This paper looks at the role of trade policies and digitalization in increasing the resiliency of exports in oil-exporting economies. The study relies on panel data on five oil-rich countries, including Iran, Iraq, Saudi Arabia, Kuwait, and the United Arab Emirates, in 2010-2023. The findings indicate that the current value of export resilience is positively and significantly impacted by the resilience, which implies that there is persistence in export behaviour. There is also a positive role of trade policies like tariff reform and non-tariff barriers which reduce external shocks. The level of digitalization, as gauged by the index of ICT development, has a significant positive contribution to the strengthening of exports, which should underline the significance of digitalization and IT infrastructure. The paper concludes that resilience to external crisis through revising trade policies and enhancing digital capacities is necessary to ensure export resilience.

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المستخلص

تُعد مرونة الصادرات أمرًا بالغ الأهمية للاستدامة الاقتصادية، لا سيما في الاقتصادات المعتمدة على النفط. ورغم اعتمادها على عائدات النفط، تشهد العديد من الدول عدم استقرار في صادراتها بسبب الاضطرابات الخارجية، مثل تقلب الأسعار أو التوترات الجيوسياسية. تبحث هذه الدراسة في كيفية مساهمة سياسات التجارة والرقمنة في تعزيز مرونة الصادرات في الاقتصادات المصدرة للنفط. ويستخدم البحث بيانات من خمس دول رئيسية مصدرة للنفط، هي إيران والعراق والمملكة العربية السعودية والكويت والإمارات العربية المتحدة، خلال الفترة من 2010 إلى 2023. وتُظهر النتائج أن مرونة الصادرات لها تأثير إيجابي وهام على قيمتها الحالية، مما يشير إلى استمرارية سلوك التصدير. كما تلعب السياسات التجارية، مثل إصلاح التعريفات الجمركية وخفض الحواجز غير الجمركية، دورًا إيجابيًا في التخفيف من الصدمات الخارجية. وللرقمنة، وفقًا لمؤشر تنمية تكنولوجيا المعلومات والاتصالات، تأثير إيجابي قوي على تعزيز مرونة الصادرات، مما يؤكد أهمية التحول الرقمي والبنية التحتية لتكنولوجيا المعلومات. وتخلص الدراسة إلى أن مراجعة سياسات التجارة وتعزيز القدرات الرقمية أمران أساسيان لتحقيق مرونة الصادرات في مواجهة الأزمات الخارجية.

Introduction

Over the last decades, the rising level of dependence on international trade contacts has exposed countries to external shocks, especially, trade, financial, and geopolitical shocks. Among the most significant mediums of connecting the national economy to the global economy, exports are more susceptible to these shocks than any other element, and the sustainability of exports has become of particular significance, particularly to mono-product countries or nations that rely on natural resources. In this situation, the consideration of such concept as export resilience and finding out the factors which may raise their adaptive capacity and ability to recover in cases when they are exposed to external shocks becomes one of the strategic pillars of economic development research and trade policies.

The creation and adoption of smart and flexible trade policies is one of the significant tools that would strengthen the export resilience process. By generating diversity in the target markets, improving the composition of export goods, improving the competitive advantages as well as reducing the reliance on foreign inputs, these policies can effectively help in decreasing the severity of the effects of external shocks on exports. In addition to advancement in technology, the other aspect that can make countries resilient in trade is the aspect of digitalization and growth of new technologies in supply chain and exports. Digital tools in logistics management, international marketing, market analysis, and supply chain flexibility generate new possibilities of responding to the disruptions and adapting to the shifting conditions within a short period of time.

Regardless of this significance, as reviews have demonstrated, most current researches have either analyzed the impacts of trade policies on macro variables (i.e., studies by Barrios et al.[1] (2003) and Vial[2] (2019)), or have independently studied the effects of digitalization on export performance (i.e., research by Hong et al.[3] (2022) and Wang et al.[4] (2023)). Alternatively, research like that by Rezaei, Aslani et al. (2024) or Nemati Parshkoh and Hoshomandchaykhaneh (2021) has been conducted at the domestic level, discussing particular aspects of this study, however, a gap exists in felt knowledge of conducting a comprehensive study which would at the same time investigate the interaction effect of trade policies and digitalization on export resilience, especially regarding countries with similar economic structures that rely on oil. The given research gap is even more significant in the present circumstances of the global economy that is going through energy crises, pandemics, and geopolitical instabilities at the same time.

In this regard, the current study will seek to examine the impact of trade policies and digitalization in enhancing export resilience to external shocks. The primary interest of the study lies in the fact that the countries that are similar to Iran in terms of export organization and reliance on natural resources are the main target of the study, and its results can be used in scientific and policy recommendations to the oil-producing countries on the way to the enhancement of foreign trade resilience.

Evidence of the theoretical background and conceptual model of the research will be presented in the following sections, which will be divided into the explanation of the theoretical background and the empirical background related to the subject. Then there will be a description of the research methodology comprising the data, variables and estimation

methods. In the following section, the research findings will be exposed and discussed and lastly the conclusion and policy recommendation will be put forward.

2. Theoretical Foundations and Research Background

2-1. Trade Policies in enhancing Export Resilience to External Shocks.

Export resilience is the capacity of a nation or its export business to take up, adapt, and recuperate following external shocks that could be caused by global financial crisis, fluctuations in oil prices, supply chain, sanctions, or geopolitical instabilities. In such circumstances, the trade policies as relevant government measures in the context of diminishing vulnerability and enhancing the flexibility of exports become especially important.

Theoretically speaking, the debate of economic resilience and international trade demonstrates that mono-product reliant countries should mitigate the risks related to this approach or export market monopoly by applying smart policies. According to the theory of interdependence [1], diversification in the market and export products make the economy more adaptive to external shocks. Equally, dynamic competitive advantage theory[2] underlines that under circumstances where the global environment experiences high rates of change, trade policy flexibility and innovativeness can be used instead of the traditional comparative advantages and enhance export resilience.

The contribution of the trade policies in enhancing export resilience has been verified by various empirical studies. Indicatively, Barrios et al.[3] (2003) showed that the impact of external shocks on the export of the developing countries can be decreased by implementing policies of export diversification and flexible tariffs. In their comprehensive study, Vial[4] (2019) put special emphasis on regulatory institutions and policies fostering export diversity, stating that the mentioned aspects are the major determinants of export resilience. Furthermore, Piccardi and Tajoli[5] (2018) noted that the policies on flexible tariffs and regional trade agreements decrease the adverse impact of shocks on the exports of emerging countries.

Overall, various mechanisms, in which the trade policies influence export resilience, can be grouped into several broad areas:

Export admix: Geographical destination: The creation of the multilateral trade agreements and the development of the target markets reduces the reliance on the narrow markets and gives the possibility to offset the shocks within the regions by the other markets. Ozsoy et al.[6] (2022) and Mishra[7] (2018) also note that this is among the most effective methods to use in the policy.

Diversification in an export structure composition: With the stimulated production and export of high value-added products and decreased concentration on raw materials, a more robust export framework is established. In a research using Iranian data, Rezaei (2023) revealed that non-oil export diversification has a positive impact on the minimization of export variations.

Financial facilities, export insurance and tax incentives: The policies by mitigating the risks and costs of the exporters offers them the possibility of carrying out their activities in cases of crisis conditions. According to Ado Higgins and Bonuwin[8] (2022), direct government support is a critical factor that ensures export continuity in financial crises.

Policies of exchange rate and management of exchange rate volatility: Complementary monetary and fiscal policies have a relative stability of the exchange rates, which helps to

provide a stable base of export and minimize major fluctuations. This issue was introduced by Goldoust et al. (2019) as one of the valuable aspects of export resilience.

Developing sustainable legal and institutional systems: It is through the development of clear and predictable rules in foreign trade that the business environment will be more predictable and less risky of sudden alterations in laws. Ikeda and Iitomi[9] (2018) clarify that institutional changes in the customs and cargo clearing processes are an important measure to strengthen the export.

Lastly, the discussed studies underline that trade policies when supported by the economic structure and specifics of the target markets can contribute greatly to export resiliency by increasing the level of diversity, minimizing the risk, and enhancing flexibility. Such policies are of increased strategic value in those countries that rely on exports of natural resources that are prone to extreme shocks. The additional contribution of digitalization to the enhancement of this resilience will be discussed in the next sections.

2-2. How Digitalization Can Enhance Export Resilience to External Shocks.

The concept of digitalization, i.e. the usage of new information and communication technologies in the production, management, and trade processes, is being identified as one of the most significant in improving export resilience. As the processes of globalization and the speed of technological change are becoming more complex, the more countries and companies implement the digital technologies in their export value chain, the more resilient they will be towards the external shocks and will react faster to the new conditions.

Theoretically, contemporary risk management and resilience models acknowledge digitalization as a dynamic ability that eases the adverse impact of a shock by enhancing transparency, lowering, and decreasing the information expenses, and enhancing the ability to coordinate and respond. To be more precise, the theories of complex systems and international trade networks consider digitalization as a means of making the process of information and goods flow more efficient, fast, and therefore resilient in terms of the export supply chains.

This is also an important role that is proved by empirical studies. Indicatively, Hong et al. (2022) revealed that the adoption of digital technologies in import and export management led to great delays and disruptions due to external shocks. In a multi-country study, Wang et al. (2023) have found that export resilience was high in the countries that had invested more in the digitalization of trade infrastructure. On the domestic level, the role of new technologies in enhancing the adaptation of Iranian exporters to the fluctuations of global markets has been outlined by the study by Nemati Parshkoh and Hoshomandchaykhaneh (2021).

The processes, according to which digitalization influences export resilience, can be grouped into several key categories:

Opening up and facilitating information flow: Data management systems and information technologies allow exporters to access more accurate and timely information, which is very efficient in terms of dealing with commercial risks and making strategic decisions.

Enhancing the supply chain coordination: Digital technologies also offer an opportunity to enhance the quality and speed of communication among various participants of the supply chain that decreases the risk of disruptions and enhances flexibility in the case of crises.

A lowered cost of operation and higher productivity: Automation of business operations, including electronic customs, electronic payments, and smart logistics control lowers operational costs and shortens the time of transactions, which allows exporters to operate sustainably even under unfavorable circumstances.

Expanding opportunities to new markets: Digital technologies, particularly, e-commerce platforms, offer a range of access to small and medium-sized exporters to enter the global markets, thereby diversifying the markets.

Exploiting innovation and product development: Digitalization, opened by exchange of knowledge and international collaboration, provides the basis of product and process innovation, which can generate new competitive advantages in the global markets.

Altogether, digitalization as an addition to trade policies gives the essential possibilities to increase the resilience of the exports and helps the countries to react faster on the external shocks and facilitates the further path to recovery. The next sections of the article will discuss how the trade policies interact and exert a joint effect on export resilience in relation to digitalization.

2-3. Export Resilience to External Shocks: The Joint Effect of Trade Policies and Digitalization.

The intelligent and synchronized integration of trade policies and digital technologies is becoming a fundamental part of export resilience of the current complex and evolving world. Even though each of these factors singly contributes significantly to addressing external shocks, contemporary research demonstrates that actual and viable effect would be realized when trade policies are enforced suitably and unified with digitalization abilities in a combined framework.

The macro framework that will support the export development is created by trade policies that are targeted at regulating export structure, diversifying markets and goods as well as reducing trade barriers. Conversely, the accelerating and enabling factor of digitalization enhances the operational, managerial, and communicational capacity of the exporters and also raises the expertise of responding to abrupt market shifts. According to the complex systems theories, convergence of the two regions forms an export network that is dynamic and flexible and therefore, absorb external shocks better and recover faster.

This synergy has been established by several empirical studies. Indicatively, Wang et al. (2023) in a multi-country study indicated that those countries that had active trade policies and at the same time made massive investments in digitalization were more resilient to trade and economic shocks. Also, Ado Higgins and Bonuwin (2022) indicated that coordination between development of information technology infrastructure and tariff policy was important to reduce the vulnerability of the exports. At the home level, the high effectiveness of supportive policies and new technologies together to enhance the adaptation of Iranian exporters to the international volatility was also discussed by Rezaei (2023), as well as Nemati Parshkoh and Hoshomandchaykhaneh (2021):

1. Enhancement of smart export diversification: The policies on trade, which establish macro directions, lay the basis of goods and market diversification, and digitalization supplies the opportunity to monitor new target markets accurately and quickly. Such interaction enhances flexibility in export.

2. Raising efficiency and speed of response to shocks Flexible trade policies including variable tariffs and dynamic trade agreements, supported by digital supply chain

management systems, and big data analysis, open the potential of quick response and adjustment of export strategies in the event of shocks.

3. Cutting the cost of trade and enhancing transparency: Trade policies streamline administrative and customs procedures, coupled with digital customs systems and digital payments, cut costs and shorten the time of exports as well as improve the export business environment.

4. Improving export product innovation and development: Favorable and incentive trade policies, as well as digital technologies, would enable innovation in export products and export services to remain and improve the competitive advantage in the international markets.

5. Building human and organizational capacities: Co-ordination of educational and supportive policies with digital technologies usage results in the development of the human resource competencies and optimization of organizational activities within export businesses, which is one of the primary factors of export resilience.

The integrated and deliberate combination of trade policies and digitalization, which enhances efficiency, flexibility, and innovation in the structure of exports in real time, can therefore greatly improve the resiliency to external shocks. This method can be regarded as an important strategy particularly to the oil-producing countries which experience high economic swings. In the further course of discussing the article, the analysis on this topic will be performed after consideration of the research background with the help of econometric models and data on the chosen oil-producing countries.

2-4. Research Background

Some of the studies that were conducted in the domestic research literature have investigated various aspects of economic resilience, trade policies, and digitalization in boosting exports. First, the article by Nemati Parshkoh and Hoshomandchaykhaneh (2021) named The Role of Digital Transformation in Business Resilience and Flexibility investigated how organizational flexibility to external shocks is influenced by digital technologies. The study conducted based on the qualitative approach and content analysis of semi-structured interviews with managers of innovative Iranian firms revealed that the mindful exploitation of digital tools, particularly in the outside economic crisis, is a key factor in the sustainability of exports performance.

In a review study, Kuti (2024) assessed the impact of governments in steering the trade policies and reorganizing the export structure and found out that in shock conditions, the presence of government in the form of supportive policies, tariff reforms, and export promoting incentives enhances export resilience. In the empirical study, Rezaei (2023) in the period 2001-2019 and Iranian time series data revealed that the greater the foreign trade with other countries with a larger economic structural diversity is, the higher sustainability of non-oil exports of the country to external shocks.

Movahedmanesh and Alimanesh (2019) explored the effects of non-oil exports on the growth of Iranian economy through use of linear regression approach and time series data in the period 1991- 2016. Their findings revealed that expanding the non-oil exports does not only aid in enhancing economic stability in face of changes in oil prices but also gives reason to establish more stable markets. The meta-analysis method employed by Aslani, Rajabi and Karimi (2024) to estimate the effects of 25 quantitative studies on high-tech

exports published between 2011-2023 demonstrated that, the positive effect of government supportive policies to knowledge-based industries and also, the reduction of tax burden positively influence high-tech exports. These results indirectly underline the effect of trade policies on the sustainability of exports.

Focusing on the small and medium entrepreneurial enterprises in Iran, Naderi and Khosravi (2024) implemented the survey method and structural equation modeling and revealed that the absence of digital infrastructure and the complexity of trade regulations are two of the key blockers on the way to export resilience of these enterprises to global market fluctuations. In a structural model, Badri, Arabi and Badri (2023) have also discussed the export performance of Tehran productive cooperative companies in interaction with export development strategies and concluded that the design of trade policies in line with the organizational structure and the medical innovation capacity of companies is one of the most important factors in the long-term export resilience.

Rajaei and Masoumi Bilandi (2024) conducted the analysis of barriers to export development in the cooperative sector of South Khorasan province by adopting descriptive-analytical methodology, outlining the contribution of local supportive policies and digital training to the enhancement of export situation. Prioritizing the barriers to the exports of non-oil goods to the Russian market by means of hierarchical analysis and network process, Rasoolinejad (2022) identified that the absence of digital infrastructure and inflexible exchange rate policy are at the top of the current limitations.

On the macro level, Goldoust et al. (2019) through Dynamic Stochastic General Equilibrium (DSGE) model and the macroeconomic data of Iran reported that exchange rate and monetary shocks have drastic impacts on exports, and their effects can be mitigated by implementing flexible trade policies. Then, Kolabi (2023) and Sofi et al. (2023) dedicated to the issue of digital and organizational innovations, structural equation modeling underlines the importance of such elements as open innovation, organizational agility, and digital leadership in enhancing the resilience of companies operating in the export environment. The same study at the agricultural sector level by Pashanzhad et al. (2016) indicated that presence of inefficient policy structure of the natural resources may decrease the export capacity of the villages in relation to environmental catastrophes, and this survival power is contingent on intersectoral and technological policy-making. Last but not the least, a study by Zare and Pashazadeh (2023) in the defense and technology-based industry in the country established that the critical role in ensuring continuity in exports during unstable conditions involves digital transformation at the strategic level, which is related to the concept of digital leadership and organizational flexibility.

This domestic study body, while providing a perspective on challenges and capacities of trade and digital policies in the country, provides an appropriate theoretical and experimental foundation for entering international studies. In continuation, with the aim of enriching comparative analysis, a review of the most important foreign studies is conducted.

In foreign literature, the concept of digital transformation and its effects on economic performance was first examined by Vial (2019) in a study titled "Understanding Digital Transformation: A Review and Research Agenda." Through systematic review of more than 800 articles published between 2000-2020 and using path analysis method, he showed that digitalization is not only a technological tool but a fundamental mechanism for

recreating business models and strengthening economic structures against external instabilities. Continuing this path, Ozsoy et al. (2022) in an article titled "The Impact of Digitalization on High-Tech Product Exports" using panel data from 125 countries during 2007-2017 and using systematic GMM method showed that the ICT development index has a positive and significant effect on technology-oriented goods exports, especially in countries with weaker institutional infrastructure where the facilitating role of digitalization becomes more prominent. Wang et al. (2023) also in a study titled "The Impact of Digital Transformation on Companies' Export Stability" by analyzing financial data of companies listed on the Chinese stock exchange in the period 2010-2022 and estimating fixed effects regression models, showed that investment in digital infrastructure leads to increased export diversity, reduced foreign exchange income fluctuations, and increased resilience against external shocks. In the same direction, Hong et al. (2022) in research on the quality of electromechanical product exports in China, using mediation model and analysis of provincial data in recent years, proved that digitalization improves export quality through enhancing innovation and productivity, although in provinces with institutional weakness, its effects may also be negative.

Literature related to trade network resilience has also expanded in recent years with focus on network structure and international shocks. Piccardi and Tajoli (2018) through analysis of global trade networks in an article titled "Complexity, Concentration and Fragility in Economic Networks" showed that increased concentration in export networks leads to increased fragility against global disruptions, while diversity and digitalization are considered tools for recovery and sustainability. Ikeda and Iitomi (2018) in similar research with reconstruction of trade networks and modeling trade policy scenarios using graph algorithms and structured global trade data, proved that implementing changes in tariff and non-tariff policies severely fluctuates export network structure, and in the absence of digital infrastructure, vulnerability to shocks increases. In the field of small and medium enterprises, Ado Higgins and Bonuwin (2022) in analyzing Spanish SMEs' export participation in 2015-2019 using survey data and generalized least squares models, emphasized that information technology, through reducing search costs and increasing market transparency, has made export participation more sustainable. Barrios et al. (2003) also in a classic study on European industrial company data using multivariate econometric models, concluded that digital research and development, through interaction with supportive trade policies, increases export penetration coefficient in small industries.

Macro studies such as the OECD report in 2024 titled "Risk and Resilience in Global Trade" also emphasize that in the post-Corona period, countries that have simultaneously adopted free trade policies based on flexibility and had digitalized supply chains have been less damaged by global shocks. Mishra (2018) also in a comparative study among developed, developing, and emerging countries during 2005-2015 using static panel data models, showed that the positive effect of ICT investment on economic growth and export participation is much stronger in countries with open trade structure. Li and Zobel (2020) through wave effect modeling in global supply chain and measuring resilience with network methods, proved that digitalization not only has direct effect on shock response capacity but also increases recovery speed and adaptability through creating control points in supply chain. Finally, Bai et al. (2021) in empirical research on AliExpress platform using international retail transaction data and multilevel regression modeling, showed that

digitalization can reduce information barriers and search frictions and help small companies' export resilience, especially when global markets are unstable.

Review of domestic and foreign studies shows that although multiple efforts have been made in examining the effect of trade policies, digital transformation, and economic resilience at macro and sectoral levels, they have mainly been either focused on a specific dimension (such as digitalization or non-oil exports), or without considering structural interaction of these policies and technologies in the context of external shocks. Also, in most studies, comprehensive modeling for combined evaluation of trade policies and digitalization in improving export resilience has been absent, and comparative examination among countries with similar economic structure, especially oil-producing countries, has been neglected. In this regard, the present research, by combining two approaches of trade policy-making and digitalization and analyzing their role in enhancing export resilience against external shocks, in the form of an integrated framework and based on dynamic cross-sectional data from selected oil-producing countries, seeks to fill this scientific gap. This study, using advanced econometric approaches, in addition to testing theoretical hypotheses, attempts to provide reliable policy recommendations for countries with high export dependence on oil revenues, which forms the innovative and distinctive aspect of the research compared to existing literature.

3. Research Methodology

To examine the role of trade policies and digitalization in improving export resilience against external shocks in selected oil-producing countries, following the studies of Wang et al. (2023) and Ado Higgins and Bonuwin (2022), the following regression model estimation is used:

$$\text{Resilienceit} = c_0 + c_{1\text{Resilienceit}} + c_{2\text{TradePolicyit}} + c_{3\text{Digitalizationit}} + c_{4\text{TradePolicy}} * (\text{Digitalizationit} + X_{it} + \varepsilon_{it})$$

Where

the dependent variable Resilience The export resilience of the country i in the year t. Trade policies (TradePolicy) and digitalization (Digitalization) are the independent variables. The effect of interaction between the two independent variables is also taken into account. Where X will be the control variable matrix and epsilon will be the error factor.

Export Resilience of Country (Resilience): This variable is the ratio of the actual export growth of the country to the mean of global export fluctuations during the study period; the data on export is taken as a real export of the country which is taken out of the world bank and world trade organization (WTO).

Trade Policies (TradePolicy): Trade policies are founded on the overall index of the trade policies of the country and comprise of tariffs, non-tariff barriers, and supportive policies, gathered under the Global Trade Alert database and WTO reports.

Digitalization (Digitalization): Digitalization refers to the ICT Development Index that encompasses the access, use, and digital technology skills, and the data are received at the International Telecommunication Union (ITU).

Inflation rate (Inflation): This is a variable expressed as percentage change of the Consumer Price Index (CPI) and every year relative to the year before. The data of this variable is taken out of the World Bank statistical database.

Real GDP Growth rate (GDPGrowth): This index reflects yearly fluctuations in Gross domestic product (GDP) using constant prices and is indicated as a percentage. The data of this variable is taken out of the World Bank statistical database.

Unemployment Rate (UnemRate): This variable describes a percentage of an active labour force that is not employed but wants to work. The data of this variable is taken out of the World Bank statistical database.

The statistical population of the research consists of the selected countries of the Middle East and North Africa region as the main oil producers since they are important because of the high level of economic dependence on oil exports and constant exposure to external shocks. In particular, the sample includes Iran, Iraq, Saudi Arabia, Kuwait, and the United Arab Emirates. These countries were chosen because the oil exports are strategically important and the available data is reliable within the period of time 2010-2023. Iraq has been taken as one of the primary samples because it is a leading player in the oil market and is highly vulnerable to regional shocks.

The model employed is the two step GMM models with Arellano Bond technique, which is appropriate in estimating dynamic panel models with a high number of units (countries) and a small number of time periods. The approach is efficient in addressing the issue of multicollinearity of the explanatory variables and the error term and controlled the lagged dependent variable in the framework. Also, the GMM model offers the chance of controlling endogenous variables and removing unobserved country fixed effects which is highly significant in the export resilience research. The precision of estimates and their validity are guaranteed by the use of instrument validation tests and model autocorrelation tests. It is worth noting that all the analyses were done in EViews software version 13.

4. Findings

To verify the validity of the estimations of the panel data, in the first step we need to determine the stationarity of the variables that we have used to model it, so that we do not get spurious results of regression. With non-stationary variables, panel data analysis can be biased and inconsistent because of unit roots. Thus, when estimating the dynamic panel model, the Levin-Lin-Chu (LLC) and Im-Pesaran-Shin (IPS) tests were used to test the stationarity of all the variables. Table (1) summarizes the results.

Table (1) Stationarity Test Results

Variable	LLC Test Statistic	Significance Level	IPS Test Statistic	Significance Level	Test Result
Export Resilience	-4.251	0.000	-3.872	0.000	Stationary
Trade Policies	-3.734	0.001	-2.985	0.002	Stationary
Digitalization	-5.120	0.000	-4.801	0.000	Stationary
Inflation Rate	-2.602	0.009	-2.017	0.015	Stationary
GDP Growth Rate	-3.110	0.002	-3.011	0.003	Stationary
Unemployment Rate	-2.912	0.004	-2.732	0.006	Stationary

Source: Prepared by the author using EViews 13 outputs.

The results of the unit root tests presented in Table (1) indicate that all variables are stationary at their level form. In both the Levin–Lin–Chu and Im–Pesaran–Shin tests, the test statistics for all variables are significant at the 1% or 5% levels, leading to the rejection

of the null hypothesis of a unit root. This implies that none of the variables require first differencing to achieve stationarity. Consequently, the model can be estimated using the variables in their level form, ensuring the reliability and stability of the regression results over time.

Subsequently, to examine the existence of long-term equilibrium relationships among model variables, the Pedroni cointegration test was used:

Table (2) Pedroni Cointegration Test Results

Test Statistic	Statistic Value	Significance Level	Test Result
Panel v-Statistic	2.895	0.002	Cointegration exists
Panel rho-Statistic	-1.982	0.023	Cointegration exists
Panel PP-Statistic	-3.624	0.000	Cointegration exists
Panel ADF-Statistic	-3.141	0.001	Cointegration exists

Source: Prepared by the author using EViews 13 outputs.

Results from this test showed that all test statistics including v-Statistic, rho-Statistic, PP-Statistic, and ADF-Statistic are at high significance levels and reject the hypothesis of no cointegration. Therefore, the existence of a long-term equilibrium relationship among export resilience, trade policies, digitalization, and other control variables was confirmed.

Then, to confirm the status of the key explanatory variables in the model as exogenous or endogenous, a limited endogeneity test was performed based on the Wald statistic. The null hypothesis being tested in this test is that both variables are exogenous. The presence of a large Wald statistic means that the null hypothesis is rejected, which means that the variable in question is endogenous. Endogeneity is crucial to the choice of an appropriate estimation method since the endogenous variables may bring bias to the findings of the traditional panel estimators. Consequently, the endogeneity test can justify the use of the GMM method which is effective in overcoming this problem by employing internal instruments.

Table (3) Limited Endogeneity Test for Variables

Variable	Wald Statistic	Significance Level	Test Result
Trade Policies	6.284	0.012	Endogenous
Digitalization	9.105	0.004	Endogenous

Source: Prepared by the author using EViews 13 outputs.

Test results showed that both mentioned variables have endogenous characteristics and require the use of appropriate instruments in the GMM method. The test statistic values for both variables were significant and the assumption of their exogeneity was rejected. This issue further reinforces the necessity of employing internal instruments and the GMM method.

For selecting the appropriate model type for panel data, F-Limer and Hausman tests were also used

Table (4) Model Selection Test (F-Limer and Hausman)

Test	Test Statistic	Significance Level	Test Result
F-Limer	5.412	0.000	Preference for fixed effects model over pooled
Hausman	12.781	0.008	Preference for fixed effects model over random

Source: Prepared by the author using EViews 13 outputs.

Based on the F-test results, the fixed effects model was preferred over the pooled model, and in the Hausman test, a significant difference was obtained between random and fixed model estimates, leading to rejection of the random model. Therefore, using the GMM method considering heterogeneity and endogeneity of variables was identified as the optimal approach for estimating the final model.

Considering the above, the intended regression model was estimated using the two-stage GMM method (Arellano-Bond):

Table (5) Two-stage GMM (Arellano-Bond) Model Estimation Results

Variable	Coefficient	t-Statistic	Significance Level
Export resilience with one lag	0.481	4.302	0.000
Trade Policies	0.227	2.148	0.034
Digitalization	0.351	3.902	0.000
Trade Policies × Digitalization	0.198	2.781	0.006
Inflation Rate	-0.113	-2.341	0.020
GDP Growth	0.179	2.508	0.014
Unemployment Rate	-0.061	-1.561	0.118

Source: Prepared by the author using EViews 13 outputs.

The results obtained show that the lagged export resilience variable has a positive and significant coefficient at the one percent level, indicating relative stability of export structure in selected countries. Also, the coefficient of trade policies (TradePolicy) is positive and significant at the five percent level, demonstrating the positive and significant role of appropriate trade policies in increasing export resilience. The digitalization variable (Digitalization) also showed a stronger positive effect than trade policies and was significant at the one percent level. The interaction effect of these two variables (TradePolicy*Digitalization) was also positive and significant, confirming the potential synergy between trade policies and digitalization level in strengthening exports against external shocks. On the other hand, the control variable inflation rate had a negative and significant effect, showing that price instability weakens export resilience. Real GDP growth rate had a positive and significant effect, while the unemployment rate showed a negative but statistically insignificant effect, indicating that its influence on export resilience is not supported by the data.

Finally, to validate the estimated model, Sargan and Hansen tests were used to examine the validity of internal instruments:

Table (6) Model Validation Test Results

Test	Test Statistic	Significance Level	Conclusion
Sargan Test	14.273	0.361	Instruments are valid
Hansen Test	13.982	0.389	Instruments are valid
First-order autocorrelation AR (1)	-2.741	0.006	Exists (acceptable)
Second-order autocorrelation AR (2)	-0.827	0.408	Does not exist (desirable)

Source: Prepared by the author using EViews 13 outputs.

The results of these tests indicate the validity of instruments used and the absence of over-instrumentation in the model. Additionally, residual autocorrelation tests were performed using AR(1) and AR(2) statistics. Results showed that although first-order autocorrelation exists in the model (which is allowed in the Arellano-Bond method), second-order autocorrelation was rejected and the hypothesis of no autocorrelation at higher levels was

accepted. Therefore, the estimated model is statistically acceptable and its results are reliable.

5. Discussion and Conclusion

In this research titled "The Role of Trade Policies and Digitalization in Improving Export Resilience Against External Shocks: Evidence from Selected Oil-Producing Countries," an attempt was made to examine the impact of trade policies and digital development on export resilience against external shocks using panel data from five oil-focused countries including Iran, Iraq, Saudi Arabia, Kuwait, and the United Arab Emirates during 2010-2023. To estimate relationships among variables, dynamic panel data econometric methods using two-stage GMM models with the Arellano-Bond approach were used to obtain accurate and stable estimates while controlling for endogeneity, variance heterogeneity, and dynamic effects of exports.

The model estimation outcomes are mostly supportive of the research hypotheses. One, the hypothesis that trade policies have a positive impact on the export resilience was confirmed because the coefficient of this variable was significant and positive. Secondly, the hypothesis that digitalization increases the export resilience was accepted as well, and the positive effect of the digitalization index was strong and significant. Last, the hypothesis on the interaction between trade policies and digitalization was confirmed, because the interaction term demonstrated a positive and important effect on the resilience of exports. That implies that a coordinated trade liberalization and digital transformation can better cushion against external shocks. General, the results indicate that the three key research variables such as trade policy, digitalization, and their interplay make the difference in increasing export resilience and minimizing susceptibility to external shocks.

Model estimation results revealed that the trade policy variable impacts positively and significantly on the resilience of exports. The resilience of the export of countries also increased significantly due to the digitalization index. More to the point, the interaction variable of trade policies and digitalization also had a positive and significant impact, and it demonstrates that the combination of the two policies can be more significant to enhance export resilience. In general, the three key research variables are effectively relevant in minimizing susceptibility of exports to external shocks.

In order to discuss the received findings, it is possible to refer to the theoretical background associated with the trade policy performance and the impact of technological advances in open economies. Trade policies, particularly those targeted at liberalization of trade, diversification of export baskets, less reliance on few limited markets as well as ameliorated institutional trade infrastructure significantly increases the flexibility of the export structure of countries during external shocks. A further point that has been put across by modern trade theories of the international trade is that regulatory stability, lessening non tariff barriers and destroying trade subsidies and the transparency of the trade environment can lessen transaction risks and make exporters more responsive to crisis.

In addition to this, theories on technological development and digital economy reveal that digitalization is not only a complementary capacity in export mechanisms, but also a transformative capacity. ICT infrastructure, resilience of export structure is enhanced through accelerated information flow, enhanced business intelligence, lowered exchange

time and costs, and expanded access to international markets, transparency in supply chain and development of digital export platforms (e.g. cross-border e-commerce and digital logistics management systems).

Moreover, recent literature on resilient economy points out that resilience can be built by building digital capabilities, which can generate structural flexibility and quick recovery of export performance following shock. Integratively, a strategic synergy between active and technology-oriented trade policies and digitalization capabilities makes countries gain the benefits of a competitive advantage on the use of technology and at the same time diminishes the use of traditional benefits. Such synergy allows the quick responsiveness, flexibility, and effective export recovery in the case of demand variability, geopolitical crisis, and disruption of the supply chains. The results of this study empirically prove these theoretical hypotheses and demonstrate that co-/intelligent application of reformist trade policies and digital capabilities can raise the resistance to exports to a substantial level.

When matching the results of the research and the structural and economic peculiarity of the chosen oil-producing nations, one must mention the weak position of these economies in the world economy. The high dependency of the export of crude oil as the primary source of foreign exchange earnings and funding of the budget of the state, precondition the devastating impact of fluctuations of the oil price, global demand-side shocks, trade sanctions, and natural geopolitical disruptions on the balance of trade and the economic state of these countries.

The results of research indicate that dependence of oil export can be minimized through the adoption of trade policies that focus on diversifying exports, minimizing non-tariff barriers, enhancing access to new markets and restructuring tariff frameworks to enhance flexibility of the trade structure. Also, the creation of digital infrastructure and the use of new ICT substantially improves the ability of countries to engage in the global digital economy, supply chain efficiency, open up new markets, and open up the processes of exports.

Of these, Iran and Iraq, that have infrastructural problems in digital technology and political and institutional restrictions in the trade policy-making, require structural changes in these two sectors rather than in other ones. Investments into the development of IT platforms, training in digital skills, enhancing e-commerce platforms, and at the same time changing the trade policy structure that is sometimes deemed internationally uncompetitive can make the increase in non-oil exports a significant factor in the resilience of these two countries.

Conversely, those nations, such as the UAE and Saudi Arabia, which have made decisive moves in the digitalization of their governments, the e-logistics transformation, and the reform of their commercial policy, have been in a position to enlarge the proportion of non-oil exports in their export mix and become more responsive to extra-regional crises. Thus, the results of the study not only ensure the success of trade policies and digitalization on the macro level but also offer a viable branch of economic structure transformation in more susceptible oil-producing nations.

When the findings of this study are compared to those of the empirical literature, it is possible to note that the results are consistent as Vial (2019), Ozsoy et al. (2022), Wang et al. (2023), and Hong et al. (2022) also focused on the importance of digital technologies in ensuring trading sustainability. The usefulness of open and smart trade policies in

enhancing export resilience was also established in studies by Piccardi and Tajoli (2018) and Ikeda and Iitomi (2018). Positive effects of modern economic and trade tools on export resiliency were also reported by such domestic research as Nemati Parshkoh and Hoshomandchayneh (2021), Aslani, Rajabi and Karimi (2024), and Kolabi (2023). This consistency enhances the usefulness of the results of this study.

Three recommendations based on the results of the research are given:

Designing a smart and adaptive system of trade policies: The oil-producing nations are to develop supportive models of non-oil export, minimize tariffs, and ease the access to the new markets.

Specific investment in digital export facilities: The access to digital platforms including single trade windows, smart customs, and online skills training of exporters is essential in improving resilience of exports.

Integrating trade policy and digitalization into an overall strategy: A national digital export strategy can be developed by integrating trade policy and technology to enable agile and productive economies to external shocks.

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