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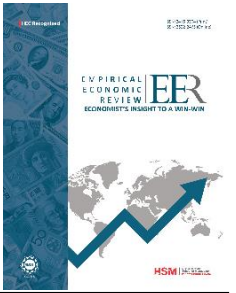

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Pakistan's Digital Transformation and Edge in Service Exports

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Abstract

Service exports play an important role in Pakistan's economy and its valuable foreign exchange while showcasing the country's strengths in sectors like information technology, finance, and tourism. They support economic diversification, generate employment opportunities, and enhance Pakistan's competitiveness worldwide. This study discovers the link between digital technology adoption and Pakistan's service exports. A key contribution is the development of a Digital Economy Development Index (DEDI) for the period of 1993–2023, highlighting the country's digitalization trends and their connection with service export performance. Using the ARDL approach, it studies the impact of digital economy development (DEDI), financial depth, domestic lending and the real effective exchange rate on Pakistan's service exports. The results disclose that DEDI has a positive and significant long run effect on service exports, underscoring the critical role of digital transformation in improving trade performance. In contrast, financial depth shows a negative and significant long-term impact, indicating slow adaptation within the financial sector in supporting service trade. Domestic lending to the private sector has an insignificant bearing on services exports in both the long term and the short term whereas the REER has a positive significant effect in the short term. The study recommends advancing the digital economy and digital infrastructure to strengthen Pakistan's service exports by increasing connectivity for companies engaged in service exports by investing in high-speed internet, effective data centers, and cloud computing infrastructure. Moreover, enhancing financial policies, credit access and implementing comprehensive training programs for digital upskilling to thrive in the digital economy is needed.

Keywords: connectivity, digital economy, digitalization, digitization, digital transformation services exports

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Introduction

The services sector is the largest and fastest-growing fragment of the global economy, vital for both the developed and developing countries. The exchange of services[1] is an essential component in stimulating economic expansion, creating job prospects and promoting engagement in value-added networks. In contrast to the trade in physical goods, wherein physical commodities are exchanged, trade in services contains transactions primarily involving the transfer of services rather than material products. These services span a spectrum of sectors, including banking, insurance, telecommunications, education, consulting, and tourism. Its trade involves a variety of services like professional services, financial services, transportation, tourism, information technology, education, healthcare, entertainment, and environmental services.

In 2022, the global exports of services reached a value of $7.1 trillion, which accounted for 7.1% of the world's GDP and contributed to 23% of the total world trade, including both goods and services (UNCTAD, 2023). When compared to the pre-pandemic era, all primary service sectors exceeded their 2019 values, except for travel and construction, as noted by UNCTAD. According to the World Development Indicators, wealthier nations exhibit a higher percentage of services in their GDP as compared to less wealthy countries. The economic history of developed nations and the current trend in some developing countries strongly indicate that the services sector expands with the rise in per capita income, in proportion to other sectors of the economy.

Digital technology has transformed the services sector by reducing barriers to costs, distance, expanding market access, and enabling real-time transactions. Platforms like fintech and AI-driven solutions have dropped blockades for businesses and are now boosting exports. In Pakistan, while Information and Communications Technology (ICT) services are growing, gaps in broadband access, regulations, and digital skills must be addressed to fully achieve the digital trade potential.

The significance of this study is reflected in the fact that service exports are the fastest-growing element of global trade. The digital economy has significantly enhanced service trade in Pakistan through numerous ways,

[1]Interchange of intangible economic activities among different countries, such as banking, healthcare, education, IT, tourism, and more.

and a rise in digital trade opportunities is reported, with the ICT services sector showing substantial growth. E-commerce and digital financial services have experienced significant development, contributing to an increase in services exports (ITC). New opportunities have been generated for Pakistan in terms of employment and the advancement of business. Foreign investments in digital sectors have transformed conventional industries, enhancing their operational efficiency. The future of Pakistan's economy heavily rests on the development of its services sector. Novelty has been built in this study by developing a Digital Economy Development Index (DEDI) for the period of 1993–2023, highlighting the country's digitalization trends and their links with service export performance. With this backdrop, the study observes how digital technology adoption impacts service exports while also assessing the level of digital uptake in Pakistan's economy. The matter of concern is how digital tools[2] help increase the amount and quality of service exports, whether digital adoption is leading to higher service export performance, and how well Pakistan is adopting digital technology.

Literature Review

This section discovers how policies and institutional frameworks shape the services trade sector of Pakistan. The review tries to assess the barriers and opportunities that facilitate the services trade of Pakistan. Likewise, an analysis of global service export trends is necessary to comprehend Pakistan's economy.

It is imperative to see global trends before diving into the subject matter. As reported by the International Trade Centre (2022), BRICS nations are major participants in the international services market, with rapid growth over the past two decades contributing markedly to the economic effectiveness of the BRICS group. In 2020, services trade reported for 5.5% to approximately 12% of the GDP of BRICS countries, comparable to or slightly higher than the United States' figure of 5.6% in the same year. However, it still falls behind leading European countries such as France (18.7%) and Germany (16%). In 2020, based on data from the WB, BRICS countries collectively represented 10% of the total global services exports, and 13% of the total global services imports.

[2]Internet use, roadband connections, mobile technology, digital payments and online platforms.

Recent studies by Cirera et al. (2021) underscore the increasing importance of integrating services related policy agenda into broader development strategies, highlighting the need to not only focus on manufacturing for development but also judge the performance of the services sector, considering the complex connections between the two domains.

With over $1 trillion in 2023, the United States is the greatest exporter of services, according to data from the TINA[3] Trade in Services database maintained by the United Nations ESCAP. With $584 billion, the UK stands at second, while Indian economy is also prominent and recorded $336 billion. In contrast, Pakistan's 2023 service exports were $7.5 billion. The State Bank of Pakistan has divided service trade into eleven categories[4], since international agreements and frameworks facilitate it, with the GATS founded by the World Trade Organization (WTO) serving as a key framework for member countries to liberalize trade in services.

Cross-border trade (Mode 1)[5] is probably how the majority of Pakistan's service exports are carried out. This emphasizes how crucial telecommunications are as a service delivery channel. Even though Pakistan's service exports improved between 2019 and 2023 (by an average of 6%), no increase has been observed in the market share. The exports of Pakistan's ICT sector, on the other hand, have grown by 20% on average every year over this time, while its share of the global market has only scaled by 0.25%. In contrast, India testified exporting (more than $250 billion worth) of ICT and other business-related services in 2023, with an annual growth rate of 14%, and an 8% gain in market share. Although cross-border trade is the main way that India exports its services, foreign commercial involvement in the services industry has grown in significance as FDI has surged recently.

[3]Trade Intelligence and Negotiation Advisor

[4]As per the State Bank of Pakistan, services trade is divided into 11 categories, including ICT services, business services, cultural and personal services, government services, maintenance and repair, transport, travel, construction, insurance and pensions, financial services, and intellectual property fees.

[5]Mode 1 is one of the classifications of the mode of service supply by WTO under the GATS agreement where service supply across border is without the need for the service provider to be physically present in the country of consumption.

Digital Economy and the Service Exports of Pakistan

The digital transformation[6] has impacted numerous sectors of Pakistan, including transport, finance, education, health, agriculture and manufacturing. Firms invested in digital technologies like cloud computing, big data, and artificial intelligence have revealed sharp growth in their information technology exports. Initiatives like the Digital Silk Road between China and Pakistan have promoted e-commerce and business opportunities. Chinese investments and technological improvements have contributed to the growth of digital economy.

The services sector's contribution to Pakistan's GDP is 61.5%, and it is undergoing significant growth due to digitization, while creating new trade predictions. Jobs in professional services, particularly freelancing, are dynamic, with Pakistan ranking among the top ten fastest-growing freelance markets globally, with a 47 percent growth rate. Most Pakistani freelancers are software developers, representing a significant share of global freelance developers (10.5%). Pakistan is also recognized as the fourth-largest supplier of freelancing services. The country's digital space is active with social enterprises engaging in various digital activities.

Similarly, the ICT services sector in Pakistan has shown an average annual growth of 10.8% from 2010 to 2019. Computer services have experienced substantial growth in their proportion of total ICT services, with an average yearly increase of 17%. Pakistan exports more than 50% of its ICT services to the US, with the UK, United Arab Emirates, and Canada being the next largest importers. Despite these significant exports, there remains substantial potential for intra-regional trade within the region.

The launch of 3G and 4G technology indeed gave a significant boost to the digital economy[7]. The deployment of fiber optic and wireless internet infrastructure, because of the introduction of 3G and fixed 4G services, played a crucial role in strengthening the economy. Research has shown that mobile technology upgrades, including 2G, 3G, and 4G, have generated additional returns and have been the drivers of GDP growth. According to

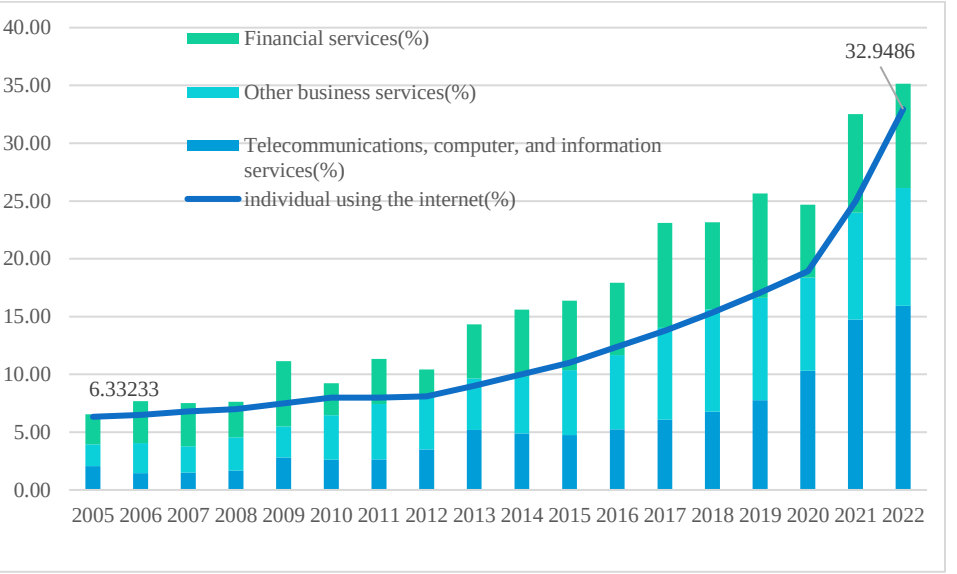
[6]Digital transformation is the integration of digital technology to alter services or businesses, such as replacing manual procedures with digital ones or modernizing old technology.

[7]The digital economy includes the economic activities that develop from connecting persons, businesses, devices, data, and processes using digital technologies.

research, a 10% increase in mobile adoption rates might result in a 0.5%–1.2% boost in GDP, as was the case between 2000 and 2017.

Figure 1

Service Exports and Internet Usage in Pakistan



Note. Data Source: International Trade Centre (ITC)

The determinants of service trade include several factors that influence the exchange of services among countries. These factors can include regulatory frameworks, economic conditions, technological advancements, service demand, and trade policies. Additionally, factors like export competitiveness, natural resources, consumer demand, trade policies, economic growth, exchange rate, technological advancements and demographics can influence an economy's balance of trade in goods and services. During the period of 2018 and 2021, Pakistan implemented important digital policies to support economic growth, adopt innovation, and tried to work for connectivity. These strategies underscored the need for digital transformation to reach sustainable development objectives and advance services.

Methodology

In Pakistan, as ICT services have contributed to significant growth, the expansion of digital trade remains dependent on digital infrastructure,

regulatory frameworks, and human capital development. Addressing challenges in broadband access, cybersecurity regulations and digital skills training is vital to unlock the full potential of the digital economy in boosting services exports. This aspect is a source of motivation for conceptualizing methodology and developing a digital index for Pakistan. The index is made by using the entropy weight method[8] proposed by Shannon and Weaver (1948), and amended by Zeleny (1982). The index reflects the degree of digitalization across different periods and links it to the performance of service exports. This study further identifies variables, an econometric model, data sources, a developing digital index (as a measurement of the digital economy using the entropy method), and develops basis for the econometric model.

Digital Economy Development Index (DEDI): Digital Economy Development Index is made by the variables listed here: digital technology infrastructure investment, R&D & skill environment metrics and Degree of application of Digital Technology (See table in Annexure for details). It is built in three levels. In level 1, the overall DEDI represents the overall combined score after assigning weights to all indicators. In level 2, index is divided into three categories showing digital technology infrastructure investment, R&D and skill environment metrics and Degree of application of Digital Technology. This gives us indication of the strong and weak areas. In level 3, individual variables are placed in sub-indexes. Digital technology infrastructure investment measures digital readiness of the country. R&D and skill environment measure innovation and human capital. Degree of application of Digital Technology shows the correct use of internet and related items. The index is comprehensive and multi-dimensional. PCA and Entropy methods were applied but Entropy was found superior as our aim is to give a clean, data-driven index where each indicator's weight reflects its variability.

For DEDI, we utilize, digital technology infrastructure, its application, R&D, and skill environment metrics, as these factors facilitate and promote the trade of a country (Li et al., 2023). The development of the digital

[8]This method is remarked for its superior accuracy relative to the Principal Component Analysis (PCA), especially as the dimensionality of the dataset increases, which results in more accurate entropy measurements. One of the primary benefits of this method over subjective weighting models is to remove human bias from the weighting of the indicators, thereby enhancing the objectivity of the overall results.

economy (DE) in any country can significantly boost service exports. Important variables selected are Financial Depth (M2/GDP), Domestic Credit to Private Sector by Banks, Real Effective Exchange Rate (REER).

Econometric Model to Measure the Impact of Digital Economy on Services Export

To investigate the dynamic interactions between the variables, this study utilized time series data using the ARDL model. ARDL is a consequent model; the serially correlated residual series from static equation identifies the existence of ARDL process, which is equivalent to Common Factor (COMFAC) Analysis. ARDL has the ability to accommodate the mixed integration order of relevant regressors, it estimates consistent and efficient parameters even in the presence of non-stationarity. The ARDL model, which was first presented by Pesaran et al. (2001), is especially useful for examining situations in which the dependent variable is affected by both the current and lagged values of one or more independent variables, as well as by its own lagged values.

To estimate the impact of the digital economy on services export, a model is proposed following Li et al. (2023). Although there are various models that are estimated in literature like Standard Gravity Models and Revealed Comparative Advantage, this appears to be the most relevant model in literature based on post-estimation residual analysis. The ARDL model enables researchers to identify both short-term and long-term effects. ARDL framework is utilized when the variables are integrated at varying levels, notably I(0) (stationary) and I(1) (non-stationary), however, it cannot be utilized when any variable is integrated of order two. In our analysis, we don't find I(2) variables.

Besides variables of services export, digital index, real effective exchange rate, we include two other variables, i.e. domestic credit to the private sector and financial depth (Sahoo & Dash, 2014) as the indicators of financial development. Following is the proposed structure of our general model in mathematical formulation.

$$\Delta Serexp_t = \beta_0 + \sum_{i=1}^{l} \beta_1 \Delta Serexp_{t-i} + \sum_{i=0}^{l} \beta_2 \Delta Digindex_{t-i} + \sum_{i=0}^{l} \beta_3 \Delta ReeR_{t-i} + \sum_{i=0}^{l} \beta_4 \Delta DCr_{t-i} + \sum_{i=0}^{l} \beta_5 \Delta Fin\_depth_{t-i} + \mu_t \quad (1)$$

$\Delta Serexp_t$ = Difference Services Exports of Pakistan in current $US

$\Delta DEDI_t$ = Difference Digital Economy Development Index

$\Delta REER_t$ = Difference Real Effective Exchange Rate

ΔDCr_t = Difference Domestic Credit to Private sector by bank (% of GDP)

ΔFin_Depth_t = Difference Financial Depth is calculated as M2/GDP

In equation (1), delta shows the first difference, *l* shows the optimal lag length, β's are the parameters, and μ is the error term. The equation indicates that the service exports of Pakistan measured in the current $US, are the dependent variable, affected by the digital economy, exchange rate, domestic credit to private sectors by banks, and financial depth (regressors).

Initially, the F-test is conducted to assess the existence of a long-term relationship among the variables. The calculated F-statistics are then compared to the critical values established by Pesaran et al. (2001). If the computed F-statistics falls outside the lower upper bounds of these critical values, it indicates the existence of cointegration between the variables.

Data Sources

This study utilized data on services exports for Pakistan over the period 1993-2023. The statistics on exports of services are sourced from the WDI. The data for the DEDI and other variables are taken from the WB database and the International Telecommunication Union (ITU) database.

Measuring the Digital Economy

The study measures a comprehensive digital economy development index based on the Digital Opportunity Index (DOI), established by the ITU, as a principal metric to assess digital accessibility and connection because of the limited data of the index as the study is using the data from 1993 to 2023. The DOI includes essential aspects such as digital access, utilization, and affordability. The current measurement is based on ten universally acknowledged and accepted fundamental ICT indicators. These indicators include measurements related to mobile and fixed telecommunications coverage, the cost-efficiency of ICT services, usage intensity and their socio-economic effects. To facilitate a comprehensive review of the digital environment, the study also includes the ICT Development Index (IDI), released by the ITU. The IDI assesses ten indicators with three dimensions: infrastructure, research and innovation, and skills application, establishing an ICT assessment framework. The choice of specific indicators is governed by the availability of synchronized data sets, however, most relevant and theoretically backed variables are

used. The entropy approach is employed for weighted index calculation; contemporaneously in use, the entropy approach is more dynamic and less restricted compared to the conventional PCA technique. The index yields scores from 0 to 1 to evaluate digital opportunities and connectivity fully, ensuring precision and objectivity.

Results

This section demonstrates the results of quantitative analysis which calculates DEDI and explores the effect of the digital economy on service exports of Pakistan. It examines short-term and long-term cointegration by applying the ARDL technique. The necessary unit root, correlation, and stability tests are applied. Digital economy development index is constructed by assigning weights to the components of the index.

Table 1

Components of Digital Economy Development Index Weights

	Weights (indicators)	Weights (sub-indices)
Infrastructure investment		0.388
Fixed telephone subscriptions	0.014	
Power supply	0.001	
Secure server internet	0.372	
R&D & skill environment		0.116
Patent applications (by nonresidents)	0.014	
Patent applications (by residents)	0.091	
Secondary school enrolment	0.008	
Tertiary school enrolment	0.001	
Degree of application		0.494
Individuals using the Internet	0.135	
Fixed broadband subscriptions	0.208	
Mobile cellular subscriptions	0.150	

Table 1 shows the weights for each indicator, and then each sub-index is calculated by entropy method. The ARDL approach is applied to examine the association between Pakistan's service exports and the digital economy, exchange rate, domestic credit, and financial depth, both in short and long run. Before performing a cointegration analysis, it is imperative to ascertain the stationarity characteristics of each variable. The Augmented Dickey-Fuller (ADF) test, developed by Dickey and Fuller in 1979, is utilized to

evaluate the integration order of variables. It is essential to confirm that none of the variables are integrated of order two. Stationarity test is applied. To check the presence of the long-term relationship among variables, we have compared the computed F-statistic of ARDL from Pesaran et al. (2001) with the upper bound critical values of Narayan (2005).

Table 2

Long Run Cointegration Test

Test Statistic	Value	*K*
F-statistics	4.151077	4
Significance	I0 Bound	I1 Bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

Table 2, displays the calculated *F*-statistics and the critical bound values. Since the computed *F*-statistic (4.151) exceeds the upper bound critical value at 2.5%, 5%, and 10% significance levels, the null hypothesis of no cointegration among the variables is rejected. The results indicate that there is a statistically significant long-term relationship among the variables.

Table 3

Long Run Results of ARDL Model

Variables	Selected Model: ARDL (2, 0, 1, 0, 1)		
	Coefficients	*t*-statistic	Prob.
DEDI	62699.85**	2.719	0.013
ReeR	-94022.58	-1.260	0.221
DCr	-171911.1	-1.129	0.272
Fin_Depth	-434059.5	-1.727	0.099

Note. **Significance of variables at a 5% level

The long-run results from the ARDL model estimation are presented in Table 3. The findings indicate a positive and significant relationship between service exports and the digital economy, suggesting that advancements in the digital economy contribute to enhancing a country's service exports. These results are consistent with the study by Li et al. (2023), who also identified a positive correlation between service exports

and digital economic progress.

However, financial depth has shown a negative and marginally significant effect on service exports reflecting underdevelopment of financial system. According to Sahoo et al. (2015), the development of the financial sector plays a vital role in enhancing a country's capacity to supply exports, positively influencing trade but in contrast, underdeveloped financial markets can hinder trade performance. In Pakistan, financial depth negatively affects service exports due to Pakistan's underdeveloped financial system. In Pakistan, financial depth (M2/GDP) is frequently used as a metric of liquidity, however, lending is biased toward the government and major businesses rather than the services sector (State Bank of Pakistan [SBP], 2023). Instead of facilitating the exports, Pakistan's financial system is discouraging the exporters.

Additionally, domestic credit provided to the private sector by banks and the real effective exchange rate (REER) shows a negative insignificant relationship with service exports in the long run. The government absorbs a considerable percentage of banking credit to finance its fiscal shortfalls. The private businesses are left with lesser funds, particularly service-oriented SMEs (small and medium-sized enterprises), which require capital to expand and export their services. In 2023, the government received 65% of all bank loans in Pakistan, with only 35% going to the private sector, including services. The service sector, which frequently comprises startups, freelancers, and IT enterprises, struggles to secure funding for innovation, scaling, and entering export markets (Government of Pakistan, 2023).

Table 4

Diagnostic Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.123	Prob. *F* (2,18)	0.884
Obs**R*-squared	0.392	Prob. Chi-Square	0.821

The LM test is used in table 4 to determine whether the regression model's residuals exhibit autocorrelation or serial correlation. We can conclude that there is no evidence of serial correlation in the regression model's residual at standard significance levels (e.g., 5% or 1%), as table 5 demonstrates both the *F*-statistic and the Obs**R*-squared provide high *p*-values (0.8845 and 0.8216 respectively).

Table 5
ARDL Short Term Results (ECM)

Variable	Coefficient	*t*-Statistic	Prob.
Δ(SEREXP (-1))	-0.483**	-3.913	0.0009
Δ(DCR)	90116.69	1.696	0.1054
Δ(REER)	43597.38	1.996	0.0597
CointEq(-1)	-0.279**	-5.579	0.0000

Note. **Significance of variables at a 5% level

The results from the ARDL Error Correction Regression, presented in table 5, indicate that there is a positive and significant relationship between the exchange rate and export services. These results are in line with the results presented by Tran (2022), who also explained a positive relationship between services exports and real effective exchange rates for Asian economies. Another study by Mahmood et al. (2020) has also shown positive significant effect of exchange rate on export growth in Pakistan.

The Real Effective Exchange Rate (REER) typically has a negative effect on the growth of service exports. However, because of certain regional dynamics, this effect seems to be positive in the case of Asian countries. One reason for this could be that a stronger currency makes it more affordable for service providers to invest in foreign technology and expertise or buy necessary inputs, which raises the standard and efficacy of their products and services. For example, nations like the Philippines and India frequently depend on foreign cybersecurity systems, cloud-based infrastructure, and sophisticated software tools in the IT services industry. The cost of purchasing these technologies can be decreased by a stronger currency, increasing their ability to provide top-notch IT solutions on a global scale. In the same way, nations with thriving tourism sectors, such as Thailand and Malaysia, gain by importing luxury services, hotel management systems, and expensive equipment to satisfy international standards. This compensates for the possible loss of competitiveness brought on through fluctuations in exchange rates by allowing them to offer superior services at competitive pricing. These illustrations support the principle of comparative advantage by showing how export growth can be fueled by access to high-quality inputs in the services sector.

The coefficient of domestic credit to the private sector is positive but insignificant. A positive relationship indicates that more domestic credit to

private sectors by banks can increase service exports, however, the effect is insignificant. The error correction term (CointEq (-1)) is negative and highly significant ($p < 0.01$). This indicates that approximately 27.93% of any short-run deviation from the long-run equilibrium can be corrected in the next period, confirming a strong adjustment mechanism back to equilibrium aftershocks.

The model stability has been evaluated using CUSUM and CUSUM-Square tests. These tests ensure that the ARDL model's parameters are consistent and do not vary over time. They also identify structural breaks or changes in the relationships being studied, which may require model re-specification or consideration of additional variables. The test statistics for both CUSUM and CUSUM Squares are within critical bounds, which shows that the model is stable over time.

Conclusion

In comparison to imports, exports are the most critical component of international commerce, as they are directly associated with the expansion of the economy. Taiwan, China, Malaysia, and South Korea are among the numerous Asian economies that have experienced economic development because of their increased services exports. Developed economies are progressively governed by services so the importance of service exports cannot be denied.

The impact of DE on service exports in Pakistan has been profound and multifaceted. Over the recent years, particularly since 2014, Pakistan has witnessed significant growth in IT service exports which has increased by 2.7 times, and now constitutes approximately 35% of total service exports. This growth is largely attributed to the advancements in digital technologies that have enabled Pakistani businesses to reduce costs, streamline operations, and improve their competitive edge in the global market.

This analysis developed a thorough digital economy development index for Pakistan by using the Entropy method. The influence of DEDI on service exports in Pakistan is estimated for the long term and short term. To achieve the objective of this study, the ARDL model has been applied for Pakistan. Empirical results from the long-run ARDL model indicate that there is a positive and significant relationship between the digital economy development and service exports of Pakistan. If the digital environment (digital connectivity, digital logistics, training of hard skills, digital

infrastructure, cloud computing) of the country expands/improves, it will bring improvement in services exports. The financial depth negatively and significantly affects the exports of services. It shows that the country's financial system is underdeveloped and non-supportive of services exports. The results also indicate underdeveloped digital infrastructure, limited access to credit for exporters in the services sector, lack of investment in the services sector, and weak policy options available. The other variables such as REER, and domestic credit to the private sector by banks are negatively affecting the service exports of Pakistan. However, the results are statistically insignificant in the long term. Although, in the short run, real effective exchange has a positive influence on the services exports. While all the other variables are statistically insignificant. The domestic credit to the private sector by banks is negatively affecting service exports due to high interest rates that stop the service exporters from accessing finances. Small and medium enterprises, new startups, and freelancers find it difficult to get loans due to strict conditions for newcomers and lack of credit records in past years.

Recommendations

The study recommends that Pakistan must develop the digital economy framework with digital logistics and must introduce workable financing solutions (digital payment mechanism like Sada Pay; liquidity to meet expenses, banking sector expansion, risk management & cyber security, insurance, SME lending facility) to improve the competitiveness of the country's service exports. Careful observation of the exchange rate must be observed and overvaluation must be avoided. Pakistan must facilitate the digital economy to increase connectivity for companies/firms engaged in service exports, investing in high-speed internet, data centers and cloud computing infrastructure. Development of improved financial policies for the services sector trade, and improved access to credit for service exporters must be ensured. Extensive training programs must be conducted for digital up skilling to enhance workers' technological know-how, and to facilitate the digital transformation of service exports.

Author Contribution

Samia: conceptualization, data curation. **Uzma Zia:** methodology, writing-original draft, writing-review & editing. **Saud Ahmad Khan:** data curation, validation.

Conflict of Interest

The authors of the manuscript have no financial or non-financial conflict of interest in the subject

matter or materials discussed in this manuscript.

Data Availability Statement

Data supporting the findings of this study will be made available by the corresponding author upon request.

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Annexure

Digital Economy Development Index - Variable Selection

Total index	Sub index	Third-level indicators
DEDI	Digital Technology Infrastructure Investment	Fixed telephone subscriptions (per 100 people)
		Power supply (percentage of population)
		Secure internet server (per million people)
	R&D & Skill Environment	Patent applications (nonresidents)
		Patent applications (residents)
		School enrolment, secondary (% gross)
		School enrolment, tertiary (% gross)
	Degree of Application	Individuals using the internet (% of population)
		Fixed broadband subscriptions (per 100 people)
		Mobile cellular subscriptions (per 100 people)