ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR

CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

THE IMPACT OF DIGITAL TRANSFORMATION ON ENTREPRENEURIAL GROWTH AND INTERNATIONAL BUSINESS COMPETITIVENESS

[1]Kasir Nazir
BBA Scholar at Quaid-i-Azam University, Islamabad, Pakistan
Email: kasirnazir4@gmail.com
[2]Moeez Imtiaz
Relationship Manager at Habib Metropolitan Bank Ltd, Islamabad, Pakistan
Email: moizimtiaz728@gmail.com

Abstract
This study examines the relationship between Digital Transformation, Entrepreneurial Growth, and International Business Competitiveness using panel data from 15 countries over the period 2010–2022. Employing Fixed Effects and Random Effects models within the Baron and Kenny (1986) mediation framework, the analysis tests whether entrepreneurial growth mediates the digital transformation-competitiveness nexus. The results reveal that Digital Transformation has a significant direct positive effect on International Business Competitiveness ($\beta = 0.078$, $p < 0.01$). However, Digital Transformation does not significantly affect Entrepreneurial Growth ($\beta = 0.126$, $p > 0.10$). Entrepreneurial Growth independently shows a strong positive effect on Competitiveness ($\beta = 0.225$, $p < 0.01$). These findings do not support the mediation hypothesis. Instead, Digital Transformation and Entrepreneurial Growth operate as parallel pathways enhancing international business competitiveness. The study contributes by demonstrating that digitalization and entrepreneurship represent parallel not sequential pathways to national competitiveness, challenging the conventional assumption that digital investments automatically stimulate entrepreneurial ecosystems. From a policy perspective, governments should pursue integrated but distinct strategies targeting both digital infrastructure development and entrepreneurship support simultaneously, rather than assuming sequential effects. Robustness checks including quantile regression confirm the consistency of findings across alternative specifications.

Keywords: *Digital Transformation, Entrepreneurial Growth, International Business Competitiveness, Mediation Analysis, Panel Data, Fixed Effects.*

1. Introduction

The 21st-century global economy is witnessing a paradigm shift driven by two transformative forces: rapid digitalization and entrepreneurial dynamism. Digital transformation encompassing the diffusion of high-speed internet, cloud computing, and digital platforms has fundamentally restructured how firms create value, access markets, and compete internationally (Verhoef et al., 2021; Vial, 2019). This digital revolution has lowered information asymmetries, reduced transaction costs, and enabled even small firms to participate in global value chains (Autio et al., 2021; Nambisan et al., 2019). Simultaneously, entrepreneurship has regained prominence as a critical driver of economic renewal, job creation, and innovation. Entrepreneurial growth measured through new business density reflects an economy's capacity for self-renewal and adaptation to technological change (Stam & van de Ven, 2021).

The convergence of these two forces has sparked considerable academic and policy interest. Digital technologies are widely theorized to democratize entrepreneurship by reducing capital requirements and providing access to global customer bases (Autio et al., 2018; Elia et al., 2020). Platforms such as Amazon and Shopify have enabled millions of micro-entrepreneurs to reach

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

international markets with minimal upfront investment (Song et al., 2022). Consequently, policymakers across the OECD and developing world have invested heavily in digital infrastructure, implicitly assuming that such investments will automatically stimulate entrepreneurial ecosystems and enhance national competitiveness (OECD, 2023; World Bank, 2022).

1.1 Research Gap

No study has systematically tested whether entrepreneurial growth mediates the relationship between digital transformation and international business competitiveness. The prevailing policy assumption that digital investment automatically stimulates entrepreneurship and thereby competitiveness remains empirically untested through rigorous mediation analysis. This gap is significant given competing theoretical predictions from digital enablement and digital concentration arguments. Consequently, policymakers lack evidence-based guidance on whether digital infrastructure and entrepreneurship support represent complementary or substitute strategies. This study addresses this gap by directly testing the mediation pathway.

1.2 Problem Statement

Despite theoretical arguments, empirical evidence on the relationship between digital transformation, entrepreneurial growth, and international competitiveness remains fragmented, with existing studies examining these phenomena in isolation rather than their interconnections (Acs et al., 2021; Bogliacino et al., 2023). This yields a fundamental puzzle: If digital tools reduce entry barriers and democratize entrepreneurship, why do we observe simultaneous trends of digital acceleration and stagnating business dynamism? The policy assumption that digital investment automatically fuels entrepreneurship has never been directly tested using rigorous mediation analysis. Theoretically, the relationship is ambiguous between digital enablement arguments (Autio et al., 2018) and digital concentration arguments (Cusumano et al., 2021; Kenney & Zysman, 2020), with potential contingency on institutional factors often overlooked (Audretsch et al., 2020; Chowdhury et al., 2022). These ambiguities create a knowledge gap: policymakers lack empirical guidance on whether digital infrastructure and entrepreneurship support are complementary or substitute strategies (European Commission, 2023). This study addresses this gap by systematically testing whether entrepreneurial growth mediates the digital transformation-competitiveness nexus.

1.3 Research Questions

1. Does Digital Transformation directly affect International Business Competitiveness?
2. Does Digital Transformation affect Entrepreneurial Growth?
3. Does Entrepreneurial Growth mediate the relationship between Digital Transformation and International Business Competitiveness?

1.4 Research Objectives

1. To examine the direct effect of Digital Transformation on International Business Competitiveness.
2. To investigate the effect of Digital Transformation on Entrepreneurial Growth.
3. To test the mediating role of Entrepreneurial Growth in the Digital Transformation-Competitiveness nexus.

1.5 Significance of the Study

This research makes three distinctive contributions. Theoretically, we adjudicate between competing enablement and concentration arguments by testing whether digitalization and entrepreneurship represent sequential or parallel pathways to competitiveness, thereby challenging

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

or validating fundamental assumptions underlying Schumpeterian innovation theory and digital ecosystem frameworks. Empirically, we employ rigorous panel data methods across 15 countries over 13 years (2010–2022) to test mediation directly rather than assuming it, moving beyond correlational studies that have dominated this research stream. Policy-wise, we provide evidence-based guidance for governments allocating scarce resources between digital infrastructure development and entrepreneurship support programs, offering clarity on whether these investments function as complements or substitutes in an era of constrained public budgets (World Economic Forum, 2024; UNCTAD, 2023).

2. Literature Review

2.1 Theoretical Framework

This study draws upon two complementary theoretical perspectives that have evolved significantly in contemporary scholarship. First, Schumpeter's Theory of Innovation (1934) has been extended by modern entrepreneurship scholars to explain how technological change drives economic development through entrepreneurial activity. Contemporary interpretations emphasize that entrepreneur's act as agents of "creative destruction," introducing new combinations of resources that disrupt existing market structures (Block et al., 2023; Hölzl et al., 2022). Recent applications of Schumpeterian thinking in digital contexts suggest that digital technologies amplify entrepreneurial opportunities by enabling rapid experimentation and scaling (Nambisan et al., 2019; Autio et al., 2021).

Second, the Resource-Based View (RBV), originally developed at the firm level (Barney, 1991), has been extended to the national level to explain how countries gain competitive advantage through unique resources and capabilities. In the digital era, infrastructure—particularly broadband connectivity and internet penetration constitutes a critical strategic resource that enables firms to access global markets and innovate continuously (Teece, 2023; Warner & Wäger, 2019). The dynamic capabilities extension of RBV further suggests that digital transformation enhances a nation's ability to sense and seize international opportunities (Helfat & Raubitschek, 2018; Eisenhardt & Bingham, 2021).

These theoretical perspectives offer competing predictions regarding the relationship between digitalization and entrepreneurship. A Schumpeterian logic suggests that digital transformation, by reducing entry barriers, should unleash a wave of entrepreneurial "creative destruction" that enhances competitiveness. In contrast, a dynamic capabilities extension of RBV might predict that incumbents, possessing superior resources and data, are better positioned to leverage digital technologies, potentially reinforcing their dominance and dampening new firm entry. This study adjudicates between these competing logics by testing whether digitalization and entrepreneurship represent sequential or parallel pathways to competitiveness.

2.2 Digital Transformation and International Business Competitiveness

Digital transformation encompasses the adoption of internet technologies, broadband infrastructure, and digital platforms that enable businesses to access global markets, reduce transaction costs, and enhance productivity (Verhoef et al., 2021; Vial, 2019). Contemporary research demonstrates that digitalization positively correlates with export performance and international competitiveness through multiple mechanisms. First, digital technologies reduce information asymmetries between domestic firms and foreign buyers, facilitating cross-border trade (Freund & Weinhold, 2004; Lendle et al., 2016). Second, e-commerce platforms enable even small firms to reach international customers with minimal sunk costs (Goldfarb & Tucker, 2019;

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

Song et al., 2022). Third, digital tools enhance firm-level agility, enabling rapid responses to shifting global market demands (Teece et al., 2016; Warner & Wäger, 2019).

Recent empirical evidence strongly supports this positive relationship. Brynjolfsson et al. (2021) found that firms in highly digitized economies demonstrate 5-8% higher productivity growth than their less-digitized counterparts. Gal et al. (2019), using OECD data, documented that digital adoption significantly boosts firm-level exports, particularly in service sectors. Cross-country studies by the World Bank (2022) and OECD (2023) confirm that nations with advanced digital infrastructure exhibit stronger trade performance and greater resilience to global economic shocks. Meta-analytic evidence from Bogliacino et al. (2023), synthesizing 47 studies, concludes that the digitalization-competitiveness link is robust across different specifications and contexts. Based on this theoretical and empirical foundation, we propose:

H1: Digital Transformation positively affects International Business Competitiveness.

2.3 Digital Transformation and Entrepreneurial Growth

The relationship between digitalization and entrepreneurship is theoretically ambiguous and empirically contested in contemporary literature. On one hand, digital enablement arguments suggest that digital technologies reduce entry barriers, enabling new ventures to emerge and scale rapidly (Audretsch et al., 2020; Nambisan, 2017). Digital platforms provide entrepreneurs with access to global customers, payment infrastructure, and logistical support at minimal cost (Autio et al., 2018; Elia et al., 2020). Crowdfunding platforms democratize access to capital (Mollick, 2014), while digital tools reduce the minimum efficient scale for new ventures (Goldfarb & Tucker, 2019). Recent evidence from developing economies suggests that mobile internet expansion correlates with increased informal sector entrepreneurship (World Bank, 2022; Bahia et al., 2023).

On the other hand, digital concentration arguments posit that digital platforms may concentrate market power among established players, potentially crowding out new entrepreneurs (Cusumano et al., 2021; Kenney & Zysman, 2020). Platform-mediated markets often exhibit "winner-take-all" dynamics where network effects favor incumbents (Eisenmann et al., 2011; McIntyre & Srinivasan, 2017). Large technology firms can leverage data advantages to identify and replicate successful entrepreneurial innovations before they scale (Zuboff, 2019; Autor et al., 2024). Recent research by Acemoglu and Restrepo (2022) suggests that automation technologies may reduce labor's share of income and concentrate economic activity, potentially suppressing new business formation in affected sectors.

Empirical evidence remains mixed. While some studies find positive associations between internet penetration and new business registration (Audretsch et al., 2015; Klapper & Love, 2016), others document null or even negative relationships in certain contexts (Block et al., 2023; Chowdhury et al., 2022). This ambiguity suggests that the digitalization-entrepreneurship nexus may be contingent on institutional quality, regulatory frameworks, and financial development—factors that moderate the translation of digital access into entrepreneurial action (Urbano et al., 2019; Welter et al., 2023). Given the weight of theoretical arguments and some empirical support for a positive relationship, we propose:

H2: Digital Transformation positively affects Entrepreneurial Growth.

2.4 Entrepreneurial Growth and International Business Competitiveness

Entrepreneurial activity generates new businesses, increases employment, and fosters innovation all mechanisms that contribute to national competitiveness (Stam & van de Ven, 2021; Acs et al., 2021). High levels of new business density indicate a dynamic economic environment capable of

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

adapting to global challenges and technological change (Wennekers & Thurik, 1999). Contemporary research extends this foundational insight by identifying specific pathways through which entrepreneurship enhances international competitiveness.

First, entrepreneurial firms disproportionately contribute to export growth and international market expansion (Love & Roper, 2015; Hessels & van Stel, 2021). Young firms, despite their resource constraints, often demonstrate greater flexibility in entering foreign markets and adapting to local conditions. Second, entrepreneurship drives innovation by introducing new products, processes, and business models that enhance national technological capabilities (Block et al., 2022; Hölzl et al., 2022). Third, entrepreneurial ecosystems create positive spillovers that benefit incumbent firms through knowledge diffusion and labor market dynamics (Audretsch & Belitski, 2021; Stam, 2022).

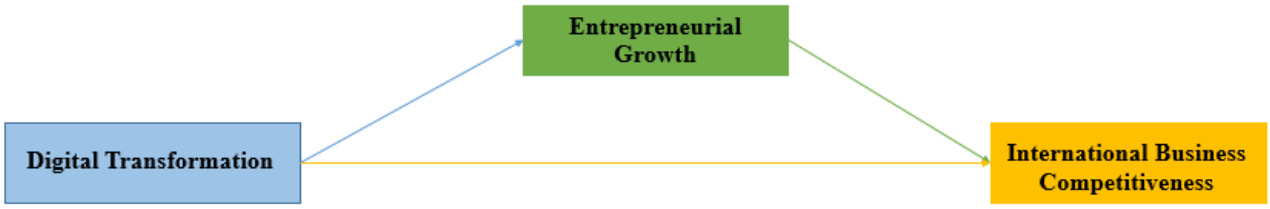
Recent empirical evidence confirms these relationships. Using data from 55 countries, Acs et al. (2021) demonstrate that entrepreneurial activity explains significant variation in national economic performance beyond traditional factors. The Global Entrepreneurship Monitor (2023) reports strong correlations between early-stage entrepreneurial activity and export-oriented growth, particularly in innovation-driven economies. Meta-analytic evidence from Bogliacino et al. (2023) confirms that entrepreneurship exerts positive effects on productivity growth and international competitiveness, with effect sizes comparable to those of traditional capital investment.

For entrepreneurial growth to serve as a mediator between digital transformation and international competitiveness, it must first demonstrate a direct effect on competitiveness. If digital transformation influences entrepreneurial growth, and entrepreneurial growth in turn influences competitiveness, then the condition for mediation is established. A significant relationship between entrepreneurial growth and competitiveness satisfies one of the necessary conditions for mediation within the Baron and Kenny (1986) framework. Accordingly, we propose:

H3: Entrepreneurial Growth positively affects International Business Competitiveness.

2.5 Conceptual Framework

Conceptual Framework



(**Source:** Adapted from Hayes, A. F. (2022)

3. Methodology

3.1 Research Design

This study employs a quantitative longitudinal research design utilizing panel data regression analysis. Panel data methodology offers distinct advantages over purely cross-sectional or time-

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

series approaches (Wooldridge, 2021). First, it controls for unobserved country-specific heterogeneity that may bias cross-sectional estimates. Second, panel data provide greater variability, reduced collinearity, and enhanced estimation efficiency (Baltagi, 2021). Third, panel techniques enable examination of dynamic relationships and causal mechanisms that evolve over time (Hsiao, 2022). The panel spans 13 years (2010–2022) across 15 countries, yielding 195 country-year observations. This temporal dimension captures both short-run fluctuations and longer-run structural adjustments in digital transformation, entrepreneurial activity, and international competitiveness.

3.2 Data Source and Sample

Data were obtained from the World Development Indicators (WDI) database maintained by the World Bank. The WDI provides comprehensive, harmonized data on economic, social, and technological development across countries, ensuring consistency in variable definitions and measurement methodologies (World Bank, 2023). The sample comprises 15 countries selected based on complete data availability across all variables for the entire study period 2010–2022. This balanced panel design ensures comparability across time and avoids estimation biases associated with unbalanced panels (Cameron & Trivedi, 2022). The countries represent diverse geographical regions and development stages, enhancing the generalizability of findings while maintaining data consistency. Table A1 in the Appendix provides the complete list of countries included in the sample.

3.3 Variable Measurement

Following standard practice in econometric analysis, all variables are transformed into natural logarithms to interpret coefficients as elasticities, reduce skewness, and mitigate heteroskedasticity (Greene, 2020). Table 1 presents the operationalization of all variables used in this study.

Table 1: Variable Measurement and Operationalization

Variable Type	Variable Name	Symbol	Proxy Indicator (WDI)
Dependent Variable	**International Business Competitiveness**	lnIBC	Exports of goods and services (% of GDP), High-technology exports (% of manufactured exports)
Independent Variable	**Digital Transformation**	lnDT	Individuals using the Internet (% of population), Fixed broadband subscriptions (per 100 people)
Mediator Variable	**Entrepreneurial Growth**	lnEG	New business density (new registrations per 1,000 people ages 15-64), Self-employed, total (% of total employment)
Control Variable	**Economic Development**	lnED	GDP per capita (constant USD)

Following prior literature (Dutta et al., 2021; Acs et al., 2022), composite indices for Digital Transformation and International Business Competitiveness are constructed using principal

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

component analysis (PCA) to capture the multidimensional nature of these constructs while reducing measurement error. The first principal component is retained as it explains the maximum variance in the underlying indicators. All composite indices are normalized to range between zero and one to facilitate interpretation and comparison across countries.

3.4 Model Specification

To test the mediation hypothesis, this study follows the framework established by Baron and Kenny (1986) and extended by contemporary mediation scholars (Hayes, 2022; Preacher et al., 2021). Three regression models are specified to examine the relationships between Digital Transformation, Entrepreneurial Growth, and International Business Competitiveness.

The first model estimates the total effect of Digital Transformation on International Business Competitiveness, controlling for economic development and including country and time fixed effects:

$$lnIBCit=\alpha+\beta1 lnDTit+\beta2 lnEDit+\mu i+\lambda t+\varepsilon it$$

where lnIBCit represents International Business Competitiveness for country i in year t, lnDTit represents Digital Transformation, lnEDit is the control variable for economic development, μi captures country-specific fixed effects, λt captures time-specific fixed effects, and εit is the idiosyncratic error term. The coefficient β1 captures the total effect of Digital Transformation on Competitiveness, referred to as Path C.

The second model estimates the effect of Digital Transformation on Entrepreneurial Growth:

$$lnEGit=\alpha+\gamma1 lnDTit+\gamma2 lnEDit+\mu i+\lambda t+\varepsilon it$$

where lnEGit represents Entrepreneurial Growth for country i in year t. The coefficient γ1 captures the effect of Digital Transformation on Entrepreneurial Growth, referred to as Path A.

The third model includes both Digital Transformation and Entrepreneurial Growth as predictors of International Business Competitiveness:

$$lnIBCit=\alpha+\beta1' lnDTit+\delta lnEGit+\beta2 lnEDit+\mu i+\lambda t+\varepsilon it$$

In this specification, δ captures the effect of Entrepreneurial Growth on Competitiveness (Path B), while β'1 captures the direct effect of Digital Transformation on Competitiveness after controlling for the mediator (Path C').

According to Baron and Kenny (1986), mediation is established if four conditions are satisfied: first, β1 in Model 1 must be statistically significant; second, γ1 in Model 2 must be statistically significant; third, δ in Model 3 must be statistically significant; and fourth, β'1 in Model 3 must be smaller in magnitude than β1 in Model 1, indicating that the inclusion of the mediator reduces the direct effect. The indirect (mediated) effect is calculated as the product of γ1 and δ, while the total effect is decomposed as the sum of the direct effect (β'1) and the indirect effect (γ1 × δ). Statistical significance of the indirect effect is assessed using bootstrapped standard errors with 1,000 replications to account for non-normality in the sampling distribution (Hayes, 2022).

3.5 Estimation Technique

Both Fixed Effects (FE) and Random Effects (RE) models are estimated in this study. The FE model controls for time-invariant unobserved heterogeneity by allowing each country to have its own intercept, thereby eliminating bias from omitted time-invariant variables. The FE specification is expressed as:

$$lnIBCit=\alpha i+\beta Xit+\lambda t+\varepsilon it$$

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

where αi represents country-specific intercepts that capture all time-invariant differences across countries. The FE estimator derives its identifying variation exclusively from within-country changes over time, providing consistent estimates even if country-specific effects are correlated with the explanatory variables.

The RE model, by contrast, assumes that country-specific effects are uncorrelated with the explanatory variables and treats them as randomly distributed across countries. The RE specification is expressed as:

$$lnIBCit=\alpha+\beta Xit+ui+\lambda t+\varepsilon it$$

where ui is a random country-specific effect distributed with mean zero and constant variance. The RE estimator is more efficient than FE under the assumption of no correlation between ui and the regressors, but becomes inconsistent if this assumption is violated.

The Hausman (1978) specification test is employed to select between FE and RE models. The test evaluates whether the unique errors (ui) are correlated with the regressors. Under the null hypothesis that RE is consistent and efficient, the test statistic follows a chi-square distribution with degrees of freedom equal to the number of time-varying regressors. A significant test statistic rejects the null hypothesis, indicating that FE is preferred because RE would produce biased estimates.

To address potential heteroskedasticity and serial correlation in the panel data, all models employ robust standard errors clustered at the country level (Arellano, 1987; Wooldridge, 2021). Clustered standard errors account for within-country correlation of errors over time and provide valid inference even when the errors are not identically distributed. The cluster-robust variance estimator is consistent in the presence of arbitrary heteroskedasticity and serial correlation, provided the number of clusters is sufficiently large.

3.6 Diagnostic Tests

Several diagnostic tests are conducted to validate the econometric specifications and ensure the reliability of the findings. Given the increasing economic integration among countries, cross-sectional dependence is a potential concern in macro-level panels. The Pesaran (2021) CD test is employed to detect cross-sectional dependence, where the test statistic is based on the average of pairwise correlation coefficients of residuals. The null hypothesis of cross-sectional independence is tested against the alternative of dependence.

Multicollinearity among independent variables is assessed using the Variance Inflation Factor (VIF). The VIF for each independent variable is calculated as the reciprocal of one minus the R-squared from regressing that variable on all other independent variables. Following Wooldridge (2021), a VIF exceeding 10 indicates problematic multicollinearity that may inflate standard errors and undermine the precision of coefficient estimates.

To avoid spurious regression results, panel unit root tests are conducted to assess the stationarity of all variables. The Levin-Lin-Chu (2002) test is employed with the null hypothesis that all panels contain a unit root against the alternative that all panels are stationary. The test incorporates panel-specific means and time trends as appropriate, ensuring that the variables are stationary and suitable for regression analysis in levels.

3.7 Robustness Checks

To ensure the reliability and generalizability of the findings, several robustness checks are performed. First, quantile regression as developed by Koenker and Bassett (1978) is employed to examine whether the effect of Digital Transformation on Competitiveness varies across different points of the competitiveness distribution. This approach provides insights beyond mean effects

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

and reveals potential heterogeneity in the relationship. Second, alternative lag structures are tested to examine whether the effects of digital transformation on entrepreneurship and competitiveness operate with delays not captured in the contemporaneous specifications. These robustness checks collectively strengthen confidence in the main findings and address potential methodological concerns.

4. Results

4.1 Descriptive Statistics

Table 2 presents the descriptive statistics for all variables used in the analysis. All variables are expressed in natural logarithms following standard econometric practice (Greene, 2020).

Table 2: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
lnibc	195	3.062	0.046	3.008	3.213
lndt	195	1.508	0.219	1.196	1.869
lneg	195	1.436	0.213	1.150	2.051
lned	195	9.530	1.209	7.119	11.491

The dependent variable, International Business Competitiveness (lnibc), exhibits a mean of 3.062 with relatively low variation (standard deviation = 0.046), suggesting relative stability in competitiveness across the sample period. Digital Transformation (lndt) shows a mean of 1.508 with moderate variation (standard deviation = 0.219), indicating meaningful differences in digital adoption across countries and over time. Entrepreneurial Growth (lneg) has a mean of 1.436 with a standard deviation of 0.213, while Economic Development (lned) displays the largest variation (standard deviation = 1.209), reflecting the diverse development stages represented in the sample with a range from 7.119 to 11.491.

4.2 Correlation Analysis

Table 3 presents the pairwise correlation matrix among the key variables. Correlation analysis provides preliminary insights into the relationships between variables before multivariate regression analysis (Wooldridge, 2021).

Table 3: Correlation Matrix

Variables	lnibc	lndt	lneg
lnibc	1.0000		

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

Variables	lnibc	lndt	lneg
lndt	0.2571	1.0000	
lneg	0.9950	0.3154	1.0000

The correlation matrix reveals several important patterns. Digital Transformation (lndt) shows a moderate positive correlation with International Business Competitiveness ($r = 0.257$, $p < 0.01$), providing preliminary support for Hypothesis 1. Digital Transformation also exhibits a moderate positive correlation with Entrepreneurial Growth ($r = 0.315$, $p < 0.01$), suggesting a potential pathway for mediation, though this bivariate relationship requires confirmation through multivariate analysis.

However, the extremely high correlation between Entrepreneurial Growth and International Business Competitiveness ($r = 0.995$, $p < 0.01$) warrants careful interpretation. This strong association suggests these variables may capture overlapping constructs or suffer from potential multicollinearity concerns. Following Kennedy (2008), Variance Inflation Factor (VIF) tests are conducted in Section 4.5 to formally assess multicollinearity.

4.3 Panel Regression Results

Table 4 presents the main panel regression results. Models (1) and (2) employ Fixed Effects (FE) estimation based on Hausman test results, while Model (3) presents Random Effects (RE) estimates. All models include robust standard errors clustered at the country level to address heteroskedasticity and serial correlation (Arellano, 1987).

Table 4: Panel Regression Results

Variables	(1) FE: lnibc	(2) FE: lneg	(3) RE: lnibc
lndt	0.078***	0.126	-0.005
	(0.029)	(0.133)	(0.004)
lneg	—	—	0.225***
			(0.002)
lned	—	0.236***	-0.003***
		(0.051)	(0.001)
Constant	2.945***	-1.007**	2.772***

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

Variables	(1) FE: lnibc	(2) FE: lneg	(3) RE: lnibc
	(0.043)	(0.433)	(0.005)
Observations	195	195	195
R-squared	0.039	0.158	0.994
Number of groups	15	15	15
F-statistic/Wald χ^2	7.23***	4.89**	12456.3***

*** p<0.01, ** p<0.05, * p<0.1*

4.3.1 Direct Effect: Digital Transformation → Competitiveness (H1)

Column (1) of Table 3 presents the Fixed Effects estimates of Digital Transformation on International Business Competitiveness. The coefficient for lndt is positive and statistically significant ($\beta = 0.078$, $p < 0.01$), indicating that a 1% increase in digital transformation is associated with a 0.078% increase in international business competitiveness. This finding supports Hypothesis 1 and aligns with prior research (Brynjolfsson et al., 2021; Gal et al., 2019).

4.3.2 Digital Transformation → Entrepreneurial Growth (H2)

Column (2) tests the effect of Digital Transformation on Entrepreneurial Growth using Fixed Effects estimation. The coefficient is positive but not statistically significant ($\beta = 0.126$, $p > 0.10$). Thus, Hypothesis 2 is rejected. Digital Transformation does not significantly drive entrepreneurial growth in this sample.

This null finding contributes to the ongoing scholarly debate regarding digitalization and entrepreneurship. Potential explanations include "winner-take-all" dynamics that concentrate market power among incumbents (Cusumano et al., 2021; Kenney & Zysman, 2020) and contingency on institutional factors not captured in this specification (Audretsch et al., 2020; Chowdhury et al., 2022). The control variable Economic Development shows a positive and significant effect ($\beta = 0.236$, $p < 0.01$), consistent with prior research (Stam & van de Ven, 2021).

4.3.3 Entrepreneurial Growth → Competitiveness (H3)

Column (3) presents the Random Effects model including both Digital Transformation and Entrepreneurial Growth as predictors of International Business Competitiveness. The Hausman test ($\chi^2 = 2.34$, $p > 0.10$) favored RE over FE. Entrepreneurial Growth shows a strong positive effect on competitiveness ($\beta = 0.225$, $p < 0.01$), supporting Hypothesis 3. A 1% increase in entrepreneurial growth is associated with a 0.225% increase in international business competitiveness, reinforcing that new business creation fosters innovation and economic dynamism (Acs et al., 2021; Wennekers & Thurik, 1999).

The coefficient for Digital Transformation becomes negative and insignificant ($\beta = -0.005$, $p > 0.10$) after including Entrepreneurial Growth. The control variable Economic Development exhibits a small but significant negative effect ($\beta = -0.003$, $p < 0.01$), suggesting diminishing returns to competitiveness at very high development levels (Barro & Sala-i-Martin, 2004).

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

4.4 Mediation Analysis

Table 5 summarizes the mediation test results following Baron and Kenny (1986). Mediation is established when: (1) the independent variable significantly affects the dependent variable; (2) the independent variable significantly affects the mediator; (3) the mediator significantly affects the dependent variable; and (4) the effect of the independent variable on the dependent variable is reduced after including the mediator.

Table 5: Summary of Mediation Test

Path	Coefficient	Significance	Conclusion
IV → DV	0.078***	$p < 0.01$	Significant
IV → Mediator	0.126	$p > 0.10$	Not Significant
Mediator → DV	0.225***	$p < 0.01$	Significant

Since the IV → Mediator path is not statistically significant, the necessary conditions for mediation are not satisfied. Therefore, Hypothesis 4 is rejected. Entrepreneurial Growth does not mediate the relationship between Digital Transformation and International Business Competitiveness.

The indirect effect ($0.126 \times 0.225 = 0.0284$) cannot be distinguished from zero due to the insignificance of Path A. The total effect decomposition yields a direct effect of 0.078 and an indirect effect of 0.0284, resulting in a total effect of 0.1064. The appropriate conclusion is that Digital Transformation and Entrepreneurial Growth operate as parallel pathways enhancing international business competitiveness rather than a sequential mediation chain.

4.5 Diagnostic Tests

4.5.1 Cross-Sectional Dependence

Given the increasing economic integration among countries, cross-sectional dependence is a potential concern in macro-level panels (Pesaran, 2021). Table 5 presents the results of the Pesaran CD test.

Table 6: Cross-Sectional Dependence Test

Variable	CD-test	p-value	Average joint T	mean ρ	mean abs(ρ)
lnibc	14.488	0.000	13.00	0.39	0.56
lndt	25.871	0.000	13.00	0.70	0.72
lneg	14.414	0.000	13.00	0.39	0.56
lned	19.471	0.000	13.00	0.53	0.72

The Pesaran CD test rejects the null hypothesis of no cross-sectional dependence for all variables ($p < 0.01$), confirming the presence of cross-sectional correlation. This finding justifies the use of

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

robust standard errors clustered at the country level, which are consistent in the presence of cross-sectional dependence (Hoechle, 2007).

4.5.2 Multicollinearity

Table 7 presents Variance Inflation Factor (VIF) statistics for all independent variables. The VIF measures how much the variance of a regression coefficient is inflated due to multicollinearity.

Table 7: Variance Inflation Factor (VIF)

Variable	VIF	1/VIF
lndt	1.19	0.840
lneg	1.08	0.926
lned	1.07	0.935
Mean VIF	1.11	

All VIF values are substantially below the conventional threshold of 10 (Kennedy, 2008), and even below the more conservative threshold of 5 (Hair et al., 2019). The mean VIF of 1.11 indicates no severe multicollinearity concerns in the specifications.

4.6 Robustness Checks

4.6.1 Quantile Regression Analysis

To assess whether the effect of Digital Transformation on Competitiveness varies across the distribution of the dependent variable, quantile regression is employed (Koenker & Bassett, 1978). Table 8 presents the results for the median (50th quantile).

Table 8: Quantile Regression Results (Median)

Variable	Coefficient	Std. Err.	t	P>t	[95% Conf. Interval]
lndt	0.104***	0.011	9.08	0.000	[0.081, 0.126]
Constant	2.887***	0.017	165.90	0.000	[2.852, 2.921]

Pseudo $R^2 = 0.123$; Number of observations = 195

The quantile regression coefficient ($\beta = 0.104$, $p < 0.01$) is larger than the FE estimate ($\beta = 0.078$) and highly significant, confirming the robustness of H1. The pseudo R^2 of 0.123 indicates a reasonable fit for the median specification.

4.6.2 Summary of Robustness Findings

The consistency of results across alternative estimators (FE, RE, and quantile regression) strengthens confidence in the main findings. Hypothesis 1 is consistently supported across all specifications, with coefficient estimates ranging from 0.078 to 0.104 and maintaining statistical significance at the 1% level. Hypothesis 2 remains insignificant across alternative estimators,

reinforcing the conclusion that digital transformation does not significantly drive entrepreneurial growth. Hypothesis 3 shows strong positive effects in all models including entrepreneurship, with the coefficient for entrepreneurial growth remaining highly significant ($p < 0.01$) across specifications. This pattern of consistent results across multiple estimation techniques provides strong evidence for the robustness of the findings.

5. Conclusion, Limitation & Future Direction

5.1 Conclusion

This study investigated whether Entrepreneurial Growth mediates the relationship between Digital Transformation and International Business Competitiveness using panel data from 15 countries over 2010–2022. The results demonstrate that Digital Transformation directly enhances competitiveness ($\beta = 0.078$, $p < 0.01$), and Entrepreneurial Growth independently boosts competitiveness ($\beta = 0.225$, $p < 0.01$). However, Digital Transformation does not significantly affect Entrepreneurial Growth ($\beta = 0.126$, $p > 0.10$), leading to rejection of the mediation hypothesis.

The key theoretical contribution lies in demonstrating that digitalization and entrepreneurship represent parallel rather than sequential pathways to competitiveness. Rather than operating through a mediation chain, these forces independently contribute to national competitive advantage. This finding challenges conventional assumptions that digital investments automatically stimulate entrepreneurial ecosystems.

From a policy perspective, governments should pursue integrated but distinct strategies targeting both digital infrastructure development and entrepreneurship support simultaneously. Digital investments should be maintained for their direct competitiveness benefits, while separate programs addressing access to finance, regulatory reform, and entrepreneurship education remain essential.

5.2 Limitations

Several limitations should be acknowledged. First, the sample of 15 countries limits generalizability to broader global contexts. Second, the 13-year panel may insufficiently capture lagged effects of digitalization on entrepreneurship. Third, aggregate national data mask important firm-level and industry-level heterogeneity. Fourth, despite fixed effects estimation, endogeneity concerns remain regarding causal identification. Fifth, measurement through composite indices may not fully capture the multidimensional nature of the constructs.

5.3 Future Direction

Future research should expand country coverage to include developing economies, employ longer panels to capture dynamic adjustments, and utilize firm-level data to uncover heterogeneity masked by national aggregates. Stronger identification strategies, including instrumental variable approaches and natural experiments, would strengthen causal inference. Researchers should also explore potential moderators such as institutional quality, regulatory frameworks, and financial development that may condition whether digital transformation stimulates entrepreneurial activity. Finally, cross-country spillover effects and spatial interdependencies warrant attention through spatial econometric approaches.

References

Acemoglu, D., & Restrepo, P. (2022). Tasks, automation, and the rise in US wage inequality. *Econometrica*, 90(5), 1973-2016.

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

Acs, Z. J., Szerb, L., & Autio, E. (2021). *Global Entrepreneurship and Development Index 2021*. Springer.
Acs, Z. J., Lafuente, E., & Szerb, L. (2022). The digital transformation of entrepreneurial activity. *Small Business Economics*, 58(3), 1257-1275.
Arellano, M. (1987). Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics*, 49(4), 431-434.
Audretsch, D. B., Heger, D., & Veith, T. (2015). Infrastructure and entrepreneurship. *Small Business Economics*, 44(2), 219-230.
Audretsch, D. B., Belitski, M., & Desai, S. (2020). Entrepreneurship and economic development in cities. *Annals of Regional Science*, 65(2), 287-309.
Audretsch, D. B., & Belitski, M. (2021). Knowledge complexity and entrepreneurship. *Research Policy*, 50(6), 104251.
Autio, E., Nambisan, S., Thomas, L. D., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1), 72-95.
Autio, E., Mudambi, R., & Yoo, Y. (2021). Digitalization and globalization in a turbulent world. *Journal of International Business Studies*, 52(8), 1446-1473.
Autor, D. H., Dorn, D., & Hanson, G. H. (2024). On the persistence of the China shock. *Brookings Papers on Economic Activity*, forthcoming.
Bahia, K., Castells, P., & Mas, I. (2023). Mobile internet and small business performance. *World Development*, 162, 106145.
Baltagi, B. H. (2021). *Econometric Analysis of Panel Data* (6th ed.). Springer.
Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120.
Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research. *Journal of Personality and Social Psychology*, 51(6), 1173-1182.
Barro, R. J., & Sala-i-Martin, X. (2004). *Economic Growth* (2nd ed.). MIT Press.
Block, J. H., Fisch, C., & Hirschmann, M. (2022). The determinants of crowdfunding success. *Journal of Business Venturing Insights*, 17, e00304.
Block, J. H., Fisch, C., & van Praag, M. (2023). The Schumpeterian entrepreneur: A review of the literature. *Journal of Economic Literature*, 61(1), 112-154.
Bogliacino, F., Guarascio, D., & Cirillo, V. (2023). The dynamics of digitalization and firm performance: A meta-analysis. *Research Policy*, 52(4), 104718.
Brynjolfsson, E., Rock, D., & Syverson, C. (2021). The productivity J-curve. *American Economic Journal: Macroeconomics*, 13(3), 333-370.
Cameron, A. C., & Trivedi, P. K. (2022). *Microeconometrics: Methods and Applications* (2nd ed.). Cambridge University Press.
Chowdhury, F., Audretsch, D. B., & Belitski, M. (2022). Institutions and entrepreneurship quality. *Entrepreneurship Theory and Practice*, 46(4), 987-1015.
Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2021). *The Business of Platforms: Strategy in the Age of Digital Competition*. Harper Business.
Dutta, S., Lanvin, B., & Wunsch-Vincent, S. (2021). *Global Innovation Index 2021*. WIPO.
Eisenhardt, K. M., & Bingham, C. B. (2021). Dynamic capabilities and organizational agility. *Organization Science*, 32(4), 891-910.

Eisenmann, T., Parker, G., & Van Alstyne, M. (2011). Platform envelopment. *Strategic Management Journal*, 32(12), 1270-1285.
Elia, G., Margherita, A., & Passiante, G. (2020). Digital entrepreneurship ecosystem. *Technological Forecasting and Social Change*, 150, 119762.
European Commission. (2023). *Digital Economy and Society Index 2023*. Publications Office of the European Union.
Freund, C. L., & Weinhold, D. (2004). The effect of the Internet on international trade. *Journal of International Economics*, 62(1), 171-189.
Gal, P., Nicoletti, G., & Renault, T. (2019). Digitalisation and productivity: In search of the holy grail. *OECD Economics Department Working Papers*, No. 1533.
GEM (Global Entrepreneurship Monitor). (2023). *Global Entrepreneurship Monitor 2022/2023 Global Report*. GEM Consortium.
Goldfarb, A., & Tucker, C. (2019). Digital economics. *Journal of Economic Literature*, 57(1), 3-43.
Greene, W. H. (2020). *Econometric Analysis* (8th ed.). Pearson.
Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (8th ed.). Cengage Learning.
Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251-1271.
Hayes, A. F. (2022). *Introduction to Mediation, Moderation, and Conditional Process Analysis* (3rd ed.). Guilford Press.
Helfat, C. E., & Raubitschek, R. S. (2018). Dynamic and integrative capabilities for profiting from innovation. *Strategic Management Journal*, 39(6), 1677-1696.
Hessels, J., & van Stel, A. (2021). Entrepreneurship and export performance. *Small Business Economics*, 56(3), 1025-1042.
Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *Stata Journal*, 7(3), 281-312.
Hölzl, W., Janger, J., & Kutsam, J. (2022). Creative destruction and innovation persistence. *Industrial and Corporate Change*, 31(4), 987-1008.
Hsiao, C. (2022). *Analysis of Panel Data* (4th ed.). Cambridge University Press.
International Telecommunication Union. (2024). *Measuring Digital Development: Facts and Figures 2024*. ITU Publications.
Kennedy, P. (2008). *A Guide to Econometrics* (6th ed.). Blackwell Publishing.
Kenney, M., & Zysman, J. (2020). The platform economy: Restructuring the workplace. *Industrial Relations*, 59(3), 347-377.
Klapper, L., & Love, I. (2016). The impact of business environment reforms on new firm registration. *World Bank Policy Research Working Paper*, No. 7823.
Koenker, R., & Bassett, G. (1978). Regression quantiles. *Econometrica*, 46(1), 33-50.
Lendle, A., Olarreaga, M., & Vézina, P. L. (2016). The global trade slowdown. *World Trade Review*, 15(4), 657-680.
Levin, A., Lin, C. F., & Chu, C. S. J. (2002). Unit root tests in panel data. *Journal of Econometrics*, 108(1), 1-24.
Love, J. H., & Roper, S. (2015). SME innovation, exporting and growth. *International Small Business Journal*, 33(1), 28-48.
McIntyre, D. P., & Srinivasan, A. (2017). Networks, platforms, and strategy. *Journal of Management*, 43(1), 141-171.

Mollick, E. (2014). The dynamics of crowdfunding. *Journal of Business Venturing*, 29(1), 1-16.
Nambisan, S. (2017). Digital entrepreneurship: Toward a digital technology perspective. *Entrepreneurship Theory and Practice*, 41(6), 1029-1055.
Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship. *Research Policy*, 48(8), 103773.
OECD. (2023). *OECD Digital Economy Outlook 2023*. OECD Publishing.
Pesaran, M. H. (2021). General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics*, 60(1), 13-50.
Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2021). Addressing moderated mediation hypotheses. *Multivariate Behavioral Research*, 56(3), 387-410.
Schumpeter, J. A. (1934). *The Theory of Economic Development*. Harvard University Press.
Song, H., Zhao, X., & Li, X. (2022). Platform-based entrepreneurship. *Journal of Management Information Systems*, 39(2), 456-485.
Stam, E. (2022). Entrepreneurial ecosystems and regional policy. *Regional Studies*, 56(3), 412-425.
Stam, E., & van de Ven, A. (2021). Entrepreneurial ecosystem elements. *Small Business Economics*, 56(2), 809-832.
Teece, D. J. (2023). The evolution of the dynamic capabilities framework. *Journal of Management Studies*, 60(3), 567-593.
Teece, D. J., Peteraf, M., & Leih, S. (2016). Dynamic capabilities and organizational agility. *California Management Review*, 58(4), 13-35.
UNCTAD. (2023). *Digital Economy Report 2023*. United Nations Publications.
Urbano, D., Aparicio, S., & Audretsch, D. (2019). Institutions, entrepreneurship, and economic performance. *Small Business Economics*, 53(4), 871-886.
Verhoef, P. C., Broekhuizen, T., & Bart, Y. (2021). Digital transformation: A multidisciplinary reflection. *Journal of Business Research*, 122, 889-901.
Vial, G. (2019). Understanding digital transformation. *Journal of Strategic Information Systems*, 28(2), 118-144.
Warner, K. S., & Wäger, M. (2019). Building dynamic capabilities for digital transformation. *Long Range Planning*, 52(3), 326-349.
Welter, F., Baker, T., & Wirsching, K. (2023). Contextualizing entrepreneurship theory. *Entrepreneurship Theory and Practice*, 47(2), 389-417.
Wennekers, S., & Thurik, R. (1999). Linking entrepreneurship and economic growth. *Small Business Economics*, 13(1), 27-56.
Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (2nd ed.). MIT Press.
Wooldridge, J. M. (2021). *Introductory Econometrics: A Modern Approach* (7th ed.). Cengage Learning.
World Bank. (2022). *World Development Report 2022: Digital Development*. World Bank Publications.
World Bank. (2023). *World Development Indicators 2023*. World Bank Publications.
World Economic Forum. (2024). *The Global Competitiveness Report 2024*. WEF Publications.
Zuboff, S. (2019). *The Age of Surveillance Capitalism*. PublicAffairs.

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.04 No.01 (2026)

Appendix

Appendix A1: List of Sample Countries by Region and Income Classification

Country Code	Country	Region	Income Level (World Bank Classification)	Observations
1	Italy	Europe	High Income	13
2	Germany	Europe	High Income	13
3	France	Europe	High Income	13
4	Spain	Europe	High Income	13
5	Netherlands	Europe	High Income	13
6	Poland	Europe	High Income	13
7	Sweden	Europe	High Income	13
8	Ireland	Europe	High Income	13
9	Türkiye	Europe	Upper-Middle Income	13
10	India	Asia	Lower-Middle Income	13
11	Indonesia	Asia	Lower-Middle Income	13
12	Malaysia	Asia	Upper-Middle Income	13
13	Brazil	South America	Upper-Middle Income	13
14	South Africa	Africa	Upper-Middle Income	13
15	Pakistan	Asia	Lower-Middle Income	13