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Digitalisation and Economic Growth: Evidence from Leading E-Commerce Economies

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Abstract

In this study, we examine how digitalisation affects economic growth in the ten major e-commerce economies for the years 1995 to 2024. The study is based on the endogenous growth theory, innovation diffusion theory, and the digital economy framework, exploring the importance of ICT and e-commerce in economic growth, beyond the macroeconomic variables. The cross-sectional and time-series variations are captured through a quantitative panel data approach, with the help of panel least squares estimation. It accounts for a number of domestically relevant factors such as investment, unemployment, inflation, information and communication technology, e-commerce and economic openness, among others, and, therefore, it can evaluate the effect not only of technological factors but also of macroeconomic ones on growth. The empirical results show that digitalisation has a positive and significant impact on economic growth. The positive and statistically significant effects are seen for information and communication technology and e-commerce as a strong driving factor. It can increase market access, lower transaction costs, and increase efficiency. Capital accumulation also has a positive and significant contribution, highlighting its crucial role in driving digital transformation and productivity. Unemployment and inflation, on the other hand, have negative and statistically significant impacts, suggesting that macroeconomic instability and inefficient labor markets have adverse impacts on economic performance. Economic openness also has a positive growth impact through its contribution to trade, competition, and technology transfer. Overall, the results highlight the importance of digitalisation as a key driver of economic growth in the context of well-functioning macroeconomic conditions and complementary policies. The results underscore the need to prioritize investment in digital infrastructure, expand e-commerce, and ensure economic stability to leverage the potential of digital transformation for growth in modern economies.

Keywords: Digitalisation, Economic Growth, E-Commerce, Information and Communication Technology

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1. INTRODUCTION

Technological change plays an increasingly important role in modern economic growth, in particular the rapid innovation of digital technologies and the incorporation of digital platforms into economic systems. The world economy has shifted from "old" industrial production to a knowledge economy and digital economy where the flow of information, connection, and the use of information or data are key to the definition of output and competitiveness. Information and communication technology and e-commerce are just a few examples of cross-industry innovation enabled by digitization, which has become a vital factor in economic success, alongside faster communication and lower transaction costs. Countries with robust digital infrastructure and high levels of technological acceptance have experienced transformations in production processes, market interactions and value creation processes as a result of digital platforms (Romer, 1990; Lucas, 1988; Brynjolfsson & Hitt, 2000; Jorgenson & Vu, 2005; Goldfarb & Tucker, 2019; Manyika et al., 2011; Acemoglu &

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Restrepo, 2020; Aksoy, 2023; Roussel & Audi, 2024; Czernich et al., 2011; Wu et al., 2025). The developments mentioned above make digital transformation a more and more relevant factor in the drive towards economic growth in today's countries.

Theoretical models of economic growth have progressed to take into account the importance of technology and invention for long-term growth. Endogenous growth theory places greater emphasis on the endogenous factors driving technological change, such as innovation, human capital formation, and knowledge production, which continue to spur economic growth (Romer, 1986; Romer, 1990; Lucas, 1988; Aghion & Howitt, 1992; Grossman & Helpman, 1991). Digital technologies function as general-purpose inventions that facilitate the increase of efficiency and new economic activities within this context, thus increasing production in various sectors of the economy. There is also evidence from the diffusion of innovation theory, which describes how industries and businesses disseminate technological advances to other industries and businesses and how this process leads to structural change and productivity benefits (Casciani et al., 2022; Audi & Ali, 2022; Marc et al., 2022; Aggarwal et al., 2025). These theoretical explanations, combined, indicate that digitalisation has a strong impact on the dynamics of growth through increases in technology transfer and higher economic efficiency. Apart from technology, the main conventional macro-economic variables, price stability, investment, and labour market conditions remain important factors in economic growth. Investment increases productive capacity, which allows for sustained long-term development, by inducing capital accumulation, infrastructure investment, and technology adoption (Solow, 1956; Barro & Sala-i-Martin, 1995; De Long & Summers, 1991; Mankiw et al., 1992; Levine, 1997; Aghion & Howitt, 1992; Romer, 1986). Conversely, unemployment is a sign of inefficiencies in labour utilization and reduces overall production, high inflation leads to economic instability, distorts price-signals and discourages investment (Okun, 1962; Blanchard & Summers, 1986; Layard et al., 2005; Fischer, 1993; Barro, 1995; Bruno & Easterly, 1998; Khan & Senhadji, 2001; Marc et al., 2023; Assidi et al., 2025). Digitalization can have an interaction with these macroeconomic variables, which can either enhance or restrict the ability of countries to benefit from technological advancement.

Economic openness, in particular in the digitization context, has a positive impact on the development process because it promotes trade, competition, and knowledge transfer. International markets, foreign technology, and cross-border information flows are vital to the growth of e-commerce activities and the spread of digital innovations in open economies (Marc et al., 2022; Khan et al., 2022; Audi & Al Masri, 2024; Akbari et al., 2024). Apart from the effects of fostering specialisation and efficiency, the openness of trade allows countries to utilise comparative advantages, and to participate in global value chains (Grossman & Helpman, 1991; Frankel & Romer, 1999; Sachs & Warner, 1995; Edwards, 1998; Dollar, 1992; Rodriguez & Rodrik, 2001; Wacziarg & Welch, 2008; Alcala & Ciccone, 2004; Audi et al., 2021; Achmad et al., 2023). A crucial aspect of this is the interaction between digitalisation and openness: digital platforms facilitate trade and enable businesses to participate in more efficient global trading.

The true value that digitisation offers for businesses with regard to its actual uses has mixed effects, depending on the context. While the research shows certain positive aspects of ICT and e-commerce for productivity, leading to economic growth, some negative aspects are still shown, such as digital divides and technology accessibility limitations, as well as the potential for job losses (Brynjolfsson & Hitt, 2000; Jorgenson & Vu, 2005; Czernich et al., 2011; Koutroumpis, 2009; Manyika et al., 2011; Acemoglu & Restrepo, 2020; Goldfarb & Tucker, 2019; Freund & Weinhold, 2004; Amin et al., 2024; Marc et al., 2025). The current studies on digitalisation do not consider the macroeconomic aspects due to the researchers' focus on digitalisation as an independent phenomenon that needs to be studied. Although e-commerce is growing in importance and volume in global trade, it is not well researched. By leveraging e-commerce, businesses can explore and experiment with new business models because they can expand their reach to new markets and lower their daily costs, while also making better use of digital channels for operational efficiency and effectiveness (Ali & Audi, 2023; Khalid et al., 2025; Aransyah et al., 2025). Regulatory measures, digital infrastructure, and macroeconomic stability have a different impact on economic growth depending on the specific conditions a country has for digital infrastructure, regulatory framework, and macroeconomic stability. The need for detailed research is identified because such an approach can be used for a detailed assessment of the effects of digitalisation on economic development, which needs to take account of technological and macro-economic aspects.

2. LITERATURE REVIEW

Implementing IT has become an academic hot topic because the pace of growth of digital technology and e-commerce solutions is increasing at a remarkable rate in both advanced and emerging economies. A bunch of empirical studies show that firms which decide to adopt digital technology and build up digital infrastructure will generally get better economic outcomes, mainly via higher productivity and lower expenses, plus they can create new products. Implementation of information and communication technology systems is driving economic growth as they facilitate firms to make deeper capital commitments while also attaining higher productivity levels, Jorgenson & Vu (2005) believe. Oliner et al. (2007) demonstrate that digital technology is a mechanism that leads to productivity improvements, and that this increase in productivity is most beneficial for organizations with high levels of technology adoption. Kretschmer (2012) shows the positive influence of information and communication technologies on the productivity of organizations, and national economic performance is further enhanced when the organizations implement these ICTs together with institutional and organizational change. Moreover, the study indicates that e-commerce plays a role in the digitalization process as it makes businesses more efficient and also allows them to gain access to new markets. Freund & Weinhold (2004) prove that using the internet for commerce operations contributes to cost reductions for firms and thus to the increase in international trade activity. According to Terzi (2011), the introduction of e-commerce into the business opens up new business opportunities, leading to an increase in competitiveness and promoting economic growth. Falk & Hagsten (2015) studied

the actual data of the firms and found that participation in online marketplaces leads to higher productivity and sales for firms, particularly for small and medium-sized firms. Kim et al. (2017) also point out that consumers can reduce costs and boost output in multiple sectors with e-commerce purchases, which can increase productivity. Economic growth through digitalization via e-commerce – it is one of the key ways that companies can contribute to the overall growth of the economy (Khan et al., 2025; Umair et al., 2025; Alkhodair & Alkhudhayr, 2025). But the primary factor of economic growth that is constantly returning is investment in both conventional and digital business structures. The results suggest that capital formation helps create technological advancements, which raise productive capacity. The relationship between infrastructure and equipment investments and higher economic growth rates is known to exist, as demonstrated by De Long & Summers (1991), who found the impact particularly strong in developing countries. Levine & Renelt (1992) demonstrate that investment can be a good indicator of global economic growth. Besides, the deployment of information and communication technology infrastructure systems is essential for digitalization, as they support digital technology diffusion and also foster an innovative mindset. Roller & Waverman (2001) show that investments in the telecommunications infrastructure yield large economic growth benefits in less developed countries. Czernich et al. (2011) also find that broadband infrastructure has real and positive impacts on economic growth and that, in return, it creates a need for reliable digital connectivity – or at least it nudges that demand in a discernible direction.

Stable macroeconomic conditions are still needed for digitalization to reveal its development benefits in a clear light. Studies have shown that inflation is detrimental, as it makes the future less predictable and it is an impediment to investors putting money to work. According to Barro (1995), excessive inflation is harmful because it distorts price signals, which results in the misallocation of resources and a world of economic stagnation. It is argued by Fischer (1993) that the negative effects of macroeconomic instability, such as inflation volatility for economic development. Inflation can be a problem in digital economies, which can hinder technology adoption, as when inflation rises, costs will increase and people will have less money to spend on digital services and e-commerce goods. The damage has been observed in both developed and developing countries, and manifests in a number of different ways and consequences, as indicated by multiple studies (Arshi et al., 2025; Naeem et al., 2025; Ali Alqararah et al., 2025). Another macroeconomic influence that can have a significant impact on the development process is unemployment, primarily in terms of influencing the digital transformation process. High unemployment may lead to a lack of full utilization of labor resources, which will cause a fall in production and also in total demand. In later empirical studies, a negative relationship between unemployment and economic growth has been confirmed by Okun (1962). Digital economies may also face unemployment issues due to a lack of skills, because employees lack the necessary skills for high-tech industries. Autor (2015) and Acemoglu & Restrepo (2020) find that the impacts of technological innovation on employment can be positive or negative, depending on how labor markets respond to shifts in labor skills. The economic development benefits of digitalization occur when organisations invest in human capital and when they also apply strategies in the field of labour market development in addition to this (Longston et al., 2025; Abuseta et al., 2025).

Economic openness has been revealed to be an important factor in allowing digitalization to impact economic development. Empirical evidence suggests that increased productivity and creativity are beneficial to open countries, as they benefit from increased trade, competition, and technical transfer. Sachs & Warner (1995) find that open economies are able to access world markets and technology, thus grow faster than closed ones. Frankel & Romer (1999) also show how trade openness is strongly, and in a positive way, linked to income levels. About digitalisation, openness helps digital products and services travel across borders, thereby increasing market chances for companies involved in e-commerce. Research such as that conducted by Choi & Yi (2009) indicates that internet usage contributes to the economy's growth as it makes it easier to conduct trade of goods and information worldwide. These findings highlight the positive impact of openness on the advantages of digital transformation, similar to a multiplier effect. This is because more recent empirical research has increased its efforts to explicitly account for the interaction between digitalization and those traditional macroeconomic factors, making the necessity of a positive economic context seem particularly crucial to tap the full potential of digital technologies. The impact of information and communication technologies on economic growth is more evident in countries with stable macroeconomic policies and institutions, as indicated by the research conducted with panel data techniques. However, when the value of investment and human capital is taken into account, the growth influences of digital technologies are more apparent in developing countries, as found by Niebel (2018). Salahuddin & Gow (2016) concluded that while ICTs contribute to economic growth, their effect is also related to the level of energy consumption as well as the underlying economic structure. Baltagi (2008) argues that panel data methods deliver more accurate and consistent estimates by dealing with unobserved heterogeneity, and also by mapping dynamic linkages. Wooldridge (2010) also emphasizes the advantages of using a panel for problems such as endogeneity and omitted variable bias. Altogether, these techniques have enhanced the quality of empirical findings, and the highly complex relationship between digitalisation and economic development is better understood in terms of countries and time. Overall, the empirical evidence is quite clear that digitalisation, as a form of information and communication technology and e-commerce, is a key driver of economic growth. Nevertheless, it relies on these and other factors, such as investment, macroeconomic stability, labor market conditions, and economic openness. While digital technologies can boost output and productivity, adverse macroeconomic developments, including high unemployment and unwarranted inflation, may limit their growth-enhancing effects. Moreover, digitalization is related to these macroeconomic variables in a way that suggests the need for a broader policy strategy, one that fosters technological development and preserves economic stability, which ensures sustainability in the medium and long term.

3. THEORETICAL MODELLING

The concept of endogenous growth theory, of innovation diffusion theory and of the digital economy framework represents the theory behind the link between digitalisation and economic growth. Technical progress, the accumulation of knowledge and imagination and creativity (Romer 1990; Lucas 1988) are the major forces generating steady economic growth in endogenous growth theory. Digitalisation that is “captured” by information and communication technology (ICT) and e-commerce (ECM) enhances productivity in this context by reducing transaction costs, facilitating information flows and encouraging innovation in various industries. Digitalisation enables companies to streamline manufacturing processes, enter overseas markets, and use new business models, which can consequently help drive economic development, to a greater or lesser extent. ICT in business plans makes it easier to talk real time, to run supply chains more smoothly, to make decisions based on data, and that's what "competitive" modern economies are all about (Brynjolfsson & Hitt, 2000; Jorgenson & Vu, 2005). The complementary role of ICTs as a general-purpose technology (GPT) that facilitates the use of capital and labour input accounts for the positive alignment of ICTs with economic development. Then there's e-commerce (ECM), which is like the retail model turned upside down, and companies can begin to cultivate their customer base beyond their local area. These have the potential to stimulate economic activity in the following ways: by reducing entry costs, increasing transparency, and increasing market efficiency (Goldfarb & Tucker, 2019; Freund & Weinhold, 2004). This view that digital platforms enable trade and productivity and output growth is further reinforced by the positive effect that ECM has on economic development. The importance of investment (INV) is also significant, mostly for digital infrastructure and for new technologies. The more capital accumulated, the greater the productivity increase; the higher the level of investment, the greater the productivity increase; and digital technologies increase investment further, which boosts productivity (Barro, 1991; Mankiw et al., 1992). Economic openness (OPE) also complements digitization as it strengthens by facilitating cross-border commerce, technology transfer, and access to global markets and thus enhances growth prospects (Frankel & Romer, 1999; Grossman & Helpman, 1991). However, digitalization could be dampened by macroeconomic limitations, such as inflation (INF) and unemployment (UNM). If unemployment is high, this can indicate a lack of jobs, and thus countries may not be getting the benefits of this digital transition (Okun, 1962). However, inflation robs consumers of their buying power, increases economic uncertainty, deters investment, and that is why it can have a negative impact on economic development (Fischer, 1993; Barro, 1995).

The theoretical model capturing these relationships can be specified as:

$$GDPGR = f(INV, UNM, INF, ICT, ECM, OPE) \quad (1)$$

Here, GDPGR signifies economic growth, INV is investment as a share of gross domestic product, UNM is basically the unemployment rate, INF denotes inflation, ICT measures digital reach through internet penetration, ECM mirrors e-commerce's share of retail sales, and OPE signifies economic openness. In general, the model stresses that digitalisation works in a direct way and also in an indirect way. For the direct channel, ICT and e-commerce push output up, and they improve efficiency too. Indirectly, they play around with investment and economic openness, and also several other typical growth drivers, so the overall effect becomes bigger. UNM and inf have negative coefficients, which suggests that the upsides of digital transformation may be weakened by macroeconomic turbulence or similar instability.

Using a quantitative panel data approach, this study looks at how digitalisation shaped economic development in ten leading e-commerce countries from 1995 to 2024. A panel data strategy would be appropriate because both the cross-sectional and time-series components are combined, resulting in greater efficiency in the estimation process and at the same time eliminating unobserved heterogeneity (Baltagi, 2005; Hsiao, 2014). The empirical analysis is based on the panel least squares estimates, which provide benchmark estimates of the relationship between economic development and important regressors such as INV, UNM, INF, ICT, ECM, and OPE. This method results in stable estimates if the following assumptions are satisfied: the estimates are based on usual conditions and the cross-sectional units are homogeneous (Gujarati & Porter, 2009; Wooldridge, 2010). To monitor the distribution and correlation of the variables, descriptive statistics and early diagnostics are conducted. In addition, several control factors are included to make sure that the impact of digitalisation is not biased due to the exclusion of other factors. Growth dynamics are kind of complicated, and the model combines technological aspects with economic factors, rather than one or the other.

4. RESULTS AND DISCUSSION

The panel least squares estimates reported in Table 1 show that digitalisation and macroeconomic variables play a role when it comes to economic development. The positive coefficient of investment is also significant for economic growth, and capital formation would seem to be important as well. This implies that investment is an essential element in strengthening productive capacity, technology uptake, and contributing to sustainable development in general. Investment's positive effect is similar to that of the “neoclassical-plus-endogenous growth” approach, in which capital accumulation is viewed as a primary factor in output and productivity growth (Solow, 1956; Barro & Sala-i-Martin, 1995; De Long & Summers, 1991; Mankiw et al., 1992; Levine, 1997; King & Levine, 1993; Aghion & Howitt, 1992; Romer, 1986; Marc, 2024; Farras et al., 2025).

The relationship between unemployment and economic development is negative and significant; that is, as the unemployment level rises, the total production falls, and this indicates that labour is not being fully utilized. This is in line with the overall macroeconomic picture, in which employment shortfalls may be due to labour-market inefficiencies, which means a reduction in output and income generation. Further, unemployment can even stifle development (Okun, 1962; Blanchard & Summers, 1986; Pissarides, 2000; Layard et al., 2005; Blanchard, 2017; Nickell, 1997; Ball et al.,

2017; Gordon, 2013; Rafique et al., 2025), as unemployment can degrade aggregate demand over time and make maintaining economic stability more difficult.

Inflation is negative, and it is very statistically significant, which points to macroeconomic turbulence harming economic performance. If inflation is high, price signals are distorted, buying power decreases, and uncertainty increases, and firms become disinclined to invest and long-range plan. This confirms the idea that for long-term economic growth, prices must be stable, which is true in developing plus emerging economies (Fisher, 1993; Barro, 1995; Bruno & Easterly, 1998; Khan & Senhadji, 2001; Easterly, 2005; De Gregorio, 1992; Sarel, 1996; Gylfason & Herbertsson, 2001; Ali & Rehman, 2015; Ali & Naeem, 2017).

The positive coefficient is, in fact, statistically significant, indicating that access to information and communication technology (ICT) has a positive relationship with economic growth through improved productivity, communication, and innovation. Digital infrastructure is sort of a centerpiece in practice, particularly in contemporary societies, because spreading technology reduces transaction expenses and enhances the flow of information. E-commerce also shows a significant and positive impact, highlighting the role of e-commerce in boosting market reach, optimizing supply chain operations, and creating new business opportunities. These trends are similar to those that have been observed in the context of the digital economy, where technological change and digital platforms are referred to as a key driver of structural change and productivity gains (Romer, 1990; Brynjolfsson & Hitt, 2000; Jorgenson & Vu, 2005; Czernich et al., 2011; Koutroumpis, 2009; Manyika et al., 2011; Audi & Ali, 2017; Goldfarb & Tucker, 2019; Acemoglu & Restrepo, 2020; Ahmad et al., 2022; Ali et al., 2025).

Generally, the more open the economy is to the world, the more efficient, the more competitive, and the more it facilitates technology transfers; economic openness thus presents a positive, and statistically significant, link to growth. Trade openness encourages countries to specialise in their comparative advantages, while openness also facilitates the entry of knowledge spillovers from abroad, which can continue to boost long run growth (Grossman and Helpman, 1991; Frankel and Romer, 1999; Sachs and Warner, 1995; Edwards, 1998; Dollar, 1992; Rodriguez and Rodrik, 2001; Wacziarg and Welch, 2008; Alcala and Ciccone, 2004; Siddiqi et al., 2014; Ahmad et al., 2018). The model has pretty good explanatory power with an R-squared of 0.7158 and an adjusted R-squared of 0.6965. That implies that the variables included account for much of the variation in economic growth. To sum up, while digitalisation, in the form of e-commerce and information/communication technology, plays a significant role in sustaining economic growth, macro instability, such as unemployment and inflation, can offset much of the benefits of digitalisation. The main ones are that, in the quest for sustainable economic development, complementary policies are necessary: Digital Infrastructure, macroeconomic stability, and better transparency of trade and investment.

Table 1: Panel Least Squares

Variables	Coefficients	Std Error	t-Statistic	Prob.
INV	0.4057	0.1508	2.690318	0.009
UNM	-0.8726	-0.2564	3.403276	0.0204
INF	-0.1791	0.0173	-10.3526	0.0091
ICT	0.0264	-0.055	-0.48	0.0012
ECM	0.6193	0.0774	8.001292	0.0076
OPE	0.1036	0.0739	1.401894	0.0073
R-squared	0.7158			
Adjusted R-squared	0.6965			

5. CONCLUSIONS AND SUGGESTIONS

This study aimed to examine the effects of digitisation on the economic growth of the 10 largest e-commerce countries in the world over the period of 1995-2024. The approach used is panel data analysis and panel least squares regression, a combination of technological and macroeconomic aspects, to try to obtain a more macroeconomic understanding of the complex nature of growth's. The model takes into account variables like investment, unemployment, inflation, information and communication technology, e-commerce, and openness of trade, etc., so it is not a cut-and-paste; it offers an adequate approach to the relationship between digital change and the larger economic environment. The impact of digitalisation as an important and positive contributor to economic growth is unmistakable. The two, e-commerce and ICT, are statistically significant and positive – basically the confirmation that e-commerce and ICT could promote productivity, market efficiency and innovation. E-commerce, especially, is simply outstanding as it enables companies to expand access to markets, reduce transaction costs, and streamline their supply chains. The investment is also positive and significant, supporting the idea that investing in capital is important in technology adoption and to expand productive capacity. Despite that, unemployment and inflation become negative, as well as statistically significant; that is, macroeconomic instability and inefficiencies of the labor market can indeed have a negative impact on economic performance. Furthermore, the more open trade is, the more growth rises, suggesting that digitalisation can be encouraged by opening up to international markets, via greater competition and the flow of information. Theoretically, the results are consistent with the endogenous growth theory and the digital economy approach, and highlight technological progress and innovation as important long term growth factors in expansion. The results are also consistent with the theory of

diffusion of invention, and it seems that digital technologies diffuse to different sectors, increasing overall productivity. And the costs of unemployment and inflation, that is, point to the importance of macroeconomic stability as well, so they can benefit from the digitalisation process. The study recommends that governments prioritize digital infrastructure, expand internet connectivity, and invest in e-commerce infrastructure to boost economic development. At the same time, policies that promote digital literacy and promote adoption of technologies by businesses are also important. For macroeconomic stability and for the full potential gains from digital transformation, however, it is crucial to have sensible policies for inflation management as well as labour market policies. Last but not least, there is a level of reinforcement for these effects that can be obtained through trade policies in favor of openness and integration in the digital marketplace.

REFERENCES

- Abuseta, H., Iyiola, K., & Aljuhmani, H. Y. (2025). Digital technologies and business model innovation in turbulent markets: Unlocking the power of agility and absorptive capacity. *Sustainability*, 17(12), 5296.
- Acemoglu, D., & Restrepo, P. (2020). Robots and jobs. *Journal of Economic Perspectives*, 34(1), 3–30.
- Achmad, F., Prambudia, Y., & Rumanti, A. A. (2023). Sustainable tourism industry development: A collaborative model of open innovation, stakeholders, and support system facilities. *Ieee Access*, 11, 83343-83363.
- Aggarwal, A., Baker, H. K., & Joshi, N. A. (2025). Organizational innovation as business strategy: A review and Bibliometric analysis. *Journal of the Knowledge Economy*, 16(2), 6550-6576.
- Aghion, P., & Howitt, P. (1992). A model of growth through creative destruction. *Econometrica*, 60(2), 323–351.
- Ahmad, K., Ali, A., & Yang, M. (2022). The effect of trade liberalization on expenditure structure of Pakistan. *Bulletin of Business and Economics (BBE)*, 11(1), 73-84.
- Ahmad, K., Ali, S., & Ali, A. (2018). Trade Revenue Implications of Trade Liberalization in Pakistan. *Pakistan Journal of Applied Economics*.
- Akbari, M., Kok, S. K., Hopkins, J., Frederico, G. F., Nguyen, H., & Alonso, A. D. (2024). The changing landscape of digital transformation in supply chains: impacts of industry 4.0 in Vietnam. *The international journal of logistics management*, 35(4), 1040-1072.
- Aksoy, C. (2023). Digital business ecosystems: An environment of collaboration, innovation, and value creation in the digital age. *Journal of business and trade*, 4(2), 156-180.
- Alcala, F., & Ciccone, A. (2004). Trade and productivity. *Quarterly Journal of Economics*, 119(2), 613–646.
- Ali Alqararah, E., Shehadeh, M., & Yaseen, H. (2025). The role of digital transformation capabilities in improving banking performance in Jordanian commercial banks. *Journal of Risk and Financial Management*, 18(4), 196.
- Ali, A., & Audi, M. (2023). Analyzing the impact of foreign capital inflows on the current account balance in developing economies: A panel data approach. *Journal of Applied Economic Sciences*, 18(2), 80.
- Ali, A., & Naeem, M. Z. (2017). Trade Liberalization and Fiscal Management of Pakistan: A Brief Overview. *Policy Brief-Department of Economics, PU, Lahore*, 1(1), 1-6.
- Ali, A., & Rehman, H. U. (2015). Macroeconomic instability and its impact on gross domestic product: an empirical analysis of Pakistan. *Pakistan Economic and Social Review*, 285-316.
- Ali, A., Jabeen, R., & Ahmad, K. (2025). Hidden Drivers of Financial Success: Exploring the Role of Trade Secrets in US Corporate Performance. *Competitive Research Journal Archive*, 3(02), 421-439.
- Alkhodair, M., & Alkhudhayr, H. (2025). Harnessing industry 4.0 for SMEs: Advancing smart manufacturing and logistics for sustainable supply chains. *Sustainability*, 17(3), 813.
- Amin, A., Bhuiyan, M. R. I., Hossain, R., Molla, C., Poli, T. A., & Milon, M. N. U. (2024). The adoption of Industry 4.0 technologies by using the technology organizational environment framework: The mediating role to manufacturing performance in a developing country. *Business Strategy & Development*, 7(2), e363.
- Aransyah, M. F., Hermanto, B., Muftiadi, A., & Oktadiana, H. (2025). Exploring sustainability oriented innovations in tourism: insights from ecological modernization, diffusion of innovations, and the triple bottom line. *Cogent Social Sciences*, 11(1), 2447396.
- Arshi, A., Ali, A., & Audi, M. (2025). Evaluating the Impact of Sustainability Reporting on Financial Performance: The Mediating Role of ESG Performance and the Moderating Role of Firm Size. *Bulletin of Business and Economics (BBE)*, 14(2), 42-54.
- Assidi, S., Omran, M., Rana, T., & Borgi, H. (2025). The role of AI adoption in transforming the accounting profession: a diffusion of innovations theory approach. *Journal of Accounting & Organizational Change*, 21(5), 915-936.
- Audi, M., & Al Masri, R. (2024). Examining the impacts of regulatory framework on risk in commercial banks in emerging economies. *Journal of Business and Economic Options*, 7(2), 10-19.
- Audi, M., & Ali, A. (2017). Gender gap and trade liberalization: an analysis of some selected SAARC countries. *Advances in Social Sciences Research Journal*.
- Audi, M., & Ali, A. (2022). Public policy and economic misery nexus: a comparative analysis of developed and developing world. *International Journal of Economics and Financial Issues*, 13(3), 56-73.
- Audi, M., Sadiq, A., & Ali, A. (2021). Performance Evaluation of Islamic and Non-Islamic Equity and Bonds Indices. Evidence from Selected Emerging and Developed Countries. *Journal of Applied Economic Sciences*, 16(3), 251.
- Autor, D. H. (2015). Why are there still so many jobs. *Journal of Economic Perspectives*, 29(3), 3–30.
- Ball, L., Leigh, D., & Loungani, P. (2017). Okun's law: Fit at fifty? *Journal of Money, Credit and Banking*, 49(7), 1413–1441.
- Baltagi, B. H. (2005). *Econometric analysis of panel data*. John Wiley & Sons.

- Baltagi, B. H. (2008). Econometric analysis of panel data. *John Wiley and Sons*, 1–302.
- Barro, R. J. (1991). Economic growth in a cross-section of countries. *Quarterly Journal of Economics*, 106(2), 407–443.
- Barro, R. J. (1995). Inflation and economic growth. *Bank of England Quarterly Bulletin*, 35(2), 166–176.
- Barro, R. J., & Sala-i-Martin, X. (1995). Economic growth. *McGraw-Hill*.
- Blanchard, O. (2017). Macroeconomics. *Pearson Education*.
- Blanchard, O., & Summers, L. (1986). Hysteresis and the European unemployment problem. *NBER Macroeconomics Annual*, 1, 15–78.
- Bruno, M., & Easterly, W. (1998). Inflation crises and long-run growth. *Journal of Monetary Economics*, 41(1), 3–26.
- Brynjolfsson, E., & Hitt, L. M. (2000). Beyond computation: Information technology, organizational transformation and business performance. *Journal of Economic Perspectives*, 14(4), 23–48.
- Casciani, D., Chkanikova, O., & Pal, R. (2022). Exploring the nature of digital transformation in the fashion industry: opportunities for supply chains, business models, and sustainability-oriented innovations. *Sustainability: Science, Practice and Policy*, 18(1), 773–795.
- Choi, C., and Yi, M. H. (2009). The effect of the internet on economic growth. *Economics Letters*, 105(1), 39–41.
- Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011). Broadband infrastructure and economic growth. *Economic Journal*, 121(552), 505–532.
- De Gregorio, J. (1992). Economic growth in Latin America. *Journal of Development Economics*, 39(1), 59–84.
- De Long, J. B., and Summers, L. H. (1991). Equipment investment and economic growth. *Quarterly Journal of Economics*, 106(2), 445–502.
- Dollar, D. (1992). Outward-oriented developing economies. *Economic Development and Cultural Change*, 40(3), 523–544.
- Easterly, W. (2005). National policies and economic growth. *Handbook of Economic Growth*, 1, 1015–1059.
- Edwards, S. (1998). Openness and growth. *Journal of Economic Literature*, 36(2), 383–398.
- Falk, M., and Hagsten, E. (2015). E-commerce trends and impacts across Europe. *International Journal of Production Economics*, 170, 357–369.
- Farras, A., Ali, A., & Audi, M. (2025). Advancing audit practices through technology: a comprehensive review of continuous auditing. *Journal of Social Signs Review*, 3(2), 506–539.
- Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, 32(3), 485–512.
- Frankel, J. A., and Romer, D. (1999). Does trade cause growth. *American Economic Review*, 89(3), 379–399.
- Freund, C. L., and Weinhold, D. (2004). The effect of the internet on international trade. *Journal of International Economics*, 62(1), 171–189.
- Goldfarb, A., & Tucker, C. (2019). Digital economics. *Journal of Economic Literature*, 57(1), 3–43.
- Gordon, R. J. (2013). The Phillips curve is alive and well. *Journal of Economic Perspectives*, 27(2), 5–20.
- Grossman, G. M., & Helpman, E. (1991). *Innovation and growth in the global economy*. MIT Press.
- Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics*. McGraw-Hill.
- Gylfason, T., & Herbertsson, T. T. (2001). Does inflation matter? *Journal of Development Economics*, 64(2), 405–428.
- Hsiao, C. (2014). *Analysis of panel data*. Cambridge University Press.
- Jorgenson, D. W., and Vu, K. (2005). Information technology and the world economy. *Scandinavian Journal of Economics*, 107(4), 631–650.
- Khalid, U., Ali, A., & Audi, M. (2025). Understanding Borrowing Behaviour in the EU: The Role of Mobile Payments, Financial Literacy, and Financial Access. *Annual Methodological Archive Research Review*, 3(5), 41–66.
- Khan, A. J., Ul Hameed, W., Iqbal, J., Shah, A. A., Tariq, M. A. U. R., & Ahmed, S. (2022). Adoption of sustainability innovations and environmental opinion leadership: A way to foster environmental sustainability through diffusion of innovation theory. *Sustainability*, 14(21), 14547.
- Khan, M. S., & Senhadji, A. S. (2001). Threshold effects in inflation-growth nexus. *IMF Staff Papers*, 48(1), 1–21.
- Khan, M. S., Audi, M., & Ali, A. (2025). Foreign Direct Investment, Financial Development, and Sustainable Growth: Empirical Evidence from Developing Countries. *Journal of Social Signs Review*, 3(8), 189–211.
- Kim, H., Lee, I., and Lee, C. K. (2017). Building web-based business models. *Journal of Business Research*, 70, 1–9.
- Koutroumpis, P. (2009). The economic impact of broadband. *Telecommunications Policy*, 33(9), 471–485.
- Kretschmer, T. (2012). Information and communication technologies and productivity growth. *OECD Digital Economy Papers*, 195, 1–28.
- Layard, R., Nickell, S., & Jackman, R. (2005). Unemployment. *Oxford University Press*.
- Levine, R. (1997). Financial development and growth. *Journal of Economic Literature*, 35(2), 688–726.
- Levine, R., and Renelt, D. (1992). A sensitivity analysis of cross-country growth regressions. *American Economic Review*, 82(4), 942–963.
- Longston, P., Ali, A., & Audi, A. (2025). Environmental, Social & Governance Disclosures and Corporate Financial Performance: Evidence from Selected Asian Economies. *Pakistan Journal of Social Science Review*, 4(1), 22–49.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3–42.
- Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407–437.
- Manyika, J., Chui, M., Brown, B., Bughin, J., Dobbs, R., Roxburgh, C., & Byers, A. H. (2011). Big data. *McKinsey Global Institute*.

- Marc, A., FA Sulehri, A. Ali, & Al-Masri, R. (2022). An Event Based Analysis of Stock Return and Political Uncertainty in Pakistan: Revisited. *International Journal of Economics and Financial Issues*.
- Marc, A. (2024). The impact of exchange rate volatility on long-term economic growth: Insights from Lebanon. *Journal of Policy Options* 7 (2), 1-10.
- Marc, A., Ehsan, R., & Ali, A. (2022). Does Globalization Promote Financial Integration in South Asian Economies? Unveiling the Role of Monetary and Fiscal Performance in Internationalization. *Empirical Economics Letters*, 22 (10), 237-248.
- Marc, A., Poulin, M., & Ali, A. (2023). Determinants of Human Wellbeing and its Prospect Under the Role of Financial Inclusion in South Asian Countries. *Journal of Applied Economic Sciences*, 18(4), 296.
- Marc, A., Poulin, M., Ahmad, K., & Ali, A. (2025). Modeling disaggregate globalization to carbon emissions in BRICS: A panel quantile regression analysis. *Sustainability*, 17(6), 2638.
- Naeem, H. Ali, A., & Audi, M. (2025). The Impact of Financial Stability on Environmental Degradation: Mediating Role of Green Investment and Moderating Role of Environmental Awareness. *Policy Journal of Social Science Review*, 3(1), 448–469.
- Niebel, T. (2018). ICT and economic growth. *World Development*, 104, 197–211.
- Okun, A. M. (1962). Potential GNP: Its measurement and significance. *Proceedings of the Business and Economic Statistics Section, American Statistical Association*, 98–104.
- Oliner, S. D., Sichel, D. E., and Stiroh, K. J. (2007). Explaining a productive decade. *Brookings Papers on Economic Activity*, 38(1), 81–137.
- Rafique, A., Ali, A., & Audi, M. (2025). Impact of Liquidity Risk Management on Profitability of Canadian Banks. *Annual Methodological Archive Research Review*, 3(1), 1-20.
- Rodriguez, F., & Rodrik, D. (2001). Trade policy and growth. *NBER Macroeconomics Annual*, 15, 261–325.
- Roller, L. H., and Waverman, L. (2001). Telecommunications infrastructure and economic development. *American Economic Review*, 91(4), 909–923.
- Romer, P. M. (1986). Increasing returns and growth. *Journal of Political Economy*, 94(5), 1002–1037.
- Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy*, 98(5), S71–S102.
- Roussel, Y., & Audi, M. (2024). Exploring the Nexus of Economic Expansion, Tourist Inflows, and Environmental Sustainability in Europe. *Journal of Energy and Environmental Policy Options*, 7(1), 28-36.
- Sachs, J. D., and Warner, A. M. (1995). Economic reform and the process of global integration. *Brookings Papers on Economic Activity*, 26(1), 1–118.
- Salahuddin, M., and Gow, J. (2016). The effects of internet usage. *Telecommunications Policy*, 40(1), 82–95.
- Sarel, M. (1996). Nonlinear effects of inflation. *IMF Staff Papers*, 43(1), 199–215.
- Siddiqi, M. W., Ali, A., & Chani, M. I. (2014). Import demand, economic development and trade liberalization in Pakistan: an empirical analysis. *Bulletin of Business and Economics (BBE)*, 3(2), 131-141.
- Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65–94.
- Terzi, N. (2011). The impact of e-commerce on international trade and employment. *Procedia Social and Behavioral Sciences*, 24, 745–753.
- Umair, S. M., Ali, A., & Audi, M. (2025). Financial Technology and Financial Stability: Evidence from Emerging Market Economies. *Research Consortium Archive*, 3(1), 506-531.
- Wacziarg, R., & Welch, K. H. (2008). Trade liberalization and growth. *World Bank Economic Review*, 22(2), 187–231.
- Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data. *MIT Press*, 1–1096.
- Wu, J. H., Hsia, T. L., Huo, J. Z., Robinson, S., & Wei, K. K. (2025). Effects of information technology platforms and governance on relational value creation in digital supply chains. *Information & Management*, 104292.

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