

Print ISSN: 2288-4637 / Online ISSN 2288-4645  
doi:10.13106/jafeb.2022.vol9.no5.0011

# Spillovers of Education and Job Training in Bringing Sustainable Economic Development in Pakistan: The Role of Research and Development Revisited

Sara AMIN<sup>1</sup>, Malka LIAQAT<sup>2</sup>, Noreen SAFDAR<sup>3</sup>, Sidra IQBAL<sup>4</sup>

Received: January 20, 2022 Revised: April 10, 2022 Accepted: April 25, 2022

## Abstract

Current research intended to measure the spillovers of education and on-the-job training to enhance sustainable economic development. Consideration of research and development expenditures for on-the-job training expands the impact of education and, thus, may provide spillovers for Pakistan's economic growth. The primary focus of this research is to look at the combined impact of education and research and development spending as value-added variables for sustainable growth. The econometric study uses data from a variety of sources, including the Pakistan Bureau of Statistics, the Pakistan Economic Survey, and world development indices. The secondary annual time series data from 1976 to 2019 are analyzed. To adequately estimate the empirical model, ARDL has been used while the presence of the unit root has been tested using the ADF test. The findings show that education, research, and development all contribute to all-inclusive, sustainable economic growth. Labor and capital, among other traditional components, continue to be the backbone of the development process. Still, the spillover effect is much enhanced with the expansion in education and the on-job training in the form of research and development expenditures. Consequently, the introduction of research and development in education will lead to a sustainable and inclusive economy.

**Keywords:** Education, On-the-Job Training, Research, and Development Expenditures, Sustainable Economic Development

**JEL Classification Code:** H52, H75, I21, I23

## 1. Introduction

In recent years there has been considerable interest in whether measured correlations between schooling and Economic growth reflect the causal impact of education on earnings. Education contributes a lot to the human capital

formation (Kottaridi et al., 2019). Investment in education produces skilled and efficient human resources, making it approachable for any country to achieve economic objectives, i.e., sustainable economic growth and development. Education is a currency for human capital development, treating it inseparable from human capital development. Endogenous Growth models (Lucas, 1978) and augmented growth models emphasized the role of education to determine economic growth. Economic growth is a linear function of varying levels of education and on-the-job training (Han & Lee, 2020). Numerous studies enlightened the role of education as a screening device by providing knowledge and skills and guiding individuals to choose the right professions (Altuwajri & Kalyanaraman, 2020). Education is one of the essential bases for screening, which indicates individuals' basic skills, abilities, and knowledge. The personal skills of individuals are necessary for the firms as ability raises any firm's productivity (Yao, 2019).

Economic development is complex, and economists have difficulty identifying the fundamental factors

<sup>1</sup>First Author. Lecturer, Department of Sociology, The Women University Multan, Pakistan. Email: Sara.soc@wum.edu.pk

<sup>2</sup>Assistant Professor, Institute of Management Sciences, The Women University Multan, Pakistan. Email: Malka.liaquat@wum.edu.pk

<sup>3</sup>Corresponding Author. Assistant Professor, Department of Economics, The Women University Multan, Pakistan [Postal Address: Mattital Road, Near new Katchery Multan, Multan, Punjab, Pakistan] Email: noreen.safdar@wum.edu.pk

<sup>4</sup>Lecturer, Department of Economics, Bahauddin Zakariya University Multan, Pakistan. Email: sidrach@bzu.edu.pk

© Copyright: The Author(s)

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

(Bano et al., 2018; Jesson & Newman, 2020). At its core, this process is one in which financial and human capital are combined in ever more sophisticated and productive ways. That is why certain countries advance in this process much more rapidly than others. Economists now accept that investment in education, or human capital, is essential to economic development (Belás et al., 2018). Economic studies provide robust and consistent evidence that more educated workers are more productive and earn higher salaries. There is also no doubt that average levels of education and national income rise simultaneously (Camba, 2020).

The theory of human capital plays a significant part in modern labor economics wherein it shows a meaningful relationship between education and earning. Said theory suggests earnings rise rapidly as the levels of education get better (Kengatharan, 2019). Numerous studies showed that more educated people achieve a higher wage, observe less unemployment, and engage in more prestigious professions than less knowledgeable fellows (Budig et al., 2019; Kim, 2022). Education is an investment in human capital rather than cost, the difference in economic growth rise with the difference in access to education. Skills and knowledge stimulate the ability of individuals to enhance their productivity leading to a positive rate of return (Cantillo et al., 2022; Goldin & Katz, 1996).

The significance of the research and development expenditures is highlighted all over the developed world that contribute to sustainable economic development (Coulibaly et al., 2018). There is some variation in capital accumulation in the relative amounts of the two types of capital. One is the human capital, and the second is the technological capital (Das & Drine, 2020). Capital accumulation differs from the difference in the level of growth. However, no countries have a high two type in the developing world. For instance, the U.S. has more human and technological capital while Japan has more physical than human capital, but both countries have high levels.

Similarly, studies show that economic development does not occur automatically (Diebolt & Hippe, 2022). There would not be such significant differences in the magnitude of the capital stocks between countries. However, some other research and development expenditures characteristics are lack in developing countries (Booth et al., 2001). Suppose human capital and research and development expenditures are complementary, then for history. In that case, it is indispensable to lead to the country's development and the increase in education (Hall, 2002; Long et al., 2021).

The evidence on returns to education indicates that investment in schooling is subject to increasing returns (Breton, 2013). However, all education is still considerable in highly-educated countries if supported by research and development expenditures. In developing countries, the returns are much larger than the average returns. Still, since

most of this return is indirect, but will generate spillovers using the research and development expenditures in on-the-job training. Increasing returns to education make it possible for developing countries to increase if they commit to raising their average level of schooling to sustain economic growth (Angrist et al., 2021). The evidence also indicates that literate workers boost the productivity of physical capital, and it will bring more enhanced productivity if it comes through research and development expenditures (Zhang et al., 2021). Finally, in all countries, the positive effect of rising human capital on the productivity of physical capital is required to offset the diminishing returns to investment and make the rising investment in physical capital financially viable in the development process.

Similarly, education is crucial for the development of any country, and Pakistan, like other developing countries, is experiencing a crisis in the education sector. Numerous studies have enlightened that higher growth is linked with higher levels of education in Pakistan (Bano et al., 2018; Yasmin et al., 2021). This study is a significant endeavor to address the objectives mentioned above in estimating the economic growth-education relationship using the time series data. In this paper, we provide an analytical survey of estimates of the rate of return to schooling in the form of economic growth. And it is combined with the research and development expenditures designed to determine the extent to which rates of return on education differ over time.

## 2. Literature Review

Asghar et al. (2012) analyzed human capital and economic growth using co-integration methods and causality tests. Human capital was defined in terms of education and health, and data from Pakistan for the period 1974 to 2009 was used. Long-run co-integration was found between the variables. Causality tests were also employed, and stability was checked using CUSUM and CUSUMSQ. Results suggested a positive relationship between human capital on growth, notwithstanding the low levels of investment in health and schooling in Pakistan. The study recommended further investments in health and education.

Afzal et al. (2012) evaluated the association between poverty, education, and economic progress in Pakistan. They were using yearly data from 1971–1972 to 2009–2010. They exploit ADF, PP, Ng-Perron tests to check the integration order. They used the ARDL Bond testing approach to investigate the association among the variables. Toda-Yamamoto Augmented Granger Causality (TYAGC) was used to determine the causal relationship. They concluded long-term association in poverty, schooling, physical capital, and economic growth. They also found a two-way causal connection between schooling and poverty. They concluded schooling had a more significant effect on growth than poverty's effect on economic progress.

They recommend that the government of Pakistan should make policies that enhance the education system and reduce poverty to increase economic growth (Khattak & Khan, 2012) explored the involvement of education in the economic progress of Pakistan by utilizing annual data from 1971–to 2008. They were using OLS and Johansen co-integration approach to analyze the connection among the variables. The result of OLS shows that secondary education upsurses the real GDP per capita significantly in Pakistan. Elementary education directly affected economic growth, but the findings were insignificant. Co-integration outcomes confirmed the long-term association between schooling and real GDP per capita. They recommend that government should keep schooling as the highest priority in public policies.

Awan et al. (2011) examined Pakistan’s human capital formation and economic performance. They used yearly data ranging from 1972–1973 to 2012–2013. They utilized the ADF test for the unit root problem. To calculate the effect of human capital formation and economic performance, they used JJ co-integration technique. The result analyzed a long-term affiliation between schooling enrollment and economic growth. The education enrollment index was an optimistic sign and had a significant influence on economic growth. Raza et al. (2015) interpreted empirical evidence of human capital constraint towards economic growth utilizing annual data from 1977–to 2014. They used the Johansen co-integration technique and found a strong and positive connection between human capital and economic development. They established that the current status of Pakistan’s health and education sector is inferior. They proposed that the government of Pakistan should focus on primary education and spend more on the schooling sector to boost economic growth. Zafar (2015) explored the association between human capital and the economic progress of Pakistan by utilizing yearly data ranging from 1980–to 1981 and 2009–to 2010 using OLS. Long-run attachment among school enrollment, economic growth, investment growth, CPI inflation, headcount ratio, and FCF. And Gini coefficient has a direct effect on economic development. Investment growth and headcount ratio harm economic development. He suggested that if government enhances education enrollment, it will boost economic growth.

### 3. Data and Methodology

Recent research is based on the analysis of schooling and job training and their impact on economic growth in Pakistan. Data is collected for Pakistan from 1976 to 2019 in this research. Various sources collect PBS, economic surveys, and world development indicators (Table 1). In the investigation nature of the observed variable is secondary. To adequately present the estimates, the researcher utilized an empirical model in this research.

After reviewing the theoretical and empirical work, the model to examine the impact of terms of trade on economic growth is derived using the production function framework. The empirical model form is as follows:

$$GDP_t = \beta_0 + \beta_1 SCHE_t + \beta_2 POV_t + \beta_3 INVG_t + \beta_4 ELF_t + \beta_5 RDV + e$$

- GDP<sub>t</sub> : Gross domestic product
- SCHE<sub>t</sub> : School enrollment
- POV<sub>t</sub> : Poverty
- INVG<sub>t</sub> : Investment growth
- ELF<sub>t</sub> : Employed labor force
- RDV : Research and development expenditures

### 4. Empirical Results

#### 4.1. Descriptive Statistics

Descriptive statistics is used to present the introductory statistics of the data. Tables 2 and 3 include the data of GDP, SCHE, INVG, ELF, POV, and RDV, from 1976 to 2019. The average shows the values, standard deviation, Skewness, kurtosis of the used variables.

Table 4 shows the degree of relationship among variables. This analysis investigates the relationship between the variables. A typical example of quantifying the association between two variables measured on a scale is the relationship

**Table 1:** Description of Variables

Variables Description	Description of Variables	Sources
GDP <sub>t</sub>	Gross domestic product in a year	Pakistan economic survey
SCHE <sub>t</sub>	School enrollment in total	World development indicators
POV <sub>t</sub>	poverty as headcount ratio	World development indicators
INVG <sub>t</sub>	Investment growth	State bank of Pakistan
ELF <sub>t</sub>	Employed labor force as a percentage of total	World development indicators
RDV	Research and development expenditures	World development indicators

**Table 2:** Descriptive Analysis of the Data

	<b>GDP</b>	<b>SCHE</b>	<b>INVG</b>	<b>ELF</b>	<b>POV</b>	<b>RDV</b>
Mean	4.9309	92.2569	16.2492	30.2124	24.9655	2.3432
Median	4.8465	82.9496	16.8990	29.9200	23.4772	2.3813
Maximum	10.2157	199.4646	19.2354	32.9800	34.6000	3.0223
Minimum	1.0144	6.1978	12.5206	27.4600	17.3200	1.5783
Std. Dev.	2.0666	67.1334	1.6519	1.7735	3.9962	0.3527
Skewness	0.2242	0.2654	-0.5529	0.3211	0.7841	-0.1599
Kurtosis	2.7015	1.6187	2.4061	1.8694	3.1045	2.2781

**Table 3:** Descriptive Analysis of School Enrollment at Different Levels

	<b>School Enrollment Primary</b>	<b>School Enrollment Secondary</b>	<b>School Enrollment High</b>
Mean	67.31092	27.30047	0.550162
Median	55.82214	27.20568	0.383190
Maximum	94.80907	46.10918	1.061040
Minimum	47.88664	16.50653	0.268510
Std. Dev.	17.12560	8.501581	0.280394
Skewness	0.503247	0.640448	0.677090
Kurtosis	1.541238	2.453679	1.679241

**Table 4:** Correlation Analysis

	<b>GDP</b>	<b>SCHE</b>	<b>INVG</b>	<b>LFPR</b>	<b>POV</b>	<b>RDV</b>
GDP	1.0000	-0.4081	0.2677	-0.0492	-0.1257	-0.1431
SCHE		1.0000	-0.6772	0.6339	-0.2366	0.2290
INVG			1.0000	-0.5690	0.0037	0.1345
LFPR				1.0000	-0.0406	0.0311
POV					1.0000	-0.4727
RDV						1.0000

between two variables. Each of these two characteristic variables is calculated on a continuous scale. The “r” measures the strength of the linear relationship between two variables on a continuous scale.

#### 4.2. Unit Root Test

Unit root tests can determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary. Moreover, economic theory often suggests the existence of long-run equilibrium

relationships among non-stationary time series variables. Unit root analysis is applied to check the stationarity of the variables. The first stationary level of data is checked at a level. If the data is stationary, it will be written as 1(0). To check the stationary level will end here, but the data is not stationary at the level, then more processes will be done to check the stationary level (Table 5).

The bounds tests suggest that the variables of interest are bound together in the long run when GDP is the dependent variable (Table 6). The associated equilibrium correction was also significant, confirming the existence of the long-run

**Table 5:** Unit Root Analysis

	Trend and Intercept	Intercept	Decision
GDP at level	−4.103164		I(0)
	(0.0026)		
INVG at level	−1.776716		
	(0.3864)		
INVG at 1 <sup>st</sup> difference	−4.88766		I(1)
	(0.3864)		
ELF at level	−0.338328		
	(0.9101)		
ELF at 1 <sup>st</sup> difference	−5.888655		I(1)
	(0.0000)		
POV at level		−2.975495	
		(0.0459)	
POV at 1 <sup>st</sup> difference		−3.772684	I(1)
		(0.0065)	
RDV at level		−4.560693	
		(0.0007)	
SCHE at level	− 0.218575		
	(0.9706)		
SCHE at 1 <sup>st</sup> difference	−5.422886		I(1)
	(0.0001)		

relationship. Autoregressive Distributed Lag Model (ARDL) Bounds testing procedure is a powerful statistical tool in the estimation of level relationships when the underlying property of time series is entirely  $I(0)$ , entirely  $I(1)$ , or jointly co-integrated. Bound testing as an extension of ARDL modeling uses  $F$  and  $t$ -statistics to test the significance of the lagged levels of the variables in a univariate equilibrium correction system when it is unclear if the data generating process underlying a time series is a trend or first difference stationary. Here the ARDL model is applied to examine the short and long-run association between variables. Table 6 represents the bound test is applied to check the long-run relationship between the variables. The calculated value of the  $F$ -statistic is 5.749032, which is greater than the upper bound values. The  $F$ -statistic illustrates the existence of co-integration in the long run in this research.

### 4.3. ARDL Cointegration and Long-Run Form

In Tables 7 and 8, SCHE has a coefficient equal to 0.022989, and the probability value is equal to 0.0021, which is highly statistically significant as the probability is less

**Table 6:** Bound Test Results

Test Statistic	Value	$k$
$F$ -statistic	5.749032	5
Critical Value Bounds		
Significance	$I_0$ Bound	$I_1$ Bound
10%	2.26	3.35
5%	2.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

**Table 7:** Short-Run Results

Variables	Coefficient	Prob.
D(GDP(−1))	0.877237***	0.0283
D(GDP(−2))	0.628668***	0.0258
D(GDP(−3))	0.227144	0.1348
D(SCHE)	0.003005	0.9538
D(SCHE(−1))	0.190052***	0.0128
D(SCHE(−2))	−0.086233	0.3192
D(SCHE(−3))	−0.062324	0.3540
D(INVG)	0.370148	0.4033
D(INVG(−1))	−0.404418	0.4272
D(INVG(−2))	−0.040097	0.9233
D(INVG(−3))	0.529337	0.1390
D(ELF)	0.490907	0.4200
D(ELF(−1))	0.909141	0.2959
D(ELF(−2))	1.341931	0.1217
D(ELF(−3))	−0.642262	0.2508
D(POV)	−0.148640	0.2061
D(RDV)	0.572105	0.4876
D(RDV(−1))	0.899643	0.2391
D(RDV(−2))	1.126014	0.1421
D(RDV(−3))	1.080079	0.1938
CointEq(−1)	−1.983152***	0.0003

than 0.05. This shows a positive relationship between school enrollment and economic growth. INVG has a coefficient equal to 0.019822, and the probability value is equal to 0.0073, which is highly statistically significant as the probability is less than 0.05. This shows a positive relationship between investment growth and economic growth. ELF has a coefficient equal to 0.454384, and the probability value



is equal to 0.0049, which is highly statistically significant as the probability is less than 0.05. This shows a positive relationship between the employed labor force and economic growth (Nasir et al., 2021). POV has a coefficient equal to  $-0.074951$ , and the probability value is equal to 0.2001, which is highly statistically significant as the probability is less than 0.05. This shows a negative relationship between poverty and economic growth. RDV has a coefficient equal to 0.180731, and the probability value is equal to 0.0319 is highly statistically significant as the probability is less than 0.05. This shows a positive relationship between research and development and economic growth.

The diagnostic test of the model is shown in Table 9. We dismantled the serial correlation test and the

**Table 8:** Long-Run Results

Variables	Coefficient	Prob.
SCHE	0.022989***	0.0021
INVG	0.019822***	0.0073
ELF	0.454384***	0.0049
POV	$-0.074951$	0.2001
RDV	0.180731***	0.0319
C	$-2.755204$	0.6898

**Table 9:** Diagnostic Test

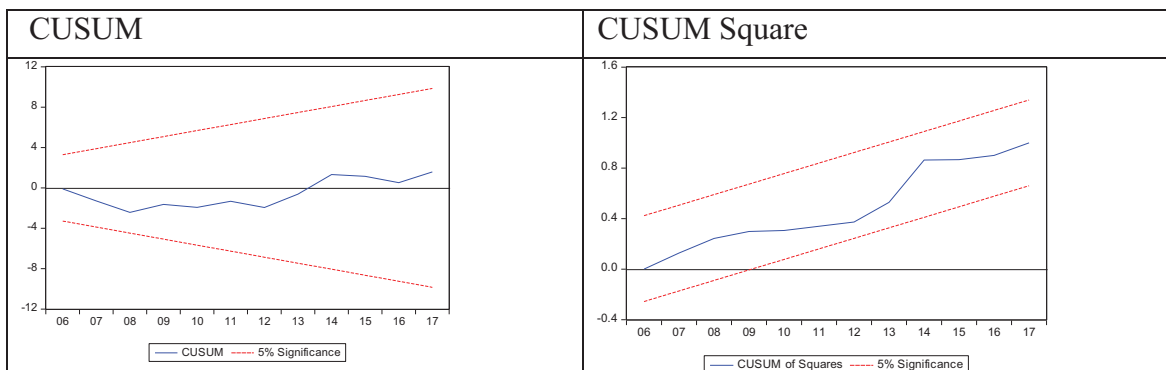
Heteroskedasticity test			
F-statistic	0.706290	Prob. F (25,12)	0.7768
Obs * R-squared	22.62433	Prob. Chi-Square (25)	0.5995
Scaled explained SS	2.488736	Prob. Chi-Square (25)	1.0000
Breusch-Godfrey correlation LM test			
F-statistic	0.527090	Prob. F (2,10)	0.6059
Obs * R-squared	3.623866	Prob. Chi-Square (2)	0.1633

Brush test in the model, and the value of  $F$ -statistics is insignificant. In this model, there is no serial correlation and no heteroskedasticity. The null hypothesis is accepted, whereas the alternative hypothesis is rejected.

The CUSUM estimates the used Model stability and CUSUM stability test in the autoregressive distributed lag (ARDL) method. The results in Figure 1 show that the current model’s coefficient is stable because of the CUSUM and CUSUMS statistic graphs.

### 5. Conclusion and Policy Recommendations

Education is crucial for the development of any country, and Pakistan, like other developing countries, Pakistan is experiencing disparities in the education sector. Numerous studies have enlightened the fact that higher growth is linked with higher levels of education in Pakistan. This study looked at education and on-the-job training to see how they affected economic growth. Education is a critical area that helps to ensure that all people in society are included in the economic growth process. The economics of education differs. As a factor of production, human capital differs from physical capital. Investing in education can have a positive economic impact. Cost of investing in human capital, returns on investment or return to education, and increased productivity are three significant economic effects



**Figure 1:** CUSUM and CUSUMS Statistic Graphs

of an investment in human capital. Furthermore, taking into account R&D expenditures for on-the-job training increases the impact of education and, as a result, may create spillovers for Pakistan's economic growth.

Economic growth is a linear function of varying levels of education and on-the-job training. Numerous studies enlightened the role of education as a screening device by providing knowledge and skills and guiding the individual to opt for the right professions. Education is one of the essential bases for screening, which indicates the basic skills, abilities, and knowledge of individuals. Personal abilities of individuals are essential for the firms as ability raises any firm's productivity.

The empirical conclusions illustrate that education, research, and development contribute to all-inclusive and sustainable economic development. Other conventional factors, labor, and capital are still the backbones of the development process. Nonetheless, the spillover impact is greatly enhanced by the expansion of education and on-the-job training in the form of R&D investments. As a result, it is suggested that education research and development be integrated into a sustainable and inclusive economy.

## References

- Afzal, M., Malik, M. E., Begum, I., Sarwar, K., & Fatima, H. (2012). Relationship among education, poverty and economic growth in Pakistan: An econometric analysis. *Journal of Elementary Education*, 22(1), 23–45. [http://pu.edu.pk/images/journal/JEE/PDF-Files/3\\_Afzal\\_malik\\_ishrat%20final\\_2012JEE\\_Vol\\_22\\_no\\_1.pdf](http://pu.edu.pk/images/journal/JEE/PDF-Files/3_Afzal_malik_ishrat%20final_2012JEE_Vol_22_no_1.pdf)
- Altuwaijri, B. M., & Kalyanaraman, L. (2020). CEO education-performance relationship: Evidence from Saudi Arabia. *Journal of Asian Finance, Economics, and Business*, 7(8), 259–268. <https://doi.org/10.13106/jafeb.2020.vol7.no8.259>
- Angrist, N., Djankov, S., Goldberg, P. K., & Patrinos, H. A. (2021). Measuring human capital using global learning data. *Nature*, 592(7854), 403–408. <https://doi.org/10.1038/s41586-021-03323-7>
- Asghar, N., Awan, A., & Rehman, H. (2012). Human capital and economic growth in Pakistan: A cointegration and causality analysis. *International Journal of Economics and Finance*, 4(4), 135–147. <https://doi.org/10.5539/ijef.v4n4p135>
- Awan, A. G., & Firidi, M. Z., Ch (2011). Human Capital Formation and Economic Performance: A case study of Pakistan. *Journal of Economics and Sustainable Development*, 6(3), 96–104. <https://doi.org/10.1.1.961.3925>
- Bano, S., Zhao, Y., Ahmad, A., Wang, S., & Liu, Y. (2018). Identifying the impacts of human capital on carbon emissions in Pakistan. *Journal of Cleaner Production*, 183, 1082–1092. <https://doi.org/10.1016/j.jclepro.2018.02.008>
- Belás, J., Smrcka, L., Gavurova, B., & Dvorsky, J. (2018). The impact of social and economic factors on the credit risk management of SMEs. *Technological and Economic Development of Economy*, 24(3), 1215–1230. <https://doi.org/10.3846/tede.2018.1968>
- Booth, L., Aivazian, V., Demircuc-Kunt, A., & Maksimovic, V. (2001). Capital structures in developing countries. *Journal of Finance*, 56(1), 87–130. <https://doi.org/10.1111/0022-1082.00320>
- Breton, T. R. (2013). The role of education in economic growth: Theory, history and current returns. *Educational Research*, 55(2), 121–138. <https://doi.org/10.1080/00131881.2013.801241>
- Budig, M. J., Hodges, M. J., & England, P. (2019). Wages of nurturant and reproductive care workers: Individual and job characteristics, occupational closure, and wage-equalizing institutions. *Social Problems*, 66(2), 294–319. <https://doi.org/10.1093/socpro/spy007>
- Camba, A. L. (2020). Estimating the nature of the relationship of entrepreneurship and business confidence on youth unemployment in the Philippines. *Journal of Asian Finance, Economics, and Business*, 7(8), 533–542. <https://doi.org/10.13106/jafeb.2020.vol7.no8.533>
- Cantillo, T., Cantillo, V., Garcia, L., & Cantillo-Garcia, V. (2022). Uncovering the wage differential between formal and informal jobs: Analysis from the Colombian Caribbean region. *Latin American Economic Review*, 31, 1–25. <https://doi.org/10.47872/laer.v31.24>
- Coulibaly, S. K., Erbao, C., & Metuge Mekongcho, T. M. (2018). Economic globalization, entrepreneurship, and development. *Technological Forecasting and Social Change*, 127, 271–280. <https://doi.org/10.1016/j.techfore.2017.09.028>
- Das, G. G., & Drine, I. (2020). Distance from the technology frontier: How could Africa catch up via socio-institutional factors and human capital? *Technological Forecasting and Social Change*, 150, 755. <https://doi.org/10.1016/j.techfore.2019.119755>
- Diebolt, C., & Hippe, R. (2022). The long-run impact of human capital on innovation and economic growth in the regions of Europe. New York: Springer. [https://doi.org/10.1007/978-3-030-90858-4\\_5](https://doi.org/10.1007/978-3-030-90858-4_5)
- Goldin, C., & Katz, L. F. (1996). Technology, skill, and the wage structure: Insights from the past. *American Economic Review*, 86(2), 252–257. <https://www.jstor.org/stable/2118132>
- Hall, B. H. (2002). The financing of research and development. *Oxford Review of Economic Policy*, 18(1), 35–51. <https://doi.org/10.1093/oxrep/18.1.35>
- Han, J. S., & Lee, J. W. (2020). Demographic change, human capital, and economic growth in Korea. *Japan and the World Economy*, 53, 984. <https://doi.org/10.1016/j.japwor.2019.100984>
- Jesson, J., & Newman, M. (2020). Radical adult education and learning. London, UK: Routledge.
- Kengatharan, N. (2019). A knowledge-based theory of the firm: Nexus of intellectual capital, productivity and firms'

- performance. *International Journal of Manpower*, 40(6), 1056–1074. <https://doi.org/10.1108/IJM-03-2018-0096>
- Khattak, N. U. R., & Khan, J. (2012). The contribution of education to economic growth: Evidence from Pakistan. *International Journal of Business and Social Science*, 3(4), 145–151. [http://www.ijbssnet.com/journals/Vol\\_3\\_No\\_4\\_Special\\_Issue\\_February\\_2012/18.pdf](http://www.ijbssnet.com/journals/Vol_3_No_4_Special_Issue_February_2012/18.pdf)
- Kim, H. (2022). Education, wage dynamics, and wealth inequality. *Review of Economic Dynamics*, 43, 217–240. <https://doi.org/10.1016/j.red.2021.02.006>
- Kottaridi, C., Louloui, K., & Karkalakos, S. (2019). Human capital, skills, and competencies: Varying effects on inward FDI in the EU context. *International Business Review*, 28(2), 375–390. <https://doi.org/10.1016/j.ibusrev.2018.10.008>
- Long, S., Duang-Ek-Anong, S., & Vongurai, R. (2021). Determinants of business education on student satisfaction in higher education: A case study in Cambodia. *Journal of Asian Finance, Economics, and Business*, 8(3), 1405–1416.
- Lucas, R. E. (1978). On the size distribution of business firms. *Bell Journal of Economics*, 9(2), 508–523. <https://doi.org/10.2307/3003596>
- Nasir, N., Yasmin, F., & Safdar, N. (2021). Employment diversification patterns in Pakistan: Empirical assessment revisited. *Review of Economics and Development Studies*, 7(1), 77–90. <https://doi.org/10.47067/reads.v7i1.323>
- Raza, K., Bashir, F., & Ashraf, M. S. (2015). Empirical evidence of human capital constraint towards economic growth. *Journal of Resources Development and Management*, 11, 63–75.
- Yao, Y. (2019). Does higher education expansion enhance productivity? *Journal of Macroeconomics*, 59, 169–194. <https://doi.org/10.1016/j.jmacro.2018.11.009>
- Yasmin, N., Safdar, N., Yasmin, F., & Khatoon, S. (2021). Education, poverty, and unemployment: A way forward to promote sustainable economic growth in Pakistan. *Journal of Contemporary Issues in Business and Government*, 27(06), 115.
- Zafar, K. (2015). The human capital development and economic growth in Pakistan 1980–2010. *RADS Journal of Social Sciences & Business Management*, 2(1), 15–26.
- Zhang, D., Mohsin, M., Rasheed, A. K., Chang, Y., & Taghizadeh-Hesary, F. (2021). Public spending and green economic growth in BRI region: Mediating role of green finance. *Energy Policy*, 153, 112256. <https://doi.org/10.1016/j.enpol.2021.112256>