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The effect of FDI inflows on unemployment in Asian developing economies and the role of digitalization

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Abstract

Asian developing countries make more effort to attract additional foreign direct investment (FDI) inflows to enhance economic growth and create more jobs. The FDI – unemployment relationship is a hotly debated topic between economists and policymakers. In the context of globalization with the high development level of the Internet, does digitalization contribute to this relationship? For the answer, the study employs individuals using the Internet and fixed broadband subscriptions as a proxy for digitalization to empirically examine the effects of FDI, digitalization, and their interaction on unemployment for a group of 32 Asian developing countries over the period 2002 – 2020. It applies the two-step and one-step difference GMM estimators and the PMG estimator. The results show that FDI decreases while digitalization increases unemployment, but their interaction reduces it. Furthermore, economic growth, trade openness, and governance are significant determinants of unemployment in these countries. The study suggests some implications for governments in Asian developing economies to develop

information technology and the Internet to receive more FDI inflows and create more jobs.

Keywords: FDI, digitalization, unemployment, Asian developing economies, difference GMM Arellano-Bond estimator, PMG estimator

1. Introduction

A high unemployment rate is one of the more serious problems in developing economies in the context of increasing digitalization and globalization. Persistently high unemployment leads to political and social instability in some countries. Creating more jobs plays a crucial role in the development agendas in these countries. Meanwhile, FDI inflows contribute significantly to the economic development and growth in Asian developing countries because FDI inflows bring technology transfer, capital accumulation, innovative capacity, and know-how acquisition to host countries (Agosin & Machado, 2005). FDI inflow shows a positive role in the fight against unemployment in the economic development in recipient countries (Folawewo & Adeboje, 2017; Rong et al., 2020). Progress in digital technology is a globally irreversible process, and digitalization is therefore considered a significant factor to attract more FDI inflows (Al-Sadiq, 2021). Unfortunately, progress in digital technology can cause unemployment because programmed equipment can displace people in performing many tasks (Abbasabadi & Soleimani, 2021). Notably, most related studies emphasize that FDI inflows reduce the unemployment rate in host countries without taking into account the role of digitalization. Does progression in digital technology significantly contribute to the FDI – unemployment relationship in Asian developing countries?

Given the relevance of this topic, Frank et al. (2020) developed a theoretical framework to link the FDI inflows to unemployment in host countries. The initial influence of FDI inflows on employment seems to be small and mainly connected with the creation of unskilled jobs, but FDI

investors diversify their operations of subsidiaries in the long-term, thereby setting up a change in the pattern of jobs in host countries. In the context of globalization and digitalization, we argue that progress in digital technology can contribute significantly to the FDI – unemployment relationship. This progress can lead to a higher unemployment rate in host countries because programmed machines can replace humans in performing many tasks (Bertani et al., 2020; Abbasabadi & Soleimani, 2021). The theory of production shows the relations among factors of production (capital, labor, land, entrepreneur) and the output of goods and services. The application of programmed machines (digitalization – a form of capital) in production enhances the output of goods and services and reduces the number of workers (labor). However, it is a significant factor to attract more FDI inflows, reducing the unemployment rate because FDI enterprises can create more jobs for people in the host countries (Abouelfarag & Abed, 2020; Rong et al., 2020).

A report by UNCTAD (2021) notes that developing Asia was the only region to record a growth rate of 4% in FDI inflows with $535 billion in 2020. FDI inflows to East Asia rose by 21% to $292 billion due to FDI inflows recovery in Hong Kong (China). FDI inflows to Mainland China increased by 6% to $149 billion, noting its success in dealing with the COVID-19 pandemic and recovering its rapid GDP growth. In contrast, FDI inflows into the Republic of Korea fell 4% to $9 billion even though it was one of the first to contain the COVID-19 outbreak and keep its economic growth strong. Meanwhile, FDI inflows to South Asia rose by 20% to $71 billion due to strong M&As in India to which FDI inflows rose 27% to $64 billion. Similarly, FDI in West Asia went up by 9% to $37 billion due to a significant rise in M&As (60% to $21 billion) in this subregion. Contrarily, FDI inflows to South-East Asia declined by 25% to $136 billion in which Indonesia, Singapore, and Vietnam, the three largest recipients capturing more than 90% of FDI inflows, recorded FDI decreases. In short, the statistical data show that Asian developing economies need more investment capital for economic development, and FDI inflows to these economies are relatively stable.

Meanwhile, a report by ADB (2021) notes the COVID-19 pandemic caused an unprecedented economic downturn, resulting in millions of jobs lost and hundreds of thousands of companies closed in developing Asia. The influences on employment were uneven, with significant job losses in hard-hit industries such as construction, retail, and tourism and some job growth in higher-skilled services industries such as pharmaceuticals, insurance, finance, information technology, and health. In India, the unemployment rate increased to 7.7% for both genders in 2020 from 5.3% for men and 5.2% for women in 2019. Nepal also had a substantial increase in unemployment with a total of 4.4% in 2020 from 3.0% for men and 2.7% for women in 2019. In the Philippines, a substantial rise in unemployment was connected to the COVID-19 pandemic and lockdown; thus, the unemployment rate hovered around 2.5%. In Thailand, a substantial increase in unemployment was from 0.7% to 1.0% in 2020, with job losses in agriculture, manufacturing, and tourism. Indeed, the statistical data report that the unemployment rate has increased in most Asian countries in recent periods due to the COVID-19 pandemic.

Motivated by the fact that digitalization plays a crucial role in Asian developing countries and can significantly contribute to the FDI – unemployment relationship, the study employs individuals using the Internet and fixed broadband subscriptions as a proxy for digitalization to investigate the effects of FDI, digitalization, and their interaction on unemployment for a group of 32 Asian developing countries from 2002 to 2020 through the two-step and one-step difference GMM (D-GMM) estimators. The study uses the Poole Mean Group (PMG) estimator to check the robustness of these estimates.

The study presents its structure as follows: Section 1 describes the introduction, while Section 2 notes the literature review indicating the effect of FDI inflows on unemployment. Methodology and research in Section 3 will emphasize the appropriateness and characteristics of D-GMM and PMG. Section 4 reports the estimated results. The final section (Section 5) will be the conclusion and some implications.

2. Literature review

The effect of FDI on unemployment/employment has been shown in related literature. Most of the studies support that FDI reduces the unemployment rate. Some additionally find that the FDI inflows – unemployment relationship is positive or inconclusive.

Regarding the negative effect, all researchers highlight the significant contribution of FDI inflows to unemployment reduction in host countries (Abor & Harvey, 2008; Schmerer, 2014; Maqbool et al., 2013; Ogbeide et al., 2016; Folawewo and Adeboje, 2017; Abouelfarag & Abed, 2020; Rong et al., 2020). Abor & Harvey (2008) apply a simultaneous panel regression model for Ghana from 1992 to 2002, while Maqbool et al. (2013) use the Autoregressive Distributed Lag (ARDL) approach for the economy of Pakistan from 1976 through 2012. Meanwhile, Schmerer (2014) notes that FDI links with lower rates of unemployment using the fixed effects estimator and the one-step difference GMM Arellano-Bond estimator for 19 OECD economies from 1980 through 2003. Similarly, Ogbeide et al. (2016) apply the error correction model (ECM) and OLS estimator for Nigeria from 1981 to 2013, while Folawewo and Adeboje (2017) use the estimators of fixed effects, random effects, and FMOL for 15 countries of ECOWAS from 1991 to 2014. Lately, Abouelfarag & Abed (2020) employ the ARDL approach for Egypt over the 1985 – 2014 period, while Rong et al. (2020) apply the one-step system GMM Arellano-Bond estimator for a sample of 30 Chinese provinces and municipalities over the 2000 – 2015 period.

Regarding the positive effect, Jude & Silaghi (2016) indicate that FDI inflows enhance the unemployment rate in 20 Central and Eastern European economies between 1995 and 2012 using the estimators of fixed effects and one-step system GMM Arellano-Bond. Meanwhile, Strat et al. (2015), Malik (2019), and Mkombe et al. (2020) conclude that there is no empirical evidence to show the significant impact of FDI inflows on unemployment. Strat et al. (2015) apply the Toda-Yamamoto procedure for the latest thirteen member

states of the EU from 1991 to 2012. In the same vein, Malik (2019) does not consider FDI as a crucial way to generate employment in the manufacturing sector in India by applying the one-step system GMM Arellano-Bond estimator for a sample of 54 three-digit sectors from the Annual Survey of Industries between 2008 and 2016. More recently, Mkombe et al. (2020) use the FGLS (Feasible Generalized Least Squares) for six countries of the SADC region between 1994 and 2017. Mkombe et al. (2020) confirm FDI inflows have no impact on youth unemployment in the SADC region due to the type of mergers and acquisitions FDI, which has less jobs generation compared with greenfield FDI.

Unlike the above studies, Saucedo et al. (2020) note that FDI inflows in the manufacturing industry hurt low- and high-skilled unemployment, but FDI inflows in the service industry are inconclusive when they apply the fixed-effects estimator and Panel Corrected Standard Errors (PCSE) estimator for a quarterly panel data of 32 Mexican states from 2005 to 2018.

In short, from the literature perspective, we note that (i) no studies introduce digitalization into the empirical model to examine its role in the FDI – unemployment relationship, and (ii) only some studies apply the one-step GMM Arellano-Bond estimator that can handle the endogenous phenomenon and the high autocorrelation in the estimation procedure. In particular, no related studies use the two-step GMM Arellano-Bond estimator that is more asymptotically efficient than the one-step GMM Arellano-Bond estimator. Therefore, the study highlights two aspects that can be different from related studies. Firstly, the study is the first one to introduce digitalization into the FDI – unemployment relationship. Secondly, the study uses the two-step D-GMM for estimation and FE-IV and PMG for robustness examination.

3. Methodology and research data

3.1 Methodology

Following Rong et al. (2020), the empirical model is modified as follows:

$$UNE_{it} = \beta_0 + \beta_1 UNE_{it-1} + \beta_2 FDI_{it} + \beta_3 DIG_{it} + \beta_4 (FDI \times DIG)_{it} + Z_{it}\beta' + \mu_i + \tau_{it} \quad (1)$$

where t and i are respectively the time and country. UNE_{it} is the unemployment rate, UNE_{it-1} is the initial level of the unemployment rate, FDI_{it} is net FDI inflows, DIG_{it} is individuals using the Internet (INN) or fixed broadband subscriptions (BRO), a proxy for digitalization, and $(FDI \times DIG)_{it}$ is the interaction between FDI and digitalization. Economic growth, trade openness, and governance are control variables in Z_{it}; μ_i is a country-specific, time-invariant unobserved effect, and τ_t is an observed error term; β_0, β_1, β_2, β_3, β_4, and β' are estimated coefficients. According to Abbasabadi & Soleimani (2021), there are some measures to proxy for digital technology, e.g., availability of latest technologies, firm-level technology absorption, FDI and technology transfer, international Internet bandwidth (kb/s) per Internet user, fixed-broadband Internet subscriptions per 100 population, and percentage of individuals using the Internet. In this paper, we use the percentage of individuals using the Internet (Bauer, 2018; Canh et al., 2020; Nguyen, 2021) and fixed-broadband Internet subscriptions per 100 population (Czernich et al., 2011; Akerman et al., 2015) as proxies for digitalization.

The control variables in this study are chosen through related papers such as economic growth (Maqbool et al., 2013; Jude & Silaghi, 2016; Ogbeide et al., 2016; Folawewo & Adeboje, 2017; Malik, 2019; Mkombe et al., 2020), trade openness (Felbermayr et al., 2011; Nwaka et al., 2015), and institutional quality (Baccaro & Rei, 2007; Abé Ndjié et al., 2019; Shabbir & Alam, 2020). Felbermayr et al. (2011) note that trade openness reduces aggregate unemployment in 62 countries. Abé Ndjié et al. (2019) report that governance indicators decrease the unemployment rate in Africa.

Digitalization can significantly contribute to the FDI – unemployment relationship. Firstly, digital technology in the form of programmed machines increases the unemployment rate (Bertani et al., 2020; Abbasabadi & Soleimani, 2021). Meanwhile, digital technology development is an advantage to attract more FDI inflows (Suh & Bae, 2002; Choi, 2003; Yin & Choi, 2021). FDI inflows can reduce the unemployment rate (Abouelfarag & Abed, 2020; Rong et al., 2020), and as a result, an increase in digital technology will attract more FDI inflows, which can lead to a decline in unemployment. Therefore, we introduce the interaction term between FDI and digitalization $(FDI \times DIG)$ into the empirical equations to examine the effect of the interaction term on unemployment.

Equation (1) is applied to examine the effects of FDI, digitalization, and their interaction on unemployment for a group of 32 Asian developing economies from 2002 to 2020. We use six dimensions of governance from the World Bank to proxy for the institutional environment in which each receives a value from –2.5 to 2.5 (Kaufmann et al., 2011). They are regulatory quality, the rule of law, voice and accountability, control of corruption, government effectiveness, and political stability.

Estimating Equation (1) causes some econometrics problems. Firstly, economic growth, governance, and FDI can be endogenous. They may correlate with μ_i, which results in the endogenous phenomenon. Secondly, country-specific characteristics such as anthropology, culture, and geography (fixed effects) may correlate with regressors. They exist in μ_i. Thirdly, the presence of UNE_{it-1} leads to a high autocorrelation. Fourthly, the research sample (panel data) has a relatively short observation length (T = 19) and a relatively large unit (N = 32). These problems can make the OLS estimator biased. The random-effects model (REM) and the fixed effects model (FEM) can handle endogenous phenomena and serial autocorrelation, while the IV-2SLS estimator needs some appropriate instrumental variables out of the model. The study, therefore, uses the two-step and one-step D-GMM as recommended by Judson & Owen (1999) to estimate and the PMG to test the robustness.

The study uses the GMM (general method of moments) developed by Arellano & Bond (1991) to estimate. First, we take the first difference in regressors to remove the country-fixed effects. Next, the regressors in the first difference are employed as instrumented by their lags with the assumption that there is no serial correlation among time-varying residuals in the original models (Judson & Owen, 1999). It is the difference GMM estimator that can deal with the simultaneity biases in estimation. Compared with the one-step D-GMM, the two-step D-GMM is more asymptotically efficient. However, using the two-step D-GMM in small research samples, like in this study, presents some problems (Roodman, 2006). They are the proliferation of instruments, which quadratically rises as the time dimension increases. It may cause the number of instruments to be very large relative to the number of units. To fix it, the study should apply the rule of thumb to ensure that the number of instruments is less than or equal to the number of units (Roodman, 2006).

In the estimation process, the study uses the Arellano-Bond statistic, the Hansen statistic, and the Sargan statistic to examine the validity of instruments in the two-step D-GMM. The Hansen and Sargan tests have null hypothesis H_0: all instruments are strictly exogenous, meaning that they do not correlate with the error terms. Meanwhile, the Arellano-Bond test detects the autocorrelation of the error terms in the first difference. The study, therefore, ignores the test result of the first autocorrelation AR(1) and keeps the second autocorrelation AR(2).

The study applies the PMG developed by Pesaran et al. (1999) to check the robustness of the two-step D-GMM. In this estimation, the short-term parameters are heterogeneous, while the long-term coefficients are homogeneous between groups. Furthermore, it shows the adjustment dynamic between the short-run and the long-run. However, it cannot handle the endogeneity of variables in the model, which is its drawback.

The PMG estimator-based error correction model as follows:

$$\Delta H_{it} = \emptyset N_{it-1} + \sum^{p}_{j=1} \delta_{ij} \Delta U_{it-j} + \mu_{it} + \tau_{it} \; where \; N_{it-1} = H_{it-1} - \theta U_{it-1} \qquad (2)$$

where H is the unemployment rate, N_{it-1} is the deviation from long-run equilibrium for group i at any period t, and ϕ is the speed of adjustment (the error-correction coefficient). The vector θ captures the long-run coefficients that do not vary across groups. They represent the long-run elasticity of the unemployment rate to each variable in U_{it-1}. Meanwhile, the vector δ captures the short-run responses of the U variables. μ_i is a country-specific, unobserved time-invariant effect, and τ_{it} is an error term. The study uses the value and significance of the error-correction coefficient ϕ to check the validity of the PMG estimates (negative and smaller than 1).

3.2 Research data

The study extracts the unemployment rate, net FDI inflows, individuals using the Internet, fixed broadband subscriptions, real GDP per capita, trade openness, and six governance dimensions from the World Bank database. The research sample contains 32 Asian developing economies[1] from 2002 to 2020.

The study presents the definition and the statistics of the dataset in the Appendix (Tables A, B, C, and D). The results in Table B indicate that Asian developing economies have poor governance. Meanwhile, the matrices of correlation coefficients are shown in Tables C and D. Notably, the correlation coefficients between the six dimensions of governance are more than 0.8, so they are separately applied in the empirical model to eliminate multicollinearity. Similarly, the correlation coefficient between individuals

[1] Armenia, Azerbaijan, Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Islamic Rep. Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Lao PDR, Malaysia, Mongolia, Myanmar, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Sri Lanka, Tajikistan, Thailand, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, and Vietnam.

using the Internet and fixed broadband subscriptions is relatively high, so the study uses them separately.

4. Results and discussion

4.1 Estimates by D-GMM

Without the interaction term between digitalization and FDI, the study illustrates the two-step D-GMM estimates in Tables 1 and 2 and the one-step D-GMM estimates in Tables 3 and 4. With the interaction term, the study reports the two-step D-GMM estimates in Tables 5 and 6 and the one-step D-GMM estimates in Tables 7 and 8. Tables 1, 3, 5, and 7 employ individuals using the Internet, while Tables 2, 4, 6, and 8 employ fixed broadband subscriptions as a proxy for digitalization. Each column in every table is the empirical model for a dimension of governance. Improving governance reduces the unemployment rate. For instance, governments formulate and implement regulations and policies to enhance the citizens' employment opportunities. In the opposite direction, the high unemployment rate that can lead to social instability puts pressure on government regulations and policies. Therefore, the relationship between governance and unemployment is bidirectional. We find that in every estimation procedure, governance is endogenous while other variables are not. Hence, we use governance as instrumented in the GMM-style with unemployment, FDI, digitalization, economic growth, and trade openness as instruments in the IV-style.

Without the interaction term, the results across empirical models show that FDI reduces unemployment while digitalization enhances it. With the presence of the interaction term, the results are still consistent where FDI decreases and digitalization increases unemployment, but the interaction reduces it. Therefore, the main result is that FDI reduces unemployment, and this negative effect is amplified by digitalization. Most previous studies such as Abor & Harvey (2008), Schmerer (2014), Maqbool et al. (2013), Ogbeide

et al. (2016), Folawewo & Adeboje (2017), Abouelfarag & Abed (2020), and Rong et al. (2020) show the negative effect of FDI on unemployment. Most Asian developing countries have a middle per capita income and lack investment capital for economic development. They make efforts to attract more FDI inflows. Therefore, FDI inflows into host Asian developing countries will bring economic activities to these countries through vertical and horizontal spillover effects, attracting more workers and thus reducing the unemployment rate. Greenfield FDI inflows into these economies will attract a large amount of redundant and cheap labor to serve production and business activities, thus decreasing the unemployment rate in these economies. Bertani et al. (2020) and Abbasabadi & Soleimani (2021) indicate the positive impact of digitalization on the unemployment rate. Bertani et al. (2020) note that a high rate of technological progress leads to a dramatic increase in unemployment. The increasing employment of digital assets developers with higher levels of technological progress results in a transformation of a clear labor market where the economic system shifts to a digital service one from a mass-production economy. Abbasabadi & Soleimani (2021) show that unemployment grows as digitalization expands. In recent years, developing Asian countries have tried to develop their economies to become industrialized nations with advanced digital technology. The application of these technologies in management and production in these countries can contribute to the increase in unemployment. On the one side, digitalization increases the unemployment rate, but on the other side, it decreases the unemployment rate by attracting more FDI inflows to host countries. Indeed, digitalization development is a significant factor to attract more FDI inflows to Asian developing economies. Elkjaer & Damgaard (2018) emphasize that digital platforms are also seen as intangible assets of multinational corporations, and the development of digital technology will help them lower costs and increase profits. Therefore, Asian developing economies with the advantage of digital technology will attract more FDI inflows. In addition to

digital technology, these multinational corporations also look at cheap labor in host Asian countries to invest and attract more workers, so the interaction between FDI and digitalization reduces unemployment.

Trade openness and economic growth reduce unemployment. Maqbool et al. (2013), Jude & Silaghi (2016), Ogbeide et al. (2016), Folawewo & Adeboje (2017), Malik (2019), and Mkombe et al. (2020) note the negative impact of economic growth on unemployment. Economic development and growth will create necessary conditions for economic activities such as production, investment, and business. Enterprises will expand business activities and hire more employees, thus decreasing the unemployment rate. Similarly, Dutt et al. (2009) support the Ricardian prediction that trade openness and unemployment are negatively linked. Hasan et al. (2012) and Nwaka et al. (2015) note that trade liberalization reduces unemployment. Conversely, governance increases unemployment. The policies and regulations in developing countries are non-transparent and unaccountable, and the implementation of these policies and regulations is not monitored or supervised publicly. Government officials often misuse them to seek rent through harassing enterprises. As a result, starting a business or expanding investments and businesses are difficult and do not create many jobs. Therefore, governance stimulates unemployment.

Table 1. FDI, digitalization, and unemployment (without interaction term): two-step D-GMM estimates, 2002 – 2020 (Digitalization = Individuals using the Internet)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment	0.254***	0.257***	0.204***	0.241***	0.264***	0.173***
(-1)	(0.015)	(0.019)	(0.014)	(0.040)	(0.028)	(0.033)
FDI	-0.016***	-0.023***	-0.018***	-0.024**	-0.018***	-0.018***
	(0.004)	(0.003)	(0.005)	(0.005)	(0.004)	(0.003)
Digitalization	0.010***	0.007***	0.012***	0.015***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.001)	(0.002)
Economic	-0.017***	-0.015***	-0.025***	-0.025***	-0.020***	-0.024***
growth	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
Trade openness	-0.015***	-0.004	-0.011***	-0.020***	-0.015***	-0.008***
	(0.002)	(0.003)	(0.003)	(0.005)	(0.004)	(0.002)
Governance	0.572***	0.8957***	0.981***	0.794***	0.933**	3.080***
	(0.106)	(0.230)	(0.263)	(0.173)	(0.669)	(0.691)
Instrument	28	28	30	23	24	23
Country/ Observation	32/544	32/544	32/544	32/544	32/544	32/544
AR(2) test	0.581	0.369	0.384	0.678	0.555	0.452
Sargan test	0.514	0.593	0.610	0.974	0.607	0.696
Hansen test	0.521	0.169	0.803	0.572	0.319	0.231

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 2. FDI, digitalization, and unemployment (without interaction term): two-step D-GMM estimates, 2002 – 2020 (Digitalization = Fixed broadband subscription)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment (-1)	0.279***	0.245***	0.241***	0.279***	0.298***	0.433***
	(0.022)	(0.021)	(0.024)	(0.027)	(0.032)	(0.143)
FDI	-0.019***	-0.025***	-0.028***	-0.019***	-0.019***	-0.022***
	(0.004)	(0.003)	(0.004)	(0.006)	(0.004)	(0.006)
Digitalization	0.0005***	0.0006***	0.0005***	0.0008***	0.0004***	0.0007***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Economic growth	-0.019***	-0.024***	-0.016***	-0.022***	-0.019***	-0.018***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Trade openness	-0.022***	-0.006***	-0.009***	-0.017***	-0.008*	-0.010*
	(0.003)	(0.001)	(0.002)	(0.004)	(0.004)	(0.006)
Governance	0.792***	1.335***	0.250	0.908***	1.203***	1.765***
	(0.268)	(0.191)	(0294)	(0.174)	(0.372)	(0.546)
Instrument	25	28	28	24	24	23
Country/Observation	32/544	32/544	32/480	32/544	32/544	32/480
AR(2) test	0.722	0.503	0.445	0.577	0.422	0.529
Sargan test	0.114	0.498	0.290	0.592	0.101	0.360
Hansen test	0.763	0.151	0.561	0.447	0.143	0.410

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 3. FDI, digitalization, and unemployment (without interaction term): one-step D-GMM estimates, 2002 – 2020 (Digitalization = Individuals using the Internet)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment	0.265***	0.253***	0.226***	0.249***	0.256***	0.213***
(-1)	(0.041)	(0.043)	(0.049)	(0.041)	(0.042)	(0.049)
FDI	-0.023***	-0.026***	-0.021**	-0.023***	-0.021***	-0.018**
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.008)
Digitalization	0.011***	0.008**	0.014***	0.008**	0.009**	0.011***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Economic	-0.016***	-0.018***	-0.022***	-0.021***	-0.019***	-0.021***
growth	(0.002)	(0.003)	(0.005)	(0.002)	(0.002)	(0.003)
Trade openness	-0.006**	-0.001	-0.007*	-0.007**	-0.007**	-0.009**
	(0.003)	(0.011)	(0.003)	(0.003)	(0.003)	(0.003)
Governance	0.726*	1.132**	1.161**	1.317***	1.479**	2.909**
	(0.425)	(0.488)	(0.534)	(0.504)	(0.644)	(1.245)
Instrument	27	28	29	23	22	23
Country/Observation	32/480	32/544	32/480	32/544	32/512	32/512
AR(2) test	0.331	0.320	0.273	0.312	0.324	0.417
Sargan test	0.436	0.593	0.243	0.890	0.639	0.696

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 4. FDI, digitalization, and unemployment (without interaction term): one-step D-GMM estimates, 2002 – 2020 (Digitalization = Fixed broadband subscription)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment	0.266***	0.243***	0.252***	0.236***	0.262***	0.549***
(-1)	(0.044)	(0.044)	(0.044)	(0.044)	(0.043)	(0.167)
FDI	-0.025***	-0.026***	-0.025***	-0.024***	-0.024***	-0.032***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)
Digitalization	0.0007**	0.0008**	0.0008**	0.001**	0.0007*	0.001**
	(0.003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Economic	-0.016***	-0.022***	-0.016***	-0.028***	-0.019***	-0.015***
growth	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)	(0.005)
Trade openness	-0.007**	-0.006*	-0.006*	-0.008**	-0.006**	-0.009**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Governance	0.766	1.171**	0.182	1.748***	0.985*	1.289*
	(0.547)	(0.501)	(0.507)	(0.508)	(0.585)	(1.169)
Instrument	25	26	26	24	29	23
Country/ Observation	32/512	32/544	32/512	32/544	32/512	32/480
AR(2) test	0.408	0.453	0.364	0.449	0.391	0.235
Sargan test	0.108	0.703	0.106	0.445	0.182	0.476

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 5. FDI, digitalization, and unemployment (with interaction term): two-step D-GMM estimates, 2002 – 2020 (Digitalization = Individuals using the Internet)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment (-1)	0.257***	0.255***	0.187***	0.238***	0.277***	0.196***
	(0.015)	(0.019)	(0.021)	(0.041)	(0.028)	(0.036)
FDI	-0.008**	-0.016***	-0.012**	-0.009**	-0.013***	-0.012***
	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.003)
Digitalization	0.010***	0.008***	0.012***	0.015**	0.010***	0.009***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.002)	(0.002)
FDI*Digitalization	-0.0006***	-0.0004***	-0.0002**	-0.0005**	-0.0007***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
Economic growth	-0.018***	-0.011***	-0.028***	-0.025***	-0.019***	-0.022***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)
Trade openness	-0.018***	-0.008**	-0.013***	-0.017***	-0.020***	-0.009***
	(0.002)	(0.003)	(0.003)	(0.005)	(0.004)	(0.002)
Governance	0.602***	0.843***	0.900***	0.779***	0.840**	2.793***
	(0.116)	(0.248)	(0.265)	(0.173)	(0.669)	(0.704)
Instrument	28	28	30	24	24	23
Country/ Observation	32/544	32/544	32/544	32/544	32/544	32/544
AR(2) test	0.607	0.379	0.494	0.596	0.583	
						0.406
Sargan test	0.536	0.545	0.554	0.969	0.623	0.652
Hansen test	0.730	0.264	0.853	0.525	0.877	0.346

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 6. FDI, digitalization, and unemployment (with interaction term): two-step D-GMM estimates, 2002 – 2020 (Digitalization = Fixed broadband subscription)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment (-1)	0.259***	0.264***	0.230***	0.288***	0.309***	0.501***
	(0.027)	(0.023)	(0.029)	(0.028)	(0.030)	(0.123)
FDI	-0.013***	-0.023***	-0.014***	-0.016***	-0.021***	-0.023***
	(0.003)	(0.003)	(0.004)	(0.005)	(0.004)	(0.004)
Digitalization	0.0006***	0.0005***	0.0004***	0.0007**	0.0007***	0.0009***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0001)	(0.0002)
FDI*Digitalization	-0.0006***	-0.0002***	-0.0008***	-0.0004***	-0.0005***	-0.0006***
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)
Economic growth	-0.019***	-0.018***	-0.017***	-0.021***	-0.020***	-0.018***
	(0.002)	(0.004)	(0.004)	(0.003)	(0.002)	(0.003)
Trade openness	-0.019***	-0.006***	-0.016***	-0.019***	-0.012***	-0.016**
	(0.004)	(0.001)	(0.004)	(0.005)	(0.005)	(0.006)
Governance	1.269***	1.016***	0.183	0.729***	0.945***	1.471***
	(0.183)	(0.261)	(0328)	(0.179)	(0.372)	(0.544)
Instrument	26	28	28	24	24	23
Country/ Observation	32/544	32/544	32/480	32/544	32/544	32/480
AR(2) test	0.682	0.439	0.577	0.587	0.459	0.527
Sargan test	0.114	0.436	0.511	0.662	0.121	0.600
Hansen test	0.672	0.212	0.854	0.748	0.540	0.902

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 7. FDI, digitalization, and unemployment (with interaction term): one-step D-GMM estimates, 2002 – 2020 (Digitalization = Individuals using the Internet)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment	0.388**	0.269***	0.237***	0.266***	0.337***	0.276***
(-1)	(0.165)	(0.042)	(0.048)	(0.011)	(0.105)	(0.049)
FDI	-0.029**	-0.023**	-0.025*	-0.025**	-0.023**	-0.022**
	(0.011)	(0.011)	(0.014)	(0.011)	(0.012)	(0.011)
Digitalization	0.007*	0.010**	0.009**	0.007*	0.010**	0.008**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
FDI*Digitaliza-	-0.000	-0.0001	-0.000	-0.0002	-0.0002	-0.0003
tion	(0.000)	(0.0004)	(0.000)	(0.0004)	(0.0004)	(0.0004)
Economic	-0.011***	-0.017***	-0.015***	-0.020***	-0.014***	-0.008*
growth	(0.003)	(0.003)	(0.006)	(0.002)	(0.003)	(0.004)
Trade openness	-0.010***	-0.005*	-0.007**	-0.008**	-0.008**	-0.007**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Governance	0.198	1.062**	0.794	1.292***	0.488	-0.460
	(0.514)	(0.423)	(0.629)	(0.504)	(0.604)	(1.247)
Instrument	28	29	30	29	27	29
Country/Obser-	32/480	32/544	32/480	32/544	32/512	32/512
vation						
AR(2) test	0.264	0.297	0.256	0.310	0.174	0.250
Sargan test	0.201	0.137	0.382	0.151	0.321	0.188

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 8. FDI, digitalization, and unemployment (with interaction term): one-step D-GMM estimates, 2002 – 2020 (Digitalization = Fixed broadband subscription)

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
Unemployment (-1)	0.270***	0.272***	0.264***	0.276***	0.439***	0.657***
	(0.044)	(0.043)	(0.044)	(0.042)	(0.106)	(0.167)
FDI	-0.019**	-0.026***	-0.016*	-0.022***	-0.017*	-0.025***
	(0.008)	(0.008)	(0.009)	(0.009)	(0.009)	(0.010)
Digitalization	0.0008**	0.0006*	0.0007*	0.0009***	0.0008*	0.001**
	(0.003)	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.000)
FDI*Digitalization	-0.0007*	-0.0001	-0.0007**	-0.0003	-0.0008**	-0.0007*
	(0.0003)	(0.0003)	(0.0003)	(0.0008)	(0.0004)	(0.0004)
Economic growth	-0.015***	-0.021***	-0.015***	-0.025***	-0.015***	-0.011**
	(0.003)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)
Trade openness	-0.008**	-0.006*	-0.008**	-0.023**	-0.027***	-0.011***
	(0.003)	(0.003)	(0.003)	(0.010)	(0.010)	(0.004)
Governance	0.704	1.070**	0.550**	1.468***	0.582	1.483*
	(0.535)	(0.407)	(0.451)	(0.430)	(0.614)	(0.877)
Instrument	26	27	29	29	30	25
Country/Observation	32/512	32/544	32/512	32/544	32/512	32/480
AR(2) test	0.350	0.391	0.304	0.601	0.337	0.187
Sargan test	0.117	0.264	0.101	0.509	0.529	0.562

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

4.2 Robustness check

The study uses the PMG estimator in Equation (2) to check the robustness of the two-step and one-step D-GMM estimates. We only use governance as a control variable in this empirical model. The PMG estimator requires the existence of co-integration between the dependent variable and regressors. First, the paper checks the stationary of all variables in the empirical model to ensure that they all have the same order of co-integration. Then, it performs the panel co-integration tests by Westerlund (2007).

The stationary tests in Table 9 indicate that unemployment, FDI, digitalization, and governance are significantly stationary at levels less than 10%, implying that all variables in the empirical model have an integration of zero-order I(0). The co-integration tests in Table 10 note that at least three in four tests deny the null hypothesis of no co-integration, suggesting that unemployment co-integrates with FDI, digitalization, and governance.

The study presents the estimated results by the PMG estimator in Table 11 (Individuals using the Internet) and Table 12 (Fixed broadband subscription). In line with the two-step and one-step D-GMM estimates, FDI decreases, and digitalization increases unemployment, but their interaction reduces. Furthermore, governance enhances unemployment. The significance level and value of the error-correction coefficients at the bottom of the tables confirm that PMG estimates are highly reliable.

Table 9. Fisher type unit root tests

Variables	Augmented Dickey-Fuller test		Phillips-Perron test	
	Prob > chi2		Prob > chi2	
	Without trend	With trend	Without trend	With trend
Unemployment	63.646	36.735	145.741***	52.433
FDI	139.165***	137.173***	156.698***	153.149***
Digitalization (Individuals using the Internet)	33.064	51.678***	8.073	41.811
Digitalization (Fixed broadband subscription)	271.051***	171.580***	698.699***	284.184***
Governance 1	76.536	82.090*	111.467***	109.634***
Governance 2	62.324	60.223	81.980*	90.954***
Governance 3	65.285	90.979***	110.046***	185.243***
Governance 4	103.604***	98.088***	137.844***	125.763***
Governance 5	80.964*	99.730***	69.951	99.887***
Governance 6	129.088***	91.433***	86.916**	90.512**

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively.

Table 10. Westerlund panel co-integration tests

Normalized variable: Unemployment (%)

Covariates	G_t	G_α	P_t	P_α
FDI	-2.406***	-9.520***	-9.814*	-5.08
Digitalization (Individuals using the Internet)	-3.225***	-14.818***	-16.020***	-10.623*
Digitalization (Fixed broadband subscription)	-3.303***	-9.149**	-14.58***	-6.656***
Governance 1	-3.345***	-13.890**	-17.864***	-12.335***
Governance 2	-3.344***	-15.686***	-14.818***	-11.076**
Governance 3	-3.190***	-14.658***	-20.95***	-15.054***
Governance 4	-3.229***	-15.652***	-21.352***	-15.164***
Governance 5	-3.658**	-14.370**	-19.171***	-11.635***
Governance 6	-3.392***	-15.852***	-21.234***	-15.275***

Note: ***, ** and * denote significance at 1 percent, 5 percent, and 10 percent levels respectively

Table 11. FDI, digitalization, and unemployment: PMG estimates, 2002 – 2020 (Digitalization = Individuals using the Internet)

Long run co-integrating vectors

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
FDI	-0.002	-0.026**	-0.004	-0.004	-0.029**	-0.013**
	(0.013)	(0.012)	(0.110)	(0.005)	(0.014)	(0.012)
Digitalization	0.030***	0.010**	0.034***	0.007***	0.010***	0.027***
	(0.005)	(0.004)	(0.005)	(0.002)	(0.003)	(0.004)
FDI*Digitali-zation	-0.001***	-0.000**	-0.002***	-0.001***	-0.000	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Governance	0.199	0.285*	0.299***	0.055	0.342**	0.562***
	(0.201)	(0.157)	(0.108)	(0.073)	(0.168)	(0.134)
Error correc-tion	-0.491***	-0.549***	-0.450***	-0.592***	-0.634***	-0.485***
Country/Ob-servation	32/576	32/576	32/576	32/576	32/576	32/576
Log likelihood	-175.958	-161.946	-174.614	-228.634	-199.377	-154.999

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

Table 12. FDI, digitalization, and unemployment: PMG estimates, 2002 – 2020 (Digitalization = Fixed broadband subscription)

Long run co-integrating vectors

Dependent variable: Unemployment (%)

Variables	GO1	GO2	GO3	GO4	GO5	GO6
FDI	-0.012	-0.019**	-0.017*	-0.009	-0.020*	-0.023**
	(0.009)	(0.010)	(0.010)	(0.007)	(0.011)	(0.011)
Digitalization	0.000***	0.000**	0.000**	0.000***	0.000	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
FDI*Digitali-zation	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Governance	-0.040	0.460***	0.183**	-0.003	0.139	1.279***
	(0.054)	(0.169)	(0.078)	(0.068)	(0.144)	(0.232)
Error correction	-0.538***	-0.492***	-0.523***	-0.538***	-0.634***	-0.474***
Country/ Observation	32/576	32/576	32/576	32/576	32/576	32/576
Log likelihood	-184.920	-151.278	-183.113	-138.116	-199.377	-161.794

Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels, respectively. The value in the parentheses is the standard error.

5. Conclusion and policy implications

FDI inflow is a crucial capital in Asian developing economies to enhance economic growth and create more jobs under increasing globalization, and digitalization is a globally irreversible process. Given these facts, the study employs individuals using the Internet and fixed broadband subscriptions as a proxy for digitalization to empirically examine the effects of FDI, digitalization, and their interaction on unemployment for a group of 32 Asian developing economies from 2002 to 2020 via D-GMM and PMG. The paper notes the contribution of digitalization to the FDI – unemploy-

ment relationship. The negative effect of FDI inflows on unemployment is consistent with the literature. In particular, the new finding in this paper is that this negative effect is amplified by digitalization.

The findings in the study suggest some necessary implications for governments in Asian developing economies in formulating and enforcing policies and regulations relating to digitalization so that progress in digital technology significantly contributes to the FDI – unemployment relationship. The implication is that digitalization amplifies the negative effect of FDI on unemployment, but digitalization itself tends to increase unemployment in Asian developing economies. Therefore, governments in these economies should choose digital development solutions which are appropriate to their national circumstances to reduce the adverse impacts of digitalization on the unemployment rate and increase its beneficial effects by attracting FDI inflows of digitalization to improve employment for people. For instance, governments should formulate and implement policies to improve the level of information technology for people and reduce taxes for businesses that apply information technology to their work (training employees, upgrading facilities, etc.). They should encourage enterprises to digitize business and production activities. Future research can address the relationship between FDI and unemployment by industry/sector with the presence of digitalization. Researchers can compare these effects in the different periods of digital technology development if possible.

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References

Abbasabadi, H. M., & Soleimani, M. (2021). Examining the effects of digital technology expansion on Unemployment: A cross-sectional investigation. *Technology in Society*, *64*, 101495. https://doi.org/10.1016/j.techsoc.2020.101495

Abé Ndjié, A., Atangana Ondoa, H., & Ngoa Tabi, H. (2019). Governance and youth unemployment in Africa. *Labor History*, *60*(6), 869-882.

Abor, J., & Harvey, S. K. (2008). Foreign direct investment and employment: Host country experience. *Macroeconomics and Finance in Emerging Market Economies*, *1*(2), 213-225. https://doi.org/10.1080/17520840802323224

Abouelfarag, H. A., & Abed, M. S. (2020). The impact of foreign capital inflows on economic growth and employment in Egypt. *Journal of Economic and Administrative Sciences*, *36*(3), 258-276. https://doi.org/10.1108/JEAS-12-2018-0138

Agosin, M. R., & Machado, R. (2005). Foreign investment in developing countries: Does it crowd in domestic investment? *Oxford Development Studies*, *33*(2), 149-162. https://doi.org/10.1080/13600810500137749

Akerman, A., Gaarder, I., & Mogstad, M. (2015). The skill complementarity of broadband internet. *The Quarterly Journal of Economics*, *130*(4), 1781-1824.

Al-Sadiq, M. A. J. (2021). *The role of e-government in promoting foreign direct investment inflows*. (Working Paper No. WP/2021/8). Washington, DC: International Monetary Fund.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277-297. https://doi.org/10.2307/2297968

Asian Development Bank. (2021, June 18). *Significant job losses in developing Asia in 2020, ADB data show*. Accessed online 6 November, 2021. https://www.adb.org/news/features/significant-job-losses-developing-asia-2020-adb-data-show.

Baccaro, L., & Rei, D. (2007). Institutional determinants of unemployment in OECD countries: Does the deregulatory view hold water? *International Organization*, *61*(3), 527-569.

Bauer, J. M. (2018). The Internet and income inequality: Socio-economic challenges in a hyperconnected society. *Telecommunications Policy*, *42*(4), 333-343.

Bertani, F., Raberto, M., & Teglio, A. (2020). The productivity and unemployment effects of the digital transformation: An empirical and modelling assessment. *Review of Evolutionary Political Economy*, *1*(3), 329-355. https://doi.org/10.1007/s43253-020-00022-3

Canh, N. P., Schinckus, C., Thanh, S. D., & Ling, F. C. H. (2020). Effects of the internet, mobile, and land phones on income inequality and The Kuznets curve: Cross country analysis. *Telecommunications Policy*, *44*(10), 102041. https://doi.org/10.1016/j.telpol.2020. 102041

Choi, C. (2003). Does the Internet stimulate inward foreign direct investment? *Journal of Policy Modeling*, *25*(4), 319-326.

Czernich, N., Falck, O., Kretschmer, T., & Woessmann, L. (2011). Broadband infrastructure and economic growth. *The Economic Journal*, *121*(552), 505-532.

Dutt, P., Mitra, D., & Ranjan, P. (2009). International trade and unemployment: Theory and cross-national evidence. *Journal of International Economics*, *78*(1), 32-44. https://doi.org/10.1016/ j.jinteco.2009.02.005

Elkjaer, T., & Damgaard, J. (2018, September 19). *How digitalization and globalization have remapped the global FDI network.* Paper presented at the 16th Conference of the International Association of Official Statisticians (IAOS). Paris.

Felbermayr, G., Prat, J., & Schmerer, H. J. (2011). Trade and unemployment: What do the data say? *European Economic Review*, *55*(6), 741-758.

Folawewo, A. O., & Adeboje, O. M. (2017). Macroeconomic determinants of unemployment: Empirical evidence from economic community of West African states. *African Development Review*, *29*(2), 197-210. https://doi.org/10.1111/1467-8268.12250

Frank, M., Heinz, J. T., & Arne, H. (2002). Foreign direct investment and employment in host regions. *European Business Review*, *14*(1), 40-55. https://doi.org/10.1108/0955534 0210414232

Hasan, R., Mitra, D., Ranjan, P., & Ahsan, R. N. (2012). Trade liberalization and unemployment: Theory and evidence from India. *Journal of Development Economics*, *97*(2), 269-280. https://doi.org/10.1016/j.jdeveco.2011.04.002

Jude, C., & Silaghi, M. I. P. (2016). Employment effects of foreign direct investment: New evidence from Central and Eastern European countries. *International Economics*, *145*, 32-49. https://doi.org/10.1016/j.inteco.2015.02.003

Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: A guide for macroeconomists. *Economics Letters*, *65*(1), 9-15. https://doi.org/10.1016/S0165-1765(99) 00130-5

Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: Methodology and analytical issues. *Hague Journal on the Rule of Law*, *3*(2), 220-246. https://doi.org/10.1017/S1876404511200046

Malik, S. K. (2019). Foreign direct investment and employment in Indian manufacturing industries. *The Indian Journal of Labour Economics*, 62(4), 621-637. https://doi.org/10.1007/s41027-019-00193-6

Maqbool, M. S., Mahmood, T., Sattar, A., & Bhalli, M. N. (2013). Determinants of unemployment: Empirical evidences from Pakistan. *Pakistan Economic and Social Review*, 191-208.

Mkombe, D., Tufa, A. H., Alene, A. D., Manda, J., Feleke, S., Abdoulaye, T., & Manyong, V. (2020). The effects of foreign direct investment on youth unemployment in the Southern African Development Community. *Development Southern Africa*, *38*(6), 863-878. https://doi.org/ 10.1080/0376835X.2020.1796598

Nguyen, V. B. (2021). The digitalization – Economic growth relationship in developing countries and the role of governance. *Scientific Annals of Economics and Business*, *68*(4), 481-493. https://doi.org/10.47743/saeb-2021-0028

Nwaka, I. D., Uma, K. E., & Tuna, G. (2015). Trade openness and unemployment: Empirical evidence for Nigeria. *The Economic and Labour Relations Review*, *26*(1), 117-136. https://doi.org/10.1177/1035304615571225

Ogbeide, F. I., Kanwanye, H., & Kadiri, S. (2016). Revisiting the determinants of unemployment in Nigeria: Do resource dependence and financial development matter? *African Development Review*, *28*(4), 430-443. https://doi.org/10.1111/1467-8268.12222

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, *94*(446), 621-634. https://doi:10.2307/2670182

Rong, S., Liu, K., Huang, S., & Zhang, Q. (2020). FDI, labor market flexibility and employment in China. *China Economic Review*, *61*, 101449. https://doi.org/10.1016/j.chieco.2020.101449

Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, *9*(1), 86-136. https://doi.org/10.1177/1536867X0900900106

Saucedo, E., Ozuna, T., & Zamora, H. (2020). The effect of FDI on low and high-skilled employment and wages in Mexico: A study for the manufacture and service sectors. *Journal for Labour Market Research*, *54*(1), 1-15. https://doi.org/10.1186/s12651-020-00273-x

Schmerer, H. J. (2014). Foreign direct investment and search unemployment: Theory and evidence. *International Review of Economics and Finance*, *30*, 41-56. https://doi.org/ 10.1016/j.iref.2013.11.002

Shabbir, A., & Alam, M. Z. (2020). Factors affecting level of unemployment in South Asia. *Journal of Economic and Administrative Sciences*, *37*(1), 1-25.

Strat, V. A., Davidescu, A., & Paul, A. M. (2015). FDI and the unemployment - A causality analysis for the latest EU members. *Procedia Economics and Finance*, *23*(2015), 635-643. https://doi.org/10.1016/S2212-5671(15)00448-7

Suh, T., & Bae, M. (2002). Foreign direct investment inflows and ICT configurations. *Pacific Focus*, *17*(2), 213-226.

UNCTAD. (2021). *The United Nations conference on trade and development: Prosperity for all*. Accessed online 6 November 2021. https://unctad.org/news/investment-flows-developing-asia-defy-covid-19-grow-4

Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, *69*(6), 709-748. https://doi.org/10.1111/j.1468-0084.2007.00477.x

Yin, Z. H., & Choi, C. H. (2021). Has the Internet increased FDI, economic growth, and trade? Evidence from Asian economies. *Information Development*, 38(2), 192-203. https://doi.org/10.1177/0266666921999749

Appendix

Table A. Data description

Variable	Definition	Type	Source
Unemployment rate (UNE)	Unemployment, total (% of total labor force)	%	World Bank
FDI, net inflows (FDI)	Foreign direct investment, net inflows (% of GDP)	%	World Bank
Individuals using the Internet (INN)	Internet users are individuals who have used the Internet (from any location) in the last 3 months.	%	World Bank
Fixed broadband subscriptions (BRO)	Fixed broadband subscriptions refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection) at downstream speeds equal to, or greater than, 256 kbit/s.	log	World Bank
GDP per capita (GDP)	GDP per capita (constant 2010 US$)	log	World Bank
Trade openness (OPE)	Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product.	log	World Bank
Regulatory Quality (GO1)	Regulatory Quality captures perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.		
Rule of Law (GO2)	Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.	value	World Bank

Voice and Accountability (GO3)	Voice and Accountability captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.
Control of Corruption (GO4)	Control of Corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests.
Government Effectiveness (GO5)	Government Effectiveness captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
Political Stability (GO6)	Political Stability and Absence of Violence/ Terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism.

Table B. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Unemployment rate (%)	608	5.2655	4.076	0.11	20.21
FDI, net inflows (%)	608	3.79532	5.746	-37.154	55.075
Individuals using the Internet (%)	608	29.518	27.543	0.0004	100
Fixed broadband subscriptions	608	4.136	5.862	0.00009	33.595
GDP per capita (USD)	608	8780	14465.45	417.975	69679.0
Trade openness (%)	608	83.255	39.485	0.167	210.400
Regulatory quality	608	-0.482	0.709	-1.672	1.648
Rule of Law	608	-0.263	0.653	-1.947	1.509
Voice and Accountability	608	-0.483	0.903	-3.180	1.283
Control of Corruption	608	-0.397	0.708	-2.344	1.120
Government Effectiveness	608	-0.425	0.666	-1.837	1.000
Political Stability	608	-0.886	0.668	-2.259	0.462

Table C. Matrix of correlation coefficients between variables

	UNE	FDI	INN	BRO	GDP	OPE
UNE	1					
FDI	0.052	1				
INN	-0.007	-0.123***	1			
BRO	0.006	-0.061	0.723***	1		
GDP	-0.025	-0.082**	0.639***	0.486***	1	
OPE	-0.093**	0.289***	0.263***	0.136***	0.239***	1

*Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels respectively.*

Table D. Matrix of correlation coefficients between dimensions of governance

	GO1	GO2	GO3	GO4	GO5	GO6
GO1	1					
GO2	0.860***	1				
GO3	0.570***	0.509***	1			
GO4	0.723***	0.836***	0.403***	1		
GO5	0.917***	0.901***	0.553***	0.835***	1	
GO6	0.339***	0.370***	-0.009	0.484***	0.447***	1

*Note: ***, **, and * denote significance at 1 percent, 5 percent, and 10 percent levels respectively.*