

# The interdependence between foreign aid, technology and employment in India

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## Abstract

This article examines, in Indian context, the interdependence of three important economic elements viz. 'foreign aid' (FA); and the resultant 'technological innovation' (TI) and 'entrepreneurship and employment generation' (E&E). FA is essentially a structural concept that embodies the other two elements. The concept is frequently presumed to exist and is rarely attempted to be defined. The article attempts to define it and extend our thoughts at the intersection of foreign assistance, technology and employment. The complex nexus mainly concludes the existence of two interdependent flow processes. The processes are differentiated based on mediation of any of the resultant scenarios of FA i.e., TI and E&E. Although interdependence is found among almost all of the variables under study, the major findings are FA affects domestic entrepreneurship; medium and high-tech exports in the country are provided by both foreign and domestic investors; and such exports can create job opportunities in the service sector.

*Keywords:* foreign aid; foreign direct investment; technological innovation; entrepreneurship; employment generation

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# 1 Introduction

In the current global economic context, it is indubitable that there will always be investors, predominantly from the developed world, and there will always be investment-seekers in the form of countries that are striving to develop. A global perception of 'development phenomenon' that has existed hitherto follows that some countries will always be denoted as 'developed' in the sense that they can produce most of the goods and services, among all, over a period of time. This is when the concept of gross domestic product (GDP) comes into picture. The higher the GDP, the more the country is 'developed'.

It is also true that no matter what the stage of development, all the countries will always be involved in economic activities to reach the maximum production target. Thence, it is important to understand the term 'economic activity'. Economic activity can be defined as a process that inputs resources and results in manufacturing a product or providing a service (Insee, 2019). Goodwin, Harris, Nelson, Rajkarnikar, Roach and Torras (2023) mentioned four essential economic activities namely, resource management and; production, distribution and consumption of goods and services.

The requirements for performing economic activities may differ on country basis due to varied geographical conditions and resource abundance. The crucial requirement to begin with any economic activity is 'capital-investments'. Many countries across the globe lack sufficient capital resources to finance these activities. These are developing countries that largely depend on foreign aid (FA) from developed countries for their capital, technological and knowledge-related requirements. As per Choi (2021), the main purpose of FA is to help the recipient countries' people both on economic and social fronts. As per him, giving and receiving aid is a form of the flow of resources, transferring money, people, and services from one country to another.

In this context, Sonaike and Olowoporoku (1979) have explained the term "economic dependence." They opine that the phrase is commonly used to describe the disparity between developing nations and the prosperous, advanced nations on which the former depends for industrial and technical know-how. The economic dependence has led to, what is termed as, "globalization." The driving force behind globalization over the course of

history has been technological and intellectual progress (Wolf, 2014). Perraton, Goldblatt, Held and Mcgrew (1997) consider globalization as the main reason for the sharp increase in international activity levels, particularly, but not exclusively, international economic flows. Though Perraton et al. (1997) argued that conceptions of globalization underlying current debates are inadequate and their analysis of empirical evidence consequently misleading. Still, the race of developing countries to match the production targets changes to another race of attracting most of the investments flows from the developed world.

The fact that, development of countries is categorized based on their capacity to produce more, makes 'technology' an important attribute for their differentiation. The struggle for attracting most of economic investment flows then diverts to becoming most technologically-advanced country. This is also relatable because investments from the developed world will inevitably introduce their technology to the country of attraction. Here, it is important to note that 'technology' is a very wide term. The term incorporates various sub-terms that sound similar but have non-identical connotations. To genuinely understand the word, it is important to understand the other terms related to it. A brief discussion on the related terms is provided in the next section of literature review (see section 2.1).

Investments and other types of aid from developed countries are considered to generate numerous employment opportunities for the people of developing countries. As per Foss (2020), foreign direct investment (FDI) is considered an important component of FA and economic development. She opines that few FA donors can fund the full cost of investment for the economic development and growth of any developing country. Technical cooperation grants (TCG) are the other form of FA. In the words of World Bank (2022), TCG is intended to finance the transfer of technical and managerial skills or technology to build up general national capacity with or without reference to any specific investment projects. By inculcating knowledge and expertise through various training and skill development programs, such investments, grants and aids make human resource capable of operating the foreign-brought technology. The process is also considered to develop and motivate domestic entrepreneurship. The ways in which foreign assistance can bring employment and entrepreneurship related benefaction to developing countries are also discussed in the coming section (section 2.2).

However, there has been a debate in the developing world concerning the economic development phenomenon. It is largely believed that technology takes over the human resource and, therefore, can create unemployment conditions in the host countries. The debate surrounds 'how to reduce the technology gap' in developing countries without compromising on the employment and entrepreneurship opportunities for the people of those countries. Concerns also arise regarding the negative influences of technology-rich investors on the domestic entrepreneurship of the investment-receiving countries. A 'crowding effect' seems to exist demonstrating that the over-investments from developed countries impact the developing people's selection of entrepreneurship as a career (Bailetti, 2012). In the interest of higher and secured earnings, many young people choose to work in MNEs despite being capable of becoming potential domestic entrepreneurs (Mosey et al., 2017). Developing people often restrain themselves from the high risk in competitive markets when they know that they have to compete with the already established tech-rich foreign investors. If only a limited number of developed investors were present, developing people would have not worked for them but might have started their own businesses and probably competed against them. The presence of multinational enterprises raises threats of competition for developing entrepreneurs. As a result, the innovativeness of developing people would deteriorate.

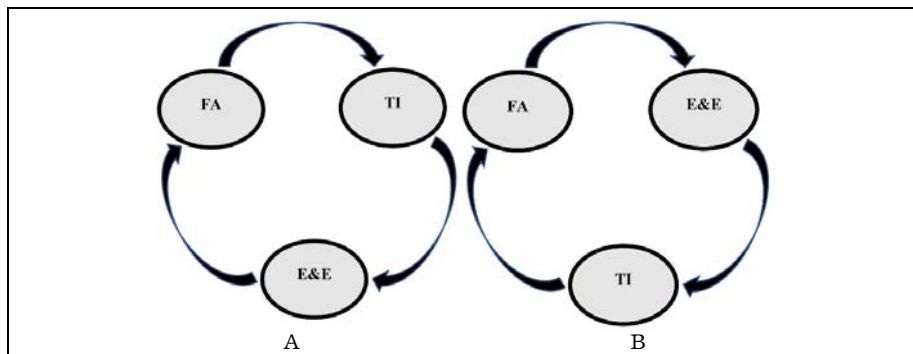
It is also argued that the technology spillover effect might not occur as developed firms set up their facilities in only those countries where the imitation of their technology is protected. Otherwise, the governments of host developing countries have to comply with the demands of foreign investors and relax the regulations and laws. Hence, foreign developed firms may stifle innovation and demoralize the entrepreneurs-generation.

The debate is though criticized on several grounds and has counterarguments too. The counterargument is in the form of 'knowledge spillover'. This spillover effect argues that foreign investments, either willingly or unwillingly, encompass latest practices in technology from the developed world. The investments and technology brings to the host country the knowledge and specialization for operating and maintaining the techno-products. They also develop creative thinking abilities and generate employment in more research-focused job opportunities. The economic growth associated with foreign investments and the improvements in living

standards due to it makes this debate null.

Therefore, there exists a complex nexus between the three important components of an economy namely, foreign investments; technology; and employment/entrepreneurship. A circular phenomenon enclosing the interrelationships among the three elements is considered to exist but is seldomly defined (see Figure 1). Yet, in order to fully understand the phenomenon, it must be sufficiently defined. Figure 1 shows the mediating roles of two elements viz., ‘technological innovation’ (TI) and ‘entrepreneurship and employment generation’ (E&E) that need to be explored in order to understand the flow process of FA. To come up with an adequate and useful definition that covers existing conditions and illuminates their interaction and dynamics is a challenging task indeed.

Figure 1. The flow process and interdependence of economic elements



In an attempt to explain an almost similar circular interdependence, Hausmann and Domínguez (n.d.) discussed about technology, knowledge and economic growth. Their article explains the links through technology perspective. They opine that ‘technology’ is responsible for increased flows of knowledge and more efficient production, on which the prosperity of any country depends. But they found the mechanisms of development, adoption and usage of technology very complex and thus recommended further research in the area. Our study follows the recommendation of Hausmann and Domínguez (n.d.) and tries to involve human resource by studying ‘how they earn their living’ is affected. It extends their work further to provide another explanation of the phenomenon. Considering the gap found in literature, the study tries to examine the following hypotheses:

Hypothesis 1 (H<sub>1</sub>). TI plays a crucial mediating role in grasping the E&E benefits of FA in India.

Hypothesis 2 (H<sub>2</sub>). E&E plays a crucial mediating role in escalating the TI benefits of FA in India.

Hypothesis 3 (H<sub>3</sub>). Due to the existence of mediation of TI and E&E, there exist two flow processes between the three economic elements of the study.

Based on the hypotheses of the study, the main objectives of this article are:

1. To examine the mediating role of TI in fully comprehending the E&E benefits of FA in India,

2. To explore the mediating role of E&E in upsurging the TI benefits of FA in India; and

3. To investigate the flow process, if any, between the three elements in the Indian context.

The rest of the manuscript is divided into various sections. Section 2 presents a detailed literature review of the topic. Section 3 discusses how this study has examined the nexus and interrelationships. The results of the analyses are reported in section 4. Finally, the conclusions based on the results obtained are discussed in the last section i.e., section 5.

## 2 Existing Literature and Our Contribution

Choi (2021) investigated three main facets of FA's effectiveness. He found that FA leads to positive economic growth of the recipient country mostly in the case of a large winning coalition. As a consequence, the recipient country experiences fewer civil wars and domestic terrorist attacks. Moreover, while investigating the effectiveness of FA from the donor country's perspective, he found that FA increases exports from the donor country to the recipient country and in the long run, this effect becomes more notable. Selaya and Sunesen (2012) examined whether aid and FDI are complementary sources of foreign capital and found that aid invested in complementary inputs like public infrastructure and human capital investments draws in FDI, whereas aid invested in pure physical capital crowds it out. Foss (2020) conducted almost similar study and examined why FA is considered in the context of FDI. As per her, direct foreign donor assistance provides a different form of FDI support e.g., FA can be in the form of technical assistance to encourage

sectoral reform, build institutional capacity, create and/or improve transparency and often to address distinct and particular policy and regulatory undertakings.

Wang, Xu, Qin and Skare (2022) conducted a detailed bibliometric study to measure the research in FDI and the consequent economic growth in the host countries from different points of view. The expectations of the host country from foreign investments are, though, not limited to only increasing the GDP, rather they involve various other benefits for the host country (Aliyu, 2005). Technology transfer and employment generation are the most documented expectations from developed world investments (e.g., Elgin, 2021; Kumari, Shabbir, Saleem, Khan, Abbasi, and Lopez, 2021; Munteanu, 2015; Osano and Koine, 2016; Singha, Choudhury and Kumar, 2022; Sultana and Turkina, 2020). Past studies in literature have examined either the reasons of FDI (Wanjala, 2001); the effects on domestic investments (King'ang'i, 2003); or on the regional inferences. These studies did not consider the FDI effects in infrastructure development and technology transfer.

In the twentieth century, during the 70's decade, there was a greater rise in international trade than in FDI. Due to it, foreign trade was preferred in comparison to any other international economic activity (Rutihinda, 2007). Though, the mid 80's decade changed the conditions that witnessed a competitive rise in FDI globally. Due to technology transfers and the creation of networks for purchasing, promoting, and selling proper and efficient global manufacturing and sales, FDI began to be seen as being of utmost importance for developing countries throughout this phase (Swenson, 2004). The transfer of technology through developed countries started to be considered as supplying productivity growth in emerging countries (Xu, 2000). In comparison to domestic investments, FDI contributes more to growth by acting as a vehicle for technology transfer (Borensztein, De Gregorio, and Lee, 1998). De Mello (1999), though, considers that the magnitude of FDI to be a contributor of growth relies on the proportion of complementarity and substitution with the domestic investments.

But, FDI's technology effect in host developing nations is unevenly distributed among different employee categories. The effect is mainly dependent on the employees' skills, so they are considered to affect the generation of high-skilled employees, not of low-skilled or unskilled ones

(Peluffo, 2015). Hansen and Rand (2006) also considered that 'host countries get positive FDI spillovers' is a flimsy claim. Hence, a conflicting view prevails on the FDI's technology effect.

It is still not clear whether foreign investments positively prove themselves as per the expectations by the host countries. The literature related to foreign investments and their technology and employment effects can be studied separately as per below.

## 2.1 Foreign Investments, Technology and Some Related Terms

In the words of United Nations Industrial Development Organization (UNIDO) and United Nations Inter-Agency Task Team (UN IATT) on Science, Technology and Innovation (STI) for the Sustainable Development Goals (SDGs) (2022):

"The 2030 Agenda for Sustainable Development, unanimously adopted at the United Nations Sustainable Development Summit in September 2015, positioned STI as one of seven key action areas for achieving the SDGs."

STI involves three distinct but strongly related domains, technology being one of the most sought out among them. Technology consists of the application of knowledge (science) for a specific purpose (innovation). Therefore, technology plays a key and mediating role in achieving the SDGs.

'Technology' is a very wide term. Eveland (1986) described 'technology' as 'information'. He argued that technology is not meant to be some physical object only, rather it involves the 'knowledge' of physical world and how this knowledge is manoeuvred for the benefit of people. The term incorporates various sub-terms that sound similar but have dissimilar meanings. Therefore, to clearly understand the flow of 'technology', it is important to understand different terms associated with it.

The *technology gap* model was developed by M.V. Posner in 1961. In economic research terminology, technology gap is the difference in economic growth (Fagerberg and Verspagen, 2007). In the words of Gandolfo (1998), technology gap is the advantage enjoyed by the country that introduces new goods. The country enjoys a monopoly until other countries learn to produce these goods. Therefore, if we follow the definition given by Eveland (1986), technology gap is *difference* in information.

Though Razzaq, An and Delpachitra (2021) examined the impact of Chinese Outward FDI (OFDI)- induced technology spill-overs on total



factor productivity growth based on the technology gap between China and Brazil, Russia and India (BRI) host countries. They studied about technology gap from home country perspective and found that Chinese OFDI spillover productivity growth in low magnitude to BRI host countries that decreases with the increase in technology gap.

Due to prevalence of technology gap, developing countries take steps to attract *technology transfer* from developed countries. In a more specific sense, technology transfer is related to relocation of some hardware or physical objects used in production processes. According to Louise (2009), all developing countries are not necessarily able to attract FDI flows. He concluded that along with the strategies of investing firms and the policies of host countries, the influence of the policies of home countries should also be given full consideration while studying the direction of FDI flows.

Transfer of 'knowledge' associated with these physical objects is equally important. Advanced technological objects can be disastrous instead of being beneficial without the knowledge of 'how' to operate them. The very definition of technology as information, makes 'technology transfer' as *communication* of information. However, Torlak (2004) tested FDI for being the best channel for technology transfer for both across national boundaries and also between foreign and domestic firms. He found that technology is transferred through multinational companies internationally but did not find any evidence of diffusion of technology from foreign to domestic firms.

In order to make unaware, unskilled, lesser-educated local people of developing countries capable of adopting the transferred technology, their 'operational knowledge' is developed by introducing educational, training and expertise development programs for employees. Therefore, *technology adoption* or implementation implies that what the investments 'seek to transfer', it facilitates the 'achievement of goals'. Drury and Farhoomand (1999) presented an exquisite investigation that compared the variables of diffusion narrative with the implementation's decision processes. Their results showed that both diffusion and implementation are connected but have differences too. Their study pointed towards need for development of integrative theories relating to the sequential aspects of technology adoption process. Technology implementation/ adoption is, hence, *acceptance* of information in similar sense.

*Technological innovation* is a crucial step in the development phenomenon. It is related to exploring new ideas and thinking of creative

ways as a result of effectively utilizing the transferred technology. Effective utilization comprises the utilization of knowledge for the benefit of society. The term 'technology innovation' is related to doing something that brings in change which is creative and beneficial. Further research and development (R&D) programs are then instituted and creative thinking starts to develop among the people of developing countries. Li (2023) analyzed the impact of FDI on the innovation capacity of the host country and proved that FDI has a positive effect on the country's overall technological innovation. The impact of a technological innovation will generally depend not only on its inventors but also on the creativity of the eventual users of the new technology (Rosenberg, 2004). Technology innovation is, therefore, the *utilization* of information so transferred.

Elgin (2021) believes that FDI is associated with technology transfer and the diffusion of technology and know-how in host countries. Developing countries, therefore, provide various benefits and law relaxations to attract foreign investors (Blomström and Kokko, 2003). Inflows of FDI fill the technology gap by fulfilling the capital requirements, knowledge, expertise, skills, and most importantly advanced technology (Arvin, Pradhan and Nair, 2021; Borensztein et al., 1998; Hu, You and Esiyok, 2021; Kumari et al., 2021; Lee, Chen, Lin and Su, 2018; Li and Liu, 2005; and Muhammad, 2013). The literature is though full of ambiguation (Amankwah-Amoah, Debrah, Yu, Lin, Danso and Adomako, 2021; Latif, Ge, Qamri and Ali, 2022; Rana and Sharma, 2020).

Borensztein et al. (1998) consider FDI as a vehicle for technology transfer. They consider that FDI is responsible for more economic growth than domestic investment. Several studies show a decline in the technology gap between countries because of the presence of foreign firms and their associates (Bodman and Le, 2013; Damooei and Tavakoli, 2006; Osano and Koine, 2016; Sharma and Gani, 2004; Swenson, 2004; and Xu, 2000). Evidences are found in the literature related to the positive effects of foreign investments on the performance and innovation levels of host countries (Hu, 2021).

## 2.2 Foreign Investments, Employment and Entrepreneurship

For 'development phenomenon' to be plausible, it must deliver unfeigned significance to the people of developing countries and the society as a whole. Therefore, foreign investments must ensure adequate employment generation. Investments from developed economies can influence the state of employment in developing economies in many ways. In the *direct employment generation* way, it is quite obvious that new investments will either establish their new industrial units in host countries or they may alternatively set up their affiliates, if not establishing new units. Regardless of their entry strategy, their hiring of human resource in the host country is inexorable (Karlsson et al., 2009).

The technology instituted by the developed world have ingrained unrivaled attributes for the developing host economies. These features get pullulated in host countries. Therefore, in the second way of *employment via spillovers*, the people of host countries get themselves engaged in R&D activities. As per United Nations Conference on Trade and Development (UNCTAD, 2005), most of the technologies around the world are either owned, or produced and controlled by MNEs that spend huge amounts on their R&D related activities. This generates a spillover effect that affects the production capacity of host countries and, hence, the requirement of more human resource affects the level of employment (Coniglio, Prota and Seric, 2015; Girma, 2005; Karlsson, Lundin, Sjöholm and He, 2009; Peluffo, 2015; Waldkirch, Nunnenkamp and Alatorre Bremont, 2009).

Thirdly, *establishment of linkages* also generate employment. Newly set up industrial units or the foreign affiliates require local resources and tools for the production processes. They, either voluntarily or not, create a network for their production supplies. The linkages are established between foreign and domestic firms in host countries (Onaran, 2008). Developing people, therefore, get engaged in the network of supply and distribution.

The fourth way is of *entrepreneurship*. The term 'entrepreneurship' is related with pro-activeness, innovation and risk-taking. It can be distinctly realized as a collection of some traits that originate new domestic investors; may be at middle or lower scales, through technical knowledge, expertise and via training and development programs. Filser, Tiberius, Kraus, Zeitlhofer, Kailer, and Müller (2023) are of the opinion that entrepreneurial opportunities are made, they do not exist already. It is also considered a key

for generating more jobs and, thereby, reducing unemployment levels. In the words of Kritikos (2014), productive entrepreneurs can revitalise the economy by creating new jobs and technologies, and also by increasing productivity. Entrepreneurship is also important for developing economies as it is credited for increasing economic growth; and accelerating business growth and creating wealth for the society.

Despite this, FDI's employment effect is not guaranteed. Mixed results have been found in literature in relation to the effects of FDI on the employment level of the host countries (Hijzen, Martins, Schank and Upward 2013; Jude and Silaghi, 2015; Onaran, 2008). FDI has also been found to be worsening the employment conditions in the host countries. As per Coniglio et al. (2015), non-rival domestic firms get crowded out by the competitive advantages of foreign multinational enterprises (MNEs) that lead to make the domestic firms either exit the market or reduce their workforce. Therefore, there is a conflicting view on FDI's employment effect.

The literature comprises a number of studies that contain detailed analysis and discussions related to the relationships among any two of these components e.g. for FDI and employment: Coniglio et al., 2015; Karlsson et al., 2009; Norbäck, Skedinger and Duanmu, 2021, etc.; for FDI and technology: Bodman and Le, 2013; Damoodei and Tavakoli, 2006; Elgin, 2021; Osano and Koine, 2016; Sharma and Gani, 2004; Swenson, 2004, etc.; and for technology and employment: Ansal and Karaomerlioglu, 2002; Hamblin, 2022; Hodder, 2020; Wiedemeyer, 1989; Wilkinson, Leggett and Patarapanich, 1986, etc. Not many studies were found that explain the nexus between all the components; except for Jude (2016) in Romanian context and Rana and Ali (2024) in Indian context.

### 3 The Methodology

The study involves three major economic elements that have a number of close representative variables. Including all the variables in a model is not practical due to several statistical requirements that need to be met in order to get reliable results. These requirements put various restrictions on the selection of variables in any model. The variables for the study are carefully chosen and the model is tested to examine its statistical significance so that

accuracy in the results can be acquired. All the potential confounding factors that may have an impact on the dependent variable in the equation such as education levels, trade, changed government policies due to the 'Make in India' programme initiative of 2014, GDP, development in infrastructure, etc. have been controlled for in the model.

### 3.1 The Model

To test the causal relationships between the three variables, the following initial model is used:

$$Emp = f(\ln FDI, EI, ES, \ln TCG, MHE) \quad (1)$$

where,

Emp is 'total employers' (percent of total employment) based on modeled estimate of International Labour Organization (ILO);

FDI is 'FDI net inflows' as per Balance of Payment (BoP) in current United States Dollars (US\$);

EI is 'employment in industry' (percent of total employment, modeled ILO estimate);

ES is 'employment in services' (percent of total employment, modeled ILO estimate);

TCG is technical cooperation grants (BoP, current US\$); and

MHE is 'medium and high-tech exports' (percent of manufactured exports)

Here,  $\ln$  denotes the natural logarithmic transformation.

A description of all the variables used in the study is given in the coming sub-section 3.2.

### 3.2 Description of Variables in the Model

As explained previously, the variables in the model are chosen to represent the three economic elements of the study as follows:

**3.2.1. Emp.** Due to the presence of FDI (as representative variable of FA), the effect on Emp is examined while taking into account the innovation and employment variables too. Emp is taken as representative of entrepreneurship in the study following its description given by World Bank Group (2022) in its Data Reports for India. World Bank Group (2022)

describes Emp in its Series-Metadata for World Development Indicators (WDI) as ‘those workers who, working on their own account or with one or a few partners, hold the type of jobs defined as a "self-employment jobs" i.e., jobs where the remuneration is directly dependent upon the profits derived from the goods and services produced), and, in this capacity, have engaged, on a continuous basis, one or more persons to work for them as employee(s)’. Therefore, apart from representing E&E element, Emp can also be considered as representative of TI as entrepreneurship is associated with risk-taking and innovation.

3.2.2. *FDI*. As evident from the literature review, there are now no doubts regarding the consideration of FDI as the best representative of FA. For any developing country like India, it is FDI that has a powerful impact on its overall economic growth. Therefore, FDI has been taken as a representative variable for FA because once foreign investments enter a country it helps in the economic development of that country.

3.2.3. *EI*. FDI-consequent employment in technology-related new jobs is considered to generate EI, which is taken as one of the two representatives of employment generation in the study.

3.2.4. *ES*. FDI is not only considered to provide EI but also ES. Therefore, for the element E&E the representative variables in the study are Emp, EI and ES.

3.2.5. *TCG*. Though Latif et al. (2022) have taken R&D expenditure (percent of GDP) as the measure for TI, but in the author’s opinion, R&D expenditure from the country’s GDP gives a limited view of TI. R&D, either in absolute terms or as a relative measure, can only tell the domestic expenditure incurred on such activities by the country’s government. It cannot explain whether these expenditures have truly turned beneficial in terms of technological advancement or not and it also does not represent FA. The grants received by the country as a result of technical cooperation provide a broader view for TI as it can also represent FA. These grants are utilized solely for the technical progress of the country. Thus, TCG has been taken as one of the representatives of TI and FA in the study.

3.2.6. *MHE*. It also represents TI. Whether the grants received and the activities performed have actually resulted in any innovation can only be

represented through MHE. The importance of including export sophistication and assortment in the analysis of exports has also been highlighted by Hausmann, Hwang, and Rodrik (2007) and Zapata, Arrazola and de Hevia, (2023). They consider that long-term economic growth depends not only on the number of exports but also, and particularly, on the technological intensity of those exports.

All the variables were selected based on the availability of data and after satisfying statistical-testing.

### 3.3 The Data and Duration

The complex nexus of all these variables have been examined for India, a developing country. The duration under study spans through post-liberalisation period till the year of availability of data at the time of study (i.e., 1991-2019). The data for all the variables is obtained from WDI of World Bank Group (2022).

### 3.4 The Technique and Procedure

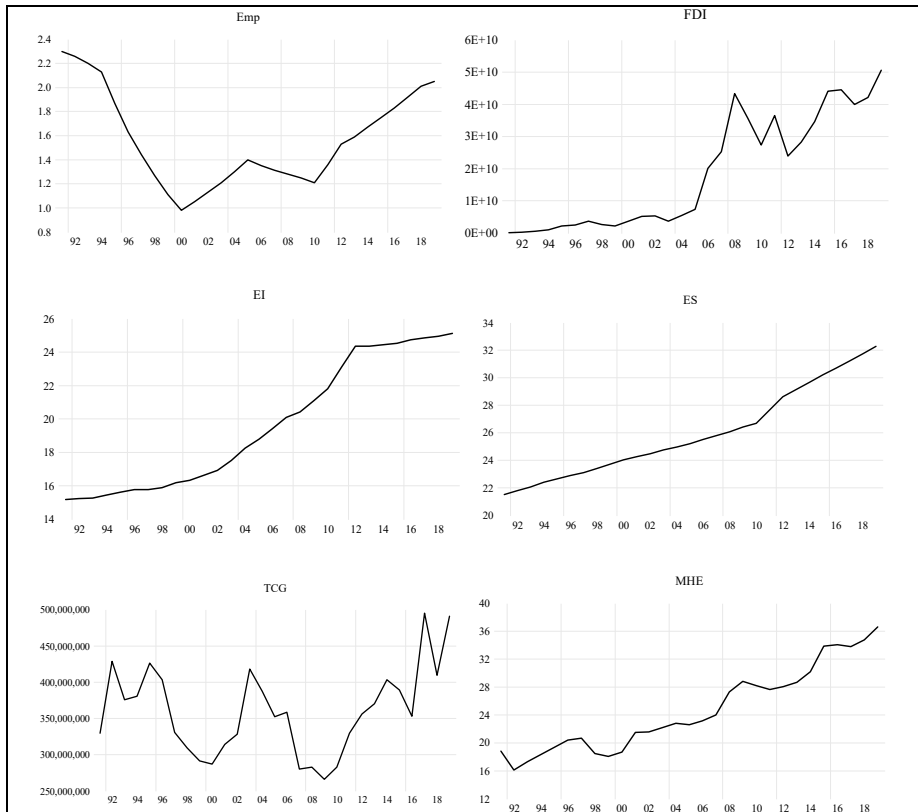
The modified Wald (M-WALD) test is the main technique used in this paper. It is a multivariate testing procedure conceptualized by Toda and Yamamoto (1995) for testing causal relationships. Following the testing procedure, first of all, a graphical representation of all the variables checks for the trend in data. The maximum order of integration ( $i_{max}$ ) of the variables is obtained next with the help of unit root tests. The unit root tests with an optimal lag length are performed with deterministic elements i.e., a time trend and a constant. The unit root tests performed in the study include Augmented Dickey Fuller (ADF) unit root test (Dickey and Fuller, 1979, 1981) and Phillips and Perron (PP) unit root test (Phillips and Perron, 1988) for obtaining robust results. Next, an appropriate lag ( $l$ ) is selected. A Vector Autoregressive (VAR) model with  $l$  lags is then set up in the levels. The stability of the model and the residuals were then examined to see whether the VAR in levels is well-specified. Lastly, a levels VAR model is set up with  $l+i_{max}$  lags to examine the relationships among variables.

## 4 Results and Discussions

### 4.1 Graphical Representation

Figure 2 shows the graphs of all the variables in the model. A first look at the graphs shows that all the variables have an increasing trend during the period under study. The graphs of Emp and TCG show various ups and downs. Due to an increase in foreign investments in the liberalization era (after 1991), the number of domestic employers declined at first. A careful examination of the graph shows a sharp decline in the number of Emp from the year 1994 till 2000 because of the presence of investments from developed countries. But as the economy started to grow, the number of

Figure 2. Graphs of variables in the study





employers also saw a sharp rise since 2010. Similarly, the graph of TCG shows the rise and falls in the amounts of grants received by the country may be depending upon the amount of FA received from the developed countries.

#### 4.2 Detection of $i_{max}$

The trend and intercept have been included while checking for stationarity in data based on the graphical representation of the variables. Null hypothesis for both ADF and PP unit root tests is that the variable has a unit root and indicates non-stationarity in the variable. Table I shows the results of both unit root tests for all the variables under study.

Table 1. Stationarity check and  $i_{max}$  detection

Variable	ADF			Order of Integration	PP			Order of Integration
	At Level	At First Difference	At Second Difference		At Level	At First Difference	At Second Difference	
Emp	0.295	0.325	0.005***	I(2)	0.887	0.325	0.005***	I(2)
lnFDI	0.037**	0.004***	-	I(0)	0.045**	0.004***	-	I(0)
EI	0.425	0.397	0.001***	I(2)	0.553	0.367	0.000***	I(2)
ES	0.953	0.135	0.001***	I(2)	0.990	0.169	0.000***	I(2)
lnTCG	0.577	0.005***	-	I(1)	0.486	0.000***	-	I(1)
MHE	0.478	0.001***	-	I(1)	0.348	0.001***	-	I(1)

Note: \*\*\*, \*\* and \* indicate significance level at 1%, 5% and 10%, respectively

The results from both stationarity tests show that lnFDI is stationary at level i.e. I(0) at 5% significance level; and lnTCG and MHE are non-stationary at level but are integrated of first-order i.e. I(1) even at 1% significance levels. But, Emp, EI and ES are found to be I(2) at 1% significance level. Therefore,  $i_{max}$  as per both the tests is 2 and has been selected for this study.

#### 4.3 Detection of $l$

Table II shows the results of various information criteria for an optimal lag selection.

Table 2. Optimal Lag Selection

Lag	Sequential Modified Likelihood Ratio (LR)	Final Prediction Error (FPE)	Akaike Information Criterion (AIC)	Schwarz Information Criterion (SC)	Hannan-Quinn Information Criterion (HQ)
0	NA	0.002020	10.82235	11.11031	10.90797
1	291.3344	1.47e-08	-1.077706	0.938040*	-0.478319
2	52.80836*	7.65e-09*	-2.183065*	1.560463	-1.069918*

Note: \* indicates lag order selected by the criterion at 5% significance level

It is evident from Table II that all the information criteria (except SC) suggest a maximum lag length of 2 for the study. As explained by Kurozumi and Yamamoto (2000) and also suggested by Giles (2014), in the TY test,  $l$  must be either greater than or equal to  $i_{max}$ . As  $i_{max}$  in the study is 2,  $l$  should either be equal to or more than 2. So, following all the criteria,  $l=2$  has been selected for the study (subject to testing).

#### 4.4 Residual Check

A VAR model in levels is then formed including intercept. The residuals are checked to ensure well-specification of VAR. The results of residuals testing are given in Table III.

Table 3. Results of VAR (2) in levels

Diagnostic Test	Test Statistic	p-value
Serial Correlation LM (with $l=2$ )	1.678848 (Rao F-stat)	0.1343
White Heteroskedasticity (No Cross Terms)	525.9965 (Chi-Sq.)	0.2407
Cholesky of Covariance (Lutkepohl)	7.939051 (J-B Stat)	0.7899
VAR Stability (AR Roots Table and Graph)	No root lies outside the unit circle	-

The null hypothesis of 'no heteroskedasticity' cannot be rejected. Similarly, the null hypothesis of 'residuals are multivariate normal' cannot be rejected in the results. Therefore, the model is found to be homoscedastic and normally distributed. Also, the null hypothesis of 'no serial correlation exists' cannot be rejected even at 10% significance level. Therefore,  $l=2$  has been taken for the study.

#### 4.5 The Relationships Found

Taking the proposed VAR model and adding  $i_{max}$  lags of all the variables in all the equations, Granger (non-) causality is tested. M-WALD test is used that has the hypothesis in the equations of other variables that ‘the coefficients of only first  $l$  lagged values of variables are zero’. The model can be written for all the six variables under study in six different forms. For example, for Emp, the equation is written as under:

$$\begin{aligned}
 (Emp)_t = & \alpha_1 + \sum_{i=1}^l \beta_{1i} (Emp)_t + \sum_{j=l+1}^{i_{max}} \beta_{2i} (Emp)_{t-j} + \sum_{i=1}^l \gamma_{1i} (\ln FDI)_t \\
 & + \sum_{j=l+1}^{i_{max}} \gamma_{2i} (\ln FDI)_{t-j} + \sum_{i=1}^l \delta_{1i} (EI)_t + \sum_{j=l+1}^{i_{max}} \delta_{2i} (EI)_{t-j} \\
 & + \sum_{i=1}^l \mu_{1i} (ES)_t + \sum_{j=l+1}^{i_{max}} \mu_{2i} (ES)_{t-j} + \sum_{i=1}^l \varphi_{1i} (\ln TCG)_t \\
 & + \sum_{j=l+1}^{i_{max}} \varphi_{2i} (\ln TCG)_{t-j} + \sum_{i=1}^l \vartheta_{1i} (MHE)_t + \sum_{j=l+1}^{i_{max}} \vartheta_{2i} (MHE)_{t-j} + \epsilon_t
 \end{aligned}
 \tag{2}$$

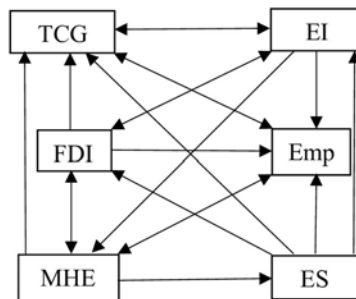
The remaining five equations can also be written in a similar way for the other variables. During Wald test, the coefficients of 2 'extra' lags are not taken because they just fixed the asymptotic. The null hypothesis in the examination is that ‘the test statistics will follow asymptotic chi-square distribution with 2 degrees of freedom’ whereas the extra 2 lags of  $i_{max}$  are not involved. The rejection of null implies the rejection of Granger (non-) causality and accepts the presence of Granger causality. The results of examination of Granger (non-) causality are given in Table IV and Figure 3.

Table 4. Granger causality results

Dependent Variable	M-WALD Test						Causal Inference
	Emp	lnFDI	EI	ES	lnTCG	MHE	
Emp	-	42.85969*** (0.000)	20.91240*** (0.000)	12.46808*** (0.002)	12.48102*** (0.002)	15.94518*** (0.000)	Emp←lnFDI Emp←EI Emp←ES Emp←lnTCG Emp←MHE
lnFDI	0.490767 (0.7824)	-	12.90847*** (0.002)	19.61189*** (0.000)	3.196179 (0.202)	19.60276*** (0.000)	lnFDI←EI lnFDI←ES lnFDI←MHE
EI	2.425829 (0.2973)	4.757406* (0.093)	-	4.741474* (0.093)	4.764525* (0.092)	3.700144 (0.1572)	EI←lnFDI EI←ES EI←lnTCG
ES	0.111825 (0.946)	3.056780 (0.217)	0.136266 (0.934)	-	0.809928 (0.667)	5.882232* (0.053)	ES←MHE
lnTCG	34.77425*** (0.000)	12.70549*** (0.002)	10.69817*** (0.005)	49.83197*** (0.000)	-	22.04732*** (0.000)	lnTCG←Emp lnTCG←lnFDI lnTCG←EI lnTCG←ES lnTCG←MHE
MHE	31.47915*** (0.000)	23.74183*** (0.000)	11.15563*** (0.004)	3.816145 (0.148)	2.082489 (0.353)	-	MHE←Emp MHE←lnFDI MHE←EI

Several statistical relationships are found from each variable to other variables of the study. Figure 3 shows the complex web of interdependence between all the variables.

Figure 3. Complex nexus of interdependence



For the ease of readers, the statistical relationships obtained from the results can be summarized under the following heads:

#### 4.5.1 Bi-directional relationships

- Between Emp and lnTCG: The bidirectional causal relationship between Emp and TCG shows that Indian domestic entrepreneurs demand more technical grants in order to compete with foreign tech-savvy players. It is true in the sense that new local entrepreneurs need more capital for technological equipment. Similarly, due to the availability of such grants, more entrepreneurs get encouraged domestically.
- Between Emp and MHE: This finding shows that domestic entrepreneurs in India have started exporting goods that are highly technological in nature. This finding is true in the sense that because domestic entrepreneurs are becoming tech-rich due to presence of foreign investments, therefore, they are slowly becoming capable of exporting high-tech products in competition with foreign investors. Moreover, the other way is also true. For exporting highly technical goods, local entrepreneurs are involved in the process.
- Between lnFDI and EI: The bi-directional relationship between these two variables indicates that firstly, FDI generates employment opportunities in industrial sector in India and secondly, that employment demands in the industrial sector acts as a driving force behind the inflows of FDI in India. It proves that the country encourages foreign investments in expectation of employment opportunities and FDI is fulfilling its expectations.
- Between lnFDI and MHE: This bi-directional relationship firstly shows that FDI leads to exports of such commodities that are highly technology-based. Foreign investments and their high-end technology raise the productivity of the country in such a way that the products are then exported to other countries. Secondly, to export high-technology goods, foreign investments are required by the country because to export such products, high capital requirements can only be fulfilled by foreign investments. Concluding this finding and the finding at second place above, it can

be said that both foreign and domestic investors are contributing in the exports of high-tech goods from India.

- Between EI and lnTCG: This finding is technically true because industrial employment is largely dependent on the availability of technological grants. Industries are set up when the country has the aid to start them, and once they are established, people get job opportunities. Conversely, these grants are helpful only if there is availability of people to use them in the industrial units.

#### 4.5.2 Unidirectional relationships

- From lnFDI to EMP: The unidirectional causal relationship from FDI to Emp indicates that FDI creates an environment that encourages domestic entrepreneurship. As explained earlier, foreign investments bring in innovation that leads to entrepreneurial traits and hence more domestic entrepreneurs in the country.
- From EI to Emp: Relating this finding to the previous one and to the bidirectional relationship between FDI and EI, it can be concluded that FDI encourages domestic entrepreneurship both directly and indirectly by setting up industries, and providing employment and technical knowledge and skills. The manpower attains knowledge and learns new techniques, skills and methods through their industrial employment that help generate entrepreneurs.
- From ES to Emp: The unidirectional causal relationship from ES to Emp indicates that employment opportunities in service sector in India demands local entrepreneurs, or we can say that there is a vast scope of employment in service sector that could most probably be to serve the foreign firms by the local entrepreneurs.
- From ES to lnFDI: A one-way relationship found from ES to lnFDI and the previous finding of one-way relationship from ES to Emp indicates that there are ample job opportunities for Indian people in service sector provided by both foreign and domestic investors. It is quite evident from the previous finding that foreign investments provide employment opportunities to India in both industrial (bi-directional relationship between FDI and EI) and service sectors.

- From ES to EI: When the customers are satisfied with the services, the demand for products rises, either by the same customers or by their word of mouth. More demand of products raises employment in industry too.
- From MHE to ES: This unidirectional relationship shows that more employment is required in services for exporting high technology-based goods. It becomes quite clear now that the more exports that are highly technical in nature, the more demand for manpower in services-related jobs. When the number of exports of a country rise, it has to increase the number of human resource to serve them that may be export-related services like loading, unloading at ports or after-sales service. Consequently, employment in services sector rises.
- From lnFDI to lnTCG: This finding reveals that FDI attracts more grants for technical cooperation in India. This may happen because with foreign investment flows, the trade relations get stronger and trustworthiness increases that attracts more grants from the developed countries that have already invested.
- From ES to lnTCG: It indicates that service sector in India is attracting grants.
- From MHE to lnTCG: This relationship shows that due to increase in exports of high-technology, more grants are expected.
- From EI to MHE: This unidirectional relationship shows that industrial manpower (either in foreign firms or domestic firms) is involved in producing highly technical goods and the productivity also increases, the excess amount of which is exported.

## 5 Conclusions and Recommendations

The article tried to explore the data and figures of the World Bank related to the complex nexus of FA and its influence on the state of technology and employment in India, a developing country. The findings summarise that firstly, FA is the main cause of economic development in India as FA is found to be causing E&E both directly and indirectly through TI. Secondly, FA brings TI in India by providing employment opportunities in both service and industry sectors. Therefore, two flow processes are found to exist. In any

case, whether first or second, the consequence leads to demand of more foreign fundings for further economic development. All this process results in a circular flow or we can say a circular interdependence exists between all the three primary economic elements of the study.

The results show that FDI affects all the variables in the study, except employment in services, whether it be related to employment or technology. FDI affects entrepreneurship both directly and indirectly. Indirectly, FDI generates employment opportunities in industries through which Indian people attain entrepreneurial skills (either by attending training programmes or while working on the job) and start their own businesses. It means FDI is truly a representative of FA. India expects two important results from FDI i.e., employment and technology and the results of this study confirm that FDI has sufficiently lived up to its expectations. Although FDI is found to be the reason for domestic entrepreneurship in India, the reverse is not found to be true. FDI maintains such conditions in the country that encourage domestic entrepreneurship. but the impact of domestic entrepreneurship is still not that significant that it can affect foreign investments. It may represent that the domestic entrepreneurship is mostly in small or medium-scaled enterprises. Hence, it is suggested that domestic entrepreneurs need to be strengthened. FDI is also found to be the reason for attracting more grants to the country for its technical progress. FDI results in exports of such commodities that are highly technology-based. It is thus evident that FDI maintains such conditions in the country that encourage an overall economic growth for the country. Therefore, it is suggested that FDI should be encouraged in Indian markets to get the overall economic benefits.

All the variables in the study are found to be affecting domestic entrepreneurship whether it be FDI or grants, employment in services or industry, or high-tech exports. It means any change in any one of the variables has an effect on the entrepreneurship. Moreover, domestic entrepreneurship seeks grants and tries to export high-tech goods. Industrial employment is also helping the country in achieving the exports of high-tech goods. All this has become possible due to FA. Therefore, TI has a crucial role to play in between FA (represented by FDI) and E&E. Hence proving  $H_1$ .

It is very important to mention that both foreign or domestic investors and also the employees in industries are targeting to export high-tech goods and these exports generate employment for services sector too.



Technical grants received by the country are also helpful in creating employment conditions in the country. The results also indicate that technical grants are fruitful in India mostly for the industrial sector and for the domestic entrepreneurs and not for services sector. Secondly, more employment, whether it be in industry or services, attracts more grants. Similarly, more technology related exports call for further technology related grants. It means TCG is affected by all the variables. It indicates that grants for technical cooperation are a must requirement for economic activities in India. Hence, maintaining cordial technical relationship with other countries is suggested. Also, investments, whether it be from foreign investors or domestic entrepreneurs, require more TCG. Therefore, from this point of view, E&E plays an important role between FA and TI. Hence proving  $H_2$ .

It is suggested that the Indian government should make efforts in encouraging local entrepreneurs maybe through technology related training programs, involving them in various technical research activities, providing sufficient technical information and knowhow, and also providing subsidies and grants so that they can compete with the foreign investors. It is also suggested to encourage domestic entrepreneurship in service sector as there is a vast scope for job opportunities in services for exporting-related jobs.

Following the above discussions, it can be said that there exists an interdependence between the three economic components of the study as shown in Figure 1 and Figure 3. The results also indicate the existence of two flow processes in the economy among the three elements of the study. Both the two effects of FA play a mediating role in achieving the other effect.

One way, FA results in an increased level of TI through E&E. By providing employment opportunities to the people, FA raises the standard of living and education-attainment levels, and thereby, creates demand for more technologically-advanced commodities and encourages people to think innovatively. The process also makes people engage in more technology-driven jobs and bring innovation. The other way, FA increases E&E through TI. The involvement of people in technology-oriented jobs is believed to rise, such as those associated with R&D activities; installation and maintenance of machinery and equipment; and providing for tools and spare parts through local production, that sets entrepreneurial conditions and further employment. Therefore, the existence of interdependence phenomenon and

of two flow processes have been found that proves hypothesis H<sub>3</sub>. Whatever the way of mediation and flow, it results in a further increase in FA because almost all of the variables are found to be causing more FDI.

## References

- Aliyu, M. A., "Foreign direct investment and the environment: Pollution haven hypothesis revisited," Paper presented at the *Eighth annual conference on global economic analysis*, June 9-11, in Lubeck, Germany, 2005.
- Amankwah-Amoah, J., Y. A. Debrah, W. Yu, Z. Lin, A. Danso and S. Adomako, "Technology Strategies in Emerging Economies: Emerging issues, Challenges and New Research Agenda," *Technological Forecasting and Social Change* 170, 2021, Art. no. 120881.
- Ansal, H. K., and D. C. Karaomerlioglu, "New technologies and employment: industry and firm level evidence from Turkey," *New Technology, Work and Employment* 14(2), 2002, 82-99.
- Arvin, M. B., R. P. Pradhan and M. Nair, "Uncovering interlinks among ICT connectivity and penetration, trade openness, foreign direct investment, and economic growth: The case of the G-20 countries," *Telematics Inform.* 60, 2021, Art. no. 101567.
- Bailetti, T., "Technology entrepreneurship: overview, definition, and distinctive aspects," *Technology Innovation Management Review* 6(2), 2012, 5-12.
- Blomström, M. and A. Kokko, "The economics of foreign direct investment incentives," *National Bureau of Economic Research (NBER) Working Paper No. 9489*, 2003, 1-25.
- Bodman, P. M. and T. Q. Le, "Assessing the roles that absorptive capacity and economic distance play in the foreign direct investment-productivity growth nexus," *Applied Economics* 45(8), 2013, 1027-1039.
- Borensztein, E., J. De Gregorio and J. W. Lee, "How Does Foreign Direct Investment Affect Economic Growth?" *Journal of International Economics* 45(1), 1998, 115-135.
- Choi, Y., "Three Essays on the Effectiveness of Foreign Aid," *Theses and Dissertations, UWM Digital Commons* 2767, 2021, 1-125.
- Coniglio, N., F. D. Prota and A. Seric, "Foreign Direct Investment, Employment and Wages in Sub-Saharan Africa," *Journal of*

- International Development* 27(7), 2015, 1243- 1266.
- Damooei, J. and A. Tavakoli, "The effects of foreign direct investment and imports on economic growth: a comparative analysis of Thailand and The Philippines," *Journal of Developing Areas* 39(2), 2006, 79-100.
- De Mello, L., "Foreign Direct Investment-Led Growth: Evidence from Time Series and Panel Data," *Oxford Economic Papers* 51(1), 1999, 133-151.
- Dickey, D.A. and W.A. Fuller, "Distribution of the estimators for autoregressive time series with a unit root," *Journal of the American Statistical Association* 74(366), 1979, 427-431.
- Dickey, D.A. and W.A. Fuller, "Likelihood ratio statistics for autoregressive time series with a unit root," *Econometrica* 49, 1981, 1063.
- Drury, D. H. and A. Farhoomand, "Innovation diffusion and implementation," *International Journal of Innovation Management* 3(2), 1999, 133-157.
- Elgin, C., "Foreign direct investment, informality and technology transfer," *Review of Development Economics* 25(2), 2021, 994-1015.
- Eveland, J. D., "Diffusion, technology transfer, and implementation: thinking and talking about change," *Science Communication* 8(2), 1986, 303-322.
- Fagerberg, J. and B. Verspagen, "Innovation, growth and economic development: have the conditions for catch-up changed?" Working Papers Archives 2007001, Centre for Technology, Innovation and Culture, University of Oslo, 2007.
- Filser, M., V. Tiberius, S. Kraus, T. Zeitlhofer, N. Kailer and A. Müller, "Opportunity recognition: conversational foundations and pathways ahead," *Entrepreneurship Research Journal* 13(1), 2023, 1-30.
- Foss, M. M., "Does Foreign Aid Help or Hurt FDI? That is the Question," Working Paper in The Role of Foreign Direct Investment in Resource-rich Regions. Center for Energy Studies, Rice University's Baker Institute for Public Policy, 2020.
- Gandolfo, G., "International Trade Theory and Policy: With 12 Tables," Springer, ISBN 3-540-64316-8, 1998, p. 234. doi:10.1007/978-3-642-61680-8
- Giles, D.E.A., "Questions about Granger causality testing - the fine print," 2014. <https://davegiles.blogspot.com/2014/05/questions-about-granger-causality.html>. Accessed 21 February 23.
- Girma, S., "Absorptive Capacity and Productivity Spillovers from FDI: A Threshold Regression Analysis," *Oxford Bulletin of Economics &*

- Statistics* 67(3), 2005, 281-306.
- Goodwin, N., J. M. Harris, J. A. Nelson, P. J. Rajkarnikar, B. Roach and M. Torras, *Microeconomics in Context*, 5th Ed., Routledge, Taylor & Francis Group, an Informa business, New York and London, 2023.
- Hamblin, K. A., "Technology in care systems: Displacing, reshaping, reinstating or degrading roles?" *New Technology, Work and Employment* 37(1), 2022, 41-58.
- Hansen, H. and J. Rand, "On the causal links between FDI and growth in developing countries" *World Economy* 29(1), 2006, 21-41.
- Hausmann, R. and J. Domínguez, "Knowledge, technology and complexity in economic growth," *Harvard University*, n.d. <https://rcc.harvard.edu/knowledge-technology-and-complexity-economic-growth>. Accessed 16 March 2023.
- Hausmann, R., J. Hwang and D. Rodrik, "What you export matters," *Journal of Economic Growth* 12, 2007, 1-25. <https://doi.org/10.1007/s10887-006-9009-4>
- Hijzen, A., P. Martins, T. Schank and R. Upward, "Foreign-owned firms around the world: A comparative analysis of wages and employment at the micro-level," *European Economic Review* 60(C), 2013, 170-188.
- Hodder, A., "New Technology, Work and Employment in the era of COVID-19: reflecting on legacies of research," *New Technology, Work and Employment* 35(3), 2020, 262-275.
- Hu, G. G., "Is knowledge spillover from human capital investment a catalyst for technological innovation? The curious case of fourth industrial revolution in BRICS economies," *Technological Forecasting Social Change* 162, 2021, Art. no. 120327.
- Hu, D., K. You and B. Esiyok, "Foreign direct investment among developing markets and its technological impact on host: Evidence from spatial analysis of Chinese investment in Africa," *Technological Forecasting Social Change* 166, 2021, Art. no. 120593.
- Insee, "Economic Activity," 2019. <https://www.insee.fr/en/metadonnees/definition/c1632>. Accessed 9 February 2023.
- Jude, C. and M. I. P. Silaghi, "Employment effects of foreign direct investment. New evidence from central and eastern European countries," *Banque de France*, 2015, Working Paper No. 553.
- Jude, C., "Technology Spillovers from FDI. Evidence on the Intensity of Different Spillover Channels," *The World Economy* 39(12), 2016, 1947-

- 1973.
- Karlsson, S., N. Lundin, F. Sjöholm and P. He, "Foreign firms and Chinese employment," *The World Economy* 32(1), 2009, 178-201.
- King'ang'i, P. K., *Private investment and economic growth in Kenya. An empirical investigation: 1980-2002, Thesis (M.A.)*, Nairobi: University of Nairobi, 2003.
- Kritikos, A. S., "Entrepreneurs and their impact on jobs and economic growth," *IZA World of Labor* 8, 2014. doi: 10.15185/izawol.8. Accessed 20 April 2023.
- Kumari, R., M. S. Shabbir, S. Saleem, G. Y. Khan, B. A. Abbasi and L. B. Lopez, "An empirical analysis among foreign direct investment, trade openness and economic growth: evidence from the Indian economy," *South Asian Journal of Business Studies*, 2021, ahead-of-print.
- Kurozumi, E. and T. Yamamoto, "Modified lag augmented autoregressions," *Econometric Review* 19, 2000, 207-231.
- Latif, Y., S. Ge, G. M. Qamri and S. Ali, "The Determinants of Trade Openness in Two Emerging Economies; China-Pakistan Economic Corridor Perspective," *IEEE Transactions on Engineering Management* 25(2), 2022, 994-1015.
- Lee, P. C., S. H. Chen, Y. S. Lin and H. N. Su, "Toward a better understanding on technological resilience for sustaining industrial development," *IEEE Transactions on Engineering Management* 66(3), 2018, 398-411.
- Li, X. and X. Liu, "Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship," *World Development* 33(3), 2005, 393-407.
- Li, L., *The impact of FDI on technological innovation: empirical analysis based on panel data of 31 provinces in China from 2010 to 2019*. Proceedings of the 2022 2nd International Conference on Public Management and Intelligent Society (PMIS 2022), Atlantis Highlights in Computer Sciences, 2023, 172-179.
- Louise, G. M., *Technology transfer through foreign direct investment to developing countries - the role of home country measures*. E-Book: Globalization of Technology in UNESCO-Encyclopedia of Life Support Systems (EOLSS), Oxford, United Kingdom 1, 2009, 1-19.
- Mosey, S., M. Guerrero and A. Greenman, "Technology entrepreneurship research opportunities: insights from across Europe," *The Journal of Technology Transfer* 42(1), 2017, 1-9.

- Muhammad, M., "The Role of Science and Technology in Development," In M. Muhammad, A. B. Garko, M. T. Yakasai and Y. B. Daraja, eds., *Dynamics in Science and Technology*, 2013, 1-13.
- Munteanu, A. C., "Knowledge spillovers of FDI," *Procedia Economics and Finance* 32, 2015, 1093-1099.
- Norbäck, P. J., P. Skedinger and J. L. Duanmu, "Employment protection and FDI revisited: New evidence from micro data," *The World Economy* 44(3), 2015, 645-670.
- Onaran, O., "Jobless growth in the central and east European countries: a country-specific panel data analysis of the manufacturing industry," *Eastern European Economics* 46(4), 2008, 90-115.
- Osano, H. M. and P. W. Koine, "Role of foreign direct investment on technology transfer and economic growth in Kenya: a case of the energy sector," *Journal of Innovation and Entrepreneurship* 5(31), 2016, 1-25.
- Peluffo, A., "Foreign Direct Investment, Productivity, Demand for Skilled Labour and Wage Inequality: An Analysis of Uruguay," *The World Economy* 38(6), 2015, 962-983.
- Perraton, J., D. Goldblatt, D. Held and A. McGrew, "The globalization of economic activity," *New Political Economy* 2(2), 1997, 257-277.
- Phillips, P. C. B. and P. Perron, "Testing for unit root in time series regression," *Biometrika* 75, 1988, 335-346.
- Posner, M. V., "International Trade and Technical Change," *Oxford Economic Papers* 13(3), 1961, 323-341.
- Rana, R. and M. Sharma, "Dynamic causality among FDI, economic growth and CO<sub>2</sub> emissions in India: with open markets and technology gap," *International Journal of Asian Business and Information Management* 11(3), 2020, 15-31.
- Rana, R. and J. Ali, "An extremely endogenous relationship of technology gap with foreign direct investment and employment in India," *IEEE Transactions on Engineering Management* 71, 2024, 4091-4100.
- Razzaq, A., H. An and S. Delpachitra, "Does technology gap increase FDI spillovers on productivity growth? Evidence from Chinese outward FDI in Belt and Road host countries," *Technological Forecasting & Social Change* 172, 2021, 1-16, Art. no. 121050.
- Rosenberg, N., "Innovation and economic growth," *OECD*, 2004.
- Rutihinda, C., "Impact of globalization on small and medium size firms in Tanzania," Hawaii: ABR and TLC Conference Proceedings, 2007.

- Selaya, P. and E. R. Sunesen, "Does foreign aid increase foreign direct investment?" *World Development* 40(11), 2012, 2155-2176.
- Sharma, B. and A. Gani, "The effects of foreign direct investment on human development," *Global Economy Journal* 4(2), 2004, 1-20.
- Singha, S., S. R. D. Choudhury and B. Kumar, "Foreign direct investments and its impact on entrepreneurship in India," *International Journal of Entrepreneurship* 26(6), 2022, 1-7.
- Sonaiku, O. and B. Olowoporoku, "Economic Dependence: The Problem of Definition," *Journal of Asian and African Studies* 14, 1979, 32 - 43.
- Sultana, N. and E. Turkina, "Foreign direct investment, technological advancement, and absorptive capacity: a network analysis," *International Business Review* 29(2), 2020, Art. no. 101668.
- Swenson, D. L., "Foreign investment and mediation of trade flows," *Review of International Economics* 12(4), 2004, 609-29.
- Toda, H. Y. and T. Yamamoto, "Statistical inferences in vector autoregressions with possibly integrated processes," *Journal of Econometrics* 66, 1995, 225-250.
- Torlak, E., "Foreign direct investment, technology transfer and productivity growth: empirical evidence for Hungary, Poland, Romania, Bulgaria and the Czech Republic," Conference papers 331189, Purdue University, Center for Global Trade Analysis, Global Trade Analysis Project, 2004, 1-22.
- UNCTAD, "Globalization of R&D and developing countries," In Proceedings, Expert Meeting Geneva (24-26 January), 2005.
- UNIDO and UN IATT on STI for the SDGs, "Science, Technology and Innovation for Achieving the SDGs: Guidelines for Policy Formulation" Vienna, 2022.
- Waldkirch, A., P. Nunnenkamp and J. E. Alatorre Bremont, "Employment effects of FDI in Mexico's non-maquiladora manufacturing," *The Journal of Development Studies* 45(7), 2009, 1165-1183.
- Wang, X., Z. Xu, Y. Qin and M. Skare, "Foreign direct investment and economic growth: a dynamic study of measurement approaches and results," *Economic Research-Ekonomska Istraživanja* 35(1), 2022, 1011-1034.
- Wanjala, B. M., "Determinants of foreign direct investment in Sub-Saharan Africa, with inferences on Kenya," *Thesis (M.A.)*, Nairobi: University of Nairobi, 2001.
- Wiedemeyer, M., "New Technology in West Germany: the employment

- debate,” *New Technology, Work and Employment* 4(1), 1989, 54–65.
- Wilkinson, B., C. Leggett and S. Patarapanich, “National ideology, technology and employment: the construction industry in Singapore,” *New Technology, Work and Employment* 1(1), 1986, 67–76.
- Wolf, M., “Shaping Globalization,” *Finance & Development* 51(3), 2014, 22–25.
- World Bank Group, “World Development Indicators,” 2022. <http://databank.worldbank.org/data/reports.aspx?source=2&country=IND>. Accessed 17 December 2022.
- Xu, B., “Multinational enterprises, technology diffusion, and host country productivity growth,” *Journal of Development Economics* 62(2), 2000, 477–493.
- Zapata, A. N., M. Arrazola and J. de Hevia, “Determinants of high-tech exports: new evidence from OECD countries,” *Journal of the Knowledge Economy*, 2023. <https://doi.org/10.1007/s13132-023-01116-z>.