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## ICT DETERMINANTS OF FDI INFLOWS: EVIDENCE FROM SINGAPORE

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**Abstract:** *The flow of foreign capital is the key driver to lift up country's development and economic growth. This paper investigates the effects of Information and Communication Technology (ICT) on FDI inflows in Singapore from 1989 to 2019. By using Autoregressive Distributed Lag (ARDL) bounds test, the findings show that there is no significant effect of ICT development on FDI flows. The insignificance of ICT in attracting FDI could be reasoned by the insufficient qualified ICT workforce to fulfill the speedy development of ICT industry in Singapore. From the policy perspectives, government may consider to increase the budget allocation for hiring more foreign ICT expertise and also provide training to increase the manpower in ICT industry.*

**Keywords:** FDI, ICT Development, Human Capital, Labor Cost

**JEL Classification:** F21; L86; L96

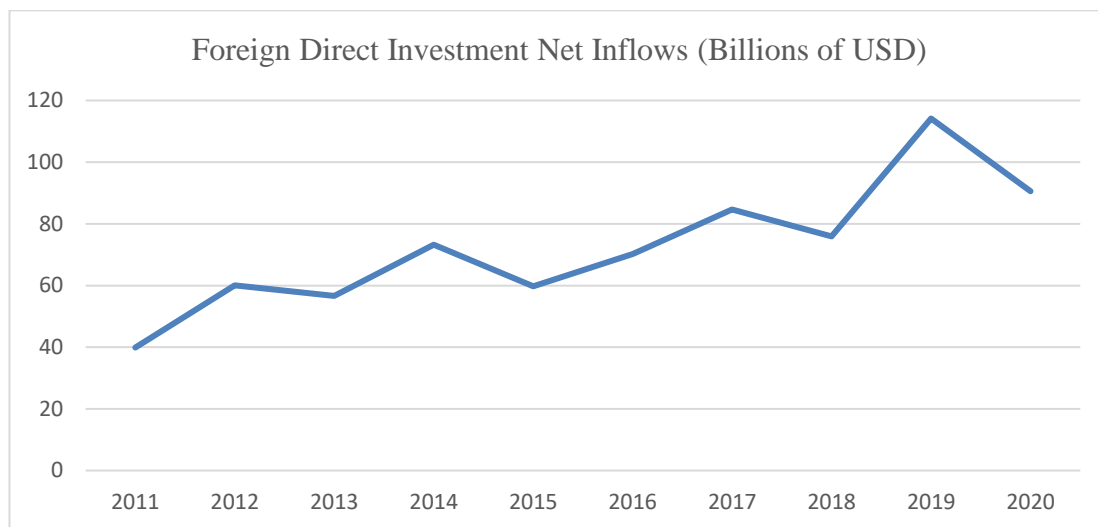
### 1. Introduction

Over the past decades, there is a broad conviction among policymakers, analysts' academicians, and worldwide organization that foreign direct investment (FDI) decidedly affects monetary development (Ali & Hussain, 2017). According to Belloumi and Touati (2022), the presence of Information and Communications Technology (ICT) capital embodied in software and databases positive drives labor productivity growth. Referring to the decisions of foreign investors, they will mostly prefer the lower costs offered by that country to the higher returns.

With good information communication technology (ICT) infrastructure, foreign investors can reduce search time, cost, or increase labor productivities (Wang & Bangash, 2021). For countries with access to broadband internet, the development of mobile payments, information communication technology (ICT) security concerns and general need in training have become major considerations for competition, economic growth, and social development.

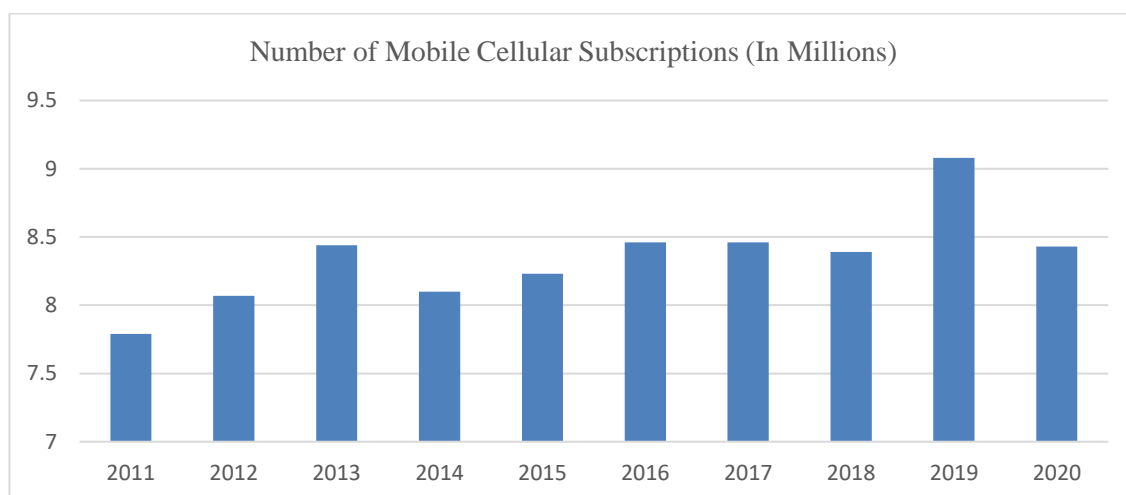
In South-East Asia, Singapore has been one of the quickest developing economies because of their capacity to accomplish a high financial development over the course of the year through the execution of powerful speculation techniques and streamlined commerce strategies. According to Ridzuan, Ismail and Hamat (2017), Singapore is fit in furnishing a superior business climate quality with high accessibility of duty motivations, great loaning rates to foreign investor, excellent framework, and political soundness. In 2020, Singapore has been ranked second in terms of the ease of doing business after New Zealand by the World Bank Group.

Based on Figure 1, the overall inflow of Singapore’s FDI experiencing a rising trend over the years. This likely to occur due to the strength of Singapore to have both strong intellectual property protections and contract enforcement which helps in excess themselves as an appealing country which attract foreign investors. However, there is a significant fall in 2020 and it was likely caused by negative global business sentiments during the COVID-19 pandemic.



**Figure 1: Foreign Direct Investment Net Inflows from 2011 to 2020.**  
**Source: Data retrieved from Statista (2021a).**

The transformation of ICT has opened for international trades where everyone can access required information or data through internet. Singapore has been adopting a proactive strategy in incorporating information communication technology (ICT) into their business environment which prompts the nation being ranked 2nd in digital competitiveness in 2019 (Dutta & Lanvin, 2020; IMD, 2019). The innovation of ICT technology is crucial for a country’s economic growth and enhance competitiveness advantages internationally. Nonetheless, Singapore managed to attract 646 FDI projects in the ICT sectors during 2013 to 2018 after the government implemented their Smart Nation Initiative in 2014.



**Figure 2: Number of Mobile Cellular Subscriptions in Singapore from 2011 to 2020.**  
**Source: Data retrieved from Statista (2021b).**

Based on Figure 2, the overall number of mobile Cellular subscription of in Singapore experiencing

a rising trend over the year and reached its peak in 2019 with about nine million contracts. The high internet usage and the further development of digitalization were partly responsible for this increasing trend. However, there is a significant fall in 2020 and it was likely caused by negative effects of global economic integration during the COVID-19 pandemic.

The expansion of the business structure was counterbalancing the barriers such as the geographical location by adoption of new technology. In general, the adoption of ICT can reduce most of the transaction cost and encourage the operation with low-cost IT services in all countries. Along these lines, it is demonstrated that the high level of ICT foundation has improved the progression of FDI that catalyzed the world economy which increase the possibilities to assess international trading for foreign investors. Thus, the effects of ICT on FDI will be considerable to policymakers and specialists who view FDI as a vital financial variable.

In general, there are no restrictions on foreign ownership of business except for national security reasons and area such as air transportation, public utilities, newspaper publishing, and shipping in Singapore. Furthermore, in 2020, Singapore ranks among the best countries in the world for human capital development, with the government increasing its spending on ICT development by 30%. Thus, against this background, will the Singapore's government initiative to promote the development of ICT to influence the FDI inflows? Hence, this paper is to examine the relationship of ICT, human capital, and labor cost to Singapore's FDI inflows.

## 2. Literature Review

### 2.1 The Effects of ICT on FDI

The availability of ICT infrastructure is given a lot of consideration when making decisions by investors and is considered as one of the important attraction factors of FDI (Gani & Sharma, 2003). It is agreed by Gholami, Lee and Heshmati (2005) and Fakher (2016) that radical transformation by ICT is a driving force because of its prowess in providing various new communication capabilities that drive the world economy to move into the "New Economy" phase. Among the notable work done is from Gani and Sharma (2003) who have demonstrated that ICT and the diffusion of new ICT instruments are the major attraction factors of FDI. Their result reinforces solid evidence that technology diffusion of new instruments of ICT is a major pull factor in attracting FDI to high-income countries based on the study period between 1994 to 1998. In the same strand of the literature, the results of Addison and Heshmati (2003) also suggest ICT had a positive impact on FDI flows to 110 developing countries during 1970-99. In India, Veeramacheni, Ekanayake and Vogel (2007) discovered a significant bidirectional relationship between FDI and ICT for the period 1970-2005 which means ICT is an important determinant of FDI and FDI promotes ICT. The authors added that the result demonstrates that the ICT sector is mature enough to attract FDI inflows on its own, meaning that ICT infrastructure is an important factor in attracting foreign investors to invest in the country.

Meanwhile, Latif, Xin, Khan, Iqbal, Pathan, Salam and Jan (2017) investigated the relationship between the diffusion of ICT and environmentally sustainable development (SusD) in South Asian countries for the period 2005–2015. By taking FDI as one of the components in SusD, the results of the study confirmed the positive relationship between ICT and the SusD in the long run. In addition, the authors added that due to the deregulation policy, increased development of ICT infrastructure creates employment opportunities rapidly and strengthens the economy by receiving FDI. A similar result was also reported by Sinha and Sengupta (2022) where ICT expansion positively influenced FDI inflows in Asia-Pacific developing countries during the period 2001-2017 where the relationship between the two could impact economic growth and development of the host country in the long run. A recent study conducted Wang and Bangash (2021) also reached the same conclusion where they

focused on D8 countries to analyze the impact of ICT infrastructure availability on FDI inflows for the period 1997-2018 and found a positive and significant effect between ICT infrastructure and FDI inflows. Like the other authors, they also support the availability and reliability of good information communication infrastructure helps to attract foreign investment thereby increasing productivity levels and attracting FDI inflows. However, an insignificant positive relationship was found by Fakher (2016) between ICT investments and FDI in the period 1995-2013 in Egypt which proves the weakness of ICT infrastructure in Egypt.

In contrast, Alraja, Hammami and Al Samman (2016) studied the relationship between FDI and Oman's ICT exports and imports from 2000 to 2014 and drew interesting results. First, FDI had a negative statistically effect on import and exports of ICT goods. However, high level of FDI had a positive statically effect on ICT service exports. Through this study, they concluded that the ICT sector in Oman is not mature enough to attract FDI inflows by itself. FDI does not affect the import of ICT goods can be interpreted as it does not play an important role in technological infrastructure which contributes later in developing the country and increasing economic growth. Meanwhile, the significant positive impact of FDI on the export of ICT services shows that FDI has played a small role in improving the technology infrastructure in Oman which plays a role in economic growth in the long run.

However, Dewan and Kraemer (2000) indicated a different result that ICT is only significant to productivity to developed countries but does seem to be insignificant to developing countries. This is in line with the study by Gholami et al. (2005) who reported that there is a causal relationship from the level of ICT to the attraction of FDI inflows in developed countries and its implications on economic growth to 23 major countries for the period between 1976 and 1999. In contrast, there is no significant causality from ICT to FDI in developing countries. Moreover, the opposite relationship has been found to indicate that FDI inflows are a necessary factor to increase ICT investment in developing countries. Nevertheless, it is refuted by a study from Suh and Bae (2002) to show that ICT infrastructure has a significant positive impact on FDI in developing countries. Taking 19 developed countries and 17 large emerging countries from 1997 to 1999 as a sample, it is revealed that ICT infrastructure may attract FDI only for large emerging markets that should be built in line with the level of economic development.

In addition, they added that foreign investors evaluate the quality of a country's infrastructure as an important factor to direct their investment but only for developing countries, however the factor is less important for developed countries that already have existing infrastructure networks. This is supported by Veljanoska, Axhiu and Husejini (2013) as developing countries benefit in terms of lower labour costs and robust natural resources that are seen to be able to attract FDI by foreign investors in turn able to expand and spread ICT.

## **2.2 The Effects of Human Capital on FDI**

Human capital that is referred as a group of efficient and skilled labour capable of generating strong economic value, plays an important development factor in attracting FDI inflows by foreign investors to the host country (Blomstrom & Kokko, 2003; Cao & Jariyapan, 2012; Osuna, 2016). According to Khafidzin (2021) FDI and human capital can be seen from 2 perspectives where firstly FDI inflows are able to provide knowledge spillover to the local laborer and secondly the level of human capital which refers to a group of efficient and trained manpower in the host country is able to determine the amount FDI inflows.

Karimi, Yusop, Hook and Chin (2013) explored the extent to which human capital can contribute to the host county's economy and its influence on FDI inflows to 50 developed and developing countries in the period between 1975-2000. The results stated that human capital formation measured

through a country's general educational attainment is important to attract FDI but should be more accentuated in developing countries if FDI attraction is regarded as a legitimate policy objective. Shah and Khan (2016) evaluated the effect of human capital on FDI inflows in 6 emerging countries for the period 1996-2014. The finding showed that primary education used as a proxy of human capital has a significant positive effect on FDI. However, Alsan, Bloom and Canning (2006) conducted a study on 74 industrialized and developing countries during the period 1980-2000 and found that secondary school education had a positive but insignificant effect on FDI inflows.

Meanwhile, Mudiyansele, Epuran and Tescasiu (2021) used labor force data in Romania in the period 1997-2019 with advanced education as a proxy for human capital and found it has a positive and significant effect on FDI inflows in the long run. Further, the authors have suggested that more highly educated and technologically capable laborers are easier and faster to attract more FDI to the host country. Positive and significant results were also reported by Akbar and Idris (2020) on official ASEAN member countries consisting of 10 countries (Indonesia, Myanmar, Laos, Philippines, Vietnam, Cambodia, Brunei Darussalam, Singapore, Malaysia and Thailand) based on data between 2000-2016. The authors added, human capital as one of the important determinants of FDI needs to be enhanced in terms of both quantity and quality with the relevance of education, which is capable of producing skilled and competitive human capital in a country. As for ASEAN-8, Khafidzin (2021) found that human capital measured through the ratio of secondary schooling had a significant impact on FDI inflows based on data for the period 2010-2019. The result is relevant to research from Hussain and Haque (2016) who asserted that the process of increasing FDI inflows has a direct impact with increasing the skill level of the workforce.

However, contrary to the above studies, Urata and Kawai (2000) investigated the factors in the host countries of 117 developed and developing economies that would attract FDI by Japanese SMEs. Using enrollment rates in secondary education as a measure of human capital, they found a significant negative impact on FDI. However, the breakdown of countries found a significant positive relationship for FDI in developed countries and a significant negative relationship for developing countries. The authors justify that this reflects investors are looking for low-wage workers in developing countries and skilled workers in developed countries. Meanwhile, Georg and Greenaway (2002) applied the gravity model to 6 countries in Central and Eastern Europe (CEE) from 1996-2000 and found a consistent negative relationship between these two variables where the human model was measured through tertiary level enrollment. According to the authors, this may suggest that inward FDI is primarily driven by labor cost considerations, i.e., mostly vertical, rather than horizontal. Most recently, taking into account the selection of different proxies for human capital, Petrovic-Randelovic, Radjenovic, Krstic and Micic (2020) demonstrated different results between the relationship of human capital and FDI in Western Balkan countries between 2008 and 2016. Positive effect was reported in primary education while negative effect while in tertiary education.

Nevertheless, Quazi (2007) examined a sample of 7 East Asian countries in the period 1995-2000 and showed that human capital had no statistically significant effect on FDI. In its justification, it is reasonable to assume that adult literacy rates as a proxy for human capital are not intact enough to capture the real impact on FDI. A similar result was found by Miningou and Tapsoba (2020) who showed that years of schooling alone had no effect on FDI inflows based on 70 developing and transition countries for the period 1988-2010. The authors have added that the capacity of the labor force to suitably translate its education into income in the labor market is more crucial in attracting FDI. In the same year also in the Indian context, Gupta (2017) found no causal relationship between human capital development and FDI. According to the authors, the availability of cheap human capital in India and other market factors are considered to have a major impact on FDI. Most recent, Pinas et al. (2020) who used data from 1971-2016 and concluded FDI inflows into the Netherlands were determined by factors other than human capital proxied by secondary school enrollment in the

study.

### 2.3 The Effects of Labor Cost on FDI

Labor cost is referred as the full cost to the firm of employing labor as a factor of production (Antos, 1983). According to Lai and Sarkar (2011), after controlling the output the effects of lower labor cost attract foreign direct investment in India. It can be supported by Bellak, Leibrecht and Reidl (2008), where they analyse the determinants of foreign direct investment across selected Central and Eastern European Countries (CEECs) investigating on labor costs. The study found that higher unit labor costs as well as higher total labor costs negatively affecting FDI, whereas higher labor productivity positively affecting FDI. Whereas research done by Saucedo, Ozuna and Zamora (2020), who investigate on the effect of FDI on the employment and wages of low and high-skilled employees in the manufacturing and service sector in Mexico. The result found that an increase of FDI inflows to the manufacture sector positively effect low and high-skilled employment. However, in the case of service, it shows inconclusive result for both models. Most past studies in the literature have focused on categorizing employees based on skill levels and analyzing the effect of FDI inflows on the labor cost of different categories of employees (Hanousek et al., 2011; Lee & Wie, 2015; Onaran, 2012).

The literature on labor market positively effects on FDI inflows has mostly focused on the impact of labor cost. Most of past studies used average wage rate and unit labor costs as measurement of labor cost (Whyman & Baimbridge 2009). Moreover, research done by Bellak et al. (2007) where to explore the determinants of FDI across selected Central and Eastern European Countries that focusing on labor costs. The results suggest that higher unit labor cost as well as higher labor costs affect FDI negatively whereas higher labor productivity positively effect on FDI. Meanwhile, Bayraktar-Saglam and Boke (2017) examines the endogenous interaction between labor costs and FDI in OECD countries via Panel VAR approach. The result found that sectoral composition of FDI and the decomposition of labor costs play significant role in determining the association between labor costs and FDI.

The prominent role of Multinational companies in the global and host country labor markets has led to increased discussion and implications on labor markets indicators especially wages (Bayraktar-Saglam & Boke, 2017). Research done by Almeida (2007) who examine whether foreign investors acquire firms with high human capital or based on labor costs or whether foreign investors improve the outcomes. The result found that foreign acquisitions of domestic firms have small effects on the human capital and average labor costs of the acquired firms. It can be supported by Gopinath and Chen (2003), investigated on FDI and wages, a cross- country analysis and found positive effect of FDI on labor costs. The study investigates the general equilibrium propositions that capital inflows (outflows) increase (lower) the labor costs in host(home) countries to the change in factor of endowment.

Overall, evidence on the influence of ICT, human capital, and labor costs to FDI remains mixed depending on the characteristics of each case. On the positive side, these variables are found to be one of the determinants for the direction of FDI flows. Therefore, the purpose of this research is to attempt to bridge this gap particularly in the context of Singapore.

## 3. Model Specification and Methodology

### 3.1 Theoretical Framework

In the field of international business, the well-known Eclectic Paradigm or OLI Paradigm was introduced by Dunning in 1977 which offers a general framework in explaining the rationale of

companies internationalizing their activities such as evolving into multinational organizations or locating their production in foreign countries. This theory describes the beneficial mechanism of foreign investment for companies by providing a three-tiered framework in terms of O-ownership, L-location and I-internalization (Dunning 1977, 1980, 2000, 2001). Over the years, the original OLI paradigm has been expanded to include additional and more dynamic elements to explain changes in international production patterns over time (Dunning, 2001). Many researchers agree the OLI paradigm offers a holistic framework to identify and evaluate the important factors that drive FDI by multinational companies (MNCs) (Bhrammanachote, 2018; Giakoulas, Kottaridi & Manolopoulos, 2016; Sharmiladevi, 2017).

In the view of supply side, the technology depends on a single factor production, labor. Therefore, the production cost function is modeled as follows:

$$y_k^j = \lambda_k^j w_k^j \quad \text{Equation 3.1}$$

where  $y_k^j$  is the production of variety good  $j$  in each country  $k$ ,  $w_k^j$  is labor cost which consists of  $L_u$  and  $L_s$  units of unskilled and skilled labors with the wages of  $w_{ku}^j$  and  $w_{ks}^j$ , respectively. Therefore, the labor cost in each country  $k$  to produce  $y$  items of product  $j$  is given as  $w_k^j = w_{ku}^j L_u + w_{ks}^j L_s$ . Lastly,  $\lambda^j$  denotes the productivity of labor in producing variety products  $j$ .

In the OLI paradigm, labour costs appear as one of the cost-related location determinants in response to cost differential factors (comparative advantage) between countries that can influence decision-making in the search for optimal resource seeking by MNCs (Bellak et al., 2008). In fact, one of the basic motivations behind FDI is the search by firms for lower production costs where high unit labor costs increase FDI outflows and lower FDI inflows. Eckel (2003) argues that this motivation leads to the flow of FDI from high-wage countries to low-wage countries. The international relocation of production from high to low-wage countries by MNCs is seen as force factor in order to put downward pressure on domestic wages and keep labor costs low (Lipse, 2004).

In addition, location-specific advantages combined with the efficiency seeking may to be an important factor to be associated with input quality and productivity in attracting FDI to the host country. The quality and productivity of this labour can implicitly refer to a high level of human capital (Noorbakhsh, Paloni & Youssef, 2001; Ta, Do, Phan, Nguyen, Nguyen, Le & Nguyen, 2021). In general, highly skilled workers have higher labour productivity because they are more efficient and able to adapt to new changes more easily which has been shown to have a positive effect on FDI inflows in some countries.

### 3.2 Model Specification and Methodology

The locational advantage in OLI framework is usually arise from comparative advantages. Hence, Equation 3.1 is extended by including labor cost, ICT, and human capital as factors in influencing the location of FDI. This study applies net inflows of foreign direct investment as percent of GDP as a proxy for FDI and the secondary enrolment for human capital. The data are retrieved from World Development Indicator (WDI). Besides, the ICT development proxied by total mobile phone subscription and unit labor cost are collected from Singapore Government Website. All variables are transformed into logarithm form.

To investigate the effects of ICT, labor cost, and human capital on foreign investment, this study

applies ARDL bounds test. In general, the model specification is shown as below:

$$FDI_t = \beta_1 + \beta_2 ICT_t + \beta_3 HC_t + \beta_4 LC_t + \mu_t \tag{Equation 3.2}$$

where FDI is foreign direct investment, ICT is ICT development, HC and LC are control variables which denote human capital and labor cost, respectively.  $\beta_i$  are parameters where  $i=1,2,3,4$ .  $\mu_t$  is error term.

To conduct the analysis, this study applies unit root tests, namely Augmented Dickey-Fuller (ADF) test and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) tests to examine the stationarity of the variables. The variables are considered as non-stationary if the result shows the existence of unit root. It is imperative to examine the stationarity of the variables to ensure the order of integration of the variables is not I(2).

Furthermore, this study employs Autoregressive Distributed Lag (ARDL) bounds test developed by Pesaran, Shin and Smith (2001) to examine the long-run cointegrating relationship among the variables. The advantages of ARDL bound test are it allows the mixed order of integration, both I(0) and I(1) and the results are performed better and more robust for small sample data. First, the existence of long-run relationship is modeled in Equation 3.2. The error correction term (ECT) is included to determine the speed of adjustment of FDI towards its long-run equilibrium.

$$\begin{aligned} \Delta FDI_t = & \beta_0 + \pi_1 FDI_{t-1} + \pi_2 ICT_{t-1} + \pi_3 HC_{t-1} + \pi_4 LC_{t-1} + \sum_{i=1}^p \tau_i \Delta FDI_{t-i} + \sum_{i=0}^p \vartheta_i \Delta ICT_{t-i} \\ & + \sum_{i=0}^p \rho_i \Delta HC_{t-i} + \sum_{i=0}^p \Omega_i \Delta LC_{t-i} + v_t \end{aligned} \tag{Equation 3.3}$$

where  $\beta_0$  is the intercept,  $\pi_j$  is the vector of conditional long run multipliers ( $j=1,2,3$ , and 4), and  $v_t$  white noise residual term. Besides, the lagged values of  $\Delta FDI_t$ ,  $\Delta ICT_t$ ,  $\Delta HC_t$  and  $\Delta LC_t$  are used to capture the short-run relationship between the variables. The optimum lag length selection is based on the information criteria of Schwarz Bayesian Criteria (SBC). Hence, the null and alternative hypotheses are stated as follow:

$$\begin{aligned} H_0: & \pi_1 = \pi_2 = \pi_3 = \pi_4 = 0 \\ H_1: & \pi_1 \neq \pi_2 \neq \pi_3 \neq \pi_4 \neq 0 \end{aligned}$$

To examine the presence of long-run relationship in the model, a standard Wald F-statistic is applied. The null hypothesis the long-run cointegrating relationship is absent among the variables. In contrast, the relationship is presented in the alternative hypothesis. Therefore, if the test statistic is greater than the critical value, this shows the evidence for the cointegration. As the long-run cointegrating relationship is presented, a long run model is used to estimate the coefficients of the variables. The model is specified as follows:

$$FDI_t = \alpha_0 + \sum_{i=1}^n \eta_{1i} FDI_{t-i} + \sum_{i=0}^n \phi_{1i} ICT_{t-i} + \sum_{i=0}^n \phi_{1i} HC_{t-i} + \sum_{i=0}^n \phi_{1i} LC_{t-i} + v_t \tag{Equation 3.4}$$



where  $\alpha_0$  is the intercept,  $\eta_{1i}$ ,  $\phi_{1i}$ ,  $\phi_{2i}$ , and  $\phi_{3i}$  are the coefficients for FDI, ICT, HC and LC, respectively, and  $V_t$  is the white noise error term. Furthermore, this study also estimates ECT with the model as below:

$$\Delta FDI_t = \alpha_0 + \lambda ect_{t-1} + \sum_{i=1}^n \chi_i FDI_{t-i} + \sum_{i=0}^n \kappa_{1i} ICT_{t-i} + \sum_{i=0}^n \kappa_{2i} HC_{t-i} + \sum_{i=0}^n \kappa_{3i} LC_{t-i} + \psi_t$$

Equation 3.5

$ECT_{t-1}$  measures the short-run dynamic of FDI. It shows the adjustment speed of FDI towards the long-run equilibrium. Hence, the coefficient of ECT must be a significant and negative value.

Lastly, this study also applies granger causality test to examine the causal relationship between FDI, ICT, HC and LC. Hence, the direction of causality will be performed by using Vector Error Correction Models (VECMs).

#### 4. RESULTS ANALYSIS

The analysis begins with ADF and KPSS test. Based on Table 1 and Table 2, the results of unit root tests indicate that all series are stationary at first difference, I(1); hence, it is concluded that no I(2) variables are existed in the analysis.

Variables	Constant without Trend		Constant with Trend	
	Level	First Difference	Level	First Difference
FDI	2.2405	-6.5068***	-2.3827	-7.6811***
ICT	0.3757	-3.0213**	-2.3954	-2.9892*
HC	-1.4879	-6.3666***	-1.1404	-6.6029***
LC	-2.2076	-4.5978***	-2.6583	-4.5016***

**Table 1: Augmented Dickey Fuller (ADF) Test Results.**

Note: \*\*\*, \*\* and \* denote the rejection of null hypothesis at significance level 1%, 5% and 10% respectively. Under ADF test, the null hypothesis refers to the presence of unit root (non-stationary).

Variables	Constant without Trend		Constant with Trend	
	Level	First Difference	Level	First Difference
FDI	2.5827***	0.1479	0.4934***	0.0189
ICT	3.1122***	0.3685	0.3471***	0.3238
HC	1.6168***	0.1868	0.4598***	0.0925
LC	0.5889**	0.1552	0.1536**	0.1254*

**Table 2: Kwiatkowski–Phillips–Schmidt–Shin (KPSS) Test Results.**

Note: \*\*\*, \*\* and \* denote the rejection of null hypothesis at significance level 1%, 5% and 10% respectively. Under

KPSS test, the null hypothesis refers to the absence of unit root (stationary).

The results of ARDL bound test are presented in Table 3. Based on the finding, FDI, HC, LC and ICT reveal a long-run cointegrating relationship since the null hypothesis of no cointegrating is rejected at even 1% level. In Table 4, all variables are statistically significant at 1%, except for HC significant at 10%. This indicates that better ICT development and higher human capital level induce FDI inflows while higher labor cost discourages FDI. The significance of ICT on foreign investment in Singapore could be attributed by the rising global linking and the competitive advantage in the country. The growing usage of ICT such as mobile phone and internet users can pull more foreign investment through “just in time” management. Hence, ICT improves the linkage between customers, producers, suppliers, and firms, lifts up the productivity, and lowers the cost of production of FDI. This finding is in line with the work of Gajjala (2006) and Sinha and Sengupta (2022) where a well-developed ICT facilities allows foreign firm to enjoy a cheaper capital and lift-up the accessibility in international market. As such, ICT expansion is a driver to attract FDI in the host countries. Furthermore, a positive significance of HC suggests that the presence of skilled human resource is a locational advantage to the host country. Skilled labor with high educational level and sufficient training accelerates the technological change and improve the productivity of multinational firms (Kheng, Sun & Anwar, 2017; Kottaridi, Louloudi & Karkalakos, 2019). Hence, countries with higher knowledge and human stock accumulation will be easier in attracting foreign investment, in particular efficiency-seeking FDI (Cleeve et al., 2015), which demands for different input factors to attain a competitive position in international market (Wadhwa & Reddy, 2011). In the vein of labor cost, the result suggests that a lower labor cost encourages more foreign investment, especially labor-intensive FDI or efficiency-seeking FDI. To lift-up the competitiveness in international market, foreign firms are seeking the location to benefit from cheaper factor inputs (Bellak et al., 2008; Vijayakumar, Sridharan & Rao, 2010). Hence, a low labor cost plays an infinite role in attracting foreign investment by making the host nation a desirable destination. The error correction term (ECT) measures the speed of adjustment of FDI towards its long-run equilibrium. Based on Table 4, ECT is negative and significant at 1% level. Therefore, it denotes that FDI, on average, will adjust about 127% towards its long-run equilibrium during the next period.

The results of Granger Causality are presented in Table 5. The findings reveal that there is a unidirectional causal relationship from ICT to FDI, FDI to LC, and LC to HC since the null hypothesis of no granger causality is rejected at 1% and 10% significance level, respectively. Nevertheless, there is no causality between HC and FDI, HC and ICT, and LC and ICT.

Test Statistic	Value	Significance level	I(0)	I(1)
F-statistic	25.4681	10%	2.37	3.20
K	3	5%	2.79	3.67
		1%	3.65	4.66

**Table 3: ARDL Bounds Test Results.**

log(FDI) is dependent variable.

Variables	Coefficient	Standard Error	t-Statistics	p-Value
log(ICT)	0.5565	0.0807	6.8959	0.0001
log(HC)	0.4926	0.2274	2.1666	0.0621*
log(LC)	-4.4078	1.1139	3.9571	0.0042***
C	21.9552	4.7994	4.5746	0.0018***
ECT	-1.2715	0.0920	-13.8207	0.0000***

**Table 4: Estimation of the Long Run Coefficients and Error Correction Term (ECT).**

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

Null Hypothesis	F-Statistics	p-Value	Conclusion
ICT does not Granger Cause FDI FDI does not Granger Cause ICT	6.0444 0.1884	0.0075*** 0.8295	Unidirectional Causality
HC does not Granger Cause FDI FDI does not Granger Cause HC	0.2985 1.2457	0.7447 0.3057	No Causality
LC does not Granger Cause FDI FDI does not Granger Cause LC	1.1407 7.3499	0.3363 0.0032***	Unidirectional Causality
HC does not Granger Cause ICT ICT does not Granger Cause HC	0.8060 0.5972	0.4584 0.5583	No Causality
LC does not Granger Cause ICT ICT does not Granger Cause LC	0.8727 1.4958	0.4307 0.2442	No Causality
LC does not Granger Cause HC HC does not Granger Cause LC	4.52276 0.9076	0.0215** 0.4169	Unidirectional Causality

**Table 5: Granger Causality Test Results**

Note: \*\*\* and \* indicate the rejection of null hypothesis at 1% and 10% significance level respectively.

Tests	Chi-Square	Probability
Jarque-Bera Test	0.6636	0.7176
Breusch-Godfrey Serial Correlation LM Test	4.3524	0.1135
Heteroscedasticity Breusch-Pagan-Godfrey Test	15.7173	0.5440

**Table 6: Diagnostic Tests Results**

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

Table 6 presents the results of diagnostic checking. The p-value of Breusch-Godfrey Serial Correlation LM test and Heteroscedasticity Breusch-Pagan-Godfrey test depicts statistically insignificant at even 1% level. This signifies that there is no serial correlation and no heteroscedasticity in model's residuals. Besides, the insignificance of Jarque-Bera test indicates the residuals are normally distributed. Hence, there is unbiased estimations in the model.

## 5. CONCLUSION

Foreign direct investment (FDI) is an essential part of an open and effective international economic system and a major catalyst to development. FDI was the aspect that policymakers and researchers are particularly paying attention to. The presence of FDI resulted in the high productivity of local firms which directly boosted a nation's economic growth. Besides that, FDI inflows through the provision of new investment, management skills, and technology advancement lead to an increase in economic growth through improvement in the productivity level. FDI also contributes to the technology spillovers of the host nation (Eudelle & Shrestha, 2017). Therefore, the development of ICT, human capital, and labor cost are the crucial aspects that policymakers, researchers, academicians, and international institutions should deepen the study and investigate to enhance FDI flow and improve economic performance. Singapore has emphasized the ICT sectors in its nation and started to embrace the innovation of ICT from the early 1980s until now. Thus, this has motivated this study to investigate whether ICT has affected the inflow of FDI to Singapore. The objective of this study aims to examine the effect between ICT and FDI in Singapore. The findings reveal that all the independent variables were shown to be significant to FDI, however, the ICT was not significant to the FDI. The rapid development of ICT in Singapore associated with inadequacy of manpower in the ICT sector could be the reason for the ICT to be an insignificant effect in attracting FDI to Singapore.

An increasing number of governments want to attract FDI rise because the features associated with FDI increasingly fit the government objectives (growth, poverty reduction). This is based on a perception that the positive effect of FDI especially in term of ICT factors generally outweigh its negative effect. Based on the development objectives, together with the ability to choose the degree of policy intervention and factors endowment can help to determine the FDI's strategy. When the strategy has been determined, there exists an array of possible FDI policies across the entire spectrum to influence FDI to the country. Hence, due to the insignificant effect of ICT on FDI, it suggests that the government may consider increasing the budget to train more professional foreign manpower to produce more ICT expertise and the government should improve the upskilling of the existing ICT workforce. With better ICT infrastructure, it is possible to attract more foreign investors to invest especially from multinational companies (MNCs). In addition, fostering the involvement of private sectors through various incentives may also increase more ICT usage in operations.

## Reference

- Ali, N., & Hussain, H. (2017). Impact of foreign direct investment on the economic growth of Pakistan. *American Journal of Economics*, 7(4), 163-170.
- Almeida, R. (2007). The labor market effects of foreign owned firms. *Journal of International Economics*, 72(1), 75-96
- Addison, T., & Heshmati, A. (2003). *The new global determinants of FDI flows to developing countries: The importance of ICT and democratization* (No. 2003/45). WIDER Discussion Paper. <https://ideas.repec.org/p/unu/wpaper/dp2003-45.html>
- Akbar, I., & Idris. (2020). Determinants of foreign direct investment in ASEAN. *Advances in Economics, Business and Management Research*, 124, 314-318.
- Alraja, M.N., Hammami, S., & Al Samman, H. M. (2016). Investment in ICT in developing countries: The effect of FDI: Evidence from sultanate of Oman. *International Journal of Economics and Financial Issues*, 6(4), 1632-1636.
- Alsan, M., Bloom, D.E., & Canning, D. (2006). The effect of population health on foreign direct investment flows to low- and middle-income countries. *World Development*, 34(4), 613-630.
- Antos, J. (1983). Analysis of labor cost: Data concepts and sources. In E. J. Triplett (Ed.), *The measurement of labor cost*. Chicago, USA: University of Chicago Press.
- Bellak, C., Leibrecht, M., & Riedl, A. (2008). Labour costs and FDI flows into Central and Eastern European countries: A survey of the literature and empirical evidence. *Structural Change and Economic Dynamics*, 19(1), 17-37.
- Belloumi, M., & Touati, K. (2022). Do FDI inflows and ICT affect economic growth? An evidence from Arab countries. *Sustainability*, 14(10), 6293.
- Bhrammanachote, W. (2018). Determinants of foreign direct investment in Thailand: Chinese investors in Chiang Mai, Thailand. *PSAKU International Journal of Interdisciplinary Research*, 7(2), 160-173.
- Blomström, M., & Kokko, A. (2003). Human capital and inward FDI. <https://core.ac.uk/download/pdf/7092079.pdf>
- Cao, X., & Jariyapan, P. (2012). Foreign direct investment, human capital and economic growth of People's Republic of China using panel data approach. *Chiang Mai University Journal of Economics*, 16(1), 36-48.
- Cleeve, E.A., Debrah, Y., & Yiheyis, Z. (2015). Human capital and FDI inflow: an assessment of the African case. *World Development*, 74, 1-14.
- Dewan, S., & Kraemer, K. (2000). Information technology and productivity: Evidence from country-level data. *Management Science*, 46(4), 548-562.
- Dunning, J.H. (1977). Trade, location of economic activity and the MNE: A search for an eclectic approach. In *The International Allocation of Economic Activity*, ed. B. Ohlin, P.O. Hesselborn, and P.M. Wijkman. London: Macmillan.
- Dunning, J.H. (1980). Trade, location of economic activity and the multinational enterprise: Some empirical tests. *Journal of International Business Studies*, 11(1), 9-31.
- Dunning, J.H. (2000). The eclectic paradigm as an envelop for economic and business theories of MNE activities. *Journal of International Business Review*, 9, 163-190.
- Dunning, J.H. (2001). The eclectic (OLI) paradigm of international production: Past, present and future. *International Journal of the Economics of Business*, 8(2), 173-90.
- Dutta, S., & Lanvin, B. (2020). *The network readiness index 2019: Towards a future-ready society*. <https://networkreadinessindex.org/wp-content/uploads/2020/03/The-Network-Readiness-Index-2019-New-version-March-2020.pdf>
- Eckel, C. (2003). Fragmentation, efficiency-seeking FDI, and employment. *Review of International Economics*, 11(2), 317-331.
- Eudelle, P., & Shrestha, A. (2017). Foreign Direct Investment and Economic Growth: The Cases of Singapore and Oman. *Global Policy*, 8(3), 402-405.

- Fakher, A. (2016). The impact of investment in ICT sector on foreign direct investment: Applied study on Egypt. *Review of Integrative Business and Economics Research*, 5(2), 151-166.
- Gajjala, V. (2006). The role of information and communication technologies in enhancing processes of entrepreneurship and globalization in Indian software companies. *The Electronic Journal of Information Systems in Developing Countries*, 26(1), 1-20.
- Gani, A., & Sharma, B. (2003). The effects of information technology achievement and diffusion on foreign direct investment. *Perspectives on Global Development and Technology*, 2(2), 161-178.
- Gholami, R., Lee, S., & Heshmati, A. (2005). The causal relationship between ICT and FDI. <https://www.semanticscholar.org/paper/The-Causal-Relationship-between-ICT-and-FDI-Gholami-Lee/235d758abe6c320558daeef830c08258369b7da8>
- Giakoulas, D., Kottaridi, C., & Manolopoulos, D. (2016). A dynamic OLI paradigm: Complementarities and substitutabilities between ownership and location factors in outward FDI. *Proceeding of the 42nd Annual EIBA Conference Liabilities of Foreignness vs. the Value of Diversity*, Vienna.
- Georg, H., & Greenaway, D. (2002). *Is there a potential for increases in FDI for central and Eastern European Countries following EU accession?* GEP Working Papers, No. 02/031. [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=410813](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=410813)
- Gopinath, M., & Chen, M. (2003). Foreign direct investment and wages: A cross country analysis. *The Journal of International Trade & Economic Development*, 12(3), 285-30.
- Gupta, V. (2017). Exploring the relation between human capital and foreign direct investment- Indian context. *The Journal of Industrial Statistics*, 6(1), 89-107.
- Hanousek, J., Kočenda, E., & Maurel, M. (2011). Direct and indirect effects of FDI in emerging European markets: A survey and meta-analysis. *Economic Systems*, 35(3), 301-322.
- Hussain, M., & Haque, M. (2016). Foreign direct investment, trade, and economic growth: An empirical analysis of Bangladesh. *Economies*, 4(7), 1-14.
- IMD. (2019). *Singapore topples United States as world's most competitive economy*. <https://www.imd.org/globalassets/wcc/docs/release-2019/digital/ind-world-digital-competitiveness-rankings-2019.pdf>
- Karimi, M.S., Yusop, Z., Hook, L.S., & Chin, L. (2013). Effect of human capital on foreign direct investment inflows. *Journal of Economic Research*, 18(1), 79-179.
- Khafidzin, H. (2021). Determinants foreign direct investment (FDI) inflow in ASEAN-8. *Media Trend*, 16(1), 12-18.
- Kheng, V., Sun, S., & Anwar, S. (2017). Foreign Direct Investment and Human Capital in developing countries: A panel data approach. *Economic Change and Restructuring*, 50(4), 341-365.
- Kottaridi, C., Louloudi, K., & Karkalakos, S. (2019). Human capital, skills and competencies: Varying effects on inward FDI in the EU context. *International Business Review*, 28, 375-390.
- Latif, Z., Xin, W., Khan, D., Iqbal, k., Pathan, Z.H., Salam, S., & Jan, N. (2017). ICT and sustainable development in South Asian countries. *Human Systems Management*, 36(4), 353-362.
- Lai, C.Y., & Sarkar, S. (2011). Labor cost and foreign direct investment—Evidence from India. *Indian Journal of Industrial Relations*, 46(3), 396-411.
- Lee, J. W., & Wie, D. (2015). Technological change, skill demand, and wage inequality: Evidence from Indonesia. *World Development*, 67, 238-250.
- Lipsey, R.E. (2004). *Home-and host-country effects of foreign direct investment*. In *Challenges to globalization: Analyzing the economics*. University of Chicago Press: USA.
- Miningou, E.W. & Tapsoba, S. (2020). Education systems and foreign direct investment: Does external efficiency matter? *Journal of Applied Economics*, 23(1), 583-599.
- Mudiyanselage, M.M.R., Epuran, G., & Tescaşiu, B. (2021). Causal links between trade openness and foreign direct investment in Romania. *Journal of Risk and Financial Management*, 14(3), 1-18.

- Noorbakhsh, F., Paloni, A., & Youssef, A. (2001). Human capital and FDI inflows to developing countries: New empirical evidence. *World Development*, 29(9), 1593-1610.
- Onaran, Ö. (2012). The effect of foreign affiliate employment on wages, employment, and the wage share in Austria. *Review of Political Economy*, 24(2), 251-271.
- Osuna, M.A.A. (2016). Human capital formation and foreign direct investment: Is it a nonlinear relationship? <https://www.redalyc.org/journal/416/41647012008/html>
- Petrovic-Randelovic, M., Radjenovic, T., Krstic, B., & Micic, V. (2020). Does the level of human capital matter for FDI in the Western Balkan countries? *Acta Oeconomica*, 70(3), 381-405.
- Pesaran, M.H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.
- Pinas, J., Wei, S., Oppong-Baah, T., & Kim, E., Addai, M., Owusu, I. ... Gyamerah, K. K. (2020). Assessing a causal relationship between foreign direct investment and human capital: The case of the Netherlands. *International Business Research*, 13(1), 247-258.
- Ridzuan, A.R., Ismail, N.A., & Hamat, A.F.C. (2017). Does foreign direct investment successfully lead to sustainable development in Singapore? *Economies*, 5(3), 1-20.
- Quazi, R. (2007). Economic freedom and foreign direct investment in East Asia. *Journal of the Asia Pacific Economy*, 12, 329-344.
- Bayraktar-Saglam, B., & Boke. S.S. (2017). Labor costs and foreign direct investment: A panel VAR approach. *Economies*, 5(36). <https://doi.org/10.3390/economies5040036>
- 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(9). <https://doi.org/10.1186/s12651-020-00273-x>
- Shah, M.H., & Khan, Y. (2016). Trade liberalisation and FDI inflows in emerging economies. *Business and Economic Review*, 8(1), 35-52.
- Sharmiladevi, J. (2017). Understanding Dunning's OLI Paradigm. *Indian Journal of Commerce & Management Studies*, 8(3), 47-52.
- Sinha, M., & Sengupta, P.P. (2022). FDI inflow, ICT expansion and economic growth: An empirical study on Asia-Pacific developing countries. *Global Business Review*, 2, 1-18.
- Suh, T., & Bae, M. (2002). Foreign direct investment inflows and ICT configurations. *Pacific Focus*, 17(2), 213-226.
- Ta, V. L., Do, A. D., Phan, T. U., Nguyen, Q. H., Nguyen, T. T. H., Le, T. D. & Nguyen, T. P. (2021). Factors affecting FDI intentions of investors: empirical evidence from provincial-level data in Vietnam. *Journal of Asian Finance, Economics and Business*, 8(4), 125-134.
- Urata, S., & Kawai, H. (2000). The determinants of the location of foreign direct investment by Japanese small and medium-sized enterprises. *Small Business Economics*, 15, 79-103.
- Veljanoska, F., Axhiu, M. & Husejini, M. (2013). Information communication technology as a determinant of the FDI Flows. *Mediterranean Journal of Social Sciences*, 4(11), 218-225.
- Veeramacheneni, B., Ekanayake, E.M., & Vogel, R. (2007). Information technology and economic growth: A causal analysis. *Southwestern Economic Review*, 34, 75-88.
- Vijayakumar, N., Sridharan, P., & Rao, K. (2010). Determinants of FDI in BRICS countries: A panel data analysis. *International Journal of Business Science and Applied Management*, 5(3), 1-13.
- Wadhwa, K., & Reddy S.S. (2011). Foreign direct investment into developing Asian countries: The role of market seeking, resource seeking, efficiency seeking factors. *International Journal of Business and Management*, 6(11), 219-226.
- Wang, P., & Rukh, B. G. (2021). The Effect of Information Communication Technology (ICT) Infrastructure availability on FDI inflow in D8 Countries. In *E3S Web of Conferences* (Vol. 235, p. 02052). EDP Sciences.
- Whyman, P., & Baimbridge, M. (2009). Labour Market Flexibility as a Key Determinant of Foreign Direct Investment: Evidence from the UK. ed) Blaine, H. *Foreign Direct Investment*. New York: Nova Science.