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Interaction of market size, inflation and trade openness on foreign direct investment inflows in India, China and Japan: panel dynamic analysis

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Abstract: In the world of competitiveness, FDI is considered as a macroeconomic component, and that developing countries are introducing it as a substitute for their larger investment gaps in policies. Fast-growing countries like China, India, and Japan are also no exception to this. Findings from the study confirm the existence of a long-term relationship among the variables. The long-run dynamic equation shows a greater degree of openness and an expansion of market size attracts more FDI in the long run, whilst raising the inflation rate discourages foreigners from investing. In the short run, none of the variables have any sort of significant relationship with the Granger causality test, giving an interesting insight that unidirectional causalities exist with the remaining variables, which run from FDI to trade openness. In a nutshell, FDI helps to sustain the economies of these countries through its multiplier impact on other macroeconomic factors.

Keywords: foreign direct investment; FDI; inflation; market size; trade openness; India; China; Japan.

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1 Introduction

Foreign direct investment (FDI) is regarded as one of the most desirable economic development indicators across the world. Beginning with the liberalisation and global integration period, developing nations are trying to make their economies more accelerative, prosperous, and sustainable by easing their business structures and policies to invite foreign investment (Asghar et al., 2011; Singhania and Saini, 2019; Kaushik and Singh, 2021). Since developing countries are always plagued by a lack of domestic investment, this kind of capital inclusion in the economy will be a blessing for them. In today's world in the name of economic aid, any kind of development cooperation or low-interest loan imposes a debt burden on a country. The efficacy of FDI is there in that it not only supplies capital to the economy in a lucrative way but also expedites the economy through job creation, introducing advanced technologies, increasing aggregate tax earnings, which is one of the main sources of income for these governments, and other spillover effects (Singh and Dave, 2013; Tan et al., 2016). As a subsequence, it leads toward potential and sustainable economic growth. As a result, in order to attract substantial foreign investment, governments and policymakers in developing countries prioritise respective policies in a way that makes their economies appear more competitive and business-friendly than others.

According to UNCTAD (2020), in 2019, developing economies received 685 billion dollars, which was 44.48% of the total share of FDI inflows around the world. Of these, the two Asian giants, China and India, alone acknowledged 141 and 51 billion dollars, respectively. The reason behind such an agglomeration of these two emerging nations is their promising economies. These two nations are the second and sixth-largest economies in the world. Their enormous population size reflects huge national demand. Higher economic growth, stable inflation, low labour costs, better infrastructure facilities, raw material availability, and cultural diversity are other economic features that would easily entice multinational corporations to establish branches in China and India. On the other hand, Japan is the third-largest economy. But excessive regulation, a stagnant rate of economic growth, business barriers, and cultural and linguistic challenges impede the inflow of foreign capital. In 2019, the FDI inflow in Japan was 14.5 billion, which is far inferior to its capability (UNCTAD, 2020). The affirmative side of Japan's economy consists of strong domestic demand, skilled manpower, a stable political situation, and advanced technologies (Santandertrade, n.d.). China, India, and Japan are considered emerging economic superpowers all over the world. Their ease of doing business ranks were 46, 77, and 39, respectively, in 2019 (WB, 2019). As these countries are moving

forward rapidly and are the recipients of 30.14% of the total FDI share, their cases easily become research interests for digging out the economic factors that are acting as significant determinants of FDI in these regions.

Whatever the reason, trade openness has a particular contribution to raising export and import volumes. Improvements in the service sectors and technological innovation have been driven by trade openness. It has contributed to raises the knowledge sharing strategies, job creation strategies, and poverty alleviation strategies (Mrinalini, 2009). The production level of domestic farms has achieved economies of scale by considering technology, which is highly influenced by trade openness. The business environment for businesses is important for seeking investments like FDI (Shravani and Sharma, 2020). Trade openness has played a significant role in the Indian economy after economic reform in 1990, when China realised the importance of trade openness early in 1978. Global business cooperation among India, China, and Japan has been attained due to regional and cultural strength, which helps reduce trade restrictions.

The key objective is to establish a new panel investigation on FDI comprising India, China, and Japan, to investigate the impact of market size, inflation, and trade openness on FDI in this panel. The independent variables are investigated in order to attract more FDI among the studied countries. Moreover, the empirical methodology has investigated the short-term and long-term impacts through the VECM method and causality approach. This study contributes to the field of FDI policies, FDI, and macroeconomics interrelations in a giant economy like China, Japan, and India where those nations are highly involved in FDI all over the world.

2 Literature review

Undoubtedly, searching for the effective determinants of FDI is not a new thing. In the last three decades since the liberalisation phase, it has become an object of attraction for almost all countries, playing a significant role in the economies of most countries. In this section, we have discussed the previous studies regarding the issues in two parts. Firstly, literature related to the study area will be brought under the microscope. Lastly, in the context of other countries, macro-economic variables that act as influencing factors will be focused. There have been many studies regarding China and India, as both of them are among the very few fast-growing economies. However, there are many disagreements among scholars about the functionality of their determinant. Using the pooled least square method, Jiang et al. (2013) analysed data from 30 provinces of China for the period of 1985 to 2006 and found that market size is the largest dominant factor in attracting FDI. His research further reveals that China is at the top of investors' favour due to its improved infrastructure and a greater degree of openness. But human resources and the innovative environment have proven to be insignificant in his research, which conflicts with the results obtained by others. For example, according to Ho (2004), 0.66 percent increases in FDI inflows would be driven by an increase in the percentage of an innovative environment, which is also significant. Vadra (2015) implies the FDI prospects between India and BRICS countries. The determinants of business and investment opportunities have been measured by Dwivedi et al. (2014) in India. To see the particular effect after affiliation to the WTO, Na and Lightfoot (2006) investigated data for the year 2002 for 30 provinces and came up with the same result as Jiang et al.

(2013). Here, market size was also revealed as the most striking factor, and openness was the second most impactful factor. A thought-provoking study was carried out by Sun et al. (2002), where they perceived the behaviour of some cognitive factors causing foreign capital inflows to change over time. As an analogy, after the year 1991, market size had a significant relationship which was not significant before 1991. On the other hand, wages turned to be negative in the previously positive relationship. However, studies conducted in India are somewhat ambiguous. Some of them have found a significant relationship between market size and FDI (Kaur and Sharma, 2013; Adhikary, 2017; Sahoo et al., 2014; Singhania and Gupta, 2011; Chakraborty and Nunnenkamp, 2008), while some of them could not even locate something like it (Tripathi et al., 2015; Zheng, 2009). Singh and Singh (2018) indicate that, inflation is one of the major determinants of market size and product pricing in India. To clarify this, in Zheng's (2009) point of view, it is expected market growth which is more appreciatable than the current market size while thinking about investing in India. Interestingly, in Iqbal's (2018) examination, market size, openness, and market soundness do not assume a noteworthy part in FDI fascination, which is not consistent with the theory. In addition, an asymmetric inspection was carried out by Sharma and Kautish (2020) revealed that a positive variation seems to have no noteworthy influence on attracting foreign investors but a plummeting movement causes a shrink in FDI inflow. In other words, for India, foreign investors pay more attention to the degree of economic sluggishness rather than a boom. There are very few significant studies that explore the correspondence between macroeconomic variables and FDI regarding Japan. An inquisition of Hara and Razafimahefa (2005) is one of them. They tried to scrutinise some potential indicators which might have some association. In line with other literature, it also related to the size of the economy as being a salient factor. Furthermore, a contraction in price levels which could be generated due to recessions could create the environment for the entry of more foreign capital by pushing local firms towards bankruptcy. It is not suitable for the economy. Moreover, the summary of the literature review for the relevant issues has been presented in Table 1.

3 Methodology

This study considers a panel data analysis based on the time period 1985 to 2019 for the selective cross-section unit. FDI is defined as net inflows (BoP, current US dollars), INF as the form of inflation, GDP deflator (annual%), MSIZ as the market capitalisation of listed domestic companies (current US dollars), and TOP as trade (% of GDP) for the specific economy. The data series was collected from world development indicators published by the World Bank (WB).

3.1 Econometric model specification

The econometric model specification defined the functional form like that:

$$FDI = f(INF, TOP, MSIZ) \tag{1}$$

Table 1 Literature reviews

Author(s)	*Study region(s) and time span*	*Methodology*	*Variables independent*	*Findings*	*Elasticity*
Jadhav (2012)	BRICS (2000 to 2009)	Multiple regressions	Market size, natural resource availability, corruption, rule of law, voice and accountability, inflation rate, trade openness, political stability no violence, government effectiveness, and regulatory quality.	Relegating variables into three determinant groups, it has come to light that political and institutional determinants were less momentous in explaining the inflow of FDI than macroeconomic determinants.	Inflation – positive (insignificant) market size – positive (significant) trade openness – positive (significant)
Ibrahim and Hassan (2013)	Sudan (1970 to 2010)	Vector error correction model (VECM), Granger causality test	Market size, inflation rate, indirect tax rates of the host country, exchange rate, investment incentive policy, and openness.	Causal relation only goes from market size to FDI but the reverse is improbable.	Inflation – negative (significant) market size – positive (significant) trade openness – positive (significant)
Liargovas and Skandalis (2012)	36 developing countries (1990 to 2008)	Panel least squares regression	Exchange rate stability, GDP, per capita GDP, trade openness, and political risk rating.	Opening economies for developing countries could have an affirmative influence on FDI inflows.	Openness – positive (significant) market size – positive (significant)
Xaypanya et al. (2015)	8 ASEAN countries (2000 to 2011)	Panel ordinary least square	Real exchange rate, inflation rate, GDP, the number of telephone lines, level of openness, official development assistance, and loan for the country development.	Among the countries, comparatively developed were still able to attract foreign investment even though their macroeconomic situation was not stable. This was possible because of the size of the economy and better infrastructure facilities. On the other hand, less developed had the potentials to bring investment from foreign territories with a greater degree of openness.	Less developed: market size – positive (insignificant) openness – positive (significant) inflation – negative (significant) Comparatively developed: market size – positive(significant) openness – negative (significant) inflation – positive (significant)
Ravinthirakumaran et al. (2015)	Sri Lanka (1978 to 2013)	ARDL	Market size, trade openness, infrastructure, exchange rate, real wage, inflation, and political instability.	Findings explain that ceteris paribus, 1% increase in market size and openness would be the cause for 1.61 and 4.47% upsurge in FDI inflows respectively whereas price has no significant impact in the long run.	Market size – positive (significant) trade openness – positive (significant) inflation – negative (insignificant)

Source: Author's selection

Table 1 Literature reviews (continued)

Author(s)	*Study region(s) and time span*	*Methodology*	*Variables independent*	*Findings*	*Elasticity*
Aziz and Mishra (2016)	16 Arab economies (1984 to 2012)	GMM	Market size, GDP growth, trade openness, inflation, exchange rate, education, total oil supply, financial development, government stability, investment profile, and corruption.	Being resourceful countries, Arab economies have a great opportunity to attract FDI. Therefore, degradation of trade barriers, expansion of privatisation, and ensuring institutional quality, these issues need to be carefully monitored and implemented in economic policies to create a place of confidence for investors.	Market size – positive (significant) trade openness – positive (significant) inflation rate – positive (significant)
Kumari and Sharma (2017)	20 developing countries from South, East, and South-East Asia (1990 to 2012)	Panel regression	Market size, trade openness, infrastructure, inflation rate, interest rate, research and development, and human capital.	Countries with a bigger market size, liberal trade policies, and a large number of human capitals, like India and China, enjoy a bulk amount of FDI inflows.	Market size – positive (significant) trade openness – positive (insignificant) inflation rate – negative (significant)
Mishra (2018)	India (1970–1971 to 2015–2016)	VECM and causality test	Electricity, economic growth determinants.	Unidirectional cause found from GDP to electricity.	Growth determinants influenced by energy consumption
Saleem et al. (2020)	Pakistan (1980 to 2016)	Auto-regressive distributed lag (ARDL), Granger causality test	Real GDP, real exchange rate, rate of inflation; degree of openness, degree of political risk, and institutional quality.	This study confirmed there is bi-directional causality of FDI with market size and inflation. On the other hand, the relationship between openness and FDI is unidirectional which goes from openness to FDI.	Market size – positive (significant) trade openness – positive (significant) inflation rate – negative (significant)

Source: Author's selection

Table 1 Literature reviews (continued)

Author(s)	*Study region(s) and time span*	*Methodology*	*Variables independent*	*Findings*	*Elasticity*
Ngo et al. (2020)	Vietnam (2000 to 2019)	Generalised methods of moments (GMM) and pooled mean group (PMG)	Market size, labour force, skilled labour, macroeconomic policy, infrastructure, trade openness, and macroeconomic stability.	Despite keeping the market open for many years, Vietnam is failing to attract the attention of developed countries due to its economic instability and market imperfection. So in the long-run trade openness has no substantial effect. Rather market size and skilled labour are having a comparatively greater impact on FDI attraction.	Market size – positive (significant) openness – negative (insignificant) inflation – negative (significant)
Hossain (2021)	Bangladesh (1975 to 2015)	ARDL	Per capita GDP, current account balance, export, import, total reserve of foreign currency, real interest rate, electricity production, and fixed telephone subscribers.	Despite being a developing country, Bangladesh has been experiencing a higher growth rate in recent years. Besides that its business and technological atmosphere are improving. That is why foreign investors find it secure enough to drop their money.	Market size – positive (significant)
Mudiyanselage et al. (2021a)	Romania (1997 to 2019)	ARDL, Granger causality test	Per capita foreign direct investment inflows, GDP, real effective exchange, trade openness, inflation, and labour force with advanced education.	This study found that due to the inefficiency of the economy greater trade openness in the Romanian economy resulted in attracting less FDI. Besides that, a unidirectional causality ran from the FDI to openness.	Market size – positive (insignificant) openness – negative (significant) inflation – negative (insignificant)

Source: Author's selection

The functional form of the econometric model helps to build the conceptual framework, which implies on dependent and independent variables. From equation (1), inflation, trade openness, market size consider to determinate FDI in particular panel section. Whatever, to show the causality relationship we use the simple linear equation model of the production function.

$$FDI_{it} = \beta_0 + \beta_1 INF_{it} + \beta_2 TOP_{it} + \beta_3 MSIZ_{it} + \varepsilon_{it} \tag{2}$$

After taking the log, the model has been developed in equation (3)

$$LNFDI_{it} = \beta_0 + \beta_1 LNINF_{it} + \beta_2 LNTOP_{it} + \beta_3 LNMSIZ_{it} + \varepsilon_{it} \tag{3}$$

where β_0 is intercept term, β_1, β_2, β_3 are presents the regression coefficients. t presents the time, i presents cross-section unit and ε_{it} presents error term.

3.2 Unit root process

Whatever test of the unit root must be checked to verify the stationarity of the variables. Owing to their non-stationarity, macroeconomic and financial data are well known. The existence of the unit root of the variables can be defined in many ways. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are commonly used. This study focused on the ADF, PP and Im, Pesaran and Shin test for analysis to test the presence of unit root and found that all variables are at levels non-stationary and can therefore not be regressed without making them stationary. The estimated equation for the unit root process is presented in equation (4)

$$\delta Y_{it} = \vartheta_1 + \vartheta_{2,t} + \varphi(Y_{it-1}) + \alpha_t \sum_{i=1}^{f} \delta Y_{it-1} + \varepsilon_{it} \tag{4}$$

where ε_{it} is an error component and δY_{it-1} is the lagged choice criteria.

When both series are incorporated in the same order, we proceed to the next stage by using the AIC and SIC criteria to assess the lag length and analyse the existence of cointegration (order of VAR). Many potential cointegration tests, like the Engle and Granger method or the Johansen approach, were employed to analyse the cointegration. Engle and Granger's bivariate approach is very limited since it can only be extended if there is only one co-integrating interaction.

3.3 Cointegration and error correction process

The Johansen cointegration test decides the number of vectors of equations that co-integrated. It is made up of two separate statistics of probability ratio (LR): the statistics of trace and the statistics of maximum eigenvalue.

$$Y_{it} = \alpha_t + \tau X_{it} + \epsilon_{it} \tag{5}$$

where α_t and τ are the parameters and ϵ_t is residual where $i = 1, \ldots, N$ and $t = 1, \ldots, T$. The Y_{it} is presents for dependent variable and X_i presents the independent variables for presenting the cointegration relations. Moreover, we need to analyse the VECM findings to assess the course of causation and differentiate between 'short-run' and 'long-run' causality. You can write the error correction model using the following equations.

$$\Delta Y_{it} = \beta_{10} + \sum_{1}^{K11} \beta_{11i} \Delta Y_{it-i} + \sum_{1}^{K12} \beta_{12j} \Delta X_{it-j} + \sum_{1}^{K13} \beta_{13n} \Delta Z_{it-n} + \sum_{1}^{K14} \beta_{14p} \Delta V_{it-P} + \beta_{15} ECT_{it-1} + \mu_{1it} \tag{6}$$

$$\Delta X_{it} = \beta_{20} + \sum_{1}^{K21} \beta_{21j} \Delta X_{it-j} + \sum_{1}^{K22} \beta_{22i} \Delta Y_{it-i} + \sum_{1}^{K23} \beta_{23n} \Delta Zi_{t-n} + \sum_{1}^{K24} \beta_{24p} \Delta V_{it-P} + \beta_{25} ECT_{it-1} + \mu_{2it} \tag{7}$$

$$\Delta Z_{it} = \beta_{30} + \sum_{1}^{K31} \beta_{31j} \Delta X_{it-j} + \sum_{1}^{K32} \beta_{32i} \Delta Y_{it-i} + \sum_{1}^{K33} \beta_{33n} \Delta Z_{it-n} + \sum_{1}^{K34} \beta_{34p} \Delta V_{it-P} + \beta_{35} ECT_{it-1} + \mu_{3it} \tag{8}$$

$$\Delta V_{it} = \beta_{40} + \sum_{1}^{K41} \beta_{41j} \Delta X_{it-j} + \sum_{1}^{K42} \beta_{42i} \Delta Y_{it-i} + \sum_{1}^{K43} \beta_{43n} \Delta Z_{it-n} + \sum_{1}^{K44} \beta_{44p} \Delta V_{it-P} + \beta_{45} ECT_{it-1} + \mu_{4it} \tag{9}$$

where Y_t, X_t, Z_t and V_t represent FDI, INF, MSIZ, and TOP respectively and μ_{it} the error term that follows a white Gaussian noise. The term i means cross-section unit and t means time dynamics. In addition, the differential operator and the error correction term are respectively presented by Δ and *ECT*. In the short term, the importance of coefficients (β_i) of the explanatory variables is referred to as the existence of causality.

3.4 Causality approach

Finally, this study has been conducted a Granger causality approach to determine the causal link between the variable. The developed equation for Granger causality for time series estimations has been presented in equation (10).

$$\vartheta X_{it} / \vartheta Y_{it} = \theta_0 + \sum_{z=1}^{k} \theta_{tz} X_{it-1} + \sum_{z=1}^{k} \varphi_z Y_{it-1} + \mu_{it} \tag{10}$$

where t is the time, i is the cross section unit and ϑ is the 1st differences operator, The causal shows assumed X and Y variables. Whatever, if the X and Y cause to each other, it will be called bidirectional causality, if X cause to Y or vies versa individually it will be called unidirectional causality.

4 Result and discussion

In this section, the findings of various analyses will be showcased and discussed according to our objectives. In Table 2, descriptive statistics of the study variables are portrayed. Here, all variables are converted into their natural logarithmic form to make the analysis more concise. The mean value of LNFDI is greater than all, which is 24.20, and the larger gap between minimum and maximum value is held by LNMSIZ, which is 25.61. Besides that, with the help of the Jarque-Bera test, it is made certain that data for study variables is normally distributed except for LNFDI. The residual cross-section

dependence test is utilised for assessing whether the dataset would follow the first or second-generation panel data analysis. All the test statistic values from Table 3 fail to reject the null hypothesis of no cross dependency. So it advocates going for first-generation panel analysis. Therefore, the detection of having stationarity or not of the variables is a must to move forward in any kind of time-series data analysis. As this set of panel data consists of annual time series data from three different countries, it will also follow the same procedure. To put it precisely, the stationarity of a series means having static and stable mean and variance values over time. So not being stationarity could create serious bias or misleading results, which is unacceptable. In Table 4, three kinds of panel unit root tests have been performed. They are the Im, Pesaran, and Shin tests, the ADF – Fisher tests, and the PP – Fisher tests. The results explain that all of the respective variables are non-stationary at their level as all of them fail to reject the null hypothesis of a unit root. Where all of their w-stat and chi-square values are not significant at the 5% level. But the first differenced value of the variables can reject the null hypothesis. Hence, all of the variables are integrated at their first order, $I(1)$. Then, as one of our objectives is to identify whether there is any kind of long-run relationship, we have to see if the variables are cointegrated or not. For this concern, the Johansen cointegration test has been employed. Table 5 demonstrates that the hypothesis of no cointegrating equation is rejected at a 10% level and at most 1 cointegrating equation is accepted as its probability value is way higher than the 10% significance level. In brief, there is at least one cointegrating equation in our analysis, and it reveals the existence of long-run relations among variables. In the selection of lag length in Table 6, VAR lag length criteria have been carried out by using the likelihood ratio (LR) test, last forecast error (FPE), Akaike information criteria (AIC), Schwarz information criteria (SC), and Hannan Quinn information criteria (HC). Detecting these criteria, it can be said that all of them suggest considering the maximum lag length is 1. Now, to avoid misspecification problems while choosing a model to test in panel data analysis, the Hausman (1978) test has been put in. It is used for comparing the fixed effect model and random effect model and finding out the right for analysis. The null hypothesis of this test is that random effects are the best and the result of Table 7 shows that rejecting the null hypothesis. So, a fixed effect is best for our further analysis. The output of Table 8 shows the linear relationship between the independent variable and the dependent one. The coefficient for the market size is insignificant. As a result, there is no significant impact on market size. Trade openness has a positive impact on FDI while inflation has an inverse relationship where the estimated R-square and adjusted R-square is 0.85 and 0.84 respectively. By estimating the VECM approach, long run and short run dynamics of the variables are extracted and outcomes are described in Tables 9 and 10. In the case of long run dynamics, whatever the signs are held by the variables are going to be reversed. As we have used e-views for the analysis, it came up with the long run dynamic equation as following.

$$0.11\,ect = LNFDI + 1.75\,LNINF - 1.79\,LNTOP - 0.04\,LNMSIZ - 18.72$$

But when it is time for discussing the result, it should be like the following

$$LNFDI = -1.75\,LNINF + 1.79\,LNTOP + 0.04\,LNMSIZ + 18.72 - 0.11\,ect$$

So the sign of each coefficient will be reversed. All of the respective coefficients in the long run dynamic equations are statistically significant at the 5% level and consistent

with the theory as well. If inflation goes up by one unit, FDI will deteriorate by 1.75 units in the long run. It indicates that the worse the macroeconomic stability is, the lower the amount of FDI will be attracted. On the other hand, both trade openness and market size have a positive impact on FDI. In the long run, the per unit change in trade openness and market size will help to raise FDI by 1.79 and 0.04 respectively. As the world market is becoming more integrated across geological borders, developing countries are searching for sources to get more capital to improve their production levels, while developed nations are looking for a larger market with cheaper input prices and greater degrees of openness (Tripathi et al., 2015). In this study, the trade openness variable has a larger impact on FDI. Conversely, market size seems to have a lower impact in China, India, and Japan, which are big economies. So it regulates the thought that there may be other microeconomic variables whose status has become the centre of attraction for foreign investors. The result of long-run dynamics is consistent with Ranjan and Agrawal (2011), Vijayakumar et al. (2010) and Shah and Ali (2016). After that, the short-run dynamics have also been extracted. In the short run, there is no significant relationship between FDI and market size. However, the other two hold the same relationship with FDI. Furthermore, the coefficient of error correction term is negative and significant. The error correction term is –0.11, which means that at a speed of 11% it adjusts the shock of short run dynamics. Besides, it ensures the presence of long-run causality among the variables. On top of that, the short-run causality has been checked. None of the hypotheses can be rejected where short-run causality is shown in Table 12. Subsequently, there is no short-run causality among the variables. The null hypothesis of this causality test is, H_0 = there is no short-run causality. Finally, the pair-wise Granger causality test has been analysed to investigate the direction of the causal relations among variables where the result is presented in Table 13. The null hypothesis of Granger causality is no causality between the variables. There is causality between FDI and inflation and FDI and openness. But there is no sign of causality between FDI and the market size. This is in line with Belloumi (2014), Naveed and Shabbir (2006), Jayachandran and Seilan (2010), Bhattacharya and Mukherjee (2016), Coban and Yussif (2019) and Asghar et al. (2011). But the findings of Chowdury and Mavrotas (2005), Banday et al. (2021), Akadiri et al. (2020) and Flora and Agrawal (2017) oppose that. FDI and inflation have a unidirectional causality that runs from FDI to inflation.

Table 2 Descriptive statistics

Criteria	*LNFDI*	*LNINF*	*LNMSIZ*	*LNTOP*
Mean	24.20	0.95	12.53	3.62
Median	24.28	1.16	4.52	3.74
Maximum	26.10	2.20	28.48	4.17
Minimum	22.03	–2.37	2.87	2.77
Std. dev.	0.98	1.08	11.42	0.43
Skewness	–0.08	–1.13	0.60	–0.80
Kurtosis	2.60	3.92	1.36	2.27
Jarque-Bera	0.32	10.36***	7.16**	5.39*
Sum	1,016.31	40.03	526.42	151.85
Sum sq. dev.	39.60	47.61	5,350.48	7.74

Notes: ***, ** and * denote 1%, 5% and 10% level of significance.

Source: Author's estimation

Table 3 Residual cross-section dependence test

Test	*Statistic*	*d.f.*	*Prob.*
Breusch-Pagan LM	6.35	3.00	0.10
Pesaran scaled LM	0.14		0.89
Pesaran CD	–0.16		0.88

Source: Author's estimation

Table 4 Unit root test result

At level	*LNFDI*	*LNTOP*	*LNMSIZ*	*LNINF*
Im, Pesaran and Shin W-stat	–1.27	1.50	–0.75	0.20
ADF – Fisher chi-square	10.57	3.28	7.57	6.96
PP – Fisher chi-square	13.97	7.92	10.15	4.40
At 1st difference	*LNFDI*	*LNTOP*	*LNMSIZ*	*LNINF*
Im, Pesaran and Shin W-stat	–4.54**	–3.62**	–3.23**	–2.35**
ADF – Fisher chi-square	29.47**	23.37**	22.24**	12.22**
PP – Fisher chi-square	139.75**	43.93**	82.91**	33.47**

Note: ** presents 5% significance level.

Source: Author's estimation

Table 5 Johansen cointegration test

Hypothesised no. of CE(s)	*Fisher stat. (from trace test)*	*Prob.*
None*	11.08	0.0850
At most 1	7.623	0.2670
At most 2	8.806	0.1848
At most 3*	12.09	0.0600

Source: Author's estimation

Table 6 Lag selection criteria

Lag	*LogL*	*LR*	*FPE*	*AIC*	*SC*	*HQ*
0.00	–500.25	NA	14.23	14.01	14.13	14.06
1.00	–203.06	553.11*	0.005*	6.196*	6.828*	6.44*
2.00	–194.18	15.53	0.01	6.39	7.53	6.85
3.00	–185.96	13.48	0.01	6.61	8.25	7.26

Note: * presents 5% significance level.

Source: Author's estimation

Table 7 Correlated random effects – Hausman test

Test summary	*Chi sq. statistic*	*Chi sq. d.f.*	*Prob.*
Cross-section random	79.64	3	0.00

Source: Author's estimation

Table 8 Panel ordinary least square (POLS)

Variable	*Coefficient*	*Std. error*	*t-statistic*	*Prob.*
LNFDI (dependent variable)				
LNINF	–0.61	0.12	–5.27	0.00
LNTOP	3.31	0.33	10.01	0.00
LNMSIZ	0.02	0.01	1.45	0.15
C	12.37	1.08	11.49	0.00
R-squared		0.85		
Adjusted R-squared		0.84		
Akaike info criterion		2.49		
Schwarz criterion		2.66		
Hannan-Quinn criter.		2.56		
F-statistic		96.67		
Prob. (F-statistic)		0.00		

Source: Author's estimation

Table 9 The long-run dynamics

Variable	*Coefficients*
LNFDI (dependent variable)	
LNINF(–1)	1.75**
	–0.17
	[10.39]
LNTOP(–1)	–1.79**
	–0.46
	[–3.92]
LNMSIZ(–1)	–0.04**
	0.02
	[–2.18]
C	–18.72

Notes: Standard errors in ( ) and t-statistics in [ ].

Source: Author's estimation

Table 10 Vector error correction estimates

Error correction	*D(LNFDI)*	*D(LNINF)*	*D(LNTOP)*	*D(LNMSIZ)*
LNFDI (dependent variable)				
*CointEq*1	–0.11	–0.33	–0.03	–0.18
	–0.05	–0.07	–0.01	–0.38
	[–1.99]	[–4.40]	[–3.06]	[–0.48]
D(*LNFDI*(–1))	–0.18	0.21	–0.02	–0.55
	–0.12	–0.16	–0.02	–0.83
	[–1.49]	[1.28]	[–0.67]	[–0.66]

Notes: Standard errors in ( ) and t-statistics in [ ].

Source: Author's estimation

Table 10 Vector error correction estimates (continued)

Error correction	*D(LNFDI)*	*D(LNINF)*	*D(LNTOP)*	*D(LNMSIZ)*
LNFDI (dependent variable)				
D(*LNINF*(–1))	–0.10	0.28	0.02	–0.17
	–0.10	–0.14	–0.02	–0.71
	[–1.00]	[2.06]	[1.02]	[–0.23]
D(*LNTOP*(–1))	0.67	0.08	0.14	5.27
	–0.60	–0.81	–0.12	–4.12
	[1.11]	[0.09]	[1.15]	[1.27]
D(*LNMSIZ*(–1))	0.00	0.00	0.00	–0.04
	–0.02	–0.02	0.00	–0.12
	[0.06]	[0.11]	[1.32]	[–0.29]
C	0.15	–0.09	0.02	0.35
	–0.06	–0.07	–0.01	–0.38
	[2.79]	[–1.20]	[2.17]	[0.92]

Notes: Standard errors in ( ) and t-statistics in [ ].

Source: Author's estimation

Table 11 Long run causality

	Coefficient	*Std. error*	*t-statistic*	*Prob.*
C(1), (ECT)	–0.11**	0.05	–2.09	0.04
C(2)	–0.15	0.11	–1.39	0.17
C(3)	–0.05	0.09	–0.52	0.60
C(4)	0.39	0.52	0.75	0.46
C(5)	0.00	0.02	0.11	0.91
C(6)	0.15***	0.05	2.92	0.00

Notes: ** and * presents 5% and 10 significance level respectively.

Source: Author's estimation

Table 12 Short run causality to FDI

	T stat.	*Pro.*	*Decision*
Inflation to FDI	–0.52	0.60	Failed to reject H_0
Trade openness to FDI	0.75	0.46	Failed to reject H_0
Market size to FDI	0.11	0.91	Failed to reject H_0

Source: Author's estimation

According to long run dynamics, FDI holds an inverse relationship to inflation. As the unidirectional causality goes from FDI to inflation, it means foreign investment lowers the price level of the country by helping to expand the level of production. If production booms, as a consequence, the price level will be lower than before as there will be more supplies than in the earlier period. This outcome is consistent with Bekhet and Al-Smadi (2014) and Mustafa (2019). On the contrary, Amoah et al. (2015) and Musyoka and Ocharo (2018) find that there is no causal relationship between FDI and inflation. The

causality between FDI and trade openness is similar to the earlier one. In other words, FDI causes trade openness. When a country's total output is facilitated by FDI, then there are opportunities to grow more output than before. As a result, after meeting domestic demand, it is possible to increase the amount of exported. Foreign investment is also directed towards the export dedicated sectors by EPZ. Therefore, it will boost the aggregate export amount. When it starts happening, the nation will automatically ease its trade barriers to earn more foreign capital, which is also beneficial for it. A similar unidirectional relation was also found by Ghosh (2007), Mudiyanselage et al. (2021a), Pourshahabi et al. (2013), and Sunde (2017). But this is contradictory to Tsaurai (2015) and Bhattacharya and Mukherjee (2016).

Table 13 Pairwise granger causality tests

Null hypothesis	*F-statistic*	*Prob.*	*Decision*
LNINF ≠ LNFDI	1.74	0.18	Unidirectional
LNFDI ≠ LNINF	4.10**	0.02	
LNMSIZ ≠ LNFDI	0.35	0.70	No causality
LNFDI ≠ LNMSIZ	0.05	0.95	
LNTOP ≠ LNFDI	0.77	0.47	Unidirectional
LNFDI ≠ LNTOP	2.86*	0.06	
LNMSIZ ≠ LNINF	0.51	0.60	No causality
LNINF ≠ LNMSIZ	0.01	0.99	
LNTOP ≠ LNINF	1.21	0.31	No causality
LNINF ≠ LNTOP	0.09	0.91	
LNTOP ≠ LNMSIZ	0.71	0.50	Unidirectional
LNMSIZ ≠ LNTOP	3.078**	0.05	

Notes: '≠' presents 'does not Granger cause'; ** and * presents 5% and 10 significance level respectively.

Source: Author's estimation

5 Conclusions

The key purposes of the study are to identify the long-run dynamic relationships and to find out the direction of the causal relationships among FDI, market size, openness, and inflation for the three FDI recipient kingpins of the world economy; China, India, and Japan, using panel data for the sample period 1985–2019. Here, the panel's ordinary least square confirms that, except for market size, other regressors are linearly related to FDI with higher significance. Thereafter, the Johansen co-integration test has been applied to examine whether the variables of interest pose a long run relationship with each other, and it ensures the long run association by rejecting the null hypothesis of no co-integration. Subsequently, this result paves the way for concern about the short-run and long-run dynamics of the study variables. In probing for the before-mentioned issue, the VECM approach shows that none of the variables have an impact on FDI in the short run. The error correction term is negative and highly significant, which tells us how quickly the short run dynamics converge to equilibrium. A normalised long-run dynamics

has also been extracted within this process, where all the variables have a significant impact on FDI. Market size and trade openness have a positive impact in the long run. The lower volume of the coefficient indicates how small an effect the market size has on FDI in the long run. Inflation has a negative impact on FDI, which is in line with the theory. Subsequently, the Granger causality test has been performed to explore pairwise causal relationships. The most striking result is that there is no causal relationship between market size and FDI. On the other hand, trade openness and inflation have unidirectional causalities with regard to FDI. Both of these causal relations run from FDI to them. All of these results and discussions are the consequence of the panel study. For countries like China, India, and Japan, which have larger economies and vast populations, questions could be raised about the result of causalities between market size and FDI. This may point toward an indirect relationship between them. During the study period, China and India had good GDP growth rates, but the growth rate of Japan was not significant enough, which could also have an impact on the analysis. A larger market size will attract more FDI when other macro-economic variables remain stable and help to produce sustainable output growth. Indicators like productivity and technology transfer are the most frequent channels to boost the total output with the help of foreign investment and vice versa. Besides that, policies in India and China are being generated by taking the geo-political issues under consideration into consideration. In addition to, political stability inside those countries does not remain stable at all. It could bring mental peace to the hard-core nationalist politicians, but ultimately have an adverse effect on the country's economy. We believe that the sovereignty aspect of one's own country must be considered in any case. But it should not be used at all to block the economic potential of the country by implementing issues related to the interests of a few people. In addition to market size, infrastructure, labour cost, corporate tax, interest rate, exchange rate, and institutional quality may have a greater impact on attracting FDI in these countries. In other words, the investment climate may be better in these countries than in other developing nations. The inflow of foreign investment into a country could create lots of opportunities like employment, raising socio-economic status, introducing advanced technologies, encouraging economic growth, and so on. That is why it can be assumed that there may not be any adverse effect of FDI. China and India, no matter how large in size and population, still carry the status of developing countries. Therefore, investment and capital inflow are blessings for these countries for overall development. Though Japan is a developed nation, its macroeconomic situation is not stable. Lower economic growth, the absence of frequent price levels, and economic sluggishness could easily discourage foreign investors. But its degree of openness is appraisable. Overall, policies should be created to provide a more investment-friendly environment by taking consideration of these macro-economic indicators' action and structural changes should be made in a manner to way out sustainability and stability of the economy. The contributions of this study indicate the new panel considering the studied country, which may help to seek more FDI, share of capital, and innovations. The considerable determinants of FDI help to create new windows in respective areas through the enhancement of economic growth and development. Another future research scope can be the analysis of this particular sample in an asymmetric way so that there could be a more robust result by making available the positive and negative variation of each regressor and stretching out their impacts.

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