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Emphasising Selected Macroeconomic Indicators to Revive Japanese Economic Growth from Post-COVID-19 Shock

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Abstract – For its unique characteristics of the continuous revitalisation of its economy, Japan is widely known around the globe. Japan made significant contributions to the world developmental agenda in the post-World War II era. Covid-19 imposed both demand and supply shocks worldwide. Japan is not an exception. Using the Autoregressive distributed lag model for the time series data on Japan, the impact of some selected macroeconomic variables on the annual growth of gross domestic products of Japan was obtained in this study. In order to revive the economic growth, Japan needs acute concentration towards its domestic economy, especially to mitigate the post-COVID impact on Japan.

Keywords Net FDI outflow · Trade · Capital formation · COVID-19 ·

JEL Classification F14 · F17 · F21 · O16 ·

1. Introduction

Japan is the synonym of miraculous growth. During the rapid growth phase of the 1970s, Japan experienced double-digit growth of approximately 12% in 1969. In the 1990s, Japan had a bubble burst followed by its lost decades. In 2000, Japan had a recovery phase, and again in 2011, Japan faced a triple disaster. That is Earthquake, Tsunami and Nuclear melt-down (Zaman, 2019). Then Japan took its revitalising policy through the Abenomics program. Now Japan emphasises the 4th industrial revolution (Onday, 2019).

COVID- 19 severely affected all the countries around the globe. Japan is not an exception. Japan is unique for its high-tech products, especially electronic appliances, worldwide disbursement of ODA (Overseas Development Assistance), and true mutual friendship.

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Historically, Japan is widely symbolised as a donor country among the developing and developed countries simultaneously for participating in the world development agenda, poverty reduction strategy, and achieving developmental goals worldwide through the ODA disbursement (Sunaga, 2004). Japan is also reputed for its high-quality electronic appliances and durability (Wana Ismail, 2013). Export has significantly induced Japan's economic growth after the second world war. Using her comparative advantages, Japan almost reached the sky-rocket in its rapid phase of economic growth in 1970. Japan emphasises trade liberalisation to mitigate its drawback in the service industries. Though Japan is highly advanced in the manufacturing sector, there is still scope for improvement in the service and agricultural sectors (Esham et al., 2012).

The unprecedented impact of Covid-19 blended with the worldwide economic crisis is taking Japan to another phase of recession, and in order to recover, Japan needs to act cautiously to mitigate the multidimensional impacts of COVID-19. The policy that helped in post-WWII may not assist this time, as the situation of the developed countries is not as it was post-WWII. Therefore, Japan can only revive if she takes policy concentrating on the domestic economy acutely and then its spillover effect in the international arena.

2. Literature review

The state has a direct intervention and role towards the rapid Japanese growth. The effective policy to boost exports using the comparative advantage accelerates the growth of Japan. Miraculous Japanese growth was fuelled with the direct intervention of the state and its effective policy to boost its export by utilising its comparative advantages (Zaman, 2019). Rani & Kumar (2019) conducted a study to investigate the -run association among variables like economic growth, the openness of trade, and gross capital formation for BRICS countries using autoregressive distributed lag (ARDL). They found significant long-run relations and causal relationships using the Granger causality approach among the variables.

The findings of Chirwa & Odhiambo (2016) study identified some key determinant factors of growth for both developed and developing countries. Trade, capital, and FDI are noteworthy, and trade has a robust and sizeable quantitative impact on income (Frankel & Romer, 1999). Solow (1962) stated that capital formation is necessary but insufficient for economic growth. The panel cointegration done by Uneze (2013) found bi-directional causality between high economic growth and capital formation. Due to higher economic growth, capital formation (either gross or private capital) increases and eventually, increased capital formation induces high growth. Sunaga (2004) stated that ODA is an essential pillar of Japanese foreign policy. In order to promote the global strategy for poverty reduction, Japan highly emphasises ODA disbursement. However, due

to the lack of proper implementation and other loopholes, the Japanese citizens have a pessimistic approach towards ODA disbursement.

Small and medium enterprises (SME) are the predominant sectors of Japanese economic growth. Since the Japanese economy accommodates around 99.7% of SMEs among all enterprises- the SME sector employs 70 per cent of the working population, and thus SMEs is proudly responsible for a larger portion of the total output of Japan. COVID-19 severely damaged the global SME sectors, and Japan is no exception. Despite the provision of emergency loans and credit to mitigate the primary impact on the SME sector, deviation from target achievement occurred due to the presence of moral hazard of both Bank and SME, risk-aversion attitude of potential investors, fund shortage for infrastructural investments because of low rate of return and associated risks (Yoshino & Hendriyetty, 2020). Covid-19 acts as both a supply shock and demand shock simultaneously. Both the attributes will affect international trade. From previous experience of the global recession of 2008-09, it was observed that global trade was slower than global growth. Therefore, it is expected that an amplified impact of Covid-19 will be seen in the upcoming days in the case of international trade. Covid-19 evolved from a contagious disease in the economy to medicine and economy (Baldwin & Tomiura, 2020).

3. Objectives

To determine the selected macroeconomic variables responsible for reducing the GDP growth rate of Japan. The growth of gross capital formation, foreign direct investment as % of GDP and trade as % of GDP contributed to the annual GDP growth over time is aimed to assess using the econometric Autoregressive distributive model (ARDL). Besides, a correlation matrix will be prepared to better understand these selected macroeconomic variables after vigorous diagnostic testing using time series data on Japan.

4. Methods

In order to detect the growth factors of Japan, time-series data from 1975 to 2018 are used in this study. Based on the availability of the required data properly to portray Japan from its rapid growth phase, data from the mentioned period is collected from the World bank database. ARDL model is used along with the error correction model.

Initially, some factors like Gross capital formation (annual % growth), Domestic credit to the private sector (% of GDP), Trade (% of GDP), Fertility rate, total (births per woman), Foreign direct investment, net outflows (% of GDP or gcf_annualgr, dom_cr_priv, trd_gdp, fer_rate fdi_outflow respectively are used to identify its contribution on the GDP growth (annual %). Finally, the statistically significant factors are considered for further explanation considering the econometric loopholes.

While using the time series data, it was attempted to check whether there are any issues related, serial correlation, heteroscedasticity, multicollinearity, non-stationarity among the explanatory variables. If the independent or explanatory variables are of integrated order zero or one (that is., I (0) or I (1)), then the ARDL test can be used. In case of any explanatory variables which are stationary at the second difference, then the ARDL model cannot be used. Thus, to find the short-run and long-run impact, the study used the Akaike Information Criterion (AIC) to select the lag length of the ARDL model.

Thus, a model was run- the autoregressive distributed lag (ARDL) model. The Breusch-Godfrey LM (Lagrange Multiplier) test tested whether there is any autocorrelation among the stochastic error terms of the regression model. On the other hand, the Breusch-Pagan / Cook-Weisberg test tests heteroscedasticity, i.e., the unequal variance of the residual terms. The multicollinearity problem is identified using the Variable Inflation Factor (VIF) value.

When the mean and the variances of the stochastic error terms are not stationary, there is a unit root, and data need to be stationary to run the model for time series data. It is required to do an ADF test for unit root for each dependent and independent variable. After performing a unit root test, the irrelevant variables are dropped.

Using the obtained results, the post- COVID performance of selected macroeconomic variables of Japan is analysed. Some recommendations are given based on the empirical research findings.

5. Analysis

Table 1: Definition and measurement of variables

Variable name	Definition	Measurement	Data source
GDP growth gdp_gr	Annual growth of Gross Domestic Products	as % of GDP	WDI*
GCF growth gcf_annualgr	Annual growth of Gross Capital Formation	as % of GDP	WDI
FDI outflows fdi_outflow	Net outward FDI by Japanese investors	as % of GDP	WDI
Trade trd_gdp	Flows of merchandise exports and imports from and to Japan	as % of GDP calculated by (Export + Import)/GDP	WDI

Source: Developed by author
*WDI = World Development Indicators

Table 2: Unit root test

Variable name	Z(t) statistic	
	At level	At First Difference
GDP growth	-4.920***	
GCF growth	-4.725***	
FDI outflow	-1.641	-4.898***

Source: Author's calculation
Significance level: *** = 1%, ** = 5%, * =10%

When the mean and variations of the stochastic error terms are not stationary, there is a unit root, and data need to be stationary to run the model for time series data. It is required to do an ADF test for unit root for each dependent and independent variable.

The null hypothesis assumes there is a unit root. If the null can be rejected, then the data is stationary.

ARDL test can only be done when data is in an integrated order of 0 or 1. Sometimes, it is required to take the first or second difference to get the stationary data. Otherwise, the variables need to be dropped.

Augmented Dickey-Fuller (ADF) test for unit root

Variable	p-value for Z(t)
GDP growth	0.0003
GCF growth	0.0006
Net FDI outflow	0.7759
First difference of net FDI outflow	0.0003
Trade	0.7341
First difference in trade	0.0000

Variable p-value for Z(t) *GDP growth* 0.0003 *GCF growth* 0.0006 Net FDI outflow 0.7759First difference of net FDI outflow0.0003Trade0.7341First difference in trade0.0000

The variables- trade and net FDI outflow are stationary at their first difference; they are integrated order of 1. In contrast, GCF growth is of integrated order of 0.

The variables- domestic credit to the private sector and fertility rate are dropped due to having unit root as they are stationary at their second differences.

Table 3: Diagnostic checks

Properties	Test name	Statistic
Serial correlation (Chi2 value)	Breusch-Godfrey LM test	1.06
Heteroscedasticity (Chi2 value)	Breusch-Pagan / Cook-Weisberg test	1.34
Multicollinearity (mean VIF)	Variable Inflation Factor test	4.47

Source: Author's calculation
Significance level: *** = 1%, ** = 5%, * =10%

Thus, some diagnostics tests were conducted to run the autoregressive distributed lag (ARDL) model.

Test for serial correlation

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	1.060	1	0.3032

H0: no serial correlation

Null hypothesis: H0: no serial correlation

Through the Breusch-Godfrey LM test, it was found that there was no serial correlation.

Again, the Durbin Watson statistic is also a test for autocorrelation in a regression model's output. The DW statistic ranges from zero to four.

Usually, when the value of d-statistic lies between 1.5 to 2.5, then there is no autocorrelation.
Here, Durbin-Watson d-statistic (6, 48) = 2.287073

Thus, using both the Breusch-Godfrey LM test and Durbin-Watson d-statistic, it is found that there is no serial correlation among the sample used the time series data.

Test for heteroscedasticity

Breusch-Pagan / Cook-Weisberg test confirmed the homoscedasticity or no issues relatedto heteroscedasticity.

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity

Ho: Constant variance
Variables: fitted values of gdp_gr
chi2(1) = 1.34
Prob > chi2 = 0.2470

Thus, no heteroscedasticity at a 5% level of significance.

Test for multicollinearity

Variable	VIF	1/VIF
dom_cr_priv	6.21	0.161140
trd_gdp	6.01	0.166339
fer_rate	4.83	0.207145
fdi_outflow	4.02	0.248465
gcf_annualgr	1.30	0.770204
Mean VIF	4.47	

If VIF <10, then there is no multicollinearity problem among the explanatory variables. Since the Variable Inflation Factor value is less than 10, that is 4.47, indicating no multicollinearity problems.

Table 4: Correlation matrix

	GDP growth	GCF growth	FDI as % of GDP	Trade as % of GDP
GDP growth	1.000			
GCF growth	0.832 (0.000)	1.000		
FDI as % of GDP	-0.323 (0.025)	0.022 (0.882)	1.000	
Trade as % of GDP	-0.296 (0.041)	-0.136 (0.357)	-0.736 (0.000)	1.000

Source: Author's calculation
Values in the parenthesis denote the standard error.

The above correlation matrix portrays the association between the variables.Pearson's Correlation Coefficient of GCF growth and GDP growth is .832, and it signifies a high degree of positive correlation or association between the variables. A negative sign denotes a negative correlation, and a value higher than 0.5 signifies a high degree of association between the variables.

Table 5: Adjusted estimate

Properties	Value
GDP growth	-.0.695*** (0.082)

Source: Author's calculation
Significance level: *** = 1%, ** = 5%, * =10%

Values in the parenthesis denote the standard error.

Adjusted estimate of the dependent variable (GDP growth) is estimated by correcting the ARDL model error. Error correction term (ect) indicates whether there is an error in the long-run relationship or any deviation from the equilibrium or not and whether that is corrected in the long run or not. Thus, in the long run, if the error correction term (ect) becomes significant, then there exists a significant long-run relationship among the dependent and independent variables. If any deviation occurs in the short run, that is also corrected eventually in the long run.

Whether any temporary deviation is corrected or not depends on the sign. A negative sign confirms the error correction in the long run, and a positive sign denotes that the deviation or the diffusion rises further. Here, the negative sign denotes that the deviation is corrected and comes back to equilibrium in the long run, and approximately 69 % correction takes place in the long run.

Table 6: Cointegration and Long-run estimates

Properties	value
GCF growth	0.521*** (0.057)
FDI outflow as % of GDP	-1.487*** (0.290)
Trade as % of GDP	0.159*** (0.050)

Source: Author's calculation
Significance level: *** = 1%, ** = 5%, * =10%

Values in the parenthesis denote the standard error.

LR: The effects of a 1% change in the level of the variable;

When there is a positive annual growth of gross capital formation, GDP growth also increases. t-statistic is significantly and statistically different from zero for this variable. Positive coefficient of the variable trade (as a % of GDP) also signifies that GDP growth increases when trade (as a % of GDP) increases. However, the net outflow of FDI has a negative coefficient which signifies that when the net outflow of FDI increases, then the growth of GDP reduces. All three variables are statistically and significantly different from zero.

If all the three explanatory variables are zero, then the growth of GDP reduces by 0.5 percentage points.

When GCF growth increases by one percentage point,the GDP growth (GDP growth) rate increases by 0.521 percentage points.

When FDI outflow as % of GDP increases by one percentage point at the level, GDP growth (GDP growth) rate reduces by 1.48 percentage points.

When trade as % of GDP increases by one percentage point, GDP growth (GDP growth) rate increases by 0.159 percentage points. The previous year value of trade has a reverse impact, whereas the value of trade for two lag years has a positive impact on GDP growth.

Table 7: Short-run estimates

Properties	Value
GDP growth	-.0.348*** (0.065)
Trade as % of GDP	0.009* (0.052)

Source: Author's calculation
Significance level: *** = 1%, ** = 5%, * =10%

Values in the parenthesis denote the standard error.

In the shortrun, the effects of a 1% change in the growth of the variable are obtained.

Table 8: Details of the ARDL (3,0,0,2) regression

Properties	Value
Sample	1975-2018
Number of obs	44
F (8, 35)	40.22
Prob>F	0.0000
R-squared	0.9078
Adj R-squared	0.887
Log likelihood	-47.194
Root MSE	0.793

Source: Author's calculation

Here, the Adjusted R-square is 0.997. It means 88.7 per cent of the variation in the dependent variables are explained by the independent variables, which also signifies the goodness of the fit.

ARDL (3,0,0,2) regression

```
------------------------------------------------------------------------------
   D.gdp_gr |      Coef.   Std. Err.      t    P>|t|    [95% Conf. Interval]
------------+-----------------------------------------------------------------
ADJ         |
     gdp_gr |
       L1. | -.6951856   .0822533    -8.45   0.000    -.8621687   -.5282025
------------+-----------------------------------------------------------------
LR          |
gcf_annualgr |   .5211517   .0567996     9.18   0.000     .4058423    .6364611
 fdi_outflow | -1.486984   .2895107    -5.14   0.000    -2.074722   -.8992465
    trd_gdp |   .1588309   .0501581     3.17   0.003     .0570045    .2606573
------------+-----------------------------------------------------------------
SR          |
     gdp_gr |
       LD. |   -.348585   .0653555    -5.33   0.000    -.4812636   -.2159063
      L2D. | -.1383989   .0532481    -2.60   0.014    -.2464984   -.0302994
           |
    trd_gdp |
       D1. |    .009527    .052503     0.18   0.857    -.0970599    .1161138
       LD. | -.1311055    .047905    -2.74   0.010    -.2283577   -.0338532
           |
     _cons .5026578    .696115    -0.72   0.475    -1.915846    .9105307
------------------------------------------------------------------------------
```

6. Findings

When net FDI Outflow (as % of GDP) increases by one percentage point at the level, GDP growth rate reduces by 1.48 percentage points.

Table 9: Relation of FDI Outflow (as % of GDP) and GDP growth rate for Japan

Variable	Year	Value	Change	Direction
Net FDI Outflow (as % of GDP)	1970 2019	0.2 % 5.1%	4.9%	Increases
GDP growth rate	1969 2019	12% 0.27%	11.73%	Decreases

Source: (CEIC, 2021)

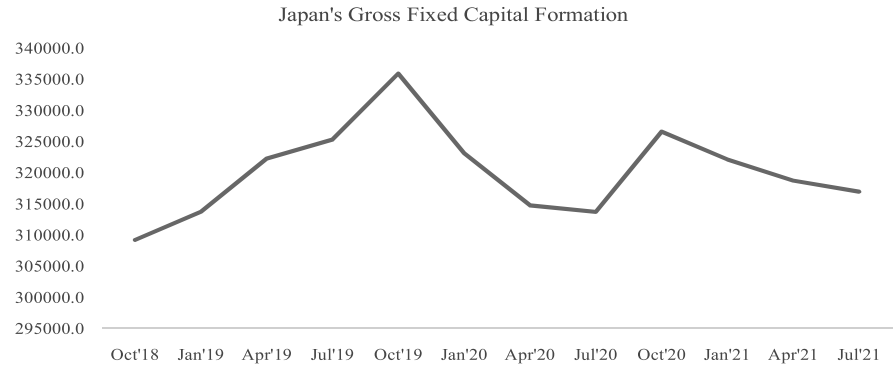
From 1970 to 2019, FDI outflow (as % of GDP) increases by 4.9 %.

From 1969 to 2019, the GDP growth rate reduces by 11.73%.

Since an increase in 1% FDI outflow reduces the GDP growth rate of Japan by 1.48% percentage point (Author's analysis using time series data).

Thus, a 4.9% increase in net FDI outflow (as % of GDP) reduces GDP growth by a 7.25 % point. Therefore, it can be concluded that, like many factors, the reduction in the GDP growth rate of Japan is attributed to the increase in FDI outflow (as % of GDP) significantly.Source: (CEIC, 2021)

Graph 1: Quarterly data of Gross fixed capital formation for Japan from October 2018 to July 2021.

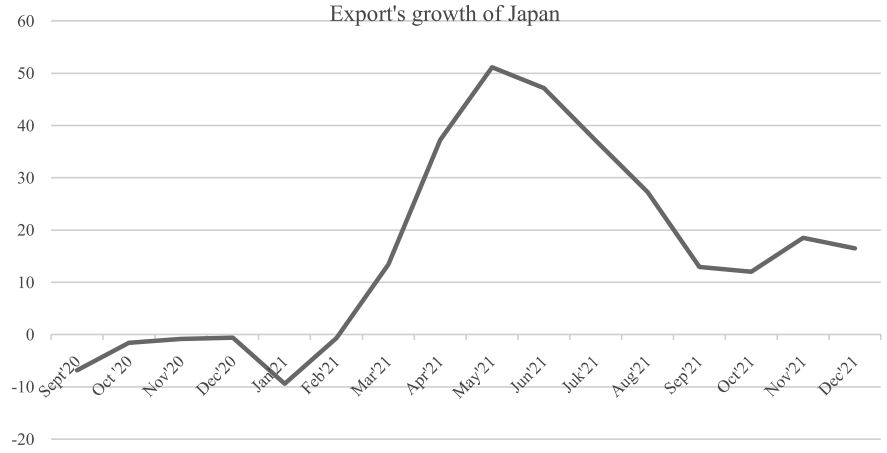


Source: (CEIC, 2021)

Since GCF also seems to be downward sloping. Thus, the reduction in GDP growth rate is also predicted and validated according to the findings.

Though in October 2020, GCF was increasing compared to April 20, but not as much as it was in July. That is why a V plus therapy (as argued by Barkat, 2021) could be of high policy utility for Japan.We need to surpass the pre-COVID situation and develop further to have an inclusive impact in the long run.

Graph 2: Monthly data for total export of Japan from September 2020 to Dec 2021.

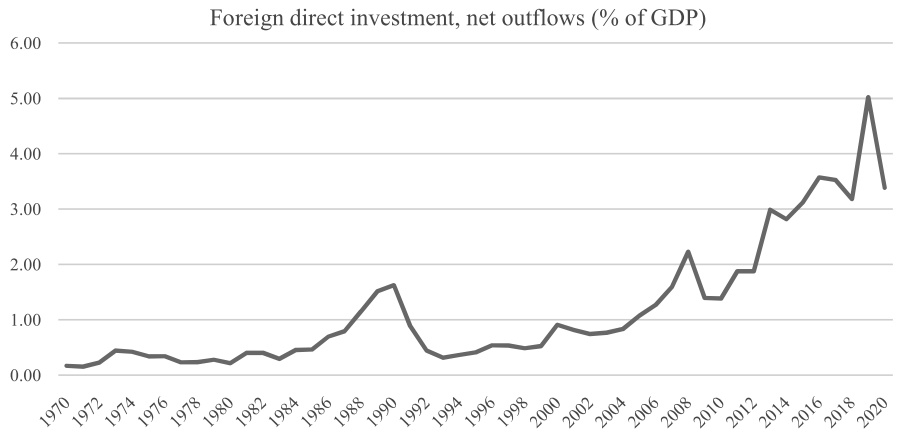


Source: (CEIC, 2021)

Export is still struggling. However, it seems that export increases for a while. However, it is not reflecting the recovery scenario. Since, during the global shut-down period of early 2020, overall export got severely affected like all other countries around the globe with that comparison, when Japan started its export, it seemed that the export was experiencing an upward trend. However, still then also, after May 2021, the export seems to have a downward trend, which needs to be addressed. Export is one of the crucial engines of economic growth irrespective of any economy, and for Japan, export historically played a prominent role in its developmental process (Zaman, 2019).

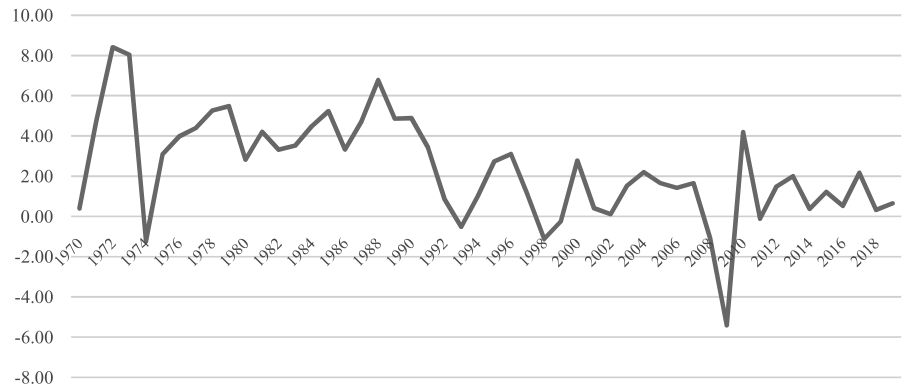
Comparative scenario of increased net FDI outflow (% of GDP) and GDP growth rate (annual %) for Japan

Graph 3: Upward trend of net FDI outflow of Japan from 1970 to 2020



Source: (WDI, 2021)

Graph 4: Downward trend of GDP growth (annual %) of Japan from 1970 to 2018 GDP growth (annual %)



Source: (WDI, 2021)

From the comparison of the net FDI outflow and GDP growth rate of Japan, it is seen that there is a reverse relationship between the two variables. The two variables' graphical representation also portrays that Japan has experienced a downward sloping GDP growth rate and upward sloping net FDI outflow over time. Net FDI outflow increase sufficiently is not responsible for reducing the Japanese GDP growth rate. However, evidence from the time series study shows that an increase in net FDI outflow necessarily attributes to the reduction of

annual growth of the GDP of Japan to some extent. FDI is a part of the national foreign policy of Japan. Undoubtedly, Japan historically contributed to poverty reduction, attainment of fundamental rights, physical and social infrastructural development of developing countries. The philanthropic investment of Japan saved and improved the quality of lives of many. However, sometimes, the recipient country does not have a positive outcome for a long time from the Japanese investment due to the marginal social cost imposed by the investments. Though, Japan is also benefitting through FDI both domestically and internationally in many ways like- increased export, diffusion of Japanese technology, culture and norms globally. However, it is high time that the Japanese government needs to re-think that the Japanese government needs to re-think the element of net FDI outflow in its foreign policy. Impact assessment of both donor and recipient countries are highly recommended to take the following steps. Since it is found that an increase in net FDI outflow of Japan reduces its annual GDP growth rate, once Japan can ensure a domestic economy with a strong base, Japan can again look outward for investment. The domestic economy needs the attention most.

7. Conclusion

Historically Japan has experienced a wave-like pattern in case of its growth. That is, it has both ups and downs at a regular interval. Whenever Japan revitalised and tried to recover, it faced any natural or artificial shock. Despite all the odds, Japan revived and contributed to theworld's development phase with its own style of contributing,especially leading from the front through its science and technological development. Since post-World War II, Japan has played a significant role through ODA disbursement (overseas development assistance). Both developed and developing countries are benefited from the spillover effect of Japanese ODA. Japan itself also got highly benefited through it as ODA disbursement enhanced the domestic export of Japan to some extent. Due to many developmental projects of Japan and other countries, Japanese technology, merchandise products, automobiles got worldwide exposure. However, the ARDL econometric model found that, in the long run, the impact of net FDI outflow on Japanese GDP growth is negative. Like many other factors, net FDI outflow has a role in reducingthe Japanese annual GDP growth rate. It is high time for Japan to assess the long-run impact of net FDI outflow from the donor and recipient country's perspective. Again, the way Japan recovered in the post-World War II era. Japan will not be able torevitalise in the post-COVID era with the same sort of policies since COVID has a drastic impact over all the countries irrespective of any indices. Thus, the post-COVID recovery of Japan will require a different and timely policy compared with that of post-WWII. To conclude, Japan is the

lighthouse, and it possesses every attribute to recover and grow continuously to contribute both in the domestic and international arena in its unique way.

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