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Population Ageing and FDI Inflows in Japan: ARDL Approach to Cointegration Analysis

Rajarshi Mitra
Tokyo International University, Japan

Md. Thasinul Abedin
University of Chittagong, Bangladesh

Abstract

The socio-economic effects of population ageing in industrialized nations have attracted the attention of academicians and policymakers worldwide. Although country-case studies on the determinants of FDI inflows are extensive, academic literature has neglected an empirical investigation of the direct effects of population ageing on FDI inflows in Japan. This is a unique study that applies Pesaran et. al.`s (2001) bounds testing approach to cointegration analysis and models the short-run and long-run effects of (a) an increase in the dependency ratio for the old (as a percentage of working age population), and (b) an increase in the number of individuals aged 65 and above (as a percentage of total population) on the net FDI inflows in Japan (as a percentage of GDP). In both bivariate and multivariate models, the short-run effects are statistically insignificant, but the long-run effects are significantly positive. Additionally, in both bivariate and multivariate analysis, the model with the number of individuals aged 65 and above (as a percentage of total population) indicates a faster speed of adjustment toward long-run equilibrium. We conclude that, while population ageing may have an insignificant effect on net FDI inflows in Japan (as a percentage of GDP) in the short-run, a significantly positive relationship between the two variables exists in the long-run.

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Contact: Rajarshi Mitra - rmitra@tiu.ac.jp, Md. Thasinul Abedin - abedin@cu.ac.bd.
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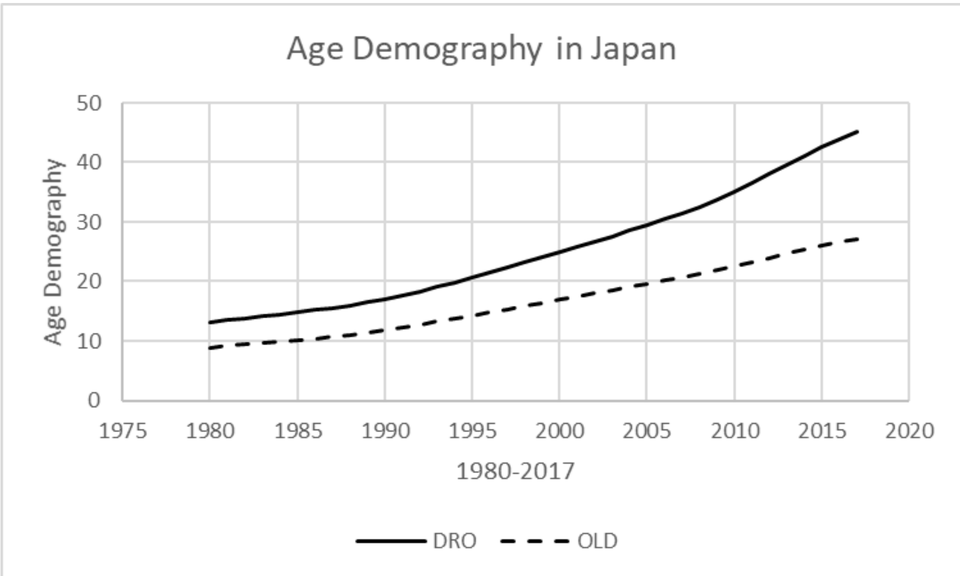
1. Introduction

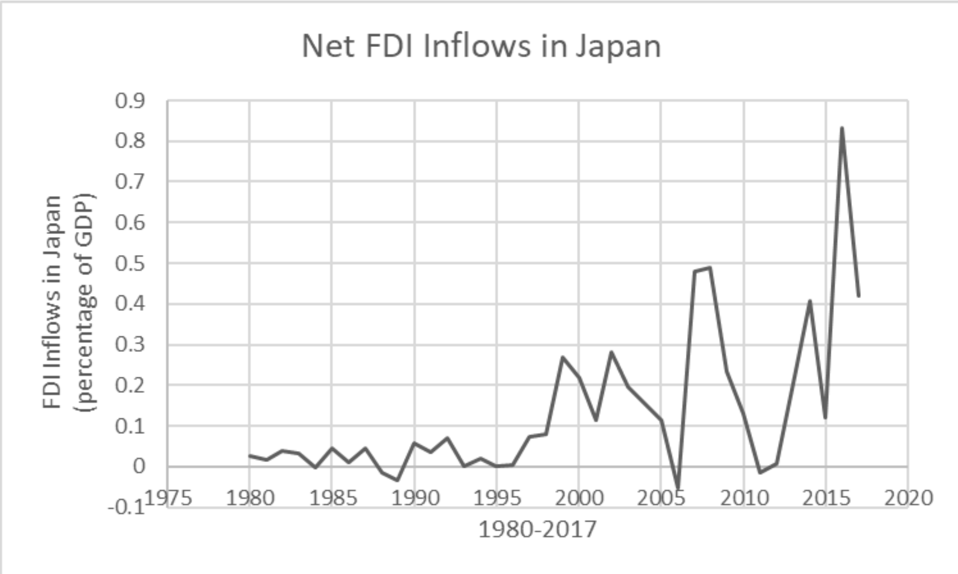
The decline in Japanese population in recent years has attracted the attention of academicians and policy makers worldwide. Population ageing is viewed as a major concern to the Japanese government because of continuously rising public social expenditure, and steady declines in per-capita GDP growth, national saving and investment rates, national labor force and tax revenues. Net foreign assets, which is the difference between capital inflow and capital outflow in proportion to GDP, is expected to decline with a decline in the working class population. The negative effect on net foreign assets may offset any positive effects of inbound FDI-oriented policy measures designed and implemented by the Japanese government over the last ten years or so. According to the most recent statistics provided by the World Bank, Japan ranked number one in the year 2018 in age-dependency ratio (as a percentage of working-age population) amongst all OECD countries. Figure 1 shows that, from 1980 until 2017, there was a sharp increase in the dependency ratio for the old (as a percentage of the working age population). It is depicted by the solid black line and labelled DRO in Figure 1. During this same period, the number of individuals aged 65 and above (as a percentage of total population) increased. It is illustrated by the dashed line and labelled OLD in Figure 1.

Figure 1. Age Demography in Japan



Although economic theory postulates a negative association between population ageing and FDI inflows, Figure 2 shows that during the period 1980-2017, an increase in population ageing actually coincided with an *increase* in net FDI inflows in Japan (as a percentage of GDP). The correlation coefficient between FDI and DRO is +0.63, and the correlation coefficient between FDI and OLD is +0.62. The positive correlation coefficients present an interesting case study and raise an important question from a policy perspective – could an increase in population ageing in Japan have been associated with an increase in net FDI inflows in the country (as a percentage of GDP)? Secondly, since demographic changes occur slowly over time, when studying the time series effects of population ageing on an economic variable, could it be possible that the short-run effect of an increase in population ageing on FDI inflows is significantly different from its long-run effect? For instance, the immediate effect of population ageing on FDI inflows could be negative. However, as Tomohara (2017) argues, inward FDI promotion and immigration enhancement may help increase inward FDI. "Migrant networks" may enhance business opportunities via FDI because "these networks reduce trans-action costs by providing local market information, and business practices, and developing trust through contacts (i.e., matching buyers and sellers)". Thus, in the long-run, as the government adjusts its policies to counteract the negative effects of population ageing, an increase in population ageing may actually be associated with an increase in FDI inflows.

Figure 2. Net FDI Inflows in Japan



Numerous studies have examined the determinants of FDI inflows in Japan; however, hardly any attempt has been made to model the short-run and long-run effects of population ageing on net FDI inflows in Japan. We apply the bounds testing approach to cointegration analysis developed by Pesaran et. al. (2001) within an autoregressive distributed lag (ARDL) framework. We first investigate the existence of a cointegrating relationship (if any) between the variables. If a cointegrating relationship is ascertained, then in the second step, we distinguish the short-run effects of population ageing on net FDI inflows from the long-run effects. The structure of the paper is as follows: Section 2 presents a brief literature review; Section 3 presents the data and the model specification; Section 4 presents a discussion of the main results; Section 5 presents the concluding remarks, the policy implications, and discusses some future extensions of this study.

2. Literature Review

Economic theory posits that, as a country experiences a decline in its population, or in other words, as its working-age population shrinks, the supply of capital will decrease. Capital will flow out of the home country to destinations that offer relatively higher rates of return on investments. Thus an increase in population ageing is expected to have a negative effect on net FDI inflows. Narciso (2010) refers to the four stages of the product life cycle theory developed by Vernon (1966), and argues that, if the overall population size does not change while the number of retired people in an economy increases, then the maturity stage of the product life cycle will come earlier. To compensate for R&D expenses, and also account for the product information costs, the producers will then search for destinations with lower production-costs and look for markets that offer higher consumption. Narciso (2010) further goes on to cite oligopolistic reasons for the negative effects of population ageing on FDI inflows. For instance, if the market faces an oligopolistic competition, then the oligopolistic reaction theory discussed by Knickerbocker (1973) would predict an increase in FDI flows to "younger" economies. Two main reasons could be (a) "following the leader", and (b) "threatening" other firms in their home markets. In an empirical study, Narciso (2010) examined the effects of population ageing on FDI inflows on a bilateral level for a panel dataset consisting of 8 capital source countries and 38 capital host countries from 2001-2007. Demographic factors are measured by (a) the current old age dependency ratio, and (b) the current youth age dependency ratio of the destination country. Consistent with economic theory, the author observed a negative coefficient for (a) and a positive coefficient for (b). A recent study by Donaldson et. al. (2018) have examined the effects of demographic changes in China arising from the implementation of the one-child policy on FDI inflows (as a percentage of GDP). The authors have found that the one-child policy have raised the capital-labor ratio in China, thereby reducing the need for FDI in China.

Conditional on the availability of data, it would be interesting to observe the saving rate by age in Japan in order to test the life cycle hypothesis developed by Modigliani and Brumberg (1954), and Ando and Modigliani (1963). For instance, how savings evolve over the life cycle in Japan. According to a recent study by Iwaisako et. al. (2016), from 2002 to 2014, a period that witnessed a demographic shift from the young to the old in Japan, the share of deposits (time deposits and other deposits) decreased, while the share of stocks, mutual funds and foreign currency denominated assets in portfolio increased. From 2002 until 2014, Japanese household wealth increased at 2.6% per annum for the age group 61-70, and at 2.1% per annum for individuals aged 71 and above. From regression analysis, Iwaisako et. al. (2016) found that the "probability of holding stocks is 10-16 percentage points higher for households over age 51". Householders in the age-groups "61-70" and "71 and over" significantly decreased the share of deposits and increased the share of stocks. The authors attribute this to two reasons - (a) the age-income profile in Japan is steeper than in other countries, and (b) the share of owner-occupied housing in household wealth in Japan is higher. According to Kitamura and Uchino (2011), elderly households are likely to be financially literate. Iwaisako et. al. (2016) further state that, the aging of the population has not resulted in "exits from the stock market….in fact, aging might have been inducing risk-taking by Japanese households in the last 15 years". The stock share of elderly household is found to be higher than that of the young. Increasing share of wealthy elderly in households across Japan is believed to have contributed to a steady increase in gross financial wealth.

Despite strong theoretical underpinnings and policy implications, to the best of our knowledge, there is hardly any country-case study on the direct relationship between population ageing and FDI inflows, especially for Japan, based on dynamic cointegration analysis. Using a more recent data, we build on Narciso (2010) and aim to fill the gap in the existing literature by developing an empirical specification that establishes a link between population ageing and FDI inflows for the Japanese economy.

3. Data and the Model

3.1 Data: This paper uses annual data from the World Development Indicators of the World Bank Group for the most recent sample period 1980-2017. The dependent variable is net foreign direct investment inflows (as a percentage of GDP). Population ageing is measured in two ways – one, by dependency ratio for the old (the number of individuals aged 65 and above as a percentage of working population aged between 15-64 years), and two, by the number of individuals aged 65 and above (as a percentage of total population). The two different measures are introduced to check for robustness in the results. The control variables are trade openness (exports plus imports as a percentage of GDP), domestic investment (gross fixed capital formation as a percentage of GDP), real effective exchange rate index (2010 as the base year), and money supply (broad money as a percentage of GDP). The real effective exchange rate index is calculated by dividing the nominal effective exchange rate index by a price deflator or an index of costs. An increase in the index would imply depreciation of the home currency, while a decrease in the index would imply home currency appreciation.

3.2 The Model: We apply the bounds testing procedure developed by Pesaran and Pesaran (1997), Pesaran and Shin (1999), and Pesaran et al. (2001) within an autoregressive distributed lag (ARDL) framework and estimate four models of the forms proposed by Mitra and Abedin (2020):

$$\Delta FDI_t = \alpha_1 + \sum_{i=1}^{m} \theta_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{p} \theta_{2i} \Delta DRO_{t-i} + \emptyset_1 FDI_{t-1} + \emptyset_2 DRO_{t-1} + \eta_t \quad (1)$$

$$\Delta FDI_t = \alpha_2 + \sum_{i=1}^{m} \theta_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{p} \theta_{2i} \Delta OLD_{t-i} + \emptyset_1 FDI_{t-1} + \emptyset_2 OLD_{t-1} + \varepsilon_t \quad (2)$$

$$\Delta FDI_t = \alpha_3 + \sum_{i=1}^{m} \theta_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{p} \theta_{2i} \Delta OPN_{t-i} + \sum_{i=0}^{q} \theta_{3i} \Delta INV_{t-i} + \sum_{i=0}^{r} \theta_{4i} \Delta RER_{t-i} + \sum_{i=0}^{s} \theta_{5i} \Delta MS_{t-i} + \sum_{i=0}^{w} \theta_{6i} \Delta DRO_{t-i} + \emptyset_1 FDI_{t-1} + \emptyset_2 OPN_{t-1} + \emptyset_3 INV_{t-1} + \emptyset_4 RER_{t-1} + \emptyset_5 MS_{t-1} + \emptyset_6 DRO_{t-1} + \mu_t \quad (3)$$

$$\Delta FDI_t = \alpha_4 + \sum_{i=1}^{m} \theta_{1i} \Delta FDI_{t-i} + \sum_{i=0}^{p} \theta_{2i} \Delta OPN_{t-i} + \sum_{i=0}^{q} \theta_{3i} \Delta INV_{t-i} + \sum_{i=0}^{r} \theta_{4i} \Delta RER_{t-i} + \sum_{i=0}^{s} \theta_{5i} \Delta MS_{t-i} + \sum_{i=0}^{w} \theta_{6i} \Delta OLD_{t-i} + \emptyset_1 FDI_{t-1} + \emptyset_2 OPN_{t-1} + \emptyset_3 INV_{t-1} + \emptyset_4 RER_{t-1} + \emptyset_5 MS_{t-1} + \emptyset_6 OLD_{t-1} + \delta_t \quad (4)$$

In equations (1) – (4), *FDI* denotes net foreign direct investment inflows (as a percentage of GDP); *DRO* denotes age-dependency ratio for the old (the number of individuals aged 65 and above as a percentage of the working age population); *OLD* denotes the number of individuals aged 65 and above (as a percentage of total population); *OPN* denotes trade openness (trade-to-GDP ratio); *INV* denotes domestic investment; *RER* denotes the real effective exchange rate index; *MS* denotes broad money supply (as a percentage of GDP).

3.3 Estimation Method: We apply the ARDL bounds testing approach to cointegration for several reasons. The bounds testing approach to cointegration technique does not require pretests for unit roots, and may be applied regardless of the order of integration of the variables (Pesaran and Shin, 1999; Pesaran et al. 2001). This is true even if the variables are fractionally integrated. The ARDL cointegration technique can be applied with a small sample size (Pesaran and Shin, 1999; Pesaran et al. 2001). The ARDL cointegration technique is found to be robust when there is a single long-run relationship among the underlying macroeconomic variables. This technique corrects endogeneity problem and fixes the autocorrelation problem due to the imposition of lags in the model.

We investigate the long-run relationship between the variables by performing the F-test for cointegration. The null hypothesis H_0 is that there is no long-run relationship. In equations (1) and (2), we test the joint significance of the coefficients on the one-period lagged levels of the variables by testing $H_0: \phi_1 = \phi_2 = 0$. Similarly, in equations (3) and (4), we test $H_0: \phi_1 = \phi_2 = \phi_3 = \phi_4 = \phi_5 = \phi_6 = 0$. We obtain the critical values for the F-test from Narayan (2004a, 2004b, 2005a). The F-test has a non-standard distribution. The F-statistic depends upon the number of regressors and on whether the ARDL model contains an intercept and/or a trend. If the computed F-statistic falls outside the critical bounds, then a conclusive decision can be made regarding the existence of cointegration without knowing the order of integration of the regressors. If the estimated F-statistic exceeds the upper bound of the critical values, then we reject the null hypothesis of no cointegration. Next, we estimate the short-run and the long-run coefficients for the cointegrated equation. The diagnostic tests are performed to examine for serial correlation at lag order, normality in error distribution, and conditional heteroscedasticity.

4. Main Results

4.1 Unit Root Tests: Although pretests for unit root in the variables are not necessary in the ARDL approach to cointegration, we have performed the ADF and PP tests. The results, reported in Table 1 below, indicate that the variables are I(1).

Table 1. Unit Root Tests

	Case-1: constant only		Case-2: constant with trend	
	ADF Test	PP Test	ADF Test	PP Test
FDI	-0.92(0.76)	-3.46**(0.01)	-2.04(0.55)	-4.98***(0.00)
OPN	-0.85(0.79)	-0.84(0.79)	-2.09(0.53)	-1.99(0.58)
INV	-1.39(0.57)	-1.30(0.61)	-2.89(0.17)	-1.89(0.64)
RER	-1.25(0.64)	-1.80(0.37)	-2.30(0.43)	-1.85(0.66)
MS	-1.34(0.60)	-1.36(0.59)	-2.14(0.51)	-2.27(0.44)
DRO	1.47(0.99)	10.34(1.00)	-1.40(0.84)	-0.20(0.99)
OLD	0.67(0.98)	58.24(0.99)	-3.42*(0.07)	-9.81***(0.00)
ΔFDI	-5.17***(0.00)	-10.02***(0.00)	-5.21***(0.00)	-10.07***(0.00)
ΔOPN	-5.63***(0.00)	-5.61***(0.00)	-5.88***(0.00)	-5.95***(0.00)
ΔINV	-3.71**(0.01)	-3.06**(0.04)	-3.66**(0.04)	-3.08**(0.04)
ΔRER	-4.97***(0.00)	-4.61***(0.00)	-5.97***(0.00)	-4.74***(0.00)
ΔMS	-5.45***(0.00)	-5.46***(0.00)	-5.39***(0.00)	-5.39***(0.00)
ΔDRO	-4.25***(0.00)	-2.13**(0.03)	-3.84**(0.03)	-2.04**(0.04)
ΔOLD	-2.78*(0.07)	-2.65*(0.09)	-2.86*(0.06)	-2.54**(0.01)

The values in parenthesis represent p-values. *** indicates significant at the 1% significance level; ** indicates significant at the 5% level; *indicates significant at the 10% significance level.

4.2 Cointegration Tests: The results of the F-bounds test for cointegration for all the four models are reported in Table 2.

Table 2. F-Bounds Test for Cointegration

	Model 1		
	Significance	I(0)	I(1)
F-Statistic: 8.49	10%	3.02	3.51
k = 1	5%	3.62	4.16
H_0: No Levels Relationship	1%	4.94	5.58
	Model 2		
	Significance	I(0)	I(1)
F-Statistic: 7.90	10%	3.02	3.51
k = 1	5%	3.62	4.16
H_0: No Levels Relationship	1%	4.94	5.58
	Model 3		
	Significance	I(0)	I(1)
F-Statistic: 5.03	10%	2.08	3.00
k = 5	5%	2.39	3.38
H_0: No Levels Relationship	1%	3.06	4.15
	Model 4		
	Significance	I(0)	I(1)
F-Statistic: 5.02	10%	2.08	3.00
k = 5	5%	2.39	3.38
H_0: No Levels Relationship	1%	3.06	4.15

For Model 1, the computed F-statistic 8.49 lies outside the I(0) and I(1) values at the 1% significance level, thereby providing evidence of cointegration between net FDI inflows (as a percentage of GDP) and age-dependency ratio for the old (as a percentage of working age population). For Model 2, the computed F-statistic 7.90 lies outside the I(0) and I(1) values at the 1% significance level, thereby providing evidence of cointegration between net FDI inflows (as a percentage of GDP) and number of individuals aged 65 and above (as a percentage of total population). For Model 3, the computed F-statistic 5.03 lies outside the I(0) and I(1) values at the 1% significance level, thereby providing evidence of cointegration between net FDI inflows (as a percentage of GDP) and age-dependency ratio for the old, controlling for trade openness (as a percentage of GDP), domestic investment (as a percentage of GDP), real effective exchange rate and broad money supply (as a percentage of GDP). For Model 4, the computed F-statistic 5.02 lies outside the I(0) and I(1) values at the 1% significance level, thereby providing evidence of cointegration between net FDI inflows (as a percentage of GDP) and the number of individuals aged 65 and above (as a percentage of total population), controlling for trade openness (as a percentage of GDP), domestic investment (as a percentage of GDP), real effective exchange rate and broad money supply (as a percentage of GDP).

4.3 Short-Run and Long-Run Dynamics: Since the cointegration tests provide strong evidence of a long-run relationship between the variables, we now estimate the models for short-run and long-run effects. The Schwarz Bayesian Information Criterion (SBIC) is used to select the optimum lag-length for each of the four models. Table 3 presents the short-run and the long-run coefficients.

Table 3. Short-Run and Long-Run Coefficients

	Short-Run Effects			
	Model 1	Model 2	Model 3	Model 4
Constant	0.04(0.51)	0.10(0.30)	-0.02(0.82)	-0.03(0.88)
ECM(-1)	-0.92***(0.00)	-0.93***(0.00)	-1.16***(0.00)	-1.20***(0.00)
ΔDRO	-0.04(0.50)	-	0.028(0.74)	-
ΔOLD	-	-0.20(0.28)	-	0.04(0.85)
ΔOPN	-	-	0.003(0.82)	0.01(0.56)
ΔINV	-	-	0.005(0.88)	0.004(0.89)
ΔRER	-	-	0.001(0.86)	0.0001(0.96)
ΔMS	-	-	0.003(0.46)	0.003(0.35)
	Long-Run Effects			
	Model 1	Model 2	Model 3	Model 4
Constant	-0.17**(0.02)	-0.21**(0.01)	-5.64***(0.00)	-5.96***(0.00)
DRO	0.01***(0.00)	-	0.07***(0.00)	-
OLD	-	0.02***(0.00)	-	0.12***(0.00)
OPN	-	-	0.05**(0.01)	0.04**(0.04)
INV	-	-	0.05***(0.00)	0.08***(0.00)
RER	-	-	0.01**(0.03)	0.02**(0.01)
MS	-	-	0.01**(0.02)	0.01*(0.05)

The values in parenthesis represent p-values. *** indicates significant at the 1% significance level; ** indicates significant at the 5% level; *indicates significant at the 10% significance level.

In bivariate Model 1 and Model 2, the short-run effects of (a) an increase in age-dependency ratio for the old (as a percentage of working age population), and (b) an increase in the number of individuals aged 65 and above (as a percentage of total population) on net FDI inflows are statistically insignificant. However, in bivariate Model 1, the long-run effect of an increase in the age-dependency ratio for the old (as a percentage of working age population) on net FDI inflows (as a percentage of GDP) is significantly positive. In bivariate Model 2, the long-run effect of an increase in the number of individuals aged 65 and above (as a percentage of total population) on net FDI inflows (as a percentage of GDP) is also significantly positive. In multivariate Model 3, although the short-run effects of all the variables are statistically insignificant, the long-run effect of an increase in the age-dependency ratio for the old (as a percentage of working age population) on net FDI inflows (as a percentage of GDP) is significantly positive. In multivariate Model 4, the long-run effect of an increase in the number of individuals aged 65 and above (as a percentage of total population) on net FDI inflows (as a percentage of GDP) is also significantly positive. Therefore, the results overall indicate that, while population ageing may have no significant short-run effect on FDI inflows (as a percentage of GDP) in Japan, however, a significantly positive effect is expected in the long-run.

Since demographic changes occur slowly over time, its immediate (or short-run) effect on net FDI inflows could be statistically insignificant. So the insignificant short-run effects of population ageing on net FDI inflows are not surprising. In a standard life-cycle model, old people dissave which creates a domestic capital shortage, thereby raising the need for foreign investment to sustain economic growth. That could be a viable reason for the positive long-run relationship between population ageing and net FDI inflows in Japan. Secondly, population ageing will affect returns to capital. Labor becomes scarce due to a shrinking workforce; consequently, the price of labor will increase relative to capital. As capital becomes less expensive relative to labor, the demand for capital will increase. That partly explains why the demand for foreign capital, and consequently, FDI inflows, may increase with an increase in population ageing. Another plausible reason for the positive long-run relationship could be the implementation of a social security reform program that aims to raise the retirement age. With this reform program, the negative effects of the increase in the old-age dependency ratio would be somewhat less pronounced, thereby decreasing net capital exports of Japan in the process. Tomohara (2017) points to "inward FDI-promotion and immigration enhancement as solutions to resolving shortages in domestic savings and labor". The author argues that, although the share of inward FDI in GDP has been low for Japan, the Japanese government has recognized the importance of increasing the stock of FDI. Trade barriers have been lowered or even removed in certain industrial sectors by the Ministry of Economy, Trade and Industry in order to increase FDI inflows. As Narciso (2010) argued, incomplete capital mobility may "hamper demographically induced capital flows". According to Head and Ries (2005) and Hibbard et el. (2009), the new legislation in Japan would facilitate the acquisition of Japanese firms by foreign investors. Japan External Trade Organization has taken the initiative to provide specific information on investment opportunities in Japan to foreign investors. Magnier-Watanabe and Lemaire (2018) argue that, with the introduction of new corporate governance rules and a revision of the existing codes, the Japanese firms will become more attractive to the foreign investors who actively engage in FDI. The immigration rules have also been revised. The introduction of a fast-track permanent residence program and large-scale investment in health and education may have played significant roles in increasing net FDI inflows in Japan (as a percentage of GDP) despite a decline in its population. The results reported by Iwaisako et. al. (2016) further confirm that the positive long-run association between population ageing and FDI inflows that we observe in our study, based on dynamic cointegration analysis, are consistent with the findings in the empirical literature as far as the Japanese economy is concerned.

An increase in trade openness is found to have a significantly positive effect on net FDI inflows (as a percentage of GDP) in the long-run. Greater openness of the economy is expected to open up investment opportunities and increase capital inflows into Japan from other countries. An increase in the real effective exchange rate, or a depreciation of the home currency, is found to have a significantly positive effect on net FDI inflows (as a percentage of GDP) in the long-run. A weak Japanese yen makes the Japanese economy more competitive relative to other economies, expectedly increasing net FDI inflows. Increases in domestic investment and money supply (as percentages of GDP) are expected to significantly increase net FDI inflows in Japan in the long-run.

The ECM(-1) coefficients for all four models are negative and statistically significant at the 1% significant level, which indicate rapid adjustment toward long-run equilibrium. The bivariate model with the number of individuals aged 65 and above (as a percentage of total population) as the explanatory variable indicates a faster adjustment toward the long-run equilibrium (0.93 > 0.92). The multivariate model with the number of individuals aged 65 and above (as a percentage of total population) as the explanatory variable also indicates a faster adjustment toward the long-run equilibrium (1.20 > 1.16).

4.4 Diagnostic Tests: The results of the diagnostic tests to examine for serial autocorrelation, normality in error distribution, and auto-regressive conditional heteroscedasticity are reported in Table 4.

Table 4. Diagnostic Tests

	Model 1	Model 2	Model 3	Model 4
Serial Corr	1.48(0.23)	3.14(0.09)	0.01(0.92)	0.02(0.91)
Normality	24.57***(0.00)	30.36***(0.00)	0.58(0.74)	0.54(0.71)
ARCH	0.64(0.43)	0.32(0.57)	1.57(0.22)	0.02(0.90)

The values in parenthesis represent p-values. *** indicates significant at the 1% significance level; ** indicates significant at the 5% level; *indicates significant at the 10% significance level.

For the LM test, the p-values for all the four models are greater than the 5% significance level; thus, we fail to reject the null hypothesis of no autocorrelation at lag order. For the normality test, the p-values for the multivariate Model 3 and Model 4 are greater than the 5% significance level; thus, for the two multivariate models, we fail to reject the null hypothesis that the errors are normally distributed. For the ARCH test, the p-values for all the four models are greater than the 5% significance level; thus, we fail to reject the null of no conditional heteroscedasticity.

5. Conclusion

Japan has been experiencing a declining population in recent times, and that is expected to have significant policy implications for its economy. The determinants of FDI inflows for Japan have been well documented in the existing literature; however, hardly any attempt has been made to model the short-run and long-run effects of population ageing on net FDI inflows for Japan. This is a unique study that expands the existing literature by applying Pesaran et. al.`s (2001) bounds testing approach to cointegration analysis and investigates the time series relationship between population ageing and net FDI inflows for Japan. To check for robustness, we use two different measures of population ageing, and estimate four different models. The bivariate and multivariate model estimates show that an increase in population ageing is expected to increase net FDI inflows (as a percentage of GDP) in the long-run. The significantly positive long-run relationship is robust across the two different measures of population ageing and across the four models. The long-run results are consistent with the stylized facts.

Economic theory postulates that population ageing will reduce net FDI inflows, but our findings are a contradiction to the predictions of economic theory. We hypothesize that the immediate effect of population ageing on net FDI inflows in Japan could be negative or insignificant in the short-run. But as the government introduces socio-economic reforms to counteract the negative effects of a declining population, eventually, in the long-run, net FDI inflows are expected to increase. Thus the relation between population ageing and net FDI inflows, for Japan, could exhibit a J-curve phenomenon. We have used aggregate level data. It might be interesting to apply the bounds testing approach to cointegration analysis and test the J-curve hypothesis for both Japan and other economies by using a more disaggregate (industry) level data as a future extension of our study.

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