

The Nexus between Female Labor Force Participation and Female Total Fertility Rate in Selected ASEAN Countries: Panel Cointegration Approach

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Abstract

The main objective of this study is to empirically investigate the relationship between female labor force participation (FLFP) and female total fertility rate (FTFR) for the ASEAN-6 countries from the period 1995 to 2013. The Fully Modify OLS (FMOLS) has been applied to explore the cointegration and causality between the suggested variables. The cointegration results confirm that the female labor force participation rate and total female fertility rate are cointegrated for the panel of ASEAN-6 countries. Whereas, long-run Granger causality confirm the causality run from the female total fertility rate to the female labor force participation rate. Moreover, the results show that 1percent increase in the female total fertility rate causes in a 0.44 percent decrease in the female labor force participation rate for the ASEAN-6 countries. The FTFR highest negative effect observed in Indonesia and smallest observed in Thailand. The results of FMOLS confirm the long run panel relationship between female labor force and total female fertility rate.

Keywords: FLFP, FTFR, FMOLS, ASEAN-6 countries

1. Introduction

The relationship between female labor force participation (FLFP) and female total fertility (FTFR) got considerable attention from the researchers of economics and demography. The FLFP rate generally falls around childbirth; mothers who have young children have traditionally been considered as having low labor force attachment. The study of Kenjoh (2005) investigates that among the OECD countries only Scandinavian countries are showing that majority females worked continuously over the life. Nevertheless, more recently, this situation has started to change and there are now other OECD countries where women are working continuously throughout their lives or with only a short interruption at the time of childbirth. As (Kenjoh, 2005) described it, *“one could say that the increase in the labor force participation rate of mothers is one of the most prominent developments of the recent labor market in OECD countries”*.

The nexus of female labor force participation rate (FLFP) and the female total fertility rate (FTFR) is a general problem for the developed and less develop economies. The existing studies only discussed the correlation between female labor force participation and total fertility rate. While the current study deal with correlation as well as causation between them. Conversely, it is possible that two variables are correlated with but not cause each other. Similarly, model based on correlation presume a one period proportional stationary framework, whereas the effect of FTFR and FLFP on each other is unlikely to be immediate and this reality have led to FLFP and FTFR to be model led in a dynamic manner and also as an autoregressive procedure. In the current economic literature question of causality “what causes what?” has received attention. The main intention of the current study is to inspect closely and thoroughly the causal relationship for a panel of ASEAN-6 countries over the period 1995–2013. Furthermore, for the purpose to confirm causality study apply unique combination of econometric approaches in three different directions.

In the first step study applied panel unit root for the purpose to confirm stationarity and level of integration. For the purpose to examine cointegration, Kao panel cointegration technique has been used. In the first step ultimate goal of the study is to confirm the causality, where stationarity and Kao cointegration leads study towards causality because these are the necessary steps before apply granger causality. So, after confirming the stationarity and cointegration Granger causality approach has been applied. Second, the long-run relationship is examined through FMOLS. Third, the study used the most recent data from ASEAN-6 countries.

1.1 ASEAN-6 Country's Comparison between FTFR and FLFP

1.1.1 Indonesia

The total Indonesian population 234,181,400, is recorded and ranked 4th as most populated countries in the world. Among ASEAN-6 countries, Indonesia was ranked 3rd with the average FTFR 2.347 per woman and ranked 4th with the average FLFP 51 percent during the period of 1995-2013. In 1995 FTFR start from 2.699 and continued decreasing till 2.163 in 2013, While, FLFP begin with 49 percent and increased up to 51 percent.

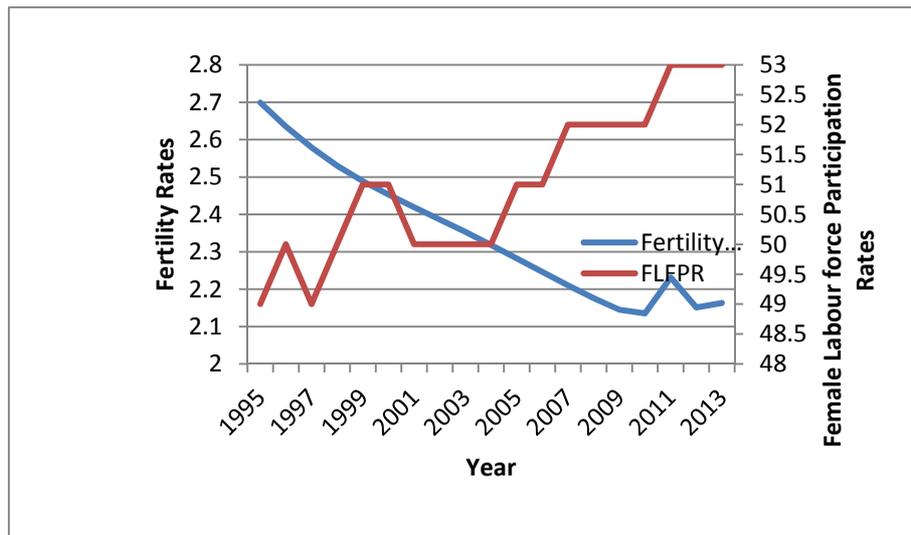


Figure 1. FTFR and FLFP comparison of INDONESIA

1.1.2 Malaysia

The total Malaysian population 28,306,700 is recorded and ranked 44th as most populated country in the world. Among ASEAN-6 countries, Malaysia was ranked 2nd with the average FTFR 2.891 per woman and ranked 6th with the average FLFP 43 percent during the period of 1995-2013. In 1995 FTFR start from 3.301 and continuously decreasing up till 2.555 in 2013, While, FLFP begin with 43 percent and decreased in 1997 up to 42 percent but 2000 it is continuously increasing up to 45 percent.

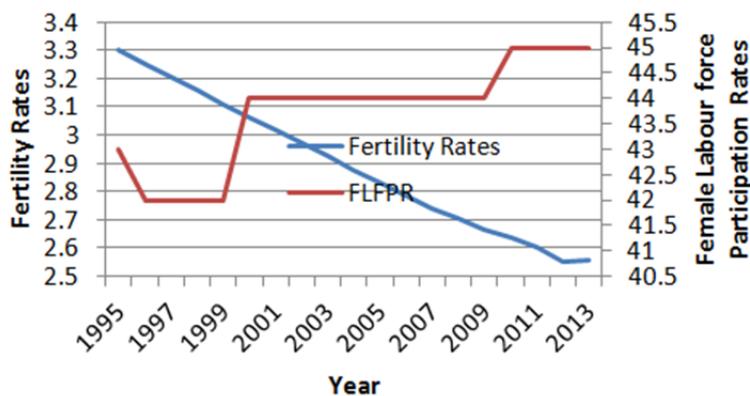


Figure 2. FTFR and FLFP comparison of MALAYSIA

1.1.3 Philippines

The total Philippines population 94,013,200, is recorded and ranked 12th as most populated countries in the world. Among ASEAN-6 countries Philippines was ranked 1st with the average FTFR 3.511 per woman and ranked 5th with the average FLFP 49 percent during the period of 1995-2013. In 1995 FTFR start from 4.006 and continued decreasing up till 2.881 in 2013, While, FLFP begin with 49 percent and shows some fluctuations with increasing and decreasing trend but overall its show decreasing trend.

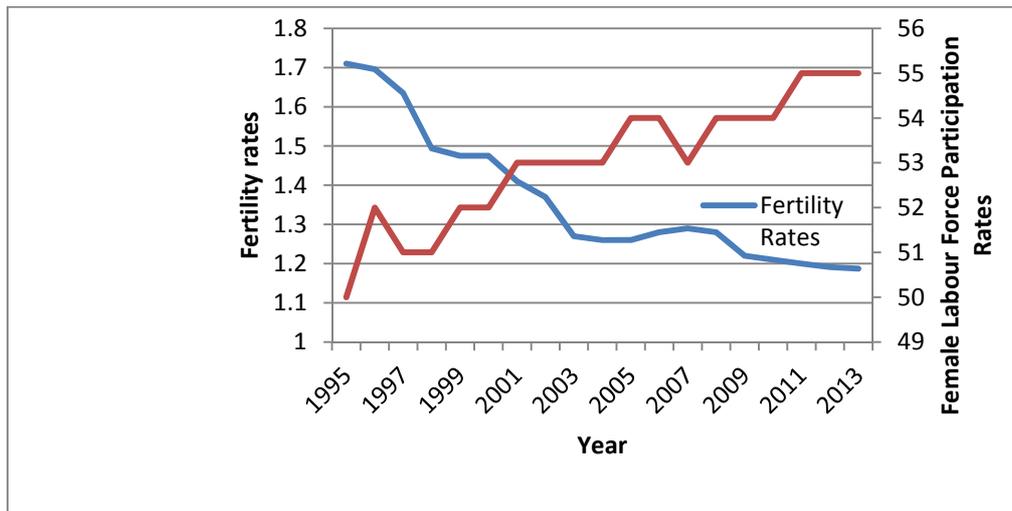


Figure 3. FTFR and FLFP comparison of PHILIPPINES

1.1.4 Singapore

The total Singapore population 4,987,600, is recorded and ranked 114th as most populated countries in the world. Among 6-ASEAN countries, Singapore was ranked 6th with the average FTFR 1.363 per woman and ranked 3rd with the average FLFP 53 percent during the period of 1995-2013. In 1995 FTFR start of 1.71 and continued decreasing up till 1.187 in 2013, While, FLFP begin with 50 percent and increased up to 55 percent.

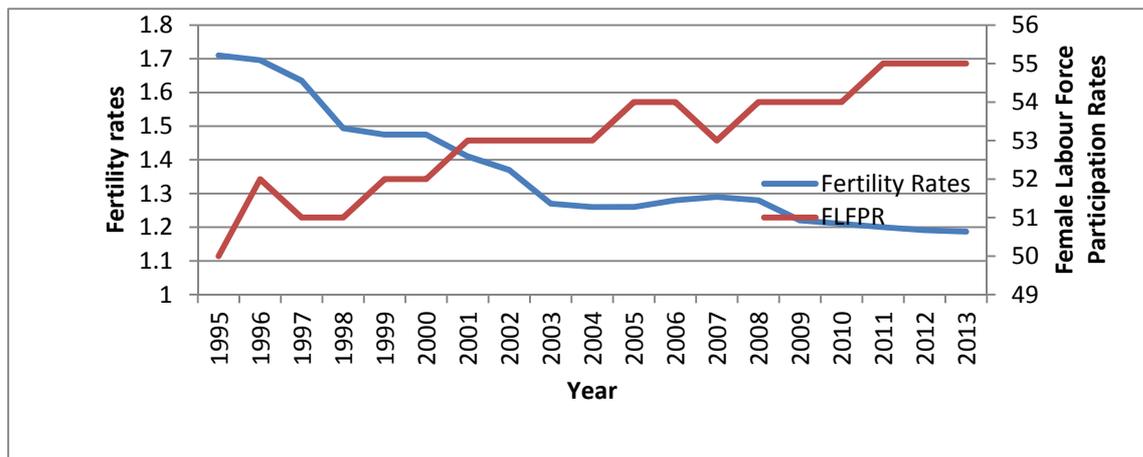


Figure 3. FTFR and FLFP comparison of SINGAPORE

1.1.5 Thailand

The total Thailand population 63,447,374, is recorded and ranked 21st as most populated country in the world. Among ASEAN-6 countries, Thailand was ranked 5th with the average FTFR 1.671 per woman and ranked 2nd with the average FLFP 66 percent during the period of 1995-2013. In 1995 FTFR start of 1.862 and continued decreasing up till 1.534 in 2013, While, FLFP begin with 66 percent and shows variation up till 2013 to 65 percent.

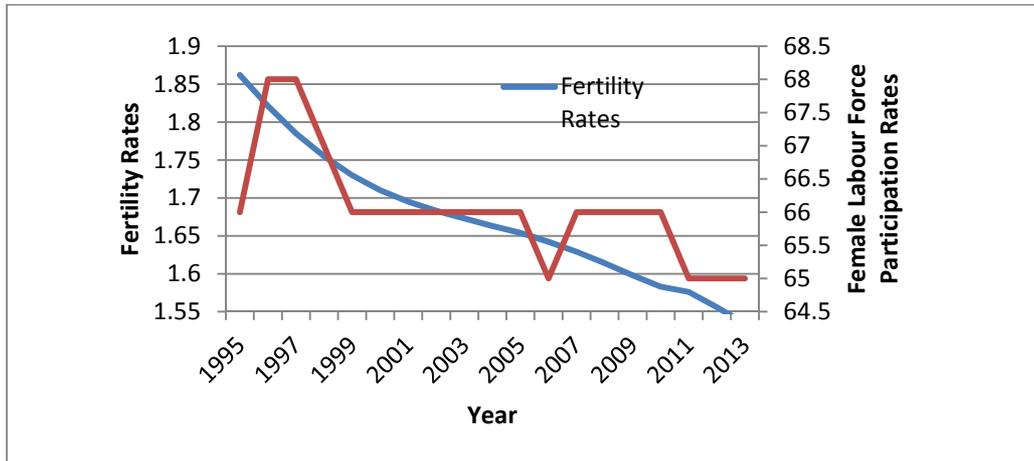


Figure 4. FTFR and FLFP comparison of THAILAND 1.1.6 Vietnam

The total Vietnam population 85,789,573, is recorded and ranked 13th as most populated countries in the world. Among ASEAN-6 countries Vietnam was ranked 4th with the average FTFR 1.991 per woman and ranked 1st with the average FLFP 69 percent during the period of 1995-2013. In 1995 FTFR start of 2.666 and continued decreasing up till 1.791 in 2013, While, FLFP begin with 73 percent and decrease up to 67 percent.

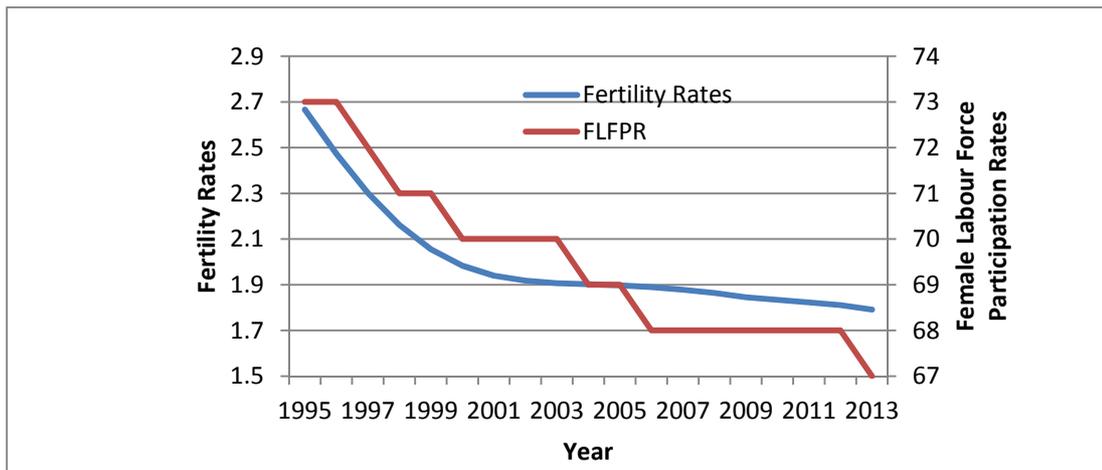


Figure 5. FTFR and FLFP comparison of VIETNAM

Among ASEAN-6 countries three countries (Indonesia, Malaysia and Singapore) showing negative relationship between FTFR and FLFP while three countries (Thailand, Vietnam and Philippines) showing positive relationship between two variables. This complex, controversial and inconsistent results open the research gate for the researchers for further investigation.

1.2 Theoretical Perceptions on Fertility and Female Labor Force Participation

The different researchers such as, Amador, Bernal, and Peña (2013) and Tam (2011) investigates increase in FTFR in two ways, like negative and positive effects on each other. On the negative side, increase in number of children can increase the amount of home work, which causes to reduce the chance of mother to seek work in the market and support the hypothesis of incompatibility role. However, on the positive side, if the number of children increase there is need to increase in household’s income too and it may cause for mother to seek outside employment.

On the other hand, if FLFP is increase and effect negative on FTFR it means its support the hypothesis of incompatibility role. Further, if female employees having children and they admission in child care centre than it is opportunity cost so, FLFP negatively affect FTFR. Additionally increase in FLFP cause in the disruption towards female’s career success, apparent in the hammering of a higher prospective future income tributary and

non-pecuniary settlement, including appreciation and status related with a more senior post in her chosen profession. An additional opportunity cost of increase in numbers of children may perhaps the loss of camaraderie and social associations in the place of work that serve as a point of liberate outside the home. However, researcher investigates that the relationship between FLFP and FTFR revolutionize from a negative to a positive value in the 1980s (Ahn & Mira, 2002).

The studies such as, Engelhardt, Kögel, and Prskawetz (2004) and Narayan and Smyth (2006) explore that the countries with lowest FTFR also have lowest level of FLFP and vice-versa. It is concluded that causality run from FTFR to FLFP and FLFP to FTFR it may has negative effect of FTFR on FLFP and FLFP on FTFR which support the hypothesis of incompatibility role. However, if causality runs from FTFR to FLFP and FLFP to FTFR it may have a positive effect FTFR on FLFP and FLFP on FTFR which support the public response hypothesis.

2. Review of Existing Literature

The nexus between female labor force participation and female total fertility rate is a recent issue among researchers. Similarly studies of Borderías (2013), de Laat and Sevilla-Sanz (2011), Humphries and Sarasúa (2012) and Mahmoudian (2006) found correlation between FLFP and FTFR. While only few studies such as, S.-H. Lee, Ogawa, and Matsukura (2009) and Mishra and Smyth (2010) explore causation between both variables. The study of de Laat and Sevilla-Sanz (2011) explore nexus of female fertility and labor force participation in OECD countries. The results are demonstrates that one effect of Southern Europe's rapid fertility decline is the emergence of a positive cross-country correlation between women's labor force participation and fertility across developed countries, despite the continuing negative correlation between these factors within countries.

The study of Tsani, Paroussos, Fragiadakis, Charalambidis, and Capros (2013), utilized annual time series data of south Mediterranean from the year 1960 – 2008; Ridao-Cano and McNown (2005), employed annual time series data of USA from 1948 – 1997 and Sugawara and Nakamura (2014), used annual time series data of Japan from 1950 – 1993 found that there is evidence of causality between both variables.

Furthermore, Amador et al. (2013) investigated the causation between FTFR and FLFP American females. The results confirm the causality from FLFP to FTFR. Engelhardt et al. (2004) used annual time series data from Sweden, Italy, UK, Germany and France from the year 1960 to 1994 and utilized cointegration and Granger causality. The results showed that there long run causality for all countries. Further, Narayan and Smyth (2006) explored the relationship between FTFR, FLFP and infant mortality rates in Australia from 1960–2000 and investigate that FTFR and infant mortality rate both jointly Granger cause FLFP. As mentioned earlier there not various studies utilized panel cointegration and panel causality between these two purposed variables. So, this the contributions of present study to apply panel cointegration and panel causality to get better results.

3. Econometric Methodology and Data Source

3.1 Data Source

The annual time series data have been used from 1995 to 2013 for the ASEAN-6 countries, namely, Malaysia, Indonesia, Thailand, Singapore, Philippines and Vietnam. The data on total fertility rates and female labor force participation collected from the World Bank data base and converted into natural logarithm before analysis. The FTFR is the weighted mean of age specific fertility rates and FLFP is defined as the adult female population in the age group 15 – 65 years in the labor force.

The different econometric approaches have been applied to test the causality as well as relationship between FTFR and FLFP.

4. Results

4.1 Unit Root Test

Before apply cointegration and causality, it is preliminary to test stationary and level of integration. The augmented Dickey-Fuller (ADF) and Phillips Perron test for unit root have been applied. The results in Table 1 suggest that all the variables of each country are non-stationary at level and become stationary at first difference it means the level of integration of all variables are I(1).

Table 1. ADF and PP Unit Root Test

Country	ADF Unit root test				
	TRF	Level	First Difference	FLFP	
		Level	First Difference	Level	First Difference
Indonesia		0.761	0.032*	1.981	0.000*
Malaysia		0.321	0.045*	0.987	0.045*
Philippines		0.061	0.001*	0.891	0.032*
Singapore		0.098	0.030*	0.762	0.010*
Thailand		0.754	0.012*	1.987	0.023*
Vietnam		1.896	0.000*	0.056	0.049*
Country	PP Unit root test				
		Level	First Difference	TRF	FLFP
		Level	First Difference	Level	First Difference
Indonesia		0.761	0.032*	1.981	0.000*
Malaysia		0.321	0.045*	0.987	0.045*
Philippines		0.061	0.001*	0.891	0.032*
Singapore		0.098	0.030*	0.762	0.010*
Thailand		0.754	0.012*	1.987	0.023*
Vietnam		1.896	0.000*	0.056	0.049*

Note: * statistically significant at 5 percent.

4.2 Cross Sectional Dependence (CD) Test

It is observed that the Panel unit root tests are more powerful because of joint information from cross section data and time series data. But it is observed that panel unit test are facing enormous problem of cross-sectional dependence. The test applied for check panel cross sectional dependence (CD) is proposed by Pesaran (2004). The statistics based on univariate AR (p) specification with the level of variables $p \leq 4$. The null hypothesis (H_0) stated that output innovation is independent by cross sectional. The critical values for CD test are 1% = 2.57, 5% = 1.96 and 10% = 1.64. The results of Pesaran (2004) test are reported in Table 2.

Table 2. Cross Section Dependence Test

ADP regression across Six-Asian countries				
1995-2013 ($T = 19, N = 6$)				
	p = 1	p = 2	p = 3	p = 4
FTFR				
\hat{I}	0.134	0.118	0.321	0.104
CD	4.532***	3.312***	3.041***	3.041***
FLFP				
\hat{I}	0.091	0.043	0.051	0.055
CD	2.413**	1.214	1.314	1.312

Note: **, *** denoted for statistically significant at 5 % and 1% level, respectively.

The CD test is significant at 1%, and FTFR correlation coefficient observed around 0.1.

4.3 Panel Unit Root Test

The panel unit root is based on different tests. The prominent tests are Im *et al.* (2003) Levin *et al.* (2002) and also include IPS test statistic (CIPS) proposed by Pesaran (2007). According to LLC tests it is presumes that countries include in the test are unite towards the equilibrium value with the same velocity under the alternative hypothesis (H_1). The panel unit root test results are reported in Table3. The results of utilized tests confirm that FLFP and FTFR are I (1).

Table 3. Panel Unit Root Test Results

	FTFR		FLFP	
	Level	Difference	Level	Difference
IPS	2.62	-7.31***	3.21	-4.82***
LLC	-0.18	-6.89***	0.54	-5.12***
CIPS	-2.312	-5.012***	-1.675	-3.123***

The IPS test is less restrictive as compare to the LLC because the IPS test does not make assumptions like LLC test. The IPS test looks towards the solution of CD problem. For transformed the data IPS test subtracts the cross sectional means and apply the *T-bar* statistic. However, Strauss and Yigit (2003) suggested that humiliate across the panel does not habitually eradicate CD. Strauss and Yigit argue that CIPS test is more powerful as compare to IPS test and LLC test because CIPS unambiguously permit for CD by suitably truncating the IPS *t*-bar statistic.

4.4 Cointegration Test

To investigate the cointegration between FTFR and FLFP this study applied Johansen maximum likelihood (JML) approach developed by Johansen (1988) instead of Kao’s cointegration approach. The results for maximum likelihood reported in Table4. The results suggest that the null hypothesis (H_0) of no cointegration rejected for Indonesia, Vietnam and Singapore and null hypothesis of one cointegration cannot be rejected in these countries. Furthermore, the null hypothesis of no cointegration and null hypothesis of one cointegration cannot be rejected for Malaysia, Philippines and Thailand.

Table 4. Johansen cointegration test results

Maximum Eigen value statistics for $H_0 : rank = r$			
Country	$r = 0$ (17.3, 19.4, 23.8)	$r \leq 1$ (10.7, 12.6, 16.6)	<i>p</i>
Indonesia	21.03**	11.44	2
Malaysia	17.78	7.15	1
Philippines	9.87	7.74	2
Vietnam	31.35***	8.93	2
Thailand	10.12	5.44	1
Singapore	25.35***	9.12	2

Note: **, *** rejected null at 5% and 1% level, respectively.

It is concluded that there is a single cointegration vector for three (Indonesia, Vietnam, Singapore) out of ASEAN-6 countries. The Pedroni (2000) panel cointegration test has been applied to confirm the long run relationship between both variables. Pedroni (2000) presents seven different statistics to test the null of no cointegration in heterogeneous panels. Pedroni divided these seven tests into two groups. Group one called within the dimension panel test and second group called between dimension group tests.

$$TFR_{i,t} = \alpha_i + \beta_i FLFP_{i,t} + \varepsilon_{i,t} \tag{1}$$

Here FLFP and FTFR are defined as above and $\varepsilon_i t = \eta_i \varepsilon_i (t-1) + \mu_i t$ is the estimated residuals from the panel regression. The values of seven statistics and two groups are tabulated in Pesaran (2004). If the calculated values are higher than tabulated value the null hypothesis of no cointegration can be rejected and it is suggested that there is exist a long run relationship between FTFR and FLFP. The results of panel cointegration presented in Table 5.

Table 5. Panel Cointegration Tests

Pedroni Test			
	Statistics	$r = 0$	$r \leq 1$
FTFR has cointegration			
Panel of v-statistics	0.32431	35.12***	13.19
Panel of rho test-statistics	0.33400		

Panel of PP test-statistics	0.42071
Panel of ADF test-statistics	-0.14563
Group rho test-statistics	1.43251
Group PP test-statistics	1.34210
Group ADF test-statistics	0.56213
FLFP has cointegration	
Panel of v-statistics	1.34512
Panel of rho test-statistics	-1.67123*
Panel of PP test-statistics	-2.41231**
Panel of ADF test-statistics	-2.13210**
Group rho test-statistics	-2.42131**
Group PP test-statistics	-3.43231***
Group ADF test-statistics	-3.34412***

The results suggested that the majority of the variables confirms the panel cointegration in case of FLFP as dependent variable, whereas, none of the variable is cointegrated in case of FTFR as the dependent variable. These seven statistics are residual-based; to aggregate the probability-values of the individual JML cointegration test statistics Fisher χ^2 cointegration test utilized.

4.5 Causality Test

After the confirmation of cointegration study examine the direction of causality between the FTFR and FLFP. As it is confirmed that there is a long run relationship between both variables, Granger causality for a long run relationship run with the dynamic error correction model (DECM) specification. The DECM is estimated by following a two-step procedure. First, the study estimates the cointegration between FTFR and FLFP follow the JML procedure. Second, the study utilizes the results of this cointegrating relation to estimate the EC term $ECT_{it} = FTFR_{it} - \hat{\alpha}_i - \hat{b}_i - \hat{\beta}_i FLFP_{it}$.

Now study estimate ECM:

$$\Delta TFR_{it} = \alpha_{1i} \sum_{l=1}^p \alpha_{11ip} \Delta TFR_{it-p} + \sum_{l=1}^p \alpha_{12ip} \Delta FLFP_{it-p} + \phi_{1i} ECT_{it-1} + \epsilon_{1it} \tag{2}$$

$$\Delta FLFP_{it} = \alpha_{2i} \sum_{l=1}^p \alpha_{21ip} \Delta FLFP_{it-p} + \sum_{l=1}^p \alpha_{22ip} \Delta TFR_{it-p} + \phi_{2i} ECT_{it-1} + \epsilon_{2it} \tag{3}$$

where FTFR and FLFP are already defined, denoted first difference,

- Δ = First Difference
- ECT = Error correction term
- p = Lag length

The results of long run panel causality are presented in Table6. The Wald test shows that variables are significant in the Equation 2 and 3. According to results reported in Table6 the null hypothesis (H_0) FTFR does not cause FLFP is rejected, while the null hypothesis (H_0) FLFP does not cause FTFR cannot be rejected at the 5% significance level. Finally, findings of these results suggested that there is a unidirectional long-run Granger causality relationship running from FTFR to FLFP. In case of large N and small T the dynamic panel data usually face the problem of Nickell (1981) bias. In this study, we used large $T = 19$ and small $N = 6$ so the Nickell (1981) bias is negligible and can be ignored.

Table 6. Long-Run Panel causality Tests

H_0 :No Causality	X^2	Probability- value
FLFP does not cause FTFR	0.66	0.44
FTFR does not cause FLFP	3.81	0.01**

** Rejection of the H_0 at the 5% critical value.

4.6 Fully Modify Least Square (FMOLS) Test

After the confirmation of cointegration and the direction of causality, the study able to test the structural coefficients by using FMOLS test. The recently numerous studies such as Abidin, Bakar and Haseeb (2014) and Haseeb et al. (2014) has been applied the same methodology in the case of Malaysia. The FMOLS test proposed by Pedroni (2000) and tackles the dilemma of regressors with non-stationary specification, as well as the dilemma of simultaneity biases. For example, $I = 1, 2, \dots, N$ countries over time $t = 1, 2, \dots, M$: than

$$Y_{it} = \alpha_{it} + \beta X_{it} + \varepsilon_{it} \quad \text{and} \quad X_{it} = X_{it-1} + \mu_{it} \quad (4)$$

The panel FMOLS estimator for coefficient β is

$$\hat{\beta}_{FMOLS} = [\sum_{i=1}^N \sum_{t=1}^T x_{it} x'_{it}]^{-1} [\sum_{i=1}^N \sum_{t=1}^T (x_{it} y_{it} - \lambda_{i,\varepsilon u})] \quad (5)$$

The results of the panel long run relationship estimator by using FMOLS are presented in Table7. The results explain that FTFR of all ASEAN-6 countries and as a whole have a statistically significant negative effect on FLFP.

Table 7. FMOLS estimators Results

FLFP is dependent variables		
Country	Coefficients	t-statistics
Indonesia	-0.66***	-9.45
Malaysia	-0.43***	-6.79
Thailand	-0.12***	-3.34
Singapore	-0.45***	-16.12
Vietnam	-0.13***	-6.13
Philippines	-0.41***	-6.13
Panel	-0.44***	-19.13

***significant at 1% critical value.

The largest effect of FTFR on FLFP is observed in Indonesia, where 1% increase in FTFR cause decreases FLFP by 0.66%. While in three countries, among ASEAN-6 countries effect of FTFR on FLFP is almost similar, which is a 1 % increase in FTFR cause decrease FLFP by 0.45%, 0.43% and 0.41% in Singapore, Malaysia and Philippines respectively. Furthermore, the smallest effect of FTFR on FLFP observed in Thailand, where increases 1% in FTFR cause reduces FLFP by 0.12%. The result of the panel long run elasticity suggested that 1% increase in FTFR causes FLFP decrease by 0.44%.

The negative equilibrium relationship between FLFP and FTFR are the witness of the lack of effective access to childcare. Chevalier and Viitanen (2002) investigate the causality between FLFP with young children and the supply of childcare in the UK. The results are suggested that lack of childcare services confines FLFP and currently increase in demand for childcare only serve to increase costs or queues rather than have an effect on the supply. The results are leads that if the Government of UK have aim to increase FLFP than change policy in the child care market is required. Similarly, Bratti (2003) also suggested childcare improvement and increased access to affordable childcare in Italy. Furthermore, B. S. Lee, Jang, and Sarkar (2008) investigates FLFP in Korea and Chen, Shao, Murtaza, and Zhao (2014) in Germany. The results are suggested that FLFP is affected by childcare supply.

5. Conclusion

The main aim of this study is to investigate the direction of causality between FLFP and FTFR for the ASEAN-6 countries. For the purpose to check the stationarity and level of integration panel unit root test have been applied. After confirmed the stationarity of each variable, panel cointegration and Granger causality test used to examine the cointegration and direction of causality between FLFP and FTFR. The panel based cointegration has advantage against individual cointegration that it is more powerful, especially in case of small size with less than 50 observations. The results of cointegration confirm the cointegration between proposed variables. In addition, results of panel causality suggested that there is causality run from FTFR to FLFP in the ASEAN-6 countries. The results also suggested that there is an opposite relationship between FLFP and FTFR. The FMOLS techniques are used to examine the long run relationship between FLFP and FTFR and results confirm the long run relationship between FLFP and FTFR. This study is multivariate setting further it can be extended

investigating causality between FLFP and FTFR from the bivariate context. Further FTFR and FLFP also can consider as factor influence the opportunity cost of having more children like household total income, female education and male unemployment.

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