Chapter 4

Empirical Results

In this chapter, research results as well as hypothesis testing will be presented. First of all, the data will be tested for stationarity using Fisher-type unit root tests—both Augmented Dickey-Fuller (ADF) and Philips-Perron (PP). After stationarity is confirmed, panel ordinary least square regression of *Model 1*—the model of direct impacts of the stock market variables upon economic growth—will be conducted. In this stage *Hypothesis 1: The stock market has a positive impact on economic growth* will be tested. Then, Granger causality test will be employed to determine whether the stock market and the economy have bi-directional causality—*Hypothesis 2.* In the next stage, two-stage least squares (2SLS) is employed on *Model 2*—the model of indirect impacts of stock market variables upon economic growth. At this stage, *Hypothesis 3* stating that the impact of the stock market upon economic growth is both direct and indirect will be tested. Finally, Tobit analysis will be employed on Model 3—the model of the impacts of stock market variables upon income inequality—and *Hypothesis 4: Stock market development has a Kuznets inverted-U relationship with income inequality* tested.

Unit root tests result

The study employs Fisher-type unit root tests (ADF and PP) to test stationarity of the data because of their ability to deal with unbalanced panel data. The tests for each variable are done in three types of model: model with intercept, model with intercept and trend, and model with neither intercept nor trend. The null hypothesis is that each variable has a unit root, i.e., the data are not stationary. The determination of stationarity of the data is based on both the Fisher Chi-square and the Choi Z-statistic. For both statistics, if the null hypothesis is rejected, the variable will be considered to be stationary. The results are presented in *Table 4.1*.

Table 4.1 Fisher-type unit root tests

Var.	Method	Fisher type test-ADF			Fisher type test-PP		
		Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
GGDP	Fisher Chi-square	30.99 ***	23.72 ***	29.54 ***	31.28 ***	23.10 ***	27.91 ***
	Choi Z-stat	-3.42 ***	-2.40 ***	-3.15 ***	-3.47 ***	-2.40 ***	-2.97 ***
GGDP CAP	Fisher Chi-square	29.05 ***	N/A	N/A	28.23 ***	7.78 *	37.52 ***
	Choi Z-stat	-3.53 ***			-3.43 ***	-1.50 *	-4.44 ***
FDI/G DP	Fisher Chi-square	33.16 ***	19.83 **	18.80 *	52.76 ***	32.36 ***	27.12 ***
	Choi Z-stat	-2.55 ***	-1.47 *	-1.85 **	-3.47 ***	-3.53 ***	-2.84 ***
GTRA DE	Fisher Chi-square	54.45 ***	56.58 ***	87.04 ***	53.89 ***	N/A	N/A
	Choi Z-stat	-4.92 ***	-5.49 ***	-7.33 ***	-4.78 ***		
GEX	Fisher Chi-square	34.95 ***	25.20 **	43.94 ***	34.58 ***	14.21 *	42.77 ***
	Choi Z-stat	-3.78 ***	-2.74 ***	-4.70 ***	-3.73 ***	-1.88 **	-4.58 ***
INTER FIN	Fisher Chi-square	28.12 ***	27.67 ***	13.33	24.96 ***	6.41 **	13.31
	Choi Z-stat	-3.07 ***	-2.76 ***	-1.21	-2.58 ***	-1.74 **	-1.25

Table 4.1 Fisher-type unit root tests (continued)

Var.	Method	Fisher type test-ADF			Fisher type test-PP		
		Intercept	Intercept and trend	None	Intercept	Intercept and trend	None
GK	Fisher Chi-square	33.39 ***	17.92 *	46.82 ***	32.08 ***	26.55 ***	45.21 ***
	Choi Z-stat	-3.45 ***	-1.52 *	-4.80 ***	-3.30 ***	-2.19 **	-4.68 ***
GC	Fisher Chi-square	46.94 ***	32.40 ***	26.75 ***	N/A	N/A	33.19 ***
	Choi Z-stat	-5.12 ***	-3.93 ***	-2.01 **			-2.93 ***
GVAAG	Fisher Chi-square	57.48 ***	42.29 ***	86.53 ***	60.01 ***	50.18 ***	80.23 ***
	Choi Z-stat	-5.66 ***	-4.29 ***	-7.67 ***	-5.83 ***	-4.62 ***	-7.33 ***
GVAMANU	Fisher Chi-square	74.59 ***	40.75 ***	72.00 ***	79.54 ***	57.48 ***	63.67 ***
	Choi Z-stat	-6.68 ***	-4.16 ***	-6.80 ***	-6.74 ***	-5.18 ***	-6.24 ***
GVASERV	Fisher Chi-square	57.09 ***	39.08 ***	50.67 ***	46.08 ***	29.52 ***	50.49 ***
	Choi Z-stat	-5.34 ***	-3.66 ***	-5.14 ***	-4.59 ***	-2.75 ***	-5.11 ***
MCR	Fisher Chi-square	28.43 ***	25.15 ***	11.14	27.49 ***	10.12	9.19
	Choi Z-stat	-2.99 ***	-2.71 ***	-0.63	-2.78 ***	-1.47 **	-0.17
TR	Fisher Chi-square	42.61 ***	30.48 ***	12.75	39.78 ***	28.55 ***	16.49
	Choi Z-stat	-4.46 ***	-3.33 ***	-0.74	-4.18 ***	-3.03 ***	-1.35 *
EHII	Fisher Chi-square	46.74 ***	28.31 ***	6.25	42.23 ***	18.60 ***	7.82
	Choi Z-stat	-2.80 ***	-1.78 **	0.78	-2.46 ***	-1.66 **	0.45

From the table all variables are stationary in at least one model in both statistics. Therefore, employing these variables in the ordinary least-squared regressions in the following sections should not lead to unbiased results.

4.1 Model 1: The direct relationship between stock market development and economic growth

The first model shows the direct relationship between stock market measures—MCR (market capitalization ratio) and TR (turnover ratio)—and economic growth—GGDP (growth of nominal gross domestic product, %). Other independent variables are also added to the model apart from MCR and TR. These are GK (growth of gross fixed capital formation, %), GC (growth of household final consumption expenditure, %), FDI/GDP (ratio of foreign direct investment to gross domestic product), GTRADE (growth of trade as % of GDP, %), GEX (growth of exports of goods and services, %), INTERFIN (financing via international capital markets as % of GDP, %) GVAAG (growth of value added in agricultural sector, %), GVAMANU (growth of value added in manufacturing sector, %) and GVASERV (growth of value added in service sector, %). The study experiments with adding and dropping variables in and out of the model to find out the best models based on the adjusted R-squared of the overall equation and the t-statistic of each variable. After such experiment, two alternatives provide strong value of fit and as many significant explanatory variables as possible. For both alternatives, the fixed effect model and the random effect model are estimated. Then a Hausman test is performed to determine whether the model should be fixed-effect or random-effect.

Alternative 1:

For *Alternative 1*, independent variables included are MCR, TR, GK, GC, FDI/GDP, GEX and GVAMANU. The estimations of fixed effect model are presented in *Table 4.2,* and *Table 4.3*; while the estimations of random effect model are presented in *Table 4.4, Table 4.5.*

Table 4.2 Fixed effect model

OLS with group dummy variables		
Dependent var.: GGDP	Mean Standard deviation	5.49 4.19
Model size	Observations Parameters Degree of freedom	98 13 85
Residuals	Sum of squares Standard error of e	323.46 1.95
Fit	R-squared Adjusted R-squared	0.81 0.78
Model test	F (prob.)	30.26 (0.00)
Diagnostic	Log likelihood Restricted (b=0) Chi-square (prob.)	-197.57 -279.03 162.92 (0.00)
Information criterion	LogAmemiya Prd. Crt. Akaike Info. Criterion	1.46 1.46
	Estimated autocorrelation of e	0.34
White Hetero. Corrected covariance matrix used. Variances assumed equal within groups		

Table 4.3 Fixed effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
MCR	0.17	0.73	0.23	0.82	0.71
TR	0.89	1.16	0.77	0.44	0.45
GK	0.08	0.02	4.93	0.00	10.46
GC	0.26	0.04	7.15	0.00	5.64
FDI/GDP	8.48	8.57	0.99	0.32	0.02
GEX	0.05	0.02	2.95	0.00	11.61
GVAMANU	0.08	0.02	4.35	0.00	10.81

Table 4.4 Random effect model

OLS without group dummy variables		
Dependent var.: GGDP	Mean	5.49
	Standard deviation	4.19
Model size	Observations	98
	Parameters	8
	Degree of freedom	90
Residuals	Sum of squares	329.59
	Standard error of e	1.91
Fit	R-squared	0.81
	Adjusted R-squared	0.79
Model test	F (prob.)	53.67 (0.00)
Diagnostic	Log likelihood	-198.49
	Restricted (b=0)	-279.03
	Chi-square (prob.)	161.08 (0.00)
Information criterion	LogAmemiya Prd. Crt.	1.38
	Akaike Info. Criterion	1.38

Table 4.5 Random effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
Constant	0.72	0.47	1.54	0.13	10.81
MCR	0.53	0.30	1.79	0.08	0.71
TR	0.76	0.63	1.21	0.23	0.45
GK	0.08	0.02	3.80	0.00	10.46
GC	0.27	0.04	6.17	0.00	5.64
FDI/GDP	12.80	7.93	1.61	0.11	0.02
GEX	0.05	0.02	2.27	0.03	11.61
GVAMANU	0.08	0.02	3.15	0.00	10.81

The Hausman test value for this model is 0.00 with probability of 1.00 implying that *Alternative 1* should be a random effect model, where a low test value favors the random effect model.

From *Table 4.5* the estimation of the random effect model shows that MCR is the only stock market measure that has significant positive impact upon economic growth at 90% level of significance. If MCR increases by 0.10 units, GGDP will increase 0.05%.[1] This implies that the larger the size of the stock exchange relative to the size of the economy, the higher the economic growth. In contrast, market liquidity has no significant impact. For other macroeconomic variables, GK, GC, GEX, GVAMANU all have positive significant impact upon GGDP at the 95% level of significance.

Testing of four different types of classical models is presented in *Table 4.6* and *Table 4.7*. From *Table 4.6* based on R-squared level, *Model 3*—with X-variables

[1] The interpretation of coefficient is based on the size of each variable's mean. For example, if the mean is less than 1.15, the independent variable will be assumed to increase by 0.10 units. If the mean is 5, the independent variable will be assumed to increase by 1 unit.

only—and *Model 4*—with X and group effects—are both significant models. In *Table 4.7* comparison of *Model 3* and *Model 4* shows that neither model is significantly better than the other one. If parsimony is at interests, *Model 3*—with less variables—should be selected.

Table 4.6 Test statistics for the Classical models

Model	Log-likelihood	Sum of squares	R-squared
(1) Constant term only	-279.03	0.1705330146D+04	0.00
(2) Group effects only	-275.14	0.1575412145D+04	0.08
(3) X-variables only	-198.49	0.3295909890D+03	0.81
(4) X and group effects	-197.57	0.3234558255D+03	0.81

Table 4.7 Hypothesis tests for the Classical models

	Hypothesis Tests						
	Likelihood ratio test			F tests			
	Chi-squared	d.f.	Prob.	F	Num.	Denom.	Prob.
(2) vs (1)	7.77	5	0.17	1.52	5	92	0.19
(3) vs (1)	161.08	7	0.00	53.67	7	90	0.00
(4) vs (1)	162.92	12	0.00	30.26	12	85	0.00
(4) vs (2)	155.16	7	0.00	47.00	7	85	0.00
(4) vs (3)	1.84	5	0.87	0.32	5	85	0.90

Alternative 2

In the second alternative model, INTERFIN is added to the previous set of independent variables. The estimations of fixed effect model are presented in *Table 4.8, Table 4.9* and the estimations of random effect model are presented in *Table 4.10, Table 4.11.*

Table 4.8 Fixed effect model

OLS with group dummy variables		
Dependent var.: GGDP	Mean Standard deviation	4.88 4.13
Model size	Observations Parameters Degree of freedom	83 13 70
Residuals	Sum of squares Standard error of e	261.77 1.93
Fit	R-squared Adjusted R-squared	0.81 0.78
Model test	F (prob.)	25.38 (0.00)
Diagnostic	Log likelihood Restricted (b=0) Chi-square (prob.)	-165.44 -235.05 139.22 (0.00)
Information criterion	LogAmemiya Prd. Crt. Akaike Info. Criterion	1.46 1.46
	Estimated autocorrelation of e	0.31
White Hetero. Corrected covariance matrix used. Variances assumed equal within groups		

Table 4.9 Fixed effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
MCR	0.23	0.91	0.26	0.80	0.69
TR	1.08	1.01	1.08	0.28	0.49
GK	0.09	0.01	6.16	0.00	8.57
GC	0.22	0.03	6.59	0.00	5.18
FDI/GDP	15.43	9.50	1.62	0.11	0.02
GEX	0.04	0.01	2.86	0.01	10.04
INTERFIN	0.22	0.10	2.27	0.03	3.50
GVAMANU	0.07	0.02	4.55	0.00	9.53

Table 4.10 Random effect model

OLS without group dummy variables		
Dependent var.: GGDP	Mean	4.88
	Standard deviation	4.13
Model size	Observations	83
	Parameters	9
	Degree of freedom	74
Residuals	Sum of squares	264.02
	Standard error of e	1.89
Fit	R-squared	0.81
	Adjusted R-squared	0.79
Model test	F (prob.)	39.83 (0.00)
Diagnostic	Log likelihood	-165.80
	Restricted (b=0)	-235.05
	Chi-square (prob.)	138.51 (0.00)
Information criterion	LogAmemiya Prd. Crt.	1.37
	Akaike Info. Criterion	1.37

Table 4.11 Random effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
Constant	-0.01	0.58	-0.03	0.98	
MCR	0.34	0.35	0.99	0.33	0.69
TR	1.23	0.68	1.81	0.07	0.49
GK	0.09	0.02	4.19	0.00	8.57
GC	0.23	0.05	4.62	0.00	5.18
FDI/GDP	17.04	8.74	1.95	0.05	0.02
GEX	0.04	0.02	1.59	0.11	10.04
INTERFIN	0.19	0.09	2.22	0.03	3.50
GVAMANU	0.07	0.03	2.76	0.01	9.53

The Hausman test value for this model is similar to that of *Alternative 1* which is 0.00—with probability of 1.00—implying that *Alternative 2* should also be a random effect model. Therefore, the random effect model is selected.

The estimation of the random effect model from *Table 4.5* shows that, unlike *Alternative 1* TR is the only stock market measure that has positive significant impact on economic growth at 90% level of significance. If TR increases by 0.10 units, GGDP will increase 0.12%. Note that the impact is much stronger than the impact of MCR in *Alternative 1*.

The interpretation is that higher liquidity in the stock exchange will lead to higher economic growth. For other macroeconomic variables, GK, GC, FDI/GDP, GVAMANU and INTERFIN all have positive significant impact on GGDP at 95% level of significance. Adding INTERFIN to the model does not significantly change the coefficients of fit of other macroeconomic variables.

Tests of classical model types are presented in *Table 4.12* and *Table 4.13*. From *Table 4.12 Model 3*—with X-variables only—and *Model 4*—with X and group effects—are both significant according to R-squared. In *Table 4.13* hypothesis test of *Model 3* versus *Model 4* shows that neither model is significantly better than the other one.

Table 4.12 Test statistics for the Classical models

Test Statistics for the Classical Model			
Model	**Log-likelihood**	**Sum of squares**	**R-squared**
(1) Constant term only	-235.05	0.1400855441D+04	0.00
(2) Group effects only	-232.87	0.1329069473D+04	0.05
(3) X-variables only	-165.80	0.2640214158D+03	0.81
(4) X and group effects	-165.44	0.2617685526D+03	0.81

Table 4.13 Hypothesis tests for the Classical models

	Hypothesis Tests						
	Likelihood ratio test			F tests			
	Chi-squared	**d.f.**	**Prob.**	**F**	**Num.**	**Denom.**	**Prob.**
(2) vs (1)	4.37	4	0.36	1.05	4	78	0.39
(3) vs (1)	138.51	8	0.00	39.83	8	74	0.00
(4) vs (1)	139.22	12	0.00	25.38	12	70	0.00
(4) vs (2)	134.86	8	0.00	35.68	8	70	0.00
(4) vs (3)	0.71	4	0.95	0.15	4	70	0.96

MODEL CHOICE: Alternative 2

To compare between *Alternative 1* and *Alternative 2*, two points are addressed: goodness of fit and model specification. According to adjusted R-squared, Alternative *1* and *Alternative 2* are equivalent models since adjusted R-squared levels are equal at 0.79. On the side of model specification, *Alternative 2* adds INTERFIN to *Alternative 1*'s set of independent variables. In reality where international capital markets certainly exist, *Alternative 2* is a more suitable model explaining economic growth.

Hypothesis testing:

"Hypothesis 1: The stock market has a positive impact on economic growth."

From *Alternative 2*, TR has significant positive impact on GGDP. Therefore, *Hypothesis 1* is accepted.

Figure 4.1 Hypothesis 1 testing

Finally, to find whether the impact of stock market on economic growth is bi-directional or not, panel Granger causality tests are employed. The results with up to 3 lag-periods are presented in *Table 4.14*. If the null hypothesis is rejected (probability is less than 0.10), then the first variable has Granger causality on the second variable stated in the null hypothesis.

Table 4.14 Panel Granger causality tests

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	4.36	0.04	25.80	0.00	15.48	0.00
GGDP does not Granger Cause MCR	2.22	0.14	2.11	0.13	0.87	0.46
TR does not Granger Cause GGDP	31.43	0.00	36.04	0.00	23.79	0.00
GGDP does not Granger Cause TR	2.34	0.13	3.08	0.05	1.72	0.17
TR does not Granger Cause MCR	0.08	0.78	1.87	0.16	1.34	0.27
MCR does not Granger Cause TR	4.99	0.03	5.78	0.00	3.89	0.01

Considering the period in the study is annually, lag of 1 year is the period that should be most likely for impact to occur. Therefore, MCR and TR have one-way causality on GGDP and MCR also has one-way causality on TR.

Hypothesis testing:

"Hypothesis 2: The stock market and the economy have two-way symbiosis in the Granger sense. In other words, the stock market both affects and is affected by GDP growth."

Since for a 1 period lag, the impact of MCR and TR on GGDP is uni-directional, *Hypothesis 2* is rejected.

Figure 4.2 Hypothesis 2 testing

Table 4.15-Table 4.20 show the re-examinations of the causality tests using time-series data from each country. For lag of 1 period, the results of the Philippines and Vietnam confirm the panel-data results. For Malaysia, Singapore and Indonesia, TR is the only stock market indicator that has uni-directional causality on GGDP. Contrasting to the panel results, GGDP has uni-directional causality on MCR in Singapore and Indonesia. For Thailand, TR has uni-directional causality on MCR instead of the other way around. Moreover, Thailand is the only country where stock market indicators do not have causality on GGDP.

Table 4.15 Granger causality tests for Singapore

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	2.25	0.15	4.81	0.02	5.22	0.02
GGDP does not Granger Cause MCR	3.00	0.10	2.67	0.10	1.36	0.30
TR does not Granger Cause GGDP	11.01	0.00	4.34	0.91	2.56	0.10
GGDP does not Granger Cause TR	1.41	0.25	0.10	0.91	0.45	0.72
TR does not Granger Cause MCR	0.10	0.76	0.67	0.53	0.25	0.86
MCR does not Granger Cause TR	1.51	0.24	0.88	0.43	1.93	0.18

Table 4.16 Granger causality tests for Malaysia

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	2.81	0.11	10.96	0.00	5.62	0.01
GGDP does not Granger Cause MCR	0.00	1.00	0.42	0.66	0.54	0.66
TR does not Granger Cause GGDP	21.10	0.00	14.18	0.00	10.77	0.00
GGDP does not Granger Cause TR	0.80	0.38	0.82	0.46	2.73	0.09
TR does not Granger Cause MCR	0.06	0.81	0.39	0.68	0.40	0.75
MCR does not Granger Cause TR	16.50	0.00	6.78	0.01	6.46	0.01

Table 4.17 Granger causality tests for the Philippines

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	3.99	0.06	4.25	0.03	3.24	0.06
GGDP does not Granger Cause MCR	1.62	0.22	1.21	0.33	2.53	0.11
TR does not Granger Cause GGDP	4.15	0.06	2.65	0.10	1.82	0.20
GGDP does not Granger Cause TR	0.05	0.82	0.02	0.98	0.59	0.63
TR does not Granger Cause MCR	0.00	0.97	0.21	0.81	1.98	0.17
MCR does not Granger Cause TR	12.25	0.00	7.20	0.01	9.90	0.00

Table 4.18 Granger causality tests for Thailand

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	0.22	0.64	6.53	0.01	4.25	0.03
GGDP does not Granger Cause MCR	0.00	1.00	0.16	0.85	0.86	0.49
TR does not Granger Cause GGDP	0.46	0.50	7.17	0.01	5.22	0.02
GGDP does not Granger Cause TR	0.05	0.82	0.05	0.96	0.88	0.48
TR does not Granger Cause MCR	16.34	0.00	15.07	0.00	8.78	0.00
MCR does not Granger Cause TR	1.19	0.29	2.06	0.16	0.58	0.64

Table 4.19 Granger causality tests for Indonesia

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	0.03	0.88	4.39	0.03	2.23	0.03
GGDP does not Granger Cause MCR	3.03	0.10	3.75	0.05	1.25	0.34
TR does not Granger Cause GGDP	40.20	0.00	22.70	0.00	13.94	0.00
GGDP does not Granger Cause TR	0.38	0.55	0.13	0.88	0.18	0.91
TR does not Granger Cause MCR	0.59	0.45	2.74	0.10	1.41	0.29
MCR does not Granger Cause TR	8.84	0.01	4.33	0.03	3.79	0.04

Table 4.20 Granger causality tests for Vietnam

Null Hypothesis	Lags: 1		Lags: 2		Lags: 3	
	F-Stat.	Prob.	F-Stat	Prob.	F-Stat	Prob.
MCR does not Granger Cause GGDP	6.76	0.08	N/A	N/A	N/A	N/A
GGDP does not Granger Cause MCR	0.12	0.75	N/A	N/A	N/A	N/A
TR does not Granger Cause GGDP	17.68	0.02	N/A	N/A	N/A	N/A
GGDP does not Granger Cause TR	0.09	0.79	N/A	N/A	N/A	N/A
TR does not Granger Cause MCR	0.58	0.50	N/A	N/A	N/A	N/A
MCR does not Granger Cause TR	25.73	0.01	N/A	N/A	N/A	N/A

4.2 Model 2: The indirect relationship between stock market development and economic growth

The second model shows the indirect relationship between stock market variables and economic growth. In other words, MCR and TR first affect some macroeconomic variables—i.e. FDI/GDP, GK, and INTERFIN—which further affect GGDP. For this model, two-stage least square regression is employed. In the first stage FDI/GDP, GK and INTERFIN are each regressed with MCR and TR. If the relationship is significant fitted values of the first group of variables are computed (represented by FFDI/GDP, FGK, and FINTERFIN). In the second stage GGDP is regressed with the fitted variables as well as other previous independent variables—excluding MCR and TR.

STAGE 1

First, GK is regressed with MCR and TR. The results are shown in *Tables 4.15* and *4.16*. From the tables, it is evident that the stock market does not have a significant impact on fixed domestic capital stock. Therefore, the fitted value of GK will not be computed and GK will be added as an independent variable to explain GGDP in the next stage of analysis.

Table 4.21 Relationship between stock market variables and GK

Panel least squares		
Dependent var.: GK	Mean Standard deviation	10.70 17.26
	Number of observations	116
Residuals	S.E. of regression Sum squared residual	17.41 34251.66
Fit	R-squared Adjusted R-squared	0.00 -0.02
Model test	F (prob.)	0.02 (0.98)
Diagnostic	Log likelihood	-494.50
Information criterion	Akaike Info. Criterion Schwarz Criterion Hannan-Quinn criterion	8.58 8.65 8.61
	Durbin-Watson statistic	1.20

Table 4.22 OLS estimations

Variable	Coefficient	Std. error	t-statistic	Prob.
Constant	11.07	3.42	3.24	0.00
MCR	0.17	2.22	0.08	0.94
TR	-1.07	5.17	-0.21	0.84

Tables 4.17 and *4.18* show the regression results of the relationship between MCR and TR, and FDI/GDP. The result shows that MCR is a significant explanatory variable of FDI/GDP. Adjusted R-squared is low (0.15), implying that there are many more variables of FDI/GDP that are not included into the model. This means that the fitted value of FDI/GDP will have high residuals. Nevertheless, identifying the

explanatory variables of FDI/GDP is not a goal of this study. Therefore FFDI/GDP will be computed with the caveat that the value may not be perfect.

Table 4.23 Relationship between stock market variables and FDI/GDP

Panel least squares		
Dependent var.: FDI/GDP	Mean Standard deviation	0.03 0.03
	Number of observations	117
Residuals	S.E. of regression Sum squared residual	0.03 0.11
Fit	R-squared Adjusted R-squared	0.16 0.15
Model test	F (prob.)	11.05 (0.00)
Diagnostic	Log likelihood	242.03
Information criterion	Akaike Info. Criterion Schwarz Criterion Hannan-Quinn criterion	-4.09 -4.02 -4.06
	Durbin-Watson statistic	0.86

Table 4.24 OLS estimations

Variable	Coefficient	Std. error	t-statistic	Prob.
Constant	0.01	0.01	1.33	0.19
MCR	0.02	0.00	4.36	0.00
TR	0.01	0.01	1.57	0.12

The regression result of relationship between MCR and TR, and INTERFIN is shown in *Table 4.19* and *Table 4.20*. The result shows that MCR and TR are significant variables explaining INTERFIN. Similar to the previous model, value of

Adjusted R-squared is small. Again, the fitted value of INTERFIN will have high residuals.

Table 4.25 Relationship between stock market variables and INTERFIN

Panel least squares		
Dependent var.: INTERFIN	Mean Standard deviation	3.50 2.62
	Number of observations	83
Residuals	S.E. of regression Sum squared residual	2.45 478.85
Fit	R-squared Adjusted R-squared	0.15 0.13
Model test	F (prob.)	7.18 (0.00)
Diagnostic	Log likelihood	-190.50
Information criterion	Akaike Info. Criterion Schwarz Criterion Hannan-Quinn criterion	4.66 4.75 4.70
	Durbin-Watson statistic	0.98

Table 4.26 OLS estimations

Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
Constant	3.27	0.57	5.70	0.00
MCR	1.34	0.41	3.29	0.00
TR	-1.45	0.84	-1.73	0.09

STAGE 2

This stage examines the relationship between GGDP, FFDI/GDP, INTERFIN, and other macroeconomic variables. In this stage, there are also two alternative models based on the two alternatives in *Model 1*. Note that similar to models used in *Model 1,* the following two models also have high adjusted R-squares with as many significant independent variables as possible.

Alternative 1:

The first alternative model includes the following independent variables: FFDI/GDP, GK, GC and GEX. Similar to *Model 1,* least squared regressions of fixed and random effect models are performed and the Hausman test is used to determine whether the model should be fixed- or random-effect. The result for *Alternative 1* is presented in *Tables 4.21* through *Table 4.24.*

Table 4.27 Fixed effect model

OLS with group dummy variables		
Dependent var.:	Mean	5.49
GGDP	Standard deviation	4.19
Model size	Observations	98
	Parameters	11
	Degree of freedom	87
Residuals	Sum of squares	328.54
	Standard error of e	1.94
Fit	R-squared	0.81
	Adjusted R-squared	0.79
Model test	F (prob.)	36.46 (0.00)
Diagnostic	Log likelihood	-198.33
	Restricted (b=0)	-279.03
	Chi-square (prob.)	161.39 (0.00)
Information criterion	LogAmemiya Prd. Crt.	1.44
	Akaike Info. Criterion	1.43
	Estimated autocorrelation of e	0.37

Table 4.28 Fixed effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
GK	0.08	0.02	4.98	0.00	10.46
GC	0.25	0.04	6.93	0.00	5.64
FFDI/GDP	29.81	39.85	0.75	0.46	0.03
GEX	0.05	0.02	3.02	0.00	11.61
GVAMANU	0.07	0.02	4.41	0.00	10.81

Table 4.29 Random effect model

OLS without group dummy variables		
Dependent var.: GGDP	Mean	5.49
	Standard deviation	4.19
Model size	Observations	98
	Parameters	6
	Degree of freedom	92
Residuals	Sum of squares	339.90
	Standard error of e	1.92
Fit	R-squared	0.80
	Adjusted R-squared	0.79
Model test	F (prob.)	73.91 (0.00)
Diagnostic	Log likelihood	-200.00
	Restricted (b=0)	-279.03
	Chi-square (prob.)	158.06 (0.00)
Information criterion	LogAmemiya Prd. Crt.	1.37
	Akaike Info. Criterion	1.37

Table 4.30 Random effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
Constant	0.55	0.49	1.11	0.27	
GK	0.08	0.02	3.74	0.00	10.46
GC	0.26	0.04	6.12	0.00	5.64
FFDI/GDP	42.26	15.59	2.71	0.01	0.03
GEX	0.06	0.02	2.80	0.01	11.61
GVAMANU	0.07	0.02	3.04	0.00	10.81

The Hausman test value is 0.00 with a probability of 1.00, which means that the random effect model should again be chosen.

The estimations in *Table 4.24* reveal that all independent variables including FFDI/GDP have positive significant impact on GGDP at 99% level of significance. Comparing these results to the results of the direct model (see *Table 4.5*), the coefficients of all variables except FDI/GDP (or FFDI/GDP) change only slightly. For foreign direct investment ratio (FDI/GDP or FFDI/GDP), the coefficient jumps from 12.80 to 42.26. This may occur from the fact that FFDI/GDP includes the effects from MCR and TR.

Table 4.25 and *Table 4.26* provide testing of the four classical models. R-squared levels in *Table 4.25* show that significant models are *Model 3*—with X-variables only—and *Model 4*—with X and group effects. Comparison of *Model 3* and *Model 4* presented in *Table 4.26* shows that neither model is significantly better than the other one. With parsimony at interests, *Model 3* which has less variables should be selected.

Table 4.31 Test statistics for the Classical models

Test Statistics for the Classical Model			
Model	**Log-likelihood**	**Sum of squares**	**R-squared**
(1) Constant term only	-279.03	.1705330146D+04	0.00
(2) Group effects only	-275.14	.1575412145D+04	0.08
(3) X-variables only	-200.00	.3399030998D+03	0.80
(4) X and group effects	-198.33	.3285431169D+03	0.81

Table 4.32 Hypothesis tests for the Classical models

	Hypothesis Tests						
	Likelihood ratio test			**F tests**			
	Chi-squared	**d.f.**	**Prob.**	**F**	**Num.**	**Denom.**	**Prob.**
(2) vs (1)	7.77	5	0.17	1.52	5	92	0.19
(3) vs (1)	158.06	5	0.00	73.92	5	92	0.00
(4) vs (1)	161.39	10	0.00	36.46	10	87	0.00
(4) vs (2)	153.63	5	0.00	66.04	5	87	0.00
(4) vs (3)	3.33	5	0.65	0.60	5	87	0.70

Alternative 2:

The second alternative model adds FINTERFIN to the previous set of independent variables. The result for *Alternative 2* is presented in *Table 4.27-Table 4.30.*

Table 4.33 Fixed effect model

OLS with group dummy variables		
Dependent var.: GGDP	Mean	4.88
	Standard deviation	4.13
Model size	Observations	83
	Parameters	11
	Degree of freedom	72
Residuals	Sum of squares	284.52
	Standard error of e	1.99
Fit	R-squared	0.80
	Adjusted R-squared	0.77
Model test	F (prob.)	28.25 (0.00)
Diagnostic	Log likelihood	-168.90
	Restricted (b=0)	-235.05
	Chi-square (prob.)	132.31 (0.00)
Information criterion	LogAmemiya Prd. Crt.	1.50
	Akaike Info. Criterion	1.50
	Estimated autocorrelation of e	0.38
White Hetero. Corrected covariance matrix used. Variances assumed equal within groups		

Table 4.34 Fixed effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
GK	0.08	0.02	5.42	0.00	8.57
GC	0.24	0.03	6.95	0.00	5.18
FFDI/GDP	69.14	44.49	1.55	0.12	0.03
GEX	0.05	0.02	2.84	0.01	10.04
GVAMANU	0.07	0.02	4.35	0.00	9.53
FINTERFIN	-0.40	0.47	-0.85	0.40	3.50

Table 4.35 Random effect model

OLS without group dummy variables		
Dependent var.: GGDP	Mean	4.88
	Standard deviation	4.13
Model size	Observations	83
	Parameters	7
	Degree of freedom	76
Residuals	Sum of squares	293.15
	Standard error of e	1.96
Fit	R-squared	0.79
	Adjusted R-squared	0.77
Model test	F (prob.)	47.86 (0.00)
Diagnostic	Log likelihood	-170.14
	Restricted (b=0)	-235.05
	Chi-square (prob.)	129.82 (0.00)
Information criterion	LogAmemiya Prd. Crt.	1.43
	Akaike Info. Criterion	1.43

Table 4.36 Random effect model estimations

Variable	Coefficient	Std. error	t-ratio	Prob.	Mean of X
Constant	0.92	0.79	1.17	0.25	
GK	0.08	0.02	3.77	0.00	8.57
GC	0.25	0.05	4.85	0.00	5.18
FFDI/GDP	60.20	23.93	2.52	0.01	0.03
GEX	0.05	0.02	2.08	0.04	10.04
GVAMANU	0.07	0.03	2.47	0.01	9.53
FINTERFIN	-0.23	0.28	-0.82	0.42	3.50

Similar to all previous models, the Hausman test value is 0.00 with a probability of 1.00, which means that random effect model should again be chosen.

The estimations of random effect model in *Table 4.30* reveal that FINTERFIN has a non-significant impact on GGDP, while in the direct model (see *Table 4.11*), INTERFIN has significant impact. The sign of the impact has also changed from positive (*Table 4.11*) to negative. The coefficients of the other variables do not change significantly except for FFDI/GDP which the coefficient now changes from 17.04 *(Table 4.11)* to 60.20. Since the fitting the value of INTERFIN from MCR and TR make INTERFIN a non-significant explanatory variable of GGDP, it cannot be concluded that stock market affect economic growth via international finance.

From the results of *Alternative 1* and *Alternative 2*, stock market relative size (MCR) affects economic growth (GGDP) via foreign direct investment ratio (FDI/GDP).

Testing of classical model types is presented in *Table 4.31* and *Table 4.32*. Based on R-squared level in *Table 4.31*, the model with X-variables only (*Model 3*) and the model with X and group effects (*Model 4*) are both significant. Comparison of *Model 3* and *Model 4* (*Table 4.7)* shows that neither model is significantly better than the other one. Again, *Model 3*—with less variables—should be selected with parsimony at interests.

Table 4.37 Test statistics for the Classical models

Test Statistics for the Classical Model			
Model	**Log-likelihood**	**Sum of squares**	**R-squared**
(1) Constant term only	-235.05	0.1400855441D+04	0.00
(2) Group effects only	-232.87	0.1329069473D+04	0.05
(3) X-variables only	-170.14	0.2931534606D+03	0.79
(4) X and group effects	-168.90	0.2845172264D+03	0.80

Table 4.38 Hypothesis tests for the Classical models

	Hypothesis Tests						
	Likelihood ratio test			F tests			
	Chi-squared	**d.f.**	**Prob.**	**F**	**Num.**	**Denom.**	**Prob.**
(2) vs (1)	4.37	4	0.36	1.05	4	78	0.39
(3) vs (1)	129.82	6	0.00	47.86	6	76	0.00
(4) vs (1)	132.31	10	0.00	28.25	10	72	0.00
(4) vs (2)	127.94	6	0.00	44.06	6	72	0.00
(4) vs (3)	2.48	4	0.65	0.55	4	72	0.70

Hypothesis testing:

"Hypothesis 3: The impact of stock market on economic growth is both direct and indirect— passing through foreign direct investment, international capital inflow and/or fixed domestic capital stock."

From the results of *Model 2*, it can be concluded that MCR has positive effect on FFDI/GDP which further positively affect GGDP. Therefore, *Hypothesis 3* is accepted.

Figure 4.3 Hypothesis 3 testing

4.4 Model 3: The relationship between stock market development and income inequality

The last model examines the impact of MCR and TR upon EHII (the estimated household inequality index). Since the dependent variable EHII has values lying within the range 0 and 100, a Tobit or censored regression model is chosen to estimate this inequality model. Apart from MCR and TR, four other independent variables were added to the model: GGDPCAP (growth of GDP per capita (purchasing power parity), %), GVAAG (growth of agricultural value added, %), GVAMANU (growth of manufacturing value added, %) and GVASERV (growth of service value added, %). The study experiments with adding and dropping variables in and out of model to yields two final alternative models for explaining EHII.

Alternative 1:

In addition to MCR and TR, independent variables included in *Alternative 1* are GGDPCAP, GVAAG, GVAMANU and GVASERV. The results in *Table 4.34* and *Table 4.35* reveal that both MCR and TR do not have significant effect on EHII. In other words, stock market development does not have impact on income inequality. In this model, GGDPCAP and GVAMANU do not have significant impact on EHII while GVAAG and GVASERV do—1% increase in GVAAG will lead to 1.13 unit decrease in EHII, and 1% increase in GVASERV will lead to 1.19 unit increase in EHII. This follow general sense that increased value added in generally poorer sector—agricultural sector—lead to better income inequality while increased value added in generally wealthier sector—service sector—increase income gap between poor and rich population and thus increase income inequality.

Table 4.39 Tobit model

Tobit: Maximum likelihood estimates		
Dependent var.: EHII		
Weighting variable	None	
	Number of observations Number of parameters	110 8
Iteration completed	9	
Log likelihood function	-335.51	
Information criterion	AIC Finite sample: AIC BIC HQIC	6.25 6.26 6.44 6.33
Threshold values	Lower = 0	Upper = 100
	ANOVA based fit measure	0.00
	DECOMP based fit measure	0.29

Table 4.40 Tobit model estimations

Variable	Coefficient	Std. error	b/ Std. error	Prob.	Mean of X
Constant	11.01	8.20	1.34	0.18	
MCR	-0.82	4.63	-0.18	0.86	0.89
TR	-9.64	10.96	-0.88	0.38	0.49
GGDPCAP	-0.02	0.02	-1.55	0.12	-42.15
GVAAG	-1.13	0.34	-3.33	0.00	-3.28
GVAMANU	0.10	0.26	0.39	0.69	10.28
GVASERV	1.19	0.35	3.43	0.00	0.84

Alternative 2:

Alternative 2 excludes GVAAG, GVAMANU and GVASERV from the model to examine the impact of GGDPCAP on EHII. The results reported in *Table 4.36* and

Table 4.37 show that, without the other three variables in the model, GGDPCAP has a significant impact on EHII. 1% increase in GGDPCAP will lead to 0.03 unit decrease in EHII. This implies that as income per capita grows faster, income inequality drops. Similar to the previous model, MCR and TR have no significant impact on EHII.

Table 4.41 Tobit model

Tobit: Maximum likelihood estimates		
Dependent var.: EHII		
Weighting variable	None	
	Number of observations Number of parameters	110 5
Iteration completed	9	
Log likelihood function	-342.55	
Information criterion	AIC Finite sample: AIC BIC HQIC	6.32 6.32 6.44 6.37
Threshold values	Lower = 0	Upper = 100
	ANOVA based fit measure	0.00
	DECOMP based fit measure	0.29

Table 4.42 Tobit model estimations

Variable	Coefficient	Std. error	b/ Std. error	Prob.	Mean of X
Constant	15.46	8.24	1.88	0.06	
MCR	1.98	4.84	0.41	0.68	0.89
TR	-12.14	11.62	-1.05	0.30	0.49
GGDPCAP	-0.03	0.02	-1.82	0.07	-42.15

Hypothesis testing:

"Hypothesis 4: The stock market development has a Kuznets inverted-U relationship with income inequality."

Model 3 shows that stock market variables do not have significant impact on the income inequality index. Therefore, *Hypothesis 4* is rejected.

Figure 4.4 Hypothesis 4 testing