

Chapter 4

Results

4.1 Result from unit root test

The test of null hypothesis (H_0) at levels nonstationary is performed using the Augmented Dickey- Fuller (ADF) test of unit root. The results show that statistical test values, in cases of No Intercept, Intercept and Trend and Intercept, are higher than MacKinnon Critical Values at 1%, 5% and 10% significantly which means that H_0 is accepted and the 1st difference needs to be applied.

The test of null hypothesis at the 1st difference is performed in the cases of No Intercept, Intercept and Trend and Intercept. The results show that statistical test values in 3 cases of are lower than MacKinnon Critical Value at 1%, 5% and 10% significantly which means that H_0 is rejected and the data is stationary.

Table 4.1 Unit root test results at level

Exchange rate	None		Intercept		Trend and Intercept	
	ADF test statistic	% critical value	ADF test statistic	% critical value	ADF test statistic	% critical value
THB/USD	0.216688	1% : -2.565559	-1.664385	1% : -3.431851	-1.254743	1% : -3.960406
		5% : -1.940906		5% : -2.862089		5% : -3.410964
		10% : -1.616645		10% : -2.567105		10% : -3.127292
THB/JYP	0.209415	1% : -2.565558	-2.007882	1% : -3.431851	-1.897042	1% : -3.960406
		5% : -1.940906		5% : -2.862088		5% : -3.410964
		10% : -1.616645		10% : -2.567105		10% : -3.127292

Source : From calculation

Table 4.2 Unit root test result at the 1st difference

Exchange rate	None		Intercept		Trend and Intercept	
	ADF test statistic	% critical value	ADF test statistic	% critical value	ADF test statistic	% critical value
THB/USD	-67.33559	1% : -2.565559	-67.33175	1% : -3.431851	-67.34457	1% : -3.960406
		5% : -1.940906		5% : -2.862089		5% : -3.410964
		10% : -1.616645		10% : -2.567105		10% : -3.127292
THB/JYP	-63.65095	1% : -2.565559	-63.64756	1% : -3.431851	-63.64938	1% : -3.960406
		5% : -1.940906		5% : -2.862089		5% : -3.410964
		10% : -1.616645		10% : -2.567105		10% : -3.127292

Source : From calculation

4.2 Results for GARCH and FIGARCH

In this section we study the volatility dynamics in exchange rate markets by utilizing GARCH and FIGARCH model under alternative distributions which are Normal, student's t and NIG distribution. The data consists of daily nominal spot exchange rates between the Thai Baht versus US Dollar and Thai Baht versus Japanese Yen. The data is the daily close rate obtained from Reuters2007 database supported by Faculty of Economics, Chiang Mai University. The sample period is October 21, 1993 to September 12, 2008, totally 3,879 observations. Therefore, following the standard practice, 3,879 daily exchange rate of returns are constructed

as $r_t = \log\left(\frac{S_t}{S_{t-1}}\right)$ where S_t denotes the spot exchange rate at day t .

Table 4.3 Summary statistics for daily exchange rate returns

	mean	med	min	max	var	skew	kurt
US Dollar	0.007	0.000	-11.737	11.072	0.668	-0.526	44.027
Japanese Yen	0.009	-0.050	-5.602	7.203	0.678	0.080	11.526

Source : From calculation

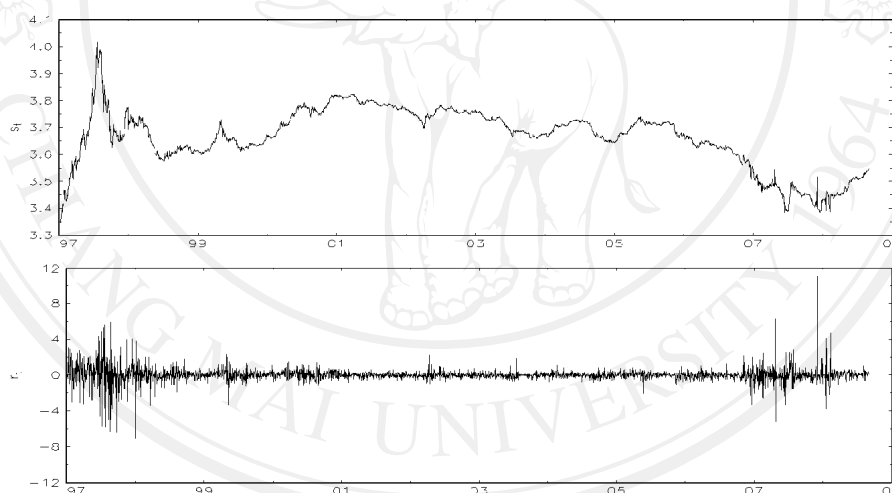
Table 4.3 reports the summary statistics together with the Box-Pierce (1979) statistics tests for up to 22nd-order serial correlation in the returns and squared returns.

Statistic values show the mean, median, minimum, maximum, variance, skewness and kurtosis. For US Dollar, there are higher values in median, maximum and kurtosis and Japanese Yen statistical vales are higher in mean, minimum, variance and skewness.

The reported results indicate that for all series, daily return average about 0.0% with considerable amount of variation. The sample variance of US Dollar return is smaller than Japanese Yen. Skewness indicates that Thai Baht – US Dollar exchange rate has negative value and Thai Baht – Japanese Yen exchange rate has positive value. The highest kurtosis value is found from US Dollar exchange return.

Figure 4.1 Daily spot exchange rates and returns

US Dollar – Thai Baht



Japanese Yen – Thai Baht

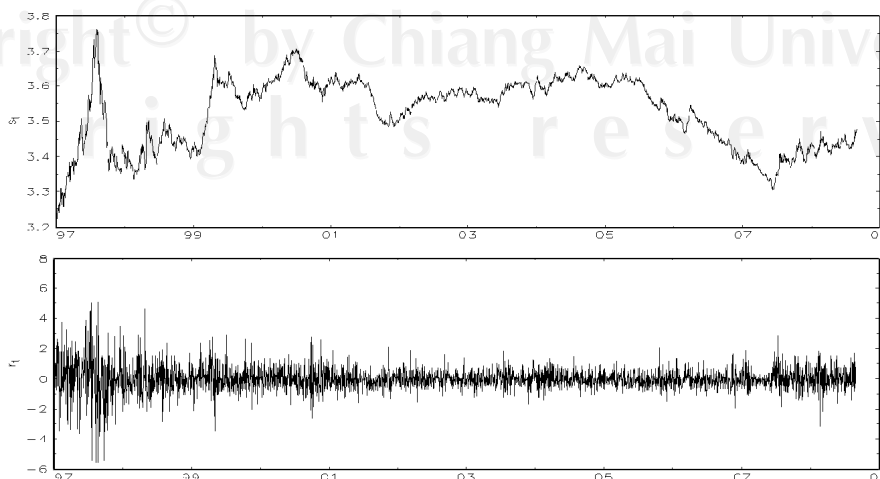
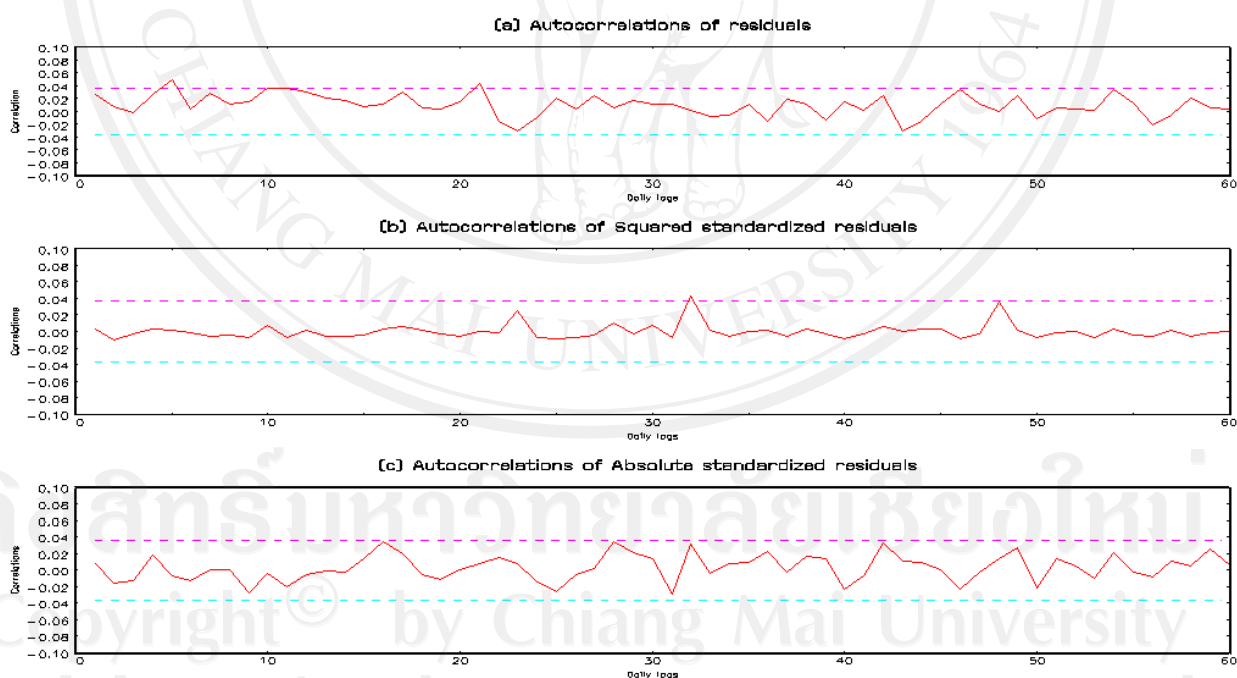


Figure 1 displays Daily spot exchange rates of returns and squared returns over the sample period. As shown in the Figure1, we estimated a model for a US Dollar – Thai Baht and Japanese Yen – Thai Baht from 1997 to 2008. The dependent variables are the daily continuously Dollar – Thai Baht and Japanese Yen – Thai Baht return respectively, $\log\left(\frac{S_t}{S_{t-1}}\right)$, where s_t is the daily Dollar – Thai Baht and Japanese Yen – Thai Baht exchange rate.

The plot in the figure clearly indicates the occurrence of tranquil and volatile periods.

Figure 4.2 Autocorrelation of Transformations of the Residuals of US Dollar - Thai Baht



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Figure 4.3 Estimated Conditional Variance of US Dollar-Thai Baht

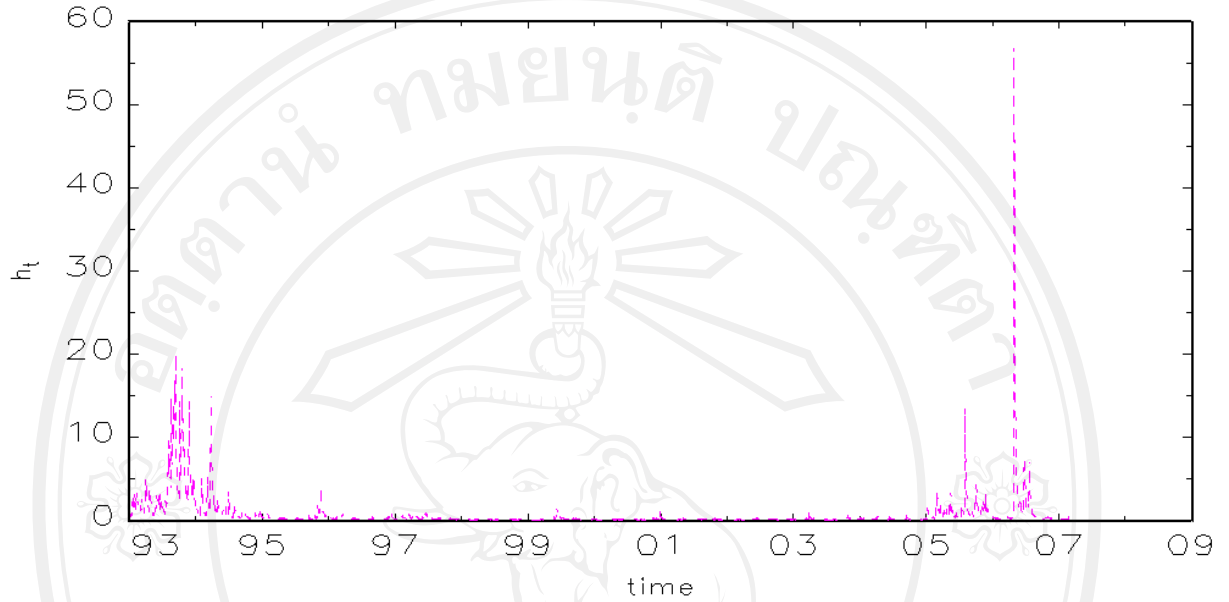


Figure 4.4 Autocorrelation of Transformations of the Residuals of Japanese Yen-Thai Baht

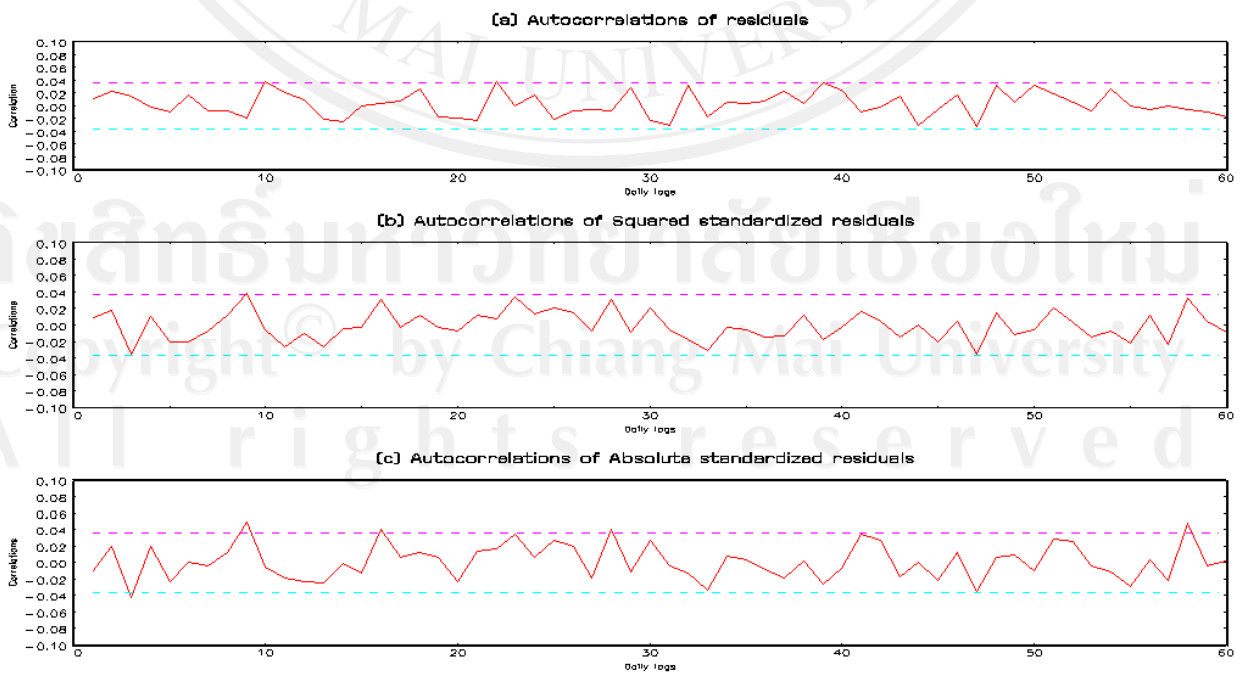


Figure 4.5 Estimated Conditional Variance of Japanese Yen - Thai Baht

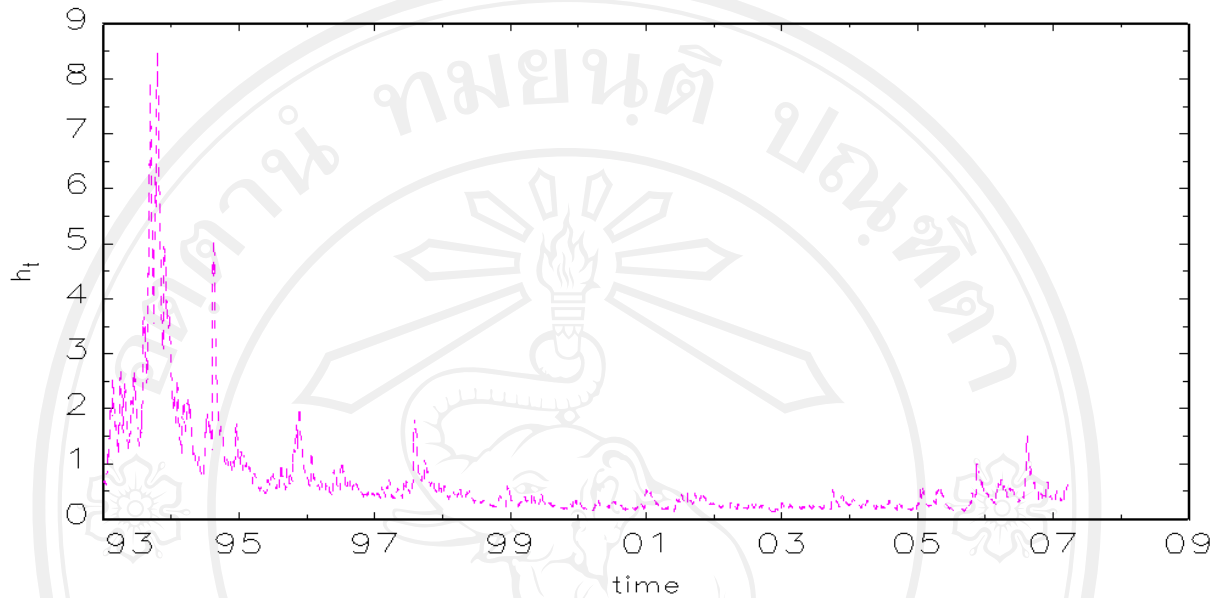


Figure 2 and Figure 3 display autocorrelation of transformations of the residuals of US Dollar-Thai Baht and Japanese Yen- Thai Baht respectively. As shown in the autocorrelation graph, both daily return series are uncorrelated through time. Q(22) values indicates some persistence in the return for both Dollar-Thai Baht and Japan Yen- Thai Baht. This is also supported by the Box-Pierce statistic for up to 22nd-order serial correlation in daily squared returns.

Table 4.4 GARCH and FIGARCH Models: Daily US Dollar - Thai Baht Returns

	G - N	G - t	G - NIG	G - NIGb	FG - N	FG - t	FG - NIG	FG - NIGb
μ	0.0010	-0.0054	-0.0050	-0.0128	-0.0023	-0.0069	-0.0063	-0.0138
	0.0055	0.0054	0.0052	0.0071	0.0057	0.0054	0.0052	0.0071
θ	-0.0057	-0.0033	-0.0055	-0.0053	0.0001	-0.0016	-0.0052	-0.0057
	0.0167	0.0176	0.0174	0.0174	0.0196	0.0189	0.0187	0.0187
d	-	-	-	-	0.7091	0.6880	0.7000	0.7013
	-	-	-	-	0.0211	0.0602	0.0610	0.0614
ω	0.0042	0.0063	0.0053	0.0053	0.0084	0.0118	0.0097	0.0097
	0.0003	0.0011	0.0010	0.0010	0.0007	0.0031	0.0026	0.0026
β	0.8489	0.8147	0.8177	0.8178	0.6098	0.5935	0.6044	0.6061
	0.0039	0.0146	0.0145	0.0145	0.0228	0.0844	0.0828	0.0832
α	0.1501	0.8143	0.1813	0.1812	-	-	-	-
	0.0039	0.0146	0.0145	0.0145	-	-	-	-
φ	-	-	-	-	0.0450	0.1936	0.1916	0.1932
	-	-	-	-	0.0175	0.0763	0.0760	0.0768
v	-	3.6365	-	-	-	3.5755	-	-
	-	0.1855	-	-	-	0.1797	-	-
a	-	-	0.6634	0.6693	-	-	0.6504	0.6556
	-	-	0.0642	0.0660	-	-	0.0625	0.0643
b	-	-	-	0.0322	-	-	-	0.0315
	-	-	-	0.0201	-	-	-	0.0203
ll	-2024.33	-1643.68	-1648.05	-1646.88	-1999.00	-1631.90	-1636.77	-1635.64
AIC	4058.67	3299.36	3308.09	3307.77	4010.01	3277.80	3287.54	3287.28
SIC	4088.56	3335.23	3343.96	3349.61	4045.87	3319.64	3329.38	3335.11
m3	1.7810	1.7100	1.6650	0.1760	1.4760	1.7740	1.7010	1.6800
m4	33.9500	31.6550	30.7980	7.5290	28.2210	32.4970	31.1010	31.4310
Q	30.5160	29.2964	30.3532	29.0382	30.3092	29.3502	30.7616	29.3774
Q²	2.3755	2.3411	2.3685	2.3411	2.9288	1.4705	1.5583	1.5028
Q_{pit}(1)	0.0975	0.0975	0.0936	0.0958	1.2980	1.7650	1.8681	1.8774
Q_{pit}(5)	0.1137	0.1222	0.1145	0.1168	1.8049	2.9741	3.2753	3.3252
Q_{pit}(10)	0.1339	0.1528	0.1406	0.1429	2.2132	3.9614	4.4619	4.5533
W_{d=1}	-	-	-	-	189.7200	26.8720	24.2020	23.6770
$\alpha+\beta=1$	-	∞	∞	∞	126.7230	2.2040	2.1230	2.0170

Table 4.5 GARCH and FIGARCH Models: Daily Japanese Yen - Thai Baht**Returns**

	G - N	G - t	G - NIG	G - NIGb	FG - N	FG - t	FG - NIG	FG - NIGb
μ	-0.0075	-0.017	-0.0171	-0.1084	-0.0073	-0.017	-0.0171	-0.1032
	0.0104	0.0098	0.0098	0.0208	0.0104	0.0098	0.0098	0.0212
θ	-0.0353	-0.0434	-0.0425	-0.0408	-0.0309	-0.041	-0.0399	-0.0458
	0.0198	0.0189	0.0188	0.0188	0.021	0.0191	0.0192	0.0192
d	-	-	-	-	0.3879	0.416	0.4055	0.3883
	-	-	-	-	0.0426	0.0711	0.0691	0.0649
ω	0.0039	0.0045	0.0044	0.0044	0.0138	0.0157	0.015	0.0133
	0.0008	0.0014	0.0014	0.0014	0.0028	0.0059	0.0057	0.0059
β	0.9346	0.9326	0.9329	0.9299	0.6234	0.6011	0.5993	0.5751
	0.0056	0.009	0.009	0.0093	0.0239	0.0765	0.0799	0.0775
α	0.0586	0.0591	0.0585	0.0598	-	-	-	-
	0.0053	0.0086	0.0085	0.0085	-	-	-	-
φ	-	-	-	-	0.3266	0.2459	0.258	0.2542
	-	-	-	-	0.0239	0.0593	0.0604	0.0628
v	-	7.0444	-	-	-	6.928	-	-
	-	0.8968	-	-	-	0.8727	-	-
a	-	-	2.1932	2.3153	-	-	2.1787	2.2445
	-	-	0.3588	0.0231	-	-	0.3666	0.3733
b	-	-	-	0.2968	-	-	-	0.2767
	-	-	-	0.0607	-	-	-	0.0723
ll	-2931.33	-2875.59	-2875.98	-2864.96	-2925.77	-2873.83	-2874.33	-2864.36
AIC	5872.67	5763.19	5763.95	5743.92	5863.54	5761.67	5762.66	5744.71
SIC	5902.56	5799.05	5799.82	5785.77	5899.41	5803.51	5804.51	5792.53
m3	0.4400	0.4920	0.4920	0.2540	0.4060	0.4710	0.4680	0.0720
m4	4.6020	4.6370	4.6360	4.3920	4.4600	4.6040	4.5840	4.3700
Q	18.2240	18.6270	18.5526	18.9237	17.6463	18.0044	17.9247	18.2076
Q²	20.4413	20.6412	20.6699	17.2444	20.3235	20.4229	20.2800	17.3481
Q_{pit(1)}	0.5529	0.5542	0.5509	0.5849	2.3569	1.8637	1.8887	1.6666
Q_{pit(5)}	0.5533	0.5538	0.5498	0.5787	4.9661	3.3460	3.3951	2.6832
Q_{pit(10)}	0.5539	0.5533	0.5484	0.5712	7.5209	4.5929	4.6675	3.4992
W_{d=1}	-	-	-	-	206.3470	67.4720	74.1140	88.7200
$\alpha + \beta = 1$	8.9670	4.1680	4.7350	6.5500	∞	1.7850	1.5380	1.9360

Parameter estimates, standard error and summary diagnostic statistics for GARCH and FIGARCH models with Normal, student's t and NIG errors from Quasi Maximum Likelihood method are presented in Table 4.4 and 4.5. A comparison of estimated GARCH and FIGARCH models with any given distribution assumption, in term of lowering the kurtosis in residuals and Box-Pierce statistics computed from standardized residuals and squared residuals and likelihood values generally favors a FIGARCH specification for the conditional volatility of daily exchange rate returns. For both exchange rate, the estimates of hyperbolic decay parameter, d is significant and greater than 0 but less than unity and are in the range of about 0.3 – 0.7 from FIGARCH model.

Consider Akaike Information Criterion (AIC) and Schwartz Information Criteria (SIC) from both US Dollar-Thai Baht and Japanese Yen-Thai Baht returns, the least values of AIC and SIC are presented in FIGARCH model in US Dollar-Thai Baht. For Japanese Yen-Thai Baht, the least values of AIC and SIC are presented very closely between GARCH-NIGb and FIGARCH-NIGb models, but FIGARCH-NIGb model is more satisfied according to the saliently presence of asymmetry.

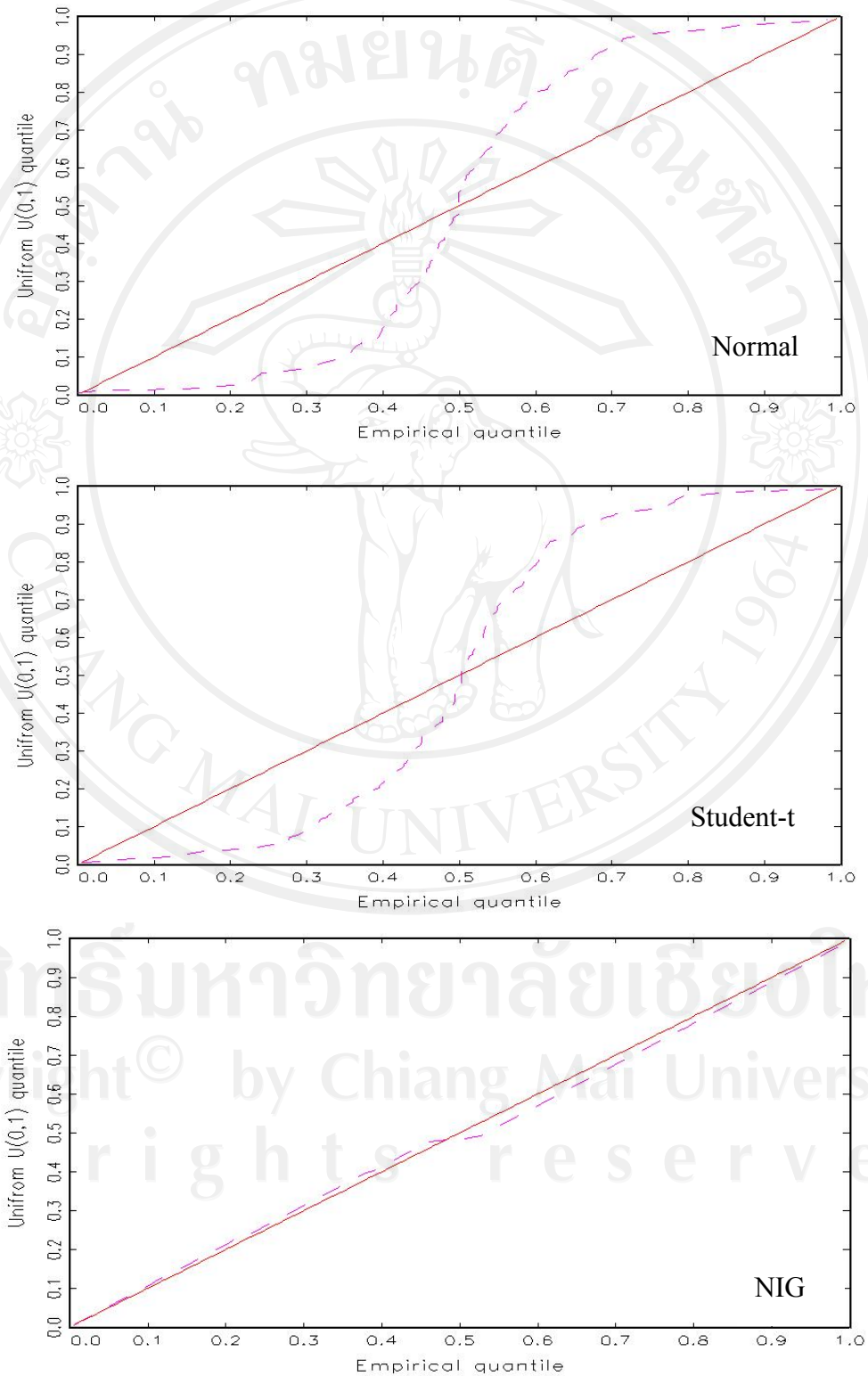
Table 4.6 Quantile Predictions-Value-at-Risk for FIGARCH models with Normal, student's t, and NIG error Distribution

Nominal		1-day ahead					
		1	5	10	90	95	99
USD-THB	FG-N	2.805	23.666	34.348	67.699	72.234	94.69
	FG-t	4.299	24.878	30.833	66.391	77.183	85.612
	FG-NIG	0.937	4.688	9.375	90.625	95.313	99.063
JPY-THB	FG-N	23.648	31.016	37.064	61.966	66.797	76.965
	FG-t	10.276	27.087	33.32	67.729	74.075	82.006
	FG-NIG	1	5	10	90	95	99

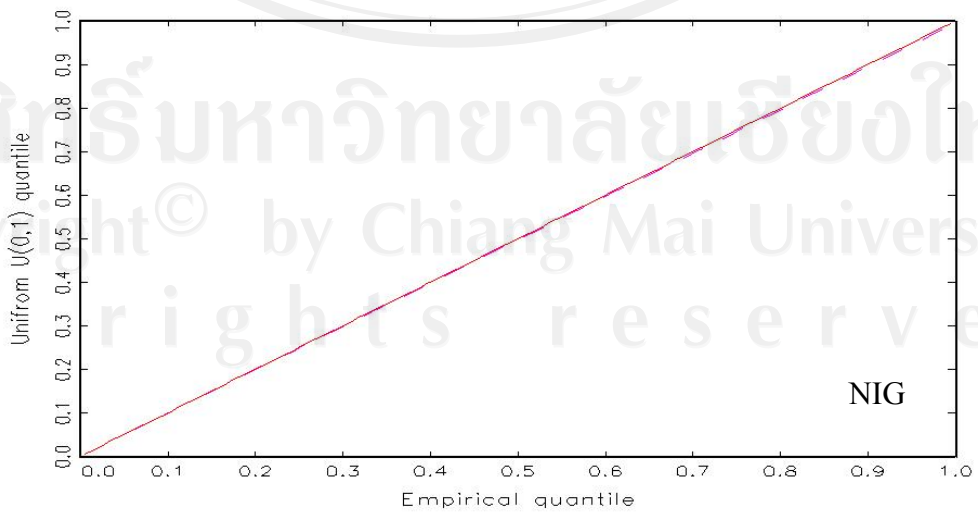
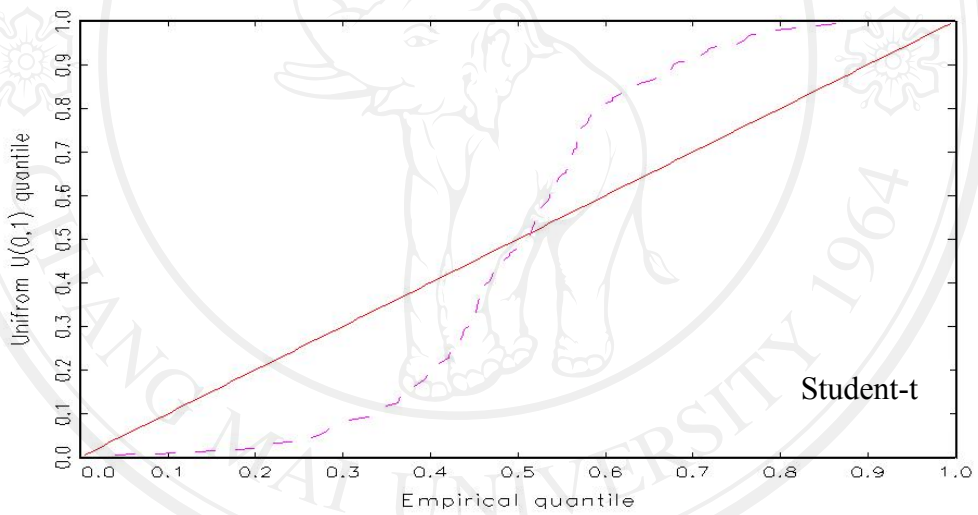
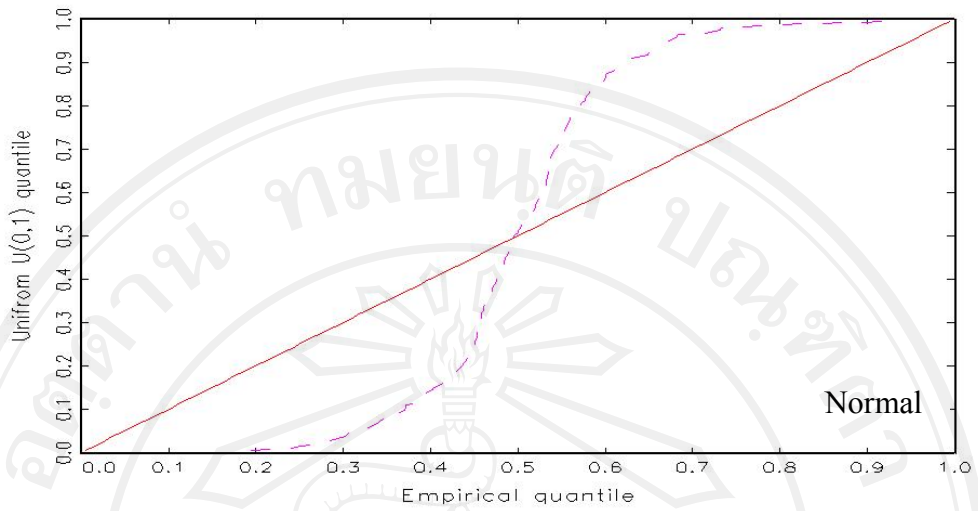
Table 4.6 shows the Quantile Predictions Value-at-Risk for 1 day forecast for FIGARCH models with Normal, student's t, and NIG error Distribution for US Dollar-Thai Baht and Japanese Yen-Thai Baht.

Figure 4.6 QQ plot for the PITs from FIGARCH models with normal, student's t and NIG errors for US Dollar – Thai Baht and Japanese Yen – Thai Baht

US Dollar – Thai Baht

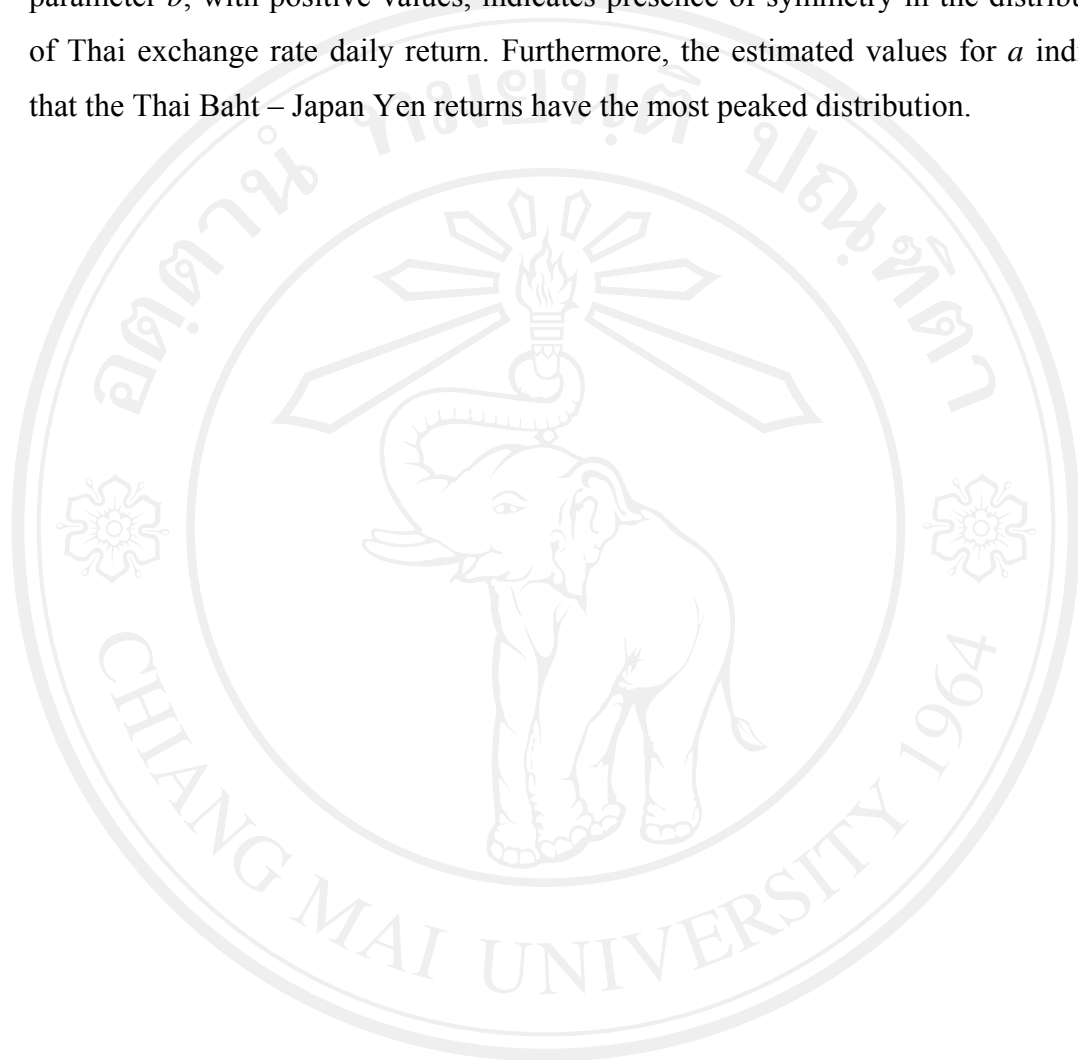


Japan Yen – Thai Baht



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Figure 4 and 5 show that the FIGACH(1,d,1) model with NIG distribution fits the Thai Baht – Japan Yen quite symmetrically. A statistically significant estimate of parameter b , with positive values, indicates presence of symmetry in the distribution of Thai exchange rate daily return. Furthermore, the estimated values for a indicate that the Thai Baht – Japan Yen returns have the most peaked distribution.



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