Chapter 4

Results

This chapter includes the results of the quantitative analysis by using time series data: gold spot price and gold future price in Thailand Future Exchange (TFEX). There are four sets of information under study from four gold future contract months (GFZ09: December 2009, GFG10: February 2010, GFV10: October 2010, GFZ10: December 2010). They will be estimated in term of returns and studied the relationship between them by Vector Autoregressive model (VAR). Otherwise, they would be studied the relationship by Least Squares estimation and Cointegrating regression as well.

Firstly, the stationary test of information under study will be Unit root test. Augmented dickey-Fuller test: Modified SIC (ADF) is employed to study the stationary, and the relationship between itself in different period of time and also the Heteroskedasticity test too. Secondary, Cointegrationwill be tested to choose the model to study the relationship between Vector Autoregressive model (VAR) and Vector Error Correction model (VEC). Then, estimate Vector Autoregressive model (VAR) and the impulse response function. Wherewith, the Least Squares estimation and Cointgrating regression will be estimated afterward. Lastly, there will be the comparison between Least Squares estimation and Cointegrating regression. The results of the study are:

4.1 Unit root test

There is a stationary $[I(0);$ Integrated of order 0]or non-stationary$[I(d);\ d > 0]$ test for the data which has different mean and variance in different period of time and also to avoid the spurious regression. Wherewith Augmented dickey-Fuller test (ADF) is used with trend and intercept, with intercept but without trend and without trend and intercept: none. Information under study is estimated in form of returns and the results are:

Table 4.1 The result of Unit root testbyAugmented dickey-Fuller test (ADF)

Variable	Include in test equation	ADF Test statistic	Prob.	MacKinnon critical 1% level	Conclusion
S1	Constant	-9.508443***	0.0000	-3.504727	Stationary
	Constant and Trend	-9.722168***	0.0000	-4.063233	Stationary
	None	-9.486200***	0.0000	-2.590910	Stationary
F1	Constant	-7.730314***	0.0000	-3.504727	Stationary
	Constant and Trend	-7.864891***	0.0000	-4.063233	Stationary
	None	-7.702707***	0.0000	-2.590910	Stationary
S2	Constant	-7.995883***	0.0000	-3.505595	Stationary
	Constant and Trend	-7.990444***	0.0000	-4.064453	Stationary
	None	-8.029884***	0.0000	-2.591204	Stationary
F2	Constant	-7.603045***	0.0000	-3.506484	Stationary
	Constant and Trend	-7.566525***	0.0000	-4.065702	Stationary
	None	-7.567795***	0.0000	-2.591505	Stationary
S3	Constant	-11.16829***	0.0001	-3.503879	Stationary
	Constant and Trend	-11.10546***	0.0000	-4.062040	Stationary

Variable	Include in test equation	ADF Test statistic	Prob.	MacKinnon critical 1% level	Conclusion
	None	-11.06252***	0.0000	-2.590622	Stationary
F3	Constant	-10.19340***	0.0000	-3.503879	Stationary
	Constant and Trend	-10.20559***	0.0000	-4.062040	Stationary
	None	-10.16954***	0.0000	-2.590622	Stationary
S4	Constant	-10.11483***	0.0000	-3.504727	Stationary
	Constant and Trend	-10.05744***	0.0000	-4.063233	Stationary
	None	-10.05603***	0.0000	-2.590910	Stationary
F4	Constant	-9.900989***	0.0000	-3.504727	Stationary
	Constant and Trend	-9.844858***	0.0000	-4.063233	Stationary
	None	-9.823255***	0.0000	-2.590910	Stationary

Source : Calculation
H_0 : Non-stationary
*** : Significant at 1% level

Table 4.1 shows the result of Unit root test by Augmented dickey-Fuller test: Modified SIC (ADF) which all information understudy has a unit root and is stationary at 1% significant level with integrated of order 0[$I(0)$]. As a result of ADF Test statistic is less than MacKinnon critical 1% level which rejects the null hypothesis of non-stationary.

4.2 Lag Length Criteria Selection

Estimating time series data needs the best suitable lag length for the data. In this study, lag length criterions used to estimate the relationship by VAR model are Akaike Information Criteria (AIC)and Schwarz Information Criterion (SC). The one with less AIC and SC will be chosen If there is conflict between these two criteria,

Schwarz Information Criterion (SC) will choose: Ender (2004) suggests that Akaike Information Criteria (AIC) might over estimate the best lag because AIC is more suitable for small sample size but SC for big sample size. From the estimation, the results of lag length criteria choosing are:

Table 4.2 The result of Lag Length Criteria of GFZ09 (December 2009)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	549.1223	NA	**6.45e-09***	**-13.18367***	**-13.12538***	**-13.16025***
1	552.1901	5.913900	6.60e-09	-13.16121	-12.98635	-13.09096
2	553.7989	3.023819	6.99e-09	-13.10359	-12.81216	-12.98651
3	555.9041	3.855270	7.32e-09	-13.05793	-12.64993	-12.89402
4	561.9806	10.83518	6.97e-09	-13.10797	-12.58340	-12.89722
5	568.8709	**11.95421***	6.51e-09	-13.17761	-12.53647	-12.92004
6	569.1985	0.552629	7.12e-09	-13.08912	-12.33141	-12.78472
7	571.7408	4.165668	7.40e-09	-13.05399	-12.17971	-12.70276
8	574.1238	3.789944	7.72e-09	-13.01503	-12.02418	-12.61696

Source : Calculation
* : Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC :Akaike information criterion
SC : Schwarz information criterion
HQ :Hannan-Quinn information criterion

Table 4.2 shows that Akaike Information Criteria (AIC) and Schwarz Information Criterion (SC) chose the lag length according to each other and also Final prediction error (FPE) and Hannan-Quinn information criterion (HQ) with 0 Lag Length. Which means the effects on variable at present period will not affect the value of others or itself in the next period.

Table 4.3 The result of Lag Length Criteria of GFG10 (February 2010)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	534.3489	NA	7.87e-09	-12.98412	**-12.92542***	**-12.96055***
1	537.8093	6.667527	7.98e-09	-12.97096	-12.79486	-12.90026
2	542.3024	8.438283	7.88e-09	-12.98299	-12.68948	-12.86515
3	544.9009	4.753254	8.16e-09	-12.94880	-12.53790	-12.78383
4	551.9219	**12.50094***	**7.59e-09***	**-13.02249***	-12.49418	-12.81038
5	555.6359	6.431541	7.65e-09	-13.01551	-12.36981	-12.75627
6	555.9791	0.577596	8.39e-09	-12.92632	-12.16321	-12.61994
7	557.5433	2.556011	8.93e-09	-12.86691	-11.98640	-12.51340
8	560.0012	3.896710	9.30e-09	-12.82930	-11.83139	-12.42865

Source : Calculation
* : Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC :Akaike information criterion
SC : Schwarz information criterion
HQ :Hannan-Quinn information criterion

Table 4.3 shows that Akaike Information Criteria (AIC) and Final prediction error (FPE) chose the lag length according to each other at four Lags. Which means the effects on variable at present period will affect the value of others or itself in the next four periods. But Schwarz Information Criterion (SC) and Hannan-Quinn information criterion (HQ) chose 0 lag length. Which means the effects on variable at present period will not affect the value of others or itself in the next period.

Table 4.4 The result of Lag Length Criteria of GFV10 (October 2010)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	676.8878	NA	3.60e-10	-16.06876	**-16.01088***	**-16.04549***
1	680.9601	7.853724	3.60e-10	-16.07048	-15.89685	-16.00068
2	684.3735	6.420441	3.65e-10	-16.05651	-15.76713	-15.94018
3	692.7387	15.33627	3.29e-10	-16.16045	-15.75531	-15.99758
4	695.0615	4.147778	3.43e-10	-16.12051	-15.59962	-15.91112
5	702.4167	**12.78408***	**3.17e-10***	**-16.20040***	-15.56375	-15.94447
6	703.7835	2.310602	3.38e-10	-16.13770	-15.38531	-15.83525
7	706.6761	4.752027	3.48e-10	-16.11133	-15.24319	-15.76235
8	707.1148	0.699891	3.80e-10	-16.02654	-15.04264	-15.63102

Source : Calculation
* : Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC :Akaike information criterion
SC : Schwarz information criterion
HQ :Hannan-Quinn information criterion

Table 4.4 shows that Akaike Information Criteria (AIC) and Final prediction error (FPE) chose the lag length according to each other at five Lags. Which means the effects on variable at present period will affect the value of others or itself in the next five periods. But Schwarz Information Criterion (SC) and Hannan-Quinn information criterion (HQ) chose 0 lag length. Which means the effects on variable at present period will not affect the value of others or itself in the next period.

Table 4.5 The result of Lag Length Criteria of GFZ10 (December 2010)

Lag	LogL	LR	FPE	AIC	SC	HQ
0	622.9542	NA	1.09e-09	-14.96275	**-14.90447***	**-14.93934***
1	623.8190	1.667017	1.17e-09	-14.88720	-14.71235	-14.81696
2	626.8501	5.697126	1.20e-09	-14.86386	-14.57243	-14.74678
3	635.2940	**15.46342***	**1.08e-09***	**-14.97094***	-14.56294	-14.80703
4	638.9072	6.442952	1.09e-09	-14.96162	-14.43705	-14.75088
5	641.6527	4.763152	1.13e-09	-14.93139	-14.29025	-14.67382
6	642.2580	1.020967	1.23e-09	-14.84959	-14.09188	-14.54518
7	644.4037	3.515971	1.28e-09	-14.80491	-13.93063	-14.45367
8	647.1263	4.329944	1.33e-09	-14.77413	-13.78328	-14.37606

Source : Calculation
* : Indicates lag order selected by the criterion
LR : Sequential modified LR test statistic (each test at 5% level)
FPE : Final prediction error
AIC :Akaike information criterion
SC : Schwarz information criterion
HQ :Hannan-Quinn information criterion

Table 4.5 shows that Akaike Information Criteria (AIC) and Final prediction error (FPE) chose the lag length according to each other at three Lags. Which means the effects on variable at present period will affect the value of others or itself in the next three periods. But Schwarz Information Criterion (SC) and Hannan-Quinn information criterion (HQ) chose 0 lag length. Which means the effects on variable at present period will not affect the value of others or itself in the next period.

Notwithstanding, there are conflicts among the results of criterions, however Schwarz Information Criterion (SC), the criteria which best fit for big sample size[1], always chose the 0 lag for this study.

[1]Ender (2004) suggests that Akaike Information Criteria (AIC) might over estimate the best lag because AIC is more suitable for small sample size but SC for big sample size.

4.3 Cointegration test

Cointegration test is the test for long term stationary of variables and also for choosing the most appropriate model which would be used to study the relationship. In this study, cointegrationhas been test by Johansen Methodology (Trace and Maximum Eigenvalue) with the null hypothesis at 0.05 significant level of coefficient matrix (Π) is 0.

Table 4.6 The result of Cointegration test by Johansen Methodology of GFZ09 (December 2009)

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	2	2	2	2
Max-Eig	2	2	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Table 4.6, the cointegration test of the return on gold spot price and gold future price from October 2009 to December 2009 shows that they are full rank (according to the hypothesis of rank = n is full rank) and stationary. Vector Autoregressive model (VAR) is capable to study the relationship between them.

Table 4.7 The result of Cointegration test by Johansen Methodology of GFG10 (February 2010)

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	2	2	2	2
Max-Eig	2	2	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Table 4.7, the cointegration test of the return on gold spot price and gold future price from December 2009 to February 2009 shows that they are full rank (according to the hypothesis of rank = n is full rank) and stationary. Vector Autoregressive model (VAR) is capable to study the relationship between them.

Table 4.8 The result of Cointegration test by Johansen Methodology of GFV10 (October 2010)

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	2	2	2	2
Max-Eig	2	2	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Table 4.8, the cointegration test of the return on gold spot price and gold future price from August 2010 to October 2010 shows that they are full rank (according to the hypothesis of rank = n is full rank) and stationary. Vector Autoregressive model (VAR) is capable to study the relationship between them.

Table 4.9 The result of Cointegration test by Johansen Methodology of GFZ10 (December 2010)

Selected (0.05 level*) Number of Cointegrating Relations by Model

Data Trend:	None	None	Linear	Linear	Quadratic
Test Type	No Intercept No Trend	Intercept No Trend	Intercept No Trend	Intercept Trend	Intercept Trend
Trace	2	2	2	2	2
Max-Eig	2	2	2	2	2

*Critical values based on MacKinnon-Haug-Michelis (1999)

Table 4.9, the cointegration test of the return on gold spot price and gold future price from October 2010 to December 2010 shows that they are full rank (according to the hypothesis of rank = n is full rank) and stationary. Vector Autoregressive model (VAR) is capable to study the relationship between them.

4.4 Vector Autoregressionmodel (VAR)

From the stationary information under study and the suitable lag length chose, the relationship between gold spot price and gold future price are:

Table 4.10 The result of VAR estimation of GFZ09 (December 2009)

	S1	F1
S1(-1)	-0.159086	0.019954
	(0.13498)	(0.12563)
	[-1.17863]^{ns}	[0.15884]^{ns}
F1(-1)	0.248831	0.177548
	(0.14467)	(0.13465)
	[1.72000]**	[1.31857]**
C	0.000809	0.000807
	(0.00108)	(0.00101)
	[0.74582]^{ns}	[0.79942]^{ns}

Standard errors in ( ) & t-statistics in [ ]
Source : Calculation
*** : Significant at 1% level: t-statistic > | 2.364 |
** : Significant at 5% level: t-statistic > | 1.290 |
ns : Not significant

The equation of return on gold spot price (S1), a coefficient of return on gold future price in last period (F1(-1))is 0.248831 with t-statistic 1.72000 shows that if there is increasing in return on gold future price in a period before, the return on gold spot price will increase with 95% confidential level.

$$S1 = 0.248831 * F1(-1)$$

The equation of return on gold spot price (F1), a coefficient of return on gold future price in last period (S1(-1)) is 0.177548 with t-statistic 1.31857 shows that if there is increasing in return on gold spot pricein a period before, the return on gold fpot price will increase with 95% confidential level.

$$F1 = 0.177548 * S1(-1)$$

Table 4.11 The result of VAR estimation of GFG10 (February 2010)

	S2	F2
S2(-1)	-0.002165	0.141633
	(0.15213)	(0.15588)
	[-0.01423]^{ns}	[0.90858]^{ns}
F2(-1)	0.177176	0.120694
	(0.14524)	(0.14882)
	[1.21991]^{ns}	[0.81101]^{ns}
C	-0.000333	-0.000647
	(0.00115)	(0.00118)
	[-0.28890]^{ns}	[-0.54778]^{ns}

Standard errors in ( ) & t-statistics in [ ]
Source : Calculation
*** : Significant at 1% level: t-statistic > | 2.364 |
** : Significant at 5% level: t-statistic > | 1.290 |
ns : Not significant

The return on gold spot price (S2), there is no significant factor which affects the return on gold spot price. Likewise, the return on gold future price (F2) there is also no significant factor which affects the return on gold future price as well.

Table 4.12 The result of VAR estimation of GFV10 (October 2010)

	S3	F3
S3(-1)	-0.375354	-0.309547
	(0.16390)	(0.12813)
	[-2.29013]**	[-2.41583]***
F3(-1)	0.341477	0.227881
	(0.20842)	(0.16294)
	[1.63842]**	[1.39859]**
C	0.000896	0.000590
	(0.00071)	(0.00055)
	[1.27030]^{ns}	[1.06965]^{ns}

Standard errors in ( ) & t-statistics in [ ]
Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S3), a coefficient of return on gold spot price in last period (S3(-1)) is -0.309547with t-statistic -2.29013and a coefficient of return on gold future price in last period (F3(-1)) is 0.341477 with t-statistic 1.63842show that if there is increasing in return on gold spot price in a period before, the return on gold spot price will decrease. If the return on gold future price in a period before is increasing, the return on gold spot price will increase with 95% confidential level.

$$S3 = -0.375354 * S3(-1) + 0.341477 * F3(-1)$$

The equation of return on gold future price (S3), a coefficient of return on gold spot price in last period (S3(-1)) is -0.375354with t-statistic -2.41583and a coefficient of return on gold future price in last period (F3(-1)) is 0.227881with t-statistic 1.39859show that if there is increasing in return on gold spot price in a period before,

the return on gold future price will decrease. If the return on gold future price in a period before is increasing, the return on gold spot price will increase with 99% and 95% confidential level respectively.

$$F3 = -0.309547 * S3(-1) + 0.227881 * F3(-1)$$

Table 4.13 The result of VAR estimation of GFZ10 (December 2010)

	ΔS4	ΔF4
ΔS4(-1)	-0.144668 (0.16369) [-0.88380]^{ns}	-0.116934 (0.13424) [-0.87106]^{ns}
ΔF4(-1)	0.110367 (0.19921) [0.55401]^{ns}	0.053938 (0.16338) [0.33014]^{ns}
C	0.000809 (0.00081) [1.00186]^{ns}	0.000744 (0.00066) [1.12264]^{ns}

Standard errors in ( ) & t-statistics in [ ]
Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The return on gold spot price (S4), there is no significant factor which affects the return on gold spot price. Likewise, the return on gold future price (F4) there is also no significant factor which affects the return on gold future price as well.

4.5 Impulse Response

The effects of shocks on each factor can be studied by the impulse response function. The results of impulse response function also show how long the effects would last as well.

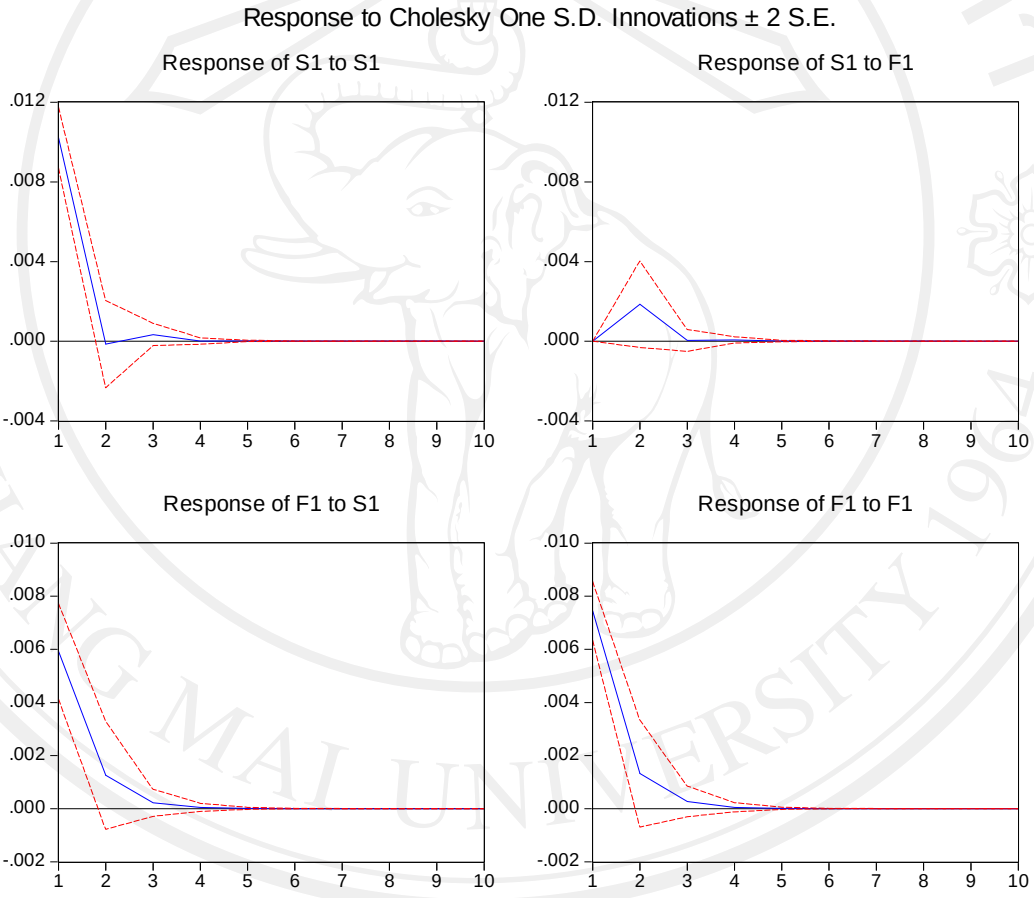

Figure 4.1 Impulse Response of GFZ09 (December 2009)

The result of impulse response on the effects of shocks of Gold Spot Price and Gold Future Price on October 2009 – December 2009as:

- The shocks of return on gold spot price on itself (S1 to S1), gold future price on gold spot price(F1 to S1), and gold future priceon itself (F1 to F1) have

negative effect on the first and second day and get better in a day after and back to equilibrium on the fourth day.

- The shocks of return on gold spot priceon gold future price(S1 to F1), there is no effect on the first day but there is positive effect on the second day and back to equilibrium on the third day.

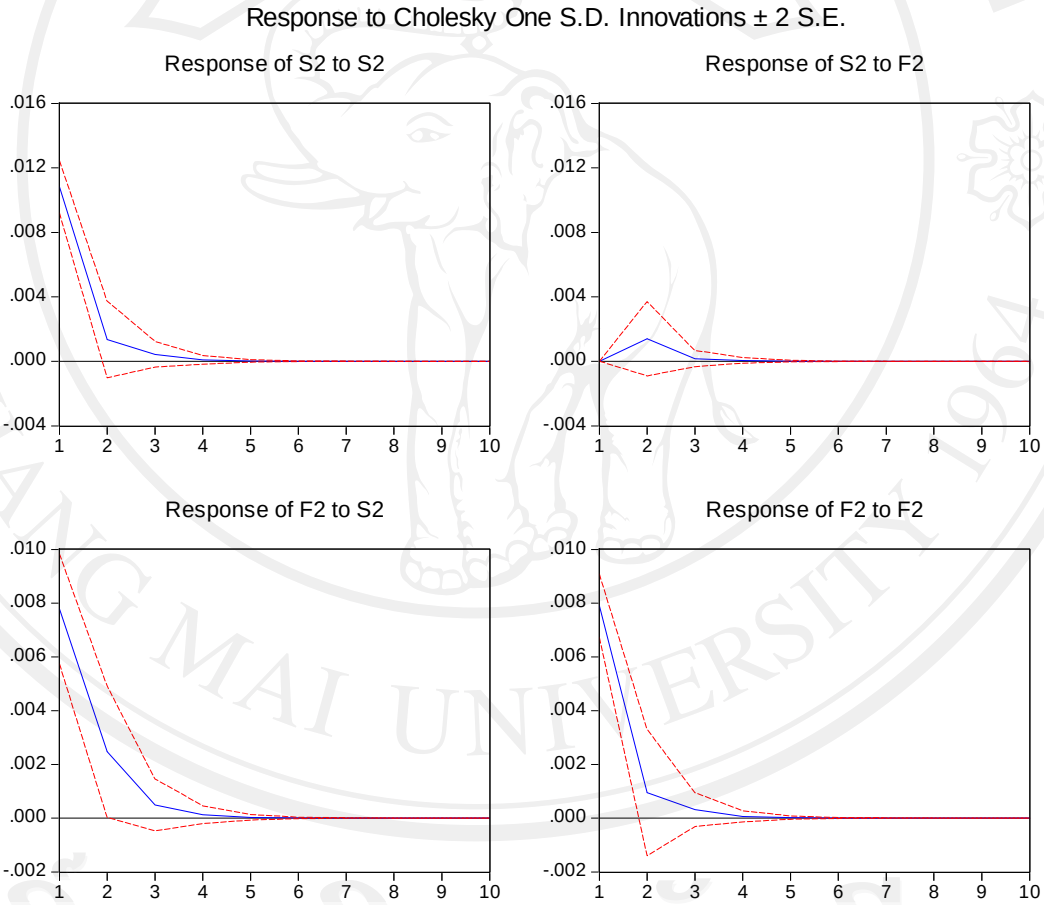

Figure 4.2 Impulse Response of GFG10 (February 2010)

The result of impulse response on the effects of shocks of Gold Spot Price and Gold Future Price on December 2009 – February 2010as:

- The shocks of return on gold spot price on itself (S2 to S2), gold future price on gold spot price(F2 to S2), and gold future price on itself (F2 to F2) have negative effect on the first and second day and get better in a day after and back to equilibrium on the fourth day.
- The shocks of return on gold spot price on gold future price(S2 to F2), there is no effect on the first day but there is positive effect on the second day and back to equilibrium on the third day.

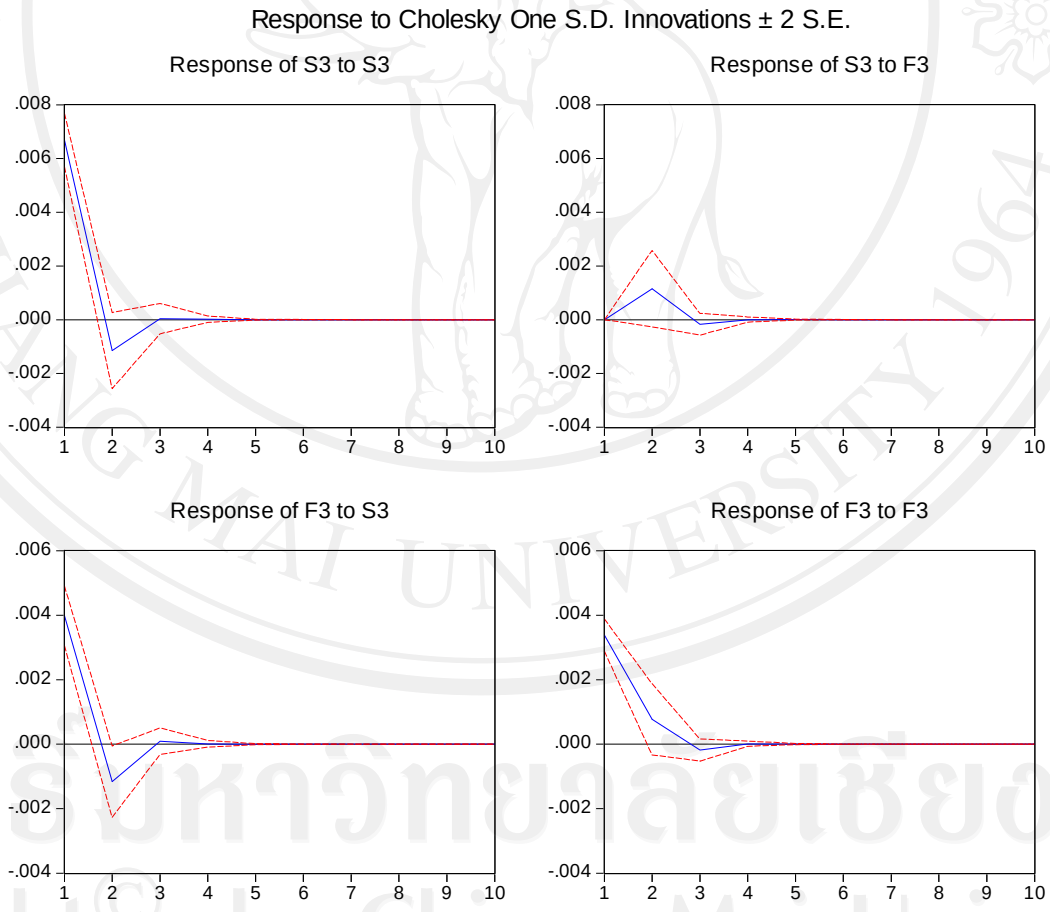

Figure 4.3 Impulse Response of GFV10 (October 2010)

The result of impulse response on the effects of shocks of Gold Spot Price and Gold Future Price on August 2010 – October 2010as:

- The shocks of return on gold spot price on itself (S3 to S3), gold future price on gold spot price(F3 to S3), and gold future price on itself (F3 to F3) have negative effect on the first and second day and get better in a day after and back to equilibrium on the fourth day.
- The shocks of return on gold spot price on gold future price(S3 to F3), there is no effect on the first day but there is positive effect on the second day and back to equilibrium on the third day.

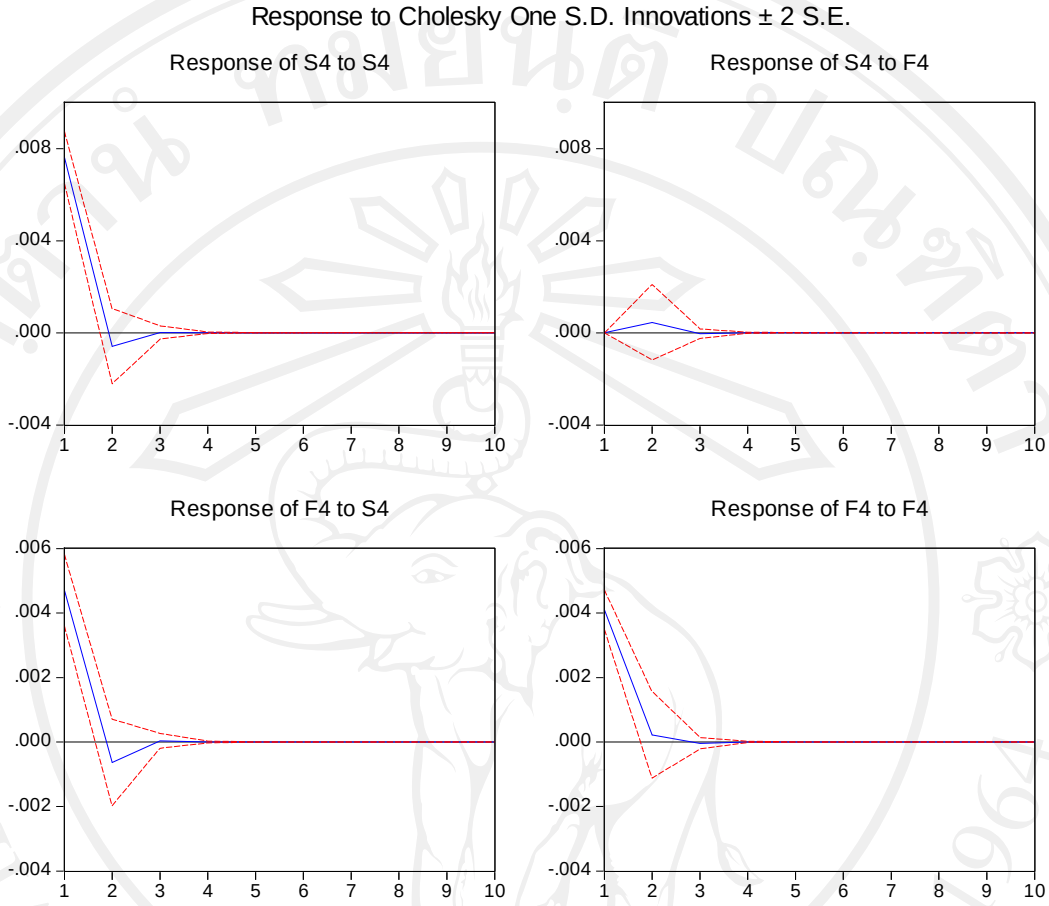

Figure 4.4 Impulse Response of GFZ10 (December 2010)

The result of impulse response on the effects of shocks of Gold Spot Price and Gold Future Price on October 2010 – December 2010as:

- The shocks of return on gold spot price on itself (S4 to S4), gold future price on gold spot price(F4 to S4), and gold future price on itself (F4 to F4) have negative effect on the first and second day and get better in a day after and back to equilibrium on the fourth day.
- The shocks of return on gold spot price on gold future price(S4 to F4), there is no effect on the first day but there is positive effect on the second day and back to equilibrium on the third day.

4.6 Least Squares Estimation

Table 4.14 The result of Least Squares Estimation of GFZ10 (December 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000247	0.000710	0.347765^{ns}	0.7288
F1	0.669142	0.178480	3.749116***	0.0003

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns :Not significant

The equation of return on gold spot price (S1), a coefficient of return on gold future price is 0.669142with t-statistic 3.749116shows that if there is increasing in return on gold future price, the return on gold spot price will increase as well with 99% confidential level.

$$S1 = 0.000247 + 0.669142 * F1$$

Table 4.15 The result of Least Squares Estimation of GFG10 (February 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.33E-05	0.000673	0.123690^{ns}	0.9018
F2	0.684427	0.143946	4.754736***	0.0000

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S2), a coefficient of return on gold future price is 0.684427with t-statistic 4.754736shows that if there is increasing in

return on gold future price, the return on gold spot price will increase as well with 99% confidential level.

$$S2 = 0.0000833 + 0.684427 * F2$$

Table 4.16 The result of Least Squares Estimation of GFV10 (October 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000311	0.000357	0.869464^{ns}	0.3869
F3	0.985848	0.099197	9.938303***	0.0000

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S3), a coefficient of return on gold future price is 0.985848with t-statistic 9.938303shows that if there is increasing in return on gold future price, the return on gold spot price will increase as well with 99% confidential level.

$$S3 = 0.000311 + 0.985848 * F3$$

Table 4.17 The result of Least Squares Estimation of GFZ10 (December 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.26E-05	0.000400	0.231376^{ns}	0.8176
F4	0.921012	0.101899	9.038503***	0.0000

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S4), a coefficient of return on gold future price is 0.921012with t-statistic 9.038503shows that if there is increasing in return on gold future price, the return on gold spot price will increase as well with 99% confidential level.

$$S4 = 0.0000926 + 0.921012 * F4$$

4.7 Cointegrating Regression

As the result from lag length criteria shows that there are many limited length of lag (lag=0). Thus the Vector Autoregressive (VAR) model and Least Squares Estimation are not enough to estimate.

Table 4.18 The result of Cointegrating Regression of GFZ10 (December 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
F1	0.661154	0.094585	6.990076***	0.0000
C	-0.001171	0.002098	-0.557968^{ns}	0.5783

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S1), a coefficient of return on gold future price is 0.661154with t-statistic 6.990076shows that if there is increasing in return on gold future price, the return on gold spot price will increase as well with 99% confidential level.

$$S1 = -0.001171 + 0.661154 * F1$$

Table 4.19 The result of Cointegrating Regression of GFG10 (February 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
F2	0.715237	0.164018	4.360719***	0.0000
C	0.003088	0.001763	1.751840**	0.0839

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S2), a coefficient of return on gold future price is 0.715237with t-statistic 4.360719 and a coefficient of constant term is 0.003088with t-statistic 1.751840shows that if there is increasing in return on gold future price, the return on gold spot price will increase as well with 99% and 95% confidential level respectively.

$$S2 = 0.003088 + 0.715237 * F2$$

Table 4.20 The result of Cointegrating Regression of GFV10 (October 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
F3	0.855536	0.123494	6.927728***	0.0000
C	0.001995	0.001111	1.796667**	0.0760

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S3), a coefficient of return on gold future price is 0.855536with t-statistic 6.927728and a coefficient of constant term is 0.001995with t-statistic 1.796667shows that if there is increasing in return on gold

future price, the return on gold spot price will increase as well with 99% and 95% confidential level respectively.

$$S3 = 0.001995 + 0.855536 * F3$$

Table 4.21 The result of Cointegrating Regression of GFZ10 (December 2010)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
F4	1.138170	0.119080	9.558036***	0.0000
C	-0.000120	0.001306	-0.091742	0.9271

Source : Calculation
*** : Significant at 1% level: t-statistic > |2.364|
** : Significant at 5% level: t-statistic > |1.290|
ns : Not significant

The equation of return on gold spot price (S4), a coefficient of return on gold future price is 1.138170with t-statistic 9.558036shows that if there is increasing in return on gold future price, the return on gold spot price will increase as well with 99% confidential level.

$$S4 = -0.00012 + 1.138170 * F4$$

4.8 The comparison of Least Squares Estimation and Cointegrating Regression

Table 4.22 The comparison of Least Squares Estimation and Cointegrating Regression

	Constant term		Relationship parameter	
	LS	CR	LS	CR
GFZ09 (December 2009)	0.000247	-0.001171	0.669142	0.661154
GFG10 (February 2010)	0.0000833	0.003088	0.684427	0.715237
GFV10 (October 2010)	0.000311	0.001995	0.985848	0.855536
GFZ10 (December 2010)	0.0000926	0.00012	0.921012	1.138170

LR: Least Squares Estimation
CR: Cointegrating Regression

From the results of Least Squares Estimation and Cointegrating Regression, there are equivalent results from both. The relationships between gold spot price and gold future price are all positive and the coefficients are very close.