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Abstract

This study examines the sensitivity of the Thai stock market to nominal and real interest rate, and exchange rate risks during January 2005 and December 2013 using quantile regression. The analysis focuses on sectoral level and one main index in the stock market. The empirical results show that the stock market is more sensitive to exchange rate risk than interest rate risk. However, the impacts of these risks are different across equity index returns. The results from this study give implication for risk management of portfolio mangers and investors.

Keywords: Equity index returns, interest rate risk, exchange rate risk, quantile regression
JEL Classification: C21, G12, G32

1. Introduction

The interest rate exposure of stock returns has become common in most empirical studies. In addition, stock returns can also be sensitive to inflation and exchange rate risk. Earlier study by Sweeney and Wargar (1986) that uses a two-factor arbitrage pricing theory to examine the impact of interest rate on the US stock market gives evidence that the stock market is sensitive to changes in the yields on long-term government bonds. The most interest-sensitive sector is utilities sector. Yourougou (1990) finds that interest rate risk has a significant impact on common stock returns of financial sector. Bae (1990) finds strong support for a negative impact of changes in interest rates on common stock returns of both depository and nondepository institutions. Isimbabi and Tucker (1997) employ principle component analysis to examine the market perception of the risk of US banking industry under a multifactor model. They find that the banking industry perceives the risk beyond the market and interest rate risk. Dinenis and Staikouras (1998) find a significantly negative relationship between interest rate changes and stock returns in banks, insurance companies, investment trust, property investment companies and finance firms. Fraser and Madura (2002) find that bank stock returns are sensitive to interest rate changes and the relationship is negative. Jareno (2008) finds that the Spanish stocks significantly respond to real interest rate and inflation. Jareno et al. (2016) examine the sensitivity of the US stock market to nominal and real interest rate and inflation. Their results show that the stock market is sensitive to changes in interest and inflation rates. The impacts of exchange rate on stock returns are also well documented. Jorion (1991) examines the impact of exchange rate on stock returns and finds that exchange rate exposure of non-financial firms is different across industries. Bodnar and Gentry (1993) examine exchange rate exposures at industry level in Canada, Japan and The US. They find that some industries in all the three countries display significant exposure to exchange rate risk. Chamberlain et al. (1997) examine the exchange rate exposure of a sample of US and Japanese banking firms using daily data. They find that the US stock returns are more prone to exchange rate than the Japanese stock returns. Muller and Verschoor (2006) find evidence suggesting that a depreciating euro against foreign currencies has a negative

impact on European stock returns while an appreciating euro has a positive impact. Jayasinghe and Tsui (2008) employ a bivariate generalized autoregressive conditional heteroskedastic (GARCH) model to examine exchange rate exposure of sectoral returns in fourteen Japanese industries. They find that many sector returns are correlated with exchange rate changes. Apergis et al. (2011) find that foreign exchange risk is priced in the cross-section of German stock returns over the period 2000-2008. In addition, the relationship between stock returns and foreign exchange sensitivity is non-linear. Inci and Lee (2014) find that there is a significant causal relationship running from exchange rate changes to stock returns in nine major industries in eight major countries.

Many previous studies focus on the impacts of both interest rate and exchange rates on stock returns. Choi et al. (1992) focus on the bank stock returns. They employ a multifactor model to examine the impact of interest rate and exchange rate risks on the returns. Their estimations of an autoregressive integrated moving average model give the results showing that exchange rate innovations significantly impose both negative and positive impacts on bank stock returns and these results depend on different time periods. Elyasiani and Mansure (2005) find that exchange rate variables are more important determinants of bank stock returns than interest rate variable. Hyde (2007) examines the sensitivity of stock return at industry level to market, exchange rate and interest rate risks in France, Germany, Italy and the UK. The main findings from this study show that the exposure to exchange rate risk is observed in all industries and countries, but the impact of interest rate risk is found only in Germany and France. Bredin and Hyde (2011) use monthly data to examine foreign exchange rate and interest rate exposure of industry level portfolios in the G7 countries. They find that there is little evidence of exchange rate exposure in most industries. However, the results for interest rate changes are mixed. The negative impacts of interest rate changes are observed only in Canada, Japan and the UK. Kasman et al. (2011) give the results from OLS estimations for the Turkish bank stock returns that stock returns are negatively related to interest rate and exchange rate changes. Olugdode et al. (2014) examine the sensitivity of 31 UK non-financial industries to exchange rate and interest rate exposure using a GARCH-in-mean approach. They find that stock returns in non-financial sectors are more affected by long-term interest rate risk than short-term interest and exchange rate risks.

The main objective of this study is to investigate the impact of changes in interest and exchange rates on sectoral equity sectors and one main index in the Thai stock market. This research includes both financial and non-financial sectors in the analysis. The sectoral analysis allows for the identification of the sectors most affected by changes in interest and exchange rates. The quantile regression (QR) approach is used to examine the sensitivity of equity index returns to interest and exchange rate risks. The study contribute to the literature in that it provides evidence showing that exchange rate risk is more likely to affect equity index returns than interest rate risk in an emerging stock market. The remainder of the study is structured as follows. Section 2 provides the description of data and estimations. Section 3 presents empirical results. The last section summarizes the most relevant conclusions.

2. Analytical Framework

This section describes the data used in this study and the estimation method that is used to analyze the sensitivity of equity index returns to changes in interest and exchange rates in the Thai stock market.

2.1 Data

The stock exchange of Thailand (SET) website provides the SET index, which comprises stock price of companies listed in the stock market. In addition, the SET50 index is also used as an index portfolio of large companies from various equity sectors. The sector equity

indices obtained from Datastream website are the end of month series. The interest rate, consumer price index and the US dollar exchange rate series are obtained from the Bank of Thailand website. The interest rate used in this study is the 10-year government bond yield.[1] The monthly data covers the 2005-2013 period. The sample has 108 observations. The return series and inflation rate are calculated as the percentage rate of change. Table 1 shows the sector classification in random order.

Table 1
Sector classification.

Number of sector	Sector name
Sector 1	Consumption
Sector 2	Financials
Sector 3	Industrials
Sector 4	Property and construction
Sector 5	Resources
Sector 6	Services
Sector 7	Agro-industry

Notes: Sector 2 includes banks and other financial institutions. Sector 5 includes energy.

Each sector portfolios are analyzed in accordance with the classification shown in Table 1. The sector analysis allows for investigating which sectors are sensitive to interest rate and exchange rate risks. The stationarity property of the variables used in this study is reported in Table 2.

Table 2
Stationarity and unit root tests of variables

Variables	PP (constant)	PP (constant+trend)
Nominal interest rate	-2.323	-3.292*
Real interest rate	-4.582***	-5.850***
Inflation rate	-7.579***	-7.576***
SET index return	-8.472***	-8.463***
SET50 index return	-8.858***	-8.842***
Consumption	-8.942***	-8.930***
Financials	-7.812***	-7.793***
Industrials	-8.375***	-8.372***
Property and construction	-7.362***	-7.394***
Resources	-9.940***	-9.902***
Services	-8.178***	-8.229***
Agro-industry	-7.892***	-7.860***

Note: ***, **, and * denote significance at the 1%, 5% and 10%, respectively.

The PP tests proposed by Phillips and Perron (1988) are used to test for unit root of all series used in the analysis. The results show that inflation rate, the two index returns and all sector returns are stationary at the 1% level of significance. Nevertheless, nominal interest rate is not stationary because it might contain unit root. Therefore, the first difference of nominal interest rate should be used in the analysis.

[1] The long-term interest rate is believed to be a better proxy for stock interest rate risk (see Ballester et al., 2011, for example).

Table 3
Descriptive statistics of variables.

Variables	Mean	Median	S. D.	Skewness	Kurtosis	JB
Nominal interest rate change	-0.0077	-0.0200	0.2944	0.0376	4.7956	14.4000
Real interest rate	3.9595	3.7276	0.9546	1.3270	5.4048	57.1854
Inflation rate	0.2650	0.2307	0.6401	-1.2679	9.7066	229.1987
SET index return	0.7931	1.9701	6.4269	-1.1807	6.8472	90.8514
SET50 index return	0.7926	2.1263	6.8211	-1.0319	6.2167	65.1244
Consumption	0.4173	0.4165	3.3582	-0.4471	4.5728	14.5934
Financials	0.8050	2.0648	6.9648	-0.7872	4.8690	26.6251
Industrials	0.6559	0.7575	8.8735	-0.7130	6.3652	59.5530
Property and construction	0.6270	1.3494	7.6185	-0.5836	4.8336	21.0625
Resources	0.7874	0.9056	7.9093	-0.5445	5.5851	35.0589
Services	1.2678	1.6872	6.2237	-1.4891	8.9595	197.8847
Agro-industry	1.5484	1.6953	13.4007	-0.8530	5.3342	37.2670

Note: JB denotes the Jarque-Bera statistics.

The average sector returns are positive and vary among sectors. The standard deviation is quite high. All sector returns are negatively skewed and exhibit excess kurtosis. Furthermore, the Jarque-Bera statistics reject normality of returns. Therefore, it can be concluded that the dependent variables have fat tails compared with the Gaussian distribution. In other words, they exhibit leptokurtic distributions.

2.2 Estimation method

The empirical models used in this research are the two-factor models of Stone (1974) and Jorion (1990).[2] The model that can examine the impact of interest rate can be expressed as:

$$R_{it} = \alpha_i + \beta_{1i} R_{mt} + \beta_{2i} r_t + \varepsilon_{it} \qquad (1)$$

where R_i is the nominal rate of return of equity index i, R_m is the overall market rate of return, r is the long-term interest rate (nominal or real) and ε_i is the random error. The second model used to examine the impact of exchange rate is expressed as:

$$R_{it} = \alpha_i + \beta_{1i} R_{mt} + \beta_{2i} r_t + \beta_{3i} \Delta EX_t + \varepsilon_{it} \qquad (2)$$

where EX is the nominal US dollar exchange rate expressed as the ratio of domestic currency (baht) and dollar. The impact of explanatory variables should be different between quantiles that occurs between the central region and the tails of the distributions of equity index returns. The two models allow for estimations of the impact of stationary variables on all equity index returns.

Even though the OLS regression is popular for economic analysis, the non-normal distribution of variables causes the estimation by OLS method to be inefficient and unreliable. The principal statistics reported in Table 3 show that dependent variables have skewness,

[2] These models adds additional explanatory variable to the market model.

kurtosis and non-normal distribution. Therefore, the quantile regression or QR proposed by Koenker and Basset (1978) can be advantageous in the estimations because this method is able to uncover differences in the response of the dependent variables across their different quantiles. This method is employed by Jareno et al. (2016). Buchinsky (1998) gives a practical guideline for an application of quantile regression for empirical research.

3. Empirical Results

This section reports the results from the estimations of the two models for the entire period from 2005 to 2013. The changes in nominal interest rate are a proxy of interest rest risk. Since the level of nominal exchange rate is non-stationary, its first difference is used instead. The results of model 1 for the SET50 index and sectoral returns estimated from Eq. (1) using QR method with the range from 0.1 to 0.9 are shown in Table 4.

Table 4
Estimated coefficients of nominal interest rate changes and stock market return, 2005-2013.

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	β_{1i}
Consumption	-1.94	0.12	-1.15	0.52	0.15	0.05	-0.56	0.36	1.84*	0.33***
Financials	3.38***	2.58*	1.73	0.29	0.13	-0.78	-0.74	-0.03	-0.12	1.03***
Industrials	-1.20	-1.65	0.35	0.94	1.97	1.68	2.64	1.05	0.96	1.16***
Prop & cons.	-0.23	2.14*	-1.18	-1.34	-1.22	-1.62	-1.45	-1.41	-1.44	1.11***
Resources	0.12	-0.64	-1.79	0.31	-0.02	-0.35	0.02	1.59	-0.98	1.08***
Services	1.15	-0.10	-1.49*	-0.36	-2.26	0.03	0.51	1.11	0.14	0.85***
Agro	0.87	0.25	0.29	0.28	1.11	0.83	0.15	0.70	3.01	0.74***
SET50	0.18	0.03	-0.42	0.57*	-0.41	-0.25	-0.27	-0.18	0.04	1.06***

Note: ***, **, and * denote significance at the 1%, 5% and 10%, respectively.
β_{1i} is the median value of the beta coefficient.

The coefficients β_i for all sectors and SET50 are highly significant and most of them are greater than one. This implies that the SET50 and sectoral stocks are exposed to the market. The coefficients of nominal interest rate changes are significant in the first two quantiles for the financial sector. For the consumption, property and construction, and service sectors, the coefficients are significant only in one quantile. Furthermore, the coefficient for the SET50 index return is significant only in the fourth quantile. It should be noted that the significantly positive signs of the coefficients in the consumption and financial sectors as well as the SET50 index returns indicate that they have the ability to counteract the changes in nominal interest rate, where as the significantly negative coefficient of the service sector return indicates that this sector has no ability to counteract the changes in nominal interest rate. Overall, most sector returns do not respond to the changes in nominal interest rate.

Table 5
Estimated coefficients of real interest rate and stock market return, 2005-2013.

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	β_{1i}
Consumption	0.69***	0.60**	0.41	0.32	0.17	0.35	0.12	-0.08	-0.41	0.32***
Financials	-0.14	0.53	0.36	0.56*	0.31	0.29	0.34	0.12	0.06	1.04***
Industrials	0.03	0.76	0.27	0.21	-0.04	0.04	-0.22	-0.96	-1.4**	1.15***
Prop & cons.	-0.23	-0.02	0.22	0.09	-0.02	0.25	0.40	0.13	0.22	1.09***
Resources	0.95***	0.35	0.72*	0.49	0.21	0.07	0.43	0.67	0.05	1.09***
Services	-0.60	-0.12	-0.04	-0.03	-0.07	-0.28	-0.36	-0.12	-0.63	0.86***
Agro	0.52*	0.19	-0.20	-0.43	-0.59	-0.8**	-0.63	-0.73	1.9***	0.66***
SET50	0.33***	0.29**	0.2**	0.14	0.19**	0.15*	0.14*	0.17**	0.06	1.06***

Note: ***, **, and * denote significance at the 1%, 5% and 10%, respectively.
β_{1i} is the median value of the beta coefficient.

The impacts of real interest rate as a measure of interest rate risk seem to be more pronounced than those of changes in nominal interest rate. More sectors are affected by real interest rate. The exposures of stock returns to real interest rate can be different.[3] The results of estimations of the model with the real interest rate variable are reported in Table 5. It should be noted that the most affected is the SET50 index return. The sectors that are not affected are property and construction, and services. The impacts of real interest rate seem to be stronger than those of nominal interest rate.

Table 6
Estimated coefficients of exchange rate changes and stock market return, 2005-2013.

Sector	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	β_{1i}
Consumption	0.19	0.27	0.14	-0.01	-0.09	-0.34	-0.19	-0.69	-0.24	0.30***
Financials	-0.73	-1.05	-1.46	-0.56	-0.75	-1.04	-0.70	-0.42	-0.47	0.98***
Industrials	-0.27	-0.25	-1.10	-0.48	-0.79	-0.77	-0.91	-0.77	-2.06	1.16***
Prop & cons.	-1.19**	-1.8**	-1.9***	-1.9**	-1.8**	-1.7*	-2.1**	-1.7	-1.69	1.01***
Resources	-0.20	0.05	1.75	2.2**	2.6**	1.72	1.8**	2.9***	2.1**	1.12***
Services	-1.4**	-1.4**	-1.6**	-0.86	-0.77	-1.6*	-1.9*	-1.66	-1.32	0.81***
Agro	1.26	0.35	-0.36	-0.99	-0.98	-1.53	-0.99	-1.56	0.12	0.66***
SET50	0.53	0.37	0.45**	0.37**	0.44**	0.44**	0.39**	0.36*	0.39*	1.09***

Note: ***, **, and * denote significance at the 1%, 5% and 10%, respectively.
β_{1i} is the median value of the beta coefficient.

The results of estimated coefficients of the model expressed in Eq. (2) are reported in Table 6. Since the impacts of real interest rate on equity index returns are similar to the results reported in Table 5, Table 6 reports only the response of equity index returns to exchange rate risk measured by changes in nominal exchange rate. Three sector returns affected by exchange rate risk are property and construction, resources and services. Only resources sector is shielded from exchange rate risk because the sign is negative. The reason is that resources sector comprises large energy corporations, especially large oil companies. These firms sell their products in domestic currency. Therefore, their profits will not be affected by changes in exchange rate. This is also true for SET50 index returns, which comprises the returns from large corporations from various sectors. It should be noted that the signs of coefficients of changes in exchange rate cannot be exactly interpreted using equity index returns. The signs of the coefficients depend on the types of firms included in each equity index. Importing firms can benefit from negative changes in foreign exchange (appreciation) while exporting firms benefit from positive changes in foreign exchange (depreciation). This kind of benefits can cause stock prices of companies to rise or fall. Overall, exchange rate exposures of firms are different across equity sectors.

4. Conclusions

This research analyzes the sensitivity of the Thai stock market to changes in interest and exchange rates. The quantile regression is used. This procedure should be superior to the ordinary least squared method because it provides estimations of different quantiles. The main equity index and sectoral returns represent the stock market. The analysis of sector returns allows for identifying differences among sectors that respond to interest and exchange rate risks. The results from this study indicate that the degrees of exposure to risks are different across sectors. Furthermore, the exposure of sectoral and main index returns to exchange rate risk seems to be more pronounced than that of interest rate risk. The implication for investors

[3] The level of real interest rate is used because its level is stationary. Real interest rate variable is calculated as the difference between the government bond yield and inflation rate. Therefore, the impact of inflation is implicit in the level of real interest rate.

and portfolio managers is that they should take into account of the impact of the two types of risk when they form portfolios by selecting stocks from different firms or equity indexes.

References

Apergis, N., Artikis, P., and Sorros, J., 2011. "Asset pricing and foreign exchange risk," Research in International Business and Finance, 25(3), 308-328.

Bae, S. C., 1990. "Interest rate changes and common stock returns of financial institutions: revisited," Journal of Financial Research, 13(1), 71-79.

Ballester, L., Ferrer, R. and Gonzales, C., 2011. "Linear and nonlinear interest rate sensitivity of Spanish banks," Spanish Review of Financial Economics, 9(2), 34-48.

Bodnar, G. M. and Gentry, W. M., 1993. "Exchange rate exposure and industry charcteristics: evidence from Cananda, Japan and USA," Journal of International Money and Finance, 12(1), 29-45.

Bredin, D. and Hyde, S., 2011. "Investigating sources of unanticipated exposure in industry stock returns," Journal of Banking and Finance, 35(5), 1128-1142.

Buchinsky, M., 1998. "Recent advances in quantile regression models: a practical guideline for empirical research," Journal of Human Resources, 33(1), 88-126.

Chamberlain, S., Howe, J. and Popper, H., 1997. "The exchange rate exposure of the US and Japanese banking institutions," Journal of Banking and Finance, 21(6), 871-892.

Choi, J. J., Elyasiani, E. and Kopecky, K. J., 1992. "The sensitivity of bank stock returns to market, interest and exchange rate risks," Journal of Banking and Finance, 16(5), 983-1004.

Dinenis, E. and Staikouras, S. K., 1998. "Interest rate changes and common stock returns of financial institutions: evidence from the UK," European Journal of Finance, 4(2), 113-107.

Elyasiani, E. and Mansur, I., 2005. "The association between market and exchange rate risks and accounting variables: a GARCH model of the Japanese banking institutions," Review of Quantitative Finance and Accounting, 25(2), 183-206.

Fraser, D. R. and Madura, J., 2002. "Sources of bank interest rate risk," Financial Review, 37(3), 351-367.

Hyde, S., 2007. "The response of industry stock returns to market, exchange rate and interest rate risks," Managerial Finance, 33(9), 693-709.

Inci, A. C. and Lee, B. S., 2014. "Dynamic relation between stock returns and exchange rate changes," European Financial Management, 20(1), 71-106.

Isimbabi, M. and Tucker, A., 1997. "The market perception of banking industry risk: a multifactor analysis," Atlantic Economic Journal, 25(1), 99-112.

Jayasinghe, P. and Tsui, A. K., 2008. "Exchange rate exposure of sectoral returns and volatilities: evidence from Japanese industrial sectors," Japan and the World Economy, 20(4), 639-660.

Jareno, F., 2008. “Spanish stock market sensitivity to real interest and inflation rates: an extension of the Stone two-factor model with factors of the Fama and French three-factor model,” Applied Economics, 40(24), 3159-3171.

Jareno, F., Ferrer, R. and Miroslavova, S., 2016. “US stock market sensitivity to interest and inflation rates: a quantile regression approach,” Applied Economics, 48(26), 2419-2481.

Jorion, P., 1990. “The exchange rate exposure of US multinationals,” Journal of Business, 63 (3), 331-345.

Jorion, P., 1991. “The pricing of exchange rate risk in the stock market,” Journal of Financial and Quantitative Analysis, 26(3), 363-376.

Kasman, W., Vardar, G. and Tunc, G., 2011. “The impact of interest rate and exchange rate volatility on banks’ stock return and volatility: evidence from Turkey,” Economic Modelling, 28(3), 1328-1334.

Koenker, R. and Basset, G. J., 1978. “Regression quantiles,” Econometrica, 46(1), 33-50.

Muller, A. and Verschoor, F. C., 2006. “European foreign exchange risk exposure,” European Financial Management, 12(2), 195-220.

Olugbode, M., El-Masry, A. and Pointon, J., 2014. “Exchange rate and interest rate exposure of UK industries using first-order autoregressive exponential GARCH-in-mean (EGARCH-M) approach,” Manchester School, 82(4), 409-464.

Phillips, P. C. B. and Perron, P., 1988. “Testing for a unit root in time series regression,” Biometrika, 75(2), 335-346.

Stone, B. K., 1974. “Systematic interest rate risk in a two-index model of returns,” Journal of Financial and Quantitative Analysis, 9(5), 709-721.

Sweeney, R. J. and Wargar, 1986. “The pricing of interest rate risk: evidence from the stock market,” Journal of Finance, 41(2), 393-410.

Yourougou, P., 1990. “Interest rate and the pricing of depository financial intermediary common stock: empirical evidence,” Journal of Banking and Finance, 14(4), 803-820.