Analysis of Risk and Return of ICT Stocks Traded on Security Exchange of Thailand

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Abstract

The research aims to study the risk and return of the securities in the Information and Communication Technology (ICT) Group traded in the Stock Exchange of Thailand. The GARCH-M model is employed to estimate the volatility and CAPM beta which will be used as a measure of the risk of the stock. The Security Market Line (SML) will then be constructed and used in a decision to invest in the Securities by considering whether the prices traded are higher or lower than the appropriate price. The secondary data used are the daily closing prices of the ICT securities, covering the 6 years from January 4, 2012, to December 29, 2017. Eight Securities with high trading volume and regular movement of price were selected for our study. The results from the GARCH-M model are analyzed by comparing the expected return of each security with the risk-adjusted return as shown on the SML line. It was found that INTUCH and SYNEX are the securities that should be selected to invest because their trading prices are lower than their appropriate level (undervalue). The remaining securities, ADVANC, TRUE, DTAC, THCOM, SAMART, and JMART should not be invested because their prices are higher than appropriate level (overvalue).

Keywords: *Information and Communication Technology Securities, CAPM beta, GARCH-M, Security Market Line (SML)*

1. Introduction

During the past couple of decades, Thailand has made substantial progress in the development of Information and Communication Technology infrastructure, resulting in the increasing number of users in internet communication, online businesses, and social media such as Facebook, Twitter, Line, and so on.

In recent years, the uses of digital technology in the forms of Internet Of Thing (IOT), Artificial Intelligence (AI), Robot and Animation, Fintech, Blockchain, and Big Data, for examples, have been widespread in many areas of applications such as online trading, tourism, health care, education, manufacturing, investment, banking, and even in agricultural operations.

The ICT development on the economy has been viewed as a Fourth Industrial Revolution. Its impact on the economy, sometimes called the "Digital Technology Disruption," is large, swift, and unavoidable. In term of the Gross Domestic Product (GDP), the digital economy's share in the aggregate output keeps growing proportionately larger and larger each day.

With the growing importance of ICT development as a major driver of economic progress, the International Telecommunication Union, the research agency under the UN direction, has constructed the so-called "ICT Development Index," or IDI, for each of 175 countries for the purpose of international comparisons.

For Thailand, it has been placed in term of IDI at the 91st rank (the lower rank, the better) in 2012 among 175 countries. Furthermore, It has surged in the ranking to around 70-80 in subsequent years, reflecting the progress in ICT development that has been made for the Thai economy. Table 1 below shows the IDI ranking for Thailand during 2012- 2017.

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Table 1 ICT Development Index- IDI ranking and score for Thailand during the years 2012- 2017

ICT Development Index: IDI (Thailand)											
2017		**2016**		**2015**		**2014**		**2013**		**2012**	
Ranking	**Score**	**Ranking**	**Score**	**Ranking**	**Score**	**Ranking**	**Score**	**Ranking**	**Score**	**Ranking**	**Score**
78	5.67	79	5.31	74	5.05	71	5.00	81	4.76	91	4.09

Source: https://www.itu.int/en/Pages/default.aspx

Table 2 Uses of internet and mobile phones in Thailand during 2012- 2017

Year	Number of people ages over 6 years old using internet (million)	Number of people ages over 6 years old using internet (%)	Number of people using mobile phones (million)	Number of people using mobile phones (%)
2017	33.40	52.90	55.60	88.20
2016	29.80	47.50	51.10	81.40
2015	24.60	39.30	49.60	79.30
2014	21.70	34.90	48.10	77.20
2013	18.30	28.90	46.40	73.30
2012	16.60	26.50	44.10	70.20

Source: http://stiic.sti.or.th/stat/ind-it/it-t0

In the areas of investment, the size of ICT technology-related businesses is growing each day, making ICT stocks more attractive to investors. As many traditional retail and wholesale businesses are now transforming into online trading, the ICT operators to support the digitization of businesses and economy will become the primary drivers in the whole market. We would then expect to see the ICT industry in Thailand to grow significantly in the near future, as much the same as what has happened in many advanced countries around the world.

2. Objectives

In this paper, we will focus on how the decision is made to select the stocks for investment, in particular, the ICT stocks. The information on return and risk of each stock will be calculated and compared based on the CAPM-beta framework. The beta of each stock is estimated using GARCH-M model. The advantage of using the GARCH-M model over the conventional OLS (Ordinary Least Square) model is that the GARCH-M model will take into account the volatility of the stock under consideration in the estimation process (See Varga & Rappai (2002)).

Once the beta for each stock is estimated, the SML (Security Market Line) can be constructed to show the risk-return profile that reflects the high-risk-high-return rationale for the stock selection decision.

The data of the daily closing price of selected 8 ICT stocks traded in the Stock Exchange of Thailand (SET) are collected, covering the 6 years from 2012 to 2017. These stocks are selected based on their large market capitalization and regular price movement. Other data on the SET Index and risk-free 5-year bond yield covering the same period are also collected.

The selected 8 ICT stocks are shown in Table 3 below.

Table 3 List of stocks selected for study

Number	Symbol	Company Full Name	Number	Symbol	Company Full Name
1	ADVANC	Advance Info Service	5	THCOM	Thaicom PCL
2	TRUE	TRUE Corporation	6	SAMART	SAMART Corporation
3	INTUCH	Intouch Holding	7	JMART	JMART PCL
4	DTAC	Total Access Communication	8	SYNEX	SYNEX (Thailand) PCL

Source: https://marketdata.set.or.th/mkt/sectorquotation.do?sector=ICT

3. Materials and Methods

Capital Asset Pricing Model (CAPM): This model establishes the relationship between the return of a single stock and the return of the total market. The correlation coefficient called CAPM-beta is estimated. This beta is used to measure the risk of a single stock in term of its volatility relative to that of the whole market. In this research work, we will use the GARCH-M model to estimate CAPM- beta for each stock rather than using the conventional OLS method.

Generalized AutoRegressive Conditional Heteroscedasticity (GARCH) Model: Introduced by Tim Bollerslev in 1986, this model assumes that the variance or volatility of a time series typically exhibits the correlation with its own past. It can be easily observed from the movements of financial time series such as stock price where its volatility varies through time and relates to its own past in the form of Autoregressive (AR) or Autoregressive-Moving Average (ARMA) process. The GARCH-M model, which is employed in this research, will include the volatility of the stock price series as one of the explanatory variables in the Mean Equation.

The working of the model will be illustrated in more details in the estimation section that follows below.

Boonyawat and Wanasilp (2016) used the GARCH-M model to estimate the CAPM-beta from time series of various stocks in the real estate industry. They found that the betas that were estimated using the GACH-M model are different significantly from those that were estimated using the conventional OLS model. This finding leads to different conclusions in the decision to select the stocks for investment, even though the same sets of data were used in both methods of estimation.

Janjaras and Makoontod (2012) used various models such as GARCH-M, ARCH, AR, and MA to estimate the risk and return of the stocks in the Mining Industry. The Minimum Root Mean Square Error will be used to judge which model is the best. It was found that there is no consensus conclusion about the best model. The models that yield the minimum RMSE vary from stock to stock under consideration.

Varga and Rappi (2002) employed the GARCH-M model to estimate CAPM-beta for the returns of the stocks traded in the Hungarian Stock Market. The Security Market Line was then constructed and used to evaluate for each stock as to whether it is undervalued (hence should be invested) or overvalued (hence should not be invested). The same data and procedure were performed using OLS model. It was found that the betas estimated by GARCH-M model yield more effective results in term of the return of the whole portfolio.

The methodology used in our work as presented in this paper follows closely that of Boonyawat and Wanasilp (2016). However, while their work focuses on real estate stocks, our study directs attention to stocks in the ICT industry instead.

Methodology

Step 1

The daily ICT stock price data covering the period from January 2012 to December 2016 were tested for stationarity. The Augmented Dickey-Fuller (ADF) Unit Root test procedure will be employed as illustrated below (see Greene, 2002 and Kraipornsak, 2016).

1. The case of without intercept and time trend
$$\Delta P_t = \theta P_{t-1} + \sum_{j=1}^{p} \lambda_j \Delta P_{t-j} + \varepsilon_t$$
2. The case with intercept only
$$\Delta P_t = a + \theta P_{t-1} + \sum_{j=1}^{p} \lambda_j \Delta P_{t-j} + \varepsilon_t$$
3. The case with both intercept and time trend
$$\Delta P_t = a + \beta t + \theta P_{t-1} + \sum_{j=1}^{p} \lambda_j \Delta P_{t-j} + \varepsilon_t$$

P_t is stock price expressed in logarithmic value, resulting in the change in stock price, ΔP_t, becoming the return of the investment, R_t, in that stock.

The hypothesis testing is as follow:

H_0: $\theta = 0$

H_1: $-1 < \theta < 0$

Accepting Ho means P_t is non-stationary (that is, having a unit root) and then the unit root test for the 1st difference of the data is required as the next step. Only the stationary data can be used to run the regression so that the coefficients obtained from the estimation will be efficient and reliable.

Step 2

After being tested for stationarity, the 1st difference of stock price in logarithmic value (log ΔP_t), which can interpret as the return from investment in that stock (that is, R_t), will be used to estimate the CAPM-beta in a GARCH-M model as illustrated below.

1. Mean equation $R_{it} = \alpha + \beta R_{mt} + \gamma\sigma_{it}^2 + \varepsilon_t$

2. GARCH equation $\sigma_{it}^2 = \mu + \alpha_p \varepsilon_{t-1}^2 + \emptyset\sigma_{it-1}^2$

Where

R_{it}	is the return from investment in stock i at time t
α, μ, γ	are constant terms
β	is the CAPM- beta for security i to be estimated
R_{mt}	is the return of the market SET Index
σ_{it}^2	is the volatility of security i at time t calculated by GARCH equation
ε_{t-1}^2	is the (squared) shock or forecast error affecting the volatility of ΔP_t

Step 3

The Security Market Line (SML) which shows the relationship between risk (beta value) and return of securities is constructed according to the following equation.

$$E(R_{SML}) = R_f + [E(R_m) - R_f]\beta_i$$

Where,

$E(R_{SML})$	is the expected return of security that reflects the change of risk, β
R_f	is the return of risk-free security (5-year bond yield)
$E(R_m)$	is the average return of the market index (SET Index)
β_i	is the beta value of security i estimated from GARCH-M model

Step 4

The expected return of each security will be compared with its return plotted on SML line.

The expected return of each security is calculated from the following equation.

$$E(R_i) = R_f + [E(R_m) - R_f]\beta_i + \gamma\sigma_i^2$$

Where σ_i^2 is the unconditional variance of security i. Other variables are defined as mentioned above.

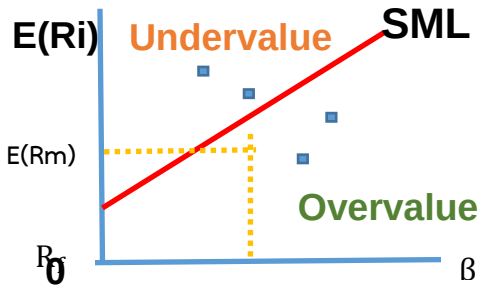

Figure 1 Security Market Line (SML)

The decision rule to invest is as follow:

Any security having expected return that lies above the SML line is considered to be undervalued or under-priced, so that it should be invested for the reason that its price will have more chance to go up further.

However, for security that has expected return lying below the SML line, it is considered to be overvalued or overpriced so that it should not be invested for the reason that its price has more tendency to go down rather than to go up.

4. Results and Discussion

Firstly, the time series data of the log of prices of 8 securities in the ICT industry and the SET Index were tested for stationarity under the hypothesis that the series contains a unit root. Using Augmented Dickey-Fuller methodology, it was found that the hypothesis cannot be rejected at 5% significant level for all securities. It means that the price of each and every security has unit root or being nonstationary. We then proceed further with the unit root test for the 1st difference of the log of the price of each security. It was found that the hypothesis is rejected at 5% level for all series, meaning that all data are stationary at their 1st difference. With this result, we can use the 1st difference of the data to estimate the CAPM-beta and volatility using the GARCH-M model without having to worry about the problem of spurious regression.

The results from the estimation using the GARCH-M model are shown in Table 4 below.

Table 4 Results from the estimations of GARCH-M model
1. Mean equation $R_{it} = \alpha + \beta R_{mt} + \gamma\sigma_{it}^2 + \varepsilon_t$
2. GARCH equation $\sigma_{it}^2 = \mu + \alpha_p \varepsilon_{t-1}^2 + \emptyset\sigma_{it-1}^2$

Coefficients	ADVANC (z-Statistic)	TRUE (z-Statistic)	INTUCH (z-Statistic)	DTAC (z-Statistic)	THCOM (z-Statistic)	SAMART (z-Statistic)	JMART (z-Statistic)	SYNEX (z-Statistic)
Mean Equation								
A	**-0.002122** (-0.32)	**0.017177** (1.73)	**0.005199** (0.85)	**0.002783** (0.30)	**0.009945** (0.85)	**-0.006684** (-0.55)	**0.030158** (1.24)	**0.007382** (0.58)
B	**1.031752*** (25.99)	**1.644287*** (27.21)	**0.972120*** (29.65)	**1.005402*** (19.04)	**1.005004*** (18.95)	**1.224969*** (23.25)	**1.208438*** (17.24)	**0.745852*** (13.60)
$\gamma\sigma^2$	**2.0308E-11** (-0.32)	**3.7885E-09** (1.78)	**9.8482E-11** (0.89)	**8.7666E-11** (0.32)	**8.0064E-10** (0.87)	**4.6534E-10** (-0.55)	**1.3060E-08** (1.24)	**5.3089E-10** (0.58)
Variance Equation								
Ω	**0.0000025*** (3.89)	**0.0000126*** (5.45)	**0.0000037*** (4.88)	**0.000051*** (6.69)	**0.0000062*** (4.39)	**0.0000207*** (4.99)	**0.000261*** (6.94)	**0.0000092*** (9.21)
ε_{t-1}^2	**0.061785*** (15.36)	**0.064182*** (8.39)	**0.095468*** (17.41)	**0.219835*** (9.56)	**0.035032*** (6.87)	**0.070895*** (8.16)	**0.117577*** (6.78)	**0.032105*** (11.37)
σ_{t-1}^2	**0.929661*** (165.50)	**0.912590*** (90.78)	**0.887757*** (98.48)	**0.689323*** (21.20)	**0.949512*** (134.66)	**0.888492*** (63.55)	**0.486668*** (7.00)	**0.951470*** (230.77)

*Significant at 5% level.

The estimated betas (β) from Table 4 will then be used to construct the Security Market Line (SML) as shown in Table 5 below.

Table 5 The Security Market Line (SML) shows the positive relationship between return and risk (β) as per equation $E(R_{SML}) = R_f + [E(R_m) - R_f]\beta_i$

Securities	Variable						
	$\gamma\sigma_t^2$	α	B	R_m	R_f	$E(R_{it}) = Y$	$R_{SML} = R_m \times \beta$
ADVANC	2.0308E-11	-0.002122	1.031752	0.1460	0.0263	0.1498	0.1506
TRUE	3.78855E-09	0.017177	1.644287	0.1460	0.0263	0.2231	0.2401
INTUCH	9.84829E-11	0.005199	0.972120	0.1460	0.0263	0.1427*	0.1419
DTAC	8.7666E-11	0.002783	1.005402	0.1460	0.0263	0.1466	0.1468
THCOM	8.00641E-10	0.009945	1.005004	0.1460	0.0263	0.1466	0.1467
SAMART	4.65344E-10	-0.006684	1.224969	0.1460	0.0263	0.1729	0.1788
JMART	1.30607E-08	0.030158	1.208438	0.1460	0.0263	0.1710	0.1764
SYNEX	5.30899E-10	0.007382	0.745852	0.1460	0.0263	0.1156*	0.1089

* The stock are undervalued since the returns are higher than (above SML line) the level required to cover the risk (β)

For each security, the expected return will be compared with the risk-adjusted return lying on the SML line. It is shown that the undervalued stocks include INTUCH and SYNEX. The rest are overvalued.

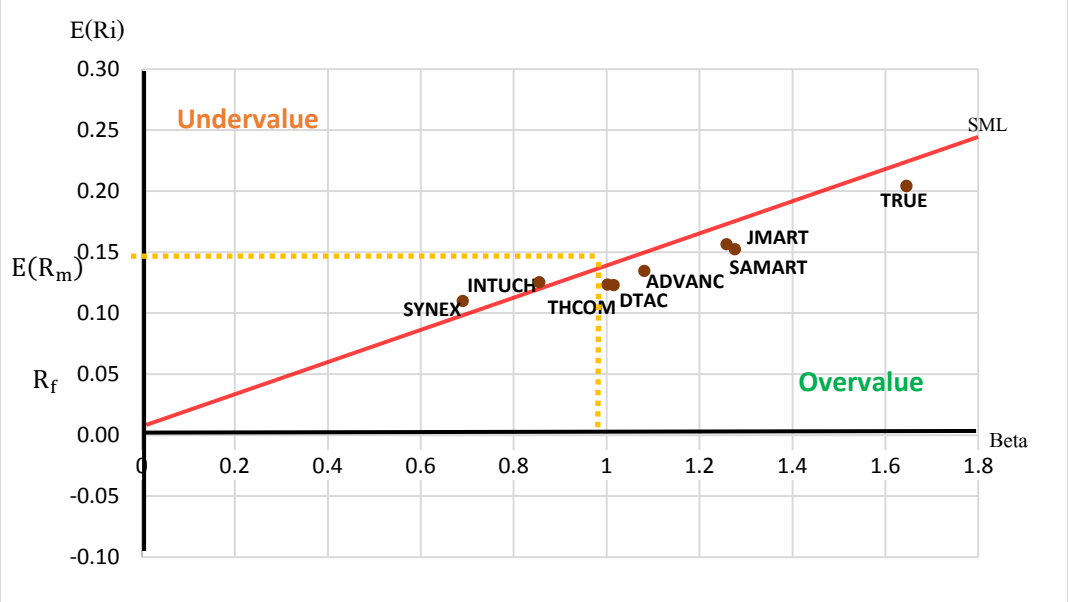

Figure 2 Comparison of expected return and the risk-adjusted return lying on the SML line

From Table 5 and Figure 2, it was found that the stock returns that lie above the SML line are those of INTUCH and SYNEX. Hence, these two stocks are undervalued and worth investing because their prices will have a tendency to go up. On the other hand, the stocks that have returns lying below the SML line comprise of THCOM, DTAC, ADVANC, SAMART, JMART, and TRUE. The stocks in this group are then overvalued and should not be invested since their prices have more chances to decline than to increase.

5. Conclusion

The objective of this research work is to find the CAPM-betas using the GARCH-Model for estimation, rather than using the traditional OLS model. Eight ICT stocks traded in the Stock Exchange of Thailand were selected for the estimation of their CAPM-betas, using GARCH-M model. The data for the period from 2012 to 2017 were used in the estimation process.

The estimated betas, being viewed as the risk measure associated with each stock, were then used together with stock returns to plot the Security Market Line (SML) to be used as a theoretical basis for evaluating the appropriate level of the price of stocks.

The advantage of using the GARCH-M model is that it includes volatility as one of the predictors for forecasting the price or the return of financial instruments (Bollerslev (1986)). It is in line with the concept of high risk high return generally assumed in theoretical finance.

Prior to the estimation, the time series of stock prices were tested for stationarity (the so-called unit root test). The Augmented Dickey-Fuller method was used to decide whether to accept or reject the hypothesis that the series contains the unit root. It was found that all-time series data of stock prices are non-stationary (that is, accepting the hypothesis that the data have unit root) at the price level at 5% significant level. However, it

turned out that all of them are stationary when the data are transformed to their 1st difference (that is, to reject the hypothesis that the data have unit root).

Upon comparing the expected or average return of each stock return with its corresponding risk-adjusted return lying on the SML line, it was found that there are two stocks, namely INTUCH and SYNEX, that have their expected returns lying above the SML line. It means that these two stocks are undervalued or underpriced. Therefore, they should be invested for the reason that their prices have a tendency to go up rather than to go down.

On the other hand, the rest of the securities, namely THCOM, DTAC, ADVANC, SAMART, JMART, and TRUE, have their return lying below the SML line. It means that they are overvalued or over-priced. Therefore, they should not be invested for the reason that their prices have more chance to go down rather than to go up.

Recommendations for Future Research

1. This methodology should be tried out for stocks of other industries in order to find the results that may be different from this research which focuses only on ICT stocks.

2. The efficiency of betas should also be evaluated in term of the profitability of the whole portfolio. Then the comparison between GARCH-beta and OLS-beta would be performed in order to judge which one yields a higher profit for the portfolio under consideration.

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