On the link volatility between tin price and stock[1]

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Abstract:

The influence of commodity prices which affects the stock market has been investigated in previous researchers. This research aims to examine the volatility effect of tin commodity prices to the company's stock price. Vector Error Correction Model (VECM) is employed with monthly data from 2003 to 2015. The results showed that the price of tin has a relationship with the equity of PT Timah Tbk, Malaysia Smelting Corporation and Yunnan Tin Company Limited which indicates the existence of financialization commodity market

Key words: stock, price, tin

JEL Classification: E30; C22; O13

Introduction

Tin is a rare industrial metal with metallic properties that are non-toxic, non-corrosive and good conductors. Indonesia, China and Malaysia are the world's tin producers so that these countries affect the volatility of the global tin price (Munandar *et al.*, 2016). Tin prices volatility also suspected to affect the stock price of tin companies such as PT Timah Tbk (TINS) in Indonesia, Malaysia Smelting Corporation (MSC) in Malaysia and Yunnan Tin Company Limited (YTCL) in China.

The influence of commodity prices affects the stock market has been investigated in previous researchers including; Aboura and Chevallier (2014), which examines the volatility of commodities that affect the financial markets (stocks, bonds and currencies). In line with Creti et al. (2013), stated that there is a relationship between stock market wich volatility of commodities. More studies specifically states there is a relationship behaviors related to volatility of oil and industrial metals (copper, gold and silver) in the stock markets (Choi, Hammoudeh 2010). Sadorsky (2014), has conducted more specific towards stock markets in developing countries that

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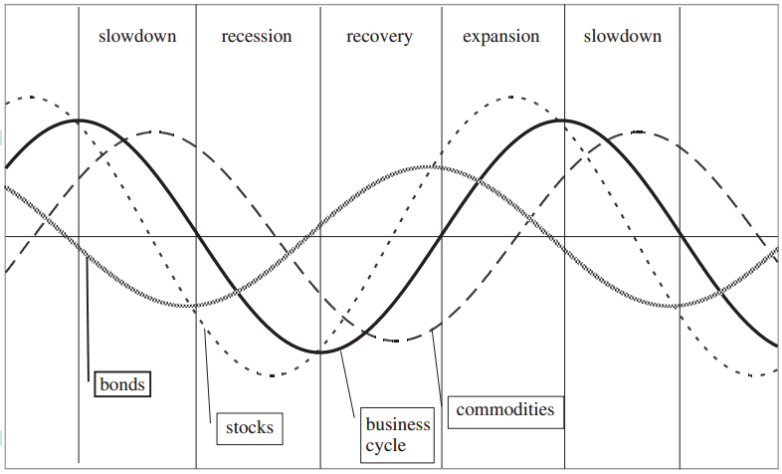
influenced by the price volatility of copper, oil and wheat. Ntantamis and Zhou (2015), suggested a link between commodity prices and stock prices of commodities.

In Figure 1, describes the inter-market relationship diagram. Inter-market relationship between commodity markets with stock market could occur because of the financialization of commodity market (Zaremba, 2015). The relationship between stock and commodity's volatility has a key relationship; financialization of commodity market (Creti *et al.*, 2013). In the study of Aboura and Chevallier (2014), also suggested a link between the stock market related to commodities. Prior research of Creti *et al.* (2013), explain that the idiosyncratic relationship also exists between the stock and commodity's volatility on oil commodities, coffee, cocoa and gold. This study focuses specifically on tin that shows strong evidence of a relationship among the tin commodity price and stock price of tin companies. Various prior researchers had not yet to observe the impact of tin commodity price volatility to the company's stock price.

Fig 1. Diagram of inter-market



Source: Liang KY and Yen CH (2014)

Literature review

The relationship between commodity prices and the stock market has had a considerable interest for researchers. Ntantamis and Zhou (2015), revealed two main reasons; (i) investor interested in whether the stock returns of companies whose main business in commodity to reflect changes in commodity prices (underlying asset), and (ii) to examine the relationship between commodity prices and the stock market in order to increase wealth in the stock market. The mechanisms that explain the relationship of commodity prices can be explained by the perspective of supply and demand channels. Fluctuations in commodity prices have an indirect effect on aggregate demand which influence the real economy (Ntantamis and Zhou, 2015).

Commodity companies may have a profit from commodity price changes on their own and the margin they earn from processing of commodities (Dunsby *et al*., 2008). In the tin companies, margins obtained from the difference between the selling price and cost of production. Tin company that organizes the optimal price difference has the resilience to shocks upon tin commodity price fluctuations. For the company with enough capital, will make the tin beams stock storage when commodity prices fall to below the cost of production. Tin companies which have high margins must be regarded as a good corporate by the investors. Cash flows are ascending when high tin

prices would be viewed favorably by investors so that it will make investors interested to invest their shares into the company.

In general, to the tin producer countries, tin price increase was a blessing due to the increment of income for the countries, labor use, multiplier effect and lead to better welfare outcomes. On the utilization of tin, tin price rise will increase spending but not significant due to the use of tin in small quantities. The increase in the tin price could induce company to earn a better margin, stable company's condition and moreover increase investor confidence in the company's stock price.

Tin company seeks to improve the performance of stocks by fixing the operational performance and investment for tin mining exploration. Tin company attempts to improve the efficiency of the company, so that the company can obtain maximum margin. On the other hand, the efficiency through new technology to produce tin products are quite abundant and the discovery of new reserves also result in fluctuations of tin price. The collapse of tin prices and ITA due to the discovery of new reserves in Latin American countries (Hilman, 2010).

Malaysia Smelting Corporation Berhad

MSC is a Malaysian state-owned enterprise which produced 30,209 tonnes of tin metal in 2015 to maintain its position as the second largest supplier of tin in the world. MSC is registered both in the Market of Bursa Malaysia since December 15th, 1994 and the main board of the Singapore Exchange (SGX-ST) since January 27th, 2011. MSC is a subsidiary of The Straits Trading Company Limited Singapore (MSC 2015).

Starting in 1887, MSC was part of the smelting operations of The Straits Trading Company Limited (STC). SMC has transformed itself into a global integrated tin producer with investments in global tin supply chain from exploration, dredging on-shore, open alluvial mining, smelting and refining. The Company has smelting facility in Butterworth which has production capacity of 40,000 tonnes of refined tin per year. The company also engaged in the tin trade among the commodity markets. It is located in Malaysia, Singapore and Indonesia. MSC is a subsidiary of The Straits Trading Company Limited (STC), and headquartered in Kuala Lumpur, Malaysia. It produced (i) Stratit Refined Tin, (ii) Premium Grade 3 Nines, (iii) Premium Grade 4 Nines, (iv) trading services, and (v) mining services.

PT Timah Tbk

PT Timah (Persero) Tbk is a tin mining company in Indonesia. The company's mining activities have been conducted since the 18th century, the new Limited Company established in 1976 under the name of PT Tambang Timah (Persero). On October 19th, 1995, the company listed IPO under the Indonesia Stock Exchange with the issuer code TINS. Currently the amount of shares is 65% owned by the Indonesian government and the remaining 35% belongs to the community both inside and outside the country. As one of the world's largest tin producer, PT Timah has operated integrated tin mining activities from exploration, mining, smelting to the marketing of products abroad. The Company's tin mining activities on land located along the East coast of Sumatra called Indonesian Tin Belt (PT Timah Tbk, 2015)

Types of products manufactured by PT Timah (Persero) Tbk were tin and its derivatives with major products including (i) Banka Tin, (ii) Kundur Tin, (iii) Banka Low Lead, (iv) Banka Four Nine, (v) Tin Solder, and (iv) Tin Chemical. As for the non-tin products produced in the form of (a) technical services and repair shipyards, (b) construction, (c) hospital services, and (d) business in agribusiness.

Yunan Tin Company Limited

Yunnan Tin Company Limited (YTCL) is one of the largest tin manufacturers and tin exporter from China. The company has an integrated complex, which conduct mineral exploration, mining, smelting, refining, chemical production and processing of tin and other non-ferrous metals. YTCL company not only produce tin, but also other industrial metals. The company's main products including tin ingots, lead ingots, indium ingots, silver ingots, bismuth ingots, copper concentrate, tin solder, products made of tin, tin plate, tin chemical organic and tin chemical inorganic. YTCL is one of the tin tester which has been approved by the London Metal Exchange. YTCL has offered more than 40 kinds of products in 1470 varieties. The Company has one of the tin mines which integrated from mining to processing in the industrial chain in the world.

YTCL parent company is Yunnan Tin Company Group Limited operates in several countries. The company has sold its products for more than 56 countries through its subsidiaries and direct sales offices. YTCL has 11 affiliated branches. It currently has distribution offices in Kunming, Beijing and Shanghai. The company has direct marketing in the United States and Germany (YTCL, 2015).

Method

This study aims to assess the effects of tin price volatility to the stock price of tin company. The data used were monthly data from 2003 to 2015. Descriptive definition of volatility refers to variations in economic variables over time. In this research, the concept of volatility is explicitly related to return variations in tin commodity prices from time to time. Measurement upon returns in tin prices beased on the following equation:

$$rTin_t = Ln\left(\frac{Tin_t}{Tin_{t-1}}\right)$$

Where:

$rTin_t$: return of normal tin price at time t

Tin_t : normal price of tin at time t

Tin_{t-1} : nomial tin price at time t

Volatility calculation utilizes the historical volatility of tin commodity prices by the following equation:

$$HV\ Tin_t = \sum_{d=1}^{D_t} (P\ Tin_d - [P\ tin])^2$$

Where:

$HV\ Tin_t$: Historical Volatility of tin commodity at time t

$P\ Tin_d$: Nominal price of tin commodity at month d

[P tin] : Average price of tin commodity at the year

The research using VECM. The samples of tin companies were PT Timah Tbk (Code: TINS.JK), Malaysia Smelting Corporation Berhad (Code: 5916.KL) and Yunnan Tin Company Limited (000960.SZ) each listed on

different exchange. All the three companies are the world's largest tin supplier and the Indonesian state-owned enterprises (TINS), Malaysia (MSC) and China (YTCL). Monthly data were collected from April 2003 until December 2015 for issuers TINS.JK and 000960.SZ, while for 5916.KL issuers in the period was from January 2007 to December 2015 because the company does not actively enter the market in 2006. This study seeks to examine return shares, the number of shares traded (trading) and the return volatility of stock prices.

In equation, Vector Error Correction Model (VECM) is a form of restricted VAR (Firdaus, 2011). This additional restriction should be given for the existence of non-stationary data at the level, VECM then utilize cointegration restriction information into the specification. Therefore VECM is often referred to as a VAR design for the non-stationary series that has cointegration relationship. Thus, in the VECM there are speed of adjustment from short term to long term (Firdaus, 2011). The equation is mathematically shown by the following equation:

$$\Delta Y_t = \sum_{i=i}^{k-1} \Gamma_i \Delta Y_{t-1} - \gamma\beta Y_{t-1} + \varepsilon_t$$

Where:

Γ : The coefficient of short-term relationship

β : The coefficient of long-term relationship

γ : Speed of adjustment

Y_i : Endogenous variables used in the model

Result and Discussion

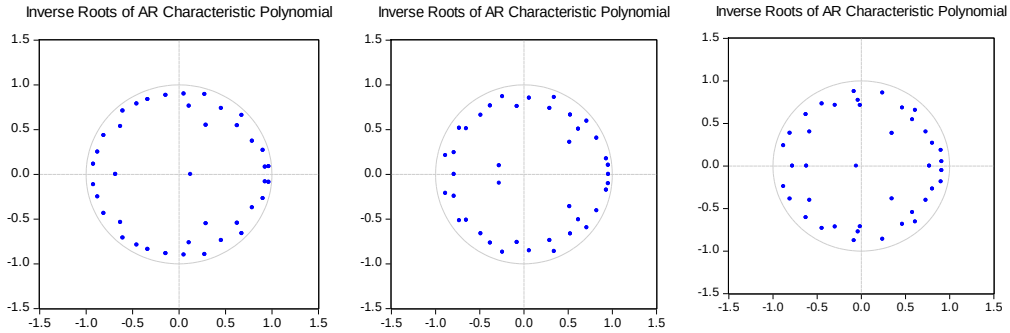
Model Identification

In the method of Vector Auto regression (VAR), requires to conduct stationary test data from the beginning. Stationary test data has utilized to the variables to be analyzed, namely the volatility of tin price (VOLATILSN), return of stock price (RETURN), the volume of stock trading (LNVOL) and the stock price volatility (VR) for companies: MSC, TINS and YTCL. Time series data stated to be stationary if the data show a pattern of constant (fixed) from time to time. On the results, the stationer data obtained after applying first differencing.

This research using the value of α =5%. When the absolute value of the ADF t-statistic is greater than the critical value, the data obtained have been stationer. Futrhermore, determine the optimum lag. The determination of optimum lag by comparing the Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), Hannan-Quinn Criterion (HQ), and the smallest Final Prediction Error (FPE), while Likelihood Ratio (LR) at the greatest value. Based on the results of the research for issuers MSC lag was at the optimum lag value 1, lag optimum value was at lag 2 for issuers TINS and optimum value at lag 1 for issuers YTCL.

At further stage, VAR stability test was performed. The results of stability tests up to the lag 10 shows that the VAR still stable with modulus value <1. The result of VAR stability testing at no root value outside the unit circle, all in the unit circle or the absolute value <1 then the VAR model is proved in stable condition at lag 10 to issuers MSC, TINS, and YTCL in Figure 2.

Fig 2. VECM Stability at lag 10



MSC TINS YTCL

Co-integration test aims to determine whether the non-stationer variables were co-integrated or not. Co-integrated variables is a prerequisite of VECM application. The test results are visible at least 1 co-integrated equation on issuers MSC, TINS and YTCL.

VECM Result

In Table 1 is the results of VECM analysis for each tin company. In the long term for three companies, the volatility of the tin price negative effect stock return. In short term for MSC and TINS, have a negative effect on the return and vary for YTCL with positive effect on returns. Differences direction of influence is possible because MSC and TINS highly dependent on commodities as an industrial tin metal produced by the company. As YTCL is the company which has a diversified metal industry business, not only tin but also lead, indium, silver, bismuth, copper concentrate.

Table 1 VECM estimation

Variable	MSC	TINS	YTCL
	Short term		
D(volatilsn(-1))	- 0.807226**	-1.086635*	1.095576*
D(volatilsn(-2))	-	-1.395925*	-
D(vr(-1))	-0.278608	-0.009297	0.000841
D(vr(-2))	-	0.309577	-
D(lnvol(-1))	-0.018101**	-0.006905	0.010628
D(lnvol(-2))	-	-0.015989	-
D(return(-1))	- 0.002662	-0.042244	-0.189258*
D(return(-2))	-	-0.027588	-
CointEq1	-1.060118*	-0.766186*	-0.744926*
CointEq2	0.014120	0.001043	-0.011402
C	-0.001104	0.000656	0.000841

Long term						
	MSC		TINS		YTCL	
Variable	CoinEq1	CoinEq2	CoinEq1	CoinEq2	CoinEq1	CoinEq2
return(-1)	1.0000	0.0000	1.0000	0.0000	1.0000	0.0000
lnvol(-1)	0.0000	1.0000	0.0000	1.0000	0.0000	1.0000
volatilsn(-1)	0.14482	-9.842240*	0.053540	-2.687398	-0.028434	-5.70318*
vr(-1)	-0.11997	7.915726*	-0.244620*	-3.625944*	0.023038	-1.235142
c	0.015529	-10.61901	0.092594	-14.56063	-0.015614	-13.85244

*) significance α = 5%, **) significance α = 10

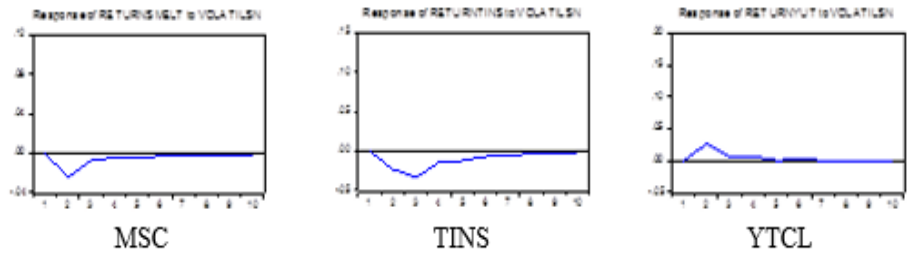
In addition the Chinese government's policies to inhibit (barrier) the exports of tin beams and has succeeded in attracting companies, tin users into the country so that the tin price volatility does not negatively affect the return of YTCL. On the other hand, the company has been successfully developed YTCL tin solder, tin-based products, tin plate tin chemical organic and tin chemical inorganic that is used for the domestic industry. YTCL also been widely recognized as a market leader for derived tin products in the world. In the tin company is also known that there is a long-term (long term) significant between stock returns with volatility of world tin prices.

In the three companies are also seen that the volume of stock trading is not affected by the volatility of the price of tin. Similarly, stock price volatility is not affected by the volatility tin price, only in MSC that there is significant influence. It is possible for MSC because they do not have enough raw materials from mining and undertake a lot of transactions of tin ore in neighboring countries such as Indonesia, Myanmar, Vietnam and even to Africa. Dependence of tin ore supply from outside which causes the volatility affect to the company's stock. MSC focuses more on the tin trade. Currently, according to the experts that MSC is a company which controls the tin trade in Southeast Asia and the world. Experts also suspect that MSC is a company that conducted a lot of speculation on commodity prices that affect the global tin price volatility. This confirms the commodity market financialization on tin.

Impulse Response Function

Impulse Response Function (IRF) is exploited to see the response of dependent variable when receiving a shock from independent variable in the amount of one standard deviation. Figure 3 shows the pattern of stock returns response data. The IRF results showed that in MSC the world volatility changes of tin prices will be responded negatively by MSC's stock return. In the period from the first to the tenth showed a negative response. The negative response enlarged up at 0:59 in the third period and then a negative response decline. The negative response to volatility change in tin price is also demonstrated by TINS's stock return. The negative responses is highest in the third period amounted to 3.1%. The negative response indicates the relationship between tin commodity prices to the company's stock. Both companies have fairly large dependence on the tin price which is the core business of the company. Thus indicates a considerable high risk in the company towards tin price volatility.

Fig 3. IRF on the response of stock returns in MSC, TINS, YTCL



Different responses generated by YTCL's stock returns in short term which showed a positive response to the shock of tin price volatility. Positive responses were obtained greater until the tenth period. These results indicate that YTCL had slightly dependence on the risk of tin commodity price. The YTCL has diversified products which not only depend on tin beams but also other metal industries in their business. Moreover, the company has carried downstream tin products directly to end-users, so that the tin price volatility does not affect company performance and the shares return, even positive results obtained with greater margin. Downstream tin products is one way to avoid the risk of high tin price fluctuations.

The YTCL is also supported by Chinese government policy by creating a strong domestic market so that products produced directly will be absorbed by the domestic industry in the country. The state policy of prohibiting the export of semi-finished goods and raw material also supported the creation of the domestic market policy and adequate infrastructure for the industry.

Forecast Error Variance Decomposition

In table 2 showed sources of stock returns. The majority of tin price volatility was affected by tin price volatility on lag periode which has the greatest contribution. Effect of stock volatility, the number of shares traded and the stock return were small. In stock return the influence increased until the tenth period. The influence stock returns are owned by YTCL, TINS and MSC. It shows the sequence on strength influences of the tin companies.

Based on table 2 that FEVD of MSC, TINS and YTCL the role of stock returns before being extended at 80% and above. The influence values of return dropped to tenth period. The largest decrease is owned by TINS, then MSC and YTCL. Thus the volatility also influence tin price which has a considerable influence on the TINS, MSC and the smallest influence in YTCL. It shows the TINS stock return is vulnerable to tin price volatility compared to MSC and YTCL. The vulnerability shows a great risk that affects the share of turmoil in tin price fluctuations. It indicates that TINS needs to diversify its business and downstream derivative tin products to lower risk of the company towards tin price fluctuations.

Table 2 Result FEVD

Variance Decomposition of RETURNTINS: (TINS stock)					
Period	S.E.	RETURNTINS	LNTINSVOL	VOLATILSN	VRTINS
1	0.144432	100.0000	0.000000	0.000000	0.000000
2	0.149315	97.02877	0.216537	2.400626	0.354066
3	0.156469	90.14740	0.628365	6.789579	2.434652
4	0.159041	88.71168	0.661782	7.328974	3.297565
5	0.160586	87.52520	0.649110	7.755079	4.070615

6	0.161947	86.63107	0.675023	7.791676	4.902231
7	0.163006	85.81786	0.675195	7.773236	5.733707
8	0.164060	84.98899	0.666572	7.712833	6.631609
9	0.165042	84.20433	0.664211	7.638188	7.493268
10	0.166011	83.44607	0.674111	7.559016	8.320802

Variance Decomposition of RETURNSMELT: (MSC stock)

Period	S.E.	RETURNSMELT	LNSMELTVOL	VOLATILSN	VRSMELT
1	0.098289	100.0000	0.000000	0.000000	0.000000
2	0.101393	93.98349	0.212676	5.781661	0.022174
3	0.102477	92.00438	1.730757	6.079616	0.185251
4	0.103116	91.55035	1.841640	6.185570	0.422444
5	0.103292	91.24411	1.855053	6.348247	0.552593
6	0.103423	91.01997	1.880456	6.396432	0.703143
7	0.103526	90.84798	1.879322	6.427824	0.844873
8	0.103613	90.69610	1.876285	6.452268	0.975345
9	0.103695	90.55362	1.873357	6.468594	1.104428
10	0.103774	90.41597	1.871106	6.482077	1.230842

Variance Decomposition of RETURNYUT: (YTCL stock)

Period	S.E.	RETURNYUT	LNYUTVOL	VOLATILSN	VRYUT
1	0.168485	100.0000	0.000000	0.000000	0.000000
2	0.171130	97.15404	0.016054	2.397812	0.432096
3	0.174683	96.26412	0.912169	2.401625	0.422082
4	0.175134	95.80698	1.257626	2.514104	0.421290
5	0.175288	95.73676	1.329359	2.511615	0.422262
6	0.175299	95.72699	1.329707	2.517839	0.425462
7	0.175313	95.71759	1.334858	2.518503	0.429052
8	0.175323	95.70722	1.337399	2.520591	0.434788
9	0.175328	95.70188	1.337360	2.521799	0.438960
10	0.175333	95.69672	1.337403	2.523087	0.442785

The study results also conveniently indicates there is a link of short-term stock returns in tin companies of TINS, MSC and YTCL with the tin price volatility, companies need to pay attention to speculation (short-term measures) undertaken by the companies. In the study of the effect of tin price volatility towards tin company's stock implies for investors to pick YTCL stocks for a good portfolio because it generates positive returns than stocks of TINS and MSC.

Conclusions

The research of tin commodity prices determinant lead to the fundamental conclusion in the study that tin price has a relationship with the equity of PT Timah Tbk, Malaysia Smelting Corporation and Yunnan Tin Company Limited which indicates the existences of financialization commodity market so that also influenced by the issuer

of tin companies. Further researches require to examine the tin relation to company performance such as financial performance and operational performance.

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