

1-30-2017

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Recommended Citation

Isnandari, Melati Laksmindra and Chalid, Dony Abdul (2017) "Stock Returns and Inflation: Evidence from Emerging Markets in Asia," *The Indonesian Capital Market Review*. Vol. 9 : No. 1 , Article 5.

DOI: 10.21002/icmr.v9i1.8554

Available at: <https://scholarhub.ui.ac.id/icmr/vol9/iss1/5>

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INDONESIAN CAPITAL MARKET REVIEW

Stock Returns and Inflation: Evidence from Emerging Markets in Asia

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(Received: March 2016/ Revised: July 2017 / Accepted: August 2017 / Available Online: October 2017)

This study examines the capability of stock from various industries to act as an inflation-hedge instrument, specifically in eight emerging-market Asian countries. By using monthly data for the period from 2001 to 2014, this study focuses on the relation between stock returns and inflation. The results of this study indicate that stocks from some non-cyclical industries have the capability to act as inflation-hedge instruments. Stocks that have the capability to inflation-hedge are come from industries with the natural characteristic of being a defensive industry.

Keywords: Inflation; Hedging; Stocks; Industry; Emerging-Market

JEL classification: E44; G12

Introduction

During the last five years, the average inflation rate in Asian emerging markets amounts to 4.2%. This inflation rate is higher than for other emerging-market countries in Middle Eastern, African, and European countries, which is about 4.1%, and also higher than other Asian countries, which are in the developed-market group (about 2.5%). Therefore, in the context of investment, it is important for investors to consider inflation risk, especially in emerging markets, because of the higher rate of inflation in these countries.

Fisher's equation tells us that nominal returns have three components; they are real returns, inflation, and the compensation resulting from every dollar earned on investment being worth less because of the inflation. A share is a representation of real assets, so the valuation should increase with inflation (Ciner, 2015).

However, the empirical studies that have previously been done (Ang, Brière, & Signori, 2012; Bodie, 1976; Fama & Schwert, 1977), show that stock returns have a negative relation with inflation. Whereas, Aktürk (2016), Anari and Kolari (2001), and Schotman and Schweitzer (2000) conclude that there is positive relation between stock and inflation, meaning that stock is a good hedge against inflation. Some studies have also tried to observe this relation at an industrial level. The empirical studies of Ciner (2015), Kim and In (2006), and Lu (2008) find that some industrial stocks are able to be a good hedge against inflation.

This study aims to determine which industries on the Asian stock exchanges that their stocks could become an inflation-hedge instruments. The objects of this research are Asian countries classified as emerging markets, specifically China, India, Indonesia, South Korea, Malaysia, Philippines, Taiwan, and Thailand,

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while the study uses monthly data from January 2001 to December 2014. Emerging-market countries are chosen to be the main focus in this research because those countries have a fairly high rate of inflation and high stock-market volatility. The essential information about inflation hedge can be used as guidelines for investment decisions and portfolio-establishment considerations (Brière & Signori, 2012).

This study is novel due to having an objective that focuses on the emerging-market Asian countries, industrial-level analysis, and the use of an unexpected inflation variable as the proxy of inflation. This study makes an effort to contribute by using a huge amount of data, which consists of eight emerging-market countries as the object at an industrial level and is collected on a monthly basis. Some previous research involves a similar study for which it was decided that the focus was either at a country level or at an industrial level in a country; therefore, the focus of this study is different from some of the previous studies. The remainder of the paper is organized as follows. Section 2 reviews the relevant studies about inflation and stock returns. Section 3 introduces our dataset and provides a brief synopsis of the method. We report on the empirical results and discussion in Section 4. Concluding remarks are presented in Section 5.

Literature Review

The price level reflects the price of a basket of goods and services. The increase in the overall level of prices is known as inflation. When the price level rises, people will have to pay more for the goods and services they buy. An increase in the price level reduces the value of money, which means every unit of currency can buy fewer goods and services compared to before the increase in the price level. In other words, inflation reduces wealth by causing a decline in the real value (Mankiw, 2015).

The previous study by Ang et al. (2012), which uses the sectoral index of the Standard and Poor's (S&P) 500 with a sample period of October 1989 to May 2010, concludes that all the sectors tested were not good inflation hedges, except for basic materials whose beta

was positive but not significantly different from zero. Another study by Kim and In (2005) relies on a multi-scaling approach with industry returns and inflation rates, both on a monthly basis for the United States in the period from January 1947 to December 2001, which shows that consumer durables and non-durables, manufacturing, business equipment, retail, and finance have a negative hedge ratio in both the short and long term. Some other industries, such as the energy, chemical and healthcare industries, show a negative hedge ratio in the short term, but a positive hedge ratio in the longer term. Another industry, utilities, provides a good hedge against inflation only in the intermediate term, but not in the shorter and longer terms. In their study, Kim and In (2005) define a short time horizon as 2–4 months and a long time horizon as 32–64 months.

Vanderhoff and Vanderhoff (1986) completed their research using the monthly returns of stocks traded on the New York Stock Exchange from October 1968 to July 1982. In this study, Vanderhoff and Vanderhoff (1986) define returns as capital gains and dividends, and they conclude that the mining and construction industries have a better ability to counter inflation compared to other industries, although these industries are not statistically significant.

More recent study by Aktürk (2016), which uses stock data from Turkish common stock market, provides empirical evidence that stock returns provide a good hedge against inflationary expectations but not for realized expected inflation. Moreover, stocks of manufacturing industry firms provide a better hedge than stocks of service industry firms.

Lu (2008) uses the S&P Global 1200 Index on each quarterly rebalance date in the period from 1998 to 2008 for a total 46 industries, which demonstrates that there is substantial variation in performance across industries, and some industries have significantly better performance during high-inflation periods than during times of low inflation. Some industries that are known to be non-cyclical in nature, such as the road and rail, healthcare providers and services, tobacco, and electric utilities industries, have better performance in a period of high in-

flation. On the other hand, some industries have worse performance during high-inflation periods; this includes the house durables, automobile, specialty retail, and electronic equipment and instruments industries.

A previous study by Boudoukh, Ricardson, and Whitelaw (1994), which uses stock data from the monthly Center for Research in Security Prices (CRSP) tapes in the period from 1953 to 1990, reveals that only the tobacco, and food and beverage industries have a positive relation with the expected inflation and all the other industries have a negative beta coefficient. In addition, only the mining industry has a positive relation with unexpected inflation.

The next two earlier studies related to this study are Wei (2009) and Ciner (2015). Wei (2009) examines the cyclical response to unexpected inflation. This study finds that stock returns respond more negatively to unexpected inflation during economic contractions than expansions. On the other hand, Ciner (2015) uses a portfolio of 48 industry stocks in the United States between January 1990 and December 2012. In this study, Ciner (2015) analyzes inflation-hedging ability by involving the decomposition of the inflation rate in its frequency components using the Ashley-Verbrugge approach. Ciner (2015) observes that commodity-sensitive and technology-related equities provide a good inflation hedge.

Research Methods

Data

The focus of this study is the stocks for industries on Asian emerging-market stock exchanges in eight countries that are classified as such by Morgan Stanley Capital International (MSCI). MSCI is an independent provider of research-driven insights and tools for institutional investors, which focuses on risk and performance measurement. The eight countries are China, India, Indonesia, South Korea, Malaysia, Philippines, Taiwan, and Thailand. These eight countries are included because they are the representatives of emerging countries in Asia with the largest economies. Analysis is conducted on

the industrial stocks that exist in at least four countries and for which the data is available on the stock exchange from 2001 to 2014. The industry classification is performed by using the Datastream. The companies are classified as being a part of an industry where at least 60% of its revenue comes from that industry.

Model Estimation

This study consists of two main stages: the first stage is inflation modeling and the second stage is the estimation of the effect of inflation on the stock returns using unexpected inflation. We use historical Consumer Price Index (CPI) data, which is modeled using a univariate time series. The residual of the univariate time-series model is subsequently used as an independent variable in the next stage.

The inflation variable used in this study is unexpected inflation. Unexpected inflation estimation is derived from innovation or the residual, univariate, time-series modeling of expected inflation. The univariate time-series method is chosen for the inflation estimation because this method is fairly simple. The stationary nature of the data needs to be ascertained in order to choose the appropriate model. The general model for expected inflation estimation is as follows:

$$y_t = \mu + \sum_{i=1}^q \theta_i u_{t-i} + \sum_{i=1}^p \phi_i y_{t-i} + u_t \quad (1)$$

where μ is the constant, u is the error term, and y_{t-1} is previous value of the data. p shows the order of the autoregressive model and q is the order of the moving-average model.

In the second stage, we use panel data analysis, which includes the classical method of looking at the significance of the rate of inflation to stock returns. We use the Hausman test to select the model that best fits the existing panel data. Fundamentally, this procedure determines whether a fixed-effect model or random-effect model is a more appropriate choice.

This research focuses on analysis at the industry level, so we aggregate the countries' data for each industry, as Lu (2008) did. Through this approach, we get more observations for

Table 1. Descriptive Statistics for Inflation

Country	Average	Std. Dev.	Max	Min
China	0.19	0.40	1.8	-0.9
India	0.56	0.57	3.1	-0.9
Indonesia	0.63	0.73	7.7	-0.4
South Korea	0.23	0.26	1.1	-0.3
Malaysia	0.18	0.36	3.4	-1.0
Philippines	0.35	0.29	1.4	-0.3
Taiwan	0.09	0.60	1.7	-1.7
Thailand	0.21	0.44	1.8	-2.5

Note: This table provides the summary statistics of the data.

each industry. However, we also realize that there are limitations to this approach, which is because we are ignoring the fact that there might be different behaviors among different capital markets.

To determine the relation between stock returns and inflation, this study uses the linear model that was used by Ciner (2015). The general model is as follows:

$$R_{it} = \alpha + \beta \pi_{it} + \varepsilon_{it} \quad (2)$$

where R_{it} is the stock return in country i at time t , π_{it} is the unexpected inflation in country i at time t , and ε_{it} is the error term in the equation. The frequency of observations in this study is monthly. This frequency is chosen due to the inflation data only existing on a monthly basis, while the monthly data for stock returns is derived from daily data.

Based on the research of Bodie (1976), Fama and Schwert (1977), Boudoukh et al. (1994), Wei (2009), and Ciner (2015), a stock is considered to have the ability to be an inflation hedge when the stock returns and inflation have a positive relation. The inflation component used in this study is the unexpected component of inflation, in reference to Ciner's (2015) study.

Bodie (1976) divides risk into two components: expected and unexpected. Economic agents estimate the amount of inflation, which is commonly known as expected inflation. Whereas the risk of unexpected inflation is a component that has not been adjusted to reflect the asset value. Therefore, an unexpected-inflation approach is used in this study. Thus, stocks are considered to have an inflation-hedging ability if the stock returns are positively and significantly influenced by unexpected infla-

tion. Hence, the hypothesis of this study is as follows:

H1: There is positive and significant relation between stock returns and unexpected inflation.

Results and Discussions

This section describes the results of the data processing that consists of constructing the univariate time series for inflation and testing the inflation-hedging ability of various industries. Based on the test results, this section will give a brief analysis of the reasoning and compare the existing result with some previous studies.

Table 1 gives the descriptive statistics for the monthly inflation in all countries. Indonesia has the highest average monthly inflation rate (0.63%). Indonesia also has experienced the highest monthly inflation rate among the other countries. However, Taiwan has the lowest average monthly inflation rate (0.09%).

This study uses the ADF test to test if the data is stationary. The result of the stationarity test on the first difference illustrates that all CPI data is stationary. The implications of the CPI data being stationary for the first difference is that the modeling of unexpected inflation will be done using an autoregressive integrated moving average (ARIMA) model. Table 2 reveals the construction of the inflation estimation model using a univariate time series for each country. According to Brooks (2002), the construction of the ARIMA model is not based on economic or financial theory, so it is often best to not interpret the individual parameter estimates, but rather to examine the plausibility of the model as a whole, and to determine whether

Table 2. Construction of the Unexpected Inflation

		Intercept	AR	MA	Adj. R ²	LM	ARCH
China	ARIMA(0,1,12)	0.013* (0.007)		-0.912*** (0.015)	0.447	0.168	0.239
India	ARIMA(12,1,12)	0.024 (0.093)	0.645*** (0.066)	-0.645*** (0.021)	0.091	0.653	0.056
Indonesia	ARIMA(0,1,1)	0.408*** (0.054)		0.355*** (0.066)	0.094	0.615	0.372
South Korea	ARIMA(3,1,3)	0.194*** (0.020)	-0.988*** (0.007)	0.964*** (0.016)	0.283	0.007	0.326
Malaysia	ARIMA(1,1,5)	0.175*** (0.032)	0.340*** (0.067)	-0.186*** (0.070)	0.145	0.243	0.718
Philippines	ARIMA(1,1,8)	0.355*** (0.031)	0.324*** (0.068)	-0.209*** (0.071)	0.113	0.282	0.121
Taiwan	ARIMA(12,1,12)	0.143 (0.180)	0.944*** (0.022)	-0.920*** (0.019)	0.290	0.085	0.971
Thailand	ARIMA(1,1,12)	0.162*** (0.055)	0.353*** (0.067)	0.191*** (0.071)	0.148	0.224	0.112

Note: This tables provides results from Equation (1). The values in parentheses are the standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

it describes the data well and produces accurate forecasts.

To choose the estimation model that best fits the data, the Hausman test is used to decide between a fixed-effect model and a random-effect model. Based on the Hausman test's results, we find that a random-effect model is the best fit for the basic materials, basic resources, chemical, and coal industries. While for the rest of the industries, we use a fixed-effect model.

Table 3 reveals that the beverage, building materials, commodity chemicals, construction and materials, electric utilities, food and beverage, tobacco, and utilities industries are positively and significantly affected by the unexpected inflation variable. In other words, an increase in unexpected inflation leads to a rise in stock returns for these industries. Conversely, the other industries are not significantly impacted by unexpected inflation.

It is interesting to find that stocks from industries related with consumer goods (such as food and beverage, and tobacco) have the ability to hedge inflation in emerging markets. This results slightly different from the evidences revealed from previously studies that using developed market data (i.e. US data). For example, Bampinas and Panagiotidis (2016) shows that stocks with the ability to hedge inflation tend to be drawn from the Energy and Industrial sectors.

Commodity chemicals stocks are positively

and significantly influenced by unexpected inflation. This result is consistent with Kim and In's (2006) research, which shows that the commodity chemicals industry has a positive inflation-hedging ratio in the long term. However, Ciner (2015) shows that commodity chemicals stocks are negatively and significantly affected by inflation in the long term. On the contrary, Ciner (2015) explains that commodity chemicals stocks are positively influenced by inflation in the short term. Fundamentally, the research by Ciner (2015) has a different focus; Ciner (2015) uses the United States, while this research focuses on emerging-market countries. In addition, the nature of the commodity chemicals industry is that of a defensive industry that is not easily affected by price increases; as a result, the companies in the commodity chemicals industry do not have to raise prices to maintain their profitability.

The test results demonstrate that the stocks for the construction and materials, and building materials industries are positively and significantly influenced by the inflation variable. This suggests that a stake in the industry has the ability to be a good inflation hedge. Lu (2008) also proves that construction stocks have the ability to hedge inflation. This result may be the consequence of the industry's characteristic of generally working on long-term projects whose cost has been adjusted for potential inflation. In general, the main client of the construction industry

Table 3. Regression Test Results

Industry	Intercept	Unexpected Inflation	Adj. R ²	Obs.
Auto Parts	0.012*** (0.003)	0.002 (0.003)	0.000	1008
Banks	0.009** (0.004)	0.006 (0.004)	0.004	1176
Basic Materials	0.009* (0.005)	0.006 (0.004)	0.002	1176
Basic Resources	0.006 (0.004)	0.005 (0.004)	0.001	1344
Beverage	0.013*** (0.003)	0.009** (0.003)	0.000	1008
Brewers	0.010*** (0.004)	-0.004 (0.007)	-0.001	672
Broadline Retailers	0.018*** (0.005)	-0.004 (0.012)	0.038	672
Building Materials	0.012*** (0.004)	0.007** (0.003)	0.002	1344
Chemical	0.007*** (0.003)	0.004 (0.003)	0.197	1008
Coal	0.014*** (0.005)	-0.001 (0.013)	0.226	672
Commodity Chemicals	0.005 (0.005)	0.016** (0.008)	0.004	840
Construction&Materials	0.009** (0.004)	0.007** (0.003)	0.004	1344
Consumer Electronics	0.008** (0.004)	0.005 (0.003)	0.002	840
Consumer Services	0.006 (0.002)	0.003 (0.003)	0.000	1176
Electric Utilities	0.007** (0.003)	0.007** (0.003)	0.004	1008
Financial	0.007 (0.004)	0.006 (0.004)	0.003	1344
Food & Beverage	0.010*** (0.003)	0.007*** (0.002)	0.005	1344
Farming & Fishing	0.013*** (0.009)	0.009 (0.005)	0.007	672
Fixed Line Telecommunications	0.004 (0.004)	0.007 (0.005)	0.005	672
General Retailers	0.018*** (0.005)	0.000 (0.010)	-0.001	840
Healthcare Providers	0.014*** (0.004)	0.005 (0.003)	0.002	672
Holdings & Development	0.010*** (0.003)	0.009 (0.009)	0.012	1008
Insurance	0.013*** (0.005)	0.013 (0.009)	0.003	840
Iron & Steel	0.006 (0.006)	0.006 (0.003)	-0.001	672
Media	0.003 (0.005)	0.003 (0.003)	0.000	672
Mining	0.014** (0.006)	0.004 (0.004)	-0.001	840
Mobile Telecommunications	0.007** (0.004)	-0.004 (0.006)	0.007	840
Personal Goods	73.867*** (19.980)	-14.231 (21.044)	-0.001	672
Real Estate	0.010** (0.005)	0.005 (0.008)	-0.001	1008
Retail	0.016*** (0.003)	0.002 (0.009)	0.000	672
Telecommunications	0.005 (0.003)	0.002 (0.003)	0.004	1176
Tobacco	0.011*** (0.003)	0.005* (0.002)	0.001	672
Travel & Leisure	0.004 (0.004)	0.004 (0.003)	0.001	1008
Utilities	0.007** (0.003)	0.006** (0.027)	0.004	1008

Note: This tables provides inflation beta from Equation (2). The values in parentheses are the standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

is the government, which aims to develop infrastructure. The role of the construction industry is considered to be important with respect to the economy of the country. In addition, the increasing population and urbanization in emerging-market countries encourages governments to boost the demand for infrastructure. However, for the construction industry to become more competitive, companies are required to be able to design and work on projects quickly, and improve their efficiency.

This study's results disclose that the electric utilities stocks are positively and significantly influenced by inflation, meaning that these stocks have the ability to hedge inflation. The electric utilities industry has the characteristics of a defensive industry, which might have made a huge contribution to this result. Also, electricity is a basic human need that will be consumed continuously even when the economy is not good. Thus, companies in this industry tend to have substantial market power over consumers, so that sales remain stable despite the highly inflationary environment. In addition, the increasing use of various electronic tools has also boosted demand in the electric utilities industry. In general, the consumers of the electric utilities industry consist of household, commercial and industrial groups, and each group has a different level of demand. Companies in this industry charge different rates to different groups of consumers. Therefore, companies in this industry are generally stable.

Food and beverage stocks are positively and significantly influenced by inflation, which means a rise in inflation effects a rise in food and beverage stock returns. This result could be due to the defensive nature of the food industry with respect to the economic cycle. Despite unfavorable economic conditions, the food industry can still maintain its performance. Therefore, the stock returns for the food industry will remain good. The previous result from Lu (2008) proves that food and beverage stocks are positively but not significantly influenced by inflation.

This study identifies that tobacco stocks are positively and significantly influenced by inflation, thus the tobacco can be used as infla-

tion-hedge instruments on the stock markets of emerging Asian countries. This result is consistent with Lu's (2008) findings using data from 1998 to 2008. Moreover, MSCI (2008) also draws the same conclusion that tobacco stocks have the ability to be good inflation hedges. Similar to Lu (2008) and MSCI (2008), Boudoukh et al. (1994) also conclude that tobacco stocks are able to hedge against inflation. The ability of a tobacco stock to be an inflation hedge might be caused by the relatively inelastic demand for products in this industry.

Moreover, utilities stocks are positively and significantly influenced by inflation. This result is consistent with previous research by Boudoukh et al. (1994), which concludes that the utilities stocks can be used to hedge inflation. This is because the production cost of this industry is not affected; for example, due to the government subsidies. In addition, the companies in the utilities industry have strong market power. The utilities industry having the characteristic of a defensive industry means the companies do not experience a change in product demand in any economic situation, and, as a result, a company's revenue in this industry is quite constant.

Conclusions

This study tests the ability of stocks to act as inflation-hedge instruments using industry stock data on eight emerging-market Asian countries, and it is also found that the Fisher model and inflation-hedging ability in every industry is different. This test investigates the empirical evidence from previous research. Based on the results and discussion for this research, there are several conclusions that have been drawn. There are several industry stocks that have the ability to be an inflation hedge. These stocks are for the beverage, building materials, commodity chemicals, construction and materials, electric utilities, food and beverage, tobacco, and utilities industries. Out of 35 industry stocks that were tested, the capabilities of the shares that could be an inflation hedge in Asian emerging-market countries are varied.

There are several implications of this study.

First, this study offers information that can be used as a consideration for building a stock portfolio. We recommend that investors consider investing in some stocks that are not adversely affected by inflation. This can be done to minimize the inflation risks that are specific to certain industries. Thus, the inflation risk can be minimized. Second, investors are able to use the information from this study as a consideration for investment decision-making in times of high inflation. Investors should invest in stocks that are inflation hedges in times of high inflation and not invest in stocks that are not inflation hedges. Third, in this study, the testing of the ability of shares to be inflation hedges focused on the past 14 years. In reality, the most appropriate model for inflation in a country

could be different to other countries. There are countries in which inflation risk is only affected in the short-term and there are also countries that are influenced by the long-term inflation rate. Therefore, further research should be conducted to consider shocks by separating the frequency of observations into different time periods. This is so that the capability of a stock to be an inflation hedge can be seen, specifically to identify those that are more suitable in each country with respect to inflation characteristics. Fourth, the CPI data used to model inflation is for the data period from 1999 to 2014. If the inflation-hedge model continues to be applied, then the inflation data should continue to be updated regularly with more recent data.

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