

EFFECT OF EXCHANGE RATE, NATIONAL INCOME, AND INFLATION ON IMPORT PRICE IN INDONESIA

Sri Isnowati

Faculty of Economics and Business

University of Stikubank ,Semarang, Indonesia

Email : isnowati@gmail.com

ABSTRACT

The aims of this research were to determine the effect of exchange rate, national income and inflation on the import price in Indonesia. The data used in this research was the secondary data issued by the International Financial Statistics (IFS) and BPS. The method of data analysis used in this research was dynamic models with a single equation that is the method of Error Correction Model (ECM). The results show that exchange rate in the short and long term has positive effect, and the Exchange Rate Pass Through value is 0.6. the variable of national income in the short and long term has positive effect on import prices, but in the short term it is not significant. In the long term, the variable of national income is significant. The variable of inflation rate in the short and long term has positive effect and significant.

Keywords: import prices, exchange rate, national income, inflation.

Introduction

In an open economy, exchange rate fluctuations will affect domestic price changes known as inflation. The changes in domestic prices known as inflation can be measured by the changes in import and consumer prices. The effect of exchange rate changes to the changes in domestic prices is known as the Exchange Rate Pass-Through (ERPT). If there is depreciation in the exchange rate of domestic currency against foreign currencies, it will cause an increase in inflation as a result of the process of pass through effect. Inflation change is more sensitive when reviewed from import prices because when using consumer price the result is not sensitive. It happens because consumer prices include non-tradable goods (Zorzi, 2007).

Of many research on Exchange Rate Pass Through, it was found that there is no uniformity regarding the definition of "pass through". Some researchers focus on the relationship between the changes in exchange rate to import prices (Parsley 2003; Champa and Goldberg ,2005). Meanwhile, there is some using consumer price index as dependent variabel (Bacchetta 2003; Bouakez 2008; Takhtamanova 2010; Beirne 2011). From the previous research, it was found that Exchange Rate Pass Through working through Consumer Price Index is usually less sensitive to the changes in exchange rates since the Consumer Price Index in it includes non-tradable goods (Zorzi, 2007; Rajan, 2008).

There is a debate on the factors that influence Exchange Rate Pass Through. There is some reviewing the aspects of macro and micro. The study from macro aspect side states that the factors affecting ERPT include inflation and exchange rate volatility. In other hand, from micro aspects, the factors affecting ERPT are the level of product differentiation and market power. Taylor (2000) is the reference to the research of ERPT with macro study, Champa and Goldberg (2005) examined the phenomenon of micro, and Champa and Goldberg (2002) examined pass-through as the phenomenon of macro or micro.

From micro study, the research results show the role of product differentiation having the character of ambiguous as two different effects; First, the more differentiated a product item, the higher the market power so that the pass-through becomes higher and consistent with the research results of Bacchetta (2003). Second, the more differentiated a product, the higher the mark-up has greater effect on pricing-to-market, so it causes the lower degree of ERPT (Champa and Goldberg, 2005).

As a country that adheres to open economy, the economy in Indonesia is highly affected by exchange rate movements. The movement of exchange rate is not free from the dynamics that occur in the external and domestic macro economy. Since the application of free floating in Indonesian exchange rate, the exchange rate in Indonesia is highly fluctuating. With the fluctuations in the exchange rate of Rupiah, the movement of the exchange rate is high. The exchange rate change of Rupiah against foreign currencies through the mechanism of "pass through" will further affect domestic prices. According to Bank Indonesia (2013), the global factors affecting inflation in Indonesia is the inflation of trading partners, global commodity prices, current account, and exchange rate.

If there is a change in the exchange rate of Rupiah against foreign currencies, it will affect the domestic price changes in Indonesia. By considering the ERPT of country which is different from other countries and the importance of the exchange rate changes of Rupiah against domestic price changes, the writer is interested in discussing the changes in exchange rate to import prices in Indonesia.

The aims of this research were to recognize the effects of exchange rate variable, the level of national income and inflation to import prices in Indonesia. The analytical tool used in this research was Error Correction Model, with the consideration that the tool can be used to determine the effect of short-term and long-term effects of the independent variables to dependent variables.

This research used American dollars as the currency used to measure the exchange rate since there is a strong foreign trade relationship between Indonesia and America. Besides, the currency of US dollar is a currency which is strong enough in the world and most of foreign trade transactions in Indonesia use US dollars.

The data used in this research was quarterly time series data, from the first quarter of 2005 to the third quarter of 2013. This research took the periods with the consideration that the periods are the periods after Indonesia embraced free floating exchange rate and the economy had stabilized after the monetary crisis. This research is important for estimating Exchange Rate Pass Through in Indonesia. In addition, it was conducted to estimate how the roles of inflation on Exchange Rate Pass Through in Indonesia.

This research began with the introduction, followed by literature review, the methodology that includes the model and the analytical tools used, the testing conducted, discussion of research results, and finally conclusion

Literature review

Exchange Rate Pass Through

Exchange Rate Pass-Through (ERPT) is defined as the level of exchange rate change sensitivity to price changes. ERPT is closely related to price-to-market (PTM). More precisely, pricing to market is defined as the percentage of price change in exporter's currencies caused by one per cent of exchange rate change. Thus, the greater the price-to-market, the lower the exchange rate pass-through.

Exchange rate pass-through and pricing-to-market have important meaning in economic policy. When pricing to market is high and the exchange rate pass-through is low, adjustment-based exchange rate to increase trade balance for the economy may be less effective as nominal exchange rate change is not translated into real exchange rate change.

Transmission Mechanism of Exchange Rate Depreciation to Prices

There are two lines that show exchange rate change to price change; direct and indirect lines (Menon, 1995) and Goldberg and Knetter (1997).

1. Direct Line

Direct line works through the external sector, namely import prices. When production costs change due to exchange rates change, it will affect consumer prices in two ways.

First, the effect of imported goods change is finished goods. When imported finished goods are directly consumed by consumers, the goods' price level change will have a direct effect on domestic price changes.

Second, if the imported goods are semi-finished goods used to produce domestic products, the prices increase of the imported goods will lead to increased production costs in the country. The effect is that output prices will rise. It is called Exchange Rate Pass Through from import prices.

2. Indirect Line

Indirect line appears through the competition of goods in international market. According to Sachs (1985), indirect effect of exchange rate fluctuations is divided into two, namely the effect of competition and inflation due to wage rate.

The effect of competition occurs when there are a change in domestic inputs due to changes in exchange rates. Appreciation in exchange rate would cause the rise in export prices and the decline in import prices. By not changing domestic costs, domestic manufacturers will react to lower import prices with their own price and lower their profit margins due to lower prices on their competitors.

Meanwhile, on the level of wages, exchange rate depreciation would lead to cheaper domestic products, so exports and aggregate demand will rise and lead to increased domestic prices. Because nominal wages are fixed in short term, this leads to a decline in real wages and the increase in output. However, the real wage offered in long term is fixed wage so that in long term it would cause the price rises and output falls. Finally, the depreciation of the exchange rate leads to a permanent increase in price level and a temporary increase in output level (Laflece, 1996)

Research method

The model analyzed in this research was the model of Exchange Rate Pass Through by Champha, Goldberg dan Gonzales (2005) :

$$p = \alpha_0 + \alpha_1 s_t + \alpha_2 y_t + \alpha_3 inf_t + \varepsilon_t \dots \dots \dots (1)$$

Where :

p is import price
 s_t is exchange rate
 y_t is national income

inf_t is inflation
 ε_t is residual value

From the basic model, it was then changed into the model using Error Correction Model introduced by Domowitz and El Badawi so that the model can be written as follows:

$$d(p) = \beta_0 + \beta_1 d(s_t) + \beta_2 d(y_t) + \beta_3 d(inf_t) + \beta_4 s_t(-1) + \beta_5 y_t(-1) + \beta_6 inf_t(-1) + ECT \dots \dots \dots (2)$$

where ECT is Error Correction Term

In this research, the data was changed in the form of logarithm, except the data of inflation rate in Indonesia.

The Operation Definition of the Variables:

1. Import prices in this research used the import price index in Indonesia, published by the Central Bureau of Statistics (BPS).
2. The exchange rate of Rupiah against the US dollar on average was obtained from the International Financial Statistics.
3. National Income is measured by the Gross Domestic Product (GDP) in Indonesia at constant prices in 2005, which was obtained from the International Financial Statistics
4. Inflation was measured using the difference between the Consumer Price Index (CPI) in Indonesia, which was published by the International Financial Statistics.

Model Testing

One of the important concepts in econometrics theory is the assumption of stationarity. Thus, it is necessary to observe the behavior of economic data time series which will be used in this research. This means that the data that will be used must be initially known whether the data is stationary or not. The method used was testing of unit roots and testing for degree integration.

Unit Root Test

This test was performed to determine early and more definite on the presence of spurious regression. The economic data of non-stationary caused spurious regression. The stationary test was conducted using the method of Dickey Fuller and Augmented Dickey-Fuller (ADF).

Integration Degree Test

Integration degree test is conducted when the data is not stationary at the time of the stationary test. This test is intended to look in what degree the data will be stationary. When the data used is not stationary, Granger and Newbold (1974) argues that regression will results in the regression with high determination coefficient (R^2) but with low Durbin Watson's statistic. This gives an indication that the resulting regression is spurious regression. The consequences caused by spurious regression are; the estimator's regression coefficient is not efficient, the forecasting using the regression will be missed and the common standard test for the associated regression coefficient is invalid. In general, when a data requires differentiation until d in order to be stationary, it can be expressed as I (d). This test is similar to the unit root test.

Cointegration test

Cointegration test is a continuation of unit root and integration degree tests. Cointegration test is intended to test whether the regression residuals resulted is stationary or not (Engle and Granger, 1987). To perform cointegration test, researchers firstly need to observe the behavior of economic data time series that will be used. It means that researchers have to be sure whether the data that will be used is stationary or not. The test that can be done is to test the unit roots and integration degrees (Insukindro, 1992). In the event when one or more variables have different degrees of integration, these variables cannot be cointegrated (Engle and Granger, 1987). In general, most of the discussions on the relevant issues focused on integrated variables 0, I (0) or degree one I (1). An important characteristic of the degree one I (1) is that the variable can be a linear combination when it is integrated to the degree 0 I (0) (Maddala & Kim, 1998).

This research used the cointegration test of Johansen. Johansen (1988) and Johansen and Juselius (1990) had developed the testing procedures of maximum-likelihood to determine the cointegration of a number of variables (vector). Johansen suggested the estimator of maximum likelihood the statistical test of Q and R to determine the cointegration vector of r and the presence or absence of cointegration based on the likelihood ratio test (LR). When the calculated value of LR is greater than the critical value of LR, the cointegration of a number of variables will be accepted. Johansen provides the alternative LR statistical test known as the maximum eigenvalue statistic. The maximum eigenvalue can be calculated from trace statistical (Widarjono, 2013).

Result and discussion

In this research, the data used was the time series data. At wrong time series data, before conducting regression analysis, it must be considered whether the data used is stationary or not. Regression involving two or more variables which are not stationary will cause spurious regression. By using stationary test, it will be seen whether the data is at the degree zero I (0), stationary or not. When the data used at the degree zero (0) is not stationary, it must first be made stationary. The way how make the data stationary is by differencing. The test stages used to test stationarity in this research were Dickey- Fuller (DF) and Augmented Dickey-Fuller (ADF).

Table 1 Unit Root Test

Variable	DF	ADF
LP	-2,0755	-2,1468
LS	-4,4087	-4,7410
LY	-5,0658	-4,5555
INF	-5,9782	-5,9393

Base on DF and ADF values for unit root test and compared with a critical value of Mac Kinnon, it appears that at the degree of confidence of 5 percent, the variable used in this research which was not stationary at the degree of zero I (0) was LP. It is necessary to test the degree of integration to determine in what degree the observed variable is stationary. Therefore, the next step is to make the data to be stationary, using first differencing. The analysis results with DF and ADF to the data after the first differencing of I (1) can be seen in Table 2.

Table 2 Integration Degree Test

Variable	DF	ADF
D(LP)	-9,9596	-10,0601
D(LS)	-6,1959	-6,3470
D(LY)	-5,7910	-5,9783
D(INF)	-6,8679	-6,8227
D(RF)	-4,0979	-4,0685

From the values of DF and ADF, it was then compared with the critical value of Mac Kinnon. The results show that all variables are stationary (integrated) at the first differencing of I(1).

Cointegration Test

After it was recognized that the variables used in this research were considered not to have the same integration degree, which were integrated to the first differencing. The next step was conducting cointegration test. The estimation result for cointegration test can be seen in Table 3

Table 3 Cointegration Estimation

Series: LP LS LY INF RF

Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.392755	78.51333	69.81889	0.0086
At most 1 *	0.328055	48.08517	47.85613	0.0476
At most 2	0.194930	23.83290	29.79707	0.2076
At most 3	0.156715	10.60652	15.49471	0.2369
At most 4	0.003421	0.209032	3.841466	0.6475

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

Based on the cointegration test using the method of Johansen, it shows that the value of the trace statistic is greater than the critical value. Thus, it can be concluded that the variables used in the research, which were LP, LS, LY, INF and RF, in the long term cointegrate each other.

Further analysis of the data used the method of Error Correction Model. The analysis results are shown in Tabel 4.

Table 4 Regression Analysis Results Using Error Correction Model

Variable	Coefficient	Error Standard	t statistic	Probability
C	-0.890923	3.353513	-0.265669	0.7925
D(LS)	0.670046	0.373408	1.794408	0.0840
D(LY)	0.905921	0.873525	1.037086	0.3089
D(INF)	0.003112	0.001086	2.865561	0.0367
LS(-1)	0.138488	0.142546	0.971531	0.2109
LY(-1)	0.392657	0.203714	1.927492	0.0645
INF(-1)	0.292302	0.127115	2.299508	0.0294
ECT(-1)	-0.270946	0.132315	-2.047732	0.0504
R ²	0.6011			
F statistic	2.583868			
Durbin Watson	1.978503			

The empirical analysis results as shown in Table 4 show that the estimation using the Error Correction Model or ECM can be used. It can be seen from the Error Correction Term (ECT) of -0.22 and significant at $\alpha = 5\%$. This indicates that the Error Correction Model specifications used are correct.

The value of F statistic result of this research is 2.583868 with the probability of 0.0355, meaning that collectively the variables of exchange rate, national income and inflation have the effect on the import prices in Indonesia.

Furthermore, the value of determination coefficient (R^2) is 0.6011, meaning that the variation of the variable of import prices in Indonesia could be explained by the variables of exchange rate, national income, and inflation of 60.11 percent and 39.89 percent is explained by the variables which were not analyzed in this research.

Before further analysis, classical assumption test was conducted to this model. The first classical assumption test was autocorrelation. The detection of autocorrelation problem can be seen using the statistical Durbin Watson. The statistical Durbin Watson value is 1.97. With the value of dl 1.28 and du 1.65, the result of statistical Durbin Watson is the reception area of Ho, which means that there is no problem of autocorrelation in this research.

Furthermore, heteroscedasticity test was conducted using ARCH test

Heteroskedasticity Test: ARCH

F-statistic	0.007406	Prob. F(1,32)	0.9320
Obs*R-squared	0.007867	Prob. Chi-Square(1)	0.9293

The important results of this test was the value of F and Obs*R squared. Particularly, it is the probability value of Obs*R squared. The checking by using the ARCH test shows that the probability of Obs*R squared is 0.9293, which means that there is no problem of heteroscedasticity.

Multicollinearity test was conducted to test whether the models examined have correlation between the independent variables. To detect the multicollinearity in this research, it was conducted by looking at the value of VIF (Variance Inflation Factor) and the value of Tolerance. Here is the table showing the multicollinearity test.

Table 5 Multicollinearity Test

Variable	Tolerance	VIF
LS	0.69	1.440
LY	0.71	1.408
INF	0.90	1.111

From Table 5, it can be seen that VIF value of each variables examined, such as LS, LY and INF is Tolerance, and greater than 0.1. It can be concluded that the model used in this research did not have the problem of multicollinearity.

From the analysis results conducted for the variable of exchange rate in the short term and the long term, it has positive effect on import prices in Indonesia, which means that in case of depreciation of Rupiah against the US dollar, the price of imports will increase. This is consistent with the hypothesis proposed; when exchange rate depreciates, import prices will rise. However, in terms of the level of significance in the long term, it was found that exchange rate is not significant to import prices. It happened because the depreciation of Rupiah against US Dollar will only affect import price in the short term. In the long term, people in Indonesia are not much affected by changes in exchange rate. In the period of this research, the prevailing exchange rate regime is free floating, and the exchange rate against the US dollar is frequently depreciated.

In Indonesia, the value of Exchange Rate Pass Through is 0.6 in the short term and in the long term is 0.14. The short-term ERPT value of 0.6 means that the depreciation of the exchange rates of Rupiah against the US dollar by ten percent will cause a rise in

import prices by six percent. ERPT value in the short term is higher than the research results of ERPT in developed countries. The research of Marazi (2005) shows that ERPT value in America was around 0.2. Meanwhile, the research of Irhig examining at G7 found the ERPT value was only amounted 0.4. This high ERPT value is in line with the opinion of Champa (2002) which states that the degree of pass-through in a country is significantly affected by the high variability value of the nominal exchange rate in a country. In Indonesia, the nominal exchange rate experienced high volatility, especially in the period of this research when Indonesia has already introduced free floating exchange rate.

For the variable of national income, it has positive effect on import prices, and it means that when there is an increase in national income, there will be an increase in import prices. When national income increases, it will make people add their consumption of imported goods. This is consistent with the theory that marginal propensity to import is positive. As the rising of imported goods, it will cause a rise in import prices in Indonesia. For statistical significance, it indicates that the variable of national income is significant variable in the long term. This needs to be studied further in the structure of imports in Indonesia. The increase in import prices in Indonesia is not solely determined by the increase in national income level. The increase in imports in Indonesia is also determined by industrial structure in Indonesia with more raw materials imported from abroad. Therefore, the rise in import prices is not only determined by the increase in national income, but it is due to the needs of industrial sector. Bruno (1976) and van Wijnbergen (1989) explained that in semi-industrialized countries in which the inputs for the industrial sector are mostly imported and cannot be produced in the countries, it will lead to higher input costs, and it will then be followed by new problems called evaluation. The negative effects of rising costs will also affect domestic production and goods traded.

The variable of inflation in the research results show that in the short term and long term the variable of inflation has positive and significant effect. It means that when there is an increase in domestic inflation in terms of consumer prices, it will raise import price. This research results are consistent with the research conducted by Gosh and Rajan (2008). Exchange rate depreciation will affect price changes either through Aggregate Demand or Aggregate Supply. When there is a depreciation of exchange rate, it will affect the prices of goods consumed by people in Indonesia. The goods imported and directly consumed by consumers in Indonesia will affect the increase in aggregate demand. The increase in transactions for goods which are directly consumed by people will raise import prices in Indonesia.

Conclusion

Based on the data analysis conducted, it can be summarized as follows:

1. By looking at the statistical value of Error Correction Term (ECT) of 0.2441 and it is statistically significant at the confidence level of 5%. This means that the specification of error correction model used is correct.
2. The results of OLS estimate with error correction model shows that the variable of exchange rates (LS) has positive effect on import prices both in short term and long term. The significance in the short term is significant and in the long-term the variable of exchange rate is not significant.
3. The variable of National Income (LY) shows that in the short term and long term, the effect of this variable is positive, but this variable is statistically significant only in the long term.
4. The estimation results for the variable of inflation (INF) are able to explain import price in both the short and long term. Sign test strongly supports the hypothesis proposed in this research.

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