

Exchange Rate and International Trade: Case From Indonesian Manufacturing Sector

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Abstract

Exchange rate fluctuation in Floating Exchange Rate Regime is considered to have impacts on the international trade through its adjustment to the price and its volatility to the trade risk. This paper is aimed at estimating those impacts on the international trade of manufacturing sector in Indonesia for period 2007 to 2014. To conduct estimation, it uses multiple regression analysis on two models: First, the import of raw-and-auxiliary materials; Second, the export of manufacturing sector. The results show that the exchange rate impacts both work significantly on the import of raw-and-auxiliary materials. The finding implies that, through the import of raw-and-auxiliary materials, manufacturing sector is very susceptible to the shock caused by exchange rate changes. Meanwhile, the export of manufacturing sector is not able to take advantage of the depreciation of the exchange rate due to the lack of competitiveness.

Keywords: exchange rate, international trade, manufacturing sector

Abstrak

Fluktuasi Nilai tukar dalam Rezim Nilai Tukar Mengambang Bebas dipandang akan berdampak pada perdagangan internasional melalui penyesuaian harga dan resiko transaksi perdagangan yang ditimbulkannya. Tulisan ini ditujukan untuk menganalisis dampak nilai tukar tersebut pada kasus sektor industri pengolahan di Indonesia pada periode 2007 sampai 2014. Analisis dilakukan dengan menggunakan regresi berganda melalui dua model: Pertama, impor bahan baku dan penolong; Kedua, ekspor industri pengolahan. Hasil yang diperoleh menunjukkan bahwa kedua dampak nilai tukar berkerja secara signifikan pada impor bahan baku dan penolong, sedangkan pada ekspor industri pengolahan. Lebih lanjut, hasil tersebut menunjukkan bahwa melihat dampak nilai tukar terhadap impor bahan baku dan penolong, industri pengolahan sangat rentan akan goncangan yang disebabkan perubahan nilai tukar. Sementara, ekspor industri pengolahan tidak bisa terdorong oleh depresiasi nilai tukar dikarenakan kurang kompetitif.

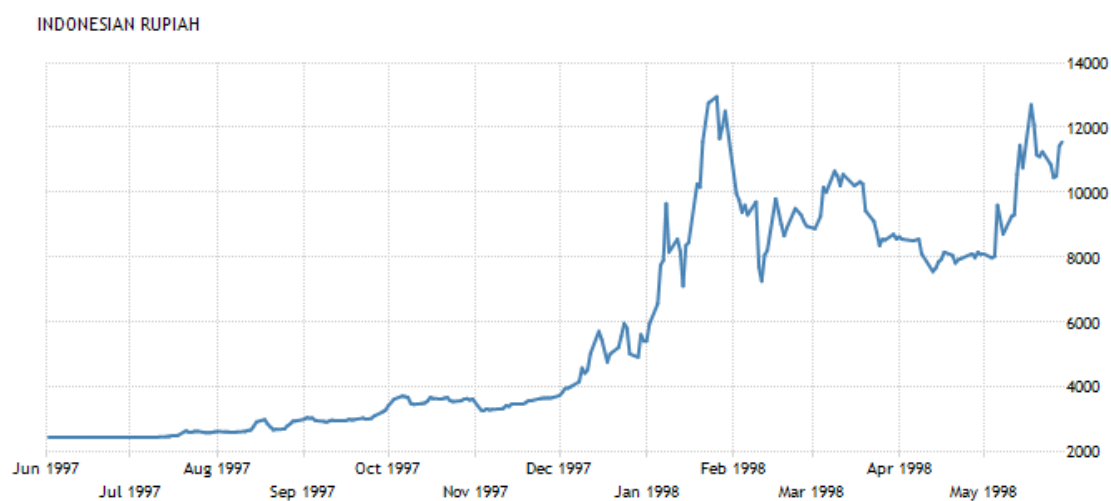
Kata Kunci: nilai tukar, perdagangan internasional, sektor industri pengolahan

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INTRODUCTION

During the exchange rate regime, Indonesia experienced an important phase when the release of the intervention band of the Rupiah against the US Dollar occurred on August 14, 1997. It marked the change of the exchange rate system from a managed floating with crawling band system to the floating exchange rate. The background of the changes in the exchange rate system is that Indonesia, of which foreign exchange reserves depleted and Rupiah underwent strong pressure backthen, decided to carry out a free floating system. This system is in accordance with the economic reform package that had been recommended by the International Monetary Finance (IMF). However, because the policy of releasing the intervention band implied more negative expectations, since it was done when the Rupiah was depressed and compounded by destabilizing speculation attacks, the follow-up impact was that the exchange rate of the Rupiah was sharply depressed (Figure 1)

Figure 1. The movement of the exchange rate of the Rupiah/US Dollar from June 1997 to Mei 1998



Source: processed online from <http://www.tradingeconomics.com/indonesia/currency>, accessed on March 2nd, 2017)

In the context of international trade, exchange rate stability is a condition preferred by market players. This is based on the influence of the exchange rate against trading through: First, costs and prices that eventually produce relative-price changes in trade (Carbaugh, 2005); Second, exchange rate volatility itself that will lead to the risk of the transaction because of the different spot value of transaction

with spot value of payment. Even though the risk can be closed by hedging—namely with transactions in the forward market—the premium covered by the importers will continue to burden the transaction. (Krugman and Obsfeld, 2003).

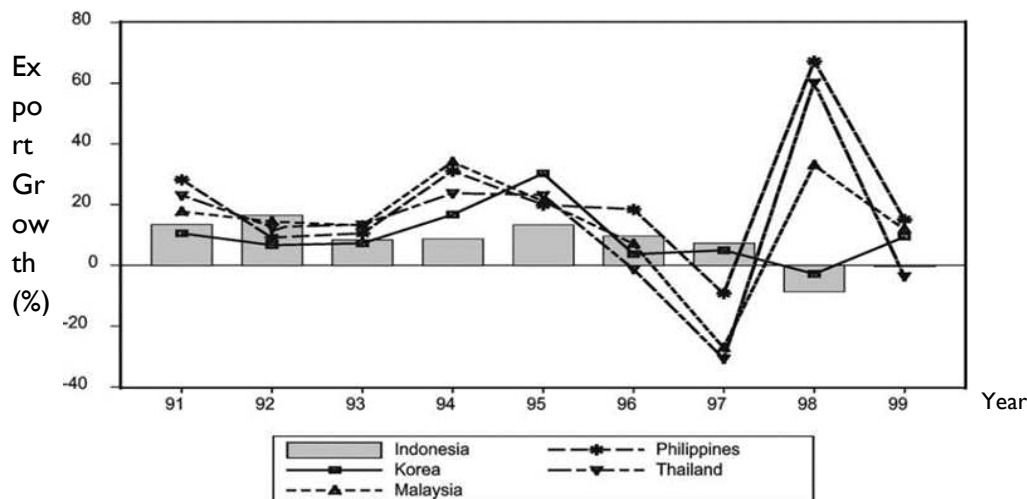
The first impact is the price adjustment and it has been discussed in the Marshall-Lerner Condition asserting how the demand elasticity towards import and export will affect the balance of payment through the current transaction (with the assumption that the capital balance remains). The Marshall-Lerner condition requires that the absolute addition of exports and imports elasticity be greater than 1 (one) in order to achieve improvement of current transaction (surplus). If the condition is not met, depreciation will not improve the current transaction or even exacerbate it.

The second impact is the exchange rate risk which occurs every time cause the investor, the company or the bank, to have to face payment obligations in the future in foreign currency. The condition means that the payers have foreign exchange risk or what is referred to as the "open position" (Salvatore, 1997). Related to the existence of the risk, the traders then can make an effort to avoid the risk of the exchange rate by hedging the exchange rate that can be done in the forward market. However, hedging the risk of the exchange rate also causes the cost if there are premiums for its transactions. The emergence of the cost that must be borne in order to hedge the risk of the exchange rate will result in the cost of international trade that has a tendency to further reduce trade volumes. Suardhini also supports this and Goeltom (1997) stated that doing transaction in the forward market could reduce the fluctuation risk of the benefits of trade in the short term. However, this will, unfortunately, lead the cost of international trade to increase and finally generate the anti-trade bias.

The failure to achieve the relationship and the adjustment direction of Marshall-Lerner condition can be seen from the discontinuation of the adjustment direction of export or import of a country through the depreciation or appreciation. In the context of Indonesian export on which there was a sharp depreciation after the monetary crisis in 1997, this condition has been described by Siregar and Rajan (2003) in the introduction of his study. When the monetary crisis began in August 1997 which is marked by shock on export growth, it shows that, in the following year, Indonesia was not able to undergo the adjustment of export through depreciation of exchange value

as other South East Asian countries that also affected by the crisis such as Malaysia, the Philippines and Thailand. (Figure 2).

Figure 2. The Exports Growth Rate in some countries that experienced the Currency Crisis in Asia in 1997

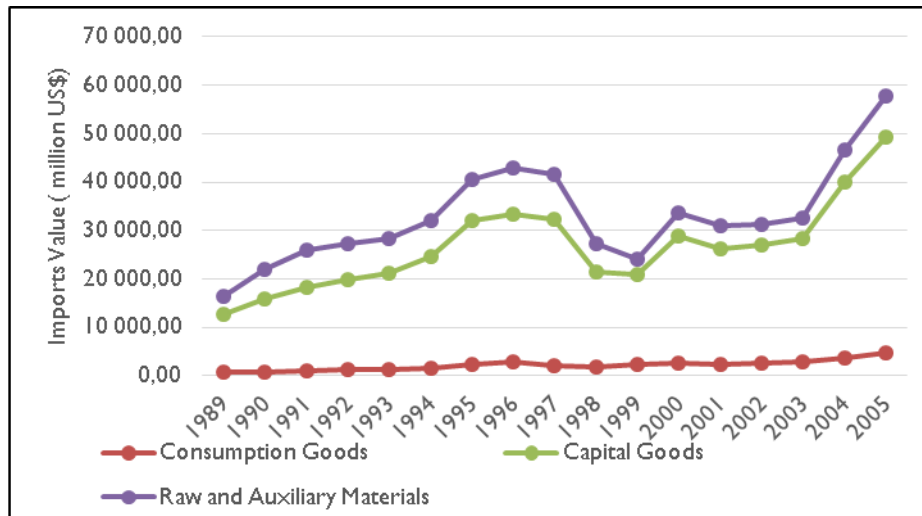


Source: Siregar and Rajan (2003)

In this regard, one of the causes of the economic crisis, which is an extension of the monetary crisis in Indonesia, can be explained by the fragility of the real sector. Before the crisis, the performance of Indonesian import was characterized by the domination of the import of raw-and-auxiliary materials, especially by the manufacturing sector. Such domination happened because of its dependence on raw-and-auxiliary materials, which were imported from abroad to perform its production. The next impact from this dependence is resulted in manufacturing sector production vulnerabilities to overseas externality. This has predicted before the crisis by Dumairy (1996). This also has been reviewed as well as observed by Tambunan (1998) particularly when the crisis occurred.

In the Figure 3, it can be seen that the contribution of the import of raw-and-auxiliary materials are far above the capital goods and consumer goods. When monetary crisis occurred in 1997-1998 –in the time when the exchange rate sharply depreciated–the import of raw-and-auxiliary materials had an upward trend tendency since 1986 until 1996. This suddenly experienced a shock that was marked by a sharp drop in the years 1997-1998. It can also be seen from the graph that the shock tends to occur only in the import of raw-and-auxiliary materials and capital goods while the import of consumer goods tends not to experience a shock.

Figure 3. The development of non-oil and gas import based on the use of Goods 1996 – 2004



Source: www.bps.go.id, accessed on March 2nd, 2017, processed

The vulnerability to shock that comes from the externality of the exchange rate or the production of the manufacturing sector is not accompanied by the reduction of the dependency on the import of raw-and-auxiliary materials. The trend in Figure 3 above shows the comparison of the import of raw-and-auxiliary materials compared to consumer goods and capital goods until the post-crisis of 1998 that has no tendency to shift and to be very dominating up to above 70 percent.

On the other hand, the export of manufacturing sector has contributed to the Indonesian economy which contributes more than 80 percent of non-oil and gas export and more than sixty percent of the total export in the period of the 1990s before the monetary crisis in 1997-1998. The large proportion, if associated with no corrected export when the Rupiah depreciated during the financial crisis in 1997-1998 as illustrated in figure 2 above, can be said that the manufacturing sector has greatly contributed to the failure of exports correction that was actually expected to rise. The studies of the impact of exchange rate on international trade in Indonesia were conducted before the 1998 crisis, as have been done by Suardhini and Goelton (1997) in period of 1979 to 1991, as well as Siregar and Rajan (2003) in period of 1997 to 2007. In those periods, The exchange rate system used was Managed Floating. Implementation of study when exchange rates fluctuate larger (with floating exchange rate system), and using the object of manufacturing sector as the largest contributing sector in Indonesia is necessary.

This paper is intended to estimate and analyze the impact of the exchange rate on the international trade industries sector in Indonesia in different periods long after the economic crisis in 1998. Through this research, it is expected that the decision maker can formulate policy in manufacturing sector within the international trade by its measurement on the impact of exchange rate adjustment. Based on the assumption of the problem identification that has been described above, the research will be specified through the model of the import of raw-and-auxiliary materials and the export of manufacturing sector as a model that describes the condition of the international trade in Indonesian manufacturing sector.

METHOD

In drawing up the import of raw-and-auxiliary materials model, the functional form using natural logarithm is as follows:

$$\ln M_t = \ln \alpha + \sum_{n=0}^k \beta_n \ln \text{PROD}_{t-n} + \sum_{n=0}^k \gamma_n \ln \text{REER}_{t-n} + \theta \ln \text{VOL}_t + \ln u \quad (1)$$

Where: M is real value of import of raw-and-auxiliary materials, PROD is real production value of domestic manufacturing sector, REER is real effective exchange rate from the import of raw-and-auxiliary materials, VOL is exchange-rate volatility and u is an error term.

Meanwhile, the export of manufacturing sector model is written as follow:

$$\ln \text{XMAN}_t = \ln \alpha + \sum_{n=0}^k \beta_n \ln \text{YLN}_{t-n} + \sum_{n=0}^k \gamma_n \ln \text{REER}_{t-n} + \theta \ln \text{VOL}_t + \ln u \quad (2)$$

Where: XMAN is real value of export of manufacturing sector, YLN is real income of destination countries, REER is the real effective exchange rate, VOL is exchange rate volatility and u is an error term.

From the explanatory variables identified in the model, REER and VOL are explanatory variables that exist to represent exchange rate impact. The model also accommodates time lag that is possible to happen because of the difference in the transaction time (decision-making) with the receipt of goods due to the required process. The formation of the lag is also strengthened by what is known as the J curve, which describes the relationship between the trade balance with the currency depreciation (Krugman and Obsfeld, 2005: 464). The J curve, as stated by Gujarati and Porter (2012), was made as the basis of the lag in the international trade model.

The model that has been arranged also illustrates an aggregation model. It creates the aggregation effect problem, which might appear and therefore the use of panel data model can be used as an alternative. However, the absence of complete data such as the data segregation of dependent variable, namely: 1) imports data of raw-and-auxiliary materials based on the country of origin, and 2) manufacturing exports data based on the destination country which is arranged on a monthly or quarterly basis, makes the panel data model difficult to be used.

The formulas to calculate REER for import of raw-and-auxiliary materials and export of manufacturing sector in sequence are written as follow:

$$REER_M = NEER \times \frac{P_M}{P_Y} \quad (3)$$

Where: $REER_M$ is real effective exchange rate for import of raw-and-auxiliary materials, $NEER$ is nominal effective exchange rate, P_M is import price of raw-and-auxiliary materials, P_Y is domestic price of raw-and-auxiliary materials

$$REER_{XMAN} = NEER \times \frac{P_{XMAN}}{P_{YLN}} \quad (4)$$

Where: $REER_{XMAN}$ is real effective exchange rate for export of manufacturing sector, $NEER$ is nominal effective exchange rate, P_{XMAN} is export price of manufacturing sector, P_{YLN} is price of manufacturing sector in abroad

To get proxy for volatility measurement or the exchange rate risk, using nominal value exchange rate (NEER) is preferable. This is due to the fact that the nominal value tends to be more able to describe the volatility that leads to uncertainty faced directly by the international traders. The volatility then measured by using moving average standard deviation as has been used by Kenen and Rodrik (1986).

The formula is written as follows:

$$VOL = \sqrt{\left(\frac{\sum_{i=1}^n (X_i - \bar{X})^2}{n-1}\right)} \quad (3)$$

Where: X_i is NEER, \bar{X} is the average of 4 quarterly NEER, and $n=4$

The secondary data used is quarterly time series data between 2007 to 2014. It is collected online through the official publication published on the sites of

the institutions providing the needed data. Most of the data are obtained from Bank Indonesia. The data are: 1) the import of goods according to the economic category in thousand USD; 2) GDP according to the field of business in billion USD; 3) The index of nominal exchange rate of the rupiah towards the major trading partner countries; 4) non-oil and gas export based on the category of sectors in thousand USD. The next data source is the official site of Organization for Economics and Co-operation and Development (OECD). The data obtained are: 1) The quarterly Index of GDP countries that become members of OECD; and 2) The producer price index of industrial manufacturing.

RESULT AND DISCUSSION

Result for Model 1: Import of Raw-and-Auxiliary Materials

The preliminary result through a scatter plot test to the import of raw-and-auxiliary materials model produces the specified independent variable (in the form of natural logarithm) which tend to have a relationship with the dependent variables. Some of them are: 1) real production value of domestic manufacturing sector with one period lagged (LNPROD_{t-1}); 2) real effective exchange rate with one period lagged (LNREER_{t-1}), and 3) exchange rate volatility (LNVOL_t). From these results, the mapping of the variable relationship shows a tendency of the presence of one period lagged in real production value of domestic manufacturing sector and exchange rate in explaining the import of raw-and-auxiliary materials in Indonesia.

Table 1. The Test Result of Augmented Dicky Fuller on The Variables of Import of Raw-and-auxiliary Materials Function

The variables	ADF t value	t table (error level 5%)
LNMB_t	-2.164747	-3.562882
$D(\text{LNMB})_t$	-4.874066	-3.568379
LNPROD_{t-1}	-3.352311	-3.562882
$D(\text{LNPROD}_{t-1})$	-5.976503	-3.568379
LNREER_{t-1}	-2.588685	-3.562882
$D(\text{LNREER}_{t-1})$	-5.976503	-3.568379
LNVOL_t	-2.112516	-3.562882
$D(\text{LNVOL})_t$	4.881631	-3.568379

Description: The ADF tests include intercept elements and trends (the largest testing power). The number of lag based on SIC.

The follow-up step is then conducting Two Steps Engle-Granger Test in order to identify stationarity and cointegration. In the step one, table 1 shows that the entire variable is not stationary at level, but stationary on the first difference. The result is seen from the absolute number on ADF t value which is entirely smaller if compared with the absolute numbers of t table using 5 percent error level. Nevertheless, on the first difference, the absolute numbers on ADF t value are entirely greater if compared with the absolute numbers of t table using 5 percent error level.

Table 2. The ADF Tests on Residual of The Import of Raw-and-auxiliary Materials Model

Residual	ADF t Value	t table (error level of 5%)
RESID 01	-2.316621	-1.952066
RESID 02	-2.569497	-1.952066
RESID 03	-3.882789	-1.953381

Description: The ADF tests for residuals, the selection of lag number based on SIC; RESID 01 is a residual of regression result of $\ln mb_t$ with $\ln prod_{t-1}$; RESID02 is a residual of regression result of $\ln mb_t$ with $\ln reer_{t-1}$; and RESID03 is a residual of regression result of $\ln mb_t$ with $\ln vol_t$

With the stationary data of all variables on the first difference, there is a possibility of a co-integrated regression occurring. The result from ADF test on Residuals (Table 2) indicates the regression is cointegrated. This can be seen from the results of ADF tests against all the stationary residuals at level indicated by the absolute value on ADF t value that is greater than the absolute value of t table (5 percent error level). By referring to this result, the explanatory variables have a long-term correlation with the dependent variable.

From the results of the regression calculations presented in table 3, we can see the description of all significant parameters direction which is in accordance with what is expected. The real production value of domestic manufacturing sector with one period lagged ($\ln PROD_{t-1}$) and the real effective exchange rate with one period lagged ($\ln REER_{t-1}$) are positively related, while the volatility (risk) of the exchange rate is negatively related. The three variables also provide simultaneous influence and are able to explain the variation of dependent variables equal to 83.3 percent.

Result for Model 2: Export of Manufacturing Sector

Different from the results of the import of raw-and-auxiliary materials model, independent variables which are specified on the export of manufacturing sector model do not experience a lag. Clear relationships are only visible on real income of destination countries (LNYLN) and exchange rate volatility (LNVOL). On the other hand, the real effective exchange-rate variable (REER) does not produce a distinct relationship either in the same period or in lag of the previous periods.

Table 3. The Results of Estimation for The Import Demand of Raw-and-auxiliary Materials Model (LNM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.014709	1.657527	3.025416	0.0053
LNPRODT_1	0.637567	0.119681	5.327202	0.0000
LNREERT_1	0.616217	0.140348	4.390647	0.0001
LNVOL	-0.132039	0.037342	-3.535959	0.0014
R-squared	0.833467	Mean dependent var		15.04843
Adjusted R-squared	0.815624	S.D. dependent var		0.203179
S.E. of regression	0.087243	Akaike info criterion		-1.923772
Sum squared resid	0.213117	Schwarz criterion		-1.740555
Log likelihood	34.78036	Hannan-Quinn criter.		-1.863041
F-statistic	46.71155	Durbin-Watson stat		1.737541
Prob(F-statistic)	0.000000			

The ADF test which is summarized in Table 4 shows that the entire variables are not stationary at level, but stationary on the first difference. It is clear that the absolute numbers on ADF t value are entirely smaller if compared with the absolute numbers of t table (5 percent error level). Yet, on the first difference, the absolute numbers on ADF t value are entirely greater if compared with the absolute numbers of t table (5 percent error level). With the production of stationary data of all variables on the first difference, thus in the model of the export of manufacturing sector there is an open possibility of a regression is co-integrated.

Then, from the results of the Table 5, it can be seen that the two relationships that cointegrated between the dependent variable with explanatory variables is resulted in the relationship between export of manufacturing sector ($LNXMAN_t$) with real income of destination countries ($LNYLN_t$) and the relationship between export of

manufacturing sector ($LN\text{XMAN}_t$) with exchange-rate volatility variable ($LN\text{VOL}_t$). On the other hand, the real effective exchange-rate variable ($LN\text{REER}_t$), which has a tendency to not having a relationship with the exports variable of manufacturing industries ($LN\text{XMAN}_t$)—does not become co-integrated.

Table 4. The Test Result of Augmented Dicky Fuller on The Variables of Export of manufacturing Sector Function

The variables	ADF t Value	t table (error level of 5%)
$LN\text{XMAN}_t$	-1.874144	-3.562882
$D(LN\text{XMAN})_t$	-4.797623	-3.568379
$LN\text{YLN}_t$	-3.259710	-3.568379
$D(LN\text{YLN})_t$	-3.682288	-3.574244
$LN\text{REER}_t$	-2.463036	-3.562882
$D(LN\text{REER})_t$	-5.351709	-3.568379
$LN\text{VOL}_t$	-2.139627	-3.562882
$D(LN\text{VOL})_t$	-4.709830	-3.568379

Description: The ADF tests include intercept elements and trends (the largest testing power). The number of the lag based on SIC.

After regression calculations, positive autocorrelation disturbance is still found. This is marked by the low value of Durbin Watson (DW) statistics, which is only equal to 1.16. Therefore, the improvement of the model is treated by using the method of weighted least square utilizing Durbin's Two-Steps method. By transforming the model in the first difference using $\hat{\rho}$ estimated from DW statistics ($\hat{\rho} \approx 1 - \frac{DW}{2}$), the result appears to have experienced changes of the value of the DW statistics of 1.72 which is greater than the value of the crisis dl of 1.17. The value—eventhough it is still slightly below the value du of 1.73 which means it is still in the area without a conclusion—can avoid the coefficient parameter produced in the area concluding the existence of positive autocorrelation. The regression results after the improvement of the positive autocorrelation are explained in Table 7.

Table 5. The ADF Tests on Residual of The Export of Manufacturing Sector Model

The variables	ADF t Value	t table (error level of 5%)
RESID 01	-2.050862	-1.952066
RESID02	-1.605562	-1.952066
RESID 03	-3.695243	-1.952066

Description: The ADF test for residuals, the selection of the number of lag based on SIC; RESID 01 is a residual regression result of $LN\dot{X}MAN_t$ with $LN\dot{Y}LN_t$; RESID02 is a residual regression result of $LN\dot{X}MAN_t$ with $LN\dot{R}EER_t$; and RESID03 is a residual regression result of $LN\dot{X}MAN_t$ with $LN\dot{V}OL_t$

The results in Table 7 show only two parameters of the variables that are significant with an error level of 5 percent, namely real income of destination countries ($LN\dot{Y}LN_t$), and the exchange rate volatility ($LN\dot{V}OL_t$) is in accordance with the expected direction. Meanwhile, the Real Effective Exchange Rate ($LN\dot{R}EER_t$) does not partially affect the exports of manufacturing sector significantly. The independent variables in the model can simultaneously explain the dependent variable variation of 67 percent.

Table 6. The Results of Estimation for The Export of Manufacturing Sector (LNMAN)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.696003	4.331887	0.622362	0.5387
LN $\dot{Y}LN$	2.766920	0.842875	3.282715	0.0028
LN $\dot{R}EER$	-0.027381	0.129037	-0.212192	0.8335
LN $\dot{V}OL$	-0.040746	0.009749	-4.179609	0.0003
R-squared	0.794037	Mean dependent var		15.34448
Adjusted R-squared	0.771969	S.D. dependent var		0.136954
S.E. of regression	0.065399	Akaike info criterion		-2.500150
Sum squared resid	0.119757	Schwarz criterion		-2.316933
Log likelihood	44.00240	Hannan-Quinn criter.		-2.439419
F-statistic	35.98219	Durbin-Watson stat		1.160819
Prob(F-statistic)	0.000000			

Discussion

To simplify in interpreting the result described in Table 3 and Table 7, the models are written as follow:

$$\text{LNM} = 5.014 + 0.637 \text{LNPROD}_{t-1} + 0.616 \text{LNREER}_{t-1} - 0.132 \text{LNVOL}_t + u$$

$$p \text{ value} = (0.005) (0.0000) \quad (0.0001) \quad (0.0014)$$

$$R^2 = 0,833 \quad F\text{-stat} = 46,71$$

$$\text{Adj. } R^2 = 0,815 \quad \text{Prob}(F\text{-statistic}) = 0,000000$$

$$\text{LNXMANT}_t^* = -1.085 + 3.61 \text{LNYLN}_t^* + 0.095 \text{LNREER}_t^* - 0.023 \text{LNVOL}_t^* + u^*$$

$$p \text{ value} = (0.695) (0.005) \quad (0.541) \quad (0.024)$$

$$R2 = 0,67 \quad F\text{-stat} = 18,34$$

$$\text{Adj. } R2 = 0,63 \quad \text{Prob}(F\text{-statistic}) = 0,000001$$

Starting from the first model, the result of the estimation also shows that the two variables which are specified as the impact of the exchange rate, namely: 1) real effective exchange rate with one period lagged (LNREER_{t-1}); and 2) exchange rate volatility (LNVOL_t), have significant impact the imports of the raw-and-auxiliary materials. In other words, the dependence on import of raw-and-auxiliary materials, as indicated earlier, is vulnerable to externality shock of the exchange rate.

Table 7. The Results of Estimation for The Export of Manufacturing Sector (LNXMANT) with Durbin's Two-Steps Method

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.085426	2.738874	-0.396304	0.6950
LNYLN*	3.617675	0.919555	3.934158	0.0005
LNREER*	0.095515	0.154319	0.618942	0.5411
LNVOL*	-0.023816	0.010030	-2.374482	0.0249
R-squared	0.670922	Mean dependent var		8.905810
Adjusted R-squared	0.634358	S.D. dependent var		0.095243
S.E. of regression	0.057592	Akaike info criterion		-2.750962
Sum squared resid	0.089554	Schwarz criterion		-2.565932
Log likelihood	46.63992	Hannan-Quinn criter.		-2.690647
F-statistic	18.34915	Durbin-Watson stat		1.724718
Prob(F-statistic)	0.000001			

Description: the numbers in the brackets are probability values; The symbol (*) is the result of the iteration of Durbin Two-Steps method, i.e.:

$$\text{LN}X\text{MAN}_t^* = \text{LN}X\text{MAN}_t - (0.4195905 \times \text{LN}X\text{MAN}_{t-1})$$

$$\text{LN}Y\text{LN}_t^* = \text{LN}Y\text{LN}_t - (0.4195905 \times \text{LN}Y\text{LN}_{t-1})$$

$$\text{LN}R\text{EER}_t^* = \text{LN}R\text{EER}_t - (0.4195905 \times \text{LN}R\text{EER}_{t-1})$$

$$\text{LN}V\text{OL}_t^* = \text{LN}V\text{OL}_t - (0.4195905 \times \text{LN}V\text{OL}_{t-1})$$

In relation to the variable in the first exchange rate impacts, namely real effective exchange rate with one period lagged ($\text{LN}R\text{EER}_{t-1}$), there is an indication that the depreciation in 1 percent real effective exchange rate with one period lagged ($\text{LN}R\text{EER}_{t-1}$) will correct the declining real value of import of raw-and-auxiliary materials in the next period ($\text{LN}M_t$) in amount 0.616. This situation also illustrates that the exchange rate shock will cause the double impact if there is a dependence (causality) on the production of the manufacturing sector toward imports of raw-and-auxiliary materials. In such condition, there is a risk that a high depreciation in a long period will likely cause the deindustrialization. Due to the fact that the specified model is a structural form, further analysis is needed to test the relationship causality. However, the limitations of the research with the structural model result in the analysis of VAR with the causality test Engle-Ganger is not being used.

Meanwhile, the second impact of the effects of the exchange rate, namely the large amount of volatility faced ($\text{LN}V\text{OL}_t$)—even if the impact is relatively smaller (the elasticity of 0.132)—shows that the more the amount of exchange rate volatility is there the more potential of negative impact will occur on domestic manufacturing industries producers in their production activities. Thus, the risks and costs of hedging caused by the exchange rate volatility reduce the number of imports of raw-and-auxiliary materials just as expected.

From here, moving to the second model of the manufacturing export sector, the price effect through changes in the exchange rate ($\text{LN}R\text{EER}_t$) on the result does not have a significant parameter coefficient in explaining the variation of export changes. Thus, the exports correction because of the exchange rate changes, as described in the condition of Marshall-Lerner, does not occur. Instead, the correction of export elastically comes from the income effect that is shown by the first variable, namely the real income of destination countries ($\text{LN}Y\text{LN}$) in amount 3.61.

The last variable, the exchange rate volatility (LNVOL_t), produces the coefficient in accordance with the expected direction (negative). This is even though the coefficient value is small or inelastic (-0.023). Thus, the increased volatility of the exchange rate gives a bad impact on the export of manufacturing sector. The results are in line with what is produced in the model of the import of raw-and-auxiliary materials that means the risk of fluctuations of the benefits of trade in the short term—although it can be reduced by doing transaction in the forward market namely hedging—will cause the cost of international trade to increase. This eventually leads to the reduction of export.

In various studies lately conducted in different countries, the impact of the exchange rate has been identified in the aggregate trade model of a country. The object of the studies may have been conducted varies, whether it is to the trade balance, or partially to export or import, and also implemented in multilateral or bilateral trade. The studies also implemented varied model using structural model or developed models of time series analysis. In spite of that, the variables of the exchange rate effect basically is not different, that is the change of the exchange rate and its volatility. In brief, previous studies are summarized in Table 8.

Table 8. Some of the Previous Studies Results

References	Object and Sample Period	Result of Exchange Rate Impact towards Trade
Baharumsha h (2001)	Bilateral trade balances of Malaysia and Thailand with the US and Japan. Data from 1980: I to 1996: IV	The real effective exchange rate is an important variable in the trade balance equation and devaluation improves the trade balances of both economies in the long-run.
Siregar and Rajan (2003)	Export and import of Indonesian. The period of the first quarter of the year 1980 until the second quarter of 1997.	Export Model: Real effective exchange rate (REER) does not has a significant effect. Exchange rate volatility impact significantly reduces exports. Import Model: REER significantly has significant impacts, which is related positively to import. Exchange rate volatility is not a significant effect, but will be significant if imposed import segregation of raw materials and capital goods.
Fang, Lai and Miller (2005)	Export of eight Asian countries (Indonesia, Malaysia, Singapore, Thailand, the Philippines, South Korea, Taiwan and Japan) to the	Depreciation encourages exports, as expected, for most countries, but its contribution to export growth is weak. Exchange rate risk generates a negative

References	Object and Sample Period	Result of Exchange Rate Impact towards Trade
	United States. The period of January 1979 until April 2003.	effect for trade in most studied countries
Marquez and Schindler (2007)	China's export and import in world trade. The period of January 1997 to July 2006	Appreciation of 10 percent Renminbi (Yuan) will lower aggregate Chinese export by nearly one percentage point. The response of import for appreciation is negligible and lacks precision.
Prusty (2008)	Export Growth of India (multilateral). The period of March 1992 until April 2007.	Two-way causality occurs between export growth and the growth of the exchange rate.
Oskooee and Wang (2008)	Bilateral trade between Australia and the US using disaggregate data in 107 industries	Exchange rate volatility to have short run effects on trade flows of most industries. However, the short-run effects last into long run, only in limited cases, though more in export commodities than import ones
Oskooee, Bahmani and Hegerty (2009)	Export and import in 102 different industries of bilateral trade between Mexico and the United States in 1962 - 2004.	Volatility has worse impacts on the bilateral trade between the industries examined.
Appuhamilage and Alhayk (2010)	Trade between Sri Lanka and China with the period of the study was from the first quarter of 1993 to the fourth quarter of 2007.	The variables Real exchange rate with 1 period lagged (RER_{t-1}) shows the depreciation effect significantly encourages export and reduces import. Exchange rate volatility negatively impacts on both export and import.
Bilquees, Mukhtar and Maliq (2010)	The export of three Asian countries namely India, Pakistan and Sri Lanka. Research period from 1960 to 2007.	Exchange rate volatility gives a negative impact on the export of the countries that are examined in both the short term and long term. The variable term of trade also produces the expected relationship, namely the decline in the REER (depreciation) will provide an increase on export.
Bethune, Thaver and Plante (2012)	Trade (export and import) of South African countries and the European Union countries during the period from 1980 to 2009.	REER negatively relates to exports, while, exchange rate volatility has a bad impact both in the short term and long term. (Note: REER is not included as a variable descriptor of import because South Africa's economic openness is considered small and replaced by the variables of foreign exchange reserves)

In general, most of the previous studies indicate a relationship between export-import with price adjustment due to changes in the exchange rate, except the result from Siregar and Rajan (2003) that shows REER has no significant effects to Indonesia

export in the 1990s, as well as the result from Marquez and Schindler (2007) that shows appreciation is negligible and lacks precision to China's Import in 1997 to 2007. The other results confirmed the relationship and the direction in line with what is described in the condition of Marshall-Lerner regarding trade adjustment comes from exchange rate.

The previous studies also show that exchange rate volatility concluded has worse impact both on export and import. Thus, the stability of the exchange rate in the short term is preferred by the international traders in running the export and import activities compared to the presence of a high level of volatility that will cause uncertainty and raises the cost of hedging.

Different results that need to be underlined with the most of the previous studies above—namely, from the result of export of Indonesian manufacturing sector model—is the ineffectiveness of price correction through this exchange rate. This result, can refer to the competitiveness and the types of products of manufacturing sector's export. The result of Baharumshah (2001), conclude Malaysia and Thailand get the benefit from the depreciation because it will improve trade balance because of their competitiveness. Compared with case in Indonesia, export of manufacturing sector has so far been supported especially by the products of unfinished goods that have less added values, namely crude palm oil around 15 percent and crumb rubber around 12 percent (average from 2007 to 2014). This circumstance, expected reduces the competitiveness and later does not support the price adjustment effectiveness through the exchange rate in encouraging export of manufacturing sector.

In the other hand, the elasticity of real income of destination countries ($LNYLN_t$) shows that the export of manufacturing sector relies very much on the income increase of its export destination countries. This result demonstrates that shock to the real income of exports destination countries of major manufacturing sector will impact more on the number of Indonesian manufacturing sector export. The distribution of the export destination countries with the largest percentage is only spreading across 6 countries: China, Japan, the United States, Singapore, India and Malaysia. With such distribution, the intended shock will illustrate the decline of the export value of manufacturing sector simultaneously in 2009 in

amount 15 percent along with the decrease of main destination countries' income after the global crisis.

The inability of the export of the manufacturing sector to respond to depreciation needs to be cautioned given the results on imports of raw-and-auxiliary materials is corrected by depreciation. Further studies are needed to assess the causes of the dependence of the manufacturing sector on import of raw-and-auxiliary materials, as well as the possibility of low value of linkage in supporting the production of the manufacturing sector. From the follow-up study, expected will answer how the steps in overcoming the dependence on import of raw-and-auxiliary materials, and further encourage the export of manufacturing sector to be competitive.

CONCLUSION

As the results obtained, the direction of the exchange rate impacts produce different results on both models specified. From both the impacts of the specified exchange rate—namely the price effect (REER) and risk effect (volatility)—are applicable to the model of the import of raw-and-auxiliary materials. While, on the export of manufacturing sector model, it is only found that the risk effect is as the impact of a significant influence.

The results show the need in the long term to seek substitution industries of imports of raw-and-auxiliary materials from domestic production in the manufacturing sector, or in this case to strengthen ties (linkage) between the input sectors for manufacturing sector. For export manufacturing sector, efforts are needed to open the export market to non-traditional countries to reduce the risk of simultaneous recession in the main destination countries. In addition, it is important to improve the quality of the competitiveness and added value on the export goods of manufacturing sectors as the main problems. These efforts will prevent the impact of the exchange rate externality causing shock on the import prices of raw-and-auxiliary materials and later threatening the continuation of the manufacturing sector production.

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