

Transmission Price of Arabica Coffee between North Sumatra and the Main Export Countries

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North Sumatra is one of the biggest Arabica coffee producers in Indonesia. Arabica coffee is one of the leading export products in North Sumatra, with export values that always fluctuate. The high production of Arabica coffee in North Sumatra is inversely proportional to the low consumption of coffee, so the need for a large export to other countries has made northern Sumatra a price recipient. This research was conducted to analyse the transmission price of North Sumatra Arabica coffee with the main destination countries of America and Europe. The method used in this study for the analysis of Arabica coffee price transmission uses the Asymmetric Error Correction Model (AECM) and analysis of the factors forming coffee prices with the Error Correction Model (ECM). In the short term, the transmission rates between North Sumatra and all countries revealed an asymmetrical relationship. This is happening because of the need for time to adjust the price of the market importers to market exporters. While the long term results of the transmission prices between the markets of North Sumatra with all countries reveal a relationship which is symmetrical in the short term, while the term length of the entire variable effect on the real in the formation of the price of coffee Arabica North Sumatra with the value of the probability of 0.00 with each value of F-stat sebesar 10.22 and 17.35.

Key words: *Arabica coffee, Asymmetric Error Correction Model, Error Correction Model.*

Introduction

North Sumatra is one of the biggest Arabica coffee producers in Indonesia. Some famous regions for coffee production are Dairi, North Tapanuli, Simalungun, and other potential districts for planting these commodities. As the region offers one of the largest provinces for

coffee-producing in Indonesia, coffee production is able to support the original income of the region for coffee growing areas, while increasing revenue for the regional income of North Sumatra, especially for exports abroad.

Aside from being a producer of Arabica coffee, North Sumatra is also one of the provinces that rely on export activities as a driver of economic growth - one of which is the export of agricultural sector commodities, which is Arabica coffee (Indonesian Coffee Export Association, 2018).

Table 1: Volume and value of Arabica coffee exports in North Sumatra 2012-2017

Year	Arabica Coffee Export	Progress (%)		Progress (%)
	Volume (Kg)		Value (USD)	
2012	61489167		364979728	
2013	61740606	0,41	250826258	-31,28
2014	65277533	5,72	348391646	38,90
2015	70784579	8,44	363265263	4,27
2016	63448254	-10,36	300828415	-17,19
2017	65324815	2,96	325229204	8,11

Source: Asosiasi Ekspotir *Kopi Indonesia (AEKI) Sumatera Utara (Edited)*

The value of the North Sumatra Arabica coffee export sector is very volatile, as seen in Table 1. In 2013, the development value of North Sumatra Arabica coffee exports decreased by 31.28% from the previous year. While in 2014, the value of North Sumatra Arabica coffee exports increased by 38.90%. The largest fluctuation in the value of North Sumatra Arabica coffee was caused by the high price of North Sumatra Arabica coffee at the level of the country of export destination. This high fluctuation level can reduce buyers' interest in doing business in the export sector.

The high coffee production in North Sumatra is greater than the average consumption per capita of North Sumatra coffee, causing most of the coffee production in North Sumatra to be exported to export destination markets. This causes dependence on world markets, which results in world markets being able to be a price determinant. The chain of supplies is dependent on the pricing models; the transmission of prices are variant towards other prices that are based on some local prices. Products that are either imported or exported are based on actual prices on which the activity has been performed, while after import and export the variation which occurs is based on the countries which are majorly causing impacts on the actual prices. The models of pricing in countries where supplies are made add up some prices in accordance with the needs that are of compulsion based in such countries.

This is in accordance with research, where the results show that there is a direct transmission price relationship between Indonesia and the main importing markets (the United States, Germany, and Japan); the importer market is able to influence prices in the Indonesian market, whereas the coffee export market in Indonesia is unable to influence coffee prices in importer markets (Khumaira, 2016).

The efficiency of two interacting markets can be seen through price transmission and the level of market integration (Meyer and Von Cramon-Taubadel 2004). Meanwhile, the asymmetrical price transmission depends on the seller's relationship with the buyer. This asymmetry can take place positively or negatively (Bailey & Brorsen, 1989).

The asymmetry of price transmission between the two markets shows that there is a blaming of market power. To see this phenomenon, research on price transmission between the North Sumatra market and the main export destination countries in America and Europe is needed. This study also examines the factors that influence the formation of Arabica coffee market prices in North Sumatra.

Literature Review

The transmission of prices has remained an important influence on the variation of products, where coffee is considered the most supplied product in various countries. The literature vastly discusses pricing transmission in many countries that involved in exports and imports, although product variation has caused important aspects. Studies have mentioned not only Arabica coffee, that is being supplied all over the world but have also mentioned various sorts of coffees (Udayana, 2017). The chain of supply is dependent on the pricing models; the transmission of prices are variant towards other prices that are based on some local prices. Products that are either imported or exported are based on actual prices on which the activity has been performed, while after import and export the variation that occurs is based on the countries which are majorly causing impacts on the actual prices. The models of pricing in countries where supplies are made add up some prices in accordance to the needs that are of compulsion based in such countries (Calvini, Amigo, & Ulrici, 2017). Despite the pricing of Arabica coffee, there are lasting effects of many more coffees that have recorded prices in various countries, although the taste is also counted as an important element. Studies mention many countries where some restricted coffees are supplied more often rather than a single product, while transmission of prices has caused important influences. It is important to ascertain the proper transmission where the products are supplied between some elective countries; the models of such countries are firstly required to be analysed by the financial observers (Mai, 2017). The disincentive levels are contributing to some lasting effects on the international markets, where the transmission of prices is not approved, for reasons due to the unmeasurable circumstances which are prevalent in both international and local markets. Better transmission has been founded in various studies where the scale of farmers is properly

analysed (Kabeta, 2017). The most consuming and cultivated product all over the world has a significant influence on the international markets, while the pricing effects also have significant influences over the countries.

The literature discusses farmers who are heavily dependent on the cultivation and brought up to the markets which are respondent towards the prices that would be asserted from such markets. It is pertinent to mention that knowledge from books not only enhances the development of minds from initial stages to advanced ones, but the practical training is also a major contribution for the development of self-confidence in youth. The media literacy has opened various ends for the students to attain educational activities not only for the enhancement of knowledge but attitudes and self-efficacy too. Studies mentioned some facts that have caused some influences upon prices, whether due to cultivation procedures or prices towards international markets (Azrag, Murungi, Tonnang, Mwenda, & Babin, 2017). The countries that grow coffee are much exported to the whole world and are renowned due to their products that reach all over the world. From past studies, it is significantly seen that Arabica coffee is the most cultivated and consumed all over the world; therefore, pricing effects are also reluctant due to the major exports. Farmers are also dependent on the prices of such coffee, while the beans of such coffee are quality based, and it also could be possible to produce some special varieties by some sort of hybridisation (Davis, Gole, Baena, & Moat, 2012; Mhando, 2018). The transmission also relies upon cultivation; most studies have found that farmers show evidence of lack of income and amounts for producing the coffee plant. The cultivation procedure is somehow the other era, while transmission of prices all along belongs to the farmers which grow the plant up. The trees are usually produced by some farmers who are placing collateral for obtaining credit from informal lenders, therefore pricing effects then prevail. It is notable in some studies that where informalities prevail, some difficult situations also prevail and cause important influences among factors where the circumstances fall (Francisco, Ceresini, Almeida, & Coletta-Filho, 2017).

The price transmission is also based on informalities where farmers being forced to adopt some procedures for selling such products could also result in higher prices. Transmission belongs to the cost and incentive, while the prevailing collateral has put significant influence on coffee that is supplied all over the world (Agwanda, Lashermes, Trouslot, Combes, & Charrier, 1997). Plenty of studies have not only endorsed some significant values that belong to the coffee selling but have also enumerated the procedures adopted for selling (Sun, Gao, Wen, Feng, & Wang, 2019). The meeting of expenses for the production of coffee, the payment of collaterals, the primary obligations, family food consumption and taxes, credits, etc. are also counted as important elements that prevail in various exporting countries. The major contribution to transmission belongs to variations of some economic effects that have a significant influence, not only on the coffee prices, but which also have vast impacts on other products. Studies have mentioned fluctuating prices of gold, which produce changes with

lasting impacts on the economies of countries all over the world (Bohl, Gross, & Souza, 2019). The spillover effects not only cause influences over the products, but also result in expensive commodities for middle-class people. Gold spillover influences commodity prices all over the world, when it comes to input the consumption of goods, access to healthcare and education are also least affected. Conversely, when the lasting effects prevail on farmers, studies have discussed the selling of their assets, properties, etc. for survival, even though such farmers are forced to work on other places rather than the least farmer (CHOU & LIN, 2019). The adverse effects are also prevalent in local and international markets where the selling of coffee has increased for the last few decades due to its consumption all over the world. Despite some losses in flavour, the continuing level of sales has not been disrupted over time, while the influential factors have somehow exerted some impacts on it.

The literature has discussed variations of coffee where Ethiopia is considered as an important exporting country of coffee, but the sub-sector of coffee has not retained much importance due to its out coming from coffee. Somehow, Arabica coffee is usually considered all over the world, with some significant values showing increasing balances that have been gathered from the selling of such coffee (Naegele, 2020). Studies have enumerated significant results from the performance of such coffee, where the performance not only came up satisfactory, but also a significant contribution is analysed from various countries. While the production element, the way, and processing of production have not been changed for many decades, amongst all other things coffee is the significant element that has been found to be important in the literature (Getahun & Keno, 2019). From the era of exporting, the transmission of prices is reluctant in the farmers' markets, while the private importer and exporter are able to enhance the prices in markets by emphasising certain levels of incentives and disrupt the level of markets (El-Karimi & El-Ghini, 2020). Most external or internal markets are found to be affected due to private dealers, which nowadays have a strong influence on the trade markets. Therefore, when it comes to the farmers, they are unable to save the share which they were about to receive from the markets, as the influence of private sellers has strongly influenced the transmission of prices between many countries. Rather than the fluctuation of gold prices internationally, many other factors also prevail that create lasting influences, not only for coffee, but for a variety of further products (Wairegi et al., 2018). The commodity price increases when it comes to the market; the researchers put forward brief views regarding many factors that result in the transmission of prices. Where international fluctuations impact most of the commodity prices, the export prices also fluctuate and also result in the drowning of some products (SM, 2018).

Some products are unable to be sold due to the high transmission of prices, so that sellers then offer some free packages for such selling. The literature on Arabica coffee aimed to notify its importance, and the transmission of prices has also been considered an important element where domestic export and imports are highly admired (Bassa & Goshu, 2019). The

stalling growth of coffee is envisaged due to the present producers, while the lack of suitable prices has reduced the markets and also put due influences on simultaneous growth and productivity. The proper policy implementation in various studies has somehow contributed important aspects for growth and productivity, where the disincentive policies adoption could better reveal the importance between markets (Otieno, Alwenge, & Okumu, 2019). The overall imperfections have been noted in various studies, where policy and non-policy at the level of markets and productions have revealed exemplary influences among prices. The proper infection of policies in some studies has also been viewed where the transmission over the world and price signals of auction markets have been grown (Pantaleo, Fordham, Oyewunmi, De Palma, & Markides, 2018). The unexpected return from the literature, where proper policies have been adopted suggests enumerated improvement in the quality and supply of coffee. In past literature, the deregulation of markets has also been suggested as having a lasting effect on the opportunities to actual buyers, where such deregulation has inserted some effect, some private people have fully taken advantage of the situation and have had influence over the market (Okoku et al., 2019). The chain of primary coffee has been significantly viewed with a positive enhancement of policies where the chain of supplies and selling is not disrupted with time, although sellers and buyers have relatively gained high competition levels over the market. Participating countries in relative coffee selling have contributed considerable focus over the transmission of prices in introductory markets where the level of private ones was disturbed (Jena, Grote, & Stellmacher, 2018). Past literature has mentioned some sort of increase over the supply of coffee where the auction market has also been seen over the transmission of Arabica coffee between many countries.

Materials and Methods

The study was conducted in North Sumatra Province. The determination of the research area was carried out by purposive sampling, that is, deliberately determined by considering the objectives of the study. North Sumatra Province was chosen with the consideration that North Sumatra Province is one of the largest Arabica coffee production centres in Indonesia and has a Belawan port as a condition for the sustainability of exports, especially Arabica coffee. This research was conducted in 2019. Data taken in this study are secondary data, collected over the last five years. The data was analysed in the form of data on export prices of major exporters of coffee, import prices of coffee in the main coffee importer market, the exchange rate of rupiah and the volume of coffee exports in North Sumatra.

Analysis of price transmission is performed using the Asymmetric Error Correction Model (AECM). This model is used to see whether price transmissions occur asymmetrically or symmetrically. The data used included the average export price of North Sumatra Arabica Coffee and the average price of Arabica coffee as the main export destination. This test is carried out through the Error Correction Model (ECM) approach as follows:

$$\Delta PES = \alpha_0 + \sum_{i=1}^n \beta_{11}^- \Delta PES_{t-1}^- + \sum_{i=1}^n \beta_{12}^- \Delta PIT_{t-1}^- + \pi_1 ECT_{t-1}^- + \sum_{i=1}^n \beta_{21}^+ \Delta PES_{t-1}^+ + \sum_{i=1}^n \beta_{21}^+ \Delta PIT_{t-1}^+ + \pi_2 ECT_{t-1}^- + \varepsilon_t$$

Error Correction Model Analysis

Error correction model analysis is used to analyse the formation of Arabica coffee prices in North Sumatra. This analysis is divided into long term and short term results.

Long-Term Model

$$\text{LnPES}_t = \alpha_0 + \alpha_1 \text{LnPES}_{t-1} + \alpha_2 \text{LnPEB}_t + \alpha_3 \text{LnPEV}_t + \alpha_4 \text{LnPIT}_t + \alpha_5 \text{LnVol}_t + \alpha_6 \text{LnNT}_t + \varepsilon_t$$

Short-term Model

$$\Delta \text{LnPES}_t = \alpha_0 + \alpha_1 \Delta \text{LnPES}_{t-1} + \alpha_2 \Delta \text{LnPEB}_t + \alpha_3 \Delta \text{LnPEV}_t + \alpha_4 \Delta \text{LnPIT}_t + \alpha_5 \Delta \text{LnVol}_t + \alpha_6 \Delta \text{LnNT}_t + \text{ECT}_{t-1} + \varepsilon$$

Results

The analysis of transmission prices of Arabica Coffee between North Sumatra and Main Destination Countries was carried out with the *Asymmetric Error Correction Model* (AECM) method. Before the asymmetry test, the following steps were carried out. In order to avoid *spurious regression*, a stationary data test is performed.

Co-integration Test

A Co-integration test is conducted to assess the long term relationship between the two markets. This research was conducted using the Johansen Co-integration Test with a lag of one, and concluded that the North Sumatra export market is vertically circulated against the destination country's import market.

A test of causality is carried out to look at the relationship between market exporter North Sumatra with the main destination countries. The result of the test reveals which market is more affected.

Causality Test

Based on Table 2, the results obtained reveal that the markets of Sumatera Utara and America have a relationship of two directions, as well as the market of North Sumatra with Germany. While the North Sumatra market has no relationship or mutual influence with Canada and Belgium. The North Sumatra market affects the formation of the British market price and not vice versa.

Table 2: Causality Test between North Sumatra and Main Destination Countries

Arah Hubungan	F-Statistic	Prob.
PIA → PES	7.13289	0.0099
PES → PIA	30.9273	8.E-07
PIG → PES	5.18751	0.0266
PES → PIG	15.7918	0.0002
PIK → PES	0.79252	0.3771
PES → PIK	3.59901	0.0630
PIB → PES	0.65702	0.4210
PES → PIB	1.09565	0.2997
PII → PES	0.19385	0.6614
PES → PII	4.23199	0.0443
PIAU → PES	1.41520	0.2392
PES → PIAU	13.6666	0.0005
PIJ → PES	3.01803	0.0878
PES → PIJ	9.07928	0.0039
PIM → PES	0.13711	0.7126
PES → PIM	0.00618	0.9376
PIS → PES	0.45302	0.5037
PES → PIS	0.23296	0.6312
PIT → PES	9.65556	0.0030
PES → PIT	17.4048	0.0001

The results obtained by the study were conducted by researching the markets of Indonesian coffee looking at the main destination countries. In this study, a one-way relationship was found, in which the main destination country influenced the formation of Indonesian prices. Differences in outcome occur between the markets of Sumatera Utara and the other primary destination countries because Arabica Sumatra is a speciality coffee that is highly in demand in various countries.

Price Asymmetry

In Table 3, it can be seen that over a period of time, shorter transmission rates between North Sumatra and all other countries reveal an asymmetrical relationship. This is happening because of the need over time to adjust the price of the market importers to market exporters. The long term results of the transmission of prices between the markets of North Sumatra with all other countries reveals a symmetrical relationship. In this case, it can be concluded that this is not the result of an abuse of power over the market by North Sumatra.

Error correction model analysis is used to analyse the formation of Arabica coffee prices in North Sumatra.

Table 3: Price Asymmetry Test Between North Sumatra and Main Destination Countries

Wald Test	Variabel	F- statistic	Prob.
Amerika → Sumut	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	4.692325	0.0352
	$\Delta PIA^+ = \Delta PIA^-$	0.001682	0.9674
	$ECT^+ = ECT^-$	0.015739	0.9007
Jerman → Sumut	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	1.705025	0.1977
	$\Delta PIJ^+ = \Delta PIJ^-$	5.848504	0.0194
	$ECT^+ = ECT^-$	0.166084	0.6854
Kanada → Sumut	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	5.120504	0.0281
	$\Delta PIK^+ = \Delta PIK^-$	5.192480	0.0271
	$ECT^+ = ECT^-$	0.074317	0.7863
Belgia → Sumut	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	4.835352	0.0326
	$\Delta PIB^+ = \Delta PIB^-$	0.293906	0.5902
	$ECT^+ = ECT^-$	0.72114	0.3999
Inggris → Sumut	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	4.822173	0.0329
	$\Delta PII^+ = \Delta PII^-$	0.149913	0.7003
	$ECT^+ = ECT^-$	0.119843	0.7307
Australia → Sumatera Utara	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	3.996666	0.0512
	$\Delta PIAU^+ = \Delta PIAU^-$	19.30409	0.0001
	$ECT^+ = ECT^-$	0.575810	0.4516
Jepang → Sumatera Utara	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	0.063140	0.8027
	$\Delta PIJ^+ = \Delta PIJ^-$	6.073777	0.0173
	$ECT^+ = ECT^-$	0.049559	0.8248
Malaysia → Sumatera Utara	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	6.750932	0.0123
	$\Delta PIM^+ = \Delta PIM^-$	1.920884	0.1720
	$ECT^+ = ECT^-$	2.021911	0.1614
Singapura →	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	4.788353	0.0335

Sumatera Utara	$\Delta PIS^+ = \Delta PIS^-$	0.498296	0.4836
	$ECT^+ = ECT^-$	0.184831	0.6691
Taiwan Sumatera Utara	$\Delta PES_{t-1}^+ = \Delta PES_{t-1}^-$	2.820245	0.0994
	$\Delta PIT^+ = \Delta PIT^-$	4.780868	0.0336
	$ECT^+ = ECT^-$	0.472219	0.4952

Discussions and Conclusion

From the results of the study, it can be concluded that in the run-length across the variable effect on the real against the formation of the price of coffee in Sumatra north with the value of the F-stat at 10:55 with a value of probability 0.000. value R-square for 0,70 can be explained that the entire variable can explain the price of coffee Arabica Sumatra north amounted to 70% and the rest is influenced by other variables that are not included in the model (Von Cramon-Taubadel, 1997); (Harahap, 2018).

From the results of research on the short term, all variables affect the real against the formation of the price of coffee in North Sumatra with the value of the F-stat is 17.35 with the value of the probability of 0.0 00. The value of the R-square of 0.82 explains that the entire variable can explain North Sumatra Arabica coffee prices by 82 %, and the rest is influenced by other variables not included in the model. The value of ECT is significant, so it can be concluded that the specifications were invalid, so that changes in the factors that are analysed will be responsive to North Sumatra. The value of ECT of 0.97 means that the adjustment of the price of 97% occurred in the month of the first and the rest of the next month .

In term shortterm, transmission rates between North Sumatra with all other countries revealed a relationship that was asymmetrical. This is happening because of the need for time to adjust the price of the market importers to market exporters. While in the long term, the results obtained of the transmission of prices between the markets of North Sumatra with all other countries reveals a relationship that is symmetrical.

In the short term and term length of the entire variable effect on the real in the formation of the price of coffee Arabica North Sumatra with the value of the probability of 0.00 with each value of F-stat is 10.22 and 17.35.

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