FACTORS AFFECTING THE INSTABILITY OF RICE PRICES IN THAILAND: A VECTOR ERROR CORRECTION MODEL APPROACH

AUDREY LIM SWEE YIN

BACHELOR OF ECONOMICS (HONOURS)
GLOBAL ECONOMICS

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF ACCOUNTANCY AND MANAGEMENT
DEPARTMENT OF ECONOMICS

May 2024

DECLARATION

I hereby declare that:

(1) This undergraduate research project is the end result of my own work, and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) The word count of this research report is 10432.

Name of Student:	Student ID:	Signature:
Audrey Lim Swee Yin	2102902	

Date: May 2024

ACKNOWLEDGEMENTS

This research would not have been possible without the invaluable contributions of many individuals. I am deeply grateful for their assistance, insights, and unwavering support throughout this journey of completing this research. My deepest gratitude goes Mr. Har Wai Mun. His guidance, encouragement, and expertise were instrumental in shaping this project. His initial recommendation to select this research topic, “Factors Affecting the Instability of Rice Prices in Thailand: A Vector Error Correction Model Approach”, which was initially helped by Dr. Aye Aye Khin with the topic, and I am very grateful for her assistance. Mr. Har’s ongoing support and watchful eye were essential for this project’s successful completion. I would also like to express my appreciation to the second examiner, Dr. Lee Hui Shan, for her valuable feedback and assistance. Finally, a heartfelt thank you to my close friends and family. Their unwavering support, both directly and indirectly, both mentally and physically, has fueled my motivation throughout this academic endeavor. Their words of encouragement were a constant source of strength for me as I completed this research.

Table Contents

LISTS OF TABLES

LISTS OF APPENDIXES

PREFACE

This preface serves as an introduction to lay the groundwork for this research. It introduces the key themes to reader like the relationship between the rice price and the macroeconomic factors. The preface highlights the importance of understanding these dynamics in the context of the rapidly evolving financial landscape. It also outlines the structure of the study, promising a detailed examination of findings, implications, limitations, and recommendations for future research. Overall, the preface serves as a roadmap for navigating the research journey ahead.

ABSTRACT

This study is submitted in partial fulfillment of the requirements for a Bachelor of Economics (Hons) in Global Economics. This study explores the Factors Affecting the Instability of Rice Price in Thailand: A Vector Error Correction Model Approach. This research utilizes EViews 12 software to conduct the VECM analysis to determine the relationship between the variables. The dependent variable for this research is Rice Prices, and a total of 3 independent variables namely Exchange Rate, Inflation Rate and Income Level is used in this research using annual data from 1990 to 2023 with a total of 33 observations.

Factors Affecting the Instability of Rice Prices in Thailand: A Vector Error Correction Model Approach

CHAPTER 1: INTRODUCTION

1.0 Introduction

Chapter 1 is crucial for this research. It provides a thorough background of study enables readers to evaluate the researcher's understanding of the research topic, instilling trust in the overall interpretation of results. The problem statement succinctly presents data explaining the research's purpose, prompting the need for further investigation. In this process, researchers outline the research objective and question, defining how they aim to respond. The significance of the study, also known as the 'rationale,' is pivotal as it's where the researcher convinces the reader of the research's value and meaning.

1.1 Research Background

Rice serves as a primary food source for many people around the world, holding substantial economic and cultural value. Researchers and economists have been intrigued by the rice prices because of the major influence that rice holds over local and worldwide markets. Moreover, the cultivation of rice has changed environments, societies, and impacted global commerce paths. Which then creates a complex interconnectedness in agriculture and economy across various regions and historical periods. A significant portion of Thai farmers are made up of rice farmers,

accumulated around 66 percent or 3.7 million of the the total of thai populations of 5.6 are made up of rice farmers. According to Kusanthia (n.d.), Thai rice farmers grow around 8.96 to 9.28 million hectares of rice annually.

This research explores the various elements that impact rice prices, with a focus on the important roles of Exchange Rates, Inflation Rates, and Income Level. The consistency of rice prices continues to be a constant worry, marked by changes that can deeply affect farmers and buyers across the globe.

Rice production in Thailand contributes to a significant portion of the Thailand economy and labour force. According to Workman (n.d.), Thailand is the second largest rice exporter in the world after India, with a total 32.9 million tons and 25.18 million tons of rice production in 2017 and 2018 respectively based on Statista (2023). Supply, demand, weather conditions, crop diseases, pests, production expenses, and other determinants can influence the price of rice.

The currency exchange rates greatly affect the dynamics of global rice trading. For instance, if a currency is weaker than another country's currency, it can make rice exports more competitive globally. This leads to increased demand and higher rice prices. But a strong Thai Baht can weaken the competitiveness of rice exports. This can lead to decreased demand and pressure on the rice prices. Therefore, the changes in exchange rates can lead to fluctuations in rice prices globally.

Moreover, the Inflation Rate impacts the pricing of rice by indicates rising in prices of goods and services for long term. Growing inflation decreases purchasing ability, making rice less accessible to consumers, particularly those with low incomes. The Consumer Price Index (CPI) serves as the measure of inflation rate, monitoring shifts of average prices of goods and services bought by consumers. Fluctuations in the CPI are caused by fluctuations in the cost of living, impacting consumers'

purchasing power and spending habits. Hence, the changes in CPI can impact rice consumption and lead to fluctuations in prices.

To study the instability rice price, income levels is included. It reflects the earning capacity of individuals and households, are fundamental determinants of rice consumption patterns and market dynamics. In regions where rice is a dietary staple, income levels directly influence the proportion of household budgets allocated to rice purchases. Rising incomes typically correlate with increased rice consumption and demand for higher-quality rice varieties, potentially driving prices upwards. The stagnating or declining incomes may constrain consumer spending on rice, leading to subdued demand and price pressures.

1.2 Problem Statement

Rice prices in Thailand are driven by several reasons, and knowing these causes is crucial to resolving the country's rice industry's problems. The goal of this research is to identify and analyse the primary factors influencing rice price fluctuations in Thailand. Rice is the world's staple meal, particularly in Asia and Africa. Rice prices are crucial in ensuring that people have access to a sufficient and cheap food supply. As a result, variations in rice prices may have an impact on disadvantaged populations' capacity to acquire basic food products.

Exchange rates are critical in the globally economy. This has an immediate impact on the cost of importing and exporting across countries. Changes in exchange rates will have a direct effect on the price of imported rice. As a result, a stronger baht would make imported rice cheaper, lowering local demand for domestically produced rice and so influencing domestic rice prices ("Rising to the Challenge in Asia: A Study of Financial Markets," n.d.). Exchange rate fluctuations also have an

impact on the competitiveness of rice from other producing countries as well as Thai rice.

On the other hand, growing input costs such as pesticides, fertilisers, fuel, and labour have increased the overall cost of rice production. This also resulted in merchants passing on the cost to buyers, raising the market price of rice. Furthermore, shipping and delivery costs rise in tandem with inflation. If delivery prices rise due to inflation, consumers may incur greater rates. Furthermore, inflation might have an impact on customers' purchasing power. When inflation rises, customers may consume less and hence limit their usage of non-essential products like rice, causing rice prices to rise (Boonsawat, n.d.).

This research is crucial due to the significant proportion of the population, particularly low-income to poor individuals, who struggle to afford necessities, especially rice, which is a staple food in Thailand. The price of rice is a crucial factor in determining the availability of affordable foods as it influence the purchasing power of disadvantaged individuals and those with low incomes when it comes to buying essential groceries. Rice prices directly impact food security and the nutritional health of millions, especially those in poverty, in regions like Thailand where it is a staple food. Securing stable and fair rice prices is crucial not just for fulfilling basic dietary requirements, but also for advancing social fairness and tackling food insecurity in underserved populations.

1.3 Research Questions

The general research question in this paper is what are the factors affecting instability of rice prices in Thailand?

The specific research questions for this study are as follows:

RQ 1: What is the relationship between Exchange Rate (ER) and Rice Price (RP)?

RQ 2: What is the relationship between Inflation Rate (IR) and Rice Price (RP)?

RQ 3: What is the relationship between Income Level (IL) and Rice Price (RP)?

1.4 Research Objectives

The general objective is to identify the variables of the factors affecting the instability of rice prices in Thailand.

The following are the specific research objectives for this research:

SO 1: To determine the relationship between Exchange Rate (ER) and Rice Price (RP).

SO 2: To determine the relationship between Inflation Rate (IR) and Rice Price (RP).

SO 3: To predict the relationship between Income Level (IL) and Rice Price (RP).

1.5 Hypotheses of the Study

From the problem and objectives stated above, the following hypotheses were formulated:

H01: There is no relationship between Exchange Rate (ER) and Rice Price (RP).

HA1: There is a significant relationship between Exchange Rate (ER) and Rice Price (RP).

H02: There is no relationship between Inflation Rate (IR) and Rice Price (RP).

HA2: There is a significant relationship between Inflation Rate (IR) and Rice Price (RP).

H03: There is no relationship between Income Level (IL) and Rice Prices (RP).

HA3: There is a significant relationship between Income Level (IL) and Rice Prices (RP).

1.6 Significance of the Study

Thailand, as a major global rice exporter, Thailand's rice prices may impact international markets. This research of VECM framework can contributes to a nuanced understanding of how Thai Rice Prices respond to exchange rate which influencing the country's role in the global rice trade. And given the vital role of rice as a staple food for the people worldwide, Thailand's may influence the global food security. This research is significant to provide valuable insights on how Thai rice prices can contribute to that related to food availability and affordability on a global scale (Giang, 2023).

Additionally, Rice is a staple food in Thailand, and the price volatility can directly affect the cost of living for the population. As a developing nation, Thailand with poverty rate of 12.20 percent in 2021 (Macrotrends, n.d.). From that, 6.3% of the population living below the national poverty line, which is also a total of 4.5million out of 71.6million of Thailand's population in 2021 living in poverty (World Bank, n.d.), living on an average of $5.50 a day, and the increase of rice price would make the poor population need to spend more on their food, as opposed to education and recreation (Asian Development Bank, 2023). According to Asian Development Bank (2023), 8 out of 1000 babies that born in 2021 dies before their 5th birthday due to poverty. Therefore, by identifying the relationship or dynamics between the rice prices and the factors may be significant for comprehending the economic implications on consumers, the farmers, and overall economy of the country.

1.7 Chapter Layout

1.7.1 Chapter 1

The 5 chapters in this research that make up this study are structured with the background serving as the focus of the first chapter. The study delves into the analysis of Rice Prices in Thailand in relation to macroeconomics factors such as exchange rate, inflation rate, and income level. The paper mainly examines the relationship between the variables. In this Chapter 1, subtopics such as research background, research questions, research objectives, problem statement, significance of study, and research hypotheses are discussed to provide a better understanding of the factors affecting rice prices in Thailand.

1.8.1 Chapter 2

In Chapter 2, this paper reviews the past literature review that are related to this research. The literature review reviews on the independent variables such as the exchange rate, inflation rate, and income level that possibly impact the dependent variable which is the Rice Prices. Furthermore, this chapter also review into important theoretical models as well as review on VECM methods.

1.8.1 Chapter 3

In Chapter 3, the research method will specify the steps in conducting this research, by data collecting, design and research instrument to provide a summary of the research report. Moreover, Chapter 3 will also specify the conceptual framework that is used in this research to understand better on how these variables impact on the dependent variable.

1.8.1 Chapter 4

The empirical findings are the focus of Chapter 4, conducted VECM analysis on the Rice Price model. This chapter uses time-series data and done the test according to the research procedure accordingly.

1.8.1 Chapter 5

In Chapter 5 of this study, specify the limitations and recommendations for future research, and a comprehensive analysis of the results in Chapter 4, and ensures consistency and accuracy compared to other studies conducted by other researchers. This Chapter 5 focus is to provide a comprehensive conclusion to the study into Rice Prices in Thailand.

1.9 Conclusion

To summarize Chapter 1, the researcher was discussing the problem statement on how the factors that affecting the instability of rice prices in Thailand, developed research objectives and research questions based on that and clarified the significance of this research.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this Chapter, we will discuss the empirical literature review of the Rice Prices in Thailand according to the previous studies that are related to the Rice Prices and the factors. Among these factors are Exchange Rate (ER), Inflation Rate (IR), and Income Level (IL) that can have impact on the Rice Prices.

2.1 Empirical Literature Review

2.1.1 Empirical Review on Rice Prices

Rice prices fluctuate due to the intricate interplay between supply and demand, which are influenced by various factors including economic indicators like the Consumer Price Index (CPI). In a comprehensive study conducted by Abdoulaye et al. (2015), the researchers investigated not only the short and long-term dynamics between CPI and cereal prices but also conducted causality tests to unravel the underlying relationships.

The study focused on Mali's market dynamics, particularly analyzing the relationship between CPI and the prices of key cereal commodities such as rice, corn, and wheat. They also utilize monthly series data from 1993 to 2014 to estimate cointegration analysis with VECM. Through rigorous econometric analysis, Abdoulaye et al. (2015) revealed intriguing insights into the price dynamics of these essential food items.

One of the significant findings of the study was the presence of a strong long-term relationship between CPI and cereal prices, with a particular emphasis on rice prices. The authors observed that as the Consumer Price Index increased, indicating a rise in overall price levels of goods and services, the prices of cereals, including rice, exhibited a downward trend over the long term. Conversely, when CPI decreased, cereal prices, including rice prices, tended to rise. This inverse relationship between CPI and rice prices highlights the complex dynamics of inflationary pressures and their impact on food pricing, especially staple food items like rice. Overall, the empirical findings from Abdoulaye et al. (2015) underscore the intricate nature of rice price dynamics, emphasizing the role of economic indicators such as CPI in shaping the market trends. Not only CPI, but other macroeconomic factors can also have an impact on Rice Price.

2.1.2 Empirical Review on Exchange Rate and Rice Price

The value of one currency in respect to another is defined as the exchange rate, which means one currency's buying power versus another. The exchange rate is generally set by market forces of foreign exchange supply and demand in a floating exchange rate regime. In the study of Fitrawaty et. al (2023), the authors attempted to investigate the impact of various elements such as production level, domestic price, exchange rate, the impact of international rice prices, and GDP per capita on domestic rice prices, as well as the resulting gaps and inequalities in national income distribution. They utilize the data from 2006 to 2020 to describe changes in domestic rice prices induced by independent variable changes from 2021 to 2026. According to the findings of this study, an increase in the exchange rate leads to a fall in rice price, whereas a decline in the exchange rate leads to a rise in rice price. This analysis confirms that changes in the exchange rate affect the pricing of rice.

Furthermore, the study "A Simulation of Increasing Rice Price Toward the Disparity of Income Distribution: Evidence from Indonesia" provided insights into how changes in exchange rates can influence rice prices and subsequently impact income distribution. Firstly, they observed 1.87% annual rise in the exchange rate until 2026, where a decrease in domestic rice price will happen and decrease the price to IDR Rp 9190.38/kg. This rising exchange rate typically leads to a decrease in the domestic price of imported goods, including rice if Indonesia relies on rice imports, and the decrease in price can benefit consumers by making rice more affordable. Next, when the exchange rate declines annually by 1.87%, the domestic price of imported goods, including rice, tends to increase by 0.97% per year. This scenario can have several implications. It may raise concerns about inflationary pressures, particularly if rice is a significant component of the consumer price index. The empirical reviews based on data from Indonesia can validate these findings and provide understanding of how exchange rate fluctuations interact with rice prices.

2.1.3 Empirical Review on Inflation Rate and Rice Price

Inflation is measured by the change in the Consumer Price Index (CPI), which represents the average growth in the price of a basket of goods and services. In Vione, Aimon, and Sentosa (2020) Inflation Analysis in West Sumatera, they explored those changes in chili prices, rice prices, onion prices, and gasoline costs had a significant impact on rising inflation in West Sumatra. The results suggest that partial changes in rice prices have a positive effect on inflation changes in West Sumatra. This means that higher rice prices will push up inflation, but lower rice prices will lower inflation. Thus, the conclusion drawn from this result confirms that the price of rice is affected by inflation.

When examining the relationship between rice, corn, and wheat prices and the Consumer Price Index (CPI), an observation emerges regarding the

directional impact on inflationary pressures. Empirical studies by Abdoulaye et al. (2015) revealed a negative correlation between the prices of these staple commodities and CPI movements. Specifically, as the respective prices of rice, corn, and wheat decrease, CPI tends to exhibit an upward trend, indicating a rise in overall price levels for consumers. Conversely, when these agricultural commodity prices increase, CPI tends to decrease, reflecting a deflationary effect on consumer prices.

Furthermore, a study by Yanti et. al. (2021), underscore the significant impact of inflationary pressures on the pricing dynamics of essential commodities, including rice in North Sumatra, where economic conditions and market structures can be sensitive to inflation shocks. The authors reveal that inflation often led to immediate upward movements in rice prices, reflecting cost-push inflationary pressures within the economy. They found that there is a significant short term and long-term effect of inflation on rice prices in North Sumatra. Based on the Impulse Response Function Analysis that they conducted, the factor that affects rice prices in North Sumatra can be seen as stability. The inflation variable reaches stability in the 27th period.

2.1.4 Empirical Review on Income Level and Rice Price

As rice plays an important role in food security and household well-being. It is crucial to understand the relationship between income level and rice prices to ensure affordability and mitigate the impact of the rising price on vulnerable population (poor and poverty level). Yanti et al. (2021) provides a compelling case study from North Sumatra, Indonesia. Their research suggests a significant influence of income on rice prices. They posit that inflationary pressures can trigger cost-push inflation, leading to immediate rice price hikes. This finding aligns with economic theory, where increased demand driven by higher incomes can put upward pressure on prices. The authors further reveal a long-term effect of income on rice prices, suggesting a more complex interplay between economic growth and rice market dynamics.

From Impulse Response Function Analysis by Yanti et al. (2021), the authors finding that the income variable reaches stability after a specific period (20th period in their study) indicates that the impact of income on rice prices eventually flattens. This suggests that other factors may come into play in the long run, which have potential in mitigating the initial price increase caused by rising incomes.

2.1.5 Empirical Review on VECM Method

The Vector Error Correction Model (VECM) serves as the overarching framework that integrates short-term dynamics and long-term equilibrium. VECM is particularly powerful in capturing the interplay of variables and their adjustments over time. In the context of this research, VECM becomes the glue that binds Exchange Rate Theory and Income Elasticity of Demand with other relevant variables. VECM allows the researcher to examine how

variations from the long-term equilibrium, influenced by exchange rates and inflation rates, are corrected over time. This model provides insights into the relationships between Rice Prices, Inflation Rates, Exchange Rates, and Income Level variable. Through VECM, the study gains an understanding of how both internal and external factors contribute to the instability of rice prices in Thailand.

2.1.6 Empirical Review on Theoretical Model

This research delves into these key theoretical models, which are Exchange Rate Theory and Income Elasticity of Demand.

Exchange rate theory assumes when the baht currency appreciates, rice prices became more expensive to foreign buyers, and the demand for rice exports depreciates, which will eventually put downward pressure on rice prices (Chen, 2022). Exchange Rate Theory is crucial in explaining the impact of the currency fluctuations on a country's economic landscape. It proposes that exchange rates significantly influence a country's competitiveness in the global market. The theory suggests that as exchange rates fluctuates, they affect the prices of exports and imports, which influence trade balances and overall economic stability. In the context of this research on the instability of rice prices in Thailand, Exchange Rate Theory becomes relevant. As a major exporter in the global rice market, Thailand is prone to changes in the currency values. Fluctuations in Thai Baht can directly impact the competitiveness of its rice exports. Integrating Exchange Rate Theory into the research allows for a significant examination of how currency contributes to short-term fluctuations and long-term equilibrium in Thai rice prices.

Furthermore, the theory of income elasticity of demand is a fundamental concept in economics that elucidates the responsiveness of demand for a good or service to changes in income levels. By integrating the theory of income elasticity of demand into the empirical analysis, researchers can identify patterns of consumer behavior, forecast demand shifts based on income changes, and evaluate the implications for market stability and pricing strategies.

2.2 Research Gap

A lot of the past research in this area has predominantly focused on short-term effects or snapshot analyses. There is a research gap in exploring the long-term temporal dynamics between rice prices and the macroeconomic variables of exchange rate, inflation rate, and income level.

Many existing studies have focused on individual factors such as exchange rate or inflation rate on rice prices. However, there is a gap in research that comprehensively examines the simultaneous effects of exchange rate, inflation rate, and income level on rice prices. Understanding how these variables interact and influence each other can provide a more holistic view of price dynamics in the rice market.

2.3 Conclusion

In summary, the researcher employs a quantitative research methodology to investigate the factors affecting the instability of rice prices in Thailand. In the literature review, it reviews the relevant variables for this research, explored relevant theories, defining a conceptual framework, and developed hypotheses.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

In this Chapter, the study's methodology elucidates the systematic approach taken to analyze the relationship between Exchange Rate, Inflation rate, GDP, Income Level and Rice Price in Thailand. This section discusses the research hypothesis, data collection methods, sample strategies, and extensive data analysis procedures that were utilized to investigate the factors affecting Rice Price in Thailand.

3.1 Conceptual Framework

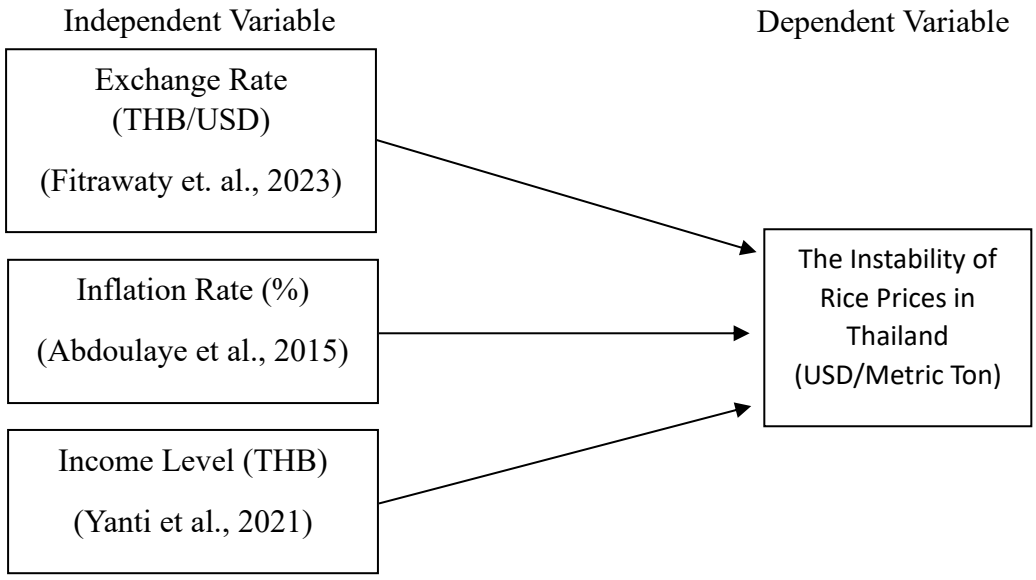


***Figure 3.1*: Conceptual Framework Model**

3.2 Empirical Model Specification

RP model will be used to discuss and justify the selection of variables and factors. Through the discussion that follows, along with examples of the model equations used in this research, it will also be demonstrated how the particular research objectives were evaluated and met.

In Rice Price model, the Rice Price is used as the dependent variable while the independent variables for it are Inflation Rate, Exchange Rate, and Income Level. This study focuses on rice prices in Thailand, specifically as the dependent variable. This choice is motivated by Thailand's prominent position as one of the world's leading rice exporters, second only to India. In fact, Thailand is projected to export a significant amount of rice in 2023, with a forecast of 8.5 million tonnes. (The Business Times, 2023). It would represent the necessity food price in the market of Thailand. Thailand’s rice price is to be said cheaper than Vietnam’s rice price that it is projected to increase exports in 2023 due to rising demand for Thailand’s rice, it would be a very influential variable as to consider the effect from within the country as well as its currency against the US as Thailand is the second-largest exporter after India surpassed Thailand in 2012 (The Economic Times, 2012). More importantly, this research has the potential to offer insights that could be helpful for the Thai government as they try to improve the paddy rice industry

Next, inflation rate represents the increase in prices of goods and services over time, reflecting changes in the purchasing power of a currency. Including inflation rate as an independent variable allows us to examine how price levels across the economy influence rice prices in Thailand. The Consumer Price Index, specifically chosen as a proxy for inflation rate, represents the general increase in prices of goods and services over time, reflecting changes in the purchasing power of a currency. Including the CPI as an independent variable allows to examine how price levels across the economy influence rice prices in Thailand.

Moreover, the Exchange Rate serves as another crucial independent variable in the Rice Price model. Exchange rate refers to the value of one currency in terms of another and plays a vital role in determining the competitiveness of a country's exports, including rice exports in the case of Thailand. A depreciating domestic currency (weakening exchange rate) can increase the cost of imported inputs, leading to higher production costs and potentially higher rice prices. Conversely, an appreciating domestic currency (strengthening exchange rate) can lower production costs and stabilize or reduce rice prices.

Lastly, Income Level is included as an independent variable in the model. Income level reflects the average purchasing power of consumers in Thailand and influences the demand for rice as a staple food item. Higher income levels typically correlate with increased demand for higher-quality rice varieties or more processed rice products, potentially driving up rice prices. On the other hand, lower income levels may result in higher demand for lower-priced rice varieties or reduced overall consumption, which could lead to stable or decreasing rice prices.

The results in Chapter 2 showed that the rice price and its factors have a significant relationship. Also, only a few past research were that expose these relationships as the research by Yanti et al (2021) and Abdoulaye et al. (2015). Thus, these researches became the inspirations to learn the factors of the rice price to ensure the relationship of the variables. Therefore, the following is the Rice Price model for VECM analysis:

$$\Delta rp_t = \beta_1 + \beta_2 \Delta er_{t-1} + \beta_3 \Delta cpi_{t-1} + \beta_4 \Delta il_{t-1} + e_t \quad (3.2)$$

Where,

rp_t = Rice Price (USD/Metric Ton)

er_{t-1} = Exchange Rate (THB/USD)

il_{t-1} = Income Level (THB)

cpi_{t-1} = Consumer Price Index (% change) [A proxy for Inflation Rate]

e_t = Error terms

t = Time Series data from 1990 to 2023 Annually

$\beta_1 \ldots \beta_5$= Regression Coefficient/Intercepts

3.3 Hypotheses Development

Three hypotheses were generated:

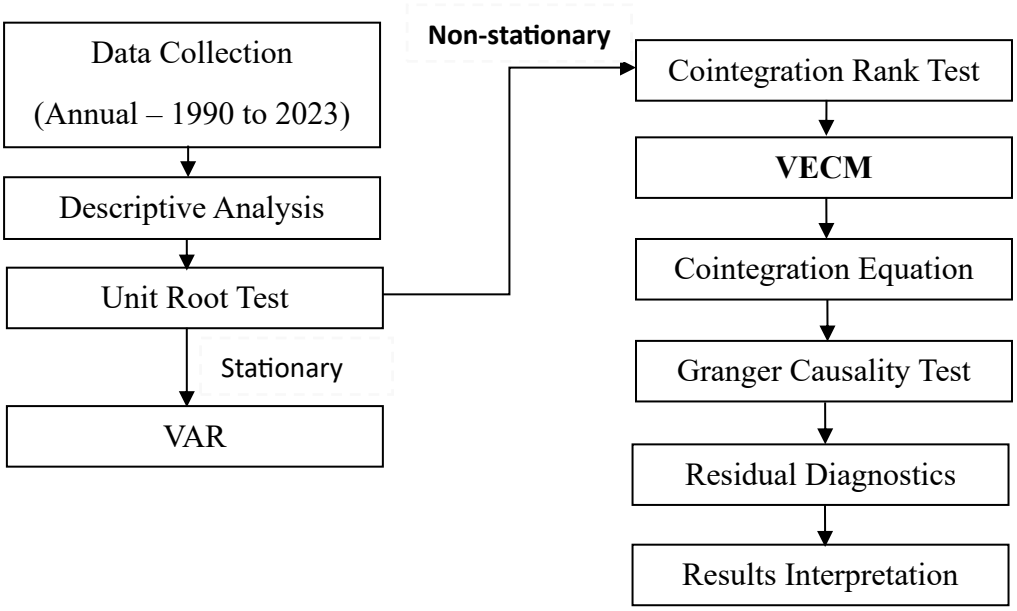
Table 3.3: Hypotheses Development

Variables	Hypotheses
ER	H_{01}: There is no relationship between ER and RP. H_{A1}: There is a significant relationship between ER and RP.
IR	H_{02}: There is no significant relationship between IR and RP. H_{A2}: There is a significant relationship between IR and RP.
IL	H_{03}: There is no significant relationship between IL and RP. H_{A3}: There is a significant relationship between IL and RP.

Source: Own Findings

3.4 Research Procedure

Figure 3.4: **Research Procedure**



Based on *Figure 3.4*, following data collection, the initial step involves conducting descriptive analysis. This initial step provides a summary of the data using statistical measures such as maximum and minimum. Then, a unit root test is conducted to assess whether the data is stationary. If the variables are stationary at the level of data, a VAR model suffices for analysis. However, if cointegration is detected, a cointegration rank test is performed, leading to the application of VECM. VECM incorporates a cointegration equation for long-run relationships and a VECM equation for short-run dynamics, aligning with the specific objectives in this study.

Next, Granger Causality tests are applied to the rice price model to ascertain causal relationships among variables. Residual diagnostic tests, including Normality (LM) test, Serial Correlation test, Heteroskedasticity (Breusch Pagan Godfrey) test, and Multicollinearity tests, are conducted for model validation. Lastly, it is to interpret the results.

3.5 Data Collection

Secondary data was mostly used because of their capacity to offer a much larger sample size, which is essential for assessing the influences on determining the factors that impact rice prices. In addition, the decision to gather secondary data was driven by the need for cost efficiency. Gather and using data from existing databases not just can save costs but also can ensure the credibility and trustworthy data for the research results (Martins et al., 2018).

The information used for this study came from popular databases like Federal Reserve Economic Data (FRED), International Monetary Fund (IMF), Board of Governors of the Federal Reserve System (US), World Bank and the National Statistical Office (NSO) of Thailand. Using these databases aids in standardizing and legitimizing data. In order to ensure uniformity and dependability, all information has been gathered and arranged within an Excel spreadsheet. The structured dataset is crucial for thorough analysis, and the statistical tests will be conducted using the EViews software.

The research analysis was carried out using collected secondary data. The information for the variable RP, which is the dependent variable was collected from IMF. The independent variables ER, CPI (used as a substitute for IR) and IL which are the independent variables, was collected from Board of Governors of the Federal Reserve System (US), World Bank and NSO of Thailand, respectively. VECM analysis will be utilized to study the RP model using annual time series data collected from 1990 to 2023, consisting of a total of 34 observations.

3.6 Vector Error Correction Model (VECM)

3.6.1 VECM Equation

VECM is a statistical model used in econometrics to analyse the relationships between multiple time series variables, it is frequently used when analysing non-stationary time series data, particularly when the variables are cointegrated. In a VECM model, there are two equations which are VECM equation and cointegration equation. While the VECM equation shows the short-run dynamics between the determinants, in contrast, the cointegration equation tells us about the stable, long-term relationship between them. Additionally, while the VECM does not show cause-and-effect, this study will also utilize Granger Causality test to identify any directional relationships between the variables.

$$\Delta rp_t = \beta_1 + \beta_2 \Delta er_{t-1} + \beta_3 \Delta cpi_{t-1} + \beta_4 \Delta il_{t-1} + e_t \quad (3.6.1)$$

Where,

rp_t = Rice Price (USD/Metric Ton)

er_{t-1} = Exchange Rate (THB/USD)

il_{t-1} = Income Level (THB)

cpi_{t-1} = Consumer Price Index (% change) [A proxy for Inflation Rate]

e_t = Error terms

t = Time Series data from 1990 to 2023 Annually

$\beta_1 \ldots \beta_5$ = Regression Coefficient/Intercepts

3.6.2 Cointegration Equation

Cointegration is when two or more time series variables, while not stationary individually, exhibit a long-term connection when combined, despite having trends or random fluctuations. Put simply, cointegration indicates that while individual variables may not have consistent patterns on their own, there is a consistent relationship between them when analyzed collectively.

The Idea of cointegration is crucial in econometrics and time series analysis as it allows for differentiation between fake correlations and real, significant long-term relationships.

$$\boldsymbol{\beta_5 \Delta rp_{t-1} + \beta_6 \Delta er_{t-1} + \beta_7 \Delta cpi_{t-1} + \beta_8 \Delta il_{t-1} = 0}$$

(3.6.2)

Where,

rp_t = Rice Price (USD/Metric Ton)

er_{t-1} = Exchange Rate (THB/USD)

il_{t-1} = Income Level (THB)

cpi_{t-1} = Consumer Price Index (% change) proxy for Inflation Rate

t = Time Series data from 1990 to 2023 Annually

$\beta_6 \ldots \beta_{10}$ = Regression Coefficient

3.6.3 Cointegration Rank Test

Cointegration Rank test helps to understand if two variables move together in the long run, even if their short-run movements can be erratic. This analysis uses 2 main tests:

1) Maximum Eigenvalue Test
   This test compares the Null hypothesis of having a specific number of long-term relationships between the variables to the Alternative hypothesis that there are actually more of such relationship (Zeng, et al, 2008)

2) Trace Test
   This test acts as a more general cheack to see whether the long-term relationship exist between the variables, without specifying the exact number (Helmut, et al., 2000).

3.7 Granger Causality Test

In most statistical analyses, one of the common concerns is causality. If two variables show cointegration, researchers would expect that there is a causal relationship extending between them in at least one direction. The Granger Causality test will be employed in this research to specifically identify the cause-and-effect relationships between the variables. By using this test, it is aimed to uncover any causal links that may exist between the variables. Although they are not exactly the same, causation and cause-and-effect relationships are pretty similar. (Gujarati & Porter, 2009; Studenmund, 2014).

3.8 Residual Diagnostics

3.8.1 Normality Test (LM Test)

Ho: Residuals are normally distributed.

H_A: Residuals are not normally distributed

Decision:

Reject Ho: (There is not normally distributed)

P-value $\leqslant \alpha = 0.05$

Or

Do not reject Ho: (There is normally distributed)

P-value $> \alpha = 0.05$

Normality tests will be used to determine if a dataset fits a normal distribution. These tests assess the null hypothesis that the data come from a population with a normal distribution. If the Ho is rejected, it suggests that the data are unlikely to come from a regularly distributed population. However, just because the null hypothesis is not rejected does not mean that the data is certainly normally distributed. Instead, the best one can say is that the data may have come from a regularly distributed population. In other words, the test does not give unequivocal proof of normalcy, but rather indicates that there is insufficient evidence to reject the premise of normality. It is vital to recall that normalcy tests give insight into the reasonableness of the premise of normality but do not establish it definitively. (Feldman, 2023).

3.8.2 Heteroscedasticity Test (Breusch Pagan Godfrey/White Test)

When the variability of the residuals—the differences between the observed and projected values—in a regression model is not constant across all levels of the independent variables, this is referred to as heteroscedasticity in the context of regression analysis. In other words, the values of the predictors cause a consistent change in the variance of the errors. Heteroscedasticity can produce statistical conclusions and forecasts that are erroneous (Porter & Gujarati, 2008).

3.8.3 Serial Correlation Test

Serial correlation or Durbin Watson test is used to find whether the correlation is positive or negative. It is a statistical diagnostic residual test to determine whether there is a serial correlation or no presence of serial correlation in the data set.

3.9 Conclusion

Chapter 3 demonstrates how the procedures used to provide a rigorous framework for evaluating the intricate interplay between the determinants and rice price, providing findings that lead to a better understanding of these key dynamics. The fourth chapter will analyze and evaluate the test results.

CHAPTER 4: DATA ANALYSIS AND RESULTS

4.0 Introduction

This chapter will focus on the result interpretation and data analysis of the rice price model. The analysis is conducted by using VECM model with secondary annual data of RP. Utilizing Unit Root test to check whether the data are stationary, and the existence of cointegrated relationships among variables is examined using the cointegration rank test. Vector Error Correction Model (VECM) analysis is conducted to discover the short-term dynamics in the Rice Price model. After analyzing the VECM, we tested the model with Granger Causality test to check whether there is a causal relationship between the variables. Additionally, residual diagnostic tests namely Normality (LM) test, Heteroskedasticity test, Serial Correlation test, and Multicollinearity test, are being performed. Lastly, hypotheses testing of the rice prices model will be the last part of this chapter.

4.1 Descriptive Analysis

***Table 4.1*: Descriptive Analysis of Rice Price VECM model**

	rp	***er***	***cpi***	***il***
Mean	354.7305	33.2657	2.8640	16703.6000
Median	348.7285	32.3825	2.9555	16456.6600
Max	580.2362	44.5319	7.5188	27389.2100
Min	172.7051	24.9214	-0.8594	5621.45800
Std. Dev.	109.5183	5.60280	2.2137	7067.84400
Obs	34	34	34	34

Source: Own data calculation

Table 4.1 presents the summary of the data used in this analysis. It covers Rice Price along with several independent variables that may influence RP, such as ER, CPI, and IL. The annual data from year 1990 to 2023 is collected in total of 34 observations/years for all variables.

4.2 Correlation Test

***Table 4.2*: Correlation Test of Rice Price Model**

Variables	***rp***	***er***	***cpi***	***il***
rp	1			
er	-0.3217	1		
cpi	-0.1366	-0.3744	1	
il	0.7261	0.1826	-0.5896	1

Source: Own data calculation

The table above explores the relationships between the variables through correlation analysis. Value of -0.3217 between RP and ER, the value of -0.1366 between RP and CPI, and the value of -0.3744 between ER and CPI indicates a weak negative correlation; RP and IL gas a strong positive correlation with the value 0.7261; 0.1826 suggest a weak positive correlation between the ER and IL; and lastly, the value -0.5896 indicates a moderate negative correlation between IL and CPI.

4.3 Unit Root Test

***Table 4.3*: Unit Root Tests of Rice Price Model**

Variables	ADF		PP	
	Level	1st Difference	Level	1st Difference
rp	-1.1799	**-3.2502****	-1.0863	**-3.3458*****
er	-1.7654	**-4.6393*****	-1.9106	**-4.5980*****
cpi	**-3.2577****	**-6.8701*****	**-3.2577****	**-8.5269*****
il	-1.1758	**-6.0839*****	-0.4955	**-10.4092*****

Note: ***, ** denote significance level of 1% and 5% respectively

Source: Own data calculation

The *Table 4.3* shows the unit root tests of RP and its factors. ADF and Phillip-Perron tests were performed. The unit root test results for CPI indicates that it is stationary at both level and after taking the first difference. This finding is statistically significant at 5% and 1% significance level, respectively. In the 1st difference data, all variables are significant according to the ADF and PP tests. The unit root test results shows that we can reject the idea of non-stationary at a 1 percent significance level. This means that all the data, including the rice prices, became stationary after taking the first diferrence. Since stationarity is a requirement for the VECM analysis, this confirms we can proceed with a VECM model using the first-differenced data.

4.4 Vector Error Correction Model (VECM)

4.4.1 Cointegration Equation

$$-\mathbf{0.2610}\Delta \boldsymbol{rp_{t-1}} - \mathbf{0.0002}\Delta \boldsymbol{er_{t-1}} + \mathbf{0.0052}\Delta \boldsymbol{cpi_{t-1}} - \mathbf{12.6889}\Delta \boldsymbol{il_{t-1}} = \mathbf{0}$$

t-stat:[-3.8563***] [-0.0377^{ns}] [1.0271^{ns}] [-5.1430***]

(4.4.1)

Note: *** statistically significant at 0.01 level

Source: Own data calculation

Equation *4.4.1* preview the RP model's cointegration equation. This equation highlights the long-term equilibrium relationship between RP and the other variables. However, the equation suggest that IL is the most influential factor affecting RP in this model. A significant negative long-term relationship exists between RP and IL at 1% level of significance. However, no presence of long run cointegrated relationship between exchange rate and consumer price index (proxy for inflation rate) with the rice prices in Thailand.

4.4.2 VECM Equation

$$\Delta rp_t = 4.8999 + 0.0570\Delta rp_{t-1} + 0.8669\Delta er_{t-1} + 2.8990\Delta cpi_{t-1}$$

t-stat: [0.3415 ^{ns}] [0.4665 ^{ns}] [1.1956 ^{ns}]

$$+0.0121\Delta \boldsymbol{il_{t-1}} + 6.6610e_t$$

[1.9891*]

(4.4.2.1)

$R^2 = 0.5367$ Adj $R^2 = 0.4440$

Note: * denote significance level of 1%

Source: Own data calculation

According to equation *4.4.2.1*, this equation is the VECM equation of Rice Price model. The model explains over half or 53.67% of the variation in the dependent variable as indicated by the R-squared value of 0.5367. However, the test statistic reveals that only Income Level (IL) has a statistically significant impact at a 10% significance level. This result implies that IL is the most important factor influencing the dependent variable (RP) in this model.

Thus, every one unit (THB) increase in the past Income Level (IL), on average, a positive increase of 0.0121 USD/Ton in current Rice Prices (RP). This relationship is statistically significant at a 10% significance level. In other words, when income rises in a given period, the RP tends to go up in the following period, assuming all other factors remain unchanged.

$$\Delta er_t = -0.0702 - 0.0330\Delta \boldsymbol{rp_{t-1}} - 0.3528\Delta \boldsymbol{er_{t-1}} + 0.3588\Delta cpi_{t-1}$$

t-stat: [-2.2051**] [-2.1141**] [1.6477 ^{ns}]

$$+0.0001\Delta il_{t-1} + 0.5981e_t$$

[0.2501^{ns}] *(4.4.2.2)*

$R^2 = 0.3395$ Adj $R^2 = 0.2074$

Note: ** denote significance level of 5%

According to equation *4.4.2.2* of the Exchange Rate model's results, the explanatory variables accounted for about 33.95 percent of the variation in the ER equation. Estimations reveal that the explanatory variables, namely lagged Exchange Rate (ER) and lagged Rice Prices (RP) were the important explanatory variables with statistical significance at the $\alpha = 0.05$ level.

Therefore, a 1 unit (THB/USD) increase in lagged Exchange Rate (ER), ddecreases Exchange Rate (ER) by 0.3528 unit (THB/USD) with statistical significance at the 0.05 level, all else constant. Furthermore, a 1 unit (USD/Ton) increase in lagged Rice Prices (RP), decreases Exchange Rate (ER) by 0.0330 unit (THB/USD) with statistical significance at the 0.05 level, holding other variables constant.

$$\Delta cpi_t = -0.0112 - 0.0089\Delta rp_{t-1} - 0.1522\Delta er_{t-1} - 0.5756\Delta \boldsymbol{cpi_{t-1}}$$

t-stat: [-0.70938 ^{ns}] [-1.0864 ^{ns}] [-3.14872***]

$$+0.0001\Delta il_{t-1} + 0.5981 e_t$$

[0.2501^{ns}] *(4.4.2.3)*

$R^2 = 0.4003$ Adj $R^2 = 0.2804$

Note: *** denote significance level of 1%

Source: Own data calculation

According to equation *4.4.2.3* of the Consumer Price Index model's results, the explanatory variables accounted for about 40.03 percent of the variation in the CPI equation. This equation shows that the past CPI is the most important factor influencing the current CPI. This finding is a negative relationship with statistically significant at 1% level of significance. On average, a 1% increase in past CPI leads to a decrease of 0.5756% in the current CPI, holding all other factors equal. This may indicate a self-correcting mechanism in the economy where inflation tends to slow down after a period of rising prices.

$$\Delta il_t = 186.6308 + 15.0681\Delta \boldsymbol{rp_{t-1}} + 83.3116\Delta er_{t-1} - 157.2193\Delta \boldsymbol{cpi_{t-1}}$$

t-stat: [2.4768**] [1.2595 ns] [-1.7788*]

$$+0.0213\Delta il_{t-1} + 242.7990e_t$$

[0.0964 ns] *(4.4.2.4)*

$R^2 = 0.7982$ Adj $R^2 = 0.7578$

Note: **, * denote significance level of 5% and 10% respectively.

Source: Own data calculation

According to equation *4.4.2.4* of the Income Level model's results, the explanatory variables accounted for about 79.82 percent of the variation in the IL equation. Estimations reveal that the explanatory variables, namely lagged Rice Price (RP) and lagged Consumer Price Index (CPI) were the important explanatory variables with statistical significance at the $\alpha = 0.05$ and 0.10 level respectively.

This equation finds a two fold effect on IL. First, 1 USD/Ton increase in past Rice Price (RP) leads to, on average, a positive increase of 15.0681 THB in Income Level (IL), holding other variables constant. This relationship is statistically significant at 5% significance level. Secondly, a 1% increase in past Consumer Price Index (CPI) has, on average, a negative on Income Level (IL), decreasing it by 157.2193 THB with statistical significance at 10% significance level, holding other variables constant. These findings suggest that higher RP can boost income, while CPI can put a downward pressure on IL.

4.5 Cointegration Rank Test

***Table 4.5*: Cointegration Rank Tests of Rice Price Model**

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.6106	77.0072	47.8561	0.0000
At most 1 *	0.5487	47.7685	29.7971	0.0002
At most 2 *	0.3372	23.1058	15.4947	0.0030
At most 3 *	0.2840	10.3578	3.84147	0.0013

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.6106	29.2387	27.5843	0.0304
At most 1 *	0.5487	24.6626	21.1316	0.0152
At most 2	0.3372	12.7481	14.2646	0.0856
At most 3 *	0.2840	10.3578	3.84147	0.0013

Note: Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values
Source: Own data calculation

According to *Table 4.5,* Maximum Eigenvalue and Trace cointegration test have been performed. The two tests results suggested same decision, except for the Maximum Eigenvalue of at most 2 cointegrating relationship. Reject the null hypothesis he P-value of 0.0013 which is $r \leq 1$ at $\alpha = 0.01$. The analysis confirms that there are three cointegrationg relationships in the RP model. This implies that over the long run, RP tend to move together with at least 3 other variables in the model.

Thus, the Trace test and the Maximum Eigenvalue test both revealed four cointegration equations for the long-term correlation among the variables RP, ER, CPI and IL, with the significance level at $\alpha = 0.01$ and 0.05.

4.6 Granger Causality Test

***Table 4.6*: Rice Price Model's Granger Causality Test**

H_A	*Observation*	*F-Statistic*	*P.*	*Results*
er Granger Cause *rp*	32	0.2124	0.8100	Not Supported
rp Granger Cause *er*		2.7353	**0.0828**	**Supported**
cpi Granger Cause *rp*	32	5.4822	**0.0100**	**Supported**
rp Granger Cause *cpi*		1.7173	0.1986	Not Supported
il Granger Cause *rp*	32	6.0943	**0.0065**	**Supported**
rp Granger Cause *il*		1.1992	0.3170	Not Supported
cpi Granger Cause *er*	32	0.1029	0.9026	Not Supported
er Granger Cause *cpi*		1.4879	0.2438	Not Supported
il Granger Cause *er*	32	0.2213	0.8029	Not Supported
er Granger Cause *il*		0.1021	0.9033	Not Supported
il Granger Cause *cpi*	32	1.5311	0.2345	Not Supported
cpi Granger Cause *il*		0.8841	0.4247	Not Supported

Source: Own data calculation

Table 4.6 summarizes the findings from Granger Causality Test, which explores the potential of cause-and-effect relationships between the variables. The results reveal 3 important causal relationships:

1) RP granger-causes ER at 10% level of significance. Past fluctuations in RP can influence future ER.

2) CPI granger-causes RP at 1% level of significance. Past inflation (CPI) can affect future RP.

3) IL granger-causes RP at 1% level of significance. Past IL can influence future RP.

4.7 Residual Diagnostics

***Table 4.7*: Residual Diagnostics of Rice Price Model**

Diagnostic test	***Result***	***Decision***
Normality	JB = 2.8752 0.2375 > α = 0.05	Don't reject nnull hypothesis, residuals are normally distributed.
Heteroscedasticity	0.7105 > α = 0.05	Do not reject null hypothesis. Thus, residuals have no heteroscedasticity.
Serial Correlation (LM Test)	0.4450 > α = 0.05	Don't reject H_0. Thus, residuals have no serial correlation.
Multicollinearity	R^2 = 0.2989 VIF =1/(1 - 0.2989) = 1.4263 < 5	Since VIF (1.4263) < 5, don't reject nulll hypotheiss. Thus, there is no multicollinearity.

Source: Own data calculation

To summarize, according to *Table 4.7*, which are a great result for the rice price model. The LM test, heteroscedasticity test, and serial correlation test all have P-values greater than 0.05 level or 5% level of significance. Since the P-values are higher than the critical value, we don't reject the null hypothesis for any of these tests. This means that the residuals in the RP model appreas to be normally distributed, without any signs of unequal variance or patterns over time.

As for the multicollinearity test, which checks for the correlated variables, the calculated VIF in this model is only 1.4263, which is also well below the common threshold of 5 (<5). Since the VIF is less than 5, we can't reject the null hypothesis. In other words, the RP model appreas to be free from multicollinearity, which means that the explanatory variables are not overly influencing each other;s effect on RP.

4.8 Hypothesis Testing

According to the exchange rate on rice price in the empirical literature review, exchange rate is to have a negative relationship with the rice price. The impact of the exchange rate on the commodity market has been largely influenced by the sampling period and its volatility. The fluctuations in exchange rates have had significant effects particularly in recent years, such as during the Asian Financial Crisis (1997-1998) and the Food Price Crisis of 2008. The Asian Financial crisis saw a devaluation of currencies especially in the Southeast Asian countries with the countries which are the major rice exporters, the devaluation made rice exports cheaper in the global market which leads to temporary increase in exports. But then it put upward pressure on domestic rice price within Thailand due to lower supply.

Next, the food price global crisis saw a surge in food prices which includes rice. Although it is not solely caused by exchange rates but the weakening US dollar, which made the commodities price such as rice priced in dollars become more

expensive for non-dollar currencies countries. It then caused overall price to increase. Note that a prior study used a sampling period ranging from 2006 to 2026. However, the data for 2021 to 2026 in that study was actually predicted, which means its not an actual data. This timeframe significantly differs from this research which focuses on actual data from 1990 to 2023. Moreover, Thai is a country that exports rice, and rise in the global price can increase the country earnings. This can increase demand for currency from foreign buyers who need to purchase the rice, which then leading to a higher demand for currency that led to stronger exchange rate relatively to other currencies. So, it may be the reason that the positive raltionsthip between the ER and RP found in this study is insignificant. This suggests that H_{A1} is unsupported.

H_{A1}: There is a positive relationship between Exchange Rate and Rice Price.

Similar to exchange rate, the inflation rate in this model has a positive relationship with the rice price. As in the context, CPI is used as the proxy for inflation rate in this thesis. The CPI is calculated based on a basket of goods and services that represents consumer spending. When the price of rice increases, prices of other goods may increase as well. This is due to the producers that use rice as ingredient may also need to raise the price to maintain their profit margins – Cost-Push Inflation. It may also indirectly cause by exchange rate that affect inflation, which then caused the changes in rice prices. The inputs for rice production costs goes up, the farmers have to raise the rice prices to make it profitable. Thus, this may be the reason for the insignificant positive relationship of the inflation rate in the rice price model in this study. Therefore, the alternative hypothesis H_{A2} is unsupported.

H_{A2}: There is a positive relationship between Inflation Rate and Rice Price.

Lastly, the results shows that there is a positive relationship between Income level and Rice Prices. This may be related to richer/higher statuses prefer to buy more expensive rice, however, the reality of this is more nuanced. There may be some regions in Thailand that has a market existed for premium rice varieties with higher rice prices. The wealthier households might be more likely to purchase this kind of rice due to their preferences since they have the choice, as well as specific dietary needs. Therefore, this may be the reason for the insignificant positive relationship of the Inflation Rate in the rice price model. Thus, the alternative hypothesis H_{A3} is supported.

H_{A3}: There is a positive relationship between Income Level and Rice Price.

In a nutshell, this study could provide the insight of the rice prices in Thailand. Rice Price be seen to have relationship with its factors.

***Table 4.8*: Hypothesis Testing of Rice Price Model**

Hypothesis	
H_{A1}: There is a positive relationship between Exchange Rate and Rice Price.	(0.4665) **Unsupported**
H_{A2}: There is a positive relationship between Inflation Rate and Rice Price.	(1.1956) **Unsupported**
H_{A3}: There is a positive relationship between Income Level and Rice Price.	(1.9891*) **Supported**

4.9 Conclusion

In this chapter, delves into the data analysis and interpretation of the various statistical tests conducted. We began with a descriptive analysis of the rice price model, providing a summary of the data for rice price, exchange rate, consumer price index, and income level. This was followed by correlation tests to examine the relationships between these variables and unit root tests to assess their stationarity, then followed by a demonstration of the data analysis portion.

Furthermore, the analysis of the RP model employed time-series data techniques. Unit root test results revealed that all the variables in the model exhibited non-stationarity in level. However, by transforming the data through differencing, all the variables became stationary. We then proceeded with a cointegration test to investigate if the long term relationships exits between the variables. The test results shows the preseace of cointegration, meaning the variables move together in the long run. Since cointegration was achieved at first difference level, the VECM will be the most suitable method for further analysis. To further verify the directional causal relationship between the variables in the model, the Granger Causality test was performed for time series data analysis. In addition, four residual diagnostic tests such as Heteroskedasticity Test, Normality test, Serial Correlation Test and Multicollinearity test were also conducted for the Rice Price model.

CHAPTER 5: DISCUSSION, CONCLUSION, & IMPLICATION

5.0 Introduction

This thesis concludes with Chapter 5, serves as the culmination of this research. It presents a comprehensive summary of the entire study, including a recap of research objectives, the analytical methods employed, the key findings derived from the data analysis. Furthermore, the chapter delves into the implications of this research, highlighting its potential contributions to the field. This is followed by a balanced discussion of the study's limitations, acknowledging areas for potential improvement. Finally, the chapter concludes with recommendations for future research directions that could build upon this work and explore the topic in even greater depth.

5.1 Summary of the Study

This study investigated the Rice Prices in Thailand. This section provides an overview of the earlier chapters, which covered the introduction, literature review, methods of study, and interpretation of the findings. Given the status of rice as one of the most consumed staple foods worldwide, the rice industry is one of the major contributions to Thailand’s economic growth and development. The data from Statista shows that Thailand is one of the ten largest producers of Milled Rice in the world in 2023.

In Thailand, rice is not just a staple food, but it is also a part of Thai culture and economy. Rice is a symbol of sustenance, tradition, and livelihood for many of Thai people. Additionally, Thailand's rice exports contribute substantially to the global

rice market, which showcases the agricultural prowess and economic importance in the region. The Thai rice market has historically experienced periods of imbalance in these recent years. In the supply and demand context, as a major rice exporter, Thailand experienced a surpluses and shortages of rice. As discussed, fluctuations in the Thai Baht have affected the competitiveness of the Thai rice exports. Strong Baht makes exports costly, and weaker Baht incentivize exports but raise domestic price of rice.

Moreover, the inflationary pressure in Thailand increases costs as well as changes power purchase by the consumers. Which also leads to higher rice price when the costs increase. This strain the affordability and reduce the Thai export competitiveness. The changes in demand can also be caused by the changes in incomes in Thailand. Rising incomes leads to increased demand for rice, which then putting upward pressure on rice prices, especially when the production of rice doesn't keep up with the pace of the growing demand. As income rises, there's also a chance for wages in agricultural labour may also increase. This potentially put an upward cost of production which may as well impacted exports of Thai rice.

Exchange Rate, Inflation Rate and Income Level are the variables chosen to be studied in this research. The VECM analysis were performed to accomplish both the general objective and the specific objectives. In chapter 2, the theoretical and literature reviews were discussed as well as the key theoretical model.

The VECM model was the rice price model, which was the function of the rice price, exchange rate, inflation rate, and income level in Thailand. The secondary data for these variables was collected from popular databases like Federal Reserve Economic Data (FRED), International Monetary Fund (IMF), Board of Governors of the Federal Reserve System (US), World Bank and the National Statistical Office (NSO) of Thailand.

In this analysis, over 3 decades, reveals a significant range with the highest RP reaching 580.2363 USD/Metric Ton and the lowest at 172.7051 USD/Metric Ton. Moreover, the correlation test shows a contrasting relationship between the RP and other factors. While ER and Inflation Rate (CPI as proxy) exhibits a weak negative correlation while IL shows a strong positive correlation. The risisng income tends to coincide with higher RP, whereas ER fluctuations and inflation may not directly impact to a higher RP.

All the variables examined displays a characteristics of non-stationarity, which means the trends and fluctuation were unstable over time. Thus, differencing was employed, transforming all the data to stationary at first difference. Additionally, the cointegration test confirms the presence of a long-term relationship between RP and IL. Given the presence of both non-stationarity in the data at level, VECM is the most appropriate method to use for this research. VECM allows to investigate the short-term dynamics between the variables. After conducting VECM analysis, we discussed on the findings and interpretation. Lastly, Granger Causality Test which explores the causal relationship provided insight for the RP model with 3 unidirectional causal relationships.

5.2 Implication of the Study

This research provided the findings on the factors affecting the rice prices, which are Exchange Rate, Inflation Rate, and Income Level, and the development of Rice Price model as accordance to the general objective of this research. The results showed that Exchange Rate and Inflation Rate (CPI as proxy) had insignificant positive relationship with the Rice Price, except for Income Level which had significant positive relationship with Rice Price. It is hoped that the results of this study can be a discussion for any of future government policies implementations on the Rice Price to reduce the risk of price fall or price hikes that could affect the economy and welfare of Thailand which the government would have to resolves.

Furthermore, the government can also give more support to the agricultural farmers especially paddy rice farmers to improve production which could contribute to more export of rice to surpass India. This study also could contribute to help the government to foresee what policies that could be more effective in stabilizing rice prices according to the macroeconomic factors.

Lastly, as rice is a staple food for many people, the changes and relationship in rice prices model suggests there are always a complicated market dynamics in Thailand. Rice can have an impact on food security, this study might shed a light the economic conditions, as well as helping to identify factors that could contribute to the increase of rice prices, and any geopolitical risks that affect the fluctuation in the price of rice that is sold globally. This study is crucial to ensure that everyone has access to affordable rice.

5.3 Limitation of the Study

There is always weakness in research because things rarely proceed as expected. This research has some limitation as well. In this study, there is only 30 years of data availability throughout this research, moreover it is reflected in annual data format whereas a monthly data format is more favored for more accurate analysis. Not only that, 33 number of observations in this research may be depicted as less accurate as it is fewer compared to another research with similar objectives involving other countries due to difficulties in data collection. Such factors might be easier to be obtained if its in the context of a developed country E.g. United States, whereas Thailand has only recently digitalized themselves. A lot of variables and information that might be useful to the research couldn't be obtained online and require a lot of cost and time to collect. Thus, there are limited independent variables that are available.

Furthermore, second limitation is qualitative factors. This empirical model research only concentrates on quantitative factors and tend to miss out qualitative aspects such as culture and staple preferences. In cultures, there are events in Thailand such as the Buddhist Goddess ceremonies that requires rice (Alan, 2024). This offerings during festivals may lead to temporary price rise. Difference in social statuses also leads to different consumer preference, also there are varieties of types of rice such as Jasmine rice, Basmati Rice, Brown Rice etc. The quality of rice also can be associated with higher social status, which create a niche market with higher prices for the varieties of rice.

5.4 Recommendation for Future Study

First of all, it is recommended that future scholars/researchers to extend the sampling period. Some factors in this study may not be significant as it is due to the sampling period. This study uses annual data with only 33 years of data, and according to the findings on VECM, only Income Level is the significant factor for Rice Prices. By extending the period to more than 60years of data and/or increase the number of observations such as using quarterly or monthly data, may be able to see that the variables that are insignificant in this study, may be statistically significant to affect Rice Prices in future studies. By extending the sampling period, could as well enhance the quality and the accuracy of the research.

Secondly, it is also recommended that future research to use more appropriate variables and with the quality variables. As mentioned before, this study only uses 3 variables namely Exchange Rate, Inflation Rate, and Income Level. Using more appropriate data minimizes bias and lead to more accurate findings. Some insignificant variables would reflect to the inaccuracy of the situation for the rice market. Moreover, Ensuring the quality of the variables can possibly reduces error as it can provides a more reliable measure than simply using a variable without categorization. Future studies can use detailed data that allows to explore different varieties of rice prices to reveal better on how income affects the buying habits more precisely. High quality data also can strengthen the credibility of the future research as well as the conclusion of the research.

5.5 Conclusion

In this study, we have looked into the rice industry in Thailand, with focus on the factors that are affecting the fluctuation and instabilities of the price. In the beginning, research background was discussed, in relation to the rice industry of Thailand. Prior to data examination, problem statement and objectives has been established as well to guide this study. To help with the research, a handful of discussion on related literary and variables including domestic rice prices, exchange rate, inflation rate, and income level were discussed. It is also important to look into other countries that has similar conditions as our object of discussion to provide another point of view. Indonesia was chosen due to geographical, cultural, and market similarities. Key theoretical models and frameworks includes Exchange Rate Theory and Income Elasticity of Demand. Vector Error Correction Model (VECM) as the glue that binds the previous two theories with other relevant variables is used to examine how variations from the long-term equilibrium, influenced by exchange rates and inflation rates are corrected over time. Subsequently, the primary findings were then summarized and analysed. The fourth chapter delineated the results obtained from both panel data and Vector Error Correction Model (VECM), along with a discourse on the acceptance or rejection of hypotheses within these models.

Furthermore, the study's implications were expounded upon. It is a sufficient material providing insights of factors affecting rice prices through econometrics point of view. As such, the writer believes and wish that this study can be of contribution to any policy implementation pertaining to rice price in mitigating price fall and price hikes in society. The limitations of this study includes the difficulties in obtaining and lack of high quality data, and absence of qualitative data (unexpected factors/variables) which has to be ruled out of the equation.

To close this study, recommendations for future research endeavours were provided to enhance studies in the similar topic. Future researchers should consider extending the sampling period and incorporating more relevant variables into their models to obtain better insights and strengthen the credibility of the research.

REFERENCES

Acclime. (n.d.). Covid-19 tax relief measures in Thailand. Retrieved from https://thailand.acclime.com/news/covid-19-tax-relief-measures-in-thailand/

Agyei, S. K., Isshaq, Z., Frimpong, S., Adam, A. M., Bossman, A., & Asiamah, O. (2021). COVID-19 and food prices in sub-Saharan Africa. *African Development Review*, *33*(S1). https://doi.org/10.1111/1467-8268.12525

Alan, D. (January 10, 2024). The Buddha & The Thai Rice Goddess Ceremony. Retrieved from https://mysakonnakhon.com/the-buddha-the-thai-rice-goddess-ceremony/

Anam, M. S., Nadila, D. L., & Iskandar, I. (2021). Pengaruh Jumlah Uang Beredar dan Kurs terhadap Harga Beras di Indonesia dengan Inflasi sebagai Variabel Intervening. *Samudra Ekonomi Dan Bisnis*, *12*(2), 168–183. https://doi.org/10.33059/jseb.v12i2.2429

Asian Development Bank. (April 2023). Poverty Data: Thailand. https://www.adb.org/where-we-work/thailand/poverty#:~:text=In%20Thailand%2C%206.3%25%20of%20the,died%20before%20their%205th%20birthday

Boonsawat, S. (n.d.). The effects of rice premium policy on Thailand's rice economy. Retrieved from https://digitalcommons.unomaha.edu/studentwork/1489

CFI. (December 6, 2022). Cointegration. Retrieved from https://corporatefinanceinstitute.com/resources/data-science/cointegration/

Chen, J. (July 21, 2022). Exchange Rates: What They Are, How They Work, Why They Fluctuate. *Investopedia.* Retrieved from https://www.investopedia.com/terms/e/exchangerate.asp

Eric. (June 29, 2021). Introduction to Granger Causality. *Aptech.* Retrieved from https://www.aptech.com/blog/introduction-to-granger-causality/

Feldman, K. (December 10, 2023). Navigating Data Analysis: The Importance of Testing for Normality. Retrieved from https://www.isixsigma.com/dictionary/normality-test/

Fernando, J. (August 11, 2023). What you need to know about the purchasing power of money and how it changes. *Investopedia*. Retrieved from https://www.investopedia.com/terms/i/inflation.asp.

Fitrawaty, Hermawan, W., Yusuf, M., & Maipita, I. (2023). A simulation of increasing rice price toward the disparity of income distribution: An evidence from Indonesia. *Heliyon*, *9*(3), e13785. https://doi.org/10.1016/j.heliyon.2023.e13785

Fitrawaty, Mardiyah, A., & Maipita, I. (2020). The Determination Analysis of Inflation in North Sumatra. Advances in Economics, Business and Management Research. https://doi.org/10.2991/aebmr.k.200305.093

Giang, N. K. (August 21, 2023). Vietnam and Thailand's Rice Cartel is a Hard Sell – but Rice Farmers Need More Help. https://fulcrum.sg/vietnam-and-thailands-rice-cartel-is-a-hard-sell-but-rice-farmers-need-more-help/

Hasudungan, P., Irham, I., & Utami, A. W. (2021). The impact of el niño southern oscillation and covid-19 on the rice price dynamics in Indonesia: the vector error correction model approach. *IOP Conference Series*, *883*(1), 012061. Retrieved from https://doi.org/10.1088/1755-1315/883/1/012061

Hayes, A. (March 21, 2023). Descriptive Statistics: Definition, Overview, Types, Example. *Investopedia*. https://www.investopedia.com/terms/d/descriptive_statistics.asp

Helmut, L., Pentti, S., & Carsten, T. (2000). Maximum eigenvalue versus trace tests for the cointegrating rank of a VAR process. Retrieved from https://www.econstor.eu/bitstream/10419/62268/1/723857962.pdf

Helper, S. & Soltas, E. (June 17, 2021). Why the Pandemic Has Disrupted Supply Chains. *White House Gov.* Retrieved from https://www.whitehouse.gov/cea/written-materials/2021/06/17/why-the-pandemic-has-disrupted-supply-chains/

Ismaya, B. I., & Anugrah, D. F. (2018). Determinant Of Food Inflation: The Case Of Indonesia. Department of Economics and Monetary Policy, Bank Indonesia, Jakarta, Indonesia., 21(1), 1–14. Retrieved from https://econpapers.repec.org/RePEc:idn:journl:v:21:y:2018:i:1:p:1-14

James, E. (n.d.). What is Correlation Analysis? A Definition and Explanation. *Flexmr.* Retrieved from https://blog.flexmr.net/correlation-analysis-definition-exploration

Kenton, W. (March 7, 2022). Cost Push Inflation: What It Occurs, Definition, and Causes. *Investopedia.* Retrieved from https://www.investopedia.com/terms/c/costpushinflation.asp

Klingaman, N. & Keat, W. (October 2018). El Niño 2018-19: Historical Impact Analysis. *Department for International Development.* Retrieved from https://www.dai.com/uploads/DFID_El%20Nino_2018_Historical%20Impact%20Analysis%20(University%20of%20Reading).pdf

Kusanthia, A. (n.d.) The Real Life of Thai Rice Farmers Who Produce to Feed the World. *Land Action Thai.* Retrieved from https://www.landactionthai.org/english/item/142-the-real-life-of-thai-rice-farmers-who-produce-to-feed-the-world.html#:~:text=Rice%20farmers%20make%20up%20the,9.28%20million%20hectares%20of%20rice

Macrobond. (n.d.). Unit Root Test. Retrieved from https://help.macrobond.com/tutorials-training/3-analyzing-data/analyses/statistical/unit-root-test/

Macrotrends. (n.d.). Thailand Poverty Rate 1981 – 2023. https://www.macrotrends.net/countries/THA/thailand/poverty-rate

Martins, et al. (December 2019). Secondary Data in Research – Uses and Opportunities. Retrieved from https://www.researchgate.net/publication/329343939_Secondary_Data_in_Research_-_Uses_and_Opportunities/link/5c116fba4585157ac1be12c7/download?_tp=eyJjb250ZXh0Ijp7ImZpcnN0UGFnZSI6InB1YmxpY2F0aW9uIiwicGFnZSI6InB1YmxpY2F0aW9uIn19

Namira, Y., Nuhung, I. A., & Najamuddin, M. (2019). ANALISIS FAKTOR-FAKTOR YANG MEMPENGARUHI IMPOR BERAS DI INDONESIA. *Agribusiness Journal*. https://doi.org/10.15408/aj.v11i2.11843

Nghiem, X., & Narayan, S. (2022). WHAT DRIVES PERSISTENTLY HIGH INFLATIONARY PRESSURES IN VIETNAM? SOME EVIDENCE FROM THE NEW KEYNESIAN CURVE FRAMEWORK. *Buletin Ekonomi Moneter Dan Perbankan*, *24*(4), 517–540. https://doi.org/10.21098/bemp.v24i4.1766

OriginLab. (n.d.). Normality Test. Retrieved from https://www.originlab.com/doc/Origin-Help/Normality-Test

Petersen, H. E. (May 8, 2019). Thai parties cry foul after election results favour military junta. *The Guardian.* Retrieved from https://www.theguardian.com/world/2019/may/08/thai-parties-cry-foul-after-election-results-favour-military-junta

Rehal, V. (May 4, 2022). Vector Error Correction (VECM) and VAR: Theory. Retrieved from https://spureconomics.com/vector-error-correction-vecm-theory/

Relief Web. (n.d.). Thailand: Floods and Landslides – Aug 2019. Retrieved from https://reliefweb.int/disaster/fl-2019-000104-tha#:~:text=On%2029%20August%202019%2C%20Tropical,Son%2C%20Maha%20Sarakham%2C%20Mukdaharn%2C

Reuters. (January 10, 2018). Thailand's 2017 rice exports hit record 11.48 million Tonnes – commerce ministry. Retrieved from https://www.reuters.com/article/thailand-rice-idAFL4N1P52UG.

Rising to the challenge in Asia: A study of financial markets. (n.d.). Retrieved from https://elischolar.library.yale.edu/ypfs-documents/8707

Saxon, S., Sodprasert, J., & Sucharitakul, V. (November 20, 2021). Reimagining travel: Thailand tourism after the COVID-19 pandemic. *McKinsey & Company.* Retrieved from https://www.mckinsey.com/industries/travel-logistics-and-infrastructure/our-insights/reimagining-travel-thailand-tourism-after-the-covid-19-pandemic

Statista. (April 14, 2023). Production Volume of Rice in Thailand from 2012 to 2022. Retrieved from https://www.statista.com/statistics/1108648/thailand-rice-production-volume/

The Business Times. (November 15, 2023). Thailand lifts 2023 rice export target to 8.5 million tonnes. Retrieved from https://www.businesstimes.com.sg/international/asean/thailand-lifts-2023-rice-export-target-85-million-tonnes

Timmer, C. P. (October 2008). Causes of High Food Prices. *Asian Development Bank.* Retrieved from https://www.adb.org/publications/causes-high-food-prices#:~:text=Rice%20is%20the%20clearest%20example,rice%20market%20were%20sharply%20reduced.

Trading Economics. (n.d.). Thailand Interest Rate. Retrieved from https://tradingeconomics.com/thailand/interest-rate

Tulasombat, S., & Ratanakomut, S. (2015). The effect of exchange rates on agricultural goods for export: A case of Thailand. *Information Management and Business Review*, *7*(1), 1–11. https://doi.org/10.22610/imbr.v7i1.1133

Vione, Aimon, H., & Sentosa, S. U. (2020). Inflation Analysis in West Sumatera. *ResearchGate*. https://doi.org/10.2991/aebmr.k.201126.016

Workman, D. (n.d.). Rice Exports by Country. *World's Top Exports.* Retrieved from https://www.worldstopexports.com/rice-exports-country/.

World Bank. (June 8, 2020). COVID-19 to Plunge Global Economy into Worst Recession since World War II. Retrieved from https://www.worldbank.org/en/news/press-release/2020/06/08/covid-19-to-plunge-global-economy-into-worst-recession-since-world-war-ii.1

World Bank. (2022). Population, total – Thailand. https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TH

Yanti, M. E, As'ad, O. A., & Sibuea, F. A. (2021). Economic Factors Affecting Rice Price Fluctuation in North Sumatera. Retrieved from https://www.bircu-journal.com/index.php/birci/article/view/1925/pdf

Yusiana, E., Hakim, D. B., Syaukat, Y., & Novianti, T. (2022). Analysis of factors influencing Thai rice trade based on Gravity model. Retrieved from https://iopscience.iop.org/article/10.1088/1755-1315/951/1/012039/pdf

Zeng, et al. (January 2008). Maximum Eigenvalue Detection: Theory and Application. Retrieved from https://www.researchgate.net/publication/221171186_Maximum_Eigenvalue_Detection_Theory_and_Application

APPENDIXES

Appendix 1: Cointegration Rank Test

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.610614	77.00719	47.85613	0.0000
At most 1 *	0.548675	47.76845	29.79707	0.0002
At most 2 *	0.337164	23.10584	15.49471	0.0030
At most 3 *	0.284033	10.35778	3.841465	0.0013

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.610614	29.23874	27.58434	0.0304
At most 1 *	0.548675	24.66261	21.13162	0.0152
At most 2	0.337164	12.74807	14.26460	0.0856
At most 3 *	0.284033	10.35778	3.841465	0.0013

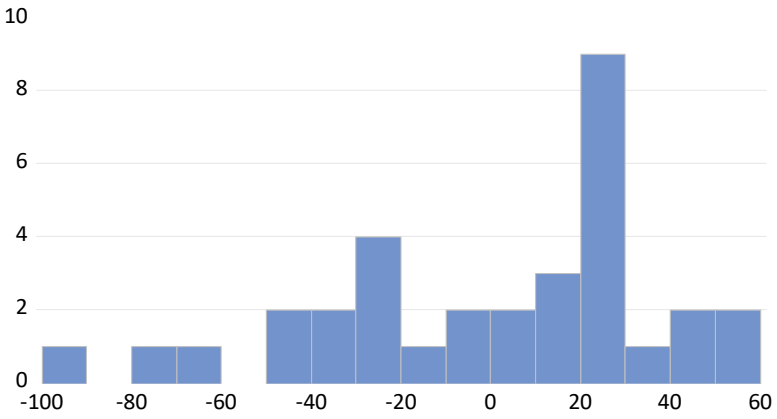
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Appendix 2: VIF

Variance Inflation Factors
Date: 04/17/24 Time: 12:13
Sample: 1990 2023
Included observations: 33

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	57.18190	1.200955	NA
DER	6.377615	1.017249	1.006896
DCPI	13.15703	1.157307	1.151046
DIL	2.27E-05	1.353149	1.146342

Appendix 3: Jarque-Bera



Appendix 4: Heteroscedasticity Test

Heteroskedasticity Test: White
Null hypothesis: Homoskedasticity

F-statistic	0.601885	Prob. F(9,23)	0.7825
Obs*R-squared	6.290599	Prob. Chi-Square(9)	0.7105
Scaled explained SS	4.439731	Prob. Chi-Square(9)	0.8802

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	1.796082	Prob. F(3,29)	0.1700
Obs*R-squared	5.170723	Prob. Chi-Square(3)	0.1597
Scaled explained SS	3.649354	Prob. Chi-Square(3)	0.3019

Appendix 5: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.696697	Prob. F(2,27)	0.5070
Obs*R-squared	1.619461	Prob. Chi-Square(2)	0.4450

Appendix 6: VECM

Vector Error Correction Estimates
Date: 04/17/24 Time: 12:24
Sample (adjusted): 1993 2023
Included observations: 31 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
DRP(-1)	1.000000
DER(-1)	9.609206 (7.40469) [1.29772]
DCPI(-1)	-6.999499 (14.4858) [-0.48320]
DIL(-1)	0.135681 (0.02608) [5.20278]
C	-79.10951

Error Correction:	D(DRP)	D(DER)	D(DCPI)	D(DIL)
CointEq1	-0.261021 (0.06769) [-3.85633]	-0.000229 (0.00608) [-0.03774]	0.005241 (0.00510) [1.02707]	-12.68887 (2.46721) [-5.14301]
D(DRP(-1))	0.056989 (0.16690) [0.34145]	-0.033048 (0.01499) [-2.20514]	-0.008926 (0.01258) [-0.70938]	15.06805 (6.08371) [2.47679]
D(DER(-1))	0.866895 (1.85830) [0.46650]	-0.352766 (0.16686) [-2.11411]	-0.152203 (0.14010) [-1.08642]	85.31157 (67.7364) [1.25946]
D(DCPI(-1))	2.899023 (2.42484) [1.19555]	0.358767 (0.21773) [1.64773]	-0.575606 (0.18281) [-3.14872]	-157.2193 (88.3869) [-1.77876]
D(DIL(-1))	0.012064 (0.00607) [1.98907]	0.000136 (0.00054) [0.25013]	-0.000338 (0.00046) [-0.73967]	0.021312 (0.22109) [0.09640]
C	4.899921 (6.66103) [0.73561]	-0.070234 (0.59811) [-0.11743]	-0.011188 (0.50217) [-0.02228]	186.6308 (242.799) [0.76866]
R-squared	0.536677	0.339522	0.400298	0.798178
Adj. R-squared	0.444013	0.207426	0.280358	0.757813
Sum sq. resids	33943.18	273.6768	192.9165	45098590
S.E. equation	36.84735	3.308636	2.777888	1343.110
F-statistic	5.791613	2.570273	3.337474	19.77427
Log likelihood	-152.4632	-77.74549	-72.32528	-263.9379
Akaike AIC	10.22343	5.402935	5.053244	17.41535
Schwarz SC	10.50098	5.680480	5.330790	17.69289
Mean dependent	4.371482	-0.004363	-0.086832	142.8913
S.D. dependent	49.41671	3.716457	3.274585	2729.206