A Grain of Hope: Analysis of The Economic Potential for an Association of South East Asian Nations (ASEAN) Rice Futures Market

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Science in Agricultural Economics

by

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Bachelor of Science in Agribusiness, 2020

August 2024
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ABSTRACT

The ASEAN (Association of Southeast Nations) region is the world's leading rice producer, yet the region lacks a dedicated *rice futures market.* In contrast other world grain markets are served by liquid futures contracts, which aid producers through price discovery and risk management. This glaring gap raises a critical question: *Can an ASEAN rice futures market be established to unlock the potential economic benefits for the region's rice sector?* By predicting ASEAN rice pricing features and analyzing the efficacy of hedging for regional rice market players, this study explores the viability of an ASEAN rice futures contract to service the ASEAN area. The study used a simulation architecture using the Thai 5% FOB rice price as a hypothetical futures contract price and prices from two other key ASEAN rice exporting and importing countries (Vietnam and Philippines) sourced from FAO GIEWS. A strong correlation between the hypothetical Thai 5% futures price and the other major ASEAN prices is a prerequisite for the success of a futures contract, which might be utilized as a risk management/hedging tool. Results show that Thai 5%, Vietnam 5%, and Philippines national average prices are highly correlated, indicating a futures contract based on Thai 5% rice has the potential to aid in risk management for Vietnamese exporters and Philippine importers. In addition, we identify a number of institutional and political challenges that would currently prevent the formulation of an ASEAN rice futures contract. Due to the absence of seasonality on the Thai5% price series, it does not make an attractive endeavor to basis trade; a necessary condition to attract more domestic market participants to enhance liquidity in the market. This analysis contributes significantly to ongoing discussions about regional agricultural cooperation and financialization efforts within ASEAN.

Keywords: Futures market, Rice, Risk Management, price dynamics, hedging effectiveness.

ACKNOWLEDGEMENTS

In heartfelt appreciation, I want to express my gratitude to Professor Andrew McKenzie, my advisor, for his unwavering guidance and assistance throughout my research journey. I am deeply grateful to Dr. Alvaro Durand-Morat and Dr. Jada Thompson, my committee members, whose academic and moral encouragement significantly enriched my work. Their valuable insights and supervision played a crucial role in refining my research. Special recognition goes to Dr. Khondoker Mottaleb for his profound expertise and contributions to this study.

I'm indebted to Dr. Lawton Lanier Nalley for his scholarly, moral, and administrative support during my time at the department. The Agricultural Economics and Agribusiness department provided an exceptional learning atmosphere, expanding my knowledge of both American and global agricultural landscapes.

My heartfelt gratitude extends to my mother, Mrs. Leora Nyarko, whose nurturing guidance and constant motivation instilled in me important values. To my siblings—Asterlina, Harrington, Denis, Beatrice, and Reginald—I owe immense appreciation for their support, tolerance, and affection, which has been a pillar of strength.

I consider myself fortunate to have amazing friends who, through their kindness, have made Fayetteville feel like home. Their generosity has made the transfer easier for me and enhanced my experience, resulting in priceless memories. To every one of my friends, I will always be grateful for the priceless gift that is your presence in my life.

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CHAPTER I

INTRODUCTION

Rice stands as the primary dietary cornerstone for nearly half of the global population, playing a vital role in upholding food security, particularly in Southeast Asia. In this region, pivotal rice consumers such as Malaysia, Indonesia, and the Philippines coexist with significant rice exporters like Thailand and Vietnam, shaping the dynamics of global rice trade (Maclean et al., 2013; Childs, Dyck, & Hansen, 2013). Notably, Vietnam and Thailand jointly contribute to almost half of the world's rice exports, while Indonesia, Malaysia, and the Philippines collectively account for around 10% of the global rice imports (Childs, Dyck, & Hansen, 2013). The rice industry's colossal scale is evident through its workforce, with an estimated 200 million farmers engaged in rice cultivation across Asia, including a staggering 36 million in Thailand, Indonesia, the Philippines, Malaysia, and Vietnam alone (Alavi et al., 2012).

The ASEAN rice market, despite its critical importance, falls short of realizing its full economic potential due to price instability, volatility, and logistical inefficiencies. For millions across Asia, rice remains a vital staple, crucial for both financial stability and food security. Yet, long-term planning faces hurdles amidst escalating risks and uncertain demand patterns in the rice sector. Consequently, Southeast Asian governments primarily focus on internal measures to safeguard food security, with limited engagement in the global rice market. To address the challenges posed by price fluctuations and spur improvements in market dynamics, establishing a regional rice futures market in Singapore has been proposed. However, opinions vary among experts regarding the effectiveness of such a market in achieving these objectives.

Significant policy adjustments are essential to foster an environment conducive to establishing a regional rice futures market, both domestically and across the region. However, the realization of these reforms seems unlikely due to countries' pursuits of self-sufficiency in rice production (Threthewie, 2012). Nevertheless, implementing a rice futures contract could offer valuable benefits for risk management and price determination within the ASEAN region. This instrument would empower market participants to safeguard against price volatility, improve price visibility, and streamline resource allocation. Nevertheless, the effectiveness of such a contract hinges on various factors, including market dynamics, the efficacy of hedging strategies, and the establishment of a robust regulatory and institutional framework to uphold market integrity and transparency.

This thesis delves into the intricacies of the ASEAN rice market, analyzing the economic viability of establishing a regional rice futures market as a potential remedy for these challenges.

Background and Context of the ASEAN Rice Market

The backdrop and circumstances surrounding the ASEAN Rice Market are intricate and involve numerous interrelated elements influencing its operation. At its core, the nations in Southeast Asia forming this market both produce and consume indica (long-grain) rice. Nevertheless, it's crucial to recognize that despite this shared characteristic, the market exhibits clear segmentation based on quality, resulting in price disparities among different nations. Notably, there's a discernible trend where Vietnamese rice tends to command lower prices compared to Thai rice of equivalent quality. This observation underscores the nuanced dynamics within the ASEAN Rice Market.

The price difference between Vietnamese and Thai 5% broken rice was most noticeable between 2000 and 2007, with Vietnamese 5% broken rice costing roughly $20 (8.4%) less on average. This price disparity increased after 2007 as a result of the food price crisis of 2007–2008, which was exacerbated by the implementation of Thailand's Paddy Price Pledging (PPP) policy between 2011 and 2014. The PPP policy led to large government stocks of rice in Thailand and an increase in rice prices both domestically and globally. Consequently, Thai rice prices witnessed a notable decline after the cessation of the PPP policy in early 2014, thereby reverting to their customary relationship with Vietnamese prices (McKenzie, 2012; Hoang & Meyers, 2015).

Embedded within an intricate network of interrelated factors, the ASEAN rice market experiences the sway of numerous elements shaping its dynamics. Among these influences lies the heterogeneous production landscapes across Southeast Asia. Nations like Thailand and Vietnam have rich fertile land and exhibit expansive, commercially driven agricultural frameworks, fostering heightened levels of productivity. Conversely, Indonesia and the Philippines feature smaller-scale, subsistence-oriented production systems, consequently yielding lower productivity outcomes (McKenzie, 2012). This diversity in productivity manifests in the yields of these nations, with Thailand and Vietnam consistently exceeding an average of 5 tons per hectare, while Indonesia and the Philippines typically achieve around 4 tons per hectare (GRiSP, 2018).

The ASEAN rice market is notably shaped by its trading dynamics and the fragmentation within the market. Despite the close proximity of ASEAN countries, there's surprisingly little intraregional rice trade. This issue stems from various factors, such as unclear pricing methods, the absence of uniform quality standards, and logistical challenges that impede smooth rice transportation across borders (McKenzie, 2012; Leung, 2014). As a result, ASEAN nations frequently seek markets outside the region for both selling and buying rice, causing price fluctuations, and overlooking chances for regional cooperation.

Furthermore, governmental interventions play a pivotal role in molding the ASEAN rice market landscape. These interventions encompass a range of policies, including price support initiatives, export constraints, and trade quotas, all aimed at ensuring food security and stabilizing domestic prices (Leung, 2014). While initially serving their intended objectives, these interventions can also yield unintended outcomes. These repercussions encompass market signal distortions, the discouragement of private sector involvement, and the escalation of price fluctuations in the long run (International Monetary Fund & United Nations Conference on Trade and Development, 2011). However, the rice trade remains small relative to other commodities. Despite being among the most widely consumed food grains globally, only approximately 6-7 percent of its total production is currently exchanged in international markets This figure pales in comparison to the trade volumes of other staples, such as wheat, with 20 percent, corn with 11 percent, and soybeans with 35 percent of their global production being traded on average (Childs & Baldwin, 2010).

The ASEAN rice market is a complex system shaped by a confluence of factors. Government policies like self-sufficiency goals and price support programs can distort the market and hinder regional trade. The fragmented market structure, with many small-scale players and limited private sector involvement, creates inefficiencies in storage, transportation, and distribution. Furthermore, inadequate infrastructure, complex regulations, and climate variability all contribute to the market's intricacies (McKenzie, 2012). Addressing these issues through regional cooperation, policy reforms, and infrastructure investments holds the key to creating a more integrated and efficient ASEAN rice market.

What do Futures Markets and Exchanges entail?

Commodity futures markets function as a stage for fair and dynamic trading of diverse commodities within a structured marketplace. This trading can occur either through traditional face-to-face auctions in a designated trading zone, termed a trading pit, or through digital platforms. While the Chicago Mercantile Exchange (CME) stands as the foremost global exchange presently, numerous other futures exchanges exist internationally, with significant hubs in Asia, as highlighted in the ADB Sustainable Working Paper Series (Prefeasibility Study of an ASEAN Rice Futures Market, 2012).

Contracts for rice futures are traded on the Chicago Board of Trade (CBOT), a subsidiary of the CME Group. The Agricultural Futures Exchange of Thailand (AFET) and the Zhengzhou Commodity Exchange (ZCE) in China have also been involved in rice futures trading historically. Most CBOT rice futures contracts are now traded electronically via the CME Group's Globex platform, highlighting the growing importance of digital trading technologies in the financial sector (McKenzie, 2012).

Advantages of Futures Exchanges

The multifaceted advantages of futures exchanges are twofold. Firstly, these markets facilitate efficient price discovery, providing crucial information for market participants all the way from farmers to exporters, retailers, and finally consumers in the supply chain. This process allows for informed decision-making regarding production and marketing strategies. Merchandising firms particularly benefit from futures markets as they offer transparent pricing, serving as a benchmark for spot market contracts. For instance, rice and other grain merchandisers in the United States use contemporaneous futures prices to devise forward contract offers to farmers, while exporters base their offers to importers on these prices. Research by McKenzie & Holt (2002) extensively documents the efficiency of futures markets in discerning prices and providing unbiased forecasts.

However, it's essential to note that futures markets rely on information for price discovery, necessitating comprehensive and regularly updated fundamental supply and demand data. The United States Department of Agriculture (USDA) has a significant role in this regard, providing vital information swiftly incorporated by futures markets, as highlighted by McKenzie (2008).

Secondly, futures markets offer significant economic benefits through price risk management, which is crucial for agribusiness firms in the United States. In today's dynamic business landscape, companies operating within procurement, merchandising, processing, and marketing of goods face intensified price fluctuations and fiercer global competition, all driven by the ever-expanding reach of globalization. To effectively navigate these challenges, these firms lean heavily on sophisticated risk management strategies and engage in basis trading, employing them as crucial tools to steer through the turbulent waters of heightened market volatility. The influence of international price shocks on domestic markets, as illustrated by McKenzie (2012), further underscores the importance of risk management strategies facilitated by futures markets.

However, it's crucial to acknowledge the limitations of futures contracts in hedging seasonal price risks. While they enable hedgers to secure prices for the duration of the hedge, which typically aligns with the maturity date of the futures contract, contracts with maturities beyond one year may lack liquidity and be challenging to trade at favorable prices. Moreover, initiating a hedge to lock in prices at the start of the hedging period can result in either advantageous or disadvantageous outcomes depending on the market conditions at that time.

Futures markets, while instrumental in reflecting current and anticipated supply and demand dynamics, do not entirely eliminate market price volatility. Nevertheless, they play a vital role in mitigating price volatility on a macroeconomic scale by smoothing prices over time and mitigating demand and supply shock impacts.

Hedging on the Futures Market for Importers and Exporters

Hedging on the futures market allows importers and exporters to manage the risk of price fluctuations. By taking a contrary position in the futures market compared to their physical transaction, they can lock in a guaranteed price for their goods, regardless of changes in the spot market.

For Exporters: Short Hedge.

Scenario 1

A Thai exporter who sells rice to a Philippine importer can enter a short futures contract on Thai 5% broken rice FOB. This means they agree to sell a predetermined quantity of rice at a fixed price at a future date. If the actual Thai5% export price has fallen when it is time to deliver, the exporter will still receive the same futures price – subject to no basis between Thai 5% futures prices and Thai 5% export prices(cash prices) and there are no losses to be compensated for.

Example:

For instance, a Thai rice exporter agrees to sell a 1000MT of rice to a Philippine importer using a short futures contract for Thai 5% broken rice FOB. In September, the exporter observes the cash market price for Thai 5% rice at $383 per ton and simultaneously sells November futures contracts at the same price, forming a basis of 0.00. As October arrives, the cash market price drops to $375 per ton, aligning with the November futures price. Consequently, the basis remains unchanged at 0.00. When it comes time to deliver in November, if the actual export price has fallen, say to $370 per ton, the exporter will still receive the fixed futures price of $383 per ton. In this scenario, there are no losses to be compensated for, as there is no basis between the Thai 5% futures prices and the Thai 5% export prices (cash prices). This example illustrates how a short futures contract can protect the exporter from price fluctuations in the cash market, ensuring a predetermined price for their rice regardless of market movements. This example is demonstrated by the subsequent T-accounts (Table 1):

Table 1: An Example of a T-Accounts Short Hedge Based on 2017 Real Prices/Ton

Month	Cash Market		Nov Futures		Basis
	Long	Short	Long	Short	
SEPT				$383	
					0.00 NOV
OCT		$375	$375		
					0.00 NOV
Effective Sale Price	$375		+$8.00		=$383

NOV = November, OCT = October, SEP = September

Scenario 2

A Vietnamese exporter who sells rice to a Philippine importer can enter a short futures contract based on Thai 5% broken rice FOB futures contract price. This means they agree to sell an already determined quantity of rice at a fixed price at a future date. If the actual Vietnamese 5% export price has fallen when it is time to deliver, the exporter will still receive the higher futures price – subject to the basis between Thai 5% and Vietnamese 5% export prices, compensating for the loss.

Example: For instance, a Vietnamese rice exporter enters a short futures contract based on Thai 5% broken rice FOB futures contract price during September. They agree to sell an agreed quantity of rice at a fixed price at a future date, aligning with the November futures contract. At this time, the cash grain price is $457 per ton, while the November futures contract price as of September is $593 per ton. This creates a November buy basis of -$131, reflecting the difference between the futures and cash market prices. However, when the exporter delivers on the contract in October, the cash market price is $457 per ton, while the November futures contract price falls to $588 per ton. Consequently, the November sell basis becomes -$135. Despite the decline in the cash market price, the exporter still receives the higher futures price, compensating for the loss incurred due to the decrease in the actual Vietnamese 5% export price. The $4 decrease in the basis from September to November showcases the unpredictable movements in basis (basis risk) and highlights the importance of hedging to mitigate such risks. This example is demonstrated by the subsequent T-accounts (Table 2):

Table 2: An Example of a T-Accounts Short Hedge Based on 2012 Real Prices/Ton

Month	Cash Market		Nov Futures		Basis
	Long	Short	Long	Short	
SEP				$593	Basis -135.00NOV
OCT		$457	$588		Basis -131.00NOV
Effective Sale Price	$457		+$5.00		=$462

NOV = November, OCT = October, SEP = September

For Importers: Long Hedge.

Scenario 3

An importer in the Philippines who buys rice from Thailand can enter a long futures contract on Thai 5% broken rice FOB. This locks in a fixed price for the rice they will buy in the future, protecting them from price increases. If the actual export price of Philippines cash prices rises, the Philippines importer effectively buys rice at the lower Thai 5% futures price – subject to the basis between Thai 5%, and Philippines cash prices.

Scenario 4

An importer in the Philippines who buys rice from Vietnam can enter a long futures contract on Thai 5% broken rice FOB. This locks in a fixed price for the rice they will buy in the future, protecting them from price increases. If the actual export price of Vietnamese rice rises, the Philippine importer effectively buys rice at the lower Thai 5% futures price – subject to the basis between Thai 5% and Vietnamese 5% export prices.

Example:

Consider a scenario where a rice importer from the Philippines, aiming to purchase rice from Thai exporters at $375 per ton during November for March delivery, takes preemptive action against potential price increases. The importer, fearing a surge in prices from the exporters, opts to hedge their position by concurrently purchasing March futures contracts, which are trading at $383 per ton. This action forms a -8.00 March (8 cents under March) buy basis, reflecting the differential between the cash and futures prices. Fast forward to January, the importer discovers that the actual export price of Thai and Vietnam 5% rice has climbed to $386 and $383 per ton respectively. Despite this price hike, the importer effectively secures rice at the lower Thai 5% futures price of $375 per ton, shielded by the -8.00 March sell basis. This strategy mitigates the impact of the price rise on the importer's bottom line, demonstrating the utility of futures contracts in managing price volatility. The T-accounts depicted in Table 3 below offer a visual representation of this scenario:

Table 3: An Example of a T-Accounts Long Hedge

Month	Cash Market		Nov Futures		Basis
	Long	Short	Long	Short	
NOV			$383		Basis -8.00 MCH
					Sell
JAN	$383			$386	Basis -3.00 MCH
Effective Purchase Price	$383		-$3.00		= $380

NOV = November, JAN = January, MCH = March

Hedging on the Futures Market for Domestic buyers and sellers of rice

Firms in the Philippines that trade rice in their own domestic markets could also use the Thai 5% futures contract to hedge future sales or purchase of rice.

Domestic Buyer Hedging:

The domestic buyer expects to purchase a certain amount of rice in the future. They can enter into a futures contract to buy Thai 5% rice at a predetermined price. When they enter into long (bought) futures (Thai 5%) position their obligation is to buy rice in the future at the initial long traded futures price subject to basis risk between Thai 5% futures and Philippines cash price. The gain in the futures contract will balance the loss on the higher priced rice purchase if the spot market price of rice rises. In contrast, the profit from buying rice at a cheaper price will be balanced by the loss in the futures contract if the price of drops in the cash markets.

Example: Assume a rice distributor in Philippines intends to buy 100 tons of rice in the Philippine cash market in three months. Spot prices are at $400/ton, but the distributor fears price hikes. They enter a Thai 5% futures contract to buy at rice at $410/ton. If Philippine spot cash prices rise to $420/ton, the distributor still pays $400/ton thanks to the futures contract, as long as the basis remains at -$10/ton, implying futures are $430. Conversely, if spot prices fall to $390/ton and basis remains at -$10/ton, the distributor is still locked in at purchase price of $400.

Table 4: T-Accounts Example of the Domestic Long Hedge

Month	Cash Market		Nov Futures		Basis
	Long	Short	Long	Short	
NOV			$410		Basis -10.00 MCH
JAN	$420			$430	Basis -10.00 MCH
Effective Purchase Price	$420		-$20.00		= $400

NOV = November, JAN = January, MCH = March

Domestic Seller Hedging:

The domestic seller expects to sell a certain amount of rice in the future. They can enter into a futures contract to sell Thai 5% rice at a predetermined price. When they enter into the futures contract, they obtain as short futures position (Thai 5%). Subject to basis, the gain in the futures contract will balance the loss on selling rice at a reduced price if the price of rice drops in the cash market. Conversely, subject to basis, the profit from selling rice at a higher cash price will be balanced by the loss in the futures contract if the price of rice rises in the cash market.

Example: Consider a scenario where a rice farmer in Philippines anticipates selling 100 tons of rice in three months. Currently, Philippine cash prices are $390/ton. To safeguard against potential price decreases the farmer decides to hedge their position by entering into a futures contract to sell Thai 5% rice at a fixed price of $400 per ton for delivery in three months. If the spot market price decreases by harvest time to $380 per ton and futures decrease to $390/ton, the farmer's effective price is $390.

Conversely, if the spot market price rises to $420 per ton by harvest time and the futures increases to $430 per ton, the farmer is still locked into an effective price of $390. In both scenarios, the farmer effectively mitigates the risk of price fluctuations in the cash market through hedging with futures contracts, ensuring a more stable and predictable revenue stream.

Challenges in the current ASEAN rice market.

The current state of the ASEAN rice market presents many challenges, and promising opportunities lie ahead. These challenges encompass various aspects that require attention and action to ensure the stability and growth of the market. One of the prominent challenges is the issue of price volatility, which stems from the fluctuations in global rice prices and localized production shocks. Such volatility affects farmers' income and threatens consumers' food security. It is crucial to address this challenge as it exposes both key stakeholders to significant risks.

Another challenge hindering the smooth functioning of the ASEAN rice market is market inefficiency. These inefficiencies are primarily attributed to fragmented trading systems, opaque pricing mechanisms, and inadequate infrastructure. A unified system is necessary to flow rice within and beyond the region efficiently. Consequently, this inhibits the market from reaching its full potential and restricts the opportunities for growth and development.

Furthermore, the limited availability of risk management tools poses a significant challenge to the rice market. Farmers and traders need well-developed rice futures markets to hedge against price risks. Risk management tools are necessary to ensure their ability to stabilize incomes and make informed decisions. Therefore, it is imperative to address this challenge by introducing comprehensive risk management tools that can enhance the resilience of stakeholders in the face of price uncertainties. On the other hand, the ASEAN rice market also presents promising opportunities that can be harnessed to benefit all stakeholders involved. One such opportunity lies in the potential for enhanced price discovery by establishing a regional rice futures market. This platform can provide transparency and facilitate price discovery, improving market efficiency. By reducing price uncertainties, this opportunity ensures that all stakeholders can make informed decisions and operate in a more stable environment.

Moreover, regional integration plays a vital role in developing the ASEAN rice market. A unified rice futures market holds the potential to foster greater regional cooperation in rice trade. By aligning strategies and collaborating on common goals, ASEAN countries can promote economic growth and food security across the region. This opportunity enhances market efficiency and strengthens ASEAN's collective bargaining power in the worldwide market for rice.

The research's remaining sections are arranged as follows. The literature review and the study's motivation are presented in Chapter 2; the conceptual framework is presented in Chapter 3; the materials and methods, as well as the model specifications, are covered in Chapter 4; the main findings and discussions are covered in Chapter 5; the conclusions and recommendations are covered in Chapter 6.

Research Objectives

In order to evaluate the possibility of an ASEAN rice futures market, the following important questions will be examined in this thesis:

1. What are the rice price dynamics and linkages among the two major export countries (Thailand and Vietnam) and importing country (Philippines) within the ASEAN region?
2. To what extent can futures contracts effectively manage price volatility in the ASEAN rice market, considering the basis risk and unique characteristics of each country's rice industry?
3. What are the optimal hedge ratios for rice exporters in Vietnam and market participants in the Philippines aiming to minimize price variance in both futures and cash markets across various time periods?
4. What are the significant challenges and limitations hindering the establishment of a successful ASEAN rice futures market, and how can these obstacles be addressed to foster market development and stability?

CHAPTER II

LITERATURE REVIEW

This review delves into the economic and operational dynamics of futures markets, tracing their historical evolution and examining successful models of regional futures exchanges within the Association of South-East Asian Nations (ASEAN). The study also addresses some challenges and opportunities inherent in establishing a regional rice futures exchange within ASEAN, along with potential market innovations. By synthesizing existing research, the review identifies gaps and provides a comprehensive insight into the feasibility and potential implications of such an endeavor.

Market Integration and Price Discovery

Rice stands as a critical commodity in ASEAN due to its significance as a staple food across the region. Countries like Thailand and Vietnam, both major rice exporters, play pivotal roles in global rice trade, underscoring the importance of rice within ASEAN's supply. With ASEAN accounting for over 40% of global rice output and consumption, the need for effective market mechanisms becomes paramount.

The review underscores the volatility inherent in rice prices, driven by factors such as weather patterns, supply fluctuations, and trade regulations. Consequently, the exploration of an ASEAN-based rice futures contract emerges as a potential instrument for mitigating risks and enhancing market efficiency.

Edi, Sirojuzilan, & and Rahmanta (2014) shed light on the intricate dance between domestic and global rice markets, emphasizing varying degrees of integration depending on rice varieties. They highlight how price shifts in one market can ripple through others, showcasing the interconnected nature of the rice trade. Understanding these connections is vital for shaping domestic rice policies, especially in regions like ASEAN, where rice holds significant importance. Their study aims to unravel the import-export dynamics within ASEAN's rice trade, outlining short- and long-term integration strategies. Additionally, it seeks to uncover the causal links between ASEAN rice market prices and the impacts of price shocks, revealing the complexities of market dynamics in the region.

A primary aim of commodity futures is to use market information to find the price of commodities in the cash market. It is crucial to determine if the agricultural futures market fulfills its intended function. Ever since the invention of derivatives, this subject has attracted a great deal of scientific attention (Rout et al., 2021). One way that economists have attempted to address this issue is to statistically test – using cointegration models – if futures and their underlying cash markets are integrated and that prices in both markets co-move or are correlated over time, which is a necessary condition for futures price discovery and effective risk management. While McKenzie and Holt, 2002 found that developed futures and cash markets for U.S. commodities are integrated, and hence futures offer accurate and impartial estimates of cash prices as well as effective hedges, results are mixed with respect to the efficacy of futures markets in developing nations.

Bose (2008) investigated if the Indian commodities futures prices from 2005 to 2007 reflect the market's effective operation. The National Commodity & Derivatives Exchange Limited (NCDEX) daily agricultural futures and spot (cash) indices are not cointegrated, according to the findings of a cointegration test. This is related to issues about the timeliness and accuracy of the agricultural cash price distribution (Rout et al., 2021).

In a study on predicting spot prices using futures prices, David, and Shaun (2011) analyzed 10 commodities across multiple exchanges for two years and found that futures prices had minimal predictive power, contradicting established market models. This aligns with Srinivasan's (2012) research using a VEC model on Indian commodities, where spot markets played a significant role in price discovery (Rout et al., 2021). Both studies suggest that spot markets hold greater weight than previously thought in determining future prices.

Ali and Gupta (2011) investigated the efficiency of India's agricultural commodities futures market between 2003 and 2008. They employed cointegration and causality tests to assess the connection between futures and spot prices for various crops. Their analysis revealed a strong long-term relationship between futures and spot prices for commodities like soybeans, chickpeas, black lentils, pepper, castor seeds, and maize. This suggests that futures market prices in India significantly influenced the physical market (spot) prices for these agricultural products over the studied period (Ali & Gupta, 2011; Rout et al., 2021).

McKenzie (2012) suggests that introducing a rice futures contract within ASEAN could significantly enhance market integration and transparency by establishing a central platform for price discovery and information exchange. This proposal indicates that such a system could streamline trading processes and improve access to crucial market data. However, Reichsfeld & Roache (2011) argue in their study "Do Commodity Futures Help Forecast Spot Prices?" that while futures markets play a vital role in reflecting current and anticipated supply-demand dynamics, they do not provide guaranteed price stability. Instead, they mirror the fluctuating nature of these conditions, which can be inherently unpredictable. While a rice futures contract could improve market efficiency and transparency, it's essential to recognize that it doesn't ensure absolute price stability but offers a mechanism for navigating supply and demand fluctuations.

Hedging and Risk Management

Rice producers, traders, and millers face significant price fluctuations throughout the production cycle. Studies like, "Hedging with Commodity Futures: Evidence from the Coffee Market in Vietnam" (Nhung et al., 2020) and "Hedging Hard Red Winter Wheat: Kansas Vs. Chicago (Wade, Buck, & Koontz, 1998) demonstrate how futures contracts effectively manage price risks in agricultural commodities. Proposing an ASEAN-based rice futures contract could provide market players with essential hedging tools to secure future prices, reducing financial vulnerabilities and enabling informed decisions on production and investments (McKenzie, 2012).

Recognizing the concept of basis risk is crucial, highlighting differences between futures and actual market prices, as discussed in "Successes and Failures of Agricultural Futures Contracts" by Garcia and Leuthold (1998). Carlton (1984) offers a historical perspective on futures markets, showing their efficiency in risk transfer and speculative opportunities. Peck (1985) expands on the economic advantages of futures markets, such as price determination and resource allocation optimization.

Hedgers use futures contracts to mitigate price uncertainties, while speculators provide liquidity and shape future prices based on their expectations. Merchants utilize futures for inventory risk management and streamlined delivery. To attract participants, markets require standardized contracts, maturity options, and supportive government measures (Telser & Higinbotham, 1977). Liquidity, gauged by trading volume and depth, facilitates cost-effective market entry and exit (Telser & Higinbotham, 1977). Pricing transparency fosters trust and market participation, while robust regulations prevent manipulation and ensure fair trading. Farmers can hedge against price volatility, access credit, and ensure fair pricing, benefiting from transparent exchanges (L. Ferguson & Scholder Ellen, 2013). Traders enjoy efficiency gains, reduced costs, and hedging opportunities, while consumers benefit from lower prices, improved quality, and enhanced food security through integrated regional trade (IMF, O., & UNCTAD, W., 2011).

Market Feasibility and Regulatory Considerations

Several studies have explored the possibility of introducing a rice futures contract centered around the ASEAN region. McKenzie (2012) outlined key prerequisites, including adequate price volatility, a well-defined underlying cash market, minimal government intervention, and robust regulatory frameworks.

Moreover, the investigation raised by McKenzie (2012) regarding the viability of a rice futures market in Southeast Asia, and its potential impact on food security, brings attention to significant concerns. Thus, it's crucial to meticulously evaluate regulatory frameworks, develop strong market infrastructure, and analyze the potential effects on food security before establishing such a market in the ASEAN region. Gray (1966) outlined the essential conditions for futures markets' success, emphasizing the need to attract both hedging and speculative activities. Conversely, factors contributing to failure encompass inadequate contract designs, market power dynamics, and the inability to stimulate speculation. Additionally, the involvement of governments and the storability of commodities are vital considerations in this context.

Specific to the ASEAN Rice Market: Why hasn't the ASEAN formed a rice futures contract yet?

The absence of a rice futures contract in Asia is puzzling and warrants an exploration of its potential benefits and the barriers to its establishment. An Asian rice futures contract could provide substantial benefits in price discovery and risk management, crucial for economic stability and growth. Price risk is a significant barrier to economic development, particularly for rice, a staple food in Asia. Events like the Ukraine-Russia conflict and the COVID-19 pandemic have shown how unexpected situations can dramatically impact commodity prices (Urak et al., 2024). Climate change and natural phenomena like El Niño further increase price volatility. Futures contracts could help mitigate these risks and stabilize prices.

Several conditions in 2012 hindered the formation of an Asian rice futures contract: the need for cash market volatility to attract hedgers and speculators, the challenge of standardizing the large and varied Asian rice markets, significant government control and interference, and the lack of reliable, transparent information on supply and demand. Assessing how these conditions have evolved since 2012 will help determine the viability of establishing a successful Asian rice futures contract today.

Market Innovation and Introduction in New Regions

The evolution of futures markets is an ongoing process spurred by the adoption of innovative technologies and financial instruments like electronic trading platforms, options, and swap contracts. These tools, labeled as "sophisticated risk management tools" in the 2012 “Prefeasibility Study of an ASEAN Rice Futures Market” by the ADB, play a crucial role in shaping the dynamic nature of financial markets. The expansion of futures markets into emerging regions such as ASEAN presents promising growth opportunities, fueled by the increasing demand for rice and the diverse production and consumption patterns observed across the region, as highlighted by the ADB in 2012. However, achieving success in establishing these markets depends heavily on carefully considering various factors, including market infrastructure, regulatory frameworks, and regional cooperation.

Successful Examples of Regional Futures Exchanges for Agricultural Commodities

Various regional futures markets have become crucial centers for the trading of agricultural goods. The Chicago Mercantile Exchange (CME), Euronext MATIF, and Tokyo Grain Exchange (TGE), play pivotal roles in facilitating the trading of agricultural commodities such as corn, wheat, and rice. They provide standardized contracts, which simplify price determination and risk management for participants across different geographical areas. These exchanges have significantly impacted global agricultural markets by offering essential risk management tools for producers and consumers worldwide.

Market Efficiency and Hedging Effectiveness

According to Ederington (1979), the goal of hedging is to limit risk, and the efficacy of hedging is measured by the variance reduction of portfolio returns. Hedging is said to be effective if the R-square in Ordinary Least Square is high, e.g. 90%. According to Markowitz (1959), the efficacy of hedging is demonstrated by the decrease in the standard deviation of portfolio returns.

In the context of an ASEAN rice futures market, further investigation is needed to assess the potential effectiveness and hedging capabilities of an ASEAN rice futures contract within the unique landscape of the region's fragmented markets. Peck's examination of commodities exchanges in centrally planned economies reveals various challenges and governmental interventions, while Bekkerman and Tejeda (2017) sheds light on the limitations of futures contracts and the importance of supplementary support markets. These studies collectively provide valuable insights into market dynamics and underscore the ongoing need for research in this area.

A prospective rice futures exchange within ASEAN presents an opportunity to enhance market efficiency, bolster resilience, and foster regional trade cohesion. Though obstacles exist, strategic coordination, regulatory alignment, and investment in infrastructure hold the key to unleashing substantial economic advantages for farmers, traders, and consumers across the area. Through collaborative endeavors involving governments, private entities, and international bodies, the establishment of a regional rice futures exchange can yield considerable economic gains while also playing a pivotal role in fortifying global food security.

CHAPTER III

CONCEPTUAL FRAMEWORK

Research Design

This study outlines a structured approach comprising three key phases. Initially, it delves into the potential hedging function of Thai 5% futures prices by analyzing its correlation with cash prices of Vietnamese 5% and Philippines National Average retail price. Following this, it computes optimal hedge ratios to provide guidance on the relative ability of a potential ASEAN rice futures markets to manage trading risk in the region. Lastly, this research investigates the possibility of practically introducing a contract for rice futures into the ASEAN market.

In order to test for cointegration between the price series, we first look at the time series characteristics of the price series to see if they are stationary in levels. The rationale being that if our hypothetical Thai 5% futures price is cointegrated with the other prices (Vietnam 5% and Philippines spot price) then the Thai 5% futures may prove to be a useful hedging tool. Cointegration between the two price series demonstrates that they have a stable long-run relationship and will adjust to price shocks over time to maintain that relationship. Given that a necessary condition for hedging effectiveness is that cash and futures prices co-move or are positively correlated, cointegration would, in turn, be a necessary statistical condition to achieve hedging effectiveness. Then, if we find the Thai5% futures price to be cointegrated with the other two prices series, we exploit this fact by estimating the cointegrating relationship and forming an error correction term, which is then used to estimate bivariate vector error correction models (VECM's). The VECM's – which better capture the true price dynamics – are then used to estimate optimal risk-minimizing hedge ratios. Ultimately, risk-minimizing optimal hedge ratios from our VECMs are compared to standard OLS optimal hedge ratios and naïve hedge ratios in terms of hedging effectiveness measures.

To address the potential usefulness of the Thai 5% hypothetical futures as a domestic hedging tool (i.e. for Thai firms involved in the procurement and storage of Thai rice in Thailand) we use an ordinary least square regression (OLS) seasonal dummy model to determine if the futures price is seasonal. A necessary condition to use a futures contract to trade basis and earn returns to storage – as U.S. grain merchandisers do – is for post-harvest deferred futures contracts to trade at higher prices than the harvest delivery month, whereby the higher deferred contract prices are embodying the higher seasonal cash prices observed in the post-harvest storage period. If Thai5% hypothetical futures prices are not seasonal, this would eliminate the potential use of basis trading as a strategy and reduce their appeal from the merchandising sector, and hence reduce the potential hedging pool of traders and the liquidity of the contract – making it less likely to succeed.

Ultimately, risk-minimizing optimal hedge ratios from our VECMs are compared to standard OLS optimal hedge ratios and naïve hedge ratios in terms of hedging effectiveness measures.

Step 1. Stationarity test (unit root test)

The Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and the Phillips-Perron (PP) unit root test (Phillips & Perron, 1988) are used to determine whether the data is stationary or non-stationary. Stationarity ensures the data's statistical properties are consistent over time, enabling accurate analysis and forecasting. The test is performed at the level stage and then at the difference stage. Order one is represented by the symbol I,(1) if the price series are stationary at the first difference stage. Similarly, prices that are stationary at the level stage are denoted by I,(0). Cointegration tests may be employed if price series are stationary in initial differences but non-stationary in levels.

Step 2. Finding the optimal lag length

To pick the best lag length for each dataset, the study utilizes the "varsoc" function in Stata. Using various criteria, including the Akaike Information Criterion (AIC) (Akaike, 1974), Schwarz Information Criterion (SC) (Schwarz, 1978), and Hannan-Quinn Information Criterion (HQ) (Hannan & Quinn, 1979), to determine the most suitable lag length. The chosen lag length is the one with the smallest statistic value among all the criteria.

Step 3. Test for Co-integration

This study employs the Johansen cointegration test (Johansen,1988) to ascertain whether spot prices across countries and hypothetical Thai 5% futures prices are cointegrated, utilizing two criteria: the max-eigenvalue test and the trace test. The null and alternative hypothesis are given below:

H_0: There is no cointegrating equation between cash and futures prices.

H_1: There is a cointegrating equation between cash and futures prices.

The null hypothesis (H_0) is rejected if the statistical values of the trace and max-eigenvalue tests exceed the 5% critical value. If there is no cointegration between the hypothetical futures, and cash market prices, the study will proceed with a Vector Autoregressive Model.

Step 4. Vector Error Correction Model (VECM)

When a bivariate relationship shows cointegration, this suggests that Granger causality exists in at least one direction. The examination of Granger causality within the Johansen cointegration model can be conducted under specific conditions with the Wald test, as outlined by Dolado and Lütkepohl (1996), and Mosconi and Giannini (1992).

If any column in the cointegration matrix (P) contains all zeros this indicates a lack of cointegrating vector in that block and signifies the absence of any causal relationship. Pair-wise causal relationship can be presented through the equation 1:

$$\begin{bmatrix} \Delta X_1 \\ \Delta X_2 \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} + \begin{bmatrix} \lambda_1 \\ \lambda_2 \end{bmatrix} (X_{1,t-1} - \beta X_{2,t-1}) + A_1 \begin{bmatrix} \Delta X_{1,t-1} \\ \Delta X_{2,t-1} \end{bmatrix} + \dots A_k \begin{bmatrix} \Delta X_{1,t-k} \\ \Delta X_{2,t-k} \end{bmatrix} + \begin{bmatrix} v_{1,t} \\ v_{2,t} \end{bmatrix} \quad (1)$$

A short-term causal relationship is represented by the parameters of matrices A_k, while the long-term equilibrium connection between the series is shown by the cointegrating parameter b.

The Johansen cointegration equation may be simplified in equation 2 and 3 in the case of bi-variate models:

$$\Delta X_{1,t} = \alpha_1 + \sum_{i=1}^{k1} b_i \Delta X_{1,t-i} + \sum_{i=1}^{k2} b_j \Delta X_{2,t-j} + \lambda_1 ECT_{t-1} + e_{t,1} \quad (2)$$

$$\Delta X_{2,t} = \alpha_2 + \sum_{i=1}^{k1} b_i \Delta X_{1,t-i} + \sum_{i=1}^{k2} b_j \Delta X_{2,t-j} + \lambda_2 ECT_{t-1} + e_{t,1} \quad (3)$$

In this examination, we delve into the connection between two sets of prices over time, $X_{1,t}$ and $X_{2,t}$, as well as the error correction term ECT. The e_t represents the error correction term following a normal distribution bounded between 0 and 1 IN(0,1). To explore immediate causation, we utilize equations (2) and (3), analyzing the importance of all previous dynamic elements. This method enables us to scrutinize the direct impacts among the variables. This thorough investigation fosters a nuanced comprehension of the short-term interactions within the price datasets.

Seasonality Testing

In this study, we employ seasonal monthly dummy variables alongside Ordinary Least Squares (OLS) regression to investigate the impact of seasonality on monthly data. First, we construct dummy variables representing each month, excluding one reference month to circumvent multicollinearity. These dummy variables allow us to capture the seasonal variations inherent in the data. The OLS regression model is then created to gauge the connection between the outcome variable and predictor variables, incorporating the seasonal effects represented by the dummy variables.

Mathematically, the model is represented as:

$$lnth5_i = \alpha + \gamma_1 D_{1i} + \gamma_2 D_{2i} + \ldots + \gamma_{11} D_{11i} + \varepsilon_i \qquad (4)$$

Where:

$Th5_i$ is the dependent variable such as the thai5% price for the ith observation.

D denotes the 11 dummy variables that denote the test for monthly seasonality, with the 12th dummy captured in the intercept.

α stands for the intercept.

γ stands for the coefficients associated with the dummy variables.

ε_i represents the error correction term following a normal distribution bounded between 0 and 1 IN(0,1).

The study will evaluate the general appropriateness of the model fit through measurements such as R-squared and p-values. Overall, our methodology integrates rigorous statistical techniques to comprehensively explore the impact of seasonality on monthly data, providing valuable insights for decision-making and further research endeavors.

Finding the Optimal Hedge Ratios

Hull (2015) posits that finding the optimal hedge ratio (h^*), which minimizes variance, depends on how fluctuations in both spot price (ΔS) and futures price (ΔF) interact throughout the hedge's duration. This highlights the importance of the correlation between these factors when designing hedging tactics. The formula for h* is calculated as equation 5:

$$h^* = \frac{\sigma^2{}_{sf}}{\sigma^2{}_{f}} = \frac{\text{Covariance of spot and futures price}}{\text{Variance of futures price}} = \frac{\text{Cov}(\Delta\text{St},\ \Delta\text{Ft})}{\text{Var}(\Delta\text{Ft})} \qquad (5)$$

where ΔS_t is cash price difference and ΔF_t is the futures price difference with σ^2_s as the variance of ΔS_t, and σ^2_f as the variance of ΔF_t.

As demonstrated by Leuthold et al. (1989), one may determine the optimal hedging ratio (h*) using OLS as in equation 6:

$$\Delta S_t = a + b\Delta F_t \qquad (6).$$

where a is the constant and b is the coefficient of the futures difference in the equation.
In the equation 6 above the calculated b also represents the optimal hedge ratio for minimizing variance in futures market trading, known as the ideal hedging ratio with the lowest volatility. The efficiency of hedging in OLS models is shown by the coefficient of determination (R^2). For the agent's aggregate spot and futures market holdings, it displays the decrease in price variance (Hull, 2012). In light of this, the first, third- and sixth-month horizon, the first, third- and sixth-month differences of rice spot prices in Vietnam and Philippines will be regressed with the first, third and sixth differences of the Thai 5% hypothetical futures price respectively. This will provide a good distribution of short- and long-duration hedges. All denominated in US dollars for metric tons.

CHAPTER IV

DATA AND METHODS

Data Description

The research employed a simulation framework, utilizing the Thai 5% FOB rice price as a hypothetical regional contract price. Price data from three crucial ASEAN rice-producing countries—Thailand, Vietnam, and Philippines—was gathered from the FAO GIEWS website (FAO/GIEWS, 2024). Thailand and Vietnam were chosen as the biggest rice exporters while Philippines was chosen as the biggest rice importer within the ASEAN region (Laiprakobsup, 2019). The monthly price series data for Thailand, Vietnam, and the Philippines spanned from January 1, 2000 through December 1, 2023. These datasets encompassed the Thai 5% FOB broken rice export price, the Vietnam 5% broken rice export price, as well as the national retail average prices for the Philippines. The selection of Philippine national average prices was not only due to their accessibility but also aimed to shed light on challenges such as government market intervention, which could potentially hinder the establishment of an efficient futures market. While presenting the opportunity to assess the potential for domestic traders to use the hypothetical futures in their domestic trade.

The Consumer Price Index of the U.S. (Rate Inflation, 2023) is used to convert all monetary variables in the price series utilized in this study into real terms, with December 2014 equal to 100. The US Bureau of Labor Statistics website served as the source for the inflation statistics. The study used the natural log of prices as this helped to normalize skewed distributions, making it easier to analyze; expresses changes as proportional increases/decreases, enabling better modeling of growth rates and stabilized variance, improving statistical tests, and allowing for interpretation of regression coefficients as percentage changes. Additionally, to support the conclusions, the study shows how well the estimated models fit the data. It is anticipated that by enhancing pricing transparency and the rice market monitoring system, the study's findings would significantly aid in the development of effective policies.

Hedge ratios are calculated for 1 month, 3 months, and 6-month calendar hedge periods as this provides a good distribution of short- and long-duration hedges. For every hedge period, the analysis uses the month of the futures contract that is closest to the month the hedge is to be terminated.

Unit Root Tests and Optimal lag length Selection

Determining if each of the price series follows the I (0) or I (1) process is essential for any time series estimate procedure. Furthermore, for every price series used, the optimal lag lengths must be determined. The rice export prices of the studied countries (Fig. 1) appear to exhibit some characteristics based on an analysis of the data series trend. Table 6 displays the stationarity test results. The critical value for both tests is set at the 5% level. The price series is stationary if the ADF value is bigger than the 5% critical value, which is -2.879. Regarding the PP test, the test statistics' 5% critical value is -2.879. We used the Stata varsoc tool to determine the best lag length for every data series. Table 5 displays the ideal lag duration that the software recommends for every pricing series.

Table 5: Choosing the Optimal Lag Length for Variables

Variable(ln)	Optimal lag length
Thailand 5% FOB Export Rice Price	2
Vietnam 5% FOB Export Rice Price	3
Philippines National Average Rice Price	2

ASEAN rice price dynamics and linkages

Johansen and Engel-Granger cointegration Tests.

The VECM for both short- and long-term price dynamics, together with the Johansen cointegration framework, will be used in the estimate of an ASEAN rice price dynamics and connections. The research uses two criteria, the max-eigenvalue test, and the trace test, to apply the Johansen cointegration test in order to determine if the cash and futures market prices are cointegrated. The following are the theories that are being examined: While H_1 shows that there is a cointegrating equation between cash and futures market prices, H_0 argues that there isn't one. In instances where the trace and max-eigenvalue statistic values are more than the 5% critical value, the hypothesis H0 will be rejected. If the contract price for futures does not show cointegration with cash prices, further actions are performed.

The cointegration framework operates within an unrestricted vector autoregressive (VAR) model, structured in error-correction form, as initially proposed by Johansen in 1988 and further developed by Johansen and Juselius in 1990. This model is represented by the equation:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \, \Delta X_{t-1} + \emptyset D_t \; + v_t \qquad (7)$$

Where X_t characterizes each of the n model variables, which are considered to be integrated of order 1 *I(1);*The parameter matrices $\Pi, \Gamma_i, \emptyset$ are subject to the estimation. Dt denotes a parameter representing the fixed components. vt is a vector of white noise error terms. A stochastic trending variable, I(1), and a non-stochastic trending variable, I(0), are irreconcilable, according to Equation (1). In simpler terms, when one variable has a random trend and another does not, they typically do not influence each other unless certain conditions are met for stationarity.

The maximum eigenvalue and the trace test are the two ways to test the reduced rank of :

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} ln(1 - \lambda_i^2) \quad (8)$$

$$\lambda_{max}(r, r+1) = -T\, ln(1 - \lambda_{r+1}) \quad (9)$$

Here, λ_i represents the estimated values of the ordered eigenvalues derived from the estimated matrix, while T signifies the number of observations following lag adjustment. The trace statistics assess the hypothesis that the count of distinct cointegrating vectors (r) is either less than or equal to a specified value, contrasting it with a broader alternative. Conversely, the maximal eigenvalue examines the null hypothesis, positing that the number of cointegrating vectors is precisely r, in comparison to an alternative hypothesis suggesting the presence of r + 1 cointegrating vectors.

Vector Error Correction Model (VECM)

VECM is more accurate for calculating the cointegration of spot and futures prices in the long run if time series data for spot and futures prices are not stationary and have long-run integration (Lien & Luo, 1993). Here is an estimated VECM:

A stated in the conceptual framework section, the Johansen cointegration equation (1) may be simplified to the following bi-variate models:

$$\Delta X_{s,t} = \alpha_s + \sum_{i=1}^{k1} b_i \Delta X_{s,t-i} + \sum_{i=1}^{k2} b_j \Delta X_{f,t-i} + \lambda_s ECT_{t-1} + e_{st} \quad (2)$$

$$\Delta X_{f,t} = \alpha_f + \sum_{i=1}^{k1} b_i \Delta X_{f,t-i} + \sum_{i=1}^{k2} b_j \Delta X_{s,t-i} + \lambda_f ECT_{t-1} + e_{ft} \quad (3)$$

Where: Eqs. (2) and (3) are used to assess the short-run dynamics, looking at the importance of each lag in the dynamic terms. The α_s and α_f are the constant terms for the spots/cash and futures equations respectively. $X_{s,t}$ represents the price time series of the Vietnam5% cash market price, and $X_{f,t}$ is the price time series of the Thai5% hypothetical futures at time t. The b_i *and* b_j terms are coefficients of the Viet5% and Thai5% rice price. The *t-i* represents the lagged values of the coefficients of the Thai5% and Viet5% rice price changes. The λ is the coefficient of the error correction term; the speed of adjustment between the cash and futures price series. The ECT_{t-1} variable is the error correction term, which is the error from the long-run cointegration equation lagged by one period. Both e_{st} and e_{ft} represents the residuals from the short-run vector error correction model from the spot and futures price equations respectively.

Vector Autoregression (VAR) Model

In the event that the price series are not cointegrated and cannot use the VECM, we go for the VAR model. According to Kumar et al. (2008), this approach reduced the issue of autocorrelation between the errors of the cash and futures price treating them as endogenous variables. The data must be stationary. The VAR model looks like this:

$$\Delta X_{s,t} = \alpha_s + \sum_{i=1}^{k1} b_s \Delta X_{s,t-i} + \sum_{i=1}^{k2} b_j \Delta X_{f,t-j} + e_{st} \quad (10)$$

$$\Delta X_{f,t} = \alpha_f + \sum_{i=1}^{k1} b_i \Delta X_{f,t-i} + \sum_{i=1}^{k2} b_j \Delta X_{s,t-j} + e_{ft} \quad (11)$$

The error term e_{st} and e_{ft} is an independent identically distributed random vector, according to the equations 10 and 11 above. The formula for the optimal hedging ratios for the VAR method is similar to that of the VECM method.

Computing optimal hedge ratios using VECM, VAR and OLS Methods.

Optimal hedge Ratios from the VECM and VAR Method

In computing the optimal hedge ratios from the VECM and VAR methods, we obtained the variance of the errors of the spot price (e_{st}) equations and the futures price (e_{ft}) equations in the form of a variance-covariance matrix. The variance of spot prices error is represented by σs and that of futures price error is σf and the covariance of both (e_{st} , e_{ft}) being σsf. The formula for h* then becomes:

$$h* = \frac{\sigma^2{}_{sf}}{\sigma^2{}_f} = \frac{\text{Covariance of spot and futures price residuals}}{\text{Variance of futures price residuals}} \quad (12)$$

Optimal hedge Ratios using the OLS Regression Method

According to Leuthold et al. (1989), the minimum variance hedge($h*$) is calculated using the ordinary least squares (OLS):

$$\Delta S_t = a + b\Delta F_t \qquad (13).$$

where the model's linear parameters are denoted by a and b.

The smallest variance optimum hedge ratio, or estimated b in equation 2, shows the overall ratio of output that ought to be used in the trade on the futures in order to produce the least variance. Given the total of the agent's holdings in both the cash and futures markets the success of hedging i.e., to reduce the variance of an agent's total position, is shown by the standard coefficient of determination (R2) in the OLS models (Hull, 2012).

In light of this, the first, third-, and sixth months' variations in rice cash prices in Vietnam, the Philippines will be regressed with the corresponding first, third-, and sixth months' variations in the Thai 5% hypothetical futures price, all expressed in US dollars for metric tons, for the first, third, and sixth months of the horizon.

Analysis of hedging effectiveness of the hypothetical futures contract price.

To assess the potential hedging effectiveness of an ASEAN rice futures contract, this study creates and analyzes portfolios of the returns based on unhedged, naïve hedged or fully hedged, and optimally hedged (from VECM or the OLS regression method). The identical spot price indexes will be produced by the unhedged portfolio for comparison. Conversely, a combination of futures and spot price index will be used to build the best hedged and hedged portfolio. Bhaduri and Durai (2008) state that the hedging effectiveness (E) is determined by comparing the variance reduction in the hedged portfolio to the unhedged portfolio.

Return on un-hedged portfolio and hedged portfolio, as follows in equations 14,15 and 16:

$$R_{(Unhedged)} = S_{t+1} - S_t \quad (14)$$

$$R_{(Fully\ hedged)} = (S_{t+1} - S_t) - 1\,(F_{t+1} - F_t) \quad (15)$$

$$R_{(Optimally\ hedged)} = (S_{t+1} - S_t) - h^*_{(Optimal)}\,(F_{t+1} - F_t) \quad (16)$$

where each portfolio's returns are $R_{(fully\ hedged)}$, $R_{(Optimally\ hedged)}$, and $R_{(Unhedged)}$. h^* is the optimal hedged ratio, while S_t and F_t are the spot and futures prices at the t time.

The capacity of various hedging techniques to lower the variance of the hedged portfolio returns or net hedged position relative to an unhedged position of cash and futures price return over the in-sample data was then used to examine the efficacy of hedging. Moreover, the percentage decrease in variance of hedged portfolio returns in comparison to the expense of an unhedged position is computed using the formula provided by Fackler and McNew (1993) in order to compare the variances more effectively. This is given by the formula:

$$1 - \frac{Var\ (Hedged\ Portfolio\ Returns)}{Var(Unhedged\ Portfolio\ Returns)} \quad (17)$$

The outcomes of the futures hedge performance are consolidated and presented in a table to offer a comprehensive summary of the effectiveness of the hedging strategy across different horizons. This approach facilitates a deeper understanding of how maintaining consistent hedge ratios impacts hedging performance over higher month horizons. After assessing how stable the VECM is, the study moves on to investigate residual autocorrelation.

The *veclmar* function in Stata performs a Lagrange multiplier test for the joint null hypothesis of no autocorrelation of the residuals of the two equations. If both the hypothetical futures and Vietnam or Philippine prices have p-values less than 5% significance level, we fail to reject the null hypothesis H_0. This will also mean that there is no autocorrelation. The primary analysis in this study was conducted using the CATS in RATS software, with STATA also employed for certain model diagnostics.

CHAPTER V

RESULTS AND DISCUSSION

General findings

4.1 Overview of the ASEAN rice market

Figure 1 shows how all three rice prices moving in synchrony with Thailand and Vietnam rice on the lower levels and Philippine national average price on the higher levels. Thailand and Vietnam prices were found to be cointegrated and highly correlated, observable from Figure 1. Additionally, the price series used for both countries were export prices. Philippine prices on the other hand has a moderate correlation with both export prices. Also, the use of the national retail average prices contributes to the difference in price levels between Thailand and Vietnam, and Philippines.

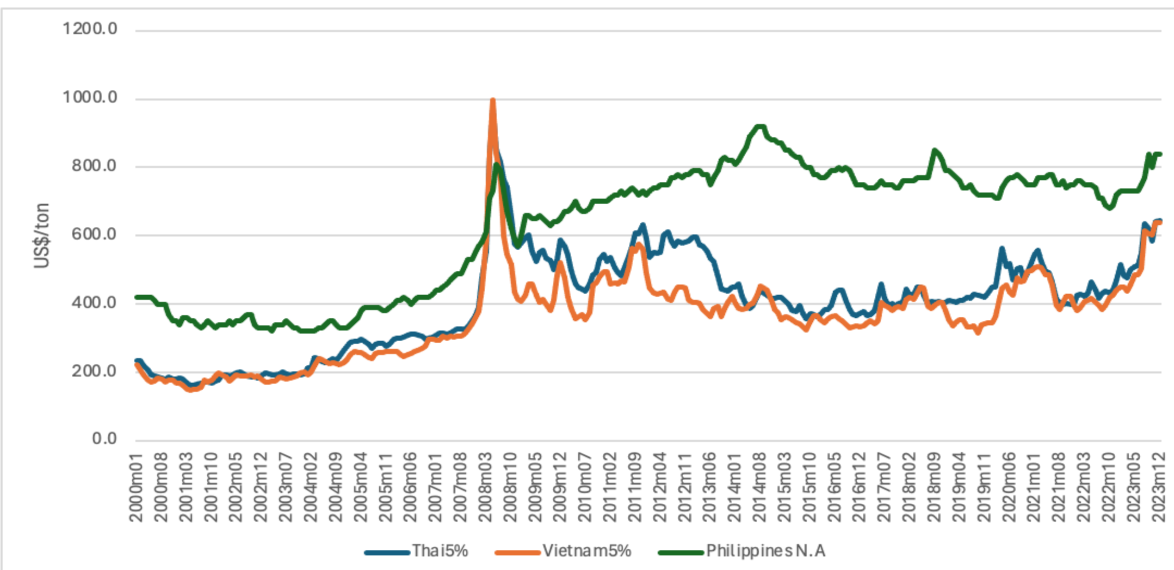

Figure 1. Real rice price of three price series (Thai5% FOB broken rice, Vietnam5% FOB broken rice, and Philippines national average) in US$/ton from January 2000–December 2023.

Source: Authors based on (FAO GIEWS, 2024)

Results from the Stationarity Test

Table 6: Augmented Dickey Fuller and Philips Perron Stationarity Tests

	ADF		PP	
Variables (ln)	Level	1st dif.	Level	1st dif.
Thailand 5%	-1.05	-11.71	-1.41	-11.59
Vietnam 5%	-1.72	-10.45	-2.33	-10.09
Philippines NA	-0.66	-12.37	-0.83	-12.30

Notes: ADF = Augmented Dickey-Fuller unit-root test for stationarity; PP = Phillips-Perron unit-root test for stationarity
Source: Author

Overall, the Table 6 results suggests that the time series data for all three countries is non-stationary at the level stage. This means that the data has a trend or seasonal fluctuations, and it cannot be used in econometric analysis without further processing. All test statistics indicate that the prices are stationary in first differences for all data series. Since all three-price series become stationary at the first difference, the Johansen Cointegration framework can be applied.

Cointegration Tests

Cointegration testing were estimated to determine whether there is a long-run correlation between the cash and futures market prices. The cointegration outcomes of the Johansen cointegration technique of reduced rank regression with the VECM are shown in Table 7. For two of the three price series, the null hypothesis of non-cointegration (k = 0) is rejected at the 0.05 level of significance.

Table 7: Johansen test for cointegration

Equation	α	β	λ_{trace} $k = 0$	λ_{trace} $k \geq 1$	λ_{max} $k = 0$	λ_{max} $k \geq 1$
Vietnam-Thailand	0.558	0.887	35.75**	3.46	32.29**	3.46
			(15.41)	(3.84)	(15.41)	(3.84)
Philippines-Thailand	-0.306	0.970	12.85	1.24	11.60	1.24
			(15.41)	(3.84)	(15.41)	(3.84)

Note: The Trace test was applied to evaluate the null hypothesis that the number of cointegrating vectors is less than or equal to k, where k represents either 0 or 1. A rejection of the null hypothesis at the 5% significance level is indicated by **. The critical values at the 5% level are sourced from λ_{trace} and λ_{max} tables, Osterwald-Lenum (1992), and are provided in parentheses below the test statistics. The cointegrating vector is normalized with respect to s_t. The lag length, determined by the AIC criteria, is indicated in parentheses following the respective price series.

The terms α and β, reported in Table 7, are the normalized intercept and futures price coefficients in the cointegrating regressions. The analysis indicates that there is evidence of cointegration between Viet5% and Thai5% evidenced by the test statistic (λtrace) of 35.75, exceeding the critical value of 15.41 at the 5% significance level. Thus, the null hypothesis (H_0: k=0) is rejected, indicating the presence of at least one cointegration equation between these variables. There is also an alpha value of 0.558 and a beta value of 0.887, which is the coefficient of the hypothetical futures (Thai5%) price series.

No cointegration is found between Phil N.A and Thai5% with the test statistic of 12.85, which is less than the critical value of 15.41 at the 5% significance level. Therefore, the null hypothesis cannot be rejected, suggesting the absence of cointegration between these two price series. In the cointegration equation, there is also an alpha value of -0.306 and a beta value of 0.970, which is the coefficient of the hypothetical futures (Thai5%) price series. In the cointegrating equations, we normalized the matrices on the cointegration cash vector because we expect the futures to have explanatory power over the spot prices in the cointegration equation.

Test for Monthly Seasonality on the Thai5% (Hypothetical Futures) Prices

Table 8. Regression Results for Monthly Seasonality on the Thai5% (Futures) Prices

Variable	Coefficients
Constant	405.15***
	(30.09)
January	-8.86
	(42.55)
February	-5.19
	(42.55)
March	-6.96
	(42.55)
April	2.52
	(42.55)
May	9.02
	(42.55)
June	5.64
	(42.55)
July	-1.74
	(42.55)
August	-1.03
	(42.55)
September	-3.31
	(42.55)
October	-11.44
	(42.55)
November	-7.17
	(42.55)
Observations	288
R^2	0.0016

Notes: *** indicates a p-value of less than 1% with standard coefficients are in parenthesis.

The regression results in Table 8 indicate coefficients for each month, assessing their impact on futures prices. Notably, the R^2 value of 0.0016 suggests extremely low seasonality. None of the coefficients except the constant exhibit statistically significant relationships with futures prices, as indicated by the p-values exceeding conventional thresholds. Consequently, these findings imply a negligible seasonal pattern in Thai 5% hypothetical futures prices. This absence of seasonality undermines the feasibility of basis trading as a strategy, thus limiting the appeal of these futures contracts for hedging purposes and potentially compromising their market liquidity and success for domestic traders within the region.

The Vector Error Correction Model Estimation Results

Table 9: Short-run Estimates and Adjustment Speeds Derived from the Vector Error Correction Model

Parameters	Vietnam-Thailand
Constant	0.0028
	(0.003)
d.(Vietnam5% Price) L_1	0.44**
	(0.073)
d.(Vietnam5% Price) L_2	-0.089
	(0.075)
d.(Thai5% Price) L_1	0.1985
	(0.077)
d.(Thai Price) L_2	-0.0975
	(0.077)
Error Correction Term Coefficient (λ)	-0.072*
	(0.037)
Durbin-Watson Statistic	1.999
Observations	285

Note: **, * indicates the significance level at 5% and 10% respectively. Standard errors are shown in parentheses for parameters.

The outcome of the regression with intercept demonstrates the cointegration of the series of futures prices and the spot price in Vietnam. According to many metrics such as AIC, SC, and HQ, the Vietnam 5% price series has an ideal lag of 3. The Vietnam 5% spot prices and the Thai 5% hypothetical futures prices show cointegration, or a long-term link, at the 5% significance level, according to the Trace and Max Eigenvalue tests. The VECM model was then estimated using the series that followed the initial difference. The overall and long-term relationships between the Vietnam5% cash prices and the Thai5% hypothetical futures prices are displayed in Table 9, which is a summary of the VECM results.

The constant is not significant, indicating it has a negligible impact on the model. The parameter d.(Vietnam Price) L_1 is highly significant, suggesting that the first lag of the changes of the Vietnam price variable has a strong positive effect in the equation. The parameters d.(Vietnam Price)L_2, d.(Thai Price)L_1, and d.(Thai Price)L_2 are not significant, indicating these specific lags of the price changes do not significantly influence the dependent variable. In practice, this means that in the Vietnam-Thailand equation, the price of Vietnam 5% is positively influenced by its price change from the previous month.

The coefficient of error correction term (λ_s) is significant at the 10% level and negative, showing that the system adjusts back to equilibrium at a monthly rate of 7.18% when deviations occur. The Durbin-Watson statistic close to 2 indicates no autocorrelation in the residuals, supporting the reliability of the model. The sample size of 285 observations enhances the robustness of these findings. In conclusion, the VECM estimation shows that while some lags do not significantly affect the dependent variable, there is a meaningful long-term equilibrium relationship, with the system correcting itself at a steady monthly rate when deviations from equilibrium occur.

The Vector Autoregressive (VAR) Model Estimation Results

Table 10: The results from the Vector Autoregressive (VAR) Model

	Philippine Price	Thailand Price
d. (Philippine Price) L_1	0.192***	0.1863
	(0.06)	(0.13)
d. (Philippine Price) L_2	0.0165	-0.1719
	(0.06)	(0.12)
d. (Thai5% Price) L_1	0.087***	0.363***
	(0.03)	(0.06)
d. (Thai5% Price) L_2	0.0480	-0.0729
	(0.03)	(0.06)
Constant	0.0014	0.003
	(0.00)	(0.00)
Observations	285	285

Standard errors in parentheses * p<0.10, ** p<0.05, *** p<0.01

Based on the data obtained on Philippine prices, both stationarity tests (ADF and PP) indicates that the price series does not meet the 5% significance level. The lag for the Philippine price is two. Between the Philippines price and the Thai5% futures price, the results from the trace and max-eigenvalue tests show an absence of significant cointegration at the 5% significance level. Therefore, the VECM model cannot be applied.

However, there is no cointegration relationship at the 5% significance level between Philippines spot prices and Thai5% rice prices (hypothetical futures). Since Philippines and Thailand are not cointegrated, we go ahead to conduct a VAR analysis using Philippines national retail average price as the dependent variable and the Thai5% price as the independent variable. The results of the analysis are displayed in table 10.

The table presents the results from a Vector Autoregressive (VAR) model involving some variables: Philippine and Thailand (hypothetical futures) and the lagged values of their price changes. Each variable is analyzed in terms of its relationship with the others over two lag periods.

Starting with the Philippine Price, in the first lag period, there is a significant positive relationship ($p<0.01$) with its own lagged value (0.192). However, in the second lag period, this relationship becomes insignificant. Similarly, the Thai5% price exhibits a highly significant positive relationship with lagged value the Philippine price and that of its own (0.087, 0.363, ***$p<0.01$). This suggests a strong short-term dependence of futures price and on its past values.

Analysis of Basis Risk and Hedging Effectiveness.

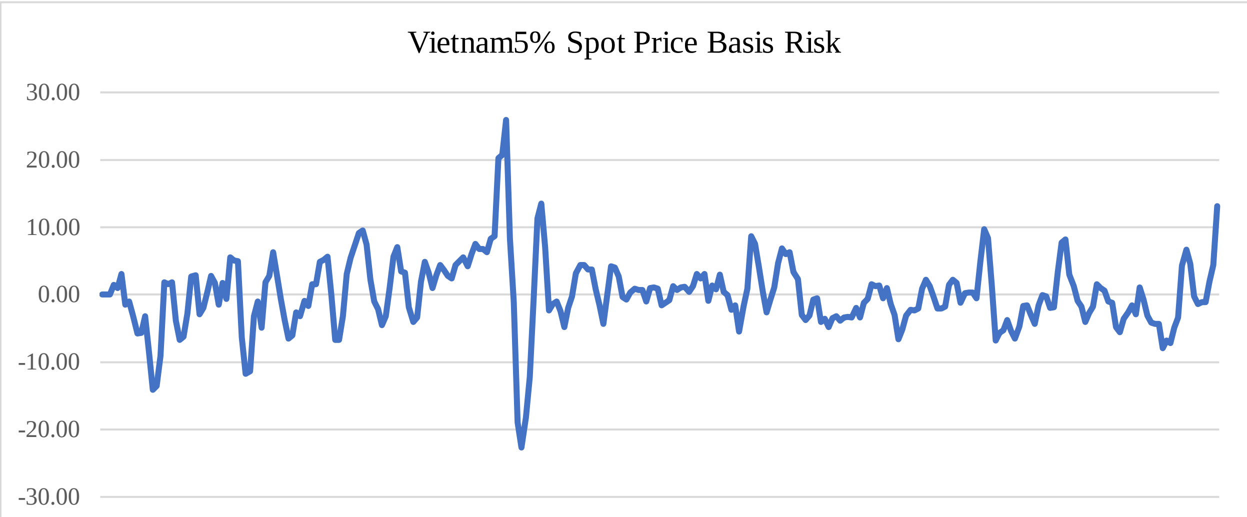

Figure 2. Vietnam5% rice basis risk. Spot prices: Vietnam5% FOB broken rice in natural log form, hypothetical futures price: Thai5% FOB broken rice in natural log form. In US$/ton from January 2000–December 2023.

Source: Based on authors calculation.

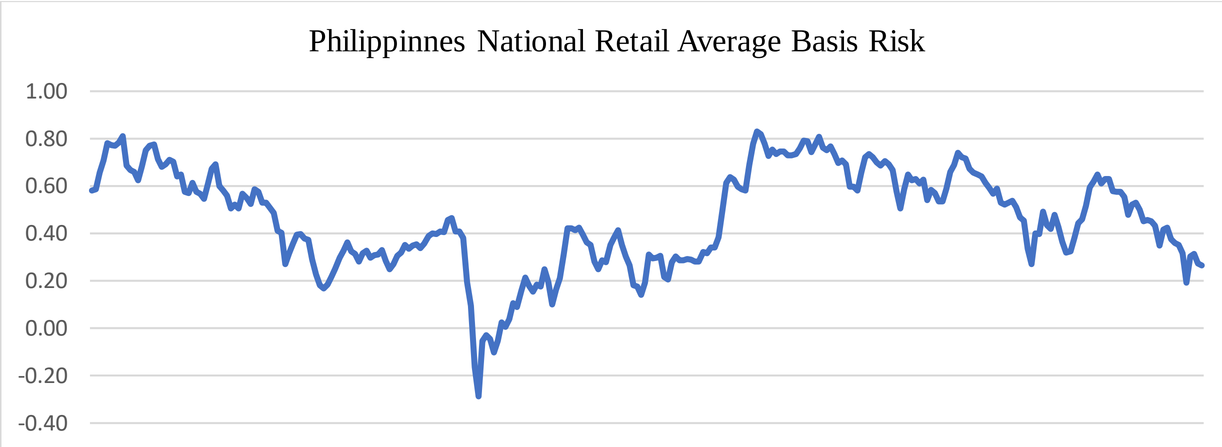

Figure 3. Philippine price basis risk. Spot price: Philippine National Average rice price in natural log form. Hypothetical futures price: Thai5% FOB broken rice in natural log form. In US$/ton from January 2000–December 2023

Source: Based on authors calculation.

The examination of Vietnam5% rice basis revealed a distinct seasonal trend emerging post the 2008 price shock. Moreover, in the Philippines, the observed positive basis could be attributed to the scrutinized price data. The absence of negative basis does not indicate strong outcomes.

Results from the estimation of the Unhedged, Fully Hedged and Optimal Hedge Ratio (h)*

From the VECM model, we derived a covariance of the Vietnam5% (spot price) and the Thai5% (hypothetical futures price) residual value (est eft ~ σ^2sf) of 0.0014939 and a Thai5% (hypothetical futures price) residual variance value (eft~σ^2f) of 0.0023193. The optimal hedge ratio for Vietnam5% price on Thai5% price from the VECM model was calculated as h^*_{VECM} = 0.0014939/0.0023193 = 0.6442, indicating that investors should allocate 64.42% of their total asset value to Thai5% futures contracts.

Similarly, the VAR model provided a covariance the Philippine national retail average (spot price) and Thai5% (hypothetical futures price) residual value (est eft ~ σ^2sf) of 0.0003124534 and a Thai5% (hypothetical futures price) residual variance value (eft~σ^2f) of 0.0024988456. From the VAR model, the optimal hedge ratio for the Philippines national retail average price on the Thai5% (hypothetical futures) was calculated as h^*_{VAR} = 0.0003124534/0.0024988456 = 0.1250, indicating an allocation of 12.50% of total assets to Thai futures contracts.

This means investors should purchase Thai futures contracts equivalent to 64.42% of their total asset value for Vietnam and 12.50% for the Philippines. For instance, with a $100,000 portfolio, an investor would buy Thai futures contracts worth $64,420 for Vietnam and $12,500 for the Philippines. This strategy allows investors to mitigate risk exposure by balancing losses in the spot market with gains in the futures market, optimizing the trade-off between risk and return. By adhering to these hedge ratios, investors can ensure they maintain a stable investment outcome without being overly or underly hedged

The study operates under the assumption that maintaining consistent hedge ratios across longer horizons may yield diminishing benefits. This assumption stems from the understanding that optimal hedge ratios, derived from the one-month horizon, may not offer as much assistance as we extend our timeframes. The rationale behind this lies in the presence of an error correction term within the VECM, implying cointegration and high correlation between the price series, particularly favoring the Vietnam-Thailand price relationship.

In light of this premise, the research retains the optimal hedging ratios obtained from the one-month horizon and applies them to the 3 and 6-month horizons to explore their efficacy further. This approach seeks to investigate how maintaining these ratios over longer periods could potentially benefit our study. Moreover, computations based on the optimal hedging ratios derived from the VECM/VAR for Vietnam and Philippines, alongside OLS with AR term, are utilized to construct a hedge portfolio. This portfolio is then employed to evaluate the performance of futures hedging.

The outcomes of the futures hedge performance are consolidated and presented in Table 11 and 12, offering a comprehensive summary of the effectiveness of the hedging strategy across different horizons. This approach facilitates a deeper understanding of how maintaining consistent hedge ratios impacts hedging performance over higher month horizons.

Table 11: Futures Hedging Performance and Hedging Effectiveness for Vietnam-Thailand Price Model

Model (Vietnam-Thailand)		Price Variance of Position ($)	Standard Deviation. of Hedged and Unhedged Position (%)	Fackler Risk Reduction from Unhedged Position (%)
1-month hedge horizon	Unhedged	339.53	6.00%	--
	Naïve/Fully Hedged	338.19	4.80%	35.99%
	VECM Optimally Hedged	338.09	4.58%	41.54%
	OLS Optimally Hedged	338.10	4.59%	41.64%
3-month hedge horizon	Unhedged	348.32	13.38%	--
	Naïve/Fully Hedged	341.66	8.30%	61.25%
	VECM Optimally Hedged	342.18	8.84%	56.35%
	OLS Optimally Hedged	342.30	8.87%	56.05%
6-month hedge horizon	Unhedged	361.09	19.10%	--
	Naïve/Fully Hedged	344.48	10.59%	69.28%
	VECM Optimally Hedged	345.94	11.69%	62.55%
	OLS Optimally Hedged	346.16	11.74%	62.20%

Table 12: Futures Hedging Performance and Hedging Effectiveness for Philippines-Thailand Price Model

Model (Philippines-Thailand)				
1-month hedge horizon	Unhedged	596.22	2.63%	--
	Naïve/Fully Hedged	598.49	5.18%	-286.25%
	VAR Optimally Hedged	595.90	2.50%	10.04%
	OLS Optimally Hedged	595.90	2.50%	9.94%
3-month hedge horizon	Unhedged	599.01	5.60%	--
	Naïve/Fully Hedged	607.14	10.10%	-225.86%
	VAR Optimally Hedged	597.40	5.09%	17.38%
	OLS Optimally Hedged	597.39	5.08%	17.70%
6-month hedge horizon	Unhedged	602.97	8.11%	--
	Naïve/Fully Hedged	617.42	13.82%	-190.32%
	VAR Optimally Hedged	601.19	7.09%	24.08%
	OLS Optimally Hedged	601.15	7.07%	23.59%

Vietnam-Thailand Price Model

The table 11 provides a comparative analysis of hedging strategies across different hedge horizons for the Vietnam-Thailand and Vietnam-Philippines price models. In each scenario, the position's price variance, standard deviation of hedged and unhedged positions, and the percentage of risk reduction from the unhedged position are evaluated.

For the one-month hedge horizon, the unhedged position exhibits a price variance of $339.53, with a standard deviation of 6.00%. By contrast, employing a naïve/fully hedged strategy slightly reduces the price variance to $338.19, accompanied by a decrease in the standard deviation to 4.80%. This represents a risk reduction of 35.99% from the unhedged position. Notably, utilizing the VECM optimally hedged approach yields a further reduction in both the price variance to $338.09 and the standard deviation to 4.58%, resulting in a greater risk reduction of 41.54%. Similarly, employing the Ordinary Least Squares (OLS) optimally hedged strategy leads to comparable outcomes, with a risk reduction of 41.64%.

Moving to the three-month hedge horizon, the unhedged position exhibits increased price variance and standard deviation, amounting to $348.32 and 13.38%, respectively. Employing a naïve/fully hedged approach significantly reduces the price variance to $341.66 and the standard deviation to 8.30%, resulting in a substantial risk reduction of 61.25% from the unhedged position. However, both the VECM and OLS optimally hedged strategies provide slightly lesser risk reduction percentages, with reductions of 56.35% and 56.05%, respectively, albeit maintaining lower price variances and standard deviations compared to the unhedged position.

For the longest hedge horizon of six months, the unhedged position experiences the highest price variance and standard deviation, amounting to $361.09 and 19.10%, respectively. Employing a naïve/fully hedged approach leads to significant risk reduction, reducing the price variance to $344.48 and the standard deviation to 10.59%, resulting in a remarkable risk reduction of 69.28% from the unhedged position. Similarly, both the VECM and OLS optimally hedged strategies provide notable risk reductions, with reductions of 62.55% and 62.20%, respectively, while maintaining lower price variances and standard deviations as compared to an unhedged position.

In summary, the analysis demonstrates the effectiveness of various hedging strategies across different hedge horizons, with both the VECM and OLS optimally hedged approaches offering considerable risk reduction benefits compared to naïve/fully hedged or unhedged positions, particularly evident over longer timeframes.

Philippines-Thailand Price Model

Concerning the results from the 1-month hedge horizon, the unhedged position shows a price variance of $596.22 with a standard deviation of 2.63%. This is the baseline against which other strategies are compared. The naïve/fully hedged strategy increases the price variance to $598.49 and the standard deviation to 5.18%, resulting in a Fackler risk reduction of -286.25%. This indicates that the naïve approach is not only ineffective but significantly worse than not hedging at all. In contrast, the VAR optimally hedged strategy brings the price variance down to $595.90 with a lower standard deviation of 2.50%, achieving a 10.04% risk reduction. The OLS optimally hedged strategy mirrors these results with the same price variance and standard deviation, but with a slightly lower risk reduction of 9.94%. Both VAR and OLS strategies show effective risk management, significantly reducing the risk compared to the unhedged position.

Over a 3-month hedge horizon, the unhedged position has a price variance of $599.01 and a standard deviation of 5.60%. The naïve/fully hedged approach again performs poorly, increasing the price variance to $607.14 and the standard deviation to 10.10%, leading to a negative risk reduction of -225.86%. The VAR optimally hedged strategy reduces the price variance to $597.40 and the standard deviation to 5.09%, achieving a 17.38% risk reduction. Similarly, the OLS optimally hedged strategy slightly improves on this with a price variance of $597.39 and a standard deviation of 5.08%, resulting in a 17.70% risk reduction. Both strategies demonstrate effective risk mitigation, with the OLS approach performing marginally better than the VAR.

For the 6-month hedge horizon, the unhedged position shows a price variance of $602.97 and a standard deviation of 8.11%. The naïve/fully hedged strategy further increases the price variance to $617.42 and the standard deviation to 13.82%, resulting in a substantial negative risk reduction of -190.32%. The VAR optimally hedged strategy reduces the price variance to $601.19 and the standard deviation to 7.09%, achieving a significant 24.08% risk reduction. The OLS optimally hedged strategy closely follows with a price variance of $601.15 and a standard deviation of 7.07%, providing a 23.59% risk reduction. Both strategies prove highly effective, with the VAR approach slightly outperforming the OLS when it comes to risk reduction.

Discussion

The results show that the spot price in Vietnam and the series of futures prices, represented in this study by the Thai5% FOB price, are cointegrated. The different criteria like AIC, SC, and HQ show that the Vietnam5% price series has an optimal lag of 3 in the model. The Trace and Max Eigenvalue tests indicate a cointegration (long-term relationship) at the 5% significance level between Vietnam5% spot prices and the thai5% hypothetical futures prices. The study then uses the series after the first difference to estimate the VECM model. Table 9 summarizes the VECM results, showing the overall relationship and the long-term relationship between Vietnam5% cash prices and the Thai5% hypothetical futures prices.

It can be seen that the volatility of the hypothetical futures market prices and the Vietnam rice cash market prices is less affected by changes in the short run. The VECM's primary function is to identify any imbalances and reroute system variables to achieve equilibrium. Table 9 shows that the coefficient (λ) of the error correction term as leading the cash prices back to the futures prices by 7.18% on a monthly basis which means that Thai futures can be used as instruments for price risk hedging for rice exporters in Vietnam.

The study, using the VECM model, finds that Thai5% futures contracts can serve as effective risk management tools for the Vietnam cash market in the short and long term. However, these futures contracts are not suitable for long-term risk management in the Philippines' market due to the absence of cointegration, which means there is no expectation for the futures and cash markets to co-move over time.

These lower optimal hedging ratios result from a loose relationship between Philippines spot prices and the Thai5% hypothetical futures prices, which means Philippine rice producers would not be able to use Thai5% based futures contract as a domestic risk-management tool. With respect to the Vietnamese exporters, results from the hypothetical futures hedging performance have proven naive/fully hedged positions to be equally effective as the optimal hedge ratio positions at the 1 month hedging horizon, and superior to the he optimal hedge ratio positions at the 3- and 6-month hedging horizons. This is because the OLS and VECM based optimal hedging ratios (coefficient of futures price series) of about 0.916 or 91.6% are close to 1, which is similar to the ratio associated with a 100% naïve hedge.

Hedging positions determined by optimal hedging ratios are more effective than a naïve/ fully hedged position for Philippine domestic producers seeking to hedge using a Thai5% futures contract. This is because Thai5% and Philippine prices are not well correlated. Taking a naive hedged position as a Philippine domestic producer/storer of rice would increase risk compared to not hedging over all horizons. However, despite the hedging performance of using optimal hedging positions, the Philippine domestic producer/storer of rice would only be marginally better off employing these strategies versus not hedging. Note the much lower price volatility in Philippine cash market (Table 12), which may be attributed to Government policies to control and stabilize prices which illustrates that Government intervention and private futures markets are substitutes for price risk management, and the presence of Government intervention reduces the need for a futures market.

However, whether this is optimal from an economic welfare standpoint is another issue, as such interventionist policies come as at a significant cost. As such, and in the current market environment – although the level of intervention has been reduced in recent years with the

Philippine's National Food Authority (NFA) having less interventionist power – we may conclude that a Thai5% futures contact would do little to help the domestic Philippine market.

One caveat to our results regarding the hedging effectiveness afforded by a Thai5%- based futures contract to Vietnamese exporters and Philippine importers is that the analysis is based on in-sample data. To accurately gauge the contract's potential, an out-of-sample hedging effectiveness analysis would need to be conducted.

The viability of introducing a rice futures market into the Philippines domestic market

Four main root causes have been identified by McKenzie (2012): (1) inadequate cash price volatility due to price stabilization in many countries across the ASEAN region; (2) lack of standardization as to the quality and varieties of rice to be used; (3) frequent government intervention in the cash markets; and (4) lack of free flow of information to attract speculative interest to a contract. The findings from this study are supportive of the first cause, indicating that price stabilization policies in the Philippines have indeed led to inadequate cash price volatility to make futures an effective risk management tool. This has made it challenging for market participants to accurately gauge market signals and make informed trading decisions, thus limiting the effectiveness of price discovery mechanisms. Furthermore, the study highlights how these stabilization measures can inadvertently dampen speculative activities, which are essential for providing liquidity and depth to the market.

According to in-depth interviews, ASEAN experts on rice emphasize how important liquidity is to the success of futures on the local commodities exchange. A significant shift in spot prices pushes traders and rice growers to look for effective ways to manage their price risk. Furthermore, in the context of emerging nations like Thailand, Philippines, and Vietnam, the involvement of the government is crucial. The current low volatility of the rice market prices makes it difficult for rice importers and merchants in the Philippines to hedge their risks. Put another way, experts on rice say that unless certain conditions are satisfied, it is still not practical to start a regional rice futures exchange for Philippine prices.

CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

The research aimed to assess the feasibility of introducing a rice futures contract for Thailand to serve the ASEAN region, using Thailand's FOB price for long-grain rice with 5% broken. It involved analyzing ASEAN rice price dynamics, linkages, basis risk, and hedging effectiveness assuming the Thai5% FOB price as a hypothetical regional contract price. Our research findings represent a first step in assessing the establishment of a rice futures contract for ASEAN, which would include rice markets in Thailand, Vietnam, and the Philippines, even though comparable studies have demonstrated that a rice futures market was not feasible for ASEAN countries. Long-term goals include using the price dynamics of ASEAN rice futures to create a worldwide market with different pricing and delivery options, similar to futures contracts for coffee and cocoa.

Additionally, our research showed that the dynamics of ASEAN rice prices show synchronicity between the prices of rice in Thailand and Vietnam, with the Philippines constantly having higher prices. Moreover, cointegration of two of the three rice price series indicates a common long-term equilibrium connection. Furthermore, a seasonality trend following the 2008 price shock was discovered by evaluating the price basis of Vietnam5%-Thai5%, and Philippine-Thai5%. Vietnam and the Philippines were found to have different optimal hedge ratios, indicating differences in hedging effectiveness.

The primary benefit of an ASEAN rice futures contract is that it may provide international rice dealers and exporters with risk management benefits. Growth in the global market through improved trade liberalization policies and more private sector participation in managing imports and exports would increase the likelihood of success (McKenzie 2012). The Thai5% could be used for forward contracts between Philippine domestic market participants instead as fees associated with trading rice futures contracts on futures exchanges, including broker margins and storage costs, could significantly reduce any potential hedging benefit. These fees can vary depending on factors like contract size and trade volume.

These results are largely influenced by the use of different price data sources. While the 5% broken FOB export rice price was used for Thailand and Vietnam, the national retail average prices was used in the case of the Philippines. This discrepancy can lead to differences in price volatility, market dynamics, and sensitivity to external factors, potentially affecting the consistency and comparability of the stationarity test outcomes across these countries. In order to inform the creation of potential ASEAN rice futures contract specifications and formulation procedure, this analysis sought to identify potential contract users and evaluate whether the hypothetical rice futures market contract would fulfil the demands of hedging for importers in the Philippines and exporters in Vietnam.

While it has been a while since the last feasibility study was conducted, it is important to acknowledge that most of these conditions for a successful futures contract have still not been met and hence continue to make the market less favorable for the establishment of a regional rice futures exchange. It is important to re-emphasize that attention be given to the necessary requirements for a successful futures market as outline by McKenzie (2012).

Nevertheless, our research results point out that in the short term, the futures contract could be much beneficial to Vietnamese exporters especially on the three- and six-month contracts. This could also prove an effective hedge in the long-term given the error correction term which causes the futures contracts to align back to the cash market prices. As indicated in the discussion, the naïve hedge effectively reduces price risk for exporters in Vietnam.

On the part of Philippines, the hypothetical futures contract could prove an effective hedging mechanism in the short term but not in the long-term given. The optimal hedge ratios are advised for the Philippine domestic markets as the naïve hedge would result in increased price risk versus not hedging for domestic producers and traders. Using the optimal hedge ratios on the futures could bring the prices down a below the cash market prices. Accounting for margins and fees that comes with hedging in the futures exchange would not be profitable for domestic producers and traders. The research proposes that futures prices could be a great tool for forward contracting instead of hedging with the futures.

On the account of government intervention, it is important to note that transforming the political and governmental stance on rice in Asia is unlikely to happen quickly, if at all. Nonetheless, any shift towards enhanced market freedoms and increased private trade in both international and domestic markets would bolster the success of futures contracts. For instance, eliminating the NFA's involvement in the Philippine rice market is a positive development.

It is essential to expand the pool of potential traders, including both hedgers and speculators. Providing comprehensive futures market education to the entire industry is crucial to expanding the potential hedging pool beyond the currently small number of sophisticated firms that benefit from a lack of futures market price transparency. Through education, the initial hedging volume required for the success of the contract could be achieved. Once the contract gains traction, all industry participants, including the sophisticated firms, will engage. This trend has been observed in the development of U.S. futures markets, where initially hesitant large firms have become the major users once the contract has attained significant trading volume.

Price discovery is also essential for fair pricing in Asian rice markets. In 2012, firms that understood futures markets resisted the idea of a rice futures contract, fearing it would reduce their competitive advantage. Ironically, those who would benefit most from such a market lacked the knowledge to support it, contributing to the contract's failure. Furthermore, considering the close link between the U.S rough rice futures on the CME and the Thai5% broken FOB export price, the implementation framework might be designed in conjunction with U.S futures markets. Specific guidelines could cover topics like specifications for the rice futures contract, the roles of market makers, speculators, industry agents' catalysts, and initiatives in education.

In conclusion, the U.S futures contract for rice took 30 years to develop—quite a while compared to soybean and corn futures—but the success of a futures market also depends on elements like tenacity, agent dedication, and education—the latter of which is especially important for the ASEAN rice futures market to prosper and distribute its financial gains to stakeholders.

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