

Food Security Policy Project (FSPP)

THE CHALLENGE OF EXPORT-LED AGRICULTURAL GROWTH WITH MONOPSONISTIC MARKETS: THE CASE OF MYANMAR'S PULSE SECTOR AND TRADE WITH INDIA

By

Duncan Boughton, Steven Haggblade, and Paul Dorosh



Food Security Policy *Research Papers*

This *Research Paper* series is designed to timely disseminate research and policy analytical outputs generated by the USAID funded Feed the Future Innovation Lab for Food Security Policy (FSP) and its Associate Awards. The FSP project is managed by the Food Security Group (FSG) of the Department of Agricultural, Food, and Resource Economics (AFRE) at Michigan State University (MSU), and implemented in partnership with the International Food Policy Research Institute (IFPRI) and the University of Pretoria (UP). Together, the MSU-IFPRI-UP consortium works with governments, researchers, and private sector stakeholders in Feed the Future focus countries in Africa and Asia to increase agricultural productivity, improve dietary diversity, and build greater resilience to challenges like climate change that affect livelihoods.

The papers are aimed at researchers, policy makers, donor agencies, educators, and international development practitioners. Selected papers will be translated into French, Portuguese, or other languages.

Copies of all FSP Research Papers and Policy Briefs are freely downloadable in pdf format from the following Web site: www.foodsecuritypolicy.msu.edu

Copies of all FSP papers and briefs are also submitted to the USAID Development Experience Clearing House (DEC) at: <http://dec.usaid.gov/>

AUTHORS

Boughton and Haggblade are both Professor, International Development, Department of Agricultural, Food, and Resource Economics (AFRE) at Michigan State University (MSU); Dorosh is Director of IFPRI's Development Strategy and Governance Division.

Authors' Acknowledgment

The authors acknowledge the generous support of the United States Agency for International Development (USAID) and the Livelihoods and Food Security Trust (LIFT) fund. The authors also wish to thank Patricia Johannes for editing and formatting assistance. The views expressed are entirely the responsibility of the authors and do not reflect any position of USAID or LIFT.

This study is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the Feed the Future initiative. The contents are the responsibility of the study authors and do not necessarily reflect the views of USAID or the United States Government

Copyright © 2018, Michigan State University. All rights reserved. This material may be reproduced for personal and not-for-profit use without permission from but with acknowledgment to MSU.

Published by the Department of Agricultural, Food, and Resource Economics, Michigan State University, Justin S. Morrill Hall of Agriculture, 446 West Circle Dr., Room 202, East Lansing, Michigan 48824, USA.

EXECUTIVE SUMMARY

Pulse crop exports from Myanmar grew from nothing to a \$1 billion per annum export industry over the past 30 years. The sector offered uniquely attractive returns to both smallholder farmers and traders during three decades of international isolation and underinvestment in agriculture. Myanmar managed this exceptional feat despite financial sanctions, acute limitations on all forms of communication and information flows, and with the weakest rural infrastructure in South East Asia. Myanmar's first democratically elected government in fifty years sought to build on this success in their new agricultural policy and development strategy published in 2017. However, in that same year, India, the major client for Myanmar's pulse exports, effectively banned imports of Myanmar's pulses, resulting in a collapse of domestic prices for black gram and pigeonpea. The loss of farmer confidence in these two crops threatens potential future gains from trade for both countries, as well as loss of potential soil health benefits for Myanmar's predominantly rice-based cropping systems.

This paper report examines 1) the evolution, structure, and performance of Myanmar's pulse sector, 2) the trade relationship with India, and 3) policy options to respond to the current crisis while addressing underlying weaknesses that threaten the sector's long-term international competitiveness. The report identifies three complementary and mutually reinforcing avenues for propelling Myanmar's pulse markets forward to increasingly higher levels: 1) expanded export earnings (from new markets and higher value added products); 2) improved farm productivity; and 3) increased domestic demand.

CONTENTS

EXECUTIVE SUMMARY.....	iii
LIST OF TABLES	vi
LIST OF FIGURES.....	vi
ACRONYMS	vi
1. INTRODUCTION.....	1
2. TAILWINDS: THE FIRST WAVE OF GROWTH, 1988 TO 2010.....	3
2.1. Market Growth.....	3
2.2. Production Response to Emerging Market Opportunities.....	3
3. CURRENT STRUCTURE AND PERFORMANCE OF THE PULSES VALUE CHAIN.....	5
3.1. Final Markets	5
3.2. Organization of the Pulse Value Chain	6
3.2.1. Market Organization in Central Myanmar.....	6
3.2.2. Market Organization in the Delta Zone	7
3.3. Domestic Market Integration.....	8
3.4. Export Marketing.....	9
3.5. Analysis of Pulse Price and Market Developments in India and Myanmar 2012-17.....	11
3.6. Institutions and Policies Affecting Pulses	12
4. TURBULENCE: FALLOUT FROM INDIA’S 2017 PULSE IMPORT RESTRICTIONS.....	14
5. LOOKING FORWARD: CAN MYANMAR PULSES ENJOY A SECOND WIND?	16
5.1. Lessons from the First Wave of Growth	16
5.2. Opportunities for Export Growth	16
5.3. Prospects for Increasing Productivity.....	18
5.4. Prospects for Increased Domestic Utilization.....	18
6. CONCLUSIONS	19
REFERENCES.....	20

LIST OF TABLES

TABLE	PAGE
1. Trends in Formal Pulse Exports 1980 – 2015.....	1
2. Domestic Consumption and Export Shares for Pulses in Myanmar.....	5
3. Spatial Price Spreads between Key Assembly Markets and Export Hubs in Yangon and Mandalay, January 2014 (US\$ per ton)	9
4. Co-integration Analysis Results for Myanmar and India Market Prices 2011-17	12

LIST OF FIGURES

FIGURE	PAGE
1. Myanmar Pulse Exports 1980 – 2015 ('000 tons).....	1
2. Pulse Value Chain Organization in Myanmar	6
3a. Prices of Black Gram in Myanmar and India 2011 – 2017	11
3b. Prices of Pigeonpea in Myanmar and India, 2011 – 2017	11

ACRONYMS

ADRE	Department of Agricultural, Food, and Resource Economics
CE	Commodity Exchange
DAR	Department of Agricultural Research
FAOSTAT	Food and Agricultural Organization Statistical Database
FOB	Freight on Board
FSP	Feed the Future Innovation Lab for Food Security Policy
IFPRI	International Food Policy Research Institute
MOAI	Ministry of Agriculture and Irrigation
MOALI	Ministry of Agriculture, Livestock and Irrigation
MPBSMA	Myanmar Pulse, Beans and Sesame Seeds Merchants Association
MSP	Minimum Support Price
MSU	Michigan State University
OATAM	Overseas Agro Traders Association of Myanmar
USAID	United States Agency for International Development

1. INTRODUCTION

Pulse crop exports from Myanmar grew into a \$1 billion export industry over the two decades following liberalization in 1988. As the first major agricultural sector to be liberalized, pulses offered uniquely attractive returns to both farmers and traders, who responded with alacrity to these new opportunities. By 1991, pulses surpassed rice to become Myanmar’s most valuable agricultural export (Okamoto 2008). Formal exports by sea increased from less than 100,000 tons in 1980 to over one million tons in 2015 (Table 1). An additional 200,000 tons are estimated to be exported annually on average through land borders.

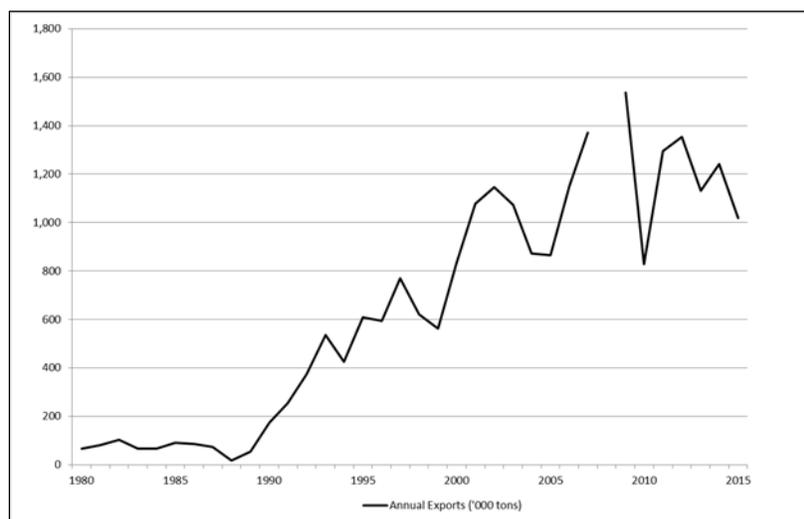
Punctuating several decades of rapid growth, a series of sharp pullbacks in pulse exports occurred in 2005 and 2011, triggered largely by changes in the Indian market which serves as destination for the majority of Myanmar’s pulse exports (Figure 1). The high level of dependence on India’s market resulted in a further price shock in 2017 after the imposition of an import ban.¹ Myanmar policy makers were left scrambling to find short-term solutions to the crisis, while industry watchers and development partners wonder if Myanmar’s pulse sector success story has come unraveled or whether growth can resume.

Table 1. Trends in Formal Pulse Exports 1980 – 2015

	1980	1985	1990	1995	2000	2005	2010	2015
Value (\$ millions)	20	29	87	239	255	322	800	990
Quantity ('000 tons)	66	90	175	610	831	865	829	1,020
Price (\$ per ton)	307	328	498	392	307	372	965	971

Source: FAOSTAT, Myanmar CSO.

Figure 1. Myanmar Pulse Exports 1980 – 2015 ('000 tons)



Source: FAOSTAT; Myanmar CSO. Note: the *unofficial estimate* reported in FAOSTAT for 2008 appears implausible to the authors hence appears as a missing data point.

¹ Technically the Government of India imposed an import quota but, since the quota was already filled at the time it was announced, the quota had the same impact as a ban.

This paper explores changes in Myanmar's pulse value chains over three decades and is organized according to the following three objectives. First, the paper examines factors driving the long wave of growth in Myanmar's pulse production and exports, during which the private sector overcame isolation constraints at multiple levels. Second, it describes the current organizational structure, incentives, and performance of Myanmar's four most important pulses value chains—green gram, black gram, pigeonpea, and chick pea. Third, we analyze the underlying causes and consequences of the India pulse trade restrictions introduced in 2017, and policy options to restore prospects for pulses at the farm level, in value added processing, and in domestic and export markets.

2. TAILWINDS: THE FIRST WAVE OF GROWTH, 1988 TO 2010

2.1. Market Growth

During the country's socialist period, from 1962 through 1988, Myanmar's government imposed tight controls on agricultural cropping choices, prices and marketing. Through a system of government-imposed production quotas, ministry officials established output targets for individual farmers covering most agricultural commodities, including paddy, pulses, and oilseeds. Failure to comply constituted grounds for rescinding tillage rights, a credible threat given government ownership of all land. Government's parallel monopoly on all agricultural marketing implied forced sales at government-imposed prices. As a result, farming offered meager returns in most of Myanmar. "Because of strict control of prices and marketing for major agricultural produce, agricultural production yielded little profit for farmers during this period." (Okamoto 2008, p.3).

Liberalization of pulse marketing and production, beginning in 1988, rapidly and radically improved the profitability of domestic pulse production and trade. In quick succession, government dropped production quotas on pulses, liberalized domestic marketing, and opened export marketing to private traders. While production quotas on paddy continued until 2003, pulses became the first major agricultural commodity to face a completely liberalized production and marketing environment. As a result, domestic pulse prices soared. By the mid-1990's, rapid gains in pulse prices had outpaced paddy prices by a factor of five, and pulse production had become significantly more profitable than monsoon or summer paddy (Fujita and Okamoto 2006).

The parallel emergence of a ready market for pulse imports in India provided a large external demand outlet right on Myanmar's doorstep. Beginning from the mid-1960s, India's green revolution had propelled a major expansion of rice and wheat production, at the expense of pulses. As a result, by the late 1980's India had begun to experience major deficits in pulses. India's trade liberalization after 1991 opened its large domestic market to international suppliers. By 2003, Myanmar accounted for 40% India's pulse imports (Fujita and Okamoto 2006). From the earliest days, Indian imports have accounted for the bulk of Myanmar's pulse exports. As a result, pulse prices on the Mumbai exchange largely determine pulse prices in Yangon, a relationship we explore in more detail in Section 3.

2.2. Production Response to Emerging Market Opportunities

The combination of radically improved domestic incentives together with a large nearby market propelled rapid growth in Myanmar's production of pulses for export (Table 1). Myanmar's three major pulses—black gram, green gram, and pigeonpea—"showed remarkable growth throughout the 1990s. No other commodity experienced anything comparable. The production of these three pulses for export grew by 17 per cent per annum on average and came to account for 60-70% of Myanmar's agricultural exports in the 1990s" (Okamoto 2008, p.4).

Area expansion has historically accounted for the bulk of the growth in Myanmar's pulse production.² In Lower Myanmar, following liberalization, farmers began growing black and green gram in the winter season, sowing immediately after harvesting their monsoon paddy. With timely

² Official Ministry of Agriculture and Irrigation statistics confirm this trend but, as with estimates of area planted for rice, appear greatly exaggerated and hence are not presented here.

planting following the harvest of monsoon paddy, the short cropping cycles of 90 to 120 days for pulses permitted their production solely on residual moisture. “In Lower Myanmar, pulses were introduced everywhere as a second crop after monsoon paddy, a new development as there was virtually no second crop produced before 1988. In the dry season, idle land suddenly came to be utilized for the production of pulses.” (Fujita and Okamoto 2006, p.14).

In Central Myanmar, where more complex dryland cropping systems prevail, expansion of pulse area typically came at the expense of other crops. Long-cycle pigeonpea, a 200-day crop planted early in the monsoon season, has been grown for many generations as a livestock forage crop in Myanmar’s dry zone, often intercropped with sorghum, cotton or sesame. As domestic pigeonpea prices surged in the 1990s, farmers began reducing the spacing allocated to intercrops between pigeonpea lines. Some even turned to sowing sole stands of pigeonpea. As a result, area expansion of pigeonpea came at the expense of these competing crops. Chickpea, a short-cycle cool season crop, competes with groundnut, sunflower, and sometimes wheat for winter season lowlands. Green gram, a short-cycle 75 to 90-day crop, features an array of varieties suitable for different growing seasons. As a result, it competes with a wide array of monsoon and dry season crops, including sesame, groundnuts, chickpeas, and sunflower.

As a result of potential crop substitutions between pulses and oilseeds such as sesame and groundnuts, Myanmar’s highly politicized oilseed policy served to shape incentives for pulse growers. During the first long wave of pulse market growth, the early liberalization of palm oil imports in 1988 accentuated farmer interest in pulses, when slumping domestic prices for oilseeds such as sesame and groundnuts served to spur incentives for crop substitution in the Dry Zone, particularly for pigeonpea which competes in the same upland monsoon plots with monsoon sesame.

3. CURRENT STRUCTURE AND PERFORMANCE OF THE PULSES VALUE CHAIN³

Our assessment of the structure and performance of the pulses value chain begins with the final markets that drive responses by traders, regional market centers, and producers in the two main agro-ecological zones supplying pulses. After examining the structure of the domestic marketing systems, we then look more closely at price transmission between India and Myanmar's principal market hubs using graphical and co-integration analysis.

3.1. Final Markets

Traders estimate that domestic consumers and livestock account for only a small share of final consumption for Myanmar's pulse production. Export markets exports account for the bulk of pulse sales (Table 2). Only chickpeas, a minor pulse among Myanmar farmers, attract a significant domestic market share. In contrast, black gram, green gram, and pigeonpea target export markets almost exclusively, with at most 15% consumed domestically.

Black gram and pigeonpea, two of Myanmar's three largest pulse export crops by volume, go primarily to India, where consumers from ancient times have used them to make dahl (Roy, Joshi, and Chandra 2017). As a result, India has long dominated as the major destination for Myanmar's pulse exports.

Green gram and chickpea enjoy more diversified market outlets. Over the past five to ten years, overland exports of green gram to China have become significant. A growing number of high-value markets such as Thailand, Taiwan, Indonesia, and Malaysia attract green gram exports from Myanmar. European buyers have also entered the market recently, although it remains to be seen whether Myanmar will be able to meet strict traceability requirements and pesticide residue limits. China and the high value markets in East Asia and Europe prefer the top quality (large diameter) green gram used for making bean sprouts.

Chickpea, unlike the other pulses, attracts a large domestic market in Myanmar. Dehuller mills split chickpeas for use in making dahl. In addition, roughly 50 vermicelli factories in Central Myanmar currently use chickpeas to make fermented noodles. Although the factories can use any pulses as a substrate for making noodles, India's cessation of chickpea imports in 2013 has resulted in abnormally low domestic chickpea prices, making it currently the preferred input in the vermicelli factories. In addition to large volumes of chickpea, domestic consumers eat a small share of black gram production, primarily in fried snack foods.

Table 2. Domestic Consumption and Export Shares for Pulses in Myanmar

	Domestic consumption (%)	Export (%)	Total
Black gram	15	85	100
Green gram	10	90	100
Pigeon pea	5	95	100
Chickpea	50	50	100

Source: Trader estimates reported by Haggblade et al. 2014.

³ This section of the paper draws heavily on an earlier study by Haggblade et al. (2014) but updated and extended using co-integration analysis of market prices for key trading centers in Myanmar and India.

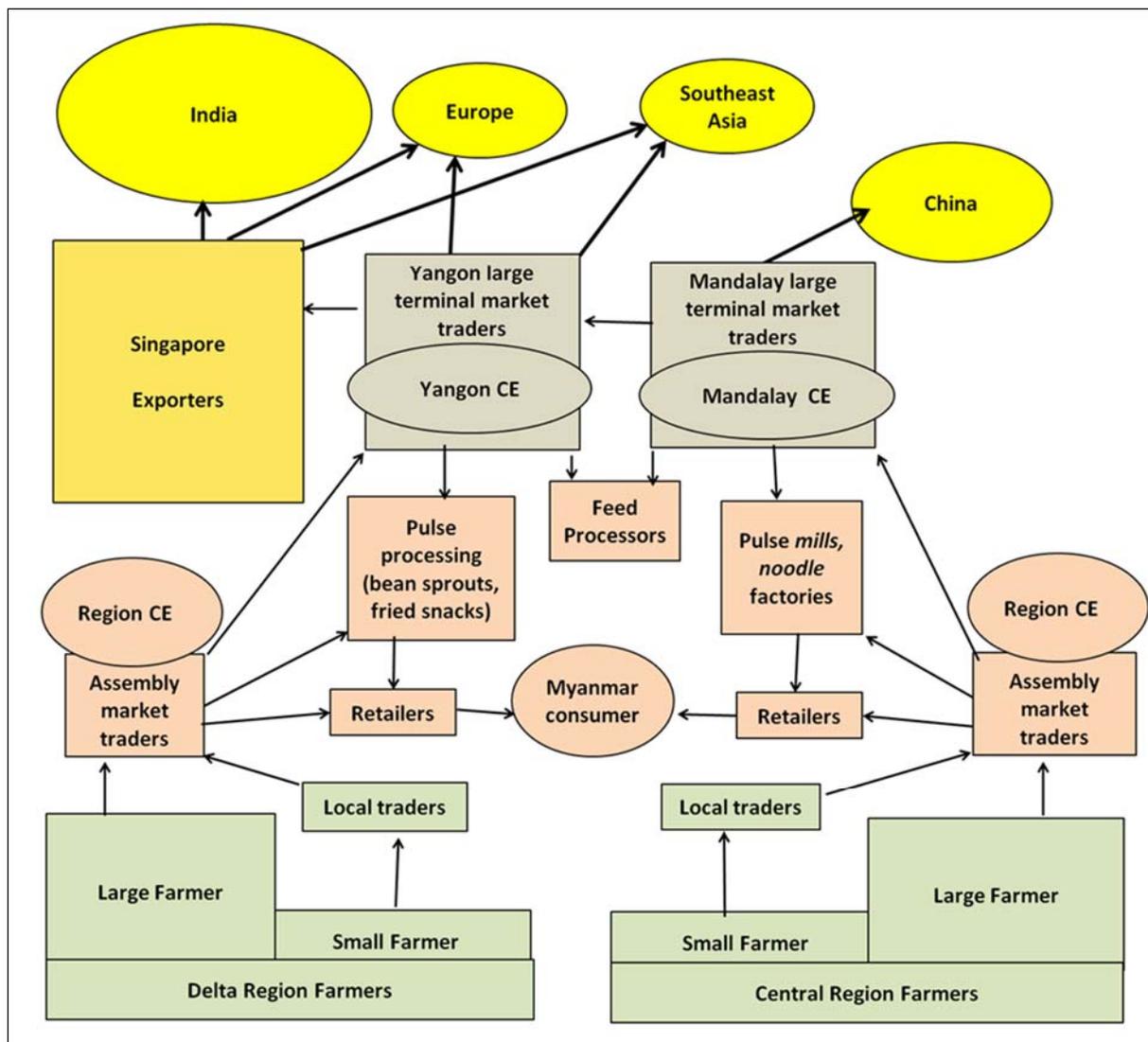
3.2. Organization of the Pulse Value Chain

The organization of pulse value chains in Central Myanmar and the Delta Zone are depicted in Figure 2.

3.2.1. Market Organization in Central Myanmar

Pulse marketing in Central Myanmar centers around the Mandalay Commodity Exchange and the roughly 2,000 pulse traders who operate there. Of these, about 20 traders export directly to China by truck, while another 200 large traders operate mills alongside their trading operations. The remaining 1,800 traders and brokers book smaller supplies which they funnel to international markets via the large export traders.

Figure 2. Pulse Value Chain Organization in Myanmar



Notes: CE = commodity exchange.

Marketing seasons differ slightly for the four major pulses. Pigeonpea, planted in May and June, enters the market beginning in December, roughly two months after the domestic supplies in India. In 2013, pigeonpea prices peaked in the month of March (Kyaw Myint 2014a and b). Chickpea, an exclusively winter crop, comes onto the market beginning in February and March. Green gram, because it is grown during all three cropping seasons, trades throughout most of the year in the dry zone.

Links between the Mandalay and Yangon exchanges remain strong. All of the pigeonpea and chickpea exports transit exchanges in Central Myanmar, often via Mandalay. The bulk of the green gram produced in Central Myanmar gets exported north to China, via Mandalay, while the remainder heads south to Yangon for shipment to India and other Asian markets.

The export traders and brokers, based in Mandalay for the China market and in Yangon for India and elsewhere, are the key players in this marketing system. Although market participants rarely hold long-term stocks, traders estimate that short-term trading stocks (of 2-4 months in duration) are held throughout the system by exporters (40%), regional traders (30%), and large farmers (30%).

Traders at six regional commodity exchanges supply terminal market wholesalers in Mandalay while traders at another five exchanges in Lower Myanmar supply the trading floor in Yangon. Commodity exchanges vary in their operation with a few conducting auctions and most functioning as meeting places where private trades are made and then recorded. All are membership based organizations with an annual membership fee. The larger regional traders operate warehouses. Smaller brokers, without financing and often with very limited storage facilities, serve as intermediaries linking farmers with traders on the exchange. On average, each exchange-based trader procures from 40-50 smaller village-based traders.

At the village level, farmers of varying sizes vie for these markets. Larger farmers and those living nearby the trading centers often sell directly to traders on the regional exchanges. Smaller farmers, however, depend on local traders and brokers to link them to the regional assembly markets. Farmers often develop long-term relationships with traders who market for them. Nonetheless, we encountered several farmers who indicate that they have changed traders over time in an effort to improve pricing and service.

Considerable turnover exists in the pulse trade, particularly among the smaller traders and brokers. In part, this turnover arises because historically the pulse trade had provided an opportunity for speculators with few alternative platforms. This phenomenon has dissipated in recent years as Yangon's property market now provides new opportunities for speculative capital. Given volatile prices, and accusations of market manipulation during the price spikes of 2006 and 2009, most traders agree that smaller traders frequently move in and out of the business.

3.2.2. Market Organization in the Delta Zone

Farmers sell either to village traders or to rural wholesalers. In either case, farmers have long standing personal, family, and economic relationships with the traders they sell to. Most grain trades hands for cash, although some traders will store grain for farmers until they are ready to sell at the prevailing market price. This model is seen as a win-win as it ensures the trader has commodity in stock to take advantage of a good offer, while the farmer is relieved of storage risk. Village traders sell to rural wholesalers or to regional wholesalers based in larger towns who are often members of a

commodity exchange. Village traders may also sell to regional wholesalers if they are not distant from the town where the regional wholesaler is based.

Regional commodity exchanges have developed in Hintada, Danubyu, and Pyay, and traders who are members of those exchanges trade on a daily basis with the Yangon commodity exchange. For Wakema, where green gram for the Indonesian market is sourced, the entire crop is purchased and transacted by approximately ten wholesalers with family roots in the area. Due to the proximity of many green gram production areas to Yangon, regional wholesalers often sell directly to Yangon traders rather than marketing through a commodity exchange.

As in Central Myanmar, members of the Yangon commodity exchange can be either wholesalers or exporters, and may have their own representatives as members of regional exchanges. Apart from green gram in Nyaunglebin, which can be shipped to either Yangon or Mandalay (for export to China) depending on relative prices, most grain in lower Myanmar is purchased for export to India through the port of Yangon. Approximately 30 companies in Yangon have size and color sorting equipment to prepare cargo for export (known as “ready cargo”). They export on their own account or sell to Singapore-registered trading companies on an FOB basis. Singapore-based companies act as “honest brokers” between Myanmar traders and Indian buyers, but are not allowed to purchase in local markets except on an FOB basis. A handful of export companies specialize in top quality produce sorted to meet exact specifications, including traceability requirements, for European and other high value buyers. They sell reject grain after size and color processing for export, along with by-products from pigeonpea milling to local feed processors. Wholesalers also sell small quantities of pulses to domestic value added processors.

A weak point in the domestic marketing channel is the lack of effective transmission of quality criteria from exporters to farmers. The pulse crop is often handled (emptied, inspected, and re-bagged) multiple times from farmer to village trader to wholesaler, with higher and lower qualities sometimes being mixed to avoid penalties from exceeding threshold size tolerances. Almost all value-added processing (as opposed to value obscuring) occurs at the exporter level. Exporters address this weakness by price discrimination on the basis of origin (grain from Hintada is known to be of poor quality due to poor harvesting practices) or knowledge of individual trader’s historical record of ability to secure quality produce.

Another factor militating against downstream investment in quality discovery and preservation is the very short trading season—just two months. Traders do not want to invest in size screening equipment for a crop they only trade two months a year. Rural wholesalers would prefer to invest resources in paddy milling which they see as a year-round value added activity with greater upside from seasonal price gains to storage.

3.3. Domestic Market Integration

Close communications between Yangon and Mandalay lead to tight linkages between these two terminal export market hubs and among the regional assembly markets that supply them. Most traders on the Yangon and Mandalay commodity exchanges have established offices on both exchanges or, at a minimum, close working relationships with traders on the sister exchange. As a result, prices in the interior markets closely follow the export prices prevailing in Yangon and Mandalay. Given improved cellphone access and improved availability of price information, spatial price spreads generally reflect costs of movement between the various feeder markets and the export hubs (Table 3).

Table 3. Spatial Price Spreads between Key Assembly Markets and Export Hubs in Yangon and Mandalay, January 2014 (US\$ per ton)

	Black gram	Pigeon pea	Green gram*	Chickpea
Central Myanmar				
Monywa		562	897	520
Pakokku		568	902	514
Mandalay		565	966	513
Lower Myanmar				
Pyay	575		946	
Hindatha	595		916	
Yangon	613	600	1095	

* Note that size and quality differences lead to wide variation in green gram prices.

Green gram, which trades in various sizes and quality levels, displays wider price spreads than other pulses, as much as \$100 for green gram compared to the more common \$40 ranges for pigeonpea and black gram (Table 3). Quality differences account for about \$30 of the green gram price spread. In January 2014, the \$966 green gram price prevailing in Mandalay for ordinary quality, large-sized green gram (Table 3), while first quality, large-sized green gram sold for \$994. Size differences intervene as well, with large grains attracting a price premium for the export markets where the large grains are preferred for making bean sprouts.

Over the past 25 years since private market liberalization, industry leaders indicate that marketing margins and the number of steps in the marketing chain have fallen as a consequence of improved telephone communication, better market price information and increased scale of the trade. Whereas farmer to exporter transfer involved 3-4 sequential transactions during the early years of the pulse market liberalization, that number now lies closer to 2-3 steps (Figure 2). Increased trading volumes, growing numbers of intermediaries and improved price information have all contributed to increased market efficiency.

Unlike in the early decades, price information now circulates freely throughout the marketing system. Most exchange traders subscribe to the E-Trade financial services in order to track Mumbai, Yangon and Mandalay pulse prices. Smaller traders and brokers see the prices posted daily on each of the regional commodity exchanges. A study of pulse export markets in the year 2000 found that only 25% of town wholesales in the major pulse-producing zones had access to export market price information (MOAI 2014). In stark contrast, during our market interviews in 2014 we found most wholesale traders well aware of Yangon and Mandalay export prices. Expansion of cell phones and the growth of public and private market information services have improved knowledge of export and terminal market prices throughout the marketing system.

3.4. Export Marketing

Currently, a cohort of large domestic trading firms export pulses directly from the country's main terminal markets. In Mandalay, about 20 large Myanmar traders funnel cross-border exports by truck north to China, while another 100 or so large bean and pulse traders in Yangon export

internationally via ship. In addition to these market leaders, several hundred additional bean and pulse trading firms operate on the Mandalay and Yangon exchanges. This complex network of large and small domestic trading firms sources pulses from rural areas and delivers them to warehouses in Yangon and Mandalay, where terminal market exporters prepare them for inspection and export. Together these traders form the Myanmar Pulse, Beans and Sesame Seeds Merchants Association (MPBSMA), with 1,080 members listed on the organization's website. Another 2,000 to 3,000 smaller scale traders and brokers operate on the regional exchanges in the growing regions.

In serving the India market, several dozen international trading firms have historically served as intermediaries through whom ocean-based exports via Yangon have transited. Today in Yangon, about 20 international firms have established offices from which they serve as export traders and brokers. In the early days of the pulse market liberalization, these international firms provided two key services to local traders: • contacts with pulse buyers abroad (particularly in India), and • financing (in an era of restricted international fund transfers). Many of these firms, based in Singapore where most of Myanmar's exports trans-shipped, opened domestic offices to service the rapidly growing pulse export trade. Myanmar's Ministry of Commerce has forbidden direct purchase of pulses in local currency by these international firms. As a result, a symbiotic relationship has grown up, through which the international trading firms contract with large MPBSMA firms to procure and prepare required export quantities for export. Inspection of each shipment's quality and quantity specifications, by one of two international inspection services, provides the exporter with certification for each shipment. In normal commercial practice, this certification would trigger payment based on a letter of credit. In practice, however, most trade takes place through telegraphic transfers of funds, either in advance or upon receipt of the inspection certificate, by the export brokers to the large Myanmar trading firms.

Due to the stringent collateral requirements of banks in Myanmar, the international export brokers often advance payment to local trading counterparts in order to procure timely quantities and qualities required. However, these advances require trust and experience. In several instances, widely discussed in the trade, Myanmar traders have defaulted after receiving an advance, absconded with the funds and failed to deliver the merchandise promised. In 2006, a politically connected trader failed to deliver on a \$40 million contract, triggering a panic in the market. In 2009, four traders served jail time for defaulting on pulse export contracts. Most recently, a \$2.5 million default required government involvement to secure warehouses. In February 2014, in response to this risk of default, the international exporting firms formed their own organization, the Overseas Agro Traders Association of Myanmar (OATAM). The Yangon-based representative of Tata International serves as the first president of OATAM, whose 16 founding members indicate they account for 85% of Myanmar's pulse exports (Tata 2014). As a result, two key private sector organizations currently monitor the Myanmar pulse trade.

Speculative behavior by pulse traders poses market risks highlighted by many of the pulse traders we interviewed throughout Myanmar. In fact, some traders specifically distinguish three categories of market participants: *traders*, *brokers*, and *speculators*. Given sharp swings in Indian pulse prices, and similar peaks and dips on the Myanmar exchanges, speculative behavior offers potential rewards for traders with early knowledge of future price movements. Some industry participants believe that efforts to manipulate pulse prices may have aggravated domestic price swings. Although this potential has likely diminished as price information flows have improved, many traders remain convinced that speculation poses a real risk. We, therefore, turn to an analysis of pulse prices to evaluate whether such fears are justified.

3.5. Analysis of Pulse Price and Market Developments in India and Myanmar 2012-17

To examine price transmission we first present graphical analysis of market prices in key wholesale markets in India and Myanmar, followed by co-integration analysis. As shown in Figures 3a and 3b, prices of pigeonpea and black gram in Myanmar closely track the prices of these commodities in wholesale markets in India. This close correspondence in price movements is due to two key characteristics of their respective markets. First, up until 2015, there were few tariffs, taxes or other trade barriers for the pulses trade between the two countries. Second, exports accounted for a very high share of production of both pigeonpeas and (especially) black gram in Myanmar, so that export prices and quantities were dominant factors in the local wholesale markets.

Figure 3a. Prices of Black Gram in Myanmar and India 2011 – 2017

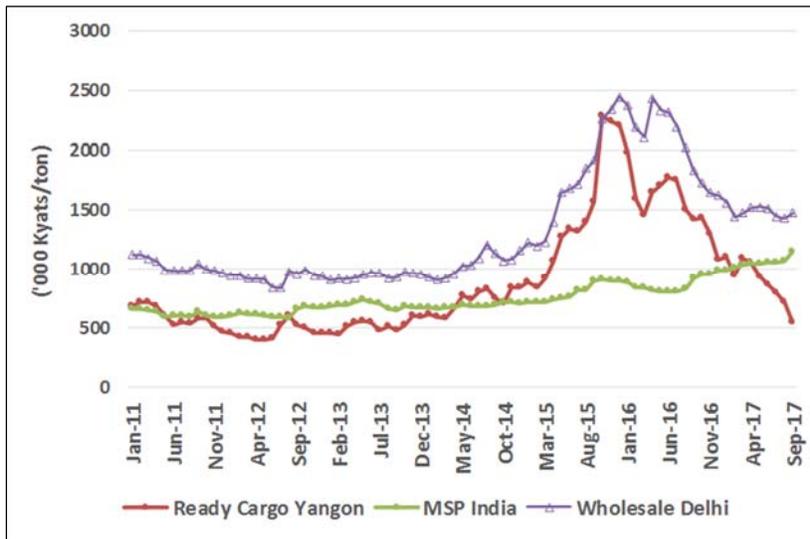
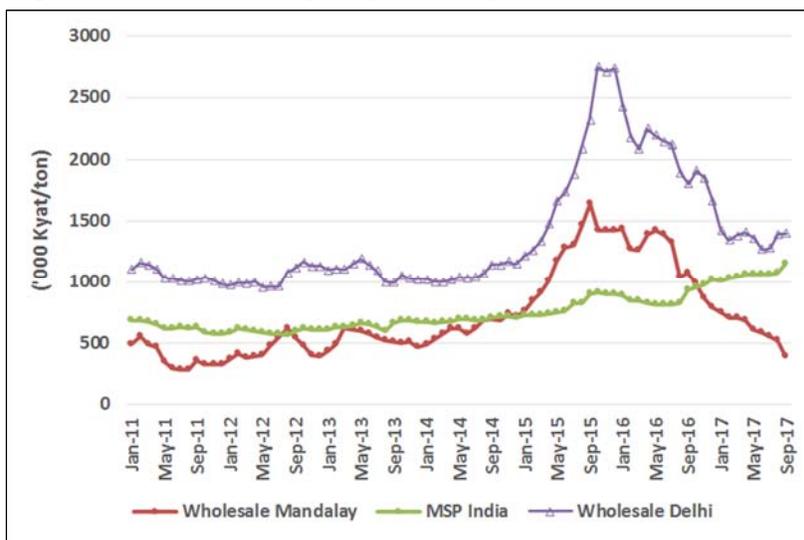


Figure 3b. Prices of Pigeonpea in Myanmar and India, 2011 – 2017



Source: Authors' analysis using Governments of Myanmar and India price data.

Co-integration analysis confirms the strong links between pulses price movements in wholesale markets in Myanmar, the export price and wholesale markets in India. Our analysis uses monthly price data for black gram and pigeonpeas (expressed in current US dollars) in three different markets: wholesale Mandalay, Ready Cargo Yangon (the price at the port before loading on the ship), and wholesale Delhi. The sample includes data from January 2011 through September 2017.

As shown in Table 4, all series are stationary in first differences, according to ADF tests with zero lags and a time trend. Prices of black gram in all three markets are co-integrated with one another with co-integration coefficients ranging from 0.875 to 1.132. Moreover, the 95% confidence interval for all market pairs includes 1.0 except for Mandalay-Yangon, indicating that for most market pairs the hypothesis of a full transmission of price movements cannot be rejected. Results are similar for pigeonpeas. All three series are co-integrated with co-integration coefficients ranging from 0.243 to 0.685. However, none of the market pairs has a co-integration coefficient for which the 95% confidence interval includes 1.0.

Imperfections in transport and foreign exchange markets are likely contributors to the range in co-integration coefficients. Due to the seasonality of pulse trade, transport bottlenecks at Yangon port (which is not accessible by deep sea vessels) as well as between Mandalay and Yangon (related to navigability of domestic waterways) imply a variable transport cost wedge. Difference between Myanmar Central Bank determined exchange rate bands and traders' valuation also bring about differences in the wholesale margin traders are willing to accept.

Neither the graphical or statistical analysis presented above provides empirical support for concerns about market manipulation by international traders.

3.6. Institutions and Policies Affecting Pulses

The Government of Myanmar has remained largely laissez-faire, letting the pulse trade develop based on private sector initiative and incentives, with the important exception that foreign companies are not allowed to trade in local currency on their own account.

Table 4. Co-integration Analysis Results for Myanmar and India Market Prices 2011-17

Dependent Variable	Independent Variable	Cointeg. Coeff.	Stand. Error	Confidence Interval*	ADF(0 lags) w/trend	ADF (11 lags) w/trend	
Black Gram							
				First Differences			
Ready Cargo Yangon (US\$/ton) ^b	Wholesale Delhi (US\$/ton)	1.132	0.170	Yes	-7.098***	-1.121	
Wholesale Mandalay (US\$/ton)	Wholesale Delhi (US\$/ton)	1.018	0.175	Yes	-7.403***	-1.171	
Wholesale Mandalay (US\$/ton)	Ready Cargo Yangon (US\$/ton)	0.875	0.051	No	-12.700***	-2.774***	
Pigeon Pea							
Ready Cargo Yangon (US\$/ton) ^b	Wholesale Delhi (US\$/ton)	0.673	0.158	No	-6.097***	-0.546	
Wholesale Mandalay (US\$/ton)	Wholesale Delhi (US\$/ton)	0.243	0.172	No	-6.790***	-2.588**	
Wholesale Mandalay (US\$/ton)	Ready Cargo Yangon (US\$/ton)	0.685	0.082	No	-7.735***	-1.347	
ADF critical values							
					1%	-2.617	-2.625
					5%	-1.950	-1.950
					10%	-1.610	-1.610

Notes: Sample is monthly prices January 2011 to September 2017. * significant at .10; ** significant at .05, and *** significant at .01 level

The reduction in the commerce tax rate on exports from 10% to 2% has increased incentives for all players in the sector and, since the domestic marketing system is intensely competitive, is likely to have resulted in higher farm-gate prices for farmers.

The Ministry of Agriculture, Livestock and Irrigation (MOALI) conducts research on pulse new varieties—particularly green gram, pigeonpea, and chickpea. The Department of Agricultural Research (DAR), however, remains highly constrained by limited budgets and staffing. They have relied primarily on testing international varieties from Indian and international research centers. The DAR has no research facilities in Lower Myanmar, and on-farm testing of improved varieties is rare. Given the lack of systematic on-farm testing and demonstration of improved varieties, only a small proportion of farmers appear to have been exposed to improved germplasm that could potentially increase yields.

Access to quality seed supplies remains a problem for Myanmar pulse farmers. Acute funding constraints at MOAI have limited the DOA's capacity to supply cleaned, certified seed to farmers. Although pulses are closed-pollinators, resulting in no genetic loss from recycled seed, many bacterial and fungal diseases are transmitted on seed coatings. As a result, agronomists recommend that farmers purchase clean, certified seed roughly every five years to maintain yields. Given DOA limited capacity in this area, private sector traders have largely served this role of seed suppliers to Myanmar's pulse farmers. Seed supplied by traders is neither certified nor based on known genetic qualities—it is simply commercial crop with desirable size and color that is correctly stored. No traders that we spoke to reported obtaining access to seed of improved varieties through DOA.

Most farmers have no access to extension recommendations on pulse crop management, except what they can glean from input suppliers, primarily of pesticides and to a lesser extent foliar fertilizers. Farmers make choices based on trial and error, exchanging information with neighbors. Unlike domestic traders and foreign-based exporters, the roughly three million farmers growing pulses in Myanmar remain largely unrepresented in policy debates.

4. TURBULENCE: FALLOUT FROM INDIA'S 2017 PULSE IMPORT RESTRICTIONS

The import restrictions imposed by India in August 2017 resulted in a complete cessation of black gram and pigeonpea purchases by Myanmar traders, followed by an inevitable collapse of prices as seen in Figures 3a and 3b above. At the time of the announcement of the ban, the pigeonpea crop was already planted. For black gram, the post-monsoon planting season was still 3-4 months in the future. The Myanmar government formed a task force under the leadership of the Ministry of Commerce. The main participants were other key government Ministries such as Agriculture, Livestock and Irrigation, and Planning and Finance, and representatives of the Myanmar Pulses, Beans, and Sesame Seeds Merchants Association (MPBSMA). Discussions focused on three main areas: domestic price support measures, farm diversification options for the coming post-monsoon (winter) season, and how to respond to a Government of India long-term trade deal.

The MPBSMA requested government to provide a soft loan of approximately \$40 million to augment the working capital of traders to purchase and stock pigeonpea and black gram. The government was only able to accede to a much smaller loan, approximately \$11 million, and a group of major traders publicly announced plans to purchase a limited quantity at close to prevailing market prices. The committee also considered encouraging the substitution of pigeonpea for chick pea for public tenders for use by public institutions such as the military. There was some reticence to push for large-scale substitution because of concerns about consumer acceptability. Nevertheless, some traders report purchasing pigeonpea in response to regional government tenders.

A number of diversification options for the post-monsoon season were open to farmers. For those with access to irrigation, post-monsoon rice is an attractive option due to robust paddy prices in response to increased export demand for Myanmar rice. For farmers without sufficient irrigation resources to grow paddy, but with adequate residual moisture, chick pea and green gram prices had remained relatively stable. MOALI has taken steps to improve seed availability for farmers seeking to diversify, although most will rely on neighbors and traders to acquire seed. Anecdotal evidence suggests that farmers are adjusting quickly to the dramatic change in price signals.

In late 2017, the Government of India offered the Government of Myanmar a five-year agreement for up to one million tons of exports per annum at a sales price linked to the India minimum price plus a marketing margin. Some type of Government to Government agreement could potentially be attractive for both countries, protecting Indian consumers from excessively high prices in a short supply year, while protecting Myanmar farmers from excessively low prices in a high supply year.

In initial discussions, the Government of India proposed linking a negotiated sales price to India's domestic Minimum Support Price (MSP). However, as shown in Figures 3a and 3b, for much of 2015 and 2016, wholesale prices in India, as well as export and wholesale prices in Myanmar were far above the MSP. Had such a fixed price agreement been in place in that period, Myanmar farmers and traders would have lost substantial income.

More generally, any arrangement where the sales price is set equal to the MSP (adjusted for a marketing margin) would provide stability, but could result in a wide disparity between the negotiated sales price and market prices. Setting the sales price equal to a lagged market price (e.g. the wholesale Delhi lagged six months, plus a marketing margin) would provide no stabilization relative to the market, but would facilitate planning for both buyers and sellers. A third option, the average of the MSP and the lagged wholesale market price (both adjusted for margins) results in increased stability with some responsiveness to market forces.

Ultimately, the size of the margins used (to translate the Minimum Support Price or wholesale Delhi price to an equivalent Yangon price) and the weights could be determined in future trade negotiations.

It is important to recognize, however, that the incentives of Myanmar's farmers, domestic traders, exporters, and government differ in some respects. Myanmar's farmers benefit from higher prices, of course, but can also reap substantial benefits from measures to promote crop productivity. Myanmar's domestic traders have little incentive to commit to an international price agreement since their profits are largely determined by geographical price arbitrage and trader margins are likely to be unaffected by the presence or absence of a deal. Moreover, speculators benefit from price instability since it provides an opportunity for temporal price arbitrage. Some traders and processors, eager to increase value added through processing and quality upgrading, are not interested in continued sales to the Indian market, which they perceive as a low quality / low value trap. Finally, the Myanmar government has to balance desire to support farmers with significant obstacles to implementing an agreement, including: 1) a lack of fiscal resources to underwrite potential trader losses, 2) the potential for false declarations by traders if Myanmar government that could greatly increase government costs if it agrees to cover losses, and 3) the risk of setting a precedent for providing support to special agricultural interest groups that could be demanded by other actors (e.g., support for rice producers).

Ultimately, the Myanmar task force established to respond to the crisis was over-awed by the scale of the quantity commitment in the Government of India offer, and worried by the consequences of not being able to fulfil it. Moreover, there was no assurance of what the India MSP would be in the future, nor whether the marketing margin would defray the costs of delivery. Consequently, the Government of Myanmar never formally responded to the Government of India offer. In the meantime, farmers in India, supported by the Indian Council on Agricultural Research, have expressed strong opposition to the Government of India offer as they see it as supporting foreign producers even when the government is unable to defend the MSP at home (Avinash Kishore, personal communication, December 14, 2017). Myanmar traders appear resigned to "business as usual" with India, a business they have much experience in navigating. Instead, the Ministry of Commerce turned its attention to expanding alternative pulse export market, organizing a trade fair in China in January 2018 where ninety Chinese companies participated.

In sum, efforts by the Myanmar government and traders to address the collapse in pigeonpea and black gram prices do not appear to have had any impact on market fundamentals in the short or long term to date.

5. LOOKING FORWARD: CAN MYANMAR PULSES ENJOY A SECOND WIND?

5.1. Lessons from the First Wave of Growth

Myanmar's private marketing system has shown tremendous responsiveness as well as a capacity to adapt in response to changing incentives. The growth and development of the commodity exchange system has resulted in an organized trade with large numbers of traders and well-publicized market prices throughout the system. The emergence of a fee-based private market information service has clearly helped to improve information flows throughout the system. Yet Myanmar pulse export markets have diversified only to a very limited degree and remain heavily dependent on a single, volatile, raw quality commodity market—India, for over half of the country's pulse exports.

The convergence of three major forces propelled the first wave of pulse market development in the 1990s and early 2000s: a) rising pulse prices; b) a simultaneous fall in oilseed prices, which compete for the same cropland in Central Myanmar; and c) growing demand for pulses in India. In the past decade, however, these three trade-promoting winds have blown with less consistency, they have become less synchronized, and indeed sometimes begun to move in opposite directions. The perfect storm that propelled the first stage of pulse market growth has now dissipated.

One notable absentee during the first wave of pulse market growth has been on-farm productivity. Area gains have propelled farm supply response, while on-farm productivity has remained largely stagnant over the past 30 years. Given growing competition for cultivable land, even in the cool season using residual moisture, and rising rural wage rates, a farm-level productivity revolution is essential for Myanmar to maintain a competitive position in world pulse markets.

The global market for pulses is set to expand steadily in quantity and value terms for several decades. Not only is India's population expanding, where pulses are the main source of protein for more than half the population, but consumers in many wealthy countries (e.g., Europe, Japan, Taiwan, South Korea) are seeking to consume more vegetable protein as part of a healthy diet that reduces the incidence of cardiovascular disease. Even in poorer countries, there will be increased demand for processed pulse products to substitute for increasingly costly meat protein sources.

In general, we see three avenues for propelling Myanmar's pulse markets forward to increasingly higher levels:

- expanded export earnings (from new markets and higher value added products);
- improved farm productivity; or
- increased domestic demand.

The following discussion explores each of these options in turn.

5.2. Opportunities for Export Growth

Over the past decade, India has served as the world's largest pulse producer as well as its largest consumer and importer. On average, over the past decade, India has accounted for nearly one quarter of all world pulse imports. Given its high population of vegetarians, roughly 500 million strong, India will likely remain the world's dominant consumer of pulses for the foreseeable future. Despite comparable populations, India has imported 2.3 million tons of pulses annually over the past decade compared to only 400,000 tons for China, Myanmar's closest alternate outlet.

Over time, India's demand for pulse imports has increased, particularly since 2000, as domestic production has stagnated in the face of growing population pressure and domestic demand. Yet annual import volumes fluctuate considerably from one year to the next. During poor harvest years in India, Myanmar pulse exports surge, as they did in 2008. Conversely, a bumper harvest in India (or policy changes favoring domestic pulse production), cause India's demand for imported pulses to stall. Indian traders have also been sourcing increasing quantities of pigeonpea from countries in Eastern and Southern Africa (Malawi, Tanzania, Mozambique) which have actively promoted improved varieties to take advantage of the market window prior to India's local harvest.

Reliable access (with decreased volatility) to the Indian market, thus, remains a key to future strong export markets for Myanmar pulses. In principle, there is no reason why Myanmar should not be able to export processed rather than raw pulses to India. This would reduce shipping costs per unit value added, improve quality incentives for Myanmar farmers, and increase the availability of nutrient-rich husks for local livestock feeds. However, traders have complained that Indian importers demand only raw pigeonpea, black gram, and green gram, which they process in their own mills and use byproducts for their own, large dairy industry. Myanmar traders claim that Indian import duties on processed pulses place them at a price disadvantage in trying to sell processed dehulled, split pulses.

Given the growing importance of Indian policy on pulses, Myanmar traders may need assistance from Myanmar's diplomatic missions abroad. Indian companies will certainly want reciprocal access to investment opportunities in the domestic trading and processing segments in Myanmar. Myanmar diplomats may, therefore, need to highlight the reciprocal benefits to be derived from Myanmar access to processed pulse markets in India. Other strong candidates for market development in the region include neighboring Bangladesh and Pakistan.

Higher value and value added markets also hold some potential for growth. Currently, Myanmar exporters clean and sort by size only 35% of green gram and 10% of pigeonpea exports (Kyaw Myint 2013). In recent years, forays by large Myanmar traders have focused on seeking out and expanding high value niche markets. They have achieved the most success with large-sized green gram preferred for making bean sprouts in many of the wealthy Asian countries. Europe is an important potential market for the future with high returns for meeting quality and traceability requirements.

Expanding the supply of quality value-added pulses will require investment in storage (inventory) as well as processing facilities to ensure year round supply to foreign customers. To make this possible, foreign companies need to be allowed to trade in the domestic market to purchase and store locally on their own account to ensure adequate raw material supplied to make investment in processing facilities profitable. Similarly local traders require access to inventory credit from the local banking system, and export credit guarantees, in order to compete on a level playing field with foreign companies once they are allowed to trade domestically. Opening up the domestic pulse market to foreign investors, while ensuring that local traders have access to equivalent financial services, will enhance the level of investment and liquidity in the market, and provide more stable and consistent price and quality incentives to Myanmar farmers.

5.3. Prospects for Increasing Productivity

Myanmar traders and farmers both emphasized the importance of raising farm productivity if Myanmar is to remain competitive in international pulse markets. Given currently low yields, of around one ton per hectare, scope for increasing productivity remains considerable. Improving genetic material will require increased funding for DAR researchers and improved access to new breeding lines of gram from AVRDC.

Agronomic research likewise remains critical. Time of planting is critical for the post-monsoon cool season crop which relies on residual moisture. In the delta settings where gram follows monsoon paddy, mechanical harvesting and threshing offers one possibility for speeding rice offtake and enabling earlier planting of the subsequent pulse crop. Earlier maturing varieties will also expand the options for farmers who cannot afford timely access to mechanization services. In some systems, direct seeding into paddy fields is possible, though this requires proper agronomic trials to establish optimal feasible conditions under farm conditions. Integrated pest and improved soil fertility management practices may offer scope for increased productivity while ensuring pest residues remain at internationally accepted levels.

Seed supply remains a critical yet long-neglected problem among pulse farmers. Resource constraints at DOA have resulted in private sector pulse traders and farmers taking charge of seed retention and supply. In addition to a need for a broader range of improved varieties, improved seed supply systems will be essential to disease control efforts among pulse farmers.

5.4. Prospects for Increased Domestic Utilization

Despite high levels of pulse consumption in neighboring countries such as India and Bangladesh, Myanmar households consume only limited quantities. Apart from chickpeas, pulse consumption remains very limited. Value added products such as noodles, bean sprouts, high-protein flours, and various fried snacks offer prospects for possible market growth.

Given the importance of livestock in Myanmar's dry zones, efforts to increase processing would offer important byproducts for feed industry. Indeed, we witnessed many examples of small-scale dairy production in zones where pulse mills operated.

Since consumption habits change slowly, experimentation and promotion with alternative processed products will likely require cooperation between Myanmar's bean and pulse traders, the chamber of commerce and the hospitality industry to develop and promote pulse-based products. Foreign investors could play a role here in helping Myanmar to update technologies and product ranges on offer.

6. CONCLUSIONS

Private sector initiatives by Myanmar's traders and farmers have grown the country's pulses into a billion dollar export industry over the past 25 years. The fortuitous historical convergence of multiple favorable stimuli—the opening of the Indian market, rising domestic pulse prices, and simultaneously falling oilseed prices—favored and enabled this growth, which occurred with limited government interference or involvement.

A second wave of pulse expansion appears possible, although it will require more active public support, particularly in breeding and agronomic research. Unlike hybrids, closed-pollinating crops such as pulses enable farmers to recycle seeds from one year to the next. As a result, while private seed companies often invest heavily in developing hybrid varieties, which require annual seed purchases by farmers, they have little incentive to invest in varietal development for closed-pollinating crops such as pulses. Public research, therefore, becomes critical in both breeding and agronomic research. Moreover, clean seed supplies and certification systems will require ramped-up government capacity in this area.

The prospect of a long-term bilateral trade deal with India, while it should not be ruled out, is fraught with technical difficulties. Myanmar traders have little incentive, nor the financial resources, to maintain significant stockholdings from one year to another. Myanmar's government does not have the financial or administrative resources to manage a price stabilization scheme for exporters. In the near term, the Government of India is also facing discontent from farmers for offering long-term supply contracts to exporting countries while failing to make minimum support prices effective at home.

Finally, diversification into high value new export markets requires encouragement of foreign direct investment into the processing sector, which in turn requires allowing foreign countries to purchase raw material domestically in local currency. This will increase liquidity at peak marketing times and provide stronger incentives for quality. To ensure that local traders and processors can compete on a level playing field they should also have access to bank credit and export guarantee services. While exploration and access to new international markets may well require diplomatic involvement, this will be especially important in the case of the Indian market, to support private sector overtures and efforts at expanding quantities and value added in pulse exports to that country from Myanmar.

Myanmar will not retain its position as a global giant with the public sector just sitting on the sidelines. The government must recognize that pulses are a strategic sector and engage with the private sector to ensure that public investments and policies are in place to support modernization and raise productivity throughout the value chain. Otherwise, the sector will gradually decline as high price volatility and rising labor costs discourage farmers, and lack of competitiveness in high value markets discourages traders and exporters.

REFERENCES

- Fujita, Koichi and Okamoto, Ikuko. 2006. *Agricultural Policies and Development of Myanmar's Agricultural Sector*. Institute of Developing Economies Discussion Paper No. 63. Chiba, Japan: Institute of Developing Economies.
- Haggblade, Steven, Duncan Boughton, L Seng Kham, and Myo Thaung. 2014. *Winds of Change: A Rapid Appraisal of Four Pulse Value Chains in Myanmar*. Discussion Paper. Yangon: Michigan State University and Myanmar Development Resource Institute – Centre for Economic and Social Development.
- Kyaw Mying. 2013. Pulses Production and Export in Myanmar. Myanmar Pulses and Beans and Sesame Seed Merchant Association (MPBSMA). Presentation to the Agri Trade, Investment and Technology Global Summit-2013, June 19, 2013. Yangon.
- Kyaw Myint. 2014a. "Weekly Market Information on Agricultural Commodities." *E-Trade Market Information Service* Vol.2, No.5, February 11. Yangon.
- Kyaw Myint. 2014b. "Pulses Market Information, Bi-Weekly Report." *E-Trade Market Information Service*. Vol.1 No.1. No.5, March 22-28, 2014. Yangon.
- Ministry of Agriculture and Irrigation. 2000. *Agricultural Marketing in Myanmar*. Yangon: MOAI and FAO.
- Ministry of Agriculture and Irrigation. 2013. *Report of Myanmar Census of Agriculture 2010*. Yangon: MOAI and FAO.
- Okamoto, Ikuko. 2008. *Economic Disparity in Rural Myanmar: Transformation Under Market Liberalization*. Singapore: NUS Press.
- Roy, Devesh, P.K. Joshi, and Raj Chandra, Eds. 2017. *Pulses for Nutrition in India: Changing Patterns from Farm to Fork*. Washington DC: International Food Policy Research Institute.
- Tata International. 2014. TIL Myanmar Country Head appointed first president of OATAM. <http://www.tatainternational.com/news-events/2014/feb/til-myanmar-country-head-appointed-first-president-of-oatam.html>

