Final Report

Production, Markets and Trade: A Detailed Analysis of Factors Affecting Pulses Production in India

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Executive Summary

Pulses play a pivotal role in a country like India for all categories of people due to its rich protein content. The protein content in pulses are double the protein content of wheat and three times more than that of rice. Pulses are mostly cultivated under rainfed conditions and do not require intensive irrigation facility and this is the reason why pulses are grown in areas left after satisfying the demand for cereals/cash crops. Apart from its rich protein content, pluses possess several other qualities such as they improve soil fertility and physical structure, fit in mixed/inter-cropping system, crop rotations and dry farming and provide green pods for vegetable and nutritious fodder for cattle as well.

Although, being the largest pulse crop cultivating country in the world, pulses share to total food grain production is only 6-7% in the country. As a result, the production of pulses was not commensurate with the demand. The excess demand is primarily due to the stagnation in productivity which is further accelerated by the decline in area under cultivation. As a result, the per capita net availability of pulses in the country declined sharply over the years. The persistent deficit and the soaring pulses domestic prices made it inevitable for the country to import pulses. Despite of being the second largest producer of pulses, the dependency on imported pulses continues to grow in the country.

Against this backdrop, the present research examines the factors affecting the production of pulses (Chickpea and Pigeon pea), the impact of government policies such as MSP and NFSM on pulses production, the factors influencing the farmers access and utilisation of MSP and the pricing behavior of pulses importers, exchange rate pass-through and its implications.

This study has been divided into 11 chapters including introduction and conclusion. Chapter 1 as an introduction provided the background, objectives, data, and methodology along with chapter scheme. Chapter 2 gave an overview of pulses economy. Chapter 3 discussed the importance of pulses for nutritional and food security, the importance of sustainable production practices to improve the pulses productivity and food security with an emphasis on India. Chapter 4 discussed the salient features of Government of India’s National Food Security Mission (NFSM) and its objectives especially in the context of pulses production. Chapter 5 provided a detailed discussion of socio-economic profile of the sample households.

Chapter 6 provided an overview of pulses production, trade and government policies with a special focus on the trends in trade and its implications. Chapter 7 analysed the import pricing behavior and exchange rate pass through into prices of imported pulses. Chapter 8 provided an overview of an evolution of minimum support price policies and MSP for major pulses. Chapter 9 analysed the factors influencing the access to information regarding MSP and utilisation of MSP in a joint framework. Chapter 10 made an analysis of factors influencing the supply response of chickpea and pigeon pea with a special emphasis on MSP and NFSM. Chapter 11 provided the conclusion and policy implications of the study.

The detailed household level survey was conducted for 3 major pulses-producing states. They are Karnataka, Maharashtra and Madhya Pradesh. From each state, one of the major pulses producing district was selected for further analysis. From Karnataka, Gulbarga was selected, from Maharashtra, Wardha was selected, and from Madhya Pradesh, Narsinghpur was selected.

Primary data was collected through a comprehensive household survey in the above mentioned three districts of three major pulses-producing Indian States during 2017-2018. The farmers were selected through a random sampling technique. The sample consisted of 482 pigeon pea farmers and 316 chickpea. Out of which 227 farmers were cultivating both chickpea and pigeon pea. The survey was conducted through questionnaire, framed in such way as to draw out details covering household characteristics, wealth and farm characteristics, institutional and access related variables, risk and economic factors.

After discussing the background, objectives, data and methodology in the first chapter, the second chapter provided an overview of pulses economy with a special emphasis on the trends in area, production and yield in comparison with world. The analysis broadly showed that there had been a substantial decline in area and production of pulses in India. Indian yield was much below the world average and the yield gap between the two got widened since 2001. It was the same year, the decline in production of pulses was more prominent. However, in the year 1991, the yield gap got narrowed and came very close to the world average. Interestingly, this was the same year when India marked a record production in pulses.

The 5th chapter provided an overview of the socio-economic profile of the sample households. The total households interviewed were 572 drawn from three major pulses producing States-Karnataka, Maharashtra and Madhya Pradesh. Majority of the households in the sample were either semi medium or medium farmers and agriculture was the main livelihood option for majority of the sample households. Narsinghpur (Madhya Pradesh) had the highest share of large farmers in the sample whereas Wardha (Maharashtra) had the highest share of marginal and small farmers. In our sample, 482 farmers were cultivating pigeon pea and 316 farmers were cultivating chickpea. Out of which 227 farmers were cultivating both the pigeon pea and chickpea. Majority of the sample households didn't have any awareness of government schemes to promote pulses production or new production techniques to reduce crop loss and improve productivity. The farm size wise analysis showed that large farmers were more aware about new production practices as compared to other farm categories. However, the access to training offered by government and extension services were the highest among the sample households from Wardha (Maharashtra). Interestingly, despite having higher access to training, extension services and knowledge about government schemes and new production techniques, the information of MSP received by households in Wardha (Maharashtra) were lower than that of Narsinghpur (Madhya Pradesh). This is due to the fact that Narsinghpur (Madhya Pradesh) had the highest share of large farmers in the sample. The size wise percentage of farmers who received training showed that large farmers had received more training. The training was relatively higher for semi, medium, medium and large farmers as compared to marginal and small. In addition to the fact that Narsinghpur (Madhya Pradesh) had relatively large farmers with greater access to training, the households from Narsighpur (Madhya Pradesh) had greater access to information regarding MSP. The access to MSP information was increasing as size of the farm increases. Interestingly, though households in Narsinghpur (Madhya Pradesh) had the highest information about MSP, households availing MSP was much lower and lower than Wardha (Maharashtra). In Maharashtra almost all farmers who had information about MSP availed MSP. The percentage share of households with information was 52% and utilisation was 50%. The percentage share of households in each farm size category who were availing MSP was the highest among semi, medium, medium, and large households. The percentage share of households who were not availing MSP was the lowest among marginal and small farmers.

The analysis in the 6th chapter showed showed that there has been a substantial increase in the imports of most of the pulses in the last several years. Also the share of India's imports in world imports of pulses also showed a sharp increase. This points out the increasing import dependency and severe supply deficit that India is facing in terms of meeting the demand for protein rich crop. The widening gap between supply and demand, and the domestic uncertainties with respect to the production etc. might continue to increase the import dependency unless effective policy measures are undertaken to improve the production and productivity and pulses. The implications of long term dependency on import depends upon the nature of import pricing that is undertaken by the importers as we have already discussed the import of each type of pulses is dominated by one or two single largest importers. This may increase the potential for monopoly pricing.

Chapter 7 did an analysis of pricing behaviour of pulses importers in Indian market and the exchange rate pass through into imported pulses prices. When the currency of importing country depreciates, the import is expected to become costlier. However, if the exporter is absorbing part of the increase in price to retain the market share in the importing country, then the exchange rate pass-through into import prices will be partial or incomplete. The elasticities of import prices with regard to changes in the exchange rate can range from 0% to 100%, depending on the pricing strategy of exporters. Additionally, it also shows whether an exporter is following a producer pricing strategy or local currency pricing. The former takes place in a perfectly competitive setting where the low of one price is expected to prevail due and as a result any change in exchange rate will get fully transmitted to import prices. The latter takes place under imperfect competition. Employing the econometric technique of panel corrected standard errors (PCSE) estimation technique in pricing to market (PTM) framework, the results from our analysis showed that the most of the importers were practicing non-competitive pricing behaviour due to both the market specific characteristics as well as exchange rate induced effects.

The significance of the exchange rate parameter β_i and the country-specific effects parameter λ_i in most of the models indicates that the importers work with a fluctuating exchange rate and a varying mark-up over marginal cost. The analysis of the asymmetric effects of exchange rates through an interaction dummy showed that for majority of the products, the appreciation of the Indian rupee against the partner country had greater impact than the depreciation.

We tested the PTM model under three different exchange rates, i.e. the nominal, the real and the commodity-specific (import) trade-weighted exchange rates. For all the products under study, we observed PTM in at least one of the destination markets either through exchange rate changes and/or through country specific effects. The analysis also showed that the commodity specific exchange rate better predicts the PTM behaviour in the case of kidney beans and peas whereas the nominal exchange rate better predicts the PTM behaviour of chickpea and pigeon pea.

The analaysis of the exchange rate effect showed that local currency price stabilization by the Indian importers was more prominent than the amplification of exchange rates. This is indicating competition among other importers.

Chapter 8 discussed the evolution of agricultural and food security policies in India along with the effectiveness of MSP and procurement. The data and studies at the national level broadly indicated that MSP is an important policy instrument in encouraging farmers and to stabilize market prices. However, the percentage of farmers who were aware of MSP was less especially for pulses. This was also reflected in the lack of knowledge about procurement agencies. Interestingly the percentage of households who sold their products to procurement agencies were even lower than the percentage of households who had information about procurement agencies. In chapter 5 our analysis of sample households from three states selected for analysis also showed poor awareness of MSP. The farmers who avail MSP even with a positive information about MSP was also lower.

Therefore, in chapter 9 we analysed the factors influencing the access to information regarding MSP and the decision to avail MSP. The regression equation was estimated using the conditional mixed-process (CMP) command which uses the mixed process estimator. The results showed that Maharashtra farmers were more enthusiastic in availing MSP despite of the fact that the information regarding MSP was highest among the farmers from Madhya Pradesh. However, farmers who had more diversified crop cultivation were not very enthusiastic in availing MSP. The majority of the farmers in Madhya Pradesh in our sample were large farmers and most probably they are more diversified. Market access came out to be as an important factor in information and in availing MSP. The risk faced by farmers also increased the chances to avail MSP and this points out how important MSP is in mitigating the negative effects of risk.

The supply response of two major pulses produced by 4 major states are analysed in chapter 10 using Nerlove's expectation framework. The results from our analysis indicated that lagged area under cultivation is significant in impacting the production of pigeon pea whereas the yield was significant in the case of chickpea. Prices of competing crops had a negative impact in both the models. The government policy variable-NFSM came out to be significant only in the case of pigeon pea. Interestingly, MSP was significant only in the case of pigeon pea and not for chickpea. This shows the government policies are not significant in influencing the production of chickpea.

To sum it up, the study provided evidences for non-competitive pricing behavior of importers. In the context of an increase in import dependency on the one side and the concentration of exporting countries on the other side, the non-competitive pricing behavior can have huge implications on the domestic price behavior and volatility. Additionally, the depreciation of Indian currency can make import costlier. Therefore, policies to enhance domestic production needs to be scaled up. As far as the policies are concerned there is a huge information asymmetry among the farmers. Most marginal and small farmers were deprived of the information, training and extension services whereas large farmers had greater access to all these. Another interesting observation was the lack of awareness of MSP among pulses producing farmers. Even those farmers who had information about MSP did not avail MSP due to the delay and uncertainty in price settlement. Additionally, the distance to procurement centers results in heavy transportation cost and thereby the distance to market and procurement centers reduced the probability of availing MSP.

Chapter 1
Introduction

1.1 Introduction

Pulses are an essential part of Indian diet as they are a dominant source of protein. Pulses are "the poor man's meat" because the consumption of dairy and animal products is very low among the poorest segment of both rural and urban India. Pulse crops are used as green manure and contribute in improving soil health. Therefore, pulses contribute in improving human health as well as conserving soil through their nitrogen fixing properties. The vital role played by pulses in the agriculture system and in the diets of people makes it an ideal crop for achieving food and nutritional security, reducing poverty and hunger.

Although India is the largest producer and consumer of pulses accounting for 25% of world production and 27% of world consumption (Srivastava et.al, 2010), the production of pulses were nearly stagnant until recently for nearly 40 years (Sekhar and Bhatt, 2012). The two reasons for this poor performance are firstly, the area under pulses is rain fed and secondly, pulses are mainly grown as a residual crop on marginal lands (Sekhar and Bhatt (2012). Farmers are not motivated to produce pulses owing to high production and price risk and also due to lack of effective procurement (Sekhar and Bhatt, 2012). As a result of all these, pulses witnessed a drastic decline in India especially during 1960-70s and this regime also coincides with the spread of green revolution in cereals. During this period, the area under pulses was acquired by cereal crops leading to a decline in area under pulses and the spread of green revolution technology resulted in huge yield improvement in cereals and made cereal crops relatively more competitive on farms (Akibode et.al, 2011).

The latest available data shows that the production of pulses in India was 17.15 million tons in 2014-15 which declined to 16.35 million tons in 2015-16 and further increased to 22.14 million tons in 2016-7 (Department of Agriculture and Cooperation,2017). There could be several factors that might have contributed to short term increase in pulses production including the government interventions such as National Food Security Mission (NFSM), favorable rainfall etc. However, some newspaper reports show that the area under pulses have gone down in the latest kharif season. Pulses acreage has fallen to 130.68 lakh hectares, from the earlier 135.42 lakh hectares (the pioneer, 2017). Therefore, the current trends in area and production of pulses generally reveal the uncertain and fluctuating nature of the production of pulses which are vital for food and nutritional security of the country.

Gram, Tur, Moong and Urad are the major pulses produced and consumed in India. Gram (Chick Peas) is the most dominant pulse with an average share of around 46 percent in the total pulse production during the past five years. The major states contributing to pulse production include Madhya Pradesh, Maharashtra, Uttar Pradesh, Rajasthan and Andhra Pradesh. Based on triennium ending 2010-11, the contribution of Chickpea to total pulses area was 35%, Pigeonpea 16%, Moongbean 13%, Urdbean 12%, Lentil 7%, Fieldpeas 3%, Horsegram 2% and Lathyrus 2%. Chickpea is majorly grown in Madhya Pradesh, Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Uttar Pradesh, Chhattisgarh and Gujarat (Singh, 2013).

1.2 Key Issues: Production Uncertainty and High Import Dependency

The recent decline in pulse production resulted in excess demand and an unprecedented rise in pulse price. An upward trend was observed in the price of pulses especially after 2005. In 2006, there was a sudden increase in imports of pulses which led to a high global price. The year 2009 was a poor agricultural year which led to an increase in price due to shortage in supply. Further in 2012, high Minimum Support Prices (MSP), high world price and depreciation of Indian rupee led to an exorbitant increase in pulse price (Reddy, 2015). A double digit trend in Wholesale Pirce Index (WPI) inflation of pulses was observed in 2015, reaching 39 percent in September 2015-16 which is very high relative to that of cereals (Ministry of Commerce & Industry, 2016).

Due to growing population, declining pulse production and rising pulse prices the net per capita availability of pulses in India has witnessed a sharp decline. The per capita net availability of pulses has declined from 60.7 grams/day in 1951 to 41.9 grams/day in 2013. Presently, 17 million tons of pulses are being produced annually and in order to attain self-sufficiency, the pulse requirement is projected at 50 million tons by 2050 which requires an annual growth rate of 4.2% (Indian Institute of Pulses Research, 2013).

Based on the MSP recommended by Commission on Cost and Agricultural Prices (CACP) for 2015, the movement of MSP for major pulses in last five years has shown a continuous increase. Among the major pulses, the compound annual growth rate in the MSP for Tur, Gram, Moong and Urad has been higher than that of cereals. However, lucrative MSPs alone will not be enough to persuade farmers to produce pulses. It is important that farmers are backed up by procurement operations to ensure them that market price does not fall and prevent them from producing pulses in the future. The procurement of pulses has been negligible at about 1 to 4 per cent of production of pulses compared to 28 to 30 per cent of cereals during 2012-13 to 2014-15 which forced farmers to sell their crops at a loss (CACP, 2015). Thus, a decline in pulse production resulted in excess demand and an unprecedented rise in pulse price. In order to meet the consumption demand of the rising population there has been an increase in the volume of imports in recent years.

During the 1970s and 1980s, imports were restricted in order to protect the interest of domestic farmers. The government achieved this by imposing trade barriers such as quotas, tariffs and quantitative restrictions. It was in 1990-91 when India faced a balance of payment crisis that the possible growth benefits of trade liberalization were realized and import duties declined steadily. From 2007-12, imports of pulses were made duty free and in 2013 the custom's duty on imports was reduced to zero (Negi and Roy, 2015). The perpetual shortage in India's pulses production in the wake of rising demand and adoption of a more liberal approach to international trade led to a rise in the volume of imports in the past decade.

The current pulses scenario in India shows that the domestic supply of pulses was not able to meet the rising demand from domestic consumers. This was due to the fact that different parts of the country had dietary preferences for specific type of pulses. An interesting pattern of consumption that has been observed for pulses in India is that there is very little substitution among different types of pulses (Joshi et.al. 2017).The yield performance of pulses has been low because genetic potential for high yields is limited and pulses are vulnerable to pests and diseases. Pulse production can be increased by 5-6 million tonnes by 2020 by promoting adoption of shorter duration pulse varieties and varieties that are disease and pest resistant (Joshi et.al. 2017). Mechanical harvesting of the pulse crop and crop production and protection technologies have also been limited (Indian Institute of Pulses Research, 2013). Apart from this aspect, lack of assured market, ineffective government procurement operations, unfavorable prices and trade liberalization make pulse production less attractive for farmers compared to other crops (Thomas et.al. 2013). Due to this, the relative profitability of pulse crops reduced despite of exorbitant increase in pulse price. Insurance to reduce risk associated with pulses production can incentivize farmers to grow more pulses and make them more responsive to pulse prices (Joshi et.al. 2017). In a study by Srivastava

(2010), revenue terms of trade between pulses and cereals was evaluated and it was inferred that farmer's preference was inclined towards production of cereals rather than pulses, despite of a higher MSP for pulses.

As mentioned already, pulses are grown in rain fed regions with limited input requirement, high degree of risk associated with production such as inadequate price incentives for the farmers to produce pulses. More than 83 percent area under pulses is rain fed. As a result government intervention in pulses production has assumed significance. The National Development Council in May 2007 adopted the resolution to launch the National Food Security Mission, with the objectives to increase rice production by 10 million tons, wheat by 8 million tons and pulses by 2 million tons by the end of Eleventh Five Year plan (2011-12). The pulse component of NFSM was initially launched in 171 districts across 14 states of the country. The pulse component of Integrated Scheme for Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) was serving the pulse growers in the non-NFSM districts. Later the pulses component of ISOPOM was merged with NFSM to avoid administrative difficulties and duplication of efforts. After the merger, 433 districts in the 14 states will be covered by the pulse component of NFSM (Thomas et.al, 2013).

One of the key interventions under NFSM was the delivery of quality seeds of improved variety which resulted in an increase in pulse production in 2010-11. Further, the NFSM program was responsible in providing technological inputs for plant protection and production technologies to the farmers cultivating pulses in the NFSM districts. Two important components in case of pulses were the integrated soil nutrient management (INM) and integrated pest management (IPM) (Thomas et.al, 2013).

Given the significance of government intervention in pulse production, one of the objectives of the study is to analyze the impact of government intervention on supply of pulses in the form of NFSM on area, production and yield of India's major pulses and to identify the major constraints in raising the production and productivity of pulses. The other objectives of the study are to analyses the factors influencing farmers' access to MSP and the exchange rate pass through and nature of pricing behavior of pulses importers to India.

Using the household level data, the present study will make an attempt to examine the factors affecting the pulses farmers' (Chickpea and Pigeon pea) access to information regarding MSP and utilisation of MSP. The major pulses producing states of the country are selected for a detailed household level analysis. The other two objectives are analysed using the secondary data. Area, cost of production, prices and non-price factors are used in analyzing the factors influencing the supply of pulses. The import data, exchange rate and Consumer Price Index(CPI) are used for the analysis of pricing behavior and exchange rate pass through.

1.3 The detailed objectives of the study can be listed as follows,

1. To analyze the factors affecting the production of major pulses.
2. To understand the impact of Minimum Support Price (MSP) policy and NFSM on the production of pulses.
3. To analyze the implications of pulses trade and the import pricing behavior and exchange rate pass through into major pulses imported to India.

1.4 Study Area

The present study focuses on Chickpea and pigeon pea. However, the import pricing analysis will make use four major pulses imported to India. They are chickpea, pigeon pea, dry peas and kidney beans.

For the household level data analysis three major pulses producing states from India is identified. They are Maharashtra, Madhya Pradesh and Karnataka.

Maharashtra (APY declining), Madhya Pradesh (APY improving) and Karnataka (area is declining but production & yield are improving) are selected for the purpose of analysis for chickpea. Madhya Pradesh (area is declining but production & yield are improving) Karnataka (APY improving) and Maharashtra (APY declining) are identified for the purpose of pigeon pea. The states for each pulse is selected in such a manner that one state generally shows an increase in the production while the other shows a decline in production over the past 36 years. (Please see the figures in appendix for more details). The district selected for the purpose of analysis within Maharashtra is Nagpur. Nasinghpur is selected for the purpose of analysis from Madhya Pradesh. Gulbarga district is selected for the purpose of analysis from Karnataka.

For secondary data analysis, of supply response, all the major pulses producing states are selected. They are Karnataka, Madhya Pradesh, Maharashtra and Uttar Pradesh.

1.5 Data Collection

The analysis is based on both primary as well as secondary data.

The primary data will be collected through a comprehensive household level survey. Villages/regions that have the highest production of the selected pulses are identified for the purpose of analysis. From each state, one of the major pulses producing district was selected for further analysis. From Karnataka, Gulbarga was selected, from Maharashtra, Wardha was selected, and from Madhya Pradesh, Narsinghpur was selected. Subsequently a random sample of pulses producing households are selected and interviewed. The interviews will be based on structured survey questionnaire administered by well-trained and experienced enumerators who have knowledge of the local farming system and the local language.

The sample consisted of 482 pigeon pea farmers and 316 chickpea. Out of which 227 farmers were cultivating both chickpea and pigeon pea. The survey was conducted through questionnaire, framed in such way as to draw out details covering household characteristics, wealth and farm characteristics, institutional and access related variables, risk and economic factors.

The secondary data will be collected from various sources. Trade data will be collected from World Bank's World Integrated Trade Solution database (WITS). The unit import price will be calculated using the import quantity and import value data obtained from directorate general of commercial intelligence and statistics (DGCI&S. The all India as well as state level data on area and production of pulses is Centre for Monitoring of Indian Economy's (CMIE) states of India data. The data on exchange rate is obtained from OANIDA and the Consumer Price Index is obtained from World Bank indicators. The data on cost and prices were obtained from directorate of economics and statistics.

1.6 Methodology

The access to MSP information and utilisation of MSP is analysed using an equation based on a conditional mixed process (CMP) estimator. The pricing to market and exchange rate pass-through is analysed using Panel Corrected Standard Error (PCSE) estimation technique. The supply response of pulses is analysed using a dynamic supply response equation is developed based on the theoretical framework of Nerlove's expectation model.

1.7 Chapter Scheme

This study has been divided into 11 chapters including introduction and conclusion. Chapter 1 as an introduction provided the background, objectives, data, and methodology along with chapter scheme. Chapter 2 gave an overview of pulses economy. Chapter 3 discussed the importance of pulses for nutritional and food security, the importance of sustainable production practices to improve the pulses productivity and food security with an emphasis on India. Chapter 4 discussed the salient features of Government of India's National Food Security Mission (NFSM) and its objectives especially in the context of pulses production. Chapter 5 provided a detailed discussion of socio-economic profile of the sample households. Chapter 6 provided an overview of pulses production, trade and government policies with a special focus on the trends in trade and its implications. Chapter 7 analysed the import pricing behavior and exchange rate pass through into prices of imported pulses. Chapter 8 provided an overview of an evolution of minimum support price policies and MSP for major pulses. Chapter 9 analysed the factors influencing the access to information regarding MSP and utilisation of MSP in a joint framework. Chapter 10 made an analysis of factors influencing the supply response of chickpea and pigeon pea with a special emphasis on MSP and NFSM. Chapter 11 provided the conclusion and policy implications of the study.

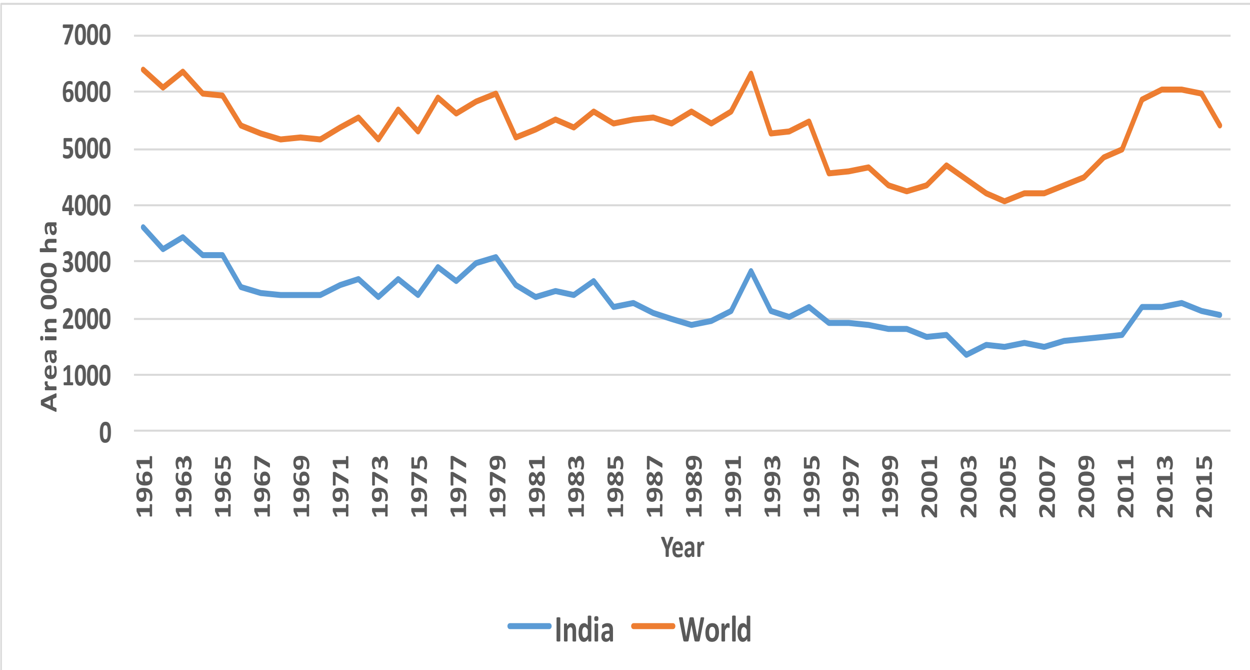
Chapter 2

An Overview of Pulses Economy

2.1 Introduction

India contributed around 38% of world's area under pulses in 2016. India's share in world area was around 56% in 1961 but gradually declined to less than 40% since 2000 (see figure 2.1). In terms of production, India contributed around 23% in 2016, whereas India's contribution was around 45% in 1961 (see figure 2.2). Though India's pulses production was always fluctuating the decline in the share of production was more prominent since 2001. Similarly, Indian pulses yield was also much below the world average. (see figure 2.4)

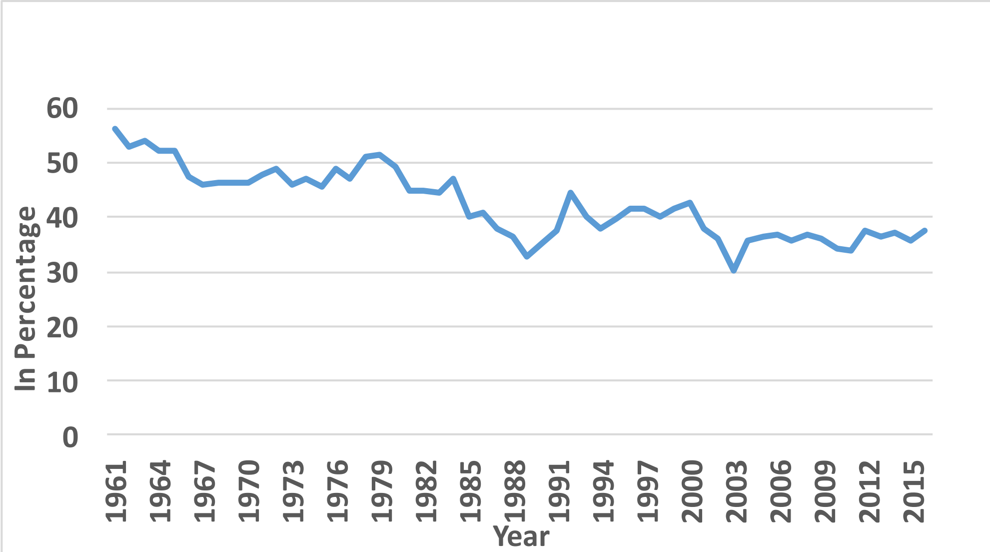
Figure 2.1: Area under Production of Pulses in 000 ha



Source: FAOSTAT

The area under pulses production in India in 1961 was around 3592 thousand hectares but sharply declined to 2039 thousand hectares in 2016. In the case of world as a whole the area under pulses declined from around 6396 hectares to around 5423 hectares during the same period (see figure 2.1). However the decline in area in India was at a much larger pace as the decline in share rightly indicates (see figure 2.2)

Figure 2.2: Area under Indian Pulses as Percentage of World Area under Pulses



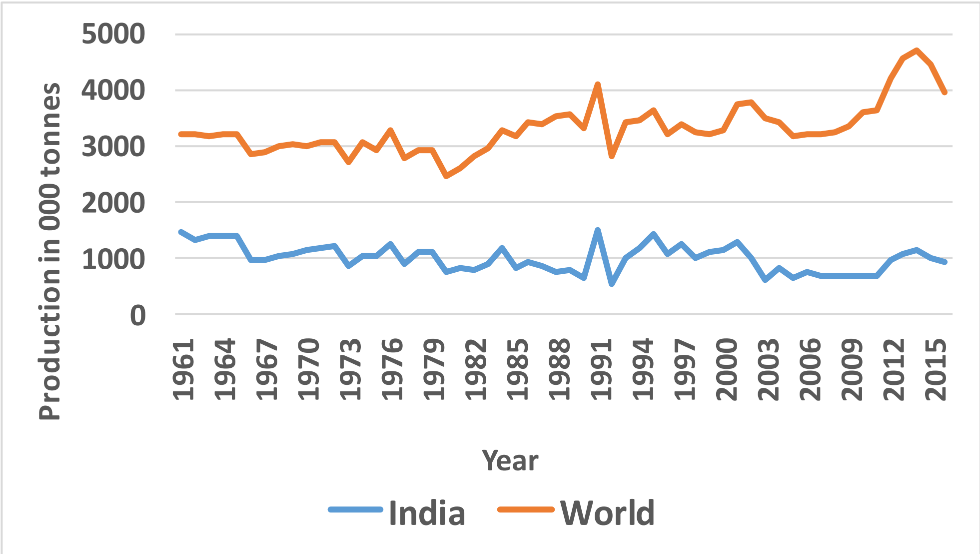
Source: FAOSTAT

The total production of pulses 1450 thousand tonnes in 1961 to 921 thousand tonnes in 2016. In India the production was the highest in 1991 marking 1507 thousand tonnes of production. (see figure 2.3). Interestingly during the same year the world production was also relatively high as 4092 thousand tonnes. But the world production was the highest in the year 2014 marking 4714 thousand tonnes of production. The faster rate of decline in production in India as compared to world production was also reflected in the declining share of India's production in world production (see figure 2.4). India's share in production declined from around 45 % in 1961 to only 23% in 2016 (see figure 2.4). The share was the lowest in 2003 marking only 18%. India being the major producer of pulses, the shrinking size of area and production of pulses is an alarming factor especially considering the population growth and protein intake for the poor segments of the country and nutritional implications.

The above is especially true when the Indian pulses yield is much below the world average (see figure 2.5). Interestingly the trends in the yield for both India and the world were somewhat similar. Another interesting observation is in the year 1991, India's yield in pulses were almost similar to world yield. Indian yield was 7096 hg/ha whereas world yield was 7252 (see figure 2.5). Note that this was the year India achieved the record production in pulses. Therefore, an understanding the factors that contributed to higher production and productivity in pulses in the year 1991 is very crucial to understand and promote policies that would help in enhancing pulses production.

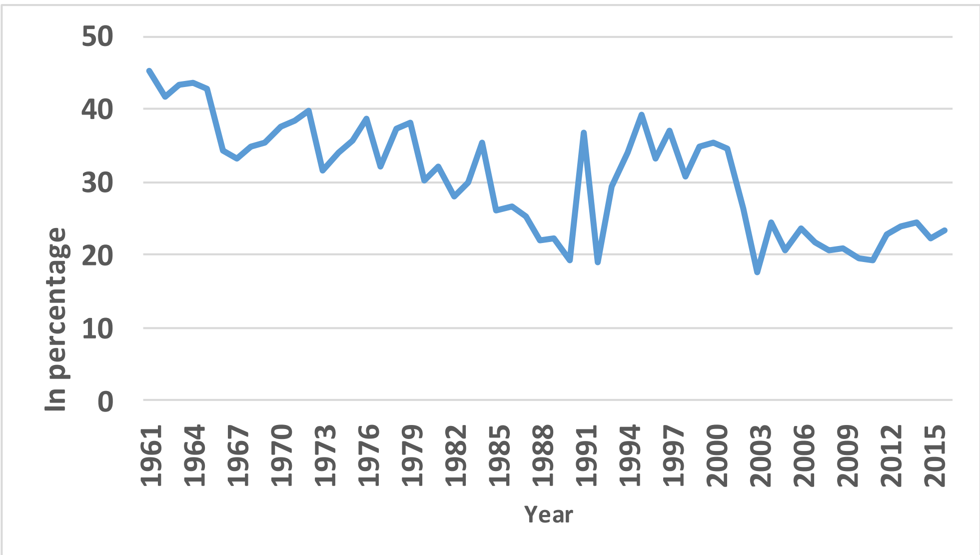
Again in 2001l, the Indian yield got closer to world yield. Indian yield was 7879 whereas the world yield was 8674. Unfortunately, since 2001, the yield gap between the world and India got widened and Indian yield went much below the world yield. As observed earlier, the declining share of India's pulses production in world pulses production was also more prominent since 2001. The decline and widening gap in the yield could be the reason for the declining share in India's pulses production.

Figure 2.3: The Trends in Production of Pulses



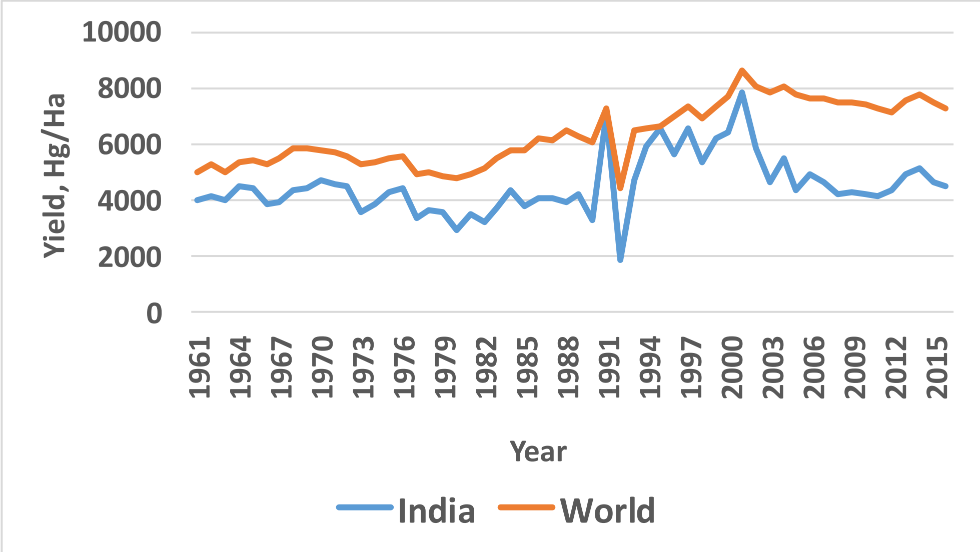
Source: FAOSTAT

Figure 2.4: Production of Indian Pulses as Percentage of World Production of Pulses



Source: FAOSTAT

Figure 2.5: Yield of Pulses in Hg/Ha



Source: FAOSTAT

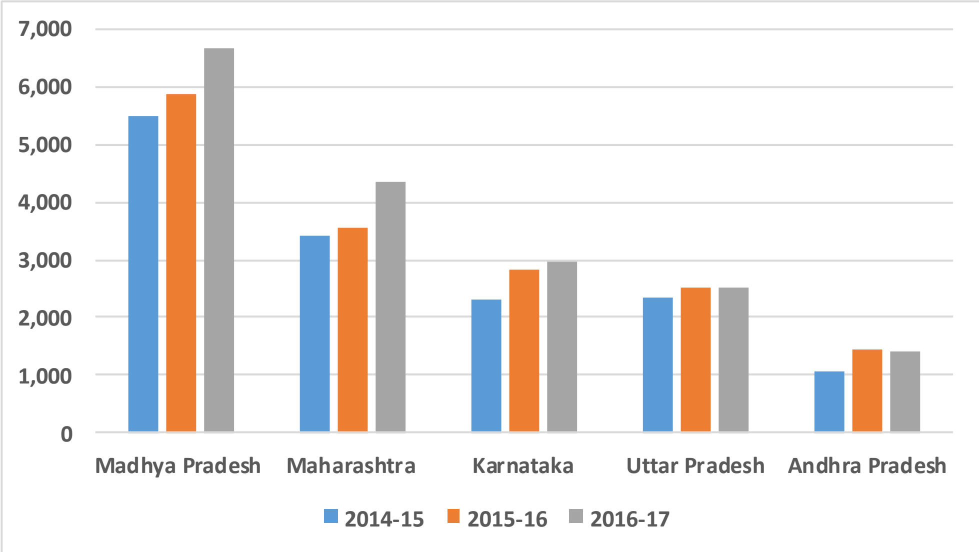
India grows and consumes several types of pulses primarily because of heterogeneity in preference across regions. Pulses are grown in all three seasons. The three crop seasons for the commodity are:

i. Kharif: Arhar (Tur), Urd (Blackgram), Moong (Greengram), Lobia (Cowpea), Kulthi (Horsegram) and Moth;
ii. Rabi: Gram, Lentil, Pea, Lathyrus and Rajmash;
iii. Summer: Greengram, Blackgram and Cowpea.

The major pulses produced in India are pigeon pea and chickpea. However, in the subsequent sections we analyse the area and production scenario of two more Pulses-Kidney beans and Peas. These crops are selected as they are heavily imported by India consistently over the last couple of years. We have also made an analysis of import pricing behavior of importers of all the above mentioned crops (refer to chapter 7).

The total area under pulses production was the highest in Madhya Pradesh and this was followed by Rajasthan, Maharashtra, Karnataka, Uttar Pradesh and Andhra Pradesh. The share of these states in total area remains to be more or less the same with an increased share of Rajasthan (see Table 2.1).

Figure 2.6: Total Area under Pulses Production in India, State-wise, in Thousand Hectares



Source: CMIE States of India

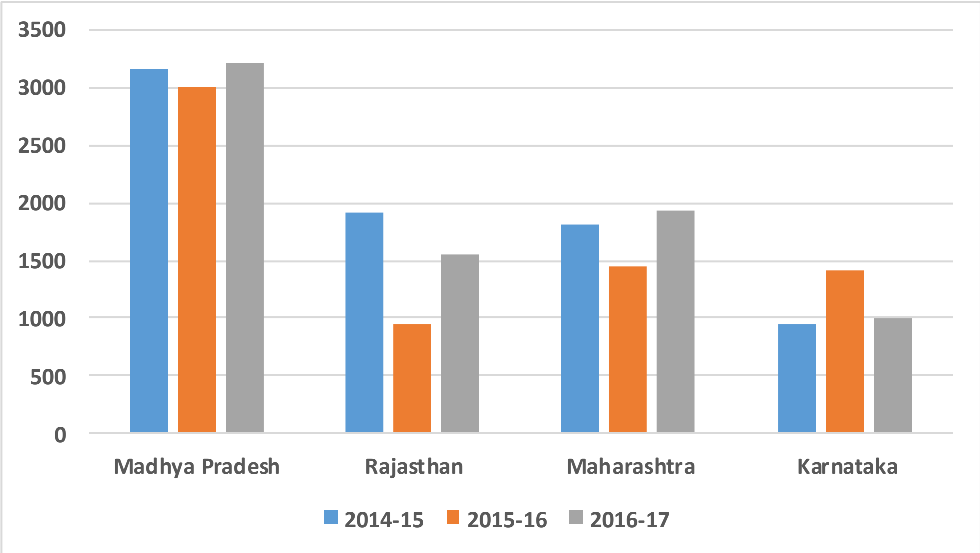
Table 2.1: Share of Major Pulses Producing States Area in Total Area

	Madhya Pradesh	Rajasthan	Maharashtra	Karnataka	Uttar Pradesh	Andhra Pradesh
2014-15	23	14	14	10	10	4
2015-16	24	16	14	11	10	6
2016-17	23	18	15	10	9	5

Source: CMIE States of India

The area under chickpea was also the highest in Madhya Pradesh and this was followed by Rajasthan, Maharashtra and Karnataka. When area under chickpea remained more or less the same in Madhya Pradesh during the three years under analysis, the area under chickpea in other states showed slightly more fluctuations (see figure 2.7). When all these states experienced a mild decline in area under chickpea, the area increased in Karnataka in 2015-16. However, when all the states experienced an increase in area, Karnataka experienced a decline in 2016-17. This actually shows that farmers are adjusting their area under cultivation based on the surplus production and the subsequent market prices. The increase in one year and then decline in the next year in area allocation is a testimony to this fact.

Figure 2.7: Area under Chickpea in India in Major Producing States, in Thousand Hectares



Source: CMIE States of India

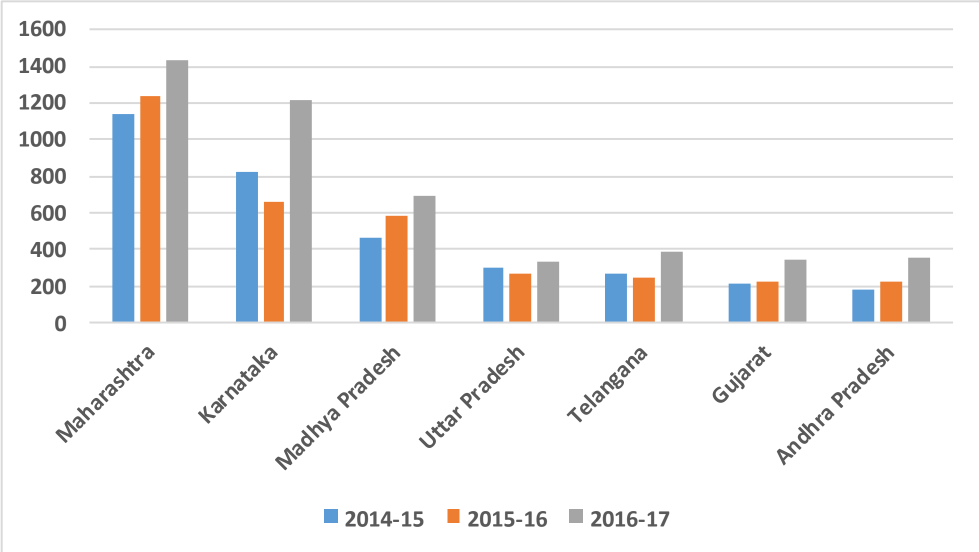
Table 2.2: Share of Major Chickpea Producing States Area in Total Area in India

Year	Madhya Pradesh	Rajasthan	Maharashtra	Karnataka
2.14-15	32	19	18	10
2015-16	36	11	17	17
2016-17	33	16	20	10

Source: CMIE States of India

As compared to the concentration of production of chick pea area in few states, there were more states producing pigeon pea. The highest area under pigeon pea was in Maharashtra and this was followed by Karnataka, Madhya Pradesh and Uttar Pradesh. Telengana, Gujarat and Andhra Pradesh were the other major producers (see figure 2.8). All the states experienced an increase in area under cultivation in 2016-17. The increased area allocation could be due to the high market prices prevailed in the previous year. Though area had increased in 2016-17, the share of some of these states' in total area under pigeon pea in India had declined as compared to the previous year. For example, the share in area had declined in Maharashtra, Madhya Pradesh and Uttar Pradesh while the share had increased in Karnataka (see table 2.3).

Figure 2.8: Area under Pigeon Pea in India in Major Producing States, in Thousand Hectares



Source: CMIE States of India

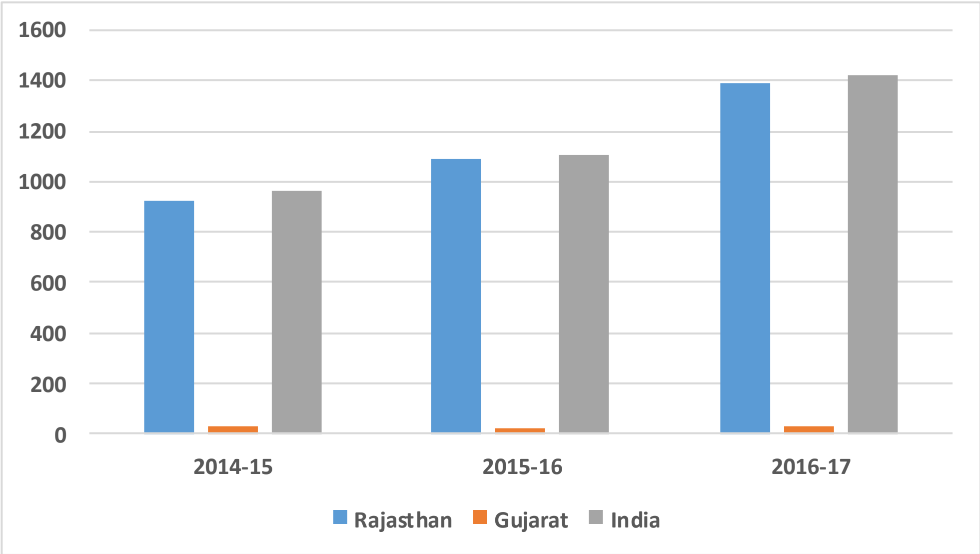
Table 2.3: Share of Major Pigeon Pea Producing States in Total Area under Pigeon Pea in India

Year	Maharashtra	Karnataka	Madhya Pradesh	Uttar Pradesh	Telangana	Gujarat	Andhra Pradesh
2014-15	29	21	12	8	7	5	5
2015-16	31	17	15	7	6	6	6
2016-17	27	23	13	6	7	7	7

Source: CMIE States of India

The production of kidney beans was concentrated only in Rajasthan with a negligible share also from Gujarat. Rajasthan contributes almost all of the kidney beans produced in India. The lack of sufficient supply in kidney beans could be the reason for substantial imports in kidney beans. The area under kidney beans experienced an increase over the three periods under study (see figure 2.9).

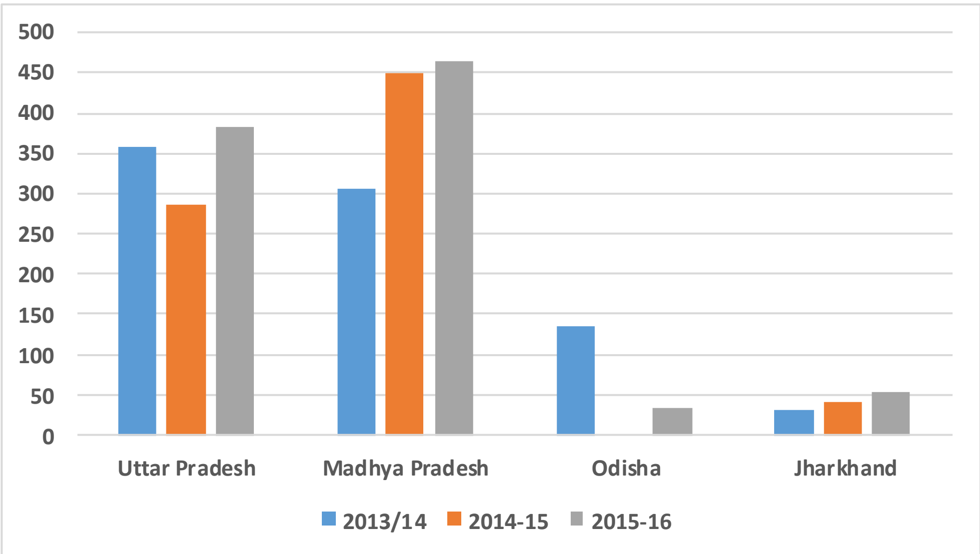
Figure 2.9: Area under Kidney Beans in Major Producing States of India, in Thousand Hectares



Source: CMIE States of India

The area under peas was the highest in Uttar Pradesh and Madhya Pradesh. Madhya Pradesh experienced a continuous increase in area under peas during the three-year period (see figure 2.10). The other two producers were Odisha and Jharkhand. However they had only a negligible share in total area under peas.

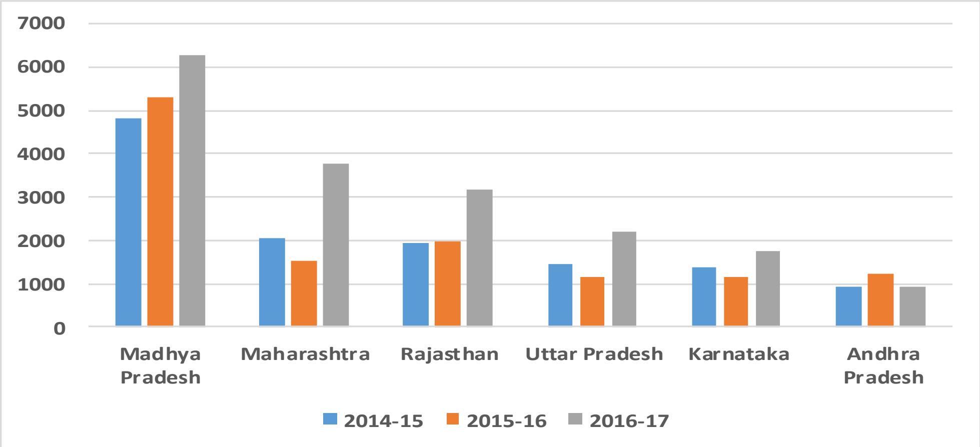
Figure 2.10: Area under Peas in Major Producing States of India, in Thousand Hectares



Source: CMIE States of India

As in the case of area, the production of pulses is also the highest in Madhya Pradesh (see figure 2.11). This was followed by Maharashtra, Rajasthan, UP, Karnataka and Andhra Pradesh. Though Karnataka had more area under production, UP has more production as compared to Karnataka. This points out the productivity differences in production. Though the production has increased in Madhya Pradesh, the share of the state in total production in the country declined to 27.20% as compared to 32.43% in 2015-16 (see table 2.4). In the case of Maharashtra, both the production and the share had increased considerably in 2016-17 as compared to 2015-16. The share of Maharashtra increased from 9.45 % to 16.29% (see table 2.4).

Figure 2.11: Production of Pulses in Major Producing States, in Thousand Tonnes



Source: CMIE States of India

Table 2.4: Production Share by Major Pulses Producing States

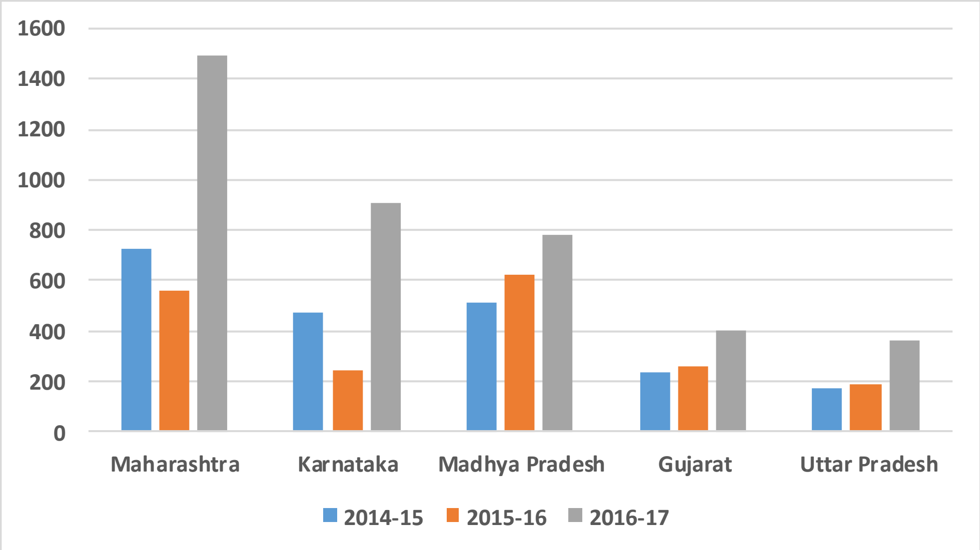
Year	Madhya Pradesh	Maharashtra	Rajasthan	Uttar Pradesh	Karnataka	Andhra Pradesh
2014-15	28.15	11.97	11.38	8.39	8.10	5.54
2015-16	32.43	9.45	12.17	7.12	6.97	7.52
2016-17	27.20	16.29	13.75	9.44	7.51	4.02

Source: CMIE States of India

Production of pigeon pea was the highest in Maharashtra and this was followed by Karnataka and Madhya Pradesh. The production of pigeon pea increased considerably in Maharashtra in 2016-17 as compared to 2015-16 (see figure 2.12). The production had increased in Karnataka also. But in the case of Madhya Pradesh, Gujarat and Uttar Pradesh the production increased continuously over the three year period (see figure 2.12).

Due to substantial increase in production in Maharashtra, the share also increased from 22% to 31 % (see table 2.5). The share of Karnataka also increased from 9% to 19%.

Figure 2.12: Production of Pigeon Pea in Major Producing States



Source: CMIE States of India

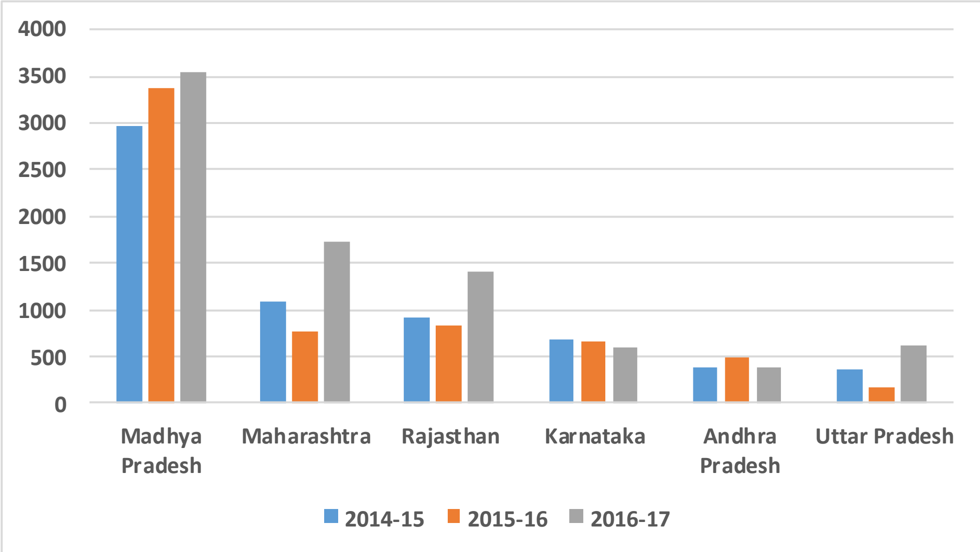
Table 2.5: Share of Major Pigeon Pea Producing States' Production in Total Production

Year	Maharashtra	Karnataka	Madhya Pradesh	Gujarat	Uttar Pradesh
2014-15	26	17	18	8	6
2015-16	22	9	24	10	7
2016-17	31	19	16	8	7

Source: CMIE States of India

Madhya Pradesh was the highest producer of chickpea. This was followed by Maharashtra and Rajasthan (see figure 2.13). Though the absolute amount of production increased in Madhya Pradesh, the share declined from 48% to 38% during the three-year period under study (see table 2.6). Whereas the share increased in Maharashtra, Rajasthan and Uttrar Pradesh (see table 2.6). The share of Maharashtra increased from 11% to 18%, Rajasthan from 12% to 15% and Uttar Pradesh from 2% to 7%.

Figure 2.13: Production of Chickpea in Major Producing States



Source: CMIE States of India

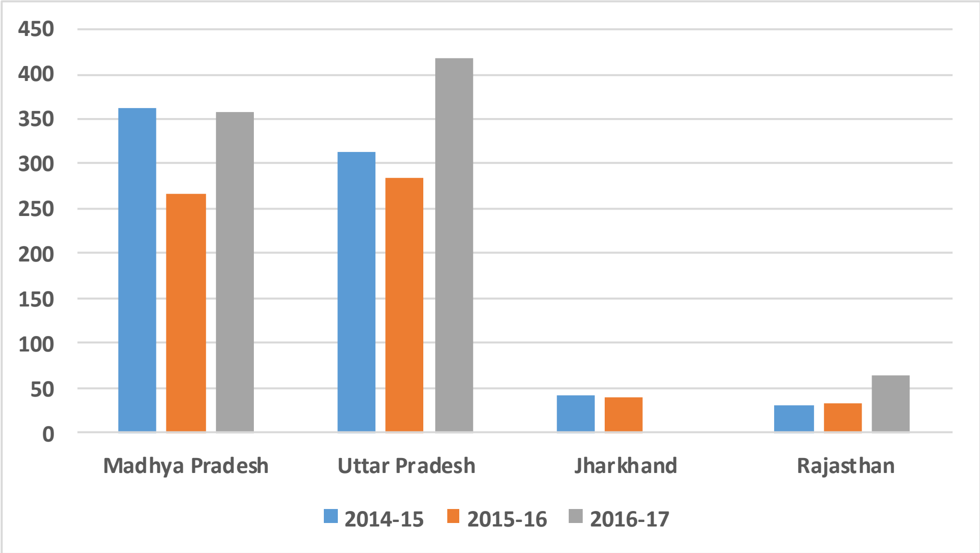
Table 2.6: Share of Major Chickpea Producing States' Production in Total Production

Year	Madhya Pradesh	Maharashtra	Rajasthan	Karnataka	Andhra Pradesh	Uttar Pradesh
2014-15	40	15	12	9	5	5
2015-16	48	11	12	9	7	2
2016-17	38	18	15	6	4	7

Source: CMIE States of India

The production of peas was mainly by Madhya Pradesh and Uttar Pradesh. Though Orissa was the third in area under cultivation of peas, the productivity of peas was very less in Orissa. This was the reason why Orissa was not appearing among the top producers of peas. Though Jharkhand was not appearing among the top states in terms of area under cultivation, it has appeared among the top in terms of production indicating better productivity of peas in Jharkhand as compared to Rajasthan or Orissa (see figure 2.14). The total peas production had increased from 742 thousand tonnes in 2015-16 to 1011 thousand tonnes in 2016-17.

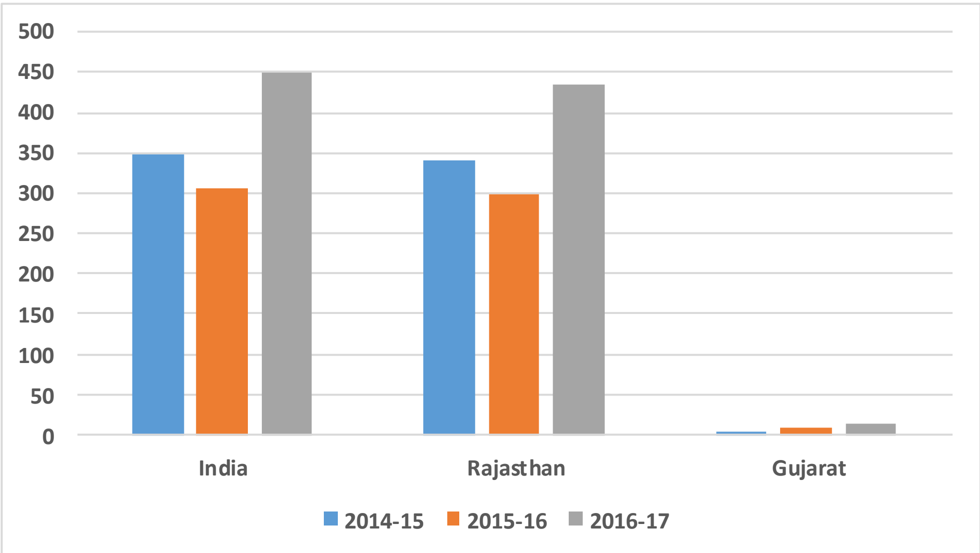
Figure 2.14: Production of Peas in Major Producing States



Source: CMIE States of India

Rajasthan contributed almost all of the kidney beans produced in the country along with a negligible share from Gujarat (see figure 2.15).

Figure 2.15: Production of Kidney Beans in Major Producing States



Source: CMIE States of India

Conclusion

An analysis of area, production and yield of pulses and major pulses produced in India showed that there was a substantial decline in area and production of pulses in India. Indian yield was much below the world average and the yield gap between the two got widened since 2001. It was the same year, the decline in production of pulses was more prominent. However, in the year 1991, the yield gap got narrowed and came very close to the world average. Interestingly, this was the same year when India marked a record production in pulses. The declining share in area and production and widening gap between the yield is very alarming in the context of an increased demand for pulses. Since it is a protein rich crop, and there is a decline in per capita availability of pulses, considerable efforts are required to boost the production. The year 2016-17 shows marginal increase in the production of pulses. Though the dominant producing states have either continued or marginally improved the production, an increase in production was observed by other states who were not major contributors of pulses. This could be due to the impact of government policies such as an increase in MSP or the efforts to boost production through National Food Security Mission (NFSM). The subsequent chapters will make an analysis of these factors in greater detail.

Chapter 3
Pulses Production and Food Security

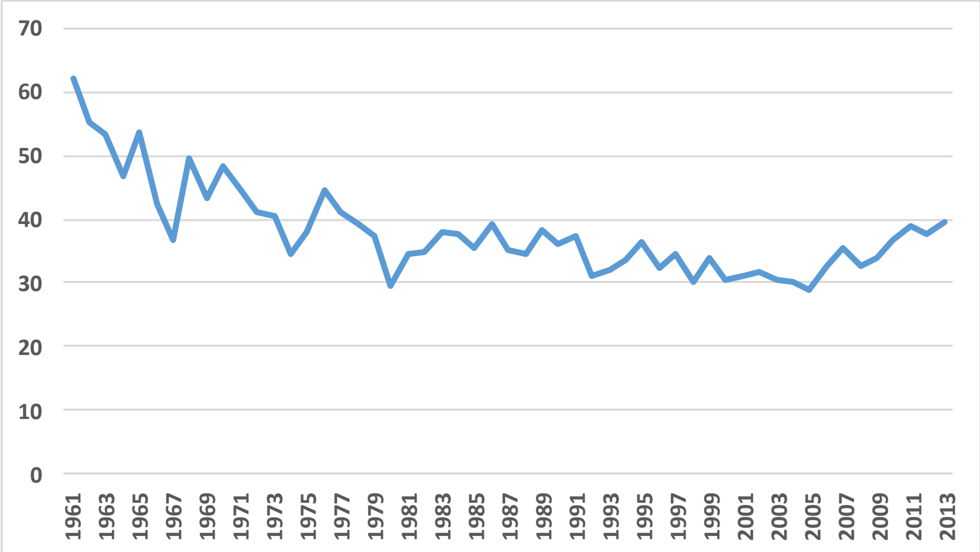
3.1 Introduction

India's total food grain production substantially increased from around 80 million tonnes in 1965 to around 250 million tonnes in 2015 (Bhattacharya et al., 2017). Though the improvement in self-sufficiency had a positive impact on production, the per capita availability declined consistently and the difference becomes starker when one looks at the fact that an average family of five had 198 kg of food grain less to eat than in 1991 (pal et al., 2019). The scenario becomes more dismal in the case of pulses though with a paramount importance in contribution to food and nutritional security remained outside the ambit of productivity benefits (Bhattacharya et al., 2017).

The per capita net availability of pulses in the country was 62.19 g/capita/day in 1961, which is reduced sharply to 34.42 g/capita/day in 1974. Although the figure showed some tendency to improve in the next few years to 44.45 g/capita/day, it further declined to 39.45 g/capita/day in 2013 (see figure 3.1). The figures overall point out a sharp and persistent decline in the per capita net availability of pulses.

The available projection based on supply demand gap reveals huge excess demand (Jadhav et al, 2018). For example, the projection using the population and income data showed that the demand for chickpea(gram) and pigeon pea (tur) would reach 62.31 and 143.30 lakh tonnes by the end of 2020 and by the end of 2030 the demand for gram and tur is expected to increase to 171.10 and 391.70 lakh tonnes, respectively (Jadhav et al, 2018). The projected demand for pigeon pea (tur) is greater than chickpea (gram) possibly due to the low productivity of pigeon pea (tur) due to lack of moisture availability in soil as it is grown mainly in dry lands (Jadhav et al, 2018). As a result, the projected shortfall in supply due to the excess demand for chickpea (gram) would be 47.5 lakh tonnes by 2025 and 114.5 lakh tonnes by 2030. Similarly, for pigeon pea (tur), the projected shortfall would be around 211.6 lakh tonnes by 2015 and this is expected to increase to 365.6 lakh tonnes by the end of 2030 (Jadhav et al, 2018).

Figure 3.1: The Per Capita Net Availability of Pulses in India (in gm/capita/day)



Source: FAOSTAT

Pulses, in India assumes significant relevance in promotion food and nutritional security as it is a staple source of protein to a significant share of Indian population. The estimates show that the daily protein requirement of an average person is 56gram, and 100 grams of pulses contain 25 grams of protein (Rampal, 2017). This is two times higher than the protein available in wheat and three times higher than the protein available in rice (Bhattacharya et al., s 2017). Additionally, some estimates show that around 31 percent of Indians are vegetarian (Rampal, 2017) and therefore a large part of their protein requirement can be met by consuming pulses. Therefore, at least half of the daily requirement of protein can be met by including two servings of pulses in the daily diet.

Pulses are also a rich source of fiber, vitamins and minerals, such as iron, zinc, folate and magnesium. Just as pulses provide nutritional benefits to humans, they also produce a number of different compounds that feed soil microbes, thus benefiting soil health (Bhttacharya et al., 2017). Table 3.1 summarises the nutritional content of some of the major pulses produced and consumed in India.

Table 3.1: Nutritional Content of Major Pulses in India (per 100 gram)

	Chickpea	Pigeon pea	Lentil	Urad (black gram)	Green Gram	Cowpea	Pea	Kidney beans
Protein(g)	19.3	21.7	25.8	25.21	23.86	23.85	24.55	23.58
Total lipid(fat)g	6.04	1.49	1.06	1.64	1.15	2.07	1.16	0.83
Carbohydrate, by diff(g)	60.7	62.8	60.1	59	62.6	59.6	60.4	60
Fibre, total dietary(g)	17.4	15	30.5	18.3	16.3	10.7	25.5	24.9
Sugar(g)	10.7		2.03		6.6		8	2.23
Calcium (mg)	105	130	56	138	132	85	55	143
Iron(mg)	6.24	5.23	7.54	7.57	6.74	9.95	4.43	8.2
Magnesium (mg)	115	183	122	267	189	333	115	140
Phosphorous(mg)	366	367	451	379	367	438	366	407
Potassium(mg)	875	1392	955	983	1246	1375	981	1406
Sodium(mg)	24	17	6	38	15	58	15	24
Zinc(mg)	3.43	2.76	4.78	3.35	2.68	6.11	3.01	2.79
Vitamin C(mg)	4		4.4		4.8	1.5	1.8	4.5
Vitamin B-6(mg)	0.535	0.283	0.54	0.281	0.382	0.361	0.174	0.397
Vitamin A (mg)	67	28	39	23	114	33	149	53

Source: Bhattacharya et al., 2017

A key benefit of pulses cultivation is their ability to fix atmospheric nitrogen, thus improving soil fertility. Not only do pulses discharge greater and different types of amino acids, but the plant residues left after harvesting pulse crops also improve biochemical composition of the soil. Hence, pulses production can promote sustainability of the farming systems.

3.2 Consumption of Pulses

In the coming decades, the producers globally will need to feed an additional 3 billion people and a large part of that population would be from the developing regions of the world. The global demand for pulses has been increasing. The table 3.2 summarises the protein intake in developing countries where pulses contribute more than 10% of per capita total protein intake. The data shows that India's protein intake is 13%.

Table 3.2: Developing Countries where Pulses Contribute more than 10% of Per Capita Total Protein Intake

Countries	Percentage	Countries	Percentage
Burundi	55%	Mauritania	13%
Rwanda	38%	Sierra Leone	13%
Uganda	20%	**India**	13%
Kenya	20%	Brazil	13%
Comoros	18%	Trinidad and Tobago	12%
Haiti	18%	Mozambique	12%
Ertirea	18%	Cameroon	12%
Nicaragua	16%	D.R. Korea	11%
Cuba	16%	Guatemala	11%
Niger	15%	Mexico	10%
Ethiopia	15%	Togo	10%
Malawi	15%	Belize	10%
Angola	15%	Paraguay	10%
Tanzania	14%	Botswana	10%

Source: FAO (2005-07)

As mentioned previously, in India, the rate of an increase in the production of pulse has been less than the increase in the population. The declining per capita production of pulses (14 kg in mid-1990s to 12 kg in 2008) has been compensated by the increasing imports of the commodity. With the declining production globally, and rising prices both in domestic as well as international markets, the per capita availability of pulses has continued to deteriorate.

The declining per capita consumption of cereal and pulses has led to their declining importance as a source of calories and proteins in diets, which according to NSSO data, has come concomitantly with a decline in average per capita calorie and protein consumption in rural India and a stagnant level of those nutritional indicators for urban India (Deaton and Dreze, 2009).

The government policy initiatives such enhancing production through National Food Security Mission (NFSM) and higher minimum support prices (MSP) were considered to have played a positive role in encouraging production (Bhattacharya et al., 2017). However, a breakthrough in technological innovations are highly required to reduce the crop loss and to improve productivity.

The below sections will discuss the major production technologies of pulses, thereby highlighting the growing importance for sustainable production practices in agriculture. Major varieties of pulses would be highlighted and towards the end of the chapter consumption pattern of various pulses would be discussed.

3.3 Production Technologies

Some of the major constraints in the production of pulses in India have been the unfavourable weather conditions, the abnormal soil conditions, agro-economic constraints, availability of better input quality, pests and diseases, technological and infrastructural constraints, blue-bull trouble and credit, marketing and policy constraints (Singh et al., 2015).

Improved Varieties or Hybrids

Over the years there has been less research on pulses than on cereals. From the studies that have been conducted, it was found that yields in pulses in India have been lower in comparison with the other countries. For increasing yields in pulses it is important to encourage GM technologies. In pulses, breeding is limited both by the narrow genetic base of varieties and their high susceptibility to pest and disease attacks. Indian scientists have already made progress in this area. GM pod borer insect pest-resistant chana and arhar have been developed by Assam Agricultural University and ICRISAT respectively (Subramanian, 2016).

Further, there is an urgent need to broaden the genetic base by strengthening pre-breeding of pulses and developing core sets of germplasm, harnessing hybrid potential through the development of CMS (cytoplasmic nuclear male sterility) based hybrids in pigeon pea, mapping and tagging of genes and marker-assisted selection for resistance to insect pests and diseases, gene pyramiding for stable resistance, development of transgenics in chickpea, and genomic research for understanding the structure and function of genes (Ali and Gupta, 2012).

Vertical Approach

Singh et al. (2015) has detailed the possible methods and techniques which ensure an increase in production without an expansion in the cropping area. The first in vertical approach is the promotion of sequential cropping and intercropping of pulses. A number of intercropping systems for pulses is developed by Agricultural Research Stations. Farmers in rain-fed states such as Gujarat, Madhya Pradesh, Maharashtra, Karnataka etc. are familiar with these practices and have been practising them in traditional ways. However, it should be ensured that the seeds of pulse varieties that are recommended for intercropping are available to the farmers. Demonstrations must be made with suitable seeding devices and seed mini-kits of pulses must be provided to the farmers.

Table 3.3: Promising Intercropping for Different Pulse Producing States

Intercropping Systems	**States**
Soybean + Pigeon pea	Madhya Pradesh, Maharashtra
Pearl Millet / Sorghum + Pigeon pea	Karnataka, Andhra Pradesh, Gujarat, Maharashtra
Groundnut + Pigeon pea	Gujarat
Groundnut / Sorghum / Pearl Millet + Urad bean	Bihar, Maharashtra, Madhya Pradesh, Karnataka
Mung bean / Cowpea	Gujarat, Uttar Pradesh, Rajasthan
Sugarcane + Cowpea / Mung bean / Urad bean	Uttar Pradesh, Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu
Cotton + Mung bean / Urad bean /Cowpea	Punjab, Haryana, Madhya Pradesh, Gujarat, Andhra Pradesh, Maharashtra

The second in the vertical approach is the seed replacement or multiplication strategy. The major constraint related to the promotion of quality seeds is the availability of better varieties of seeds in adequate quantities at appropriate times. The Seed Replacement Rate (SRR) estimated for the year 2006-07 was a mere 10.41%. However, through efforts by various Government schemes and programmes such as Integrated Scheme of Pulses, National Food Security Mission (NFSM), Seed Village Programme etc. the SRR was successfully raised to 22.5% by 2010-11.

The third in the vertical approach is the balanced nutrient management. Through various studies, it was found that Sulphur application at the rate of 20-40 kg/hectare at the time of sowing and the application of Zinc Sulphate at the rate of 25-50 kg/hectare once in every two years effectively addresses the problem of deficiency of these compounds in the pulses. It was also noted that by the application of these compounds, crop productivity could be maximised along with the efficient use of water. Most of the Nitrogen requirement was met through biological N-fixation.

Mechanization in pulses comes next in the vertical approach. Mechanisation of soils is very important to raise the productivity of crops. Adoption of deep ploughing, ridge planting, line sowing, inter-culture operations along with mechanization contributes to the timeliness of operations, reduces cost of production and improves resource use efficiency (Singh et al., 2014a and Patel et al., 2014). Custom hiring of the machines, especially for farmers with small holdings proves to be a good option for increasing farm mechanisation. In this context, example of '*Haldhar*' program of Madhya Pradesh Government is a good practice that subsidizes the farmers to the extent of Rs. 2000 per hectare for deep ploughing of their lands (Anonymous, 2013 and Singh et al., 2013a).

The last in the vertical approach is the expansion of irrigation services by the use of resource conservation technologies. The use of sprinkler irrigation not only saves irrigation water but also expands the area under irrigation. Further, another method, drip irrigation has also gained attention worldwide. Fertigation has also proved fruitful for widely spaced crops such as pigeon pea.

Horizontal Approach

Under the horizontal approach, Singh et al. (2015) has discussed about the efficient utilisation of rice fallow lands and replacement of low productivity crops with pulses. After the cropping of kharif rice, the area left un-cropped is estimated to be around 11.65 million hectares. Bihar, Madhya Pradesh, Chhattisgarh, Odisha and Eastern parts of Uttar Pradesh are the states that consist of such areas. Depending upon the soil type and depth, around 25 percent of such area has the potential of supporting a rabi pulse. Hence, nearly 3 to 4 million hectares of additional area can be brought under rabi pulses. Assuming an average productivity of 600 kg/hectare, the same area can produce 1.8 to 2.4 million tons of pulses. Thus, necessary technological back up in terms of suitable short varieties must be made (Journal of Agrisearch, Vol 2, No. 2). Further, mustard, barley and wheat could be replaced by rabi pulses such as lentils and chickpeas. Harvested rain-water could be used for rabi crop establishment (Anonymous, 2013 and Singh et al., 2013a).

Rhizobium Inoculation

Jeswani and Baldev (1990) have pointed out that the pulses have a unique property of association with Rhizobium which lives freely in soils. The Rhizobium enters the root hair of pulse crops and fixes atmospheric nitrogen. Artificial inoculation with an efficient Rhizobium culture and in this way ensures the availability of maximum quantity of symbiotic nitrogen to the crop. Rhizobium inoculation increases yields. Various studies have suggested that up to 100 percent of the nitrogen requirement of the pulse crops could be met by providing efficient strains of Rhizobium coupled with sound agro-economic services. After meeting their own requirements, pulses leave behind sufficient residual nitrogen for the succeeding crop. Keeping this in mind, many microbiological laboratories have started producing Rhizobium culture and substantial funds are being provided to build up such laboratories.

Integrated Pest Management

Pulse crops are attacked by more than one disease or pest at a time, which makes a need for multiple disease resistant varieties a must. Reddy (2009) discusses that Integrated Pest Management (IPM) is essentially a farmer activity of using one or more than one management options to reduce pest population below the economic injury level, while ensuring productivity and profitability of the entire farming system. Cropping systems involving crop rotation or intercropping of non-host and host crops, different agro-economic practices like the use of solar energy by summer ploughing preceding Kharif pulses are some of the cost effective components of IPM. However, this process takes time to yield results and also needs a community approach which makes some of the farmers hesitant to use it.

Post-Harvest Technology

Post-Harvest losses account for nearly 9.5 percent of the total production of pulses. And among the post-harvest operations, storage operations are responsible for the maximum loss (7.5%). Further losses are caused due to processing (1%), threshing (0.5%) and transportation (0.5%) (Deshpande and Singh, 2001). Processing efficiency in dal mills must be increased. Over the years, the net availability of end products in modern dal mills has been increased to 70-75 percent compared to 65-66 percent in traditional dal mills. Appropriate storage structures must be popularised. Propagation of mini-dal mills through the formation of pulses producers and processors associations is one of the components of NFSM, which will not only decrease post-harvest losses but also increase rural employment (Reddy, 2009).

3.4 The Need for Sustainable Practices

Despite a considerable fall in the global percentage of people employed in agriculture over the years, the contribution of greenhouse gas emissions from agriculture was nearly 25 percent of the total greenhouse gas emissions in the year of 2014 (The Guardian, July 2014).

Further, with the ever increasing population in the already overpopulated nation, it has become very important now more than ever that we look towards more sustainable agricultural options. Sustainable agriculture works in harmony with the nature and not against it. Sustainable agriculture is the need of the hour as it reduces the use of energy, contributes to the conservation of water and nourishes the soil among other things.

By ensuring use of alternate or renewable sources of energy, using crop rotation or crop diversity, making use of natural pesticides and by better water management, sustainability in farming techniques could be achieved.

3.5 Major Varieties

The cultivation of pulses is distributed between two major seasons, viz; *Kharif* and *Rabi.* There are at least 10 important pulse crops grown in India.

3.5.1 Rabi Pulses

a) Chickpeas

Chickpeas or *Chana Dal,* also known by the names of garbanzo bean, ceci bean, sanagalu, hummus and Bengal gram is the most important pulse crop grown in the country. Currently, it is grown in India, Middle East and various parts of Africa. The major chickpea-growing states in India are Madhya Pradesh, Uttar Pradesh, Rajasthan, Haryana and Maharashtra.

The low rainfall period in some semi-arid regions, like parts of Haryana and Rajasthan, proves to be insufficient in providing enough residual moisture during October and March to sustain a crop of chickpea. Yet, the farmer takes the risk in growing chickpea in alternate years in a single crop rotation with millets and kharif pulses (Jeswani and Baldev, 1990).

Drought-tolerance capacity of chickpea finds expression in crop mixtures which are common in many parts of the country. Unirrigated wheat is commonly grown mixed with chickpea. When the weather is too dry for wheat, the chickpea compensates for loss in wheat yields. Hence, the combination of chickpea and wheat is a safeguard against unfavourable weather conditions.

b) Peas

In the Indo-Gangetic plains, Peas, also called *Matar*, are one of the most important pulse crops and about 90 percent of its area and production is confined to Uttar Pradesh.

c) Lentils

Lentils or *Masur Dal* are mostly grown in Uttar Pradesh, Madhya Pradesh, Maharashtra and West Bengal. Lentils are also rain-fed crops and grown under same circumstances as that of Chickpea.

d) Lathyrus

Another popular rabi pulse crop is Lathyrus or *Khesari*. Lathyrus is a significant crop of the Indo-Gangetic plains and about 80 percent of it is grown in Bihar, Madhya Pradesh, Maharashtra and West Bengal. This crop needs very little field preparation and has the ability to withstand extreme moisture-stress conditions and hence, is highly preferred by the farmers. Farmers also prefer Lathyrus as its moisture requirement is much lesser than that of Chickpeas and Lentils.

3.5.2 Kharif Pulses

a) Pigeon pea

Pigeon peas or *Tur Dal* are the second most important pulse crop grown in India. The six states viz., Maharashtra, Uttar Pradesh, Madhya Pradesh, Karnataka, Gujarat and Andhra Pradesh together contribute to nearly 85 percent of the total area and production of the crop.

In spite of its long duration and the attainment of grain-development stage long after the rainy season is over, farmers prefer Pigeon pea especially in the low- rainfall areas as the crop is drought-tolerant. The long duration of Pigeon pea in north India also makes it admirably suitable for mixed cropping and intercropping with Sorghum or Pearl millet or maize (Jeswani and Baldev, 1990).

b) Green gram

Green gram or *Mung Dal* is the third most important pulse crop in India. Yield of green gram is only half of that of Pigeon pea and Chickpea. It is mainly grown as a Kharif crop in Maharashtra and Andhra Pradesh and in Orissa as a Rabi crop. Other states growing green gram are Madhya Pradesh and Rajasthan.

c) Black gram

Black gram or *Urad Dal* is mostly grown in Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh and Rajasthan during Kharif season and in Andhra Pradesh and West Bengal in the Rabi season. However, low yield of Green gram has restricted its cultivation to fields which are relatively poor in fertility status or moisture to suit other crops (Jeswani and Baldev, 1990).

d) Cowpea

Cowpea also called *Lobiya* in Hindi is a dual purpose crop grown either for grain or for the fodder. Though mainly grown as a Kharif crop, Cowpea has become a very important summer crop. It is mainly grown in Kerala, West Bengal and Punjab.

e) Horse gram

Horse gram or *Chana Dal* is usually grown in the dry and upland areas of the peninsular and eastern states of India such as Orissa, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh and Tamil Nadu.

f) Moth bean

Moth bean or *Keet Sem* is one of the most drought-tolerant crops and is primarily grown in the dry western and central India. Rajasthan is the major contributor of this crop.

Chapter 4

National Food Security Mission and Pulses Production

4.1 Introduction

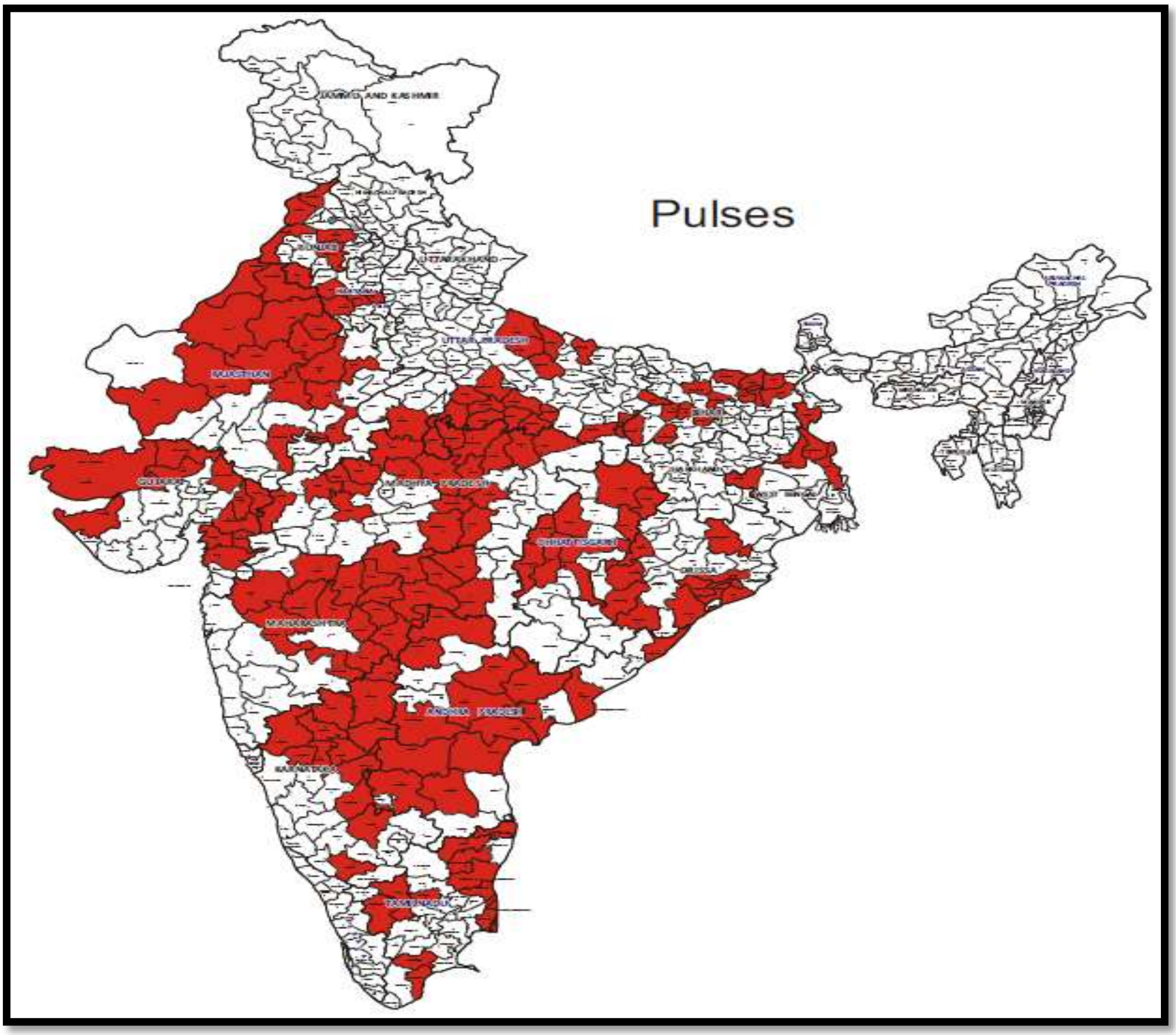
The National Food Security Mission (NFSM) was launched by the Government of India during 2007-08 at the beginning of the 11th five-year plan. The major objective of the programme was to address the issue of food security by devising programmes targeted to escalate production of rice, wheat and pulses by 10, 8 and 2 million tonnes respectively by the end of the 11th five-year plan. The NFSM was initially implemented in 482 districts of 19 States comprising of 144 districts under Rice in 16 States, 142 districts under Wheat in 9 States and 468 districts under Pulses in 16 States. The scheme continued during the twelfth five-year plan with a new set of targets. The objective of this scheme was the distribution of revamped technologies and farm management practices, thereby bridging the yield gap of the food grains.

The NFSM had a two pronged strategy. First strategy was to expand the area, and the second strategy was to enhance the productivity by bridging the gap between the actual and potential yield. However, the area expansion was confined to mainly wheat and pulses (Manjunatha and Kumar, 2015). In order to augment productivity, the NFSM had adopted several measures including 1) quality seed production; 2) emphasising integrated nutrient management and integrated pest management; 3) Promotion of new technologies; 4) restoring soil fertility; 5) improved farm implements etc. As a result a total amount of Rs 4500 crores have been spent under NFSM during the 11th five year plan (Manjunatha and Kumar, 2015).

Other objectives of the scheme include restoring soil fertility and productivity at the individual farm level, creation of employment opportunities, enhancing farm profits, promotion and extension of improved technologies such as Integrated Nutrient Management.
During the eleventh five-year plan, NFSM was implemented in 482 districts of 19 states. NFSM-Rice was implemented in 144 districts of 16 states, NFSM-Wheat in 142 districts of 9 states and NFSM-Pulses in 468 districts of 16 states. The mission when launched had five components, which were – (i) NFSM-Rice, (ii) NFSM-Wheat, (iii) NFSM-Pulses, (iv) NFSM-Coarse cereals and (v) NFSM-Commercial crops.

Rashtriya Krishi Vikas Yojana (RKVY) programme was also introduced during the same period when NFSM was introduced. Apart from NFSM, several state and centrally sponsored programmes were also added impetus to the food security promotion programmes. As a joint results of all these the wheat production during the end of the 11th Five Year Plan increased by 19.1 million tonnes, paddy production increased by 12.1 million tonnes, and pulses production by 3 million tonnes as compared to the year 2006-07.

Figure 4.1: States covered by NFSM for Pulses.



Source: NFSM

4.2 NFSM-Pulses Districts

Table 4.1: Districts Covered (Identified) Under National Food Security Mission (2017-18)

S. No.	State	NFSM-Rice	NFSM-Wheat	NFSM-Pulses	NFSM-Coarse
1	Andhra Pradesh	5	-	13	6
2	Arunachal Pradesh	10	-	17	17
3	Assam	13	-	27	4
4	Bihar	15	10	38	11
5	Chhattisgarh	13	-	27	9
6	Goa	-	-	2	-
7	Gujarat	2	5	26	8
8	Haryana	-	7	21	5
9	Himachal Pradesh	2	11	12	12
10	Jammu & Kashmir	8	8	22	22
11	Jharkhand	4	-	24	11
12	Karnataka	7	-	30	11
13	Kerala	1	-	14	1
14	Madhya Pradesh	8	16	51	16
15	Maharashtra	8	3	33	8
16	Manipur	9	-	9	9
17	Meghalaya	7	-	11	11
18	Mizoram	6	-	8	8
19	Nagaland	11	-	11	11
20	Odisha	8	-	30	6
21	Punjab	-	12	22	3
22	Rajasthan	-	14	33	12
23	Sikkim	2	-	4	4
24	Tamil Nadu	8	-	30	10
25	Telangana	4	-	9	6
26	Tripura	8	-	8	8
27	Uttar Pradesh	23	31	75	20
28	Uttarakhand	5	9	13	13
29	West Bengal	7	-	18	3
	Total	**194**	**126**	**638**	**265**

Source: Ready Reckoner (NFSM Cell, Crops Division), DAC&FW

Table 4.1 elucidates the districts covered under Rice, Wheat, Pulses and Coarse cereals under the National Food Security Mission in the year 2017-18. The table shows that currently, a total of 638 districts are covered under NFSM-Pulses and the mission covers 30, 51 and 33 districts in Karnataka, Madhya Pradesh and Maharashtra respectively.

4.3 Major Interventions

Some of the major interventions that were undertaken to improve the productivity of pulses under National Food Security Mission are detailed here.

Improved package of pulses are being provided. Provision of high yielding varieties of pulses has been done and seeds are provided at 25 rupees per kg or 50 percent of the cost, whichever is less. Further, farm machineries/tools such as manual sprayers, chisellers, seed drills, multi crop planters, power weeders, etc., are being provided at half the actual cost. Farmers have access to better and improved water application tools along with plant protection measures. Soil ameliorants are also being provided such as Gypsum, Bentonite sulphur, liming materials and some of the bio-fertilisers. Farmers are also being given cropping system-based training.

Table 4.2 lists the districts covered under the National Food Security Mission – Pulses in the states of Karnataka, Madhya Pradesh and Maharashtra.

Table 4.2: Districts Covered under NFSM-Pulses in the Study States

States	Districts	
Karnataka	Bagalkot	Haveri
(30 Districts)	Bangalore (Rural)	Gadag
	Bangalore (Urban)	Gurbarga
	Belgaum	Koppal
	Bellary	Kodagu (Coorg)
	Bidar	Kolar
	Bijapur	Mandya
	Chamarajanagar	Mysore
	Chikballapur	Raichur
	Chikmagalur	Ramnagar
	Chitradurga	Shimoga
	Dakshin Kannada	Tumkur
	Davangiri	Udupi
	Dharwad	Uttar Kannada
	Hassan	Yadgiri
Madhya Pradesh	Agar	Mandla
(51 Districts)	Alirajpur	Mansaur
	Anup Pur	Morena
	Ashok Nagar	Narsinghpur
	Balaghat	Neemach
	Barwani	Panna
	Betul	Raisen
	Bhind	Rajgarh

	Bhopal	Ratlam
	Burhanpur	Rewa
	Chhattarpur	Sagar
	Chhindwara	Satna
	Damoh	Sahdol
	Datia	Sehore
	Dewas	Seoni
	Dhar	Shajapur
	Dindori	Sheopurkalan
	East Nimar (Khandwa)	Shivpuri
	Gwalior	Sidhi
	Guna	Singrauli
	Harda	Tikamgarh
	Hoshangabad	Ujjain
	Indore	Umaria
	Jabalpur	Vidisha
	Jhabua	West Nimar (Khargaon)
	Katni	
Maharashtra	Ahmednagar	Nanded
(33 Districts)	Akola	Nandurbar
	Amravati	Nasik
	Aurangabad	Osmanabad
	Beed	Parbhani
	Bhandara	Pune
	Buldhana	Raigad
	Chandrapur	Ratnagiri
	Dhule	Sangli
	Gadchiroli	Satara
	Gondia	Sindhudurga
	Hingoli	Sholapur
	Jalgaon	Thane
	Jalna	Wardha
	Kolhapur	Washim
	Latur	Yavatmal
	Nagpur	

Source: nfsm.gov.in

4.4 NFSM in Maharashtra

National Food Security Mission – Wheat, National Food Security Mission – Rice and National Food Security Mission – Pulses, all are being implemented in the state of Maharashtra currently. As of 2014-15, Maharashtra covered more than 14 percent of the total area (nearly 3.5 million hectares) and almost 12 percent of the total production of pulses in the country.

The area production and yield of pulses in both NFSM and non-NFSM districts are given in Tables 4.3 and 4.4. In Maharashtra, Yavatmal is the district where NSFM has been implemented since the advent of this scheme, while Dhule has been selected as the non-NFSM district for the period starting 2007 to 2009. Post 2009, Dhule was also covered under this scheme.

The data shows that area under the cultivation of pulses was higher in Yavatmal in both the years. However, despite a decline in production in Yavatmal in 2008, the average yield was much higher in the district in comparison with Dhule.

Table 4.3: Area, Production and Yield of Pulses in NFSM District - Yavatmal

Year	Area(000 Ha)	Production(000 Tonnes)	Yield(Kg/Ha)
2007-2008	241.86	224.81	929
2008-2009	160.23	89.05	556

Source: National Food Security Mission, Ministry of Agriculture and Farmers Welfare

Table 4.4: Area, Production and Yield of Pulses in non-NFSM District - Dhule

Year	Area(000 Ha)	Production(000 Tonnes)	Yield(Kg/Ha)
2007-2008	79.39	59.70	752
2008-2009	45.93	19.31	420

Source: National Food Security Mission, Ministry of Agriculture and Farmers Welfare

4.5 NFSM in Karnataka

National Food Security Mission – Rice and National Food Security Mission – Pulses and National Food Security Mission – Coarse Cereals are being implemented in the state of Karnataka currently.

Karnataka is the fifth largest producer of pulses in India. In 2015-16, Karnataka's share of production was nearly 1.14 million tonnes in the total pulse production in the country.

The area production and yield of pulses in both NFSM and non-NFSM districts are given in Tables 4.5 and 4.6. In Karnataka, the NFSM district was Chitradurga and non-NFSM district was chosen as Mandya. From the data, it can be observed that in Chitradurga, the average yield is marginally higher than in Mandya. In the period of two years, the area under cultivation in both the districts has remained nearly unchanged. After 2009, Mandya also came under the ambit of the scheme.

Table 4.5: Area, Production and Yield of Pulses in NFSM District - Chitradurga

Year	Area(000 Ha)	Production(000 Tonnes)	Yield(Kg/Ha)
2007-2008	37.44	26.38	705
2008-2009	37	19.17	518

Source: National Food Security Mission, Ministry of Agriculture and Farmers Welfare

Table 4.6: Area, Production and Yield of Pulses in non-NFSM District - Mandya

Year	Area(000 Ha)	Production(000 Tonnes)	Yield(Kg/Ha)
2007-2008	35.18	21.58	610
2008-2009	32.16	13.74	427

Source: National Food Security Mission, Ministry of Agriculture and Farmers Welfare

4.6 NFSM in Madhya Pradesh

National Food Security Mission – Rice, National Food Security Mission – Wheat and National Food Security Mission – Pulses are being implemented in the state of Madhya Pradesh. Madhya Pradesh is the largest producer of pulses in India. It accounts for nearly 5.3 million tonnes (2015-16) of total pulses produced in the nation. Major districts producing pulses in Madhya Pradesh are – Dewas, Chhindwara, Narsinghpur, Raisen, etc.

The area production and yield of pulses in both NFSM and non-NFSM districts are given in Tables 4.7 and 4.8.

From the data, it can be seen that there is a significant difference in the average yield of both the districts. While area under the cultivation of pulses in Dewas increased slightly in the second year, it decreased marginally in Dindori.

Hence, a huge difference in the average yields of both the districts was witnessed.

Table 4.7: Area, Production and Yield of Pulses in NFSM District - Dewas

Year	Area(000 Ha)	Production(000 Tonnes)	Yield(Kg/Ha)
2007-2008	110.27	113.01	1025
2008-2009	115.76	127.47	1101

Source: National Food Security Mission, Ministry of Agriculture and Farmers Welfare

Table 4.8: Area, Production and Yield of Pulses in NFSM District - Dindori

Year	Area(000 Ha)	Production(000 Tonnes)	Yield(Kg/Ha)
2007-2008	56.71	13.58	239
2008-2009	52.28	16.07	307

Source: National Food Security Mission, Ministry of Agriculture and Farmers Welfare

Table 4.9 provides a brief summary of interventions and patterns of assistance provided to the farmers in the implementation of National Food Security Mission – Pulses during 2017-18.

Table 4.9: Action Plan for Implementation of NFSM-Pulses in all States during 2017-18

S.No.	Interventions	Approved Assistance (in Rupees)
1	*Demonstrations on improved technologies*	
	Arhar	7500 per ha
	Moong	7500 per ha
	Urad	7500 per ha
	Gram	7500 per ha
	Lentil	7500 per ha
	Other	7500 per ha
2	*Production and Distribution of HYV seeds*	2500/quintal or 50% of cost (whichever less)
3	*Integrated Nutrient Management*	
	Micro-Nutrients	500/ha or 50% of cost (whichever less)
	Gypsum/80% WG Sulphur	750/ha or 50% of cost (whichever less)
	Lime	1000/ha or 50% of cost (whichever less)
	Bio-Fertilisers	300/ha or 50% of cost (whichever less)
4	*Integrated Pest Management*	
	Distribution of PP Chemicals	500/ha or 50% of cost (whichever less)
	Weedicides	500/ha or 50% of cost (whichever less)

5	*Resource Conservation Technologies/Tools*	
	Power Knap Sack Sprayers	3000/unit or 50% of cost (whichever less)
	Manual Sprayers	600/unit or 50% of cost (whichever less)
	Zero Till Seed Drills	15000/unit or 50% of cost (whichever less)
	Multi-Crop Planters	15000/unit or 50% of cost (whichever less)
	Seed Drills	15000/unit or 50% of cost (whichever less)
	Zero Till Multi Crop Planters	15000/unit or 50% of cost (whichever less)
	Ridge Furrow Planters	15000/unit or 50% of cost (whichever less)
	Rotavators	35000/unit or 50% of cost (whichever less)
	Chilseller	8000/unit or 50% of cost (whichever less)
	Laser Land Levellers	1.5 lakh or 50% of cost (whichever less)
	Tractor Mounted Sprayers	10000/unit or 50% of cost (whichever less)
	Multi Crop Threshers	40000/unit or 50% of cost (whichever less)
6	*Efficient Water Application Tools*	
	Sprinkler Sets	10000/ha or 50% of cost (whichever less)
	Pump Sets	10000/unit or 50% of cost (whichever less)
	Pipe for carrying water from source to field	20/meter or 50% of cost (whichever less)
	Mobile Rain Gun	15000/unit or 50% of cost (whichever less)

Source: nfsm.gov.in/notifications

Chapter 5

Socio-Economic Profile of the Sample Households

5.1 Introduction

The present chapter provides an overview of socio-economic profile of the sample households. Considering the heterogeneous nature of the country and the study region, there were considerable differences across the States in terms of the profile of the households. The sections below undertake a discussion of the socio-economic profile of the total sample size as well as a detailed socio-economic profile at the district level. A detailed socio-economic profile at the district level is undertaken to understand the disparities in terms of various social, economic and institutional factors across different States.

Household survey was conducted in three districts drawn from three States-Karnataka, Madhya Pradesh and Maharashtra. The major districts producing chickpea and pigeon are identified from each state. Accordingly, Gulbarga is selected from Karnataka, Narsinghpur is selected from Madhya Pradesh and Wardha is selected from Maharashtra. A random sample of chickpea and pigeon pea producing farmers are selected from each district. The total number of households surveyed was 572. Subsequently 195 farmers are selected from Gulbarga, 198 farmers are selected from Wardha and 179 farmers are selected from Narsinghpur. The total sample consisted of 482 pigeon pea farmers and 316 chickpea farmers and out of which 228 farmers were cultivating both chickpea and pigeon pea. In our sample, Pigeon pea farmers were 189 from Gulbarga (Karnataka), 145 from Wardha (Maharashtra), 149 from Narsinghpur (Madhya Pradesh). Chick pea farmers were 40 from Gulbarga (Karnataka), 102 from Wardha (Maharashtra) and 175 from Narsinghpur (Madhya Pradesh). Similarly, those who are cultivating both chickpea and pigeon pea were 34 from Gulbarga (Karnataka), 49 from Wardha (Maharashtra), 145 from Narsinghpur (Madhya Pradesh) (see table 5.1).

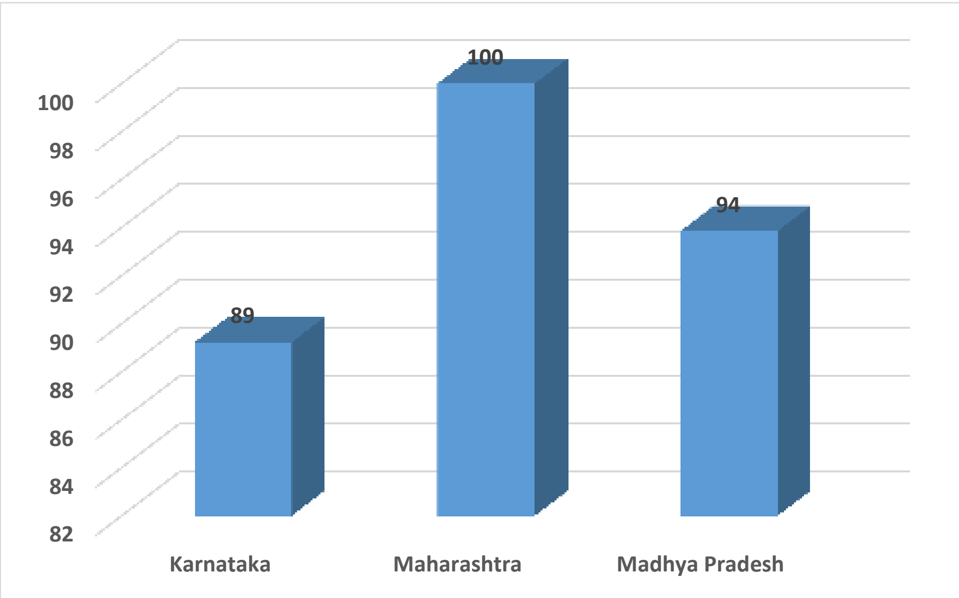
Table 5.1: Households According to Type

Farmer type	Gulbarga (Karnataka)	Wardha (Maharashtra)	Narsinghpur (Madhya Pradesh)	Total
Chickpea farmers	40	102	175	317
Pigeon Pea farmers	189	145	149	483
Chickpea and pigeon pea farmers	34	49	145	228

Source: Survey Data

Agriculture was the main occupation and livelihood strategy for most of the farm households in the study districts. Farming was the main occupation for 540 households interviewed. This constitutes around 95% of the total households interviewed. Out of which farming was main occupation for around 89% of the households in Gulbarga (Karnataka), 100% of households in Wardha (Maharashtra), 94% of households in Narsinghpur (Madhya Pradesh) (see figure 5.1).

Figure 5.1: Percentage of Households with Farming as Main Occupation in Percentage

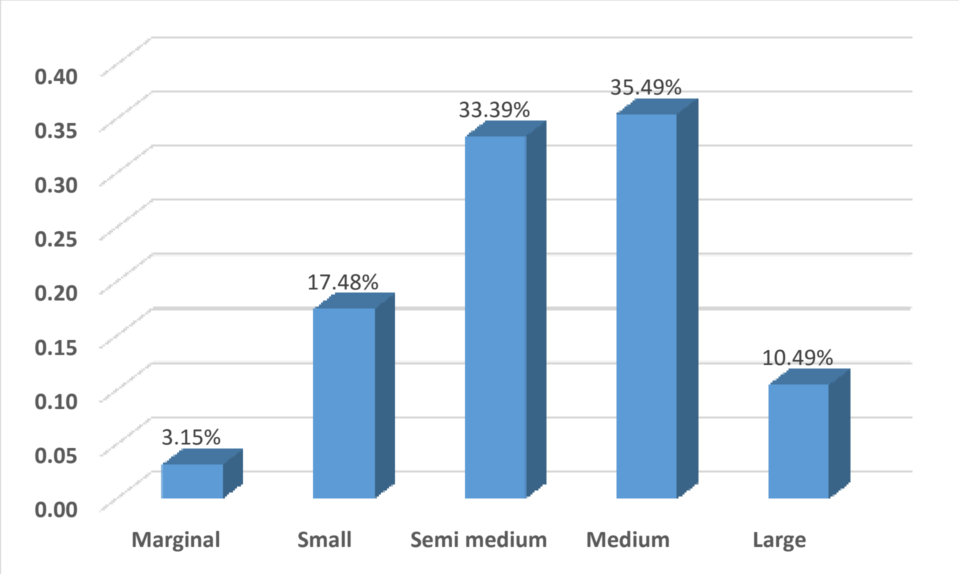


Source: Survey Data

Majority of the farm households interviewed were either semi medium farmers or medium farmers. Marginal farmers were around 45%, small farmers around 36%, semi-medium farmers around 16%, medium farmers around 3% and large famers were less than 1% (see figure 5.2). Marginal and small farmers were the highest in Wardha (Maharashtra) and

Gulbarga (Karnataka) whereas medium and large farmers were highest in Narsinghpur (Madhya Pradesh) (See table 5.2).

Figure 5.2: Households According to Farm Size (in%)



Source: Survey Data

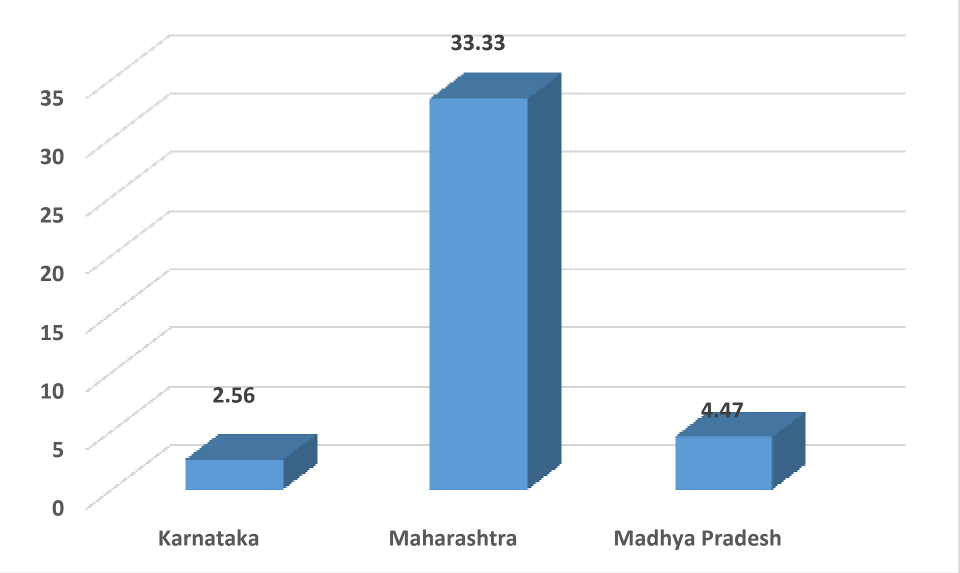
Table 5.2: Percentage of Households According to Farm Size in Different States

State	Marginal	Small	Semi medium	Medium	Large
Karnataka	6	21	37	30	7
Maharashtra	2	26	40	29	2
Madhya Pradesh	2	4	22	49	24
Total	3	17	33	35	10

Source: Survey Data

As far as government schemes to promote pulses production, only 86% of households didn't have any awareness of any such schemes. Among the total number of households who had awareness, 84% of households were from Wardha (Maharashtra). The awareness was lowest in Gulbarga (Karnataka) and Narsinghpur (Madhya Pradesh) (see figure 5.3). This also means 33% of total households interviewed from Wardha (Maharashtra) had information about government schemes to promote the cultivation of pulses (see figure 5.3). The percentage of households who had such information was very negligible in other two states.

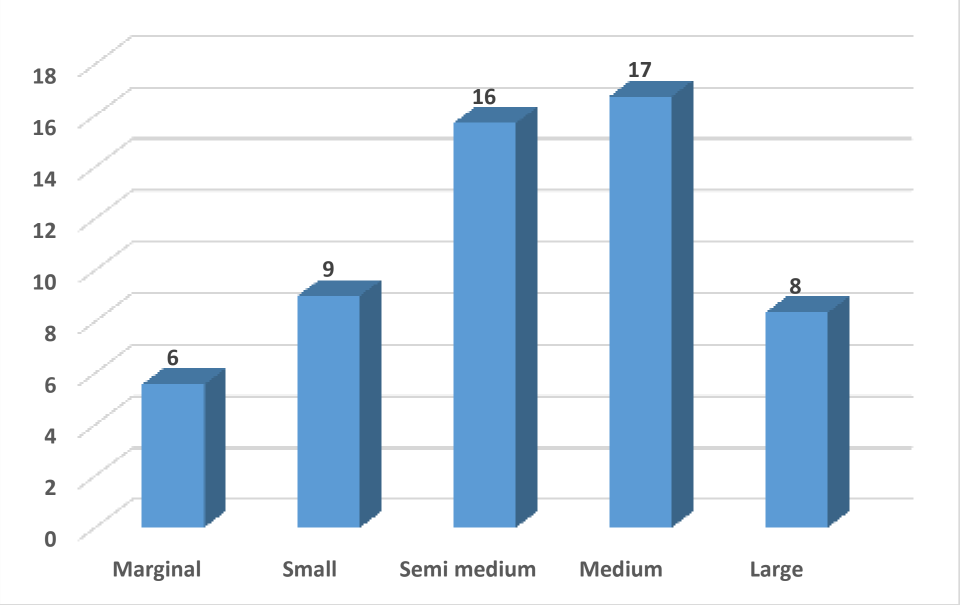
Figure 5.3: Percentage Share of Households with Awareness in any Government Schemes



Source: Survey Data

Farm size wise awareness of government schemes showed that the awareness was the highest among the medium and semi medium farmers. The percentage of farmers with such awareness among medium and semi medium farmers were around 17% and 16% respectively. Whereas the awareness was the lowest among marginal farmers followed by large and small farmers.

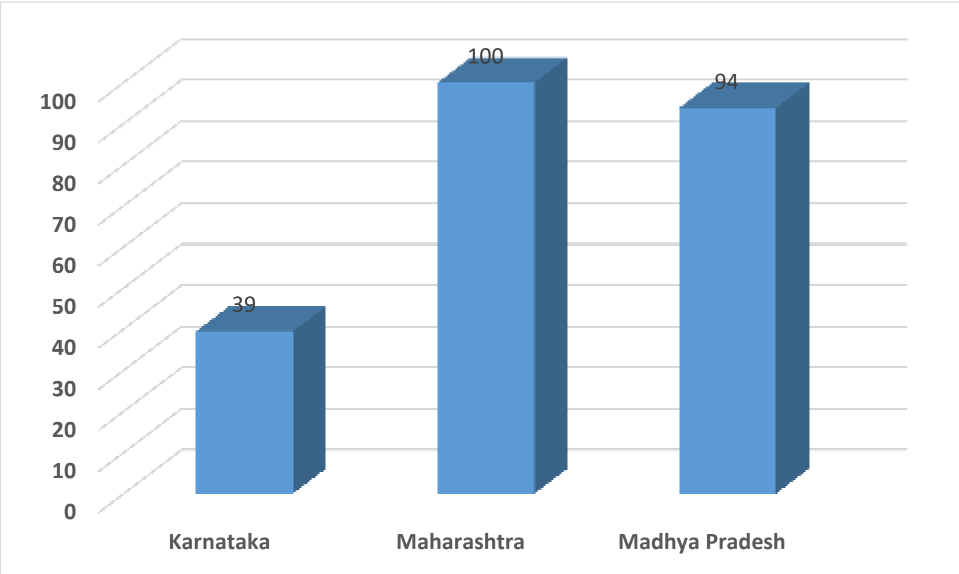
Figure 5.4: Households with Government Scheme Awareness According to Farm Size (in%)



Source: Survey Data

Note that medium and large farmers were more diversified in terms of crop cultivation (see figure 5.6). The crop diversification by large farmers can also be a reason why they were not paying much attention to the government schemes to promote pulses production. Around 77% of the households in the total sample had diversified crop cultivation. The crop diversification was the highest among the sample households from Wardha (Maharashtra) and lowest among the sample households from Gulbarga (Karnataka) (see figure 5.5).

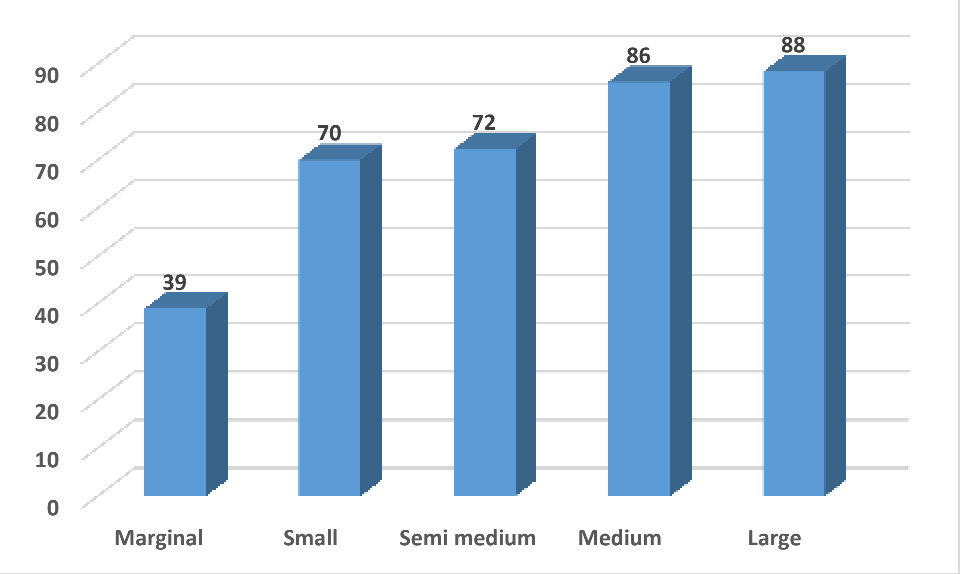
Figure 5.5: Crop Diversification State Wise (in%)



Source: Survey Data

The crop diversification was lowest among the marginal farmers in the sample households and highest among the medium and large farmers (see figure 5.6). The crop diversification by small and medium farmers were more or less similar.

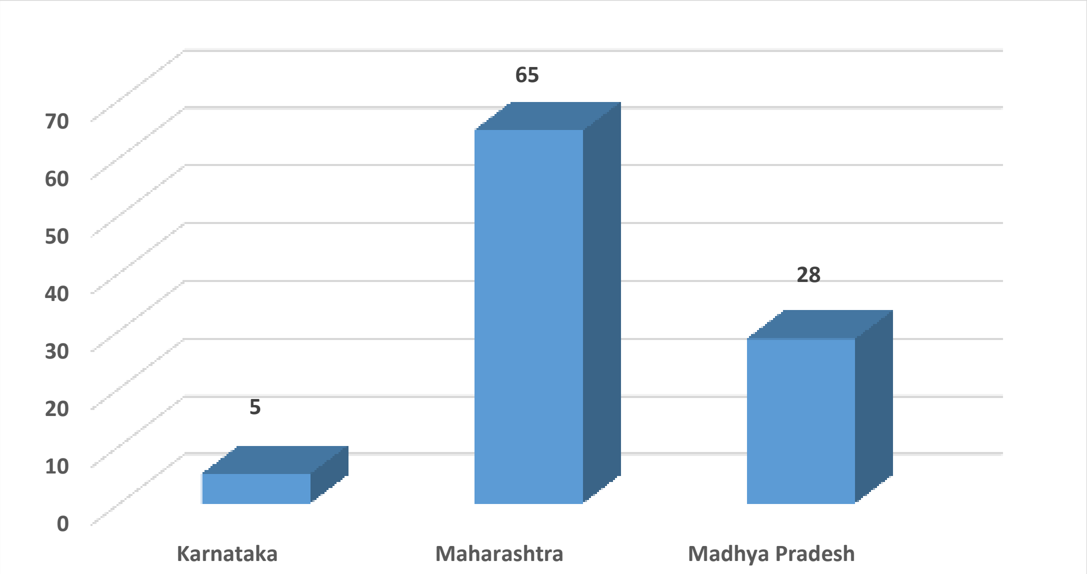
Figure 5.6: Crop Diversification According to Farm Size (in%)



Source: Survey Data

Not only the awareness, even the knowledge about new production techniques were highest among the sampled households from Wardha (Maharashtra) (65%). The percentage of households with awareness of new production technique among the sample was only 33%. The knowledge was lowest in Gulbarga (Karnataka). The knowledge in Narsinghpur (Madhya Pradesh) and Gulbarga (Karnataka) were 28% and 5% respectively (See figure 5.7).

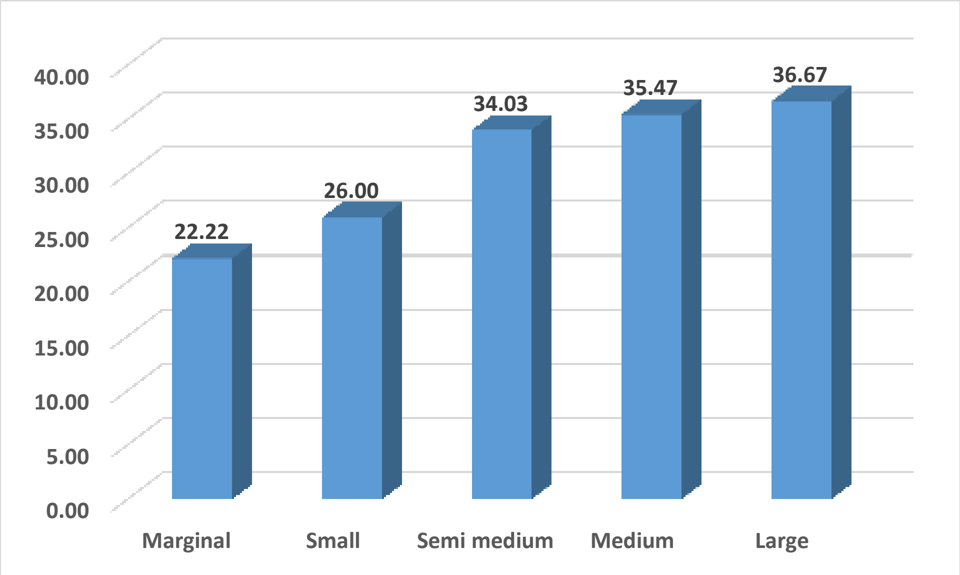
Figure 5.7: Percentage of Farmers with Knowledge about New Production Techniques



Source: Survey Data

Farm size wise knowledge about new production techniques among the sample households were the highest among the medium and large farmers. The knowledge of production techniques was increasing as farm size increases (Se figure 5.8). But even then only 35-36% of medium and large farmers had knowledge about new production techniques which was very less.

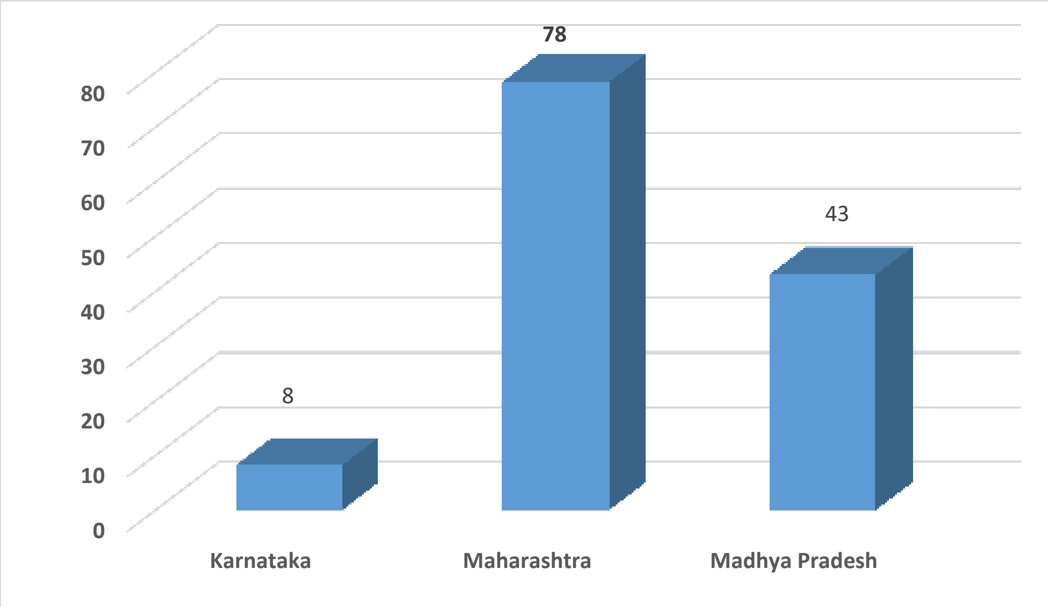
Figure 5.8: Farm Size Wise Knowledge about New Production Techniques (in%)



Source: Survey Data

The poor access to government extension services can be the reason for poor knowledge in government schemes or new production techniques. The households with access to extension services were only 43% in the total sample households. The state wise percentage of access to extension services in the sample households showed that households in Wardha (Maharashtra) had greater access to extension services (78%). The access to extension services was lowest among the households interviewed in Gulbarga (Karnataka) (8%). The percentage of households with access to extension services in Narsinghpur (Madhya Pradesh) was 43% (see figure 5.10).

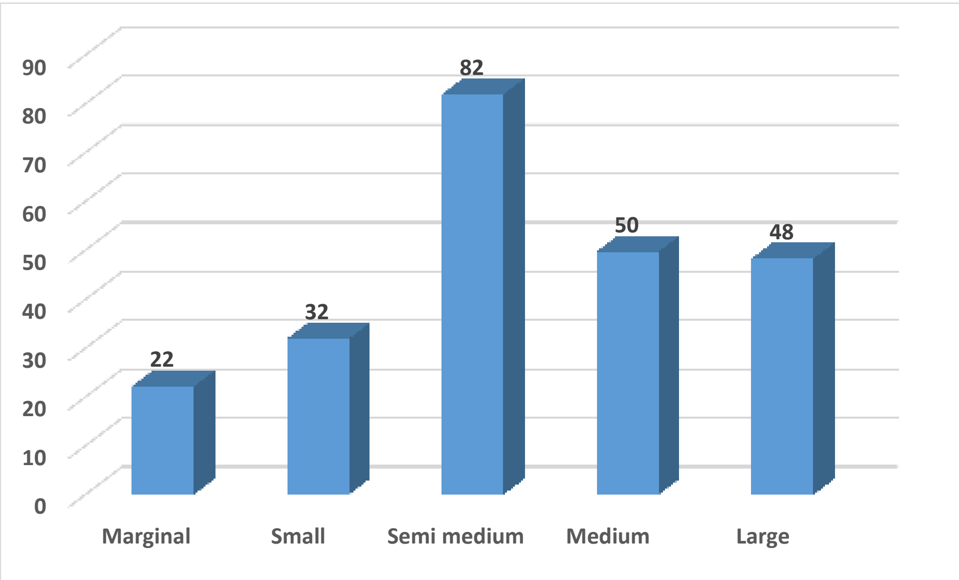
Figure 5.9: Percentage of Households with Contact with Government Extension Services



Source: Survey Data

Farm size wise access to extension services among the sample households showed that the access to extension services were highest for semi medium farmers (82%) and this was followed by medium and large farmers, 50% and 48% respectively. The access to extension services were the lowest for marginal farmers (22%) (see figure 5.10).

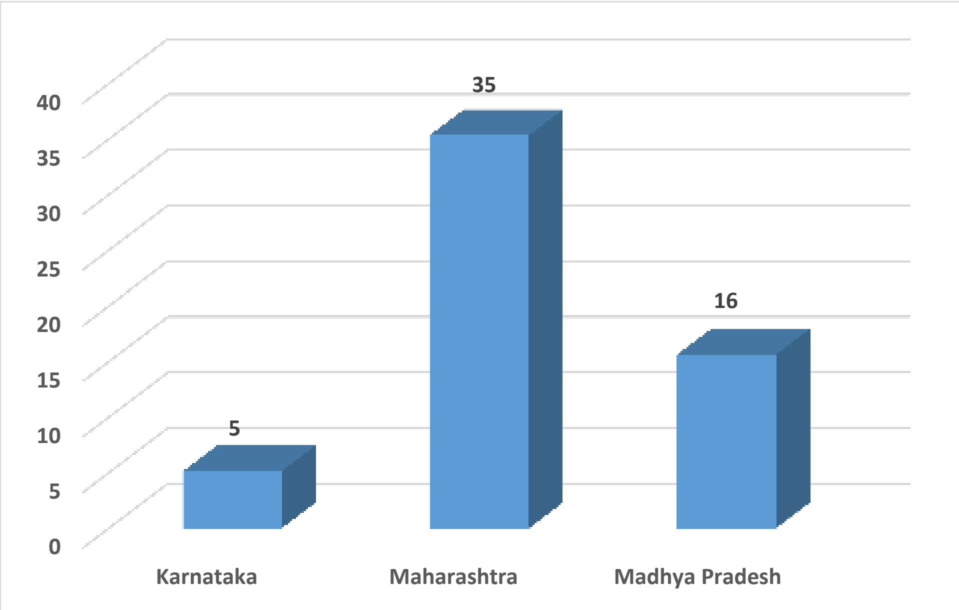
Figure 5.10: Farm Size Wise Contact with Government Extension Services (in%)



Source: Survey Data

As far as the training received from government department or NGOs are concerned only 19% of the sample households had received any kind of training. Training received from government departments or NGOs were also highest in Wardha (Maharashtra) (35%) and lowest in Gulbarga (Karnataka) (55). The training received was 16% om Narsinghpur (Madhya Pradesh) (see figure 5.12).

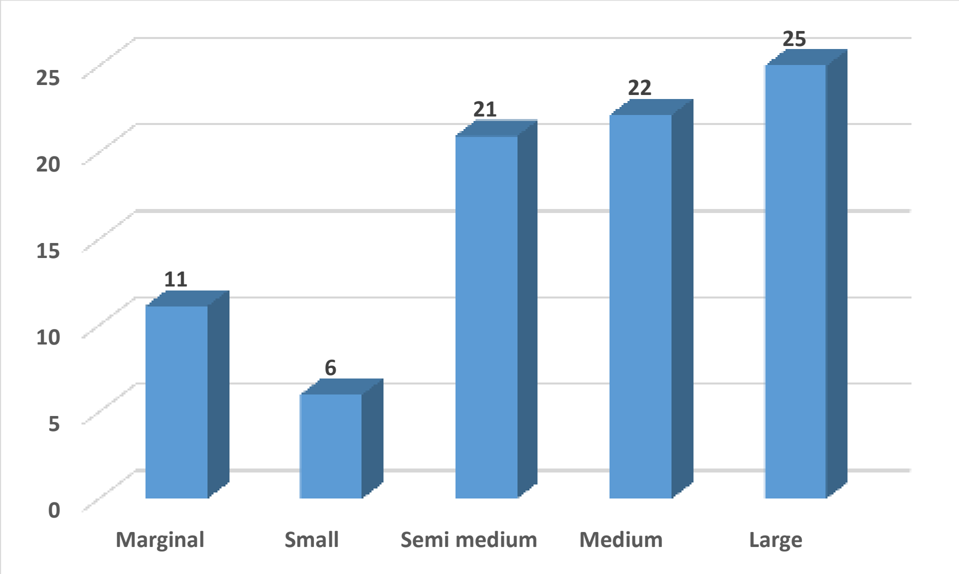
Figure 5.11: Percentage of Households with Access to Training



Source: Survey Data

Interestingly, the size wise percentage of farmers who received training showed that large farmers had received more training. The training was relatively higher for semi, medium, medium and large farmers as compared to marginal and small. The training was the lowest for small farmers (see figure 5.12).

Figure 5.12: Training Received by Farm Size Wise (in%)

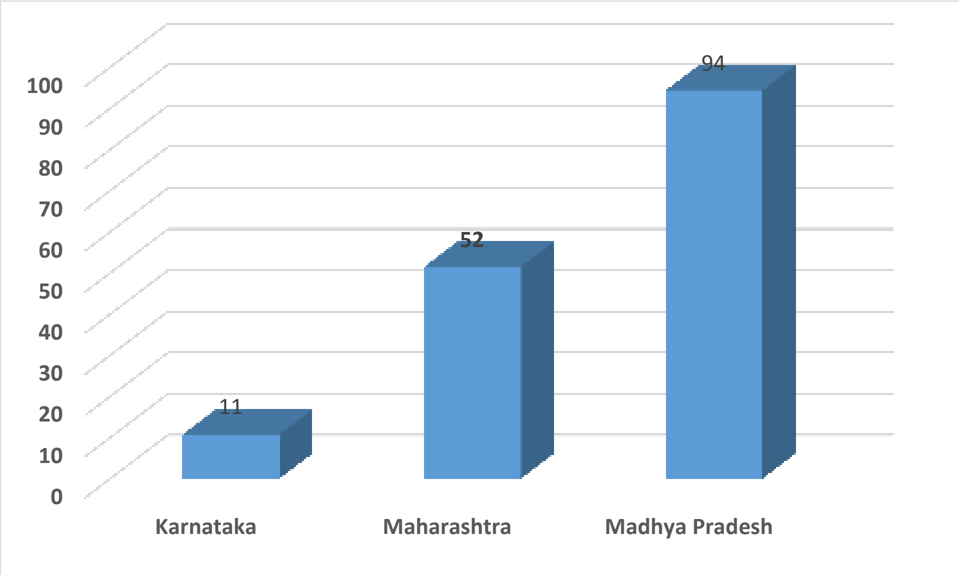


Source: Survey Data

The poor access to training, extension services information about government schemes and new production techniques etc. were reflected in the information regarding MSP received by households. In our sample, only 51% of the sample households had information about the MSP. Information regarding the MSP was the highest in Madhya Pradesh possibly due to the highest share of medium and large farmers in the sample by Narsinghpur (Madhya Pradesh). The information was the lowest in Gulbarga (Karnataka). Contact with extension services, access to training, knowledge of government schemes or new production techniques, crop diversification were also the lowest among the sample households from Gulbarga (Karnaka). It shows that the disadvantage faced by all these had a direct link with the access to information regarding MSP.

Despite having higher access to training, extension services and knowledge about government schemes and new production techniques, the information of MSP received by households in Wardha (Maharashtra) were lower than that of Narsinghpur (Madhya Pradesh) (see figure 5.14). In Wardha (Maharashtra) around 52% of the sample households had information about MSP whereas in Narsinghpur (Madhya Pradesh) around 94% of sample household had information about MSP. Again this could be partly due to the high share of medium and large farmers in the sample by Narsinghpur (Madhya Pradesh).

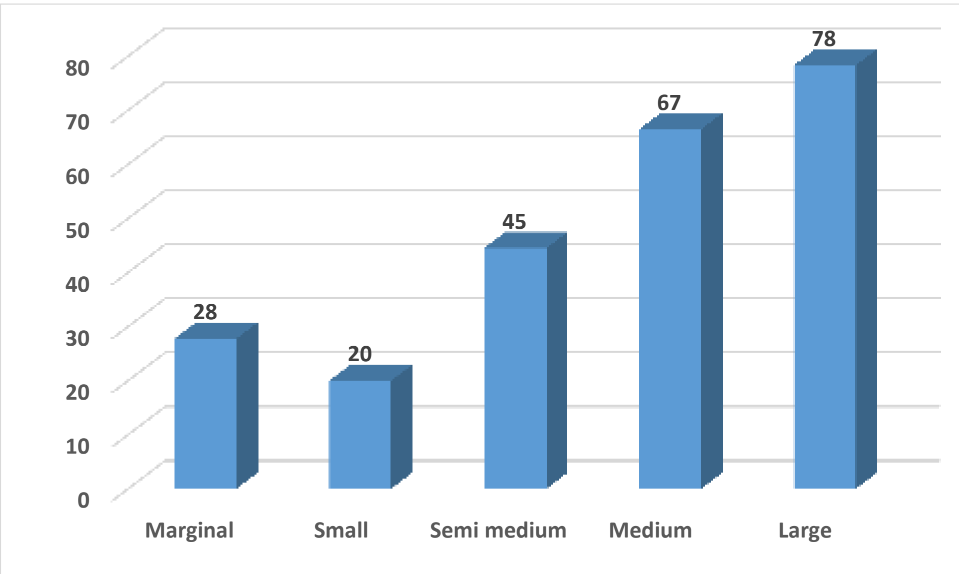
Figure 5.13: Percentage Share of Households with Information about MSP, State wise



Source: Survey Data

The reason why Narsinghpur (Madhya Pradesh) had the highest share of sample households with information regarding MSP is also clear from the below figure (see figure 5.14). Medium and large farmers had greater access to information and the size of medium and large farmers in the sample households were the highest from Narsinghpur (Madhya Pradesh) as compared to the other two states. The access to information was increasing as the farm size increases. The access to information, however was the lowest among the small farmers in the sample (see figure 5.14)

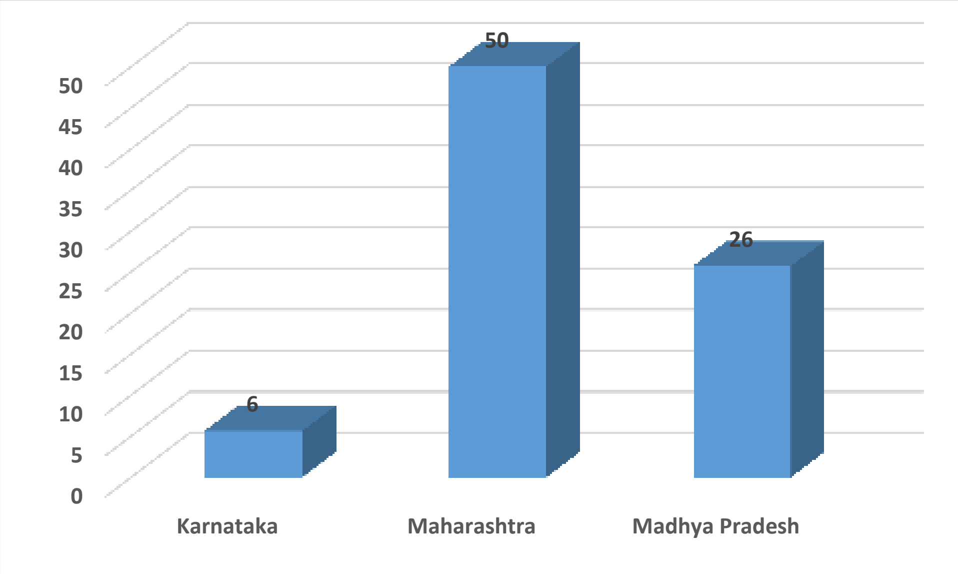
Figure 5.14: Farm Size Wise Information about MSP (in%)



Source: Survey Data

Interestingly, though households in Narsinghpur (Madhya Pradesh) had the highest information about MSP, households availing MSP was much lower and lower than Wardha (Maharashtra). In Maharashtra almost all farmers who had information about MSP availed MSP. The percentage share of households with information was 52% and utilisation was 50%. The poor access to information by households in Gulbarga (Karnataka) were also reflected in the poor utilisation of MSP by these households (see figure 5.15).

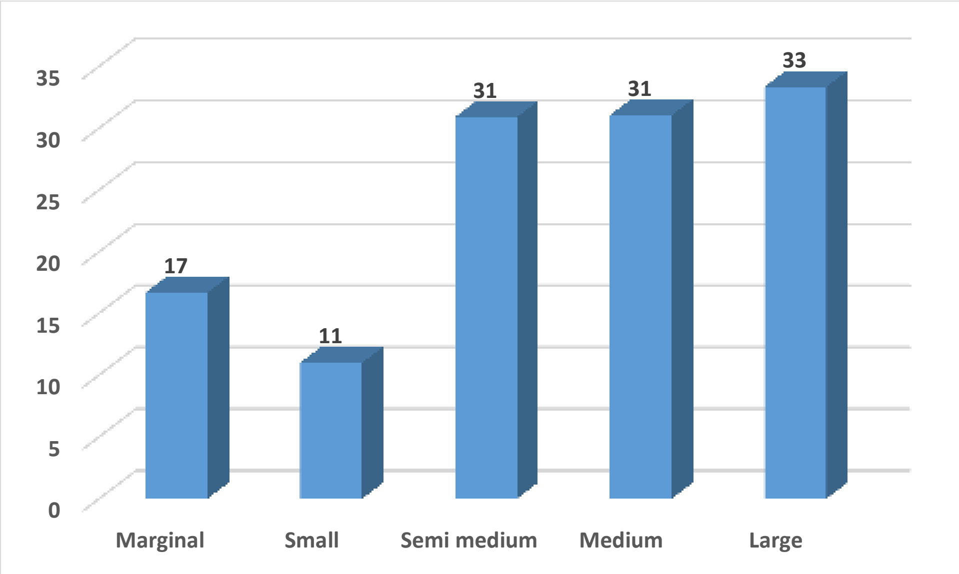
Figure 5.15: Percentage Share of Households with Utilisation of MSP State Wise



Source: Survey Data

The percentage share of households in each farm size category who were availing MSP was the highest among semi, medium, medium, and large housheolds. The percentage share of households who were not availing MSP was the lowest among small farmers (see figure 5.16). Though 78% of large farmers had information about MSP, only 33% of large farmers availed MSP. Similarly, 67% of medium farmers had information about MSP but only 31% availed MSP.

Figure 5.16: Utilisation of MSP Farm Size Wise (in%)



Source: Survey Data

Conclusion

This chapter provided an overview of the socio-economic profile of the sample households. The total households interviewed were 572 drawn from three major pulses producing States- Karnataka, Maharashtra and Madhya Pradesh. Majority of the households in the sample were either semi medium or medium farmers and agriculture was the main livelihood option for majority of the sample households. Narsinghpur (Madhya Pradesh) had the highest share of large farmers in the sample whereas Wardha (Maharashtra) had the highest share of marginal and small farmers. In our sample, 482 farmers were cultivating pigeon pea and 316 farmers were cultivating chickpea. Out of which 227 farmers were cultivating both the pigeon pea and chickpea. Majority of the sample households didn't have any awareness of government schemes to promote pulses production or new production techniques to reduce crop loss and improve productivity. The farm size wise analysis showed that large farmers were more aware about new production practices as compared to other farm categories. However, the access to training offered by government and extension services were the highest among the sample households from Wardha (Maharashtra). Interestingly, despite having higher access to training, extension services and knowledge about government schemes and new production techniques, the information of MSP received by households in Wardha (Maharashtra) were lower than that of Narsinghpur (Madhya Pradesh). This is due to the fact that Narsinghpur (Madhya Pradesh) had the highest share of large farmers in the sample. The size wise percentage of farmers who received training showed that large farmers had received more training. The training was relatively higher for semi, medium, medium and large farmers as compared to marginal and small. In addition to the fact that Narsinghpur (Madhya Pradesh) had relatively large farmers with greater access to training, the households from Narsighpur (Madhya Pradesh) had greater access to information regarding MSP. The access to MSP information was increasing as size of the farm increases. Interestingly, though households in Narsinghpur (Madhya Pradesh) had the highest information about MSP, households availing MSP was much lower and lower than Wardha (Maharashtra). In Maharashtra almost all farmers who had information about MSP availed MSP. The percentage share of households with information was 52% and utilisation was 50%. The percentage share of households in each farm size category who were availing MSP was the highest among semi, medium, medium, and large households. The percentage share of households who were not availing MSP was the lowest among marginal and small farmers.

Chapter 6
Pulses Production, Trade and Government Policies

6.1 Introduction

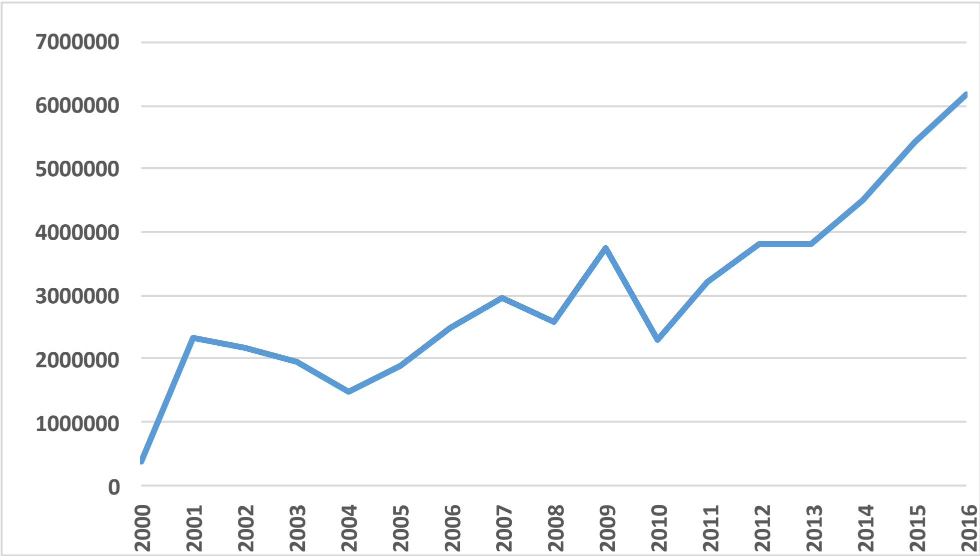
The dependence of pulses on rainfed production leads to highly volatile domestic production from one year to the next. Due to this erratic production, domestic pulses production faces the challenge of meeting domestic demand. Also, the production of pulses lagged behind population growth and as a result the per capita net availability of pulses declined over the years. (refer chapter 3). The sluggish production and widening gap between the supply and demand and volatility in prices are the major challenges faced by Indian pulses sector in the recent years. The data shows that India is the world's largest consumer of pulses (Reddy, Bantilan, & Mohan, 2012), yet the domestic production is not commensurate with demand, thereby making India a net importer of pulses. The last couple of years witnessed huge increase in imports of pulses to match the consumption requirements. Note that India is the largest importer of pulses despite of being the second largest producer of pulses. The persistent deficit and the soaring pulses prices made it inevitable for the country to import pulses. The excess demand is primarily due to the stagnation in productivity which is further accelerated by the decline in area under cultivation which we observed in chapter 2. The data shows that India's import doubled over the last 10 years and it accounts for around 15-16 per cent of total domestic production (Bhattacharya et al., 2017). Growing import dependency and rising prices forced government to adopt duty-free import policy.

India's import demand has affected negatively due to the depreciation of Indian currency with respect to US, Australian and Canadian dollars (Bhatacharya et al., 2017). This had caused inflation of pulse prices in Indian domestic markets. Depreciation of Indian currency implies higher import bill for Indian pulse importers, making import less viable.

India's total pulses imports sharply increased from around 352 thousand tonnes in 2000 to 6185 thousand tonnes in 2016 (see figure 6.1). As a result, the share of India's imports of pulses in the total world pulses import increased from mere 5% to around 36% in 2016 (see figure 6.2). Canada, Australia, Myanmar and China were among the top exporters of pulses in the world. India had been always a major importer of pulses and the imports began to increase during the period of 1998-2000. The major importers of pulses to India were

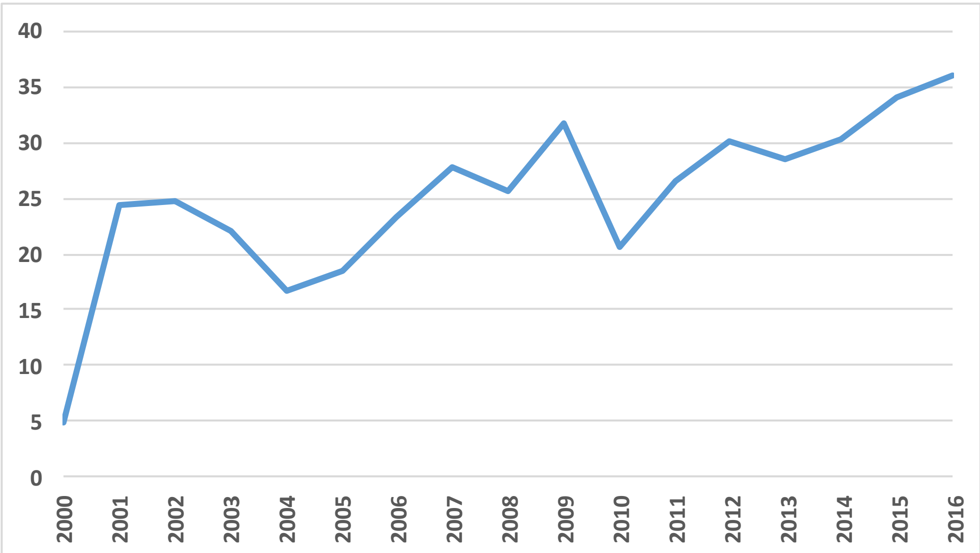
Australia, Canada, Myanmar, Tanzania and US. Over time volume of pulses imports increased, and India also started to import from additional countries. For example, India started to import pulses from Ethiopia, Mozambique, Russia, China etc. Additionally, in 2016, in the wake of soaring pulse prices in the domestic market, India signed an MoU to double pulses imports — mostly pigeon pea — from the east African nation over a five-year period.

Figure 6.1: India's Import of Pulses in Tonnes



Source: FAOSTAT

Figure 6.2: India's Share in Total World Import of Pulses

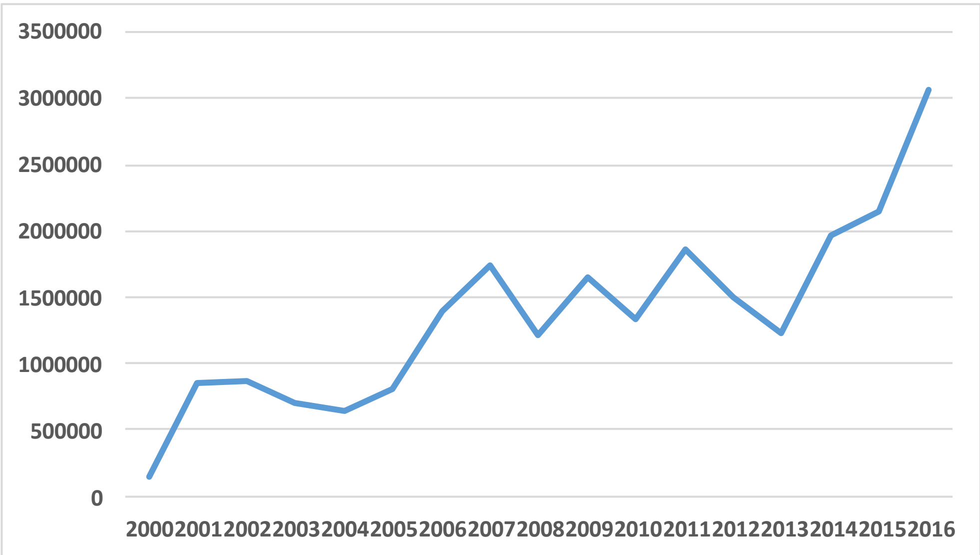


Source: FAOSTAT

Peas, kidney beans, chickpea and pigeon pea were the major pulses that were imported to India. One of the key issues with regard to import of pulses is the high degree of concentration from few exporting nations. For each type of pulses there has usually been a single largest importer with significant market share. For example, Canada for peas, Australia for chickpea, China for kidney beans and Myanmar for pigeon pea. Therefore, any shifts in domestic-trade policies or crop failure can have huge implications on the pulses imported by India. For example, there has been stagnancy in area under peas cultivation in Canada and weather fluctuations in Myanmar that affected the output significantly (Bhattacharya et al., 2017). Also the study note that Canada, Australia and Myanmar have high instability with respect to production and area.

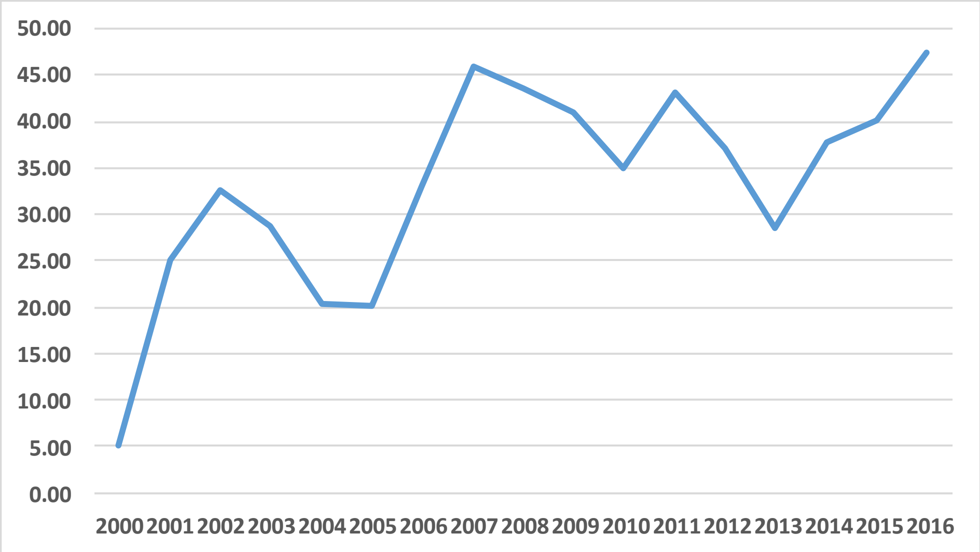
Imports of all types of pulses were increasing over the period except for pigeon pea. For example, total imports of dry peas increased from around 137 thousand tonnes in 2000 to around 3061 thousand tonnes in 2016 (see figure 6.3). This marked an increase in India's share in total world peas (dry) imports from around 5% to 47% during 2000-2016 (see figure 6.4).

Figure 6.3: Trends in Imports of Peas (dry) in Tonnes



Source: FAOSTAT

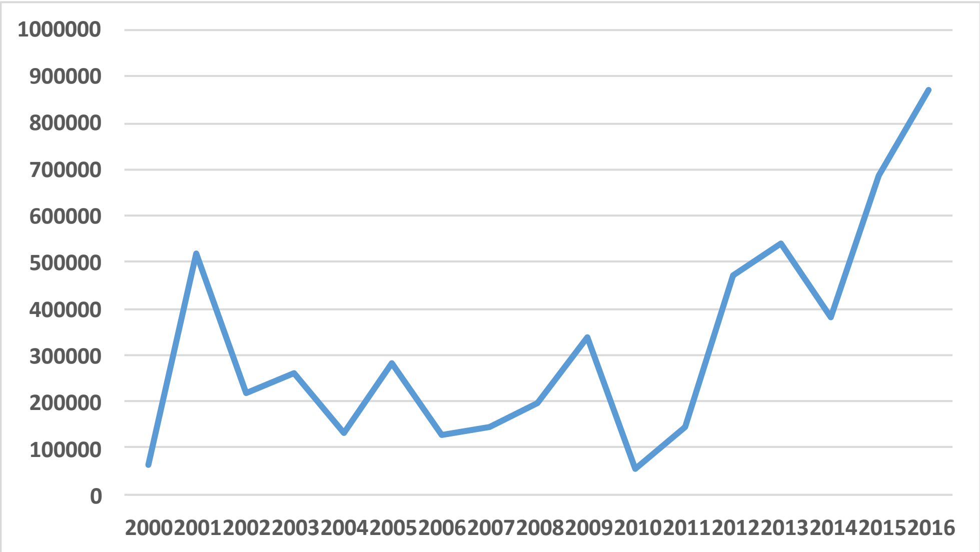
Figure 6.4: India's Peas (dry) Import as a Percent of Total World Import



Source: FAOSTAT

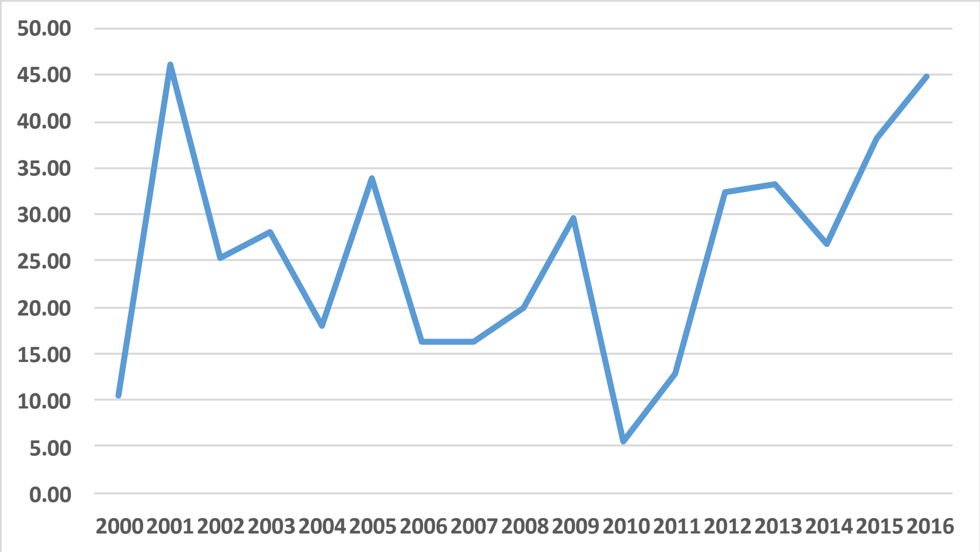
Similarly, India's chickpea imports also increased during the same period from around 64 thousand tonnes in 2000 to around 873 thousand tonnes in 2016 (see figure 6.5). As a result, India's share in world imports of chickpea also increased from around 10% in 2000 to around 45% in 2016(see figure 6.6). But the imports of chickpea experienced more fluctuations as compared to peas.

Figure 6.5: Trends in Imports of Chickpea in Tonnes



Source: FAOSTAT

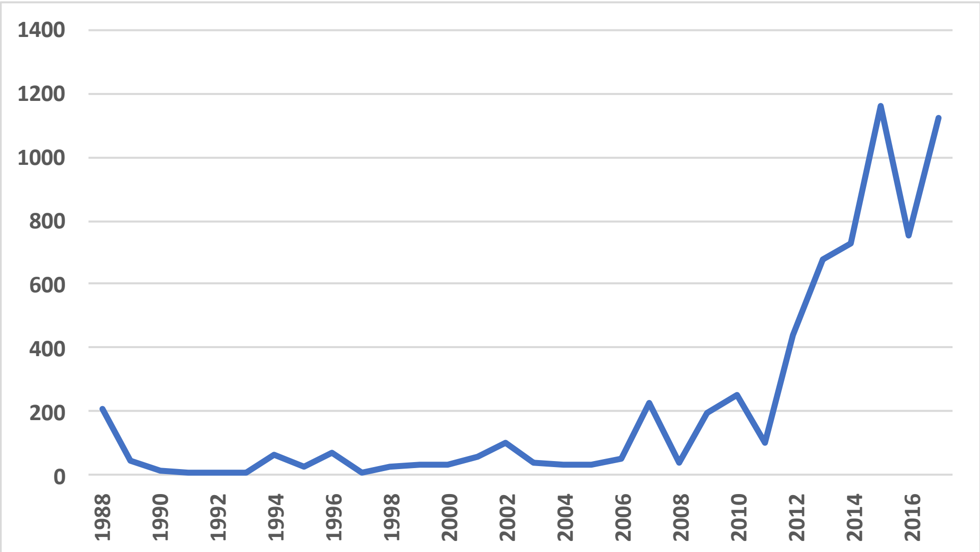
Figure 6.6: India's Chickpea Import as a Percent of Total World Import



Source: FAOSTAT

Another major pulse imported by India is lentils. The imports of lentils were sharply increasing over the last couple of years especially since 2012. The imports of lentils increased from around 206thousand tonnes in 1988 to 1123 thousand tonnes in 2017. In 2012 it was 441 thousand tonnes. The highest import occurred in the year 2015 and the total quantity imported was around 1162 (see figure 6.7).

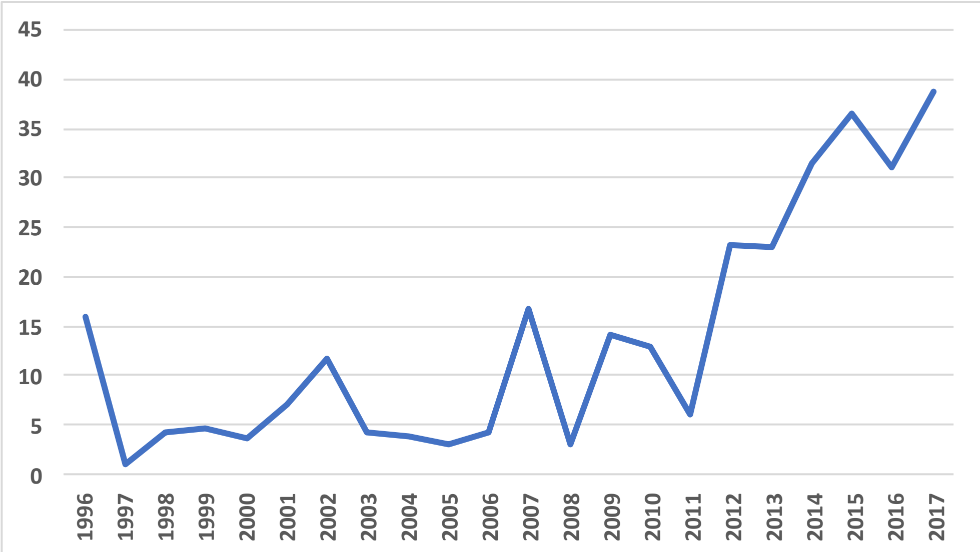
Figure 6.7: Trends in India's Imports of Lentils in Thousand Tonnes



Source: wits.org

As a result of an increase in imports of lentils, the share of the same in total world import also sharply increased from around 1% in 1997 to around 39% in 2017 (see figure 6.8).

Figure 6.8: India's Import of Lentils as a Percent of Total World Import



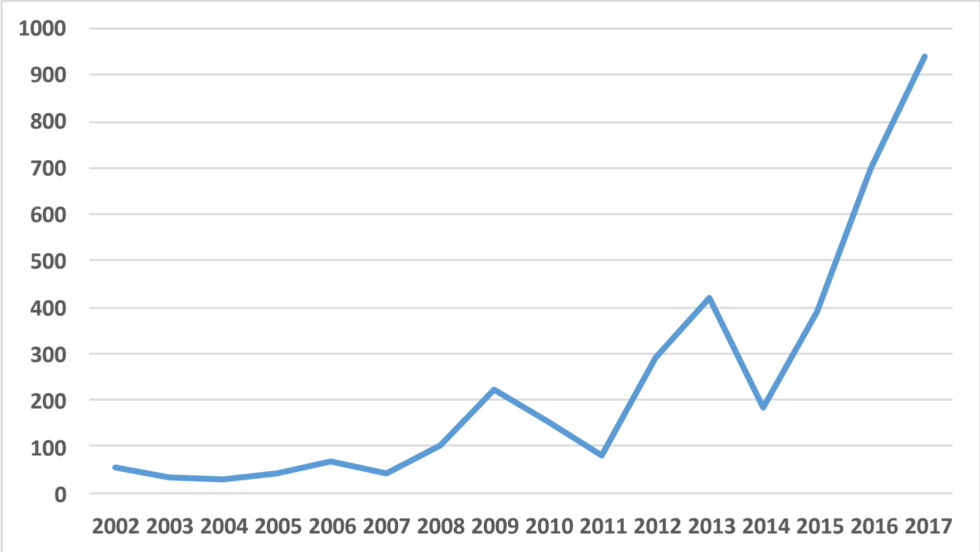
Source: wits.org

6.2 Country Wise Imports of Major Pulses

The below sections will have closer look at the import scenario by analyzing the major importers of each crop.

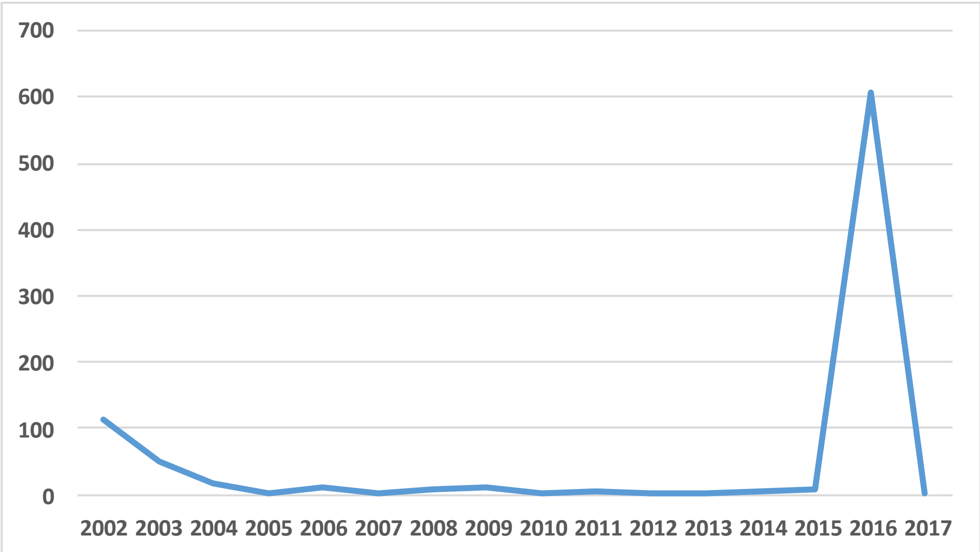
As mentioned already, Australia was the major importer of chickpea to India. For example, the import of chickpea from Australia to India sharply increased from around 55 thousand tonnes in 2002 to around 941 thousand tonnes in 2017 (see figure 6.9). The other important suppliers were Canada and Ethiopia. Canada's import was highly fluctuating during 2002-2017. (figures 6.8&6.9). In 2002 India imported around 114 thousand tonnes of chickpea from Canada and in the remaining years except 2016 the import of chickpea from Canada was negligible. In 2016 India imported around 606 thousand tonnes of chickpea from Canada. In 2017, (in the first three quarters), India imported only 3 thousand tonnes (see figure 6.10). Similarly, from Ethiopia, the import was always less than 10 thousand tonnes except in 2015. In 2015 India imported around 15 thousand tonnes of chickpea from Ethiopia (see figure 6.11).

Figure 6.9: Import of Chickpea from Australia in Thousand Tonnes



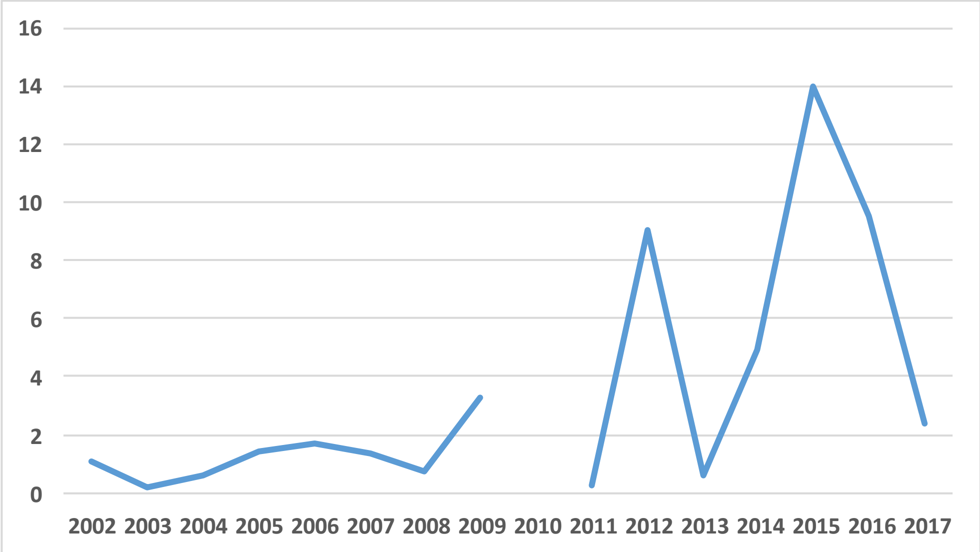
Source: DGCI&S

Figure 6.10: Import of Chickpea from Canada in Thousand Tonnes



Source: DGCI&S

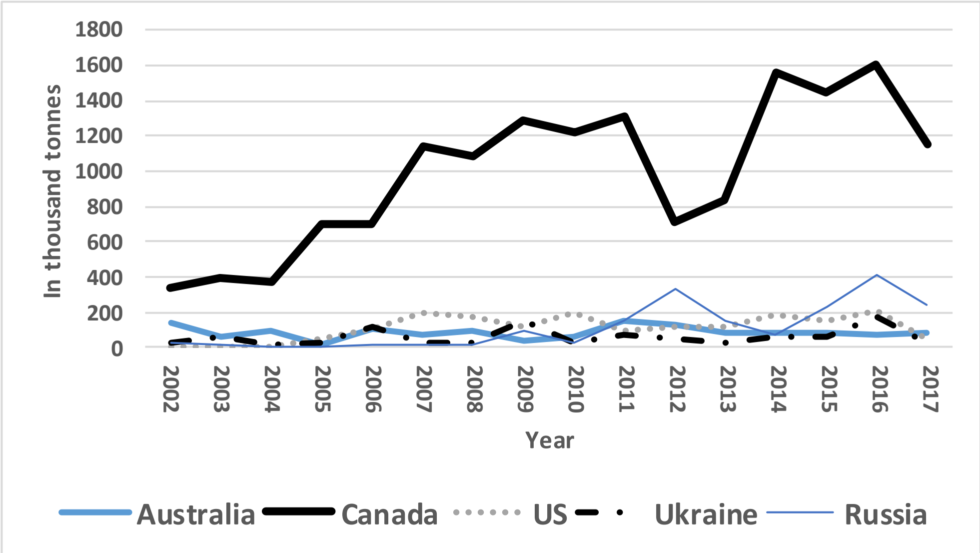
Figure 6.11: Import of Chickpea from Ethiopia in Thousand Tonnes



Source: DGCI&S

As far as peas are concerned, Canada was the major importer of peas to India. The other major importers were US, Ukraine, Australia and Russia. Among these countries, Russia emerged as a major importer in recent years (see figure 6.13). However, the share of Canada in total imports of peas much higher than the other countries. For example, the imports of peas from Canada increased around 333 thousand tonnes in 2002 to 1605 thousand tonnes in 2016. But the imports of peas from Canada only in the last three quarters of data shows that import touched around 1152 thousand tonnes (see figure 6.13). Though there was a decline in the imports of peas from Australia, there was an increase in the imports of peas from US, Ukraine and Russia. The imports of peas from US to India increased from around 3 thousand tonnes in 2002 to around 212 thousand tonnes in 2016. The import in the first three quarters of 2017 was around 49 thousand tonnes. Similarly, the imports from Russia increased from around 20 thousand tonnes in 2002 to around 414 thousand tonnes in 2016, and 237 thousand tonnes in the first three quarters of 2017. The imports from Ukraine also increased from 28 thousand tonnes to 171 thousand tonnes but declined to 25 thousand tonnes in 2017. Australia was the biggest importer of peas after Canada in the initial years but the amount sharply declined in the later years. The imports from Australia was around 143 thousand tonnes in 2002 but declined to around 70 thousand tonnes in 2016 and marginally increased to 82 thousand tonnes in 2017 (see figure6.131).

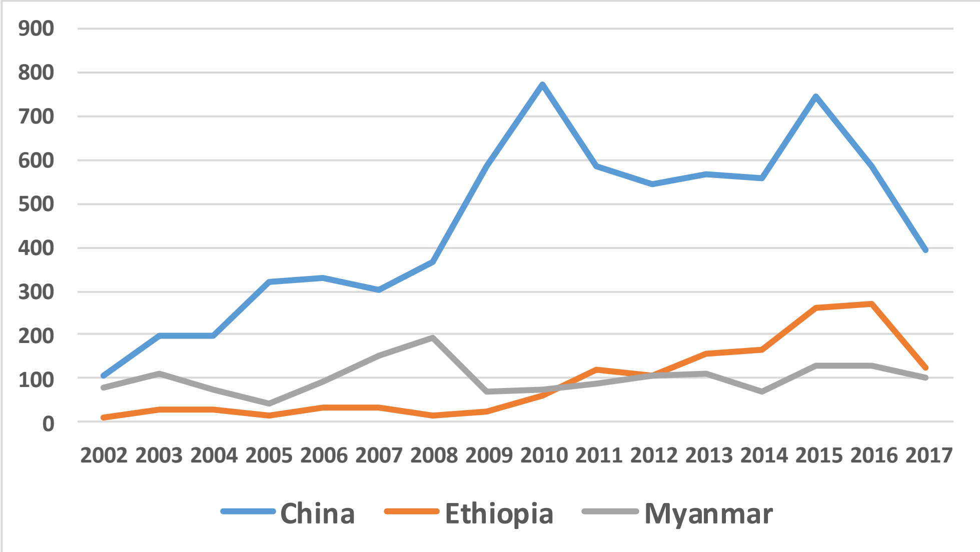
Figure 6.12: Imports of Peas from Major Importers in Thousand Tonnes



Source: DGCI&S

As far as the imports of kidney beans is concerned, as mentioned earlier China was the major importer to India. The other two importers were Ethiopia and Myanmar. The imports from Myanmar was higher than the imports from Ethiopia until 2010. But since then Ethiopian imports were higher than Mynamar imports (see figure 6.14). The imports of kidney beans from China increased from 104 thousand tonnes to 744 thousand tonnes during 2002 to 2015. In the subsequent years the imports marginally fell to 586 thousand tonnes and 393 thousand tonnes. But the figure for 2017 is only for the first three quarters. Similarly the imports from Ethiopia increased from around 11 thousand tonnes to 269 thousand tonnes during 2002-2016. The imports from Myanmar increased from 77 thousand tonnes in 2002 to 128 thousand tonnes in 2016. The imports from Myanmar was the highest in the year 2008 with the imports of around 194 thousand tonnes (see figure, 6.14).

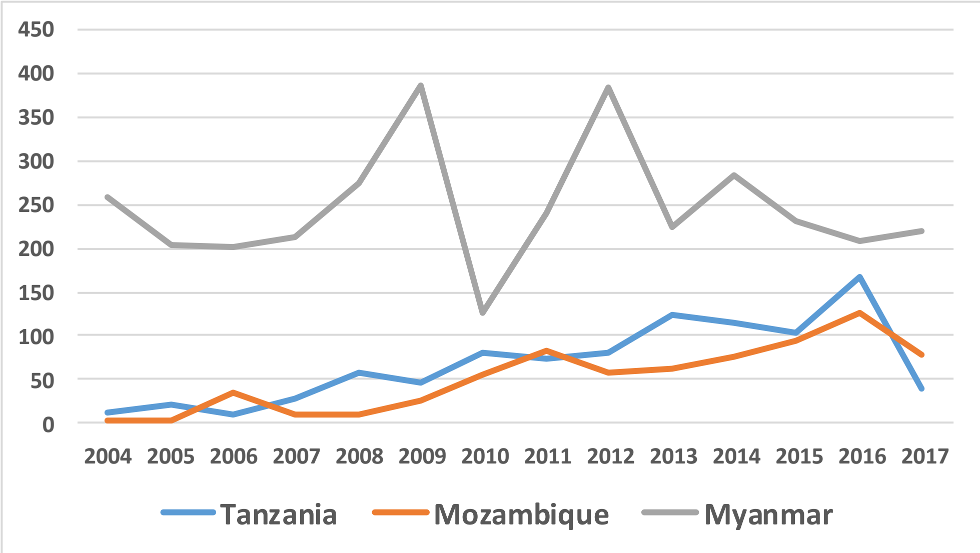
Figure 6.13: Imports of Kidney Beans from Major Importers in Thousand Tonnes



Source: DGCI&S

In the case of pigeon pea, the, major importer was Myanmar, though the import experienced sharp fluctuations during the period. These fluctuations could be attributed to the domestic fluctuations with respect to the production. The imports of pigeon pea from Myanmar was 258 thousand tonnes in 2002 and 220 thousand tonnes in 2017 (see figure 6.15). However, the imports from Mozambique and Tanzania sharply increased during the period. The imports from Tanzania increased from around 11 thousand tonnes in 2002 to 166 thousand tonnes in 2016, alomost close to the imports from Myanmar. Considering the imports in the first three quarters of 2017, the imports from Tanzania fell to 38 thousand tonnes. In the case of Mozambique, the imports experienced an increase over the period. The imports increased from 2 thousand tonnes in 2002 to 125 thousand tonnes in 2016.

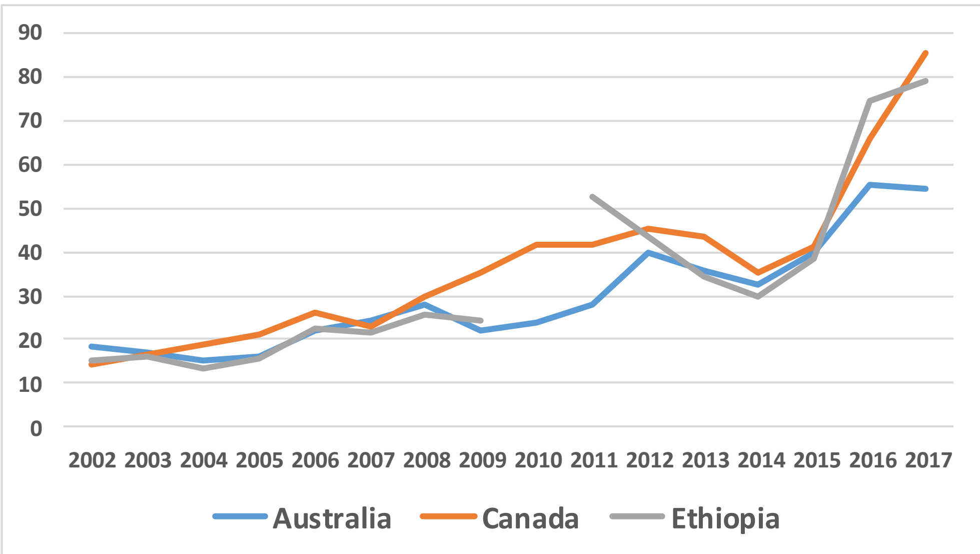
Figure 6.14: Imports of Pigeon Pea (Tur) from Major Importers in Thousand Tonnes



Source: DGCI&S

Next we will turn into the analysis of import prices. The unit value of import is taken as the proxy for import price. Though Australia was the major importer of chickpea, the prices were lower for Australian imports as compared to the other two countries. This can be one of the reasons for Australia to dominate the import. The import prices of both Canada and Ethiopia were increasing since 2014 (see figure 6.16).

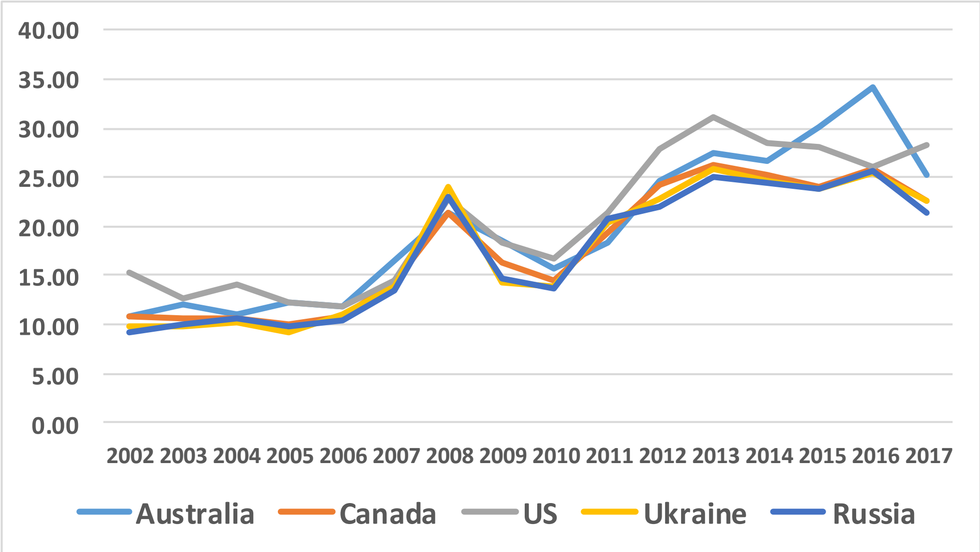
Figure 6.15: Yearly Average Prices (Rs per Kg) of Chickepea Imported by Major Importers



Source: Calculated using the data from DGCI&S

The yearly average unit import prices for peas was very much similar until 2011, but since 2011, the US and Russian price started to increase more than the prices of Australia, Canada and Ukraine (see figure 6.17).

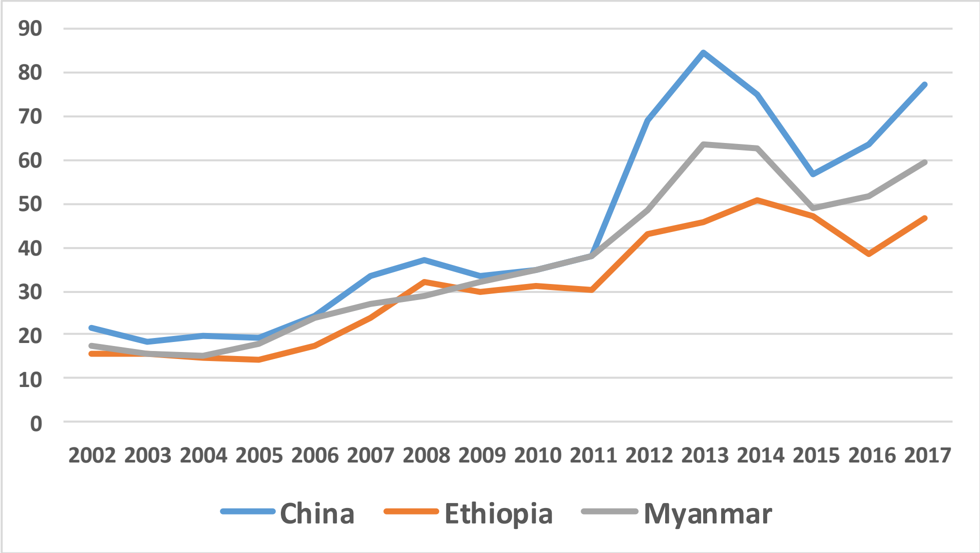
Figure 6.16: Yearly Average Prices (Rs per Kg) of Peas Imported by Major Importers



Source: Calculated using the data from DGCI&S

The yearly average import price of kidney beans from China was higher than the other major importers. The gap between Chinese price and other prices were the highest during 2011 to 2015 (see figure 6.17). As mentioned already, China is also the major importer of kidney beans to India. Among the major importers Ethiopian price was the lowest.

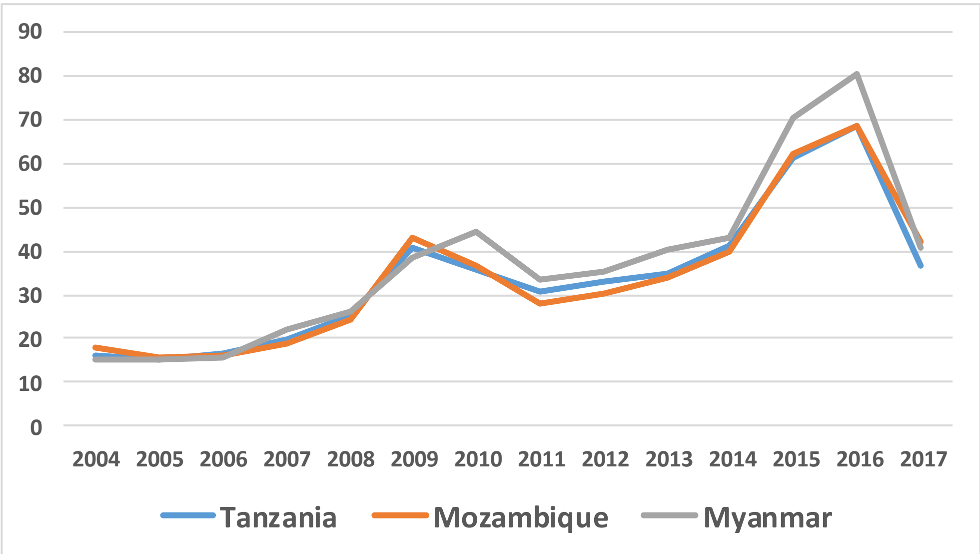
Figure 6.17: Yearly Average Prices (Rs per Kg) of Kidney Beans Imported by Major Importers



Source: Calculated using the data from DGCI&S

Similar to kidney beans, the yearly average unit import price for pigeon pea was also the highest for the major importer of pigeon pea – Myanmar. As in the case of kidney beans, the gap between Myanmar price and other two importer's price widened during 2014-16 period. The period also coincides with the deficit in pigeon pea that the country had faced (see figure 6.19).

Figure 6.18: Yearly Average Prices (Rs per Kg) of Pigeon Pea (Tur) Imported by Major Importers



Source: Calculated using the data from DGCI&S

6.3 Tariff Scenario

The most favoured nation (MFN) tariff for peas is 50, though it was reduced to 10 in 20008 again the rate was increased to 50 in the subsequent years. Whereas for chickpea it was and reduced to 10 in 2008 but again increased to 30 in the subsequent years. In 2015 and 2016, the MFN rate was again 10. Similarly, in the case of kidney beans and lentils the MFN rate was 30 except 2008. In the year 2015 the MFN rate was again reduced to 10. For pigeon pea the MFN rate was 30 from 2012 to 13 but reduced to 10 in 2015.

6.4 Conclusion

The analysis in the above sections showed that there has been a substantial increase in the imports of most of the pulses in the last several years. Also the share of India's imports in world imports of pulses also showed a sharp increase. This points out the increasing import dependency and severe supply deficit that India is facing in terms of meeting the demand for protein rich crop. The data published by National Sample Survey Office (NSSO) in 2014 shows that pulses and pulses products as a whole, the per capita consumption increased by 7778 grams between 2004-05 and 2011-12. Out of which 705 grams per month to 783 grams per month in the rural sector and 824 grams to 901 grams in the urban sector. Interestingly, 69 grams and 57 grams of increase in the rural and urban areas was contributed by the four items split gram, whole gram, pea and besan.

The four pulses *arhar*, *moong*, *masur* and *urd* – which in 2011-12 together made up about 64% of consumption of pulses and pulse products in rural India and 68% in urban India – registered a total increase in monthly per capita consumption of only 14 gm in the rural sector and 18gmin the urban sector over this 7-year period.

The widening gap between supply and demand, and the domestic uncertainties with respect to the production etc. might continue to increase the import dependency unless effective policy measures are undertaken to improve the production and productivity and pulses. The implications of long term dependency on import depends upon the nature of import pricing that is undertaken by the importers as we have already discussed the import of each type of pulses is dominated by one or two single largest importers. This may increase the potential for monopoly pricing. Therefore, the next chapter will make an analysis of import pricing and exchange rate pass through into pulses imported to India by major importers.

Chapter 7

Pricing and Exchange Rate Pass-through in Pulses Imports

7.1 Introduction

The import of pulses to keep the domestic supply high and domestic prices low were also not as straightforward as expected. Therefore, trade play a crucial role in domestic price formation. Since we are no more in a position to isolate domestic markets from world markets and the markets are getting integrated, the nature and dimensions of trade has profound implications on domestic production, consumption, prices and the supply chain that includes processing and marketing (Chandra et al.,2017). Additionally, chapter 6 showed that, India has consistent imports of peas, kidney beans, chickpea and pigeon pea from foreign countries and for each of the pulses we have a major importer along with two or three other importers. The analysis of unit import price also showed that the prices were generally high during the period when Indian experienced a deficit and also the prices of some of the dominant importers were also remained to be higher than the other importers. So it is imperative to analyze the import pricing behavior and exchange rate pass through into import prices to understand whether these importers have any monopoly power in pricing the products.

7. 2 The Concept of Pricing to Market and Exchange Rate Pass Through

In a perfectly competitive market price is determined by the intersection of the market supply and market demand. Therefore, no single supplier can influence prices. A typical outcome of perfect competition is that marginal revenue is equal to the marginal cost resulting in zero profits under equilibrium. At the equilibrium, the prices received by the seller are equivalent to marginal revenue and marginal cost. While in an imperfect competition setting, price is greater than marginal revenue and marginal cost. The new trade theories based on the assumptions of scale economies and product heterogeneity ascertains that in the real world, trade is characterised by imperfect competition and oligopolistic market structures.

The non-competitive pricing behaviour of firms is explained by a concept introduced by Krugman (1987) known as pricing to market (PTM) behaviour. PTM behaviour implies exchange-rate induced price discrimination. The exchange-rate pass-through is defined as the elasticity of export prices to exchange rate changes.

Assume that that the France imports widgets from India. The widgets cost INR 10000 and 1 Euro is equivalent to INR 79.76. The importer from France has to pay around 125 Euro. When the Indian rupee appreciates against Euro with 1 Euro now being equivalent to INR 60, the price that the importer from France has to pay increases to 166.66 Euro. Due to this, the widgets have become expensive for the importer.

Now assume that Indian exporter is absorbing part of the price increase. Assume 50% of the increase in the price is absorbed by Indian exporter. Then the price that the importer from France has to pay would be 146.02 Euro. So, 50% of the increase in the price is absorbed by the Indian exporter. This is known as incomplete pass through. This is also known as **local currency stabilisation**. The exchange rate pass through would have been complete if the price was 166.66 Euro after the change in exchange rates. If the Euro price remained as 125 Euro even after the changes in the exchange rates, the exchange rate pass through would have been 100% incomplete.

The opposite scenario will take place when there is currency depreciation. For example, assume that the Indian currency is depreciated against Euro and now INR 90 is equivalent to 1 Euro. As a result, the widget is now cheaper for the importer from France as he/she needs to pay only 111 Euro. In this case, the exchange rate passes through would be 100% complete if the price that the importer pays is 111 Euro. The exchange rate pass through in this case will be incomplete if the Indian exporter increases the price. For example, assume that Indian exporter did not allow the prices to go down to 111 Euro rather he/she increased the price by 50%. The price that the importer has to pay now is 118 Euro. This shows the exchange rate pass through is incomplete. So here the exporter has increased the price as a result of the change in the exchange rate and this is known as **amplification of exchange rate**. The pass through would have been 100% incomplete if the importer from France had to still pay 111 Euro.

7.3. Review of Literature and Theoretical Framework of the Study

Theoretical framework

The theoretical model discussed below follows the formulation developed by Knetter (1989, 1992). Let us consider an exporter selling to N destination markets, with demand faced in each market as follows:

$$q_{it} = f(p_{it}e_{it})z_{it} \quad , \forall i = 1 \ldots . N, \forall t = 1 \ldots \ldots T, \quad \textbf{(1)}$$

Where q_{it} is the quantity demanded by destination market *i* in period *t*, p_{it} is the price charged by the exporting country to importing country *i* in period *t*, denoted in terms of exporter's currency. e_{it}, is the exchange rate and z_{it}, refers to the demand shifters (a random variable), variables that induce the demand curve to shift.

The cost function for the exporter is given as;

$$C_t = C(\textstyle\sum_i q_{it})\delta_t \,, \ \forall i = 1 \ldots . N, \forall t = 1 \ldots \ldots T, (2)$$

Here, C_t, measures the cost of production in home currency, summed over all destination markets, denoted by *i* and δ_t refers to a random variable that shifts the cost function, for example, changes in input prices in period *t*.

Using equations (1) and (2), exporter's profit maximising condition for period *t* is;

$$\prod\nolimits_t (p_1, p_2, \ldots . p_n) \ = \ \sum_{i=1}^{N} p_i q_i \, (e_i p_i) - C \left\{ \sum_{i=1}^{N} q_i \ \ (e_i p_i \right\} \delta_t \ (3)$$

The first-order conditions of the profit-maximisation for an exporter at period *t*, indicates that the exporter will allocate output in different destination markets at the level where marginal revenue in each market is equated to the common marginal cost. Carew (2000) points out that prices charged by an exporter in each destination market are composed of the product of the common marginal cost and a destination specific mark-up,

$$p_i = MC \left\{ \frac{\varepsilon_i}{\varepsilon_i - 1} \right\} , \forall i = 1 \ldots . . N \ (4)$$

Where, *MC* refers to the common marginal cost faced by an exporter and ε_i is the price elasticity of demand faced by the exporter with respect to local currency price in the destination market *i*. Hence, price in the exporter's currency is a mark-up over marginal cost, and this mark-up is determined by the price elasticity of demand that the exporter faces in the destination market *i*.

2.1 Literature Review

As per the standard theory price is determined by the intersection of demand and supply. In a perfectly competitive market price is equal to marginal cost and marginal revenue. Under perfectly competitive structure, so single supplier can influence the price at which they are selling the products rather they act as price takers in the market. Therefore, in a perfectly competitive market structure setting marginal revenue is equal to the marginal cost resulting in zero profits under equilibrium. At the equilibrium, the prices received by the seller are equivalent to marginal revenue and marginal cost. While in an imperfect competition setting, price is greater than marginal revenue and marginal cost. However, this is not the case in an imperfectly competitive market structure. In an imperfectly competitive structure price is not equal to MC and MR. So a seller in an imperfectly competitive structure is a price maker in the market. The new trade theories based on the assumptions of scale economies and product heterogeneity ascertains that the real world, trade is characterised by imperfect competition and oligopolistic market structures.

The non-competitive pricing behaviour of exporting firms is explained by a concept introduced by Krugman (1987) known as pricing to market (PTM) behaviour. PTM behaviour implies exchange-rate induced price discrimination. Using this framework exchange rate pass-through into the prices of an imported commodity is analysed. As per PTM, exporters either maintain or even increases (decrease) export prices when currency depreciation (appreciation) takes place relative to importer's currency. If an exporter is not allowing the exchange rate changes to get fully reflected in the import prices of the commodity, then exchange rate pass through will be incomplete. The exporter can either absorb the increase in prices by reducing the prices when there is an appreciation of currency or increase the price when there is a depreciation of currency. It depends on the monopoly power of the firm. This is called non-competitive pricing behaviour. The exchange-rate pass-through is therefore defined as the elasticity of export prices to exchange rate changes (Mallick and Marques, 2012). An incomplete exchange rate pass-through would prevent prices from equating to marginal cost. The export prices can have destination specific mark-up of price over marginal cost. In the context of a general equilibrium framework, PTM refers to the local currency pricing whereby prices are pre-set in the buyers currency (Byrne et al., 2013). The local currency pricing has become popular in open economy macroeconomic models.

Asymmetric response of export prices to appreciation and depreciation of exporter's currency can arise due to several reasons (Knetter, 1992). Marketing bottlenecks or supply restrictions can be the reason for PTM during currency depreciation, while increasing the market share can be the reason for PTM during currency appreciation. The former is known as 'bottlenecks model' while the latter is known as 'market share model'.

The first comprehensive empirical estimation of PTM was undertaken by Knetter (1989). Using a fixed effect model, the price discrimination by US and German exporters were analysed to see responsiveness of product's export price to destination specific exchange rate changes. The study observed PTM behaviour by both German and US exporters.

There have been plenty of empirical attempts to analyse the PTM behaviour of both exporters both from an importing country perspective as well as from an exporting country perspective. However most of the empirical studies on PTM is in the context of manufactured products. There are few studies in the context of food and agricultural products. Pick and Park (1991)'s analysis was one of the early attempts in the area of food and agricultural products. They analysed the competitive structure of U.S. agricultural exports of wheat, cotton, corn and soybeans. The study reveals the market power of exporters. Furthermore, they compared their PTM results between nominal and real exchange rates. Similarly, Yumkella et al. (1994) examined the PTM behaviour by US and Thailand rice exporters and found evidence of non-competitive pricing behaviour, either through price discrimination across destination markets or through imperfect exchange rate pass-through. An analysis of pricing behaviour of wheat, pulses and tobacco exported from US and Canada is analysed by Carew (2000). The results from the analysis provided evidence for market imperfection and price discrimination with wheat exports showing greater market imperfection and price discrimination in the destination markets. Miljkovic, Brester and Marsh (2003), quantified the effects of exchange rate changes on US beef, pork and poultry export prices using the PTM model where the exchange rate were market specific exchange rates.

The study done by Lavoie (2005) analysed the case of Canadian wheat exports using monthly price data for the period of 1982 to 1994. The study observed that the Canadian Wheat Board (CWB) discriminates prices across destination markets. Following Knetter (1989, 1993), Jin and Miljkovic (2008) also examined the case of US wheat exports to 22 markets using quarterly data for the period from 1989 to 2004. The study found that exchange rate fluctuations influenced export pricing strategy of the US exporters of wheat in 9 out of 22 destination markets. One of the recent studies done by Pall et al. (2013) for Russia analysed the pricing behaviour of wheat in 25 destination markets using quarterly data for 2002 to 2010. The study observed that the exporters were able to price discriminate in a few destination markets. The study by Pall et al. (2013) made use of both the nominal as well as real exchange rates in their analysis. Nonetheless, Miljkovic and Zhuang (2011) in their study for Japan used commodity-specific (imports) trade-weighted exchange rates. This specific type of exchange rate model was different from what earlier studies used as exchange rates, i.e. in earlier studies exchange rates were aggregate trade-weighted exchange rates provided by the Central Bank authorities or sources. Goldberg (2004) and Pollard and Coughlin (2006) studies highlight the fact that exchange rate pass-through estimated results were sensitive to the exchange rate index utilised. Similarly, our study make use of nominal, real and commodity-specific export trade-weighted exchange rates.

There have been few attempts in the Indian context as well. The pioneering studies on PTM undertaken by Varma and Issar (2016) for India's exports of high value agricultural products such as ground nut, banana, onion and so on. Another study was undertaken on the exports of basmati and non-basmati rice (Issar and Varma, 2016). The results from the analysis showed that Indian exports were able to price discriminate and exchange rate pass through were incomplete at least some of the major destination markets. However, there have been no analysis for India from the import perspective. The present study is intended to fill up this gap by analysing the import pricing behaviour of pulses imported to India by major importers of pigeon pea, chickpea, kidney beans and peas.

7.4. Model Specification

The empirical specification to test the above discussed PTM model can be derived from equation (4) (Knetter, 1989) as follows

$$ln\, p_{it} = \theta_t + \lambda_i + \beta_i\, (ln\, E_{it}) + u_{it} \qquad (5)$$

Where $ln(p_{it})$is the log of the import price by country i at period t, measured in Indian rupees per kg. θ_t represents the time effects corresponding to the *t* periods. As per Silvente (2005) θ_t, is the time varying marginal costs of an exporter. The term λ_i refers to the time-invariant country specific effects. The β_i coefficient measures the exchange rate pass-through for the individual *i* countries. The $ln(e_{it})$ is the log of importer-specific exchange rate expressed as the units of the importer's currency per unit of Indian rupees. Finally, u_{it} is the regression error term distributed. According to Silvente (2005), u_{it} accounts for unobservable factors that could not account for and also any measurement error in the dependent variable.

The equation (5) allows us to test for the following hypotheses.

- Scenario 1: H_0: $\beta_i = 0$, $\lambda_i = 0$
- Scenario 2:H_A: β_i=0, H_A: $\lambda_i \neq 0$
- Scenario 3: HA: $\beta_i \neq 0$, H_A: $\lambda_i \neq 0$

The failure to reject the null hypothesis ($H_{0:}$ $\beta_i = 0$, $\lambda_i = 0$) will prove the existence of competitive pricing in the Indian market. In such case, import prices are hardly influenced by exchange rate changes ($\beta_i = 0$) and country effects ($\lambda_i = 0$) (Carew, 2000). The failure to accept the null hypothesis indicates the presence of imperfect competition and price discrimination by the importing country.

The second scenario indicates constant elasticity of demand with respect to the import price. Therefore, a statistically significant λ_i indicates the fact that the importing country is a price maker in the market. In such a model, mark-up over marginal cost is constant but may vary over time and across different importing countries. Similarly, the import prices are hardly affected by exchange rate fluctuations ($\beta_i = 0$). However, the significance of the parameter λ_i estimated with respect to the country effects does not necessarily show imperfect competition as the country effect also captures quality differences (Knetter, 1989; Falk and Falk, 2000; Pall et al., 2013). In other words the price differences across different importing countries could be also due to the quality differences in the product.

The third scenario indicates price discrimination with varying elasticity of demand. The elasticity of demand may vary along with exchange rate variations. This is pricing to market behaviour because the optimal mark up over marginal cost will not only vary across importing but also is changed due to exchange rate changes and, therefore, $\beta_i \neq 0$ and $\lambda_i \neq 0$. The estimated statistically significant parameter of β_i associated with exchange rate effects can be positive or negative (Knetter, 1993). ‘Incomplete pass-through’ would occur if $\beta_i < 0$ and it is said to be more than complete if $\beta_i > 0$.

A negative β_i implies that the exporting firms are practicing ‘local currency price stabilisation’. On the contrary, a positive β_i implies the amplification of exchange rate effects. When both the estimated coefficients are significantly different from zero ($\beta_i \neq 0$ and $\lambda_i \neq 0$), this indicates the possibility for an exporting firm to amplify the effect of destination specific exchange rate changes through destination specific changes in the mark-up (Pall et al., 2013). The price elasticity of exchange rate changes can vary between appreciation and depreciation scenario. More recently, Knetter (1994) describes how PTM behaviour may be asymmetric with respect to appreciations and depreciations. According to Knetter (1994) PTM behaviour can be greater when domestic currency (exporter's currency) depreciates when there are export volume constraints. The volume constraints can be either induced by firm-specific factors or government policies. When the domestic currency depreciates, these constraints eliminate the possibility of increasing sales volume. Instead, exporters would increase their foreign currency prices to clear the market. Therefore, in order to estimate the impact of appreciation and depreciation separately, an interaction of the dummy variable with the exchange rate is constructed. This dummy variable will capture the asymmetric effect of exchange rate changes. This is common in the literature (Knetter, 1992; Vergil, 2011). Therefore the equation (5) is re-specified in the following manner to test for asymmetries in the response of export prices to exchange rate changes.

$$E_{t=} (\beta_1 \ + \beta_2 \, D_t \,) E_t$$

$$= \beta_1 \, E_t + \beta_2 \, D_t \ \times E_t$$

A dummy variable assumes a value of 1 for periods of appreciation (a fall in E_t) and 0 for periods of depreciation and is specified in the following manner;

$D_t = 1$ if $\Delta E_t > 0$ $(i.e. the\ appreciation\ of\ the\ exporter's currency)$; $D_t = 0$ if $\Delta E_t < 0$ $(i.e. depreciation\ of\ the\ exporter's\ currency)$.

Accordingly, equation (5) can be specified as follows:

$$ln\, p_{it} = \ \theta_t + \lambda_i + \beta_1 (ln\, E_{1t}) + \ \beta_2 (ln\, E_{2t}) + u_{it} \ (6)$$

$$ln\, p_{it} = \ \theta_t + \lambda_i + \beta_1 (ln\, E_{1t}) + \ \beta_2 (ln\, E_{1t} \times D_t) + u_{it} \ (7)$$

In the above equation, the interaction term is expressed to capture asymmetry in the exchange rate fluctuations. If its coefficient is statistically significant and has a positive sign, the effect of appreciation of exporter's currency exchange rates on export prices is lower than depreciation. Similarly, a significant and negative coefficient implies that the effect of appreciation of exchange rates on export prices is greater than depreciation (Byrne et al., 2010).

7.5 Data Description

The unit value of import is taken as a proxy for import price. The import data of each type of pulses are obtained from the Directorate General of Commerce and Intelligence (DGCI&S).
The top importers are identified on the basis of their share in total imports as well as the consistency in imports throughout the period selected for study. The major pulses that are selected for the study are peas, kidney beans, chickpea and pigeon pea. Chickpea and pigeon pea are the major pulses produced in India. The contribution of chickpea and pigeon pea to the total area cultivated under pulses are 35% and 16% respectively. Subsequently, China, Ethiopia and Myanmar are selected for kidney beans, Australia, Canada, US and Ukraine are selected for peas, Tanzania, Mozambique and Myanmar are selected for pigeon pea, Australia, Canada and Ethiopia are selected for chickpea.

Nominal exchange rates and the consumer price index (CPI) to compute real exchange rates for the importing countries were obtained from the OANDA and the World Bank database[1]. The data analysis is undertaken using quarterly data and the period of analysis is from 2002 to 2017. However, for pigeon pea, two types of data set have been used. The currency of major importer of pigeon Pea-Mozambique- redenominated the metical at a rate of 1000:1 on 1 July 2006 owing to inflation. Due to the lack of availability of data prior to 2006, the present study make use of the exchange rates based on both the new and old currencies. The exchange rates were available for old currency till 2007. The exchange rates based on new currency was available from 2008 onward. Also due to the lack of considerable import of pigeon pea from 2002-2004, the present study of pigeon pea is from 2004 to 2017 for pigeon pea based on old currency exchange rate and 2008 to 2017 based on new currency exchange rate of Mozambique. The data is unbalanced for most of the pulses import as the import of pulses were missing in some quarters from some countries.

In order to calculate the real exchange rate for the importing countries, the nominal exchange rates were multiplied with the consumer price index (CPI) of India and divided it by CPI of

[1]OANDA is a website from where we obtained the exchange rates. And even though OANDA appears in uppercase, it is not an acronym.

the respective countries (Knetter (1989); Pick and Park (1991); Pall et al. (2013)). Finally, in addition to the above nominal and real exchange rates, we incorporate the commodity-specific (export) trade-weighted exchange rate, as developed by Goldberg (2004) and a variant applied by Miljkovic and Zhuang (2011). To calculate the commodity-specific (export) trade-weighted exchange rate, we use the real exchange rates computed and the weights of each importer in the following formula:

$$XER_t^p = \sum_i w_t^{pi}.RER_t^i, \ \ where\ w_t^{pi} = \frac{X_t^{pi}}{\sum_i X_t^{pi}} \qquad (8)$$

where XER_t^p is the export weighted (real) exchange rate for commodity *p* at time period *t* (here commodity *p* refers to cereal preparations, dairy, fresh onion, groundnut and guar gum products); w_t^{pi} is the export weight assigned to the importing country i ; and RER_t^i is the real exchange rate between India and country *i*.

7.6 Results and Discussion

The PTM model (equation 7) is estimated using the linear regression with panel corrected standard errors (PCSE)[2] alongwith accounting for panel-level heteroskedastic errors and errors contemporaneously correlated across panels. The analysis is undertaken under three exchange rate models: nominal, real and commodity-specific (export trade weighted) exchange rates.

The R-squared results for all three exchange rate models showed that the pricing to market behaviour is better predicted under the commodity-specific exchange rate model for peas and kidney beans, whereas under nominal exchange rate model for pigeon pea and chickpea.

The results generally showed that the impact of exchange rate effects on import prices were statistically significant for all the products and in the case of most of the importing countries. This also means the exchange rate pass through was incomplete or partial and as a result the importers have a non-competitive pricing behaviour in general. The β coefficient exhibited statistically significant relationship in the case of Ethiopia and Myanmar for kidney beans, Australia and US for peas, Australia, Canada and Ethiopia for chickpea, Tanzania and

[2] The PCSE is estimated by specifying the panel specific AR(1) form of auto correlation for those products that identified an AR1 autocorrelation structure

Myanmar for pigeon pea (old currency) (see tables 7.3, 7.6, 7.7 & 7.10). The analysis based on new currency of Mozambique also showed significant exchange rate effect in the case of Myanmar (see table 7.3).

First we will discuss the results of commodity specific exchange rate models for peas and kidney beans and nominal exchange rate model results for pigeon pea and chickpea.

Commodity Specific Exchange Rate Model for Kidney Beans

As mentioned already commodity specific exchange rate model was the best in predicting the pricing behaviour of the importers so our discussion of the results will focus on commodity specific exchange rate model for kidney beans. The results from the analysis based on commodity specific exchange rate model for peas showed that the exchange rate effect was significant in the case Ethiopia and Myanmar. In other words, exchange rate changes were only partially reflected in the import prices of kidney beans from Ethiopia and Myanmar indicating the non-competitive pricing behaviour of importers of kidney beans. The sign of the bet coefficient was negative for both countries and this showed local currency price stabilisation. Therefore, change in import prices with respect to the changes in exchanges were inverse. In other words, a 1% appreciation in Indian currency was leading to 2% decline in the import price of Ethiopian and Myanmar prices of kidney beans imported to India. This shows the residual demand is elastic, which is an indicator of competitive behaviour (Varma and Issar, 2016).

The country specific effect was also positive in the case of Ethiopia and Myanmar as compared to China indicating the prices of kidney beans from these two countries were higher than Chinese price of kidney beans. The interaction of dummy variable with exchange rate changes to capture the asymmetric effect was not significant in this model (see table 7.1). The demand schedule faced by the exporters are more concave than a constant elasticity of demand when there is local currency stabilisation along with country specific effects ($\beta_i < 0$ and $\lambda_i \neq 0$) (Varma and Issar, 2016).

Commodity Specific Exchange Rate Model for Peas

As mentioned already commodity specific exchange rate model was the best in predicting the pricing behaviour of the importers so our discussion of the results will focus on commodity specific exchange rate model for peas. The results from the analysis based on commodity specific exchange rate model for peas showed that the exchange rate effect was significant in the case of imports from Australia and US. The sign of the coefficient was negative indicating local currency stabilisation. In other words, a 1% appreciation in currency was leading to 4% decline in the import price for Australia and 5% decline in the import price for US. The country specific effect was not significant in this model indicating the prices charged by Australia, US and Ukraine were not statistically different from Canadian price (see table 7.2).

Nominal Exchange Rate Model for Chickpea

As mentioned, the nominal exchange rate model better predicted the pricing behaviour of imported chickpea. The results from the analysis showed that exchange rate effect was significant in the import pricing of all the three major importers of Chickpea-Australia, Canada and Ethiopia. The sign of the bet coefficient was negative in the case of Australia and Canada where as it was positive in the case of Ethiopia. This shows that Ethiopia was practicing amplification of exchange rate whereas the other two were practising local currency stabilisation (see table 7.3). The country specific effect was also significant for Australia and Ethiopia as compared to US. This is indicating significant price differences across importers. Dummy variable to capture the asymmetric effect was significant and positive for Australia indicating an appreciation of exchange rate had a significant impact on the import prices from Australia.

Nominal Exchange Rate Model for Pigeon pea

The nominal exchange rate models better predicted the pricing behaviour of pigeon pea analysis based on both the currencies. The results from the analysis showed that the exchange rate effect was statistically significant and negative in the case of two out of three major importers of pigeon pea-Tanzania and Myanmar. The sign was negative indicating these countries are practicing local currency price stabilisation. However, the market specific effect was significant for Mozambique indicating that though exchange rate pass through is complete, the prices charged by Mozambique was lower than the other importers and the mark up of price over cost remain to be constant. This can also be due to the quality difference in pigeon pea imported by Mozambique as compared to the other two countries. Dummy variable to capture the asymmetric effect was not significant in this model.

When we analysed the PTM using the new currency of Mozamique only for the period 2008 to 2017 showed that exchange rate was significant in the case of import from Myanmar. As in the case of old currency model, the sign of the coefficient was negative indicating local currency stabilisation by Myanmar (see table 7.4). However, the country specific effect was significant and negative for Mozambique and Tanzania indicating differential prices for imported pigeon pea. Dummy variable to capture the asymmetric effect was not significant in this model.

Table 7.1: Results of the PTM Model for Kidney Beans - Commodity Specific Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
China	-0.02	-1.37	*	*	0.01	0.59
	(0.02)		*		(0.02)	
Ethiopia	-0.02	**-2.25****	-0.4	**-5.13*****	0.01	0.71
	(0.01)		0.07		0.02	
Myanmar	-0.02	**-2.32****	-0.15	**-3.18*****	-0.01	-0.52
	(0.01)		0.05		0.02	
Observations	172					
Wooldridge Test	47.97 (0.0202)					
R-squared	0.9824					
Wald chi-sq.	2586.29 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, China is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table 7.2: Results of the PTM Model for Peas - Commodity Specific Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Australia	-0.04	**-3.81*** **	-0.09	-0.91	0.03	1.46
	(0.01)		(0.10)		(0.02)	
Canada	-0.02	-0.93			0.04	**2.27** **
	(0.02)				(0.02)	
US	-0.05	**-4.66*** **	-0.01	-0.18	-0.01	-0.7
	(0.01)		(0.08)		(0.03)	
Ukraine	-0.01	-0.95	0.01	0.08	0.02	0.81
	(0.01)		(0.07)		(0.02)	
Observations	232					
Wooldridge Test	13.2551 (0.0357)					
R-squared	0.9831					
Wald chi-sq.	3889.50 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Canada is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table 7.3: Results of the PTM Model for Chickpea - Nominal Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Australia	-0.47	**-1.76***	1.95	**3.04*** **	0.07	**2.28** **
	(0.27)		(0.64)		(0.03)	
Canada	-1.03	**-3.16*** **	*	*	0.03	0.94
	(0.33)		*		(0.03)	
Ethiopia	0.84	**3.58*** **	4.92	**3.23*** **	-0.02	-0.44
	(0.23)		(1.52)		(0.04)	
Observations	152					
Wooldridge Test	406.457 (0.0025)					
R-squared	0.9740					
Wald chi-sq.	1728.12 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Canada is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table 7.4: Results of the PTM Model for Pigeon Pea - Nominal Exchange Rate Model (old currency)

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Tanzania	-0.16	**-1.75***	-0.55	-0.89	-0.01	-0.55
	(0.09)		(0.62)		(0.03)	
Mozambique	0.01	1.41	-1.53	**-2.99** **	0.00	-0.07
	(0.01)		(0.51)		(0.02)	
Myanmar	-0.47	-3.11***	*	*	0.01	0.27
	(0.15)		*		(0.02)	
Observations	157					
Wooldridge Test	43.225 (0.0224)					
R-squared	0.9844					
Wald chi-sq.	4391.99 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Myanmar is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table 7.5: Results of the PTM Model for Pigeon Pea - Nominal Exchange Rate Model (new currency)

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Tanzania	-0.08	-0.78	-1.84	**-2.59****	0.01	0.47
	(0.10)		(0.71)		(0.02)	
Mozambique	0.01	0.76	-1.70	**-2.46****	-0.01	-0.34
	(0.01)		(0.69)		(0.03)	
Myanmar	-0.53	**-2.61****	*	*	0.03	1.18
	(0.20)		*		(0.02)	
Observations	111					
Wooldridge Test	29.004 (0.0328)					
R-squared	0.9805					
Wald chi-sq.	1237.35 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Myanmar is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

7.7 Conclusion

The analysis of pulses imports pricing behaviour by major importers based on PTM model with panel corrected standard errors (PCSE) estimation technqiue broadly indicated the presence of non-competitive pricing behaviour of India's importers due to both the exchange rate induced effects as well as market specific characteristcs. The significance of the exchange rate parameter β_i and the country-specific effects parameter λ_i in most of the models indicates that the importers work with a fluctuating exchange rate and a varying mark-up over marginal cost. The analysis of the asymmetric effects of exchange rates through an interaction dummy showed that for majority of the products appreciation of the Indian rupee against the partner country had greater impact than the depreciation.

We tested the PTM model under three different exchange rates, i.e. the nominal, the real and the commodity-specific (import) trade-weighted exchange rates. For all the products under study, we observed PTM in at least one of the destination markets either through exchange rate changes and/or through country specific effects. The analysis also showed that the commodity specific exchange rate better predicts the PTM behaviour in the case of kidney beans and peas whereas the nominal exchange rate better predicts the PTM behaviour of chickpea and pigeon pea.

The analaysis of the exchange rate effect showed that local currency price stabilization by the Indian importers was more prominent than the amplification of exchange rates. This is indicating competition among other importers.

Appendix

Table A7.1: Results of the PTM Model for Pigeon Pea - Real Exchange Rate Model (new currency)

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Tanzania	-0.03	-1.30	-0.16	-1.13	0.02	0.57
	0.02		0.14		0.03	
Mozambique	0.01	0.58	-0.07	-0.46	0.03	1.06
	0.01		0.15		0.03	
Myanmar	-0.05	-1.14	*	*	0.04	1.44
	0.04		*		0.03	
Observations	110					
Wooldridge Test	60.723 (0.0161)					
R-squared	0.9612					
Wald chi-sq.	1118.35 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Myanmar is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.2: Results of the PTM Model for Pigeon Pea - Commodity Specific Exchange Rate Model (new currency)

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Tanzania	0.01	1.52	-0.09	-2.00	0.01	###
	0.01		0.04		0.03	
Mozambique	-0.02	-1.11	*	*	0.00	0.1
	0.01		*		0.03	
Myanmar	0.01	0.89	-0.14	-3.66	0.03	1.2
	0.01		0.04		0.03	
Observations	109					
Wooldridge Test	286.701 (0.0035)					
R-squared	0.9681					
Wald chi-sq.	1173.97 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Mozambique is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.3: Results of the PTM Model for Kidney Beans - Nominal Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
China	-0.09	-0.62		0.50	0.03	1.96*
	(0.13)				(0.02)	
Ethiopia	-0.08	-0.72	-0.30		0.05	2.75**
	(0.12)		(0.38)		(0.02)	
Myanmar	-0.01	-0.46	0.04	1.26	-0.04	-2.27**
	(0.01)		(0.27)		(0.02)	
Observations	182					
Wooldridge Test	100.3 (0.009)					
R-squared	0.972					
Wald chi-sq.	1882.25 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Ethiopia is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.4: Results of the PTM Model for Kidney Beans - Real Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
China	-0.02	-1.13			0.01	0.49
	0.02				0.02	
Ethiopia	-0.05	**-2.53****	-0.37	**-5.8*****	-0.01	-0.52
	0.02		0.06		0.02	
Myanmar	-0.01	-1.14	-0.14	**-3.43*****	0.01	0.39
	0.01		0.04		0.02	
Observations	172					
Wooldridge Test	137.65 (0.0072)					
R-squared	0.978					
Wald chi-sq.	2102.59 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, China is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.5: Results of the PTM Model for Peas - Nominal Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Australia	-0.03	-0.49	-0.18	-0.42	-0.02	-0.6
	0.07		0.43		0.3	
Canada	-0.08	-1.12	-0.48	-1.17	-0.015	-0.74
	0.07		0.41		0.02	
US	-0.01	-0.08			-0.004	-0.13
	0.11				0.03	
Ukraine	0	0.05	-0.16	-0.34	-0.02	-0.78
	0.03		0.48		0.02	
Observations	239					
Wooldridge Test	4.122 (0.1353)					
R-squared	0.9450					
Wald chi-sq.	5280.63 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, US is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.6: Results of the PTM Model for Peas - Real Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Australia	0.11	2.59**	*	*	0	0.01
	0.04		*		0.02	
Canada	0.05	2.25**	-0.26	**-2.17****	0.02	0.78
	0.02		0.12		0.02	
US	0.00	-0.17	-0.25	**-1.97***	0.05	1.59
	0.02		0.13		0.03	
Ukraine	0.00	-0.25	-0.43	**-3.49*****	0.01	0.57
	0.01		0.12		0.02	
Observations	232					
Wooldridge Test	12.15 (0.0399)					
R-squared	0.9669					
Wald chi-sq.	2907.71 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Australia is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.7: Results of the PTM Model for Chickpea - Real Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Australia	-0.07	-0.86	*	*	-0.01	-0.32
	0.08		*		0.04	
Canada	0.01	0.12	0.40	1.97	-0.06	-1.52
	0.06		0.20		0.04	
Ethiopia	-0.09	-2.31	0.07	0.31	0.00	-0.07
	0.04		0.22		0.04	
Observations	153					
Wooldridge Test	120.815 (0.0082)					
R-squared	0.9674					
Wald chi-sq.	997.21 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Australia is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.8 Results of the PTM Model for Chickpea - Commodity Specific Exchange Rate Model

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Australia	-0.11	-4.12	-0.46	-3.39	0.05	1.56
	0.03		0.14		0.03	
Canada	-0.01	-1.09	*	*	0.02	0.52
	0.01		*		0.04	
Ethiopia	-0.03	-2.32	-0.20	-1.52	-0.03	-0.67
	0.01		0.13		0.05	
Observations	153					
Wooldridge Test	21.399 (0.0437)					
R-squared	0.9673					
Wald chi-sq.	1628.53 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Canada is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.9: Results of the PTM Model for Pigeon Pea-Real Exchange Rate Model (old currency)

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Tanzania	-0.03	-1.50	-0.01	-0.05	0.03	1.33
	0.02		0.15		0.02	
Mozambique	0.01	1.63	-0.09	-0.73	0.00	0.13
	0.01		0.12		0.02	
Myanmar	-0.05	-1.32	*	*	0.01	0.45
	0.04		*		0.02	
Observations	155					
Wooldridge Test	179.074 (0.0055)					
R-squared	0.9736					
Wald chi-sq.	4366.21 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Myanmar is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Table A7.10: Results of the PTM Model for Pigeon Pea - Commodity Specific Exchange Rate Model (old currency)

Country	Exchange Rate Effect	Z-Statistic	Country Specific Effect	Z-Statistic	Asymmetric Effect	Z-Statistic
Tanzania	-0.01	-1.59	-0.07	-2.00	-0.03	-1.17
	0.01		0.03		0.02	
Mozambique	0.00	0.66	*	*	-0.05	-2.40
	0.01		*		0.02	
Myanmar	0.00	-0.27	-0.09	-3.69	0.00	0.05
	0.01		0.03		0.02	
Observations	155					
Wooldridge Test	104.108 (0.0095)					
R-squared	0.9821					
Wald chi-sq.	4334.20 (0.0000)					

Notes: Standard errors are in brackets. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively. For the cross-sectional specification, Mozambique is the intercept. Wooldridge Autocorrelation Test null hypothesis is no first-order autocorrelation (p-values in brackets).

Chapter 8

Minimum Support and Price Policies

8.1 An Overview of Government Interventions in Agriculture

A defining feature of agricultural economic policy making in India until the nineties has been its inward orientation with high government intervention. The intervention was indispensable in an economy like India where agriculture inherited a very inequitable socio- economic structure mainly due to the feudal production structure. The high rate of growth of population on the one side and the sluggishness of the industrial sector on the other side gave rise to a very high demand for land. The unequal distribution of land resulted in a sharecropping system that accords monopoly power to the landlords reflected in their high share of production and monopoly power to evict the tenants from their land (Bhattacharya et al, 1996). These inequalities and imperfections in the agricultural market prompted the government to intervene in the market with multiplicity of tools.

Initially, the government intervention began in the agricultural market with the aim of the reduction of inequalities by removing the production bottlenecks and thereby promoting agricultural growth. Later, the economic policy framework for the agricultural sector indeed went a long way with the objective of achieving self-sufficiency in food production on the one hand and agrarian surplus for investment in industrial sector on the other. This approach is best illustrated in the context of direct interventions and indirect interventions in the agricultural market. Direct interventions include price policy by employing tariffs as well as more direct measurers of control on trade, such as bans, quotas, minimum export prices and intervention in the domestic market through state subsidies and government procurement. Indirect interventions include economy-wide import substitution policies and the overvaluation of real exchange rates that arise from high rates of domestic inflation and lags in adjusting the nominal exchange rate.

In the wake of Bengal Famine of 1943, A Food-grains Policy Committee was appointed under the chairmanship of George Theodore which called upon the attention of the government to the importance of rationing. Further, India struggled with a number of price controls on essential agricultural commodities post-independence. In 1964, another committee, Food-grains Prices Committee, was appointed by the government under the chairmanship of L.K. Jha, which led to the formation of Food Corporation in India (FCI) and the Agricultural Prices Commission (APC) in 1965.

The objective of APC was to determine a balanced and well-integrated price policy that would be fair to both producers and consumers. Agricultural price policy plays an important role in the economic development of an agrarian economy. The Food Corporation of India (FCI) was also established in the same year with the objective of stabilising food prices. Until the establishment of both APC and FCI, the primary concern of the government's food price policy was the stabilisation of the food prices for the consumer with little concern or recognition of the role of price incentives for encouraging production of the producers. To protect the farmers from the fluctuations in the agricultural prices and to incentivize them to continue farming, the Government of India started to announce procurement or support prices for major agricultural commodities. Further, the government also proposed a price policy in order to stabilize the general prices and promote an increase in production. The government introduced minimum support prices for rice and wheat. A positive agricultural price policy results in the stabilization of prices, increase in the overall production and most importantly, an increase in the income of the farmers. A proper price policy also leads to an effective and judicial use of the resource endowments. Further, it leads to the formation of better price policies in the areas of marketing, extension services, growth in agricultural inputs, etc.

Till the formation of APC and FCI, the requirements of the public distribution systems (PDS) were met primarily with imports rather than domestic procurement (Sukhatme and Abler, 1997). Domestic procurement was small and procurement prices were set on an ad hoc basis. The APC formalised the process of setting procurement prices by more systematically taking into account cost of production and past trends in prices. The FCI is the government's principal agency for domestic procurement, storage, public distribution and foreign trade in food grains.

Over the years several policies related to agricultural prices have been devised and all of them serve nearly the same purposes, of increasing the production, stabilizing the prices and maintaining adequate stocks of food-grains (Report, Food-grains Policy Committee, 1957).

The APC, later renamed as the Commission for Agricultural Costs and Prices (CACP), provided detailed suggestions to the government regarding interventions in the agricultural markets and price support policies. Procurement prices recommended by the CACP are usually acceptable to the government of India. The commission recommends the procurement prices for wheat and rice “in the perspective of the overall needs of the economy and with due regard to the interests of the producers and consumers”. Apparently, when recommending prices, the CACP considers production costs, domestic prices, world prices, effects of price changes on living costs and industrial production costs and the desire to maintain some predetermined intercrop price parity (Sukhatme and Abler, 1997). However, there is no formula per se. The intervention broadly aimed stabilising the prices which are prone to short-term price fluctuations (Kahlon and Tyagi, 1983; Chandra, 1985; Zant, 1998).

The decline in prices as well as the increase in prices had policy implications. For example, the unrestrained increase in the price of agricultural commodities would affect the standard of living of the masses and the other sectors of the economy because agriculture provides wage goods to the industrial sector. Moreover, the change in agricultural prices would have an adverse impact on the distribution of income between the agricultural and non- agricultural sectors of the economy. Ostensibly, the price policy in India resulted in artificially kept prices which were either below or above the world prices.

In the case of rice, for much of the 1960s and 1970s, open-market prices and procurement prices were far below world prices. It was only after the big drop in world rice prices in the 1980s that Indian market prices came close to world rice prices (Sukhatme and Abler, 1997). In the case of wheat, there was an interesting shift in the policy regime. Prior to the mid–1970s, domestic wheat prices exceeded the world prices; since that time, the opposite has been the case. With domestic production of wheat growing rapidly under the Green Revolution, the government was unwilling to pass the large world price increases of the mid–1970s on to domestic markets. In the mid–1980s, the world price of wheat was about 40 % above the open-market producer price and about 55% above the procurement price. Government controls over trade and capital flows during the past decades accounted for these large differences between domestic and world prices.

Foreign trade in agricultural commodities in most cases was guided by “residuary surplus factor”, i.e. the agricultural commodities were allowed to be exported when there existed surplus after meeting the domestic requirements. Similarly, the import was mainly done to meet the excess demand and thereby to prevent the upward movement of the domestic prices (Nayyar and Sen, 1994; Thimmaiah and Rajan, 2002). As a result, the domestic prices were controlled primarily by the domestic demand and supply conditions and were isolated from the world prices. Therefore, an important feature of the trade regime was a restrictive trade policy with strict regulation of both imports and exports of agricultural commodities. Thus, the trade regime in most cases aimed to provide protection to the domestic producers and consumers by insulating the domestic economy from external shocks.

However, the trade policy regime, especially the import substitution strategy, came in for severe criticism by the World Bank, IMF and academic proponents of structural adjustment, during the 1970s and 1980s (Bhalla, 1994). The critics argued that both the overall planning framework and sector specific governmental policies have been discriminatory against agriculture. Discrimination had been inherent in the import substitution strategy of industrialisation adopted by the country for several reasons. It was argued that the high protection accorded to industry raised the relative prices of modern farm inputs for the agricultural sector and thereby implicitly taxed agriculture. The protectionist trade regime, which resulted in the non-alignment of internal prices with border prices, resulted in inefficiency of resource use, distorted the cropping pattern and also prevented the producers from deriving benefits of comparative advantage in agriculture (Bhalla, 1994; Gulati, 1998).

India does not provide generally any product-specific support other than market price support which is implemented through a device of 'Minimum Support Prices' (hereafter MSP). The commodities included in the minimum support price policies were paddy rice, wheat, coarse cereals, various pulses, various oilseeds, sugarcane, cotton and tobacco (Orden et al., 2007). For wheat, the MSP is paid directly to farmers in the primary markets where they sell their grain. For rice, about half of total procurement is purchased in primary markets in the form of paddy at MSP and about half is purchased as milled rice through a statutory, fixed price levy imposed on rice millers in some states (Jha et al., 2007). Under the levy, millers are obligated to deliver a share of the rice they process to the government at a fixed, below-market price. The levy shares vary from State to State (from a low of 10 percent to a high of 75 percent). The farmers in states with high levies receive farm price which is below the MSP. Grain procured by government is stored by the FCI. The FCI either makes the grain available to State governments for subsidized distribution or, when conditions permit, allocates surplus grain for export (Jha et al., 2007).

8.2 Minimum Support Prices Scheme

Surplus production in a year usually results in the sharp decline in price of an agricultural commodity. To cushion the farmers against the unexpected and inevitable losses, the

Government of India came up with the concept of Minimum Support Price Scheme in 1966-67. Minimum Support Price or MSP continues to be as an integral part of the country's price policy, is announced by the Government in order to protect the farmers from the shocks or volatility in the food market. The MSPs are decided based on the recommendations of Commission for Agricultural Costs and Prices (CACP). CACP puts forward recommendations separately for both the seasons – Kharif and Rabi. The calculation of MSP is largely based on the cost of production which takes into account the variable cost, land rental value, the imputed value of family labour and a 10 percent return to family labour (Jha et al., 2007). The attempt to eliminate quantitative restrictions on cereal exports in the second half of the 1990s benefited producers as the world price for cereals at that time was quite high. However, a fall in world prices in the late nineties paved way for an additional pressure for increasing MSP in order to compensate producers' losses due to low world price. The basic staples in India, therefore, continue to be subject to MSP to the farmers, even though the government interventions in the market to procure crops have weakened.

The MSP serves the objectives of ensuring stable price environment for the farmers, preventing the farmers from the distress selling of their produce and procuring food grains for the Public Distribution System, among others. Government through MSPs, incentivizes the farmers in order to maintain an adequate amount of food grain production in the economy. At present, 24 crops are covered under this scheme, including seven cereals (paddy, wheat, barley, *jowar*, *bajra*, maize and *ragi*); five pulses (gram, *arhar*/*tur*, *moong*, *urad* and lentil); eight oilseeds (groundnut, rapeseed/mustard, *toria*, soybean, sunflower seed, sesame, safflower seed and niger seed); copra, raw cotton, raw jute and virginia flu cured (VFC) tobacco. Procurement of the crops is done by the Food Corporation of India (FCI) for release through the PDS. Other interventions such as Market Intervention Schemes (MIS), various Price Support Schemes (PSS) etc., are used for the procurement of crops that are not covered under the MSP scheme. The MSP announced for various pulses is given in table 8.1. The MSP figures shows that there has been an increase in the MSP for almost all the crops. The MSP for Pigeon pea (arhar) increased from Rs2300 per quintal in 2009-10 to Rs 5675 per quintal in 2018-19. Similarly, the MSP for gram increased from Rs. 1760 in 2009-10 to 4620 in 2018-19 (see table 8.1).

Table 8.1: Minimum Support Prices of Various Pulses in Rs Per Quintal

crops	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Khariff										
Tur(arhar)	2300	3000	3200	3850	4300	4350	4625	5050	5450	5675
Moong	2760	3170	3500	4400	4500	4600	4850	5225	5575	6975
Urad	2520	2900	3300	4300	4300	4350	4625	5000	5400	5600
Rabi										
Gram	1760	2100	2800	3000	3100	3175	3425	4000	4400	4620
Lentils(Masur)	1870	2250	2800	2900	2950	3075	3325	3950	4250	4475

Source: CACP

Awareness of MSP and Procurement Agency Among farmers

The successful implementation of a scheme can be achieved only if the targeted population is aware of most of the aspects of a scheme. Failure to do so can never lead to an effective policy implementation. Regarding MSP, the farmers need to be aware of prevailing MSP, time of their announcements and the process of procurements, the facilities provided by the government and the payment mechanism.

A survey conducted by the National Sample Survey Organization (NSS Report 2012-13) collected information on the awareness of the agricultural households regarding the minimum support prices. The households considered were the ones which have reported the sale of their harvested crops. The data showed that the awareness of MSP and procurement agency were pretty low among the households. The data of % of farmers (number per 1000 households) who are aware of MSP for various crops is given in table 8.2. It can be observed that the awareness of MSP was the highest for wheat, paddy and sugar cane the lowest for pulses. Among various pulses, the awareness was the lowest for pigeon pea (arhar), lentils (moong) and chickpea(gram) (see table 8.2). The poor awareness of MSP was reflected in the poor awareness of procurement agency as well. But what was more striking was the percentage of people who sold their crop to procurement agencies were lower than the percentage of people who had awareness about procurement agencies. Similarly, percentage of sale at MSP was also lower. A study conducted by NITI Aayog in 2016 also highlighted state-wise differences in awareness levels and lacunas in MSP announcements.

Table: 8.2: Awareness about Minimum Support Price (MSP)

Number per 1000 of agricultural households reported sale of crops having awareness about MSP					
		number per 1000 of households reporting sale of crops		**of the households sold to procurement agency**	
Crop	**Aware of MSP (%)**	**Aware of procurement agency (%)**	**Sold to procurement agency (%)**	**% of sale at MSP to total sale**	**Average sale rate received at MSP (₹ per Kg.)**
July 2012-December 2012					
Paddy	32.2	25.1	13.5	27	13.08
Arhar(tur)	4.6	3.8	1.3	1	35.47
Urad	5.7	3.7	1.6	1	37.61
Moong	9.8	7.2	1.8	1	53.33
Sugarcane	39.8	36.1	31	34	2.79
January 2013-June 2013					
Paddy	31.5	18.7	10	14	13.15
Wheat	39.2	34.5	16.2	35	13.99
Gram	12.6	9.7	3.9	5	29.96
Arhar(tur)	14.2	13.1	4.7	1	47
Moong	9.1	3.7	1.9	2	58
Masur	18.1	15.5	2	0	36
Sugarcane	45.4	40.7	36.6	33	3.25

Source: NSSO Some Aspects of Farming

Price Deficit Financing Scheme

Price Deficit Financing Scheme or Bhavantar Bhugtan Yojana (BBY) is a pilot scheme launched by the government of Madhya Pradesh, in which it transfers the difference between the MSP and Modal Rate directly in the bank accounts of the farmers. Modal rate is the average price of a particular commodity in APMCs of MP and of two other neighboring states.

The Scheme was launched in the aftermath of the massive farmers' protest in Mandsaur district of the State, in which six farmers were killed in police firing. The objective is to avoid the harm done to the farmers due to the volatility in prices of agricultural commodities, mainly oilseeds and pulses.

Under this scheme, the government does not procure food grains from the farmers as it would under the MSP scheme, hence minimizing government intervention. The government pays for the difference between the MSP of a commodity and the Modal rate if the commodity is auctioned at a price higher or equal to the latter. The scheme was initially launched for 8 notified Kharif crops—soybean, *moong*, *urad*, pigeon pea, groundnut, maize and oilseeds, and was further extended to 4 Rabi crops—chickpea, mustard, lentils and onions.

Wholesale Prices and MSP for Major Pulses

The whole sale prices of pigeon pea, lentils, black gram and chick pea were below were higher than the MSP during 2009 to 2018 (see appendix figures from 8.1 to 8.5). The whole sale prices of pigeon pea and chick pea were more or less converged across different zones (see appendix figures 8.6 &8.7).

8.3 Procurement Policy and Operations

In order to achieve the objective of national food security, the Government of India has established the Public Distribution System (PDS) through which food grains, kerosene, sugar etc., are made easily accessible to the class which is at the bottom of the income pyramid, at subsidized rates. The central government procures, stores, allocates and transports the food grains while the state government distributes the commodities among consumers through Fair Price Shops (FPS) *ration* shops.

The scheme was launched in June 1947 and the agency responsible for the procurement of food grains is the Food Corporation of India (FCI). The pulses procurement undertaken by National Agricultural Cooperative Marketing Federation of India (NAFED) is given in table 8.3. The quantity of chickpea procured in 2014-15 was much higher than the previous year. Maharashtra, Andhra Pradesh and Karnataka were the major states for procurement. Whereas in the year 2014-15, Gujarat, Madhya Pradesh, Uttar Pradesh and Rajasthan were also added to the list. As far as the black gram (urad) is concerned the procurement was the highest in 2013-14. For Pigeon pea (arhar) the procurement was the highest in 2012-13. Maharashtra, Andhra Pradesh and Madhya Pradesh were the major states for procuring pigeon pea (arhar).

Table 8.3: Procurement of Pulses under PDS by NAFED

Commodity	**Year**	**Quantity procured (Million Tons)**	**Rupees (Lakhs)**	**Major State of procurement**
Gram	2013-14	34306	10736.57	Maharashtra, AP, Karnataka
	2014-15	279611.125	94123.66	Maharashtra, Gujarat, MP, UP, Rajasthan, Karnataka
Urad	2012-13	1.57	0.63	Rajasthan
	2013-14	77050.806	34543.75	Maharashtra, AP, UP, MP, Gujarat, W.B. ,Rajasthan, Karnataka, Jharkhand
	2014-15	7453.262	3611.45	Jharkhand, WB, AP, Maharashtra, UP
	2015-16	6.70	6.56	Maharashtra
Arhar	2012-13	16004.835	6328.15	Maharashtra, AP,MP
	2013-14	42693	18755.12	Maharashtra, AP
	2014-15	1079.648	1069.87	Maharashtra, AP
Moong	2016-17	8267.58	3968.43	Maharashtra & Karnataka

Source: NAFED

The major organizations involved in the procurement of agricultural commodities are - National Agricultural Cooperative Marketing Federation of India (NAFED), National Cooperative Consumers Federation of India (NCCF), Small Farmers' Agri-Business Consortium (SFAC) and Central Warehousing Corporation (CWC). The procurement of kharif pulses by various agencies in the year 2016-17 is given in table 8.4. The procurement by the NAFED was the highest and SFAC was the lowest.

Table 8.4: Procurement of Kharif Pulses During 2016-17

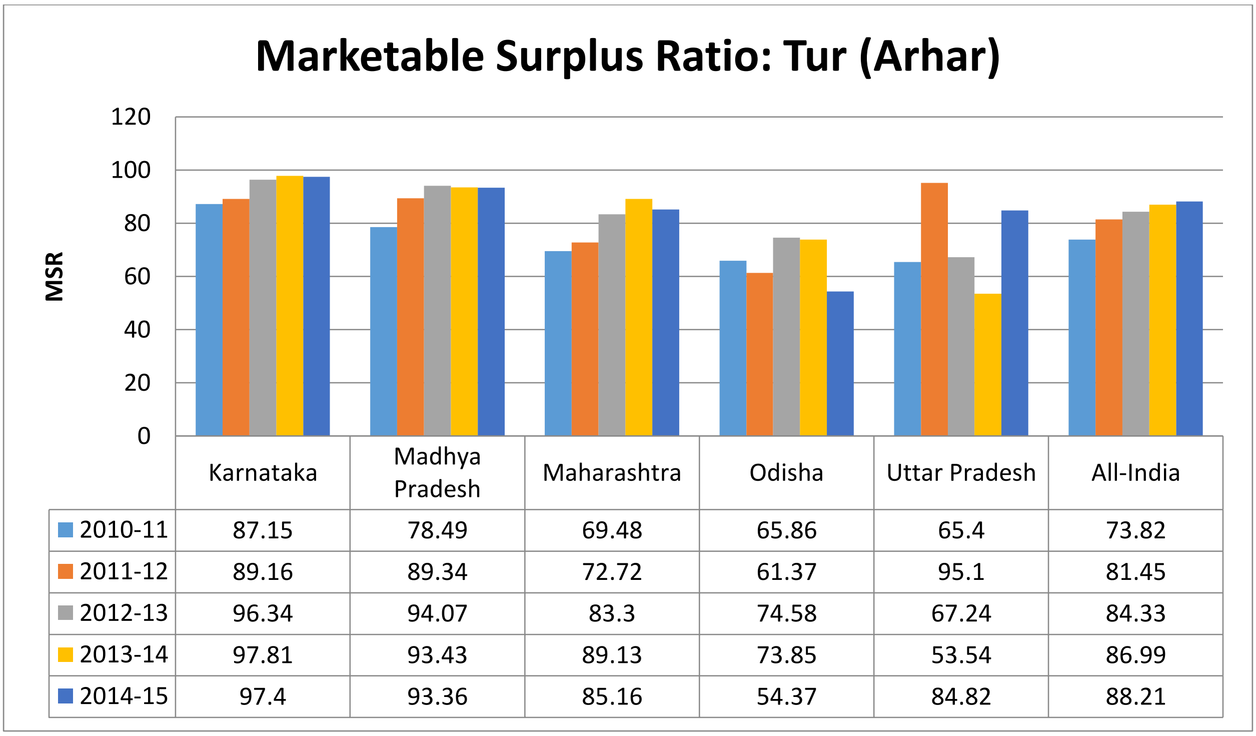
(Quantity in MTs)

Pulses	FCI	NAFED	SFAC	Total
Moong	64737	128886	26225	219848
Urad	18235	59602	10746	88582
Tur	175299	919667	71079	1166045
Total	258271	1108155	108049	1474475

Source: FCI

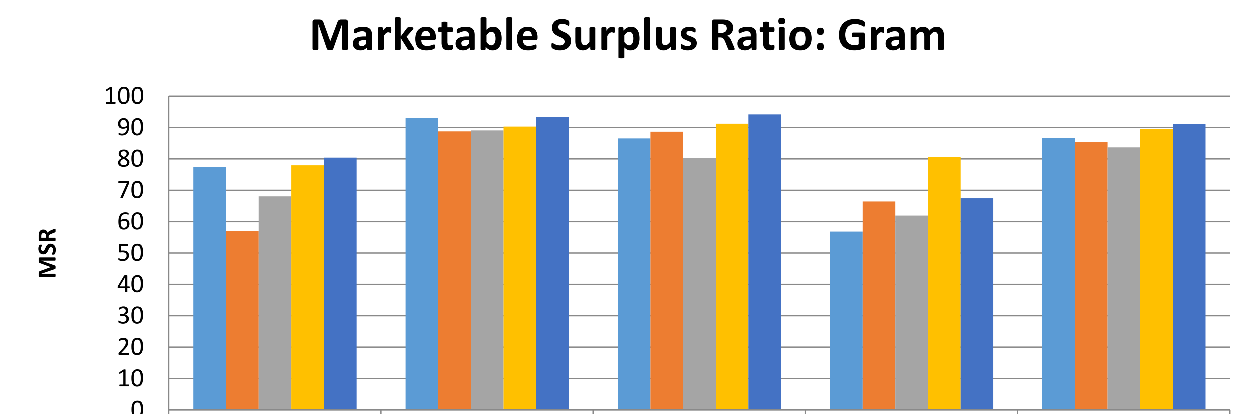
The marketable surplus ratio of Pigeon pea (arhar) was slowly increasing in Karnataka whereas the same was either stagnant of declining in states like Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh (see figure 8.1). The same was the case with chickpea (gram) except Bihar. In Bihar though there was a decline in marketable surplus ration in the year 2010-11, the marketable surplus ratio showed an increase in the remaining years (see figure 8.2).

Figure 8.1: Marketable Surplus Ratio – Tur (Arhar)



Source: Directorate of Economics & Statistics, DAC&FW

Figure 8.2: Marketable Surplus Ratio – Gram



	Bihar	Madhya Pradesh	Rajasthan	Uttar Pradesh	All-India
2010-11	77.27	92.92	86.46	56.83	86.68
2011-12	56.93	88.75	88.62	66.38	85.25
2012-13	68.06	89.04	80.23	61.91	83.67
2013-14	77.97	90.3	91.23	80.59	89.58
2014-15	80.42	93.31	94.14	67.42	91.1

Source: Directorate of Economics & Statistics, DAC&FW

E-NAM

The e-NAM or National Agriculture Market Electronic Trading (e-NAM) platform was launched by the Ministry of Agriculture, Government of India on 14th April, 2016. The e-NAM provides a single window platform, both at state-level and national-level for information regarding the prices, quality, variety, etc., to all the farmers, traders and other stakeholders.

The e-NAM is a brainchild of R Ramaseshan, a former Indian Administrative Services officer from Karnataka. Ramaseshan after becoming the Chief Executive Officer of National Commodity and Derivatives Exchange (NCDEX) proposed the idea of electronic market which actually began at the Agricultural Produce Marketing Committee (APMC) in Kalaburagi, Karnataka back in December 2011. The model initiated in Kalaburagi was called the Rashtriya electronic Market Scheme (ReMS).

SFAC is the agency responsible for the implementation of e-NAM across the country. This shift from an actual physical market to that of an online one serves a number of benefits, such as real time price discovery, transparent online trading, reduced transaction cost for buyers, better accessibility to the markets, efficient supply chain, etc. The provision of electronic market addresses a number of problems, some of which are – fragmentation of the State into multiple market areas, multiple levy of *mandi* fees, licensing barriers which lead to conditions of monopoly, poor quality of infrastructure and lower use of technology.

The facility has enabled farmers to opt to trade either by themselves through their mobile phones or through commission agents. Currently, the e-NAM is linked with 585 APMC in 16 states and two Union Territories.

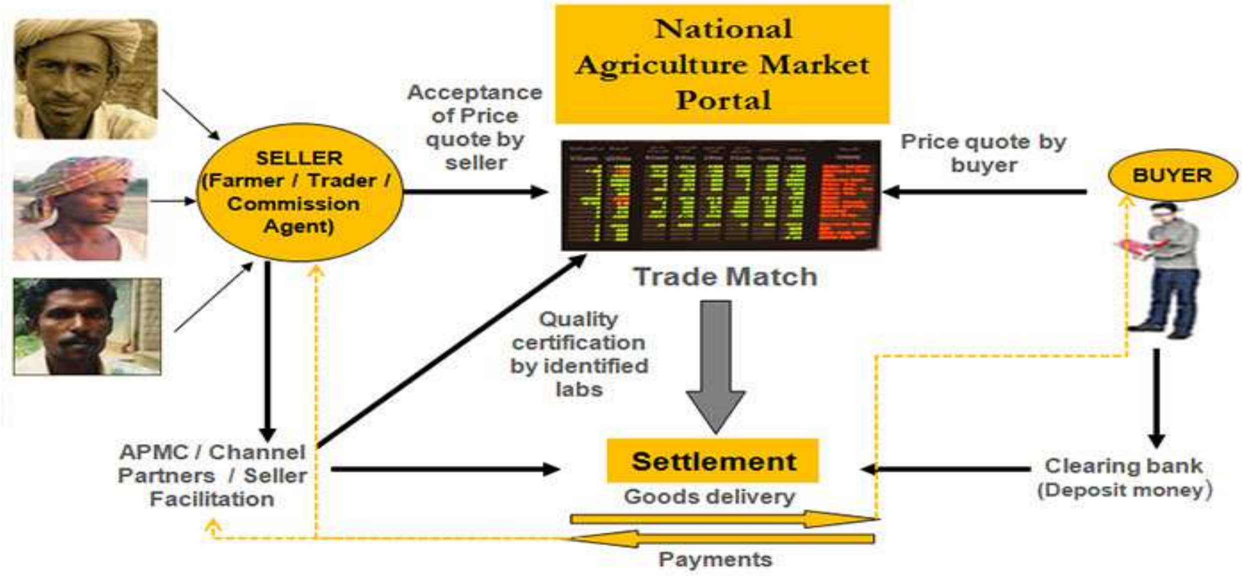
The states will be eligible for support under the e-NAM scheme only if, they have a single valid license across the state, a single point levy of market fee and a provision for electronic auction as a mode for price discovery. The respective states are required to administer agriculture marketing as per their regulations. Each state is divided into several market areas and each separate area is administered by a separate APMC.

The government through e-NAM has found a middle ground for the stakeholders, i.e., the farmers, traders, buyers, exporters etc. Due to e-NAM, the farmers are now not dependent on the middlemen for the selling of their produce, while traders have received a greater access to the national market. Electronic market would also benefit the buyers as the intermediation costs would be reduced. This would further eliminate information asymmetry and regulate traders and commission agents in a better way.

The initial target for the coverage of e-NAM was 200 APMCs and later on the target was expanded to 585 APMCs by March 2018. The focus areas of the budget 2017-18 were farmers, rural employment and infrastructure. According to the budget, assistance of up to 75 lakh rupees would be provided to every e-NAM for the establishment of cleaning, grading and packaging facilities.

Further, in budget 2018-19, the Ministry of Finance announced the creation of a 2,000 crore rupees agriculture market infrastructure fund and proposed the strengthening of electronic national agriculture market. The Ministry also announced the development and upgradation of existing 22,000 rural *haats* into Gramin Agricultural Markets (GrAMs), which would benefit more than 86 percent small and marginal farmers. The GrAMs would be electronically linked to e-NAM and exempted from the regulations of APMCs.
Currently, 90 commodities are traded on e-NAM.

Figure: 8.3: e-NAM Working Model



Source: http://sfacindia.com/images/NAM-Working-Model

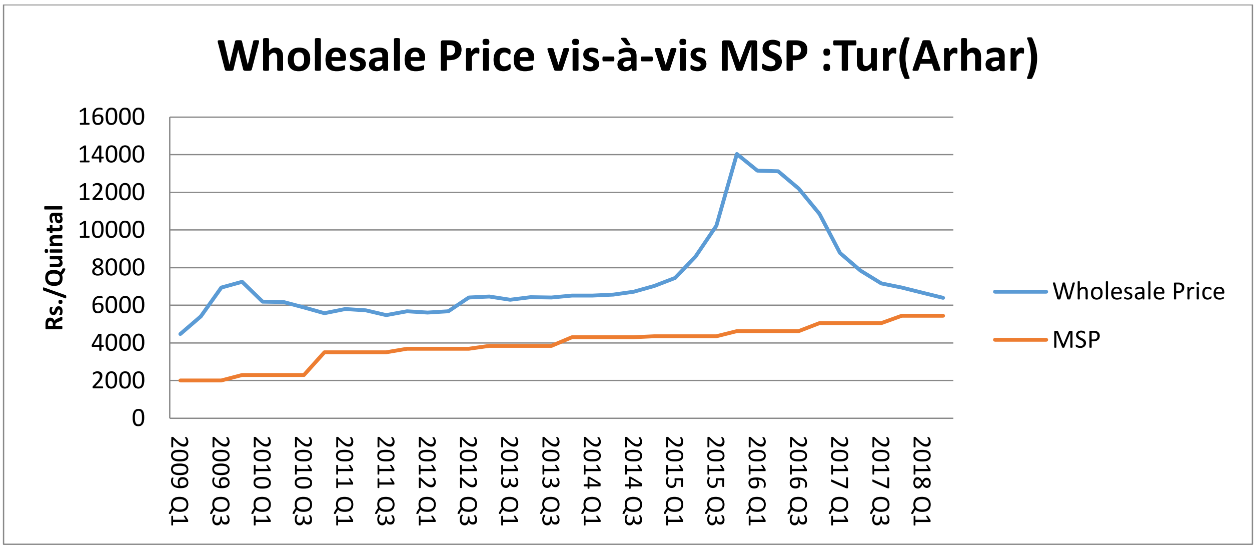
NAM is not a parallel marketing structure but a mechanism to create a unified network of physical *mandis*, which could be accessed online. NAM builds on the strength of local markets and allows them to offer their produce at a national level. Further, e-NAM increases the choice of the farmers for selling their produce. The scheme is pro-farmer in a number of ways, such as, the farmers through e-NAM would get better prices as they would now have an option to sell it wherever he wishes, the farmers would get the whole payment on time, etc.

8.4 Conclusion

The present chapter discussed the evolution of agricultural and food security policies in India along with the effectiveness of MSP and procurement. The data and studies at the national level broadly indicated that MSP is an important policy instrument in encouraging farmers and to stabilize market prices. However the percentage of farmers who were aware of MSP was less especially for pulses. This was also reflected in the lack of knowledge about procurement agencies. Interestingly the percentage of households who sold their products to procurement agencies were even lower than the percentage of households who had information about procurement agencies. In chapter 5 our analysis of sample households from three states selected for analysis also showed poor awareness of MSP. The farmers who avail MSP even with a positive information about MSP was also lower. The next chapter will therefore make an analysis of factors influencing the information access to MSP along with the factors influencing the utilization of MSP.

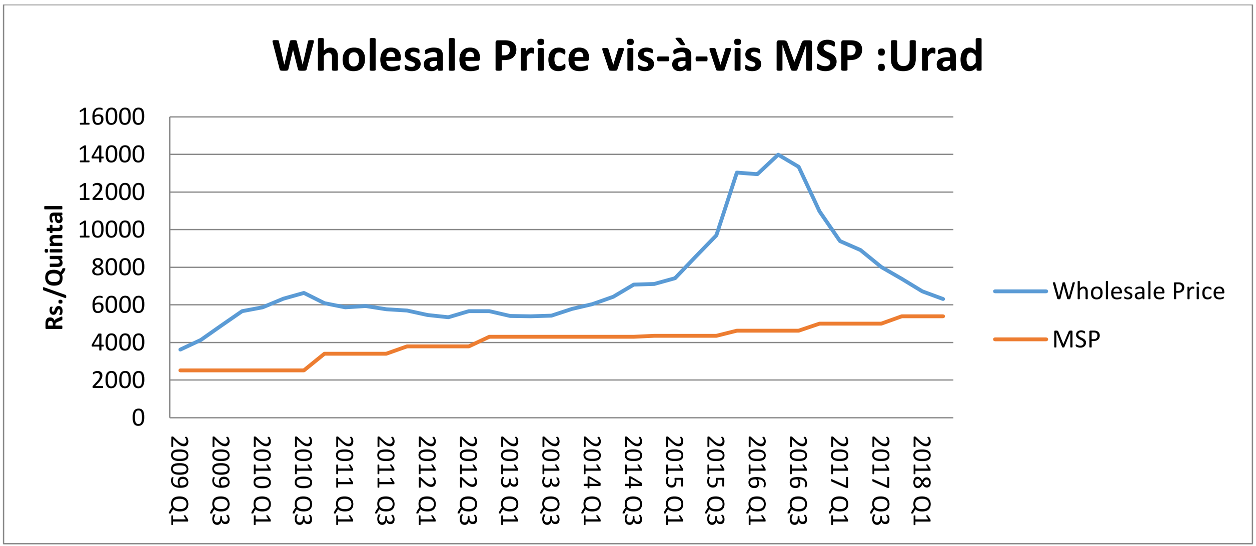
Appendix

Figure A8.1: Wholesale Price vis-à-vis MSP - Tur (Arhar)



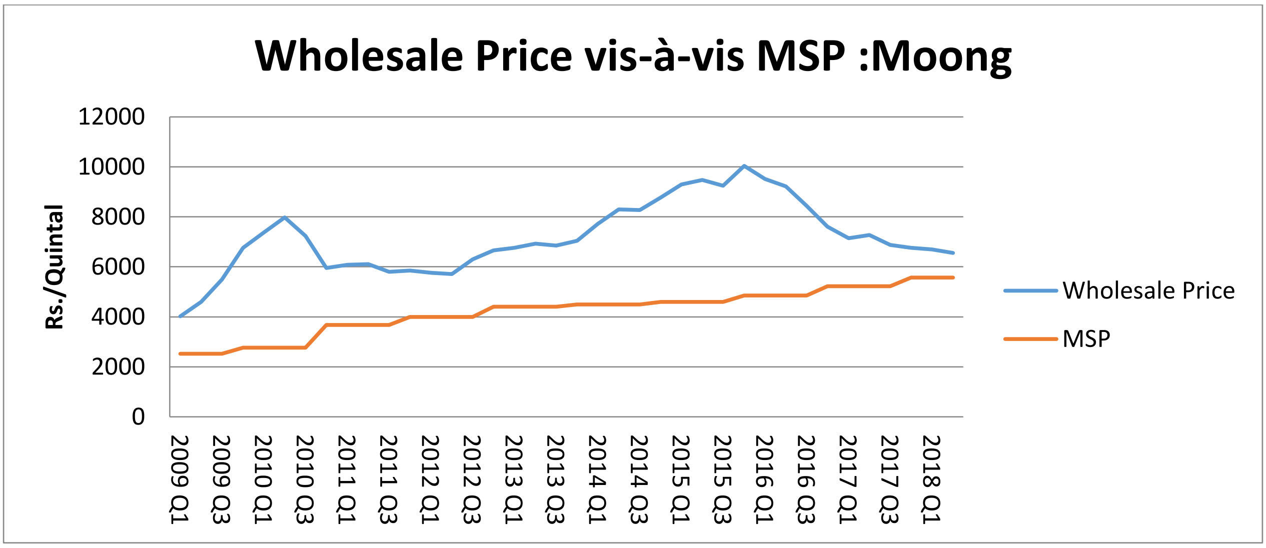
Source: Department of Consumer Affairs (Price Monitoring Cell) and Directorate of Economics & Statistics, DAC&FW

Figure A8.2: Wholesale Price vis-à-vis MSP - Urad



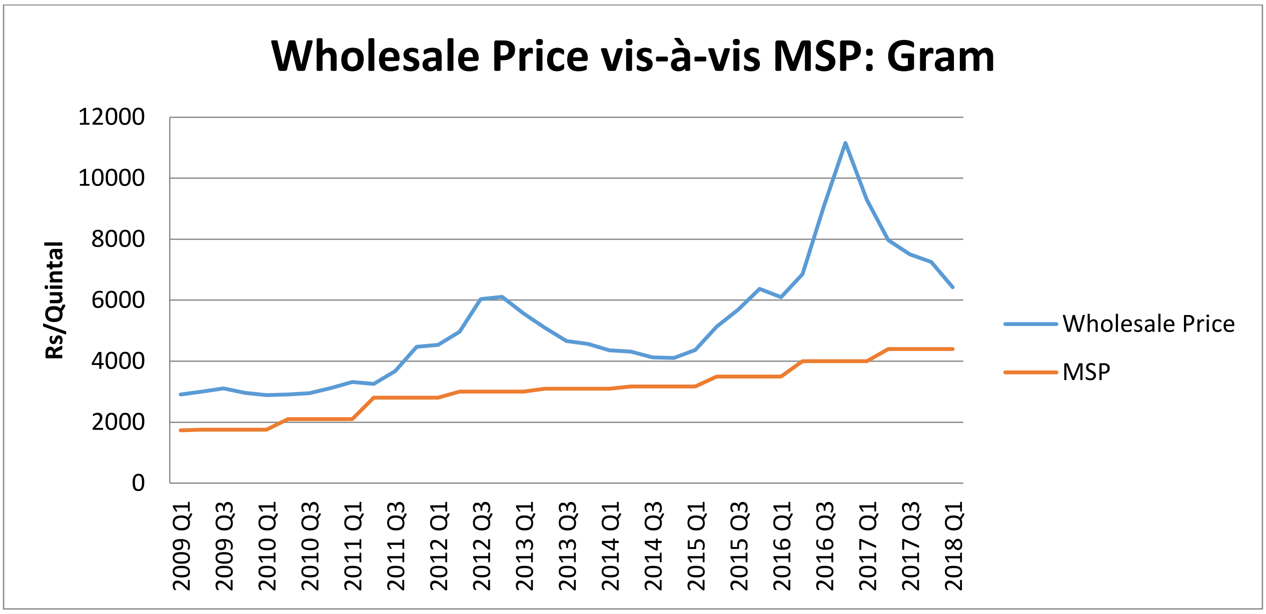
Source: Department of Consumer Affairs (Price Monitoring Cell) and Directorate of Economics & Statistics, DAC&FW

Figure A8.3: Wholesale Price vis-à-vis MSP - Moong



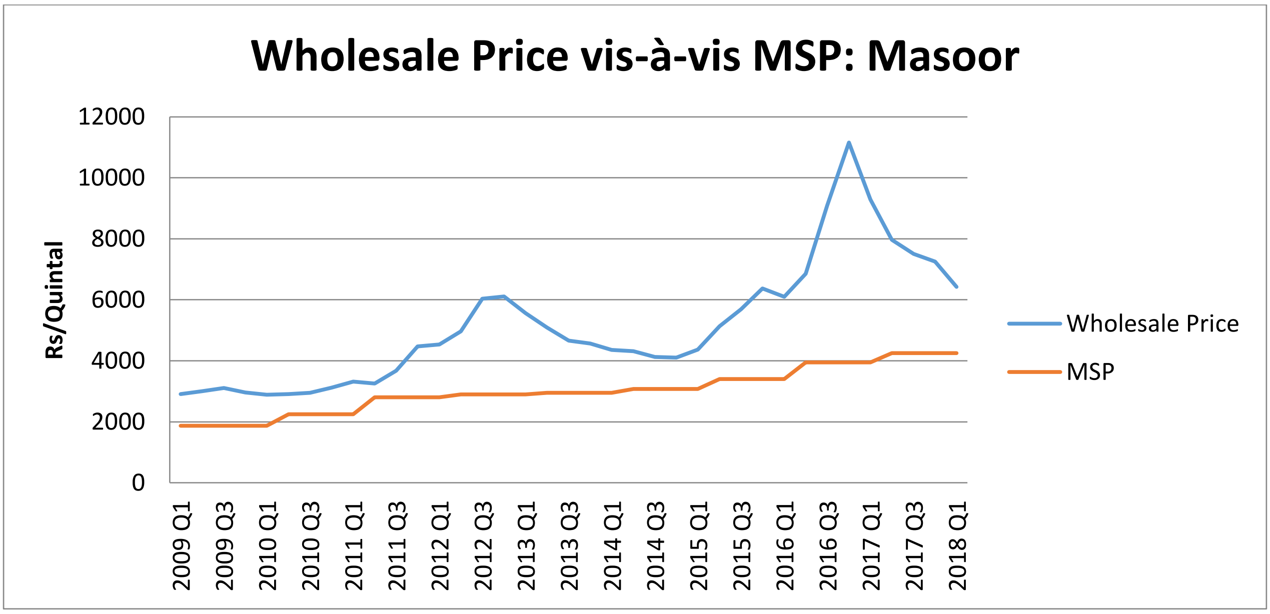
Source: Department of Consumer Affairs (Price Monitoring Cell) and Directorate of Economics & Statistics, DAC&FW

Figure A8.4: Wholesale Price vis-à-vis MSP - Gram



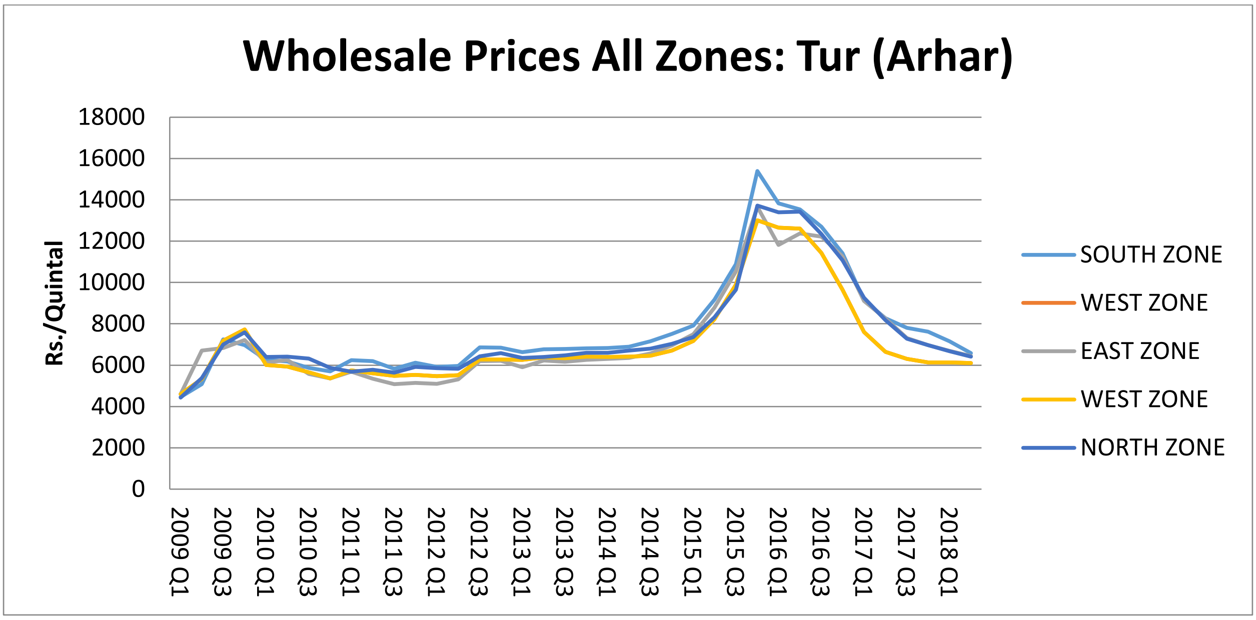
Source: Department of Consumer Affairs (Price Monitoring Cell) and Directorate of Economics & Statistics, DAC&FW

Figure A8.5: Wholesale Price vis-à-vis MSP - Masoor



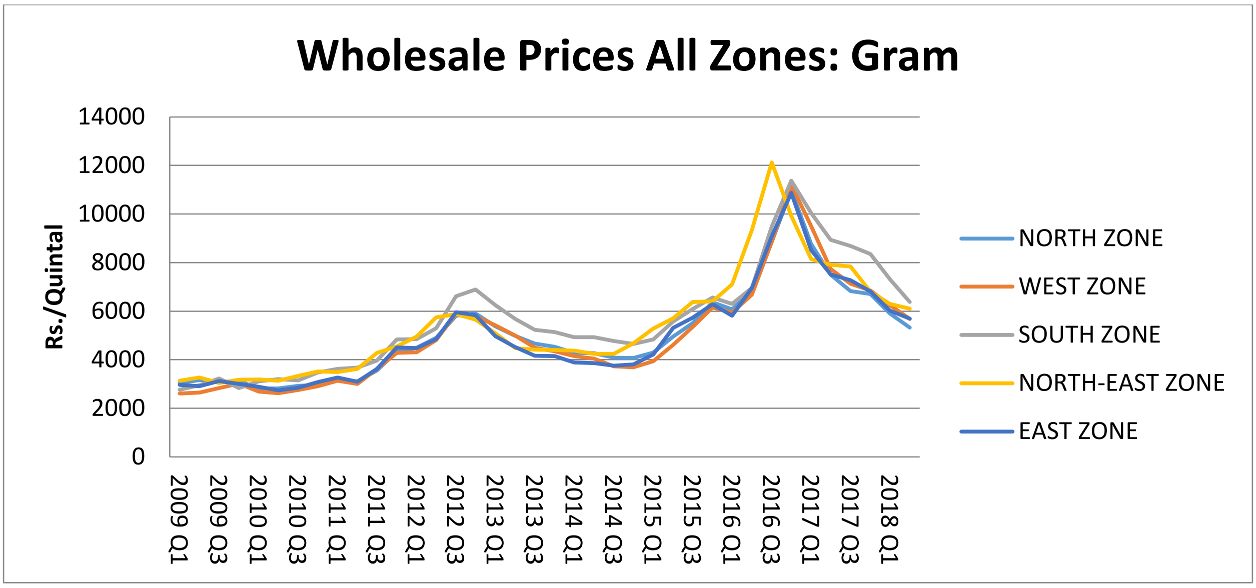
Source: Department of Consumer Affairs (Price Monitoring Cell) and Directorate of Economics & Statistics, DAC&FW

Figure A8.6: Wholesale Prices all Zones - Tur (Arhar)



Source: Department of Consumer Affairs (Price Monitoring Cell)

Figure A8.7: Wholesale Prices all Zones – Gram



Source: Department of Consumer Affairs (Price Monitoring Cell)

Chapter 9

Information and Utilisation of MSP: Major Determinants

9.1 Introduction

The prices of agricultural commodities are inherently more volatile than nonagricultural commodity prices. The major reasons are the inelastic nature of supply to prices. Lack of market integration and information asymmetry also play a role. A very good harvest in one year will result in sharp fall in the prices of that commodity and farmers will be discouraged from continuing production due to heavy loss. This then causes paucity of supply next year and hence, major price increase for consumers. Somewhat similar to this we experience in the case of pulses. A severe deficit in supply led to soaring of prices in the year 2015-16. However, an increased price and other government interventions again encouraged the production of surplus. Even with an increase in production, the import dependency to meet the excess demand is growing. Additionally, an increase in production is still lagging behind the demand. To counter this, MSP is fixed by the Government, each year. MSP is a tool which gives guarantee to the farmers, prior to the sowing season, that a fair amount of price is fixed to their upcoming crop to encourage higher investment and production. The MSP is in the nature of an assured market at a minimum guaranteed price offered by the Government. However, our analysis of the profile of sample households in chapter 5 and the discussion in chapter 9 showed that percentage of farmers who have information about pulses MSP and those who are availing MSP were very less. The farmers who sold crop to procurement agencies even when they had information about MSP and procurement agencies were also less. Therefore, the present chapter will make an analysis of factors influencing the information access to MSP and utilisation of MSP.

9.2 Conceptual Framework

The farmer's decision on whether to avail MSP or not is based on utility maximisation (Rahm and Huffman, 1984; Shiferaw *et al*., 2015). The i^{th} farmer will go for MSP if the utility derived from the same (U_{1i}) is greater than not availing it (U_{0i}), that is, $U_{1i} > U_{0i}$. By denoting A_d for availing decision we can write:

$$A_d = \begin{cases} 1\ if\ U_{0i} \ < U_{1i} \\ 0\ if\ U_{1i} \leq U_{0i} \end{cases} \qquad (1)$$

In the first scenario (A_d=1) the utility from MSP is higher whereas in the second scenario (A_d=0) the utility is smaller than or equal to not availing MSP. The probability that the farmer will avail MSP (A_d=1) depends on a set of explanatory variables.

$$P_i = P_r(A_d = 1) = P_r(U_{1i} > U_{0i})$$

$$= F_i(X_i\beta) \qquad (2)$$

Where X is the n x k matrix of the explanatory variables and β is the k x 1 vector of parameters to be estimated, *Pr (.)* is the probability function, μ_i is the random error term, and $F_i\ (X_i\ \beta)$ is the cumulative distribution function for μ_i evaluated at $X_i\ \beta$. The probability that a farmer will avail MSP is a function of the vector of explanatory variables and of the unknown parameters and error term.

As discussed earlier, the expected utility of the MSP is not, however, the only one factor that determines farmer's decision to avail MSP. This is especially true for small holder farmers in developing countries where they face information constraints. The information, *i*, that is required for a farmer to make the decision can be given as:

$$I_i = \begin{cases} 1\ if\ I_i > 0 \\ 0\ if\ I_i \leq 0 \end{cases} \qquad (3)$$

Now the farmer is aware of MSP and the information is received. Passing the first hurdle places a farmer in the class of farmers who are "potential users" due to the fact they have "effective information". This is expected to help a farmer in evaluating the benefits of the MSP. Whether the MSP has been availed or not by the households can be given as:

$$A = A_i A_d = \begin{cases} 1,\ \text{if MSP is availed} \\ 0,\ \text{if MSP is not availed} \end{cases} \qquad (4)$$

The decision to avail MSP depends on their household and farm-level characteristics along with other factors.

9.3 Model Specification

The farmer's demand for MSPcan be written as below:

$$y_i^* = \alpha \boldsymbol{x}_i' + u_i \qquad (5)$$

Where $\boldsymbol{x_i'}$ is a vector of variables that determine the demand function, α is a parameter vector, u is an error term with mean 0 and variance σ_u. Similarly, the latent variable underlying a farmer's access to information can be modelled as below:

$$I_i^* = \beta \boldsymbol{z}_i' + \epsilon_i \text{(Access to information)} \qquad (6)$$

In the above equations, $\boldsymbol{z}_i'$ is the vector of variables that affect the availability of information. And β is the parameters to be estimated; $\boldsymbol{\epsilon}$ is the error term with mean 0 and variance 1. The observed demand for MSP by a farmer (Y_i) is characterised by the interaction of models (5) and (6).

The joint probability for adoption is estimated using conditional (recursive) mixed process estimator (CMP) developed by Roodman (2009, 2011). [i]CMP estimates multi-equation, recursive mixed process models. "Mixed process" means that different equations can have different kinds of dependent variables. CMP can only fit "recursive" models with clearly defined stages. To illustrate, A and B can be determinants of C, and C a determinant of D—but D cannot be a determinant of A, B, or C (Roodman. 2011). Equations are estimated using probit models.

9.4 Description of Dependent and Explanatory Variables

The dependent variables in our analysis are access to information and utilization of MSP. In order to understand the utilization of MSP the farmers were asked whether they are availing MSP or not. Though there have not been any study analyzing the factors influencing the farmers access to MSP information and decision to avail MSP, the studies in the context of farmer's decision making in general is useful to understand the important determinants of farmer's decision. Therefore, the present study make use of such studies to draw the list of explanatory variables. Several studies have included household and farm characteristics as important factors influencing the farm level decision by farmers (Feder *et al*., 1985; Uaiene, 2011; Teklewold *et al*., 2013; Ogada *et al*., 2014; Manda *et al*., 2015). As far as the age factor is concerned, one set of studies postulate a positive relationship (Meshram *et al*, 2012; Kassie *et al*., 2013) while the other a negative relationship (Manda *et al*., 2015). Those who postulate a positive relationship argue that older farmers are more experienced and might have accumulated greater physical and social capital (Kassie *et al*., 2013). Nonetheless, there is also belief that older farmers are less amenable to change and, therefore, unwilling to change (Adesina and Zinnah, 1993).

Certain fixed social bias (that is, gender of household head) is also expected to have an impact (Langyintuo and Mungoma, 2008). There is a view that women farmers face greater constraints in terms of access to resources and time and hence can be less enthusiastic (Pender and Gebremedhin, 2008). The size of the household is used as a proxy to capture labour endowment (Pender and Gebremedhin, 2008). As far as the importance of total farm size is concerned, it is quite possible that large farmers will have greater access to information and therefore higher possibility to avail MSP.

Education of the household is also expected to have a positive impact in receiving information about MSP and also in availing MSP. Access to off-farm activities and income in general are expected to have a positive impact. Membership in farmer organisation is another important factor that can influence farmers' accessibility to information. Market access also has a huge bearing on transaction cost in accessing information (Kassie *et al*., 2015). In line with Kassie *et al.* (2015), we consider the distance from main market as a proxy for market access. The farmers were also asked whether they sell their product in APMC or not assuming it to have an implication to access information and avail MSP. Access to extension services also play a significant role. The present study has included the variable 'crop failure' that the farmers experienced in the last five years as a proxy to capture the impact of production risk-related factors in receiving information and in availing MSP. The description of variables is given in table 9.1. The descriptive statistics of the model is given in table 9.2.

Table 9.1: Variable Description

Variable	Definition
Age of the HOH	Age of the Head of the Household
Gender of HoH	Gender of the head of the household, dummy variable = 1 if the household has a male head of the household.
Education	Number of years of education of the Head of the Household
Household size	Number of the family members in the household including children.
Farm Size	Total size of owned and rented land holdings cultivated by household in hectares.
Membership in the input supply organisations	Membership of any of the family member in the input supply organisations, dummy variable = 1 if any of the family member has membership in farmer organisations, = 0 otherwise
ICT (Component 1)	First principal component of three ICT dummy Radio (= 1 if any of the household member has a radio, = 0 otherwise), TV (= 1 if any of the household member has a TV, = 0 otherwise) and Mobile (= 1 if any of the household member has a mobile phone, = 0 otherwise).
Distance from main market	Distance to the nearest main market in kilometres
Access to off farm activities	= 1 if the household had access to off farm activities, = 0 otherwise.
Awareness of KCC	= 1 if the household had awareness of KCC (Kisan Call Centre), = 0 otherwise.
Contact with government extension agents	= 1 if the household had contact with government extension agents, = 0 otherwise.
Training received for farming	= 1 if the household had received training for farming from government departments or NGO's, = 0 otherwise.
Awareness of government schemes promoting pulses production	= 1 if the household had awareness of government schemes promoting pulses production, = 0 otherwise.
Chick pea cultivated	= 1 if the household cultivates chick pea, = 0 otherwise
Pigeon pea cultivated	= 1 if the household cultivates pigeon pea, = 0 otherwise
Other crops cultivated	Total size of land under cultivation for crops besides pulses
Place of selling produce	= 1 if the household sold its produce in APMC, = 0 otherwise.
Crop failure	= 1 if the household has experienced any type of crop failure in the last 5 years, = 0 otherwise.
Maharashtra State dummy	= 1 for those households residing in Maharashtra, = 0 otherwise.
Madhya Pradesh State dummy	= 1 for those households residing in Madhya Pradesh, = 0 otherwise.

Source: Survey data

Table 9.2: Descriptive Statistics for Variables used in the Model

Variables	Adopters
Age of the HOH	48.7 (13.13)
Gender of HoH	0.98 (0.15)
Education	6.83 (5.52)
Household size	5.64 (3.18)
Farm Size	3.33 (0.98)
Membership in the input supply organisations	0.22 (0.42)
ICT (Component 1)	0 (1.48)
Distance from main market	14.21 (7.11)
Access to off farm activities	0.14 (0.35)
Awareness of KCC	0.29 (0.46)
Contact with government extension agents	0.43 (0.5)
Training received for farming	0.19 (0.39)
Awareness of government schemes promoting pulses production	0.14 (0.35)
Chick pea cultivated	0.55 (0.5)
Pigeon pea cultivated	0.84 (0.36)
Other crops cultivated	5.44 (7.52)
Place of selling produce	0.42 (0.49)
Crop failure	1.53 (0.97)
Maharashtra State dummy	0.35 (0.48)
Madhya Pradesh State dummy	0.31 (0.46)
Number of observations	572

Note: Standard deviation is given in parentheses.

Source: Survey data

Table 9.3: Results for MSP

A: Information access to MSP	
Karnataka	0
	(.)
Maharashtra	1.004
	(1.085)
Madhya Pradesh	**3.119*** **
	(0.636)
Scores for component 1	-0.106
	(0.319)
Other Crops Acres	-0.00992
	(0.0227)
Age of HOH	-0.00831
	(0.00923)
Gender of HOH (Male 1, Female 0)	0.694
	(1.165)

Number of Family Members	-0.0157
	(0.0278)
Years of Education of HOH	**0.106*** **
	(0.0286)
Access to off farm activity (Yes 1, No 0)	-0.00172
	(0.311)
Annual Family Income from farm (in Lakhs)	-0.00216
	(0.0166)
Contact with government agents(yes 1, No 0)	-0.165
	(0.218)
Member of input supply cooperation (Yes 1, No 0)	0.207
	(0.288)
Walking distance to Markets (Kms)	**-0.0449*** **
	(0.0116)
KCC Awareness (Yes 1, No 0)	0.180
	(0.372)
Chickpea Farmer	-0.365
	(0.301)
Pigeonpea Farmer	**-0.756***
	(0.367)
Farm Size	0.236
	(0.148)
Training Received (Yes 1 No 0)	**1.292*** **
	(0.229)
Constant	-1.702
	(1.429)
B. Utilisation of MSP	
Karnataka	
	(.)
Maharashtra	**0.267*** **
	(0.0582)
Madhya Pradesh	0.0542
	(0.0709)
Scores for component 1	-0.0174
	(0.0152)
Other Crops Acres	**-0.00557***
	(0.00218)
Age of HOH	**-0.00274****
	(0.00106)
Gender of HOH	0.0439
	(0.0335)
Number of Family Members	0.00127
	(0.00453)
Years of Education of HOH	**0.0143*** **

	(0.00362)
Access to off farm activity	0.0261
	(0.0460)
Place where farmer sells produce=0	0
	(.)
Place where farmer sells produce=1	**0.0876***
	(0.0367)
Annual Family Income from farm (in Lakhs)	0.00313
	(0.00460)
Contact with government agents	-0.0883*
	(0.0408)
Member of input supply cooperation	0.0597
	(0.0349)
Walking distance to Markets (Kms)	**-0.0129*****
	(0.00299)
Awareness of government schemes promoting pulses	**0.259*****
	(0.0506)
Number of crop failures in last 5 years	0.0315
	(0.0232)
Chickpea Farmer	**-0.0814***
	(0.0331)
Pigeon pea Farmer	**-0.132****
	(0.0481)
Training Received	**0.213*****
	(0.0505)
Farm Size	**0.0617*****
	(0.0182)
Constant	0.156
	(0.108)
lnsig_2	
Constant	-1.082***
	(0.0341)
atanhrho_12	
Constant	0.498***
	(0.111)
Observations	572

Notes: ***, **, * denote statistical significance at 1%, 5% and 10% respectively. Standard errors are given in the parenthesis

9.5 Results and Discussion

The results from the conditional (recursive) mixed process equation model is given in table 9.1. The results from the analysis showed that Madhya Pradesh had greater access to information about MSP as compared to other states. This was also seen in the analysis of socio economic profile of the sample households in chapter 5. However, the utilization of MSP was more in Maharashtra. Education and training received by farmers from government departments of NGOs had a positive and significant impact in accessing the information regarding MSP. Whereas market access and distance to market reduced the access to information. The variable for pigeon pea farmer also came out to be significant and negative. This indicates that Pigeon pea farmers had less probability to receive information. Information access was less in Karnataka (refer chapter 5) and Karnataka had greater share of pigeon pea farmers in our sample.

As far as the utilization of MSP is concerned those who are cultivating other crops or more diversified farmers availed MSP less. This could be the reason for statistically significant and negative relationship between utilisation of MSP and cultivation of other crops. This can also be the reason why large farmers in Madhya Pradesh despite having greater access to information about MSP is not availing MSP. This can also be the reason why the dummy variable for only Maharashtra came out to be significant in the utilization model. Age of the farmer had a significant and negative relationship with utilisation of MSP. Similarly, education of the farmer increased the chances of availing MSP as the relationship between education variable and utilisation of MSP was positive and statistically significant.

Similarly, those farmers who sell their crop in APMC also had a greater probability to avail MSP. Those farmers who receiving training had greater probability in receiving information as well as in availing MSP. The risk factor increased the probability to avail MSP. This is an interesting result. The variable number of crop failure in last five years had a positive and statistically significant relationship with availing MSP. The market access came out to be as a significant factor in availing MSP. Those who have less market access had lower probability to avail MSP. The variable distance to market came out to be negative and statistically significant in our analysis. Interestingly, the probability of chickpea and pigeon pea farmers in availing MSP was also negative and statistically significant.

9.6 Conclusion

The present chapter analysed the factors influencing the access to information regarding MSP and the decision to avail MSP. The regression equation was estimated using the cmp command which uses the mixed process estimator. The results showed that Maharashtra farmers were more enthusiastic in availing MSP despite of the fact that the information regarding MSP was highest among the farmers from Madhya Pradesh. However farmers who had more diversified crop cultivation were not very enthusiastic in availing MSP. The majority of the farmers in Madhya Pradesh in our sample were large farmers and most probably they are more diversified. Market access came out to be as an important factor in information and in availing MSP. The risk faced by farmers also increased the chances to avail MSP and this points out how important MSP is in in mitigating the negative effects of risk.

Chapter 10
Supply Response of Major Pulses[3]

10.1 Introduction

The literature on estimating supply response to prices has a long history in agricultural economics (Nerlove 1956; Houck and Ryan 1972; Lee and Helmberger 1985). There are various reasons for renewed interest in supply response analysis in the recent times including an increased volatility of agricultural commodity prices that we experienced since 2005 and its consequences on farm income and food security (Haile et al., 2016). The present analysis builds on the extensive agricultural economics literature on the estimation of agricultural supply response. Supply response models calculates the elasticities that measure the magnitude of desired supply response to expected prices (Haile et al., 2016). The empirical literature employs various supply response equations based on different theoretical underpinnings.

Though there have been couple of theoretical and empirical approaches to analyse the supply response in the literature, two major frameworks that have been widely used are the Nerlovian expectations model and the supply function approach. The first approach facilitates the analysis of both the speed and level of adjustment of actual acreage and yield to desired levels. The second approach is derived from profit-maximising framework. The supply function approach make use of profit, revenue or cost function in the estimation. Since our interest lies mainly in the output response to prices and major policy instruments, we make use of Nerlovian expectations model in our analysis.

The theoretical underpinnings of the supply response model assume that the producer's aim is to maximise the profit. Based on the firm's implicit multi- production function, the literature shows that the supply of the farm commodity is the function of both output and input prices of that commodity as well as competing crops (Beckman and Wailes 2005). Therefore, production is directly related to prices with profit maximisation being the focus of every farmer (Ferris1995). Nonetheless, the literature points out that the supply responsiveness to market prices are positive but low in the developing countries owing to many infrastructural

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[3] With necessary permissions, this chapter draws heavily from the unpublished research undertaken by Jannet John, Anar Bhatt and Poornima Varma(2019).

and technological related factors (Yu et al., 2011). Therefore non-price factors play a crucial role in the supply responsiveness of agricultural commodities in developing countries. The non-price factors include irrigation, rainfall, technology and market access. Additionally, supply response to price can vary under different policy regimes. Previous literature claims that the current year decision to plant has some correlation with the previous year's area under cultivation (Beckman and Wailes 2005). The lag in the area adjustment in agricultural production is due to resource constraints and therefore a dynamic estimation technique approach would be more appropriate to recognise the lags in supply response (Yu et al., 2011).

Generalised Method of Moments (GMM) developed by Arellano and Bond (1991) and Blundell and Bond (1998) can be used for dynamic panel data estimation (Ullaah et al., 2018). The dynamic panel data techniques are employed when we have a reason to believe that the cause and effect relationship of the underlying phenomenon is dynamic over time. For example, while making current year's acreage allocation decisions by a farmer, previous years' acreages under cultivation can also play a significant role. Dynamic panel data estimation technique employs lagged values of dependant variables as an explanatory variable to correct for this possible endogeneity issue. The GMM model which is employed to estimate dynamic panel data provides consistent estimates in the presence of different sources of endogeneity such as unobserved heterogeneity, simultaneity and dynamic endogeneity (Ullaah et al., 2018). As per the literature two years of lag is sufficient to capture the endogenous relationship (Ullah et al., 2018).

Therefore, supply is expected to be the function of input and output prices of own crop(s), prices of competing crops, previous year's area under cultivation, non-price factors such as rainfall, trade and other policy interventions. We include trade variables to capture the impact of trade on the net quantity available in the domestic market and its impact. As policy variables we include minimum support prices and a dummy variable to capture the impact of national food security mssion (NFSM). Assuming there are N regions observed over T time periods, the area of crop k in region i in period t can be specified as;

$$A_t^{ki} = \alpha_0 + \beta_1 A_{t-1}^{ki} + \beta_2 X_t^{ki} + \varepsilon_{it}$$

Where y is the crop area**,** the superscript k refers to specific crop and i indicates the specific state and subscript t indicates the time. TA^{i}_{t} indicates the total area under crops during the current year t for the state i. A_{t-1}^{ki} indicates the total lagged area under crops for the state i. X is the vector of variables (i.e. prices and exogenous variables)and β_is are parameters to be estimated.

10.2 Data

The analysis is undertaken for four major pulses producing states-Madhya Oradesh, Karnataka, Maharashtra and Uttar Pradesh. The data on cost of cultivation, prices and MSP are obtained from the CACP website. The data on trade is extracted from wits (world integrated trade solution) database managed managed by world bank. The data on area under cultivation and production are obtained from the CMIE states of India website for all the states under study.

10.3 Results and Discussion

The GMM results of supply response functions for pigeon pea and chickpea are given in table 10.3 and 10.4, assuming a two-year lag. The results showed that previous year's acreage allocation is significant in current years decision to allocate area under the crop. In the case of Pigeon pea last year and last year had a positive and significant impact whereas in the case of Chick Pea only the last year had a positive and significant impact. Interestingly, last to last year's area under cultivation of Chickpea had a negative and significant impact on this year's cultivation of chickpea. Cost of cultivation of had a negative and significant impact in the case of chickpea. The striking and expected results are in the case of MSP. MSP had a positive and significant impact on area allocation of both the crops. As expected, Prices of competing crops had a negative and significant impact on the area under cultivation of both the crops. Market prices of Chickpea had a positive impact on area under cultivation whereas in the case of pigeon pea market prices were not significant. This is indicating the fact that supply of pigeonpea is more sensitive to other factors such as MSP. The lag of net volume of trade calculated by subtracting exports from imports had a statistically significant and negative impact on chickpea production. This indicates that greater volumes of imports will increase the domestic supply and reduce the price and as a result less incentive for farmers to cultivate the crop. Similarly, the government policy variable-NFSM also had a significant and positive impact on the cultivation of pigeon pea in States like Karnataka and Madhya Pradesh whereas NFSM had a negative and significant impact on the cultivation of Chickpea in Maharashtra and Madhya Pradesh.

Table 10.1 Descriptive Statistics for Variables used in the Model

Variable	Chickpea		Pigeon Pea	
	Mean	Std. Dev.	Mean	Std. Dev.
Ln MSP	7.499	0.356	7.699	0.483
Ln Yield	6.584	.269	6.545	.299
Ln Prices of Competing crops	7.0795	0.609	7.124	0.573
Ln own Prices	7.654	0.381	7.904	0.441
Ln Cost of Cultivation	7.521	0.344	7.667	0.434
Ln Rainfall	4.192	0.886	6.895	0.235
ln Lagged net volume	18.888	0.817	19.526	0.653
NFSM dummy Karnataka	0.15	0.360	0.15	0.360
NFSM dummy Maharashtra	0.15	0.360	0.15	0.360
NFSM dummy Madhya Pradesh	0.15	0.360	0.15	0.360
NFSM Rajasthan (Uttar Pradesh for Pigeon Pea)	0.15	0.360	0.15	0.360

Table 10.2 Variable Definitions

Variable	Definition
Ln area	Log of Area under cultivation of crop
Ln MSP	Log of Minimum Support Prices
Ln Yield	Log of yield of the crop
Ln Prices of Competing crops	Log of prices of competing crops (Jowar(Karnataka), Cotton (Maharashtra), Soybean (Madhya Pradesh), Bajra (Rajasthan) for Chickpea. Jowar(Karnataka) Cotton (Maharashtra) Soyabean (Madhya Pradesh), Wheat (Uttar Pradesh) for Pigeonpea
Ln Prices of Chickpea	Log prices of Chickpea
Ln Cost of Cultivation	Log of Cost of Cultivation
Ln Rainfall	Log of average Rainfall
ln Lagged net volume	Log of lagged net volume (Imports of the crop-exports of the crop)
NFSM dummy Karnataka	NFSM interaction dummy variable for Karnataka
NFSM dummy Maharashtra	NFSM interaction dummy variable for Maharashtra
NFSM dummy Madhya Pradesh	NFSM interaction dummy variable for Madhya Pradesh
NFSM dummy Rajasthan	NFSM dummy variable for Rajasthan

Table 10.3: Supply Response Regression Results for Chickpea

Variable	**Coef.**	**z stat**
Ln Area		
L1.	0.909 (.272)	3.34***
L2.	-0.230(.138)	-1.67*
Ln MSP	9.197(.665)	13.82***
Ln Yield	-.556(.222)	-2.51**
Ln Prices of Competing crops	-8.34(3.44)	-2.42**
Ln Prices of Chickpea	1.511(.534)	2.83**
Ln Cost of	-1.389(.492)	-2.82**

Cultivation		
Ln Rainfall	3.23(5 .47)	.59
ln Lagged net volume	-.077(.039)	-1.95**
NFSM dummy Karnataka	0.447(.410)	1.09
NFSM dummy Maharashtra	-.194(.122)	-1.58
NFSM dummy Madhya Pradesh	-.2405(.103)	-2.33**
NFSM Rajasthan	0.209(.341)	.61
Constant	-16.99(9.53)	-1.78*
No of observations 15 Wald chi2=303.04 Prob >chi2=0.000 AR(1) test p value .0728 AR(2) test p value .7149		

Note: *, **, and *** indicate significance levels at 10%, 5%, and 1% level respectively. Robust Standard errors are in parenthesis.

Table 10.4: Supply Response Regression Results for Pigeon pea

Ln Area	Coef.	Robust Std. Err.	z
Ln Area			
L1.	0.489155	0.098764	4.95***
L2.	0.62235	0.06674	9.32***
Ln MSP	0.853062	0.117619	7.25***
LnYield	-0.00529	0.084835	-0.06
Ln Prices of Competing crops	-1.34377	0.09008	-14.92***
Ln Prices of Pigeon pea	-0.04497	0.069264	-0.65
Ln Cost of Cultivation	0.077701	0.07483	1.04
Ln Rainfall	-0.41329	2.58899	-0.16
ln Lagged net volume	0.057972	0.05446	1.06

NFSM dummy Karnataka	0.123902	0.023404	5.29***
NFSM dummy Maharashtra	-0.06656	0.045979	-1.45
NFSM dummy Madhya Pradesh	0.077338	0.042099	1.84*
NFSM Uttar Pradesh	0.001732	0.015689	0.11
_cons	3.832438	17.93786	0.21
No of observations 31 Wald chi2=227.01 Prob >chi2=0.000 AR(1) test p value .1589 AR(2) test p value .2075			

Note: *, **, and *** indicate significance levels at 10%, 5%, and 1% level respectively.

10.4 Conclusion

The supply response of two major pulses produced by 4 major states are analysed using Nerlove's expectation framework. The results from our analysis indicated that lagged area under cultivation is significant in impacting the production of pigeon pea and chickpea. Prices of competing crops had a negative and statistically significant impact in both the models. The government policy variable-NFSM came out to be significant only in the case of pigeon pea for two States. Interestingly, MSP was significant for both the crops.

Chapter 11

Conclusion and Policy Implications

Pulses are rich in protein content and a major source of protein in Indian diet of all categories of people. The protein content in pulses are double the protein content of wheat and three times more than that of rice. However, the production of pulses was lagging behind the population growth in India and this resulted in the widening of the gap between demand and supply. The excess demand resulted in high and volatile prices. The excess demand is primarily due to the stagnation in productivity which is further accelerated by the decline in area under cultivation. As a result, the per capita net availability of pulses in the country declined sharply over the years. The persistent deficit and the soaring pulses domestic prices made it inevitable for the country to import pulses. Despite of being the second largest producer of pulses, the dependency on imported pulses continues to grow in the country.

The present research examines the factors affecting the production of pulses (Chickpea and Pigeon pea), the impact of government policies such as MSP and NFSM on pulses production, the factors influencing the farmers access and utilisation of MSP and the pricing behavior of pulses importers, exchange rate pass-through and its implications.

This study has been divided into 11 chapters including introduction and conclusion. Chapter 1 as an introduction provided the background, objectives, data, and methodology along with chapter scheme. Chapter 2 gave an overview of pulses economy. Chapter 3 discussed the importance of pulses for nutritional and food security, the importance of sustainable production practices to improve the pulses productivity and food security with an emphasis on India. Chapter 4 discussed the salient features of Government of India’s National Food Security Mission (NFSM) and its objectives especially in the context of pulses production. Chapter 5 provided a detailed discussion of socio-economic profile of the sample households. Chapter 6 provided an overview of pulses production, trade and government policies with a special focus on the trends in trade and its implications. Chapter 7 analysed the import pricing behavior and exchange rate pass through into prices of imported pulses. Chapter 8 provided an overview of an evolution of minimum support price policies and MSP for major pulses. Chapter 9 analysed the factors influencing the access to information regarding MSP and utilisation of MSP in a joint framework. Chapter 10 made an analysis of factors influencing the supply response of chickpea and pigeon pea with a special emphasis on MSP and NFSM. Chapter 11 provided the conclusion and policy implications of the study.

The detailed household level survey was conducted for 3 major pulses-producing states. They are Karnataka, Maharashtra and Madhya Pradesh. From each state, one of the major pulses producing district was selected for further analysis. From Karnataka, Gulbarga was selected, from Maharashtra, Wardha was selected, and from Madhya Pradesh, Narsinghpur was selected.

Primary data was collected through a comprehensive household survey in the above mentioned three districts of three major pulses-producing Indian States during 2017-2018. The farmers were selected through a random sampling technique. The sample consisted of 482 pigeon pea farmers and 316 chickpea. Out of which 227 farmers were cultivating both chickpea and pigeon pea. The survey was conducted through questionnaire, framed in such way as to draw out details covering household characteristics, wealth and farm characteristics, institutional and access related variables, risk and economic factors.

After discussing the background, objectives, data and methodology in the first chapter, the second chapter provided an overview of pulses economy with a special emphasis on the trends in area, production and yield in comparison with world. The analysis broadly showed that there had been a substantial decline in area and production of pulses in India. Indian yield was much below the world average and the yield gap between the two got widened since 2001. It was the same year, the decline in production of pulses was more prominent. However, in the year 1991, the yield gap got narrowed and came very close to the world average. Interestingly, this was the same year when India marked a record production in pulses. The declining share in area and production and widening gap between the yield is very alarming in the context of an increased demand for pulses. Since it is a protein rich crop, and there is a decline in per capita availability of pulses, considerable efforts are required to boost the production. The year 2016-17 shows marginal increase in the production of pulses. Though the dominant producing states have either continued or marginally improved the production, an increase in production was observed by other states who were not major contributors of pulses. This could be due to the impact of government policies such as an increase in MSP or the efforts to boost production through National Food Security Mission(NFSM).

The 5th chapter provided an overview of the socio-economic profile of the sample households. The total households interviewed were 572 drawn from three major pulses producing States-Karnataka, Maharashtra and Madhya Pradesh. Majority of the households in the sample were either semi medium or medium farmers and agriculture was the main livelihood option for majority of the sample households. Narsinghpur(Madhya Pradesh) had the highest share of large farmers in the sample whereas Wardha (Maharashtra) had the highest share of marginal and small farmers. In our sample, 482 farmers were cultivating pigeon pea and 316 farmers were cultivating chickpea. Out of which 227 farmers were cultivating both the pigeon pea and chickpea. Majority of the sample households didn't have any awareness of government schemes to promote pulses production or new production techniques to reduce crop loss and improve productivity. The farm size wise analysis showed that large farmers were more aware about new production practices as compared to other farm categories. However, the access to training offered by government and extension services were the highest among the sample households from Wardha (Maharashtra). Interestingly, despite having higher access to training, extension services and knowledge about government schemes and new production techniques, the information of MSP received by households in Wardha (Maharashtra) were lower than that of Narsinghpur (Madhya Pradesh). This is due to the fact that Narsinghpur (Madhya Pradesh) had the highest share of large farmers in the sample. The size wise percentage of farmers who received training showed that large farmers had received more training. The training was relatively higher for semi, medium, medium and large farmers as compared to marginal and small. In addition to the fact that Narsinghpur (Madhya Pradesh) had relatively large farmers with greater access to training, the households from Narsighpur (Madhya Pradesh) had greater access to information regarding MSP. The access to MSP information was increasing as size of the farm increases. Interestingly, though households in Narsinghpur (Madhya Pradesh) had the highest information about MSP, households availing MSP was much lower and lower than Wardha (Maharashtra). In Maharashtra almost all farmers who had information about MSP availed MSP. The percentage share of households with information was 52% and utilisation was 50%. The percentage share of households in each farm size category who were availing MSP was the highest among semi, medium, medium, and large households. The percentage share of households who were not availing MSP was the lowest among marginal and small farmers.

The analysis in the 6th chapter showed that there has been a substantial increase in the imports of most of the pulses in the last several years. Also the share of India's imports in world imports of pulses also showed a sharp increase. This points out the increasing import dependency and severe supply deficit that India is facing in terms of meeting the demand for protein rich crop. The widening gap between supply and demand, and the domestic uncertainties with respect to the production etc. might continue to increase the import dependency unless effective policy measures are undertaken to improve the production and productivity and pulses. The implications of long term dependency on import depends upon the nature of import pricing that is undertaken by the importers as we have already discussed the import of each type of pulses is dominated by one or two single largest importers. This may increase the potential for monopoly pricing.

Chapter 7 did an analysis of pricing behaviour of pulses importers in Indian market and the exchange rate pass through into imported pulses prices. When the currency of importing country depreciates, the import is expected to become costlier. However, if the exporter is absorbing part of the increase in price to retain the market share in the importing country, then the exchange rate pass-through into import prices will be partial or incomplete. The elasticities of import prices with regard to changes in the exchange rate can range from 0% to 100%, depending on the pricing strategy of exporters. Additionally, it also shows whether an exporter is following a producer pricing strategy or local currency pricing. The former takes place in a perfectly competitive setting where the low of one price is expected to prevail due and as a result any change in exchange rate will get fully transmitted to import prices. The latter takes place under imperfect competition. Employing the econometric technique of panel corrected standard errors (PCSE) estimation technique in pricing to market (PTM) framework, the results from our analysis showed that the most of the importers were practicing non-competitive pricing behaviour due to both the market specific characteristics as well as exchange rate induced effects.

The significance of the exchange rate parameter β_i and the country-specific effects parameter λ_i in most of the models indicates that the importers work with a fluctuating exchange rate and a varying mark-up over marginal cost. The analysis of the asymmetric effects of exchange rates through an interaction dummy showed that for majority of the products, the appreciation of the Indian rupee against the partner country had greater impact than the depreciation.

We tested the PTM model under three different exchange rates, i.e. the nominal, the real and the commodity-specific (import) trade-weighted exchange rates. For all the products under study, we observed PTM in at least one of the destination markets either through exchange rate changes and/or through country specific effects. The analysis also showed that the commodity specific exchange rate better predicts the PTM behaviour in the case of kidney beans and peas whereas the nominal exchange rate better predicts the PTM behaviour of chickpea and pigeon pea.

The analaysis of the exchange rate effect showed that local currency price stabilization by the Indian importers was more prominent than the amplification of exchange rates. This is indicating competition among other importers.

Chapter 8 discussed the evolution of agricultural and food security policies in India along with the effectiveness of MSP and procurement. The data and studies at the national level broadly indicated that MSP is an important policy instrument in encouraging farmers and to stabilize market prices. However, the percentage of farmers who were aware of MSP was less especially for pulses. This was also reflected in the lack of knowledge about procurement agencies. Interestingly the percentage of households who sold their products to procurement agencies were even lower than the percentage of households who had information about procurement agencies. In chapter 5 our analysis of sample households from three states selected for analysis also showed poor awareness of MSP. The farmers who avail MSP even with a positive information about MSP was also lower.

Therefore, in chapter 9 we analysed the factors influencing the access to information regarding MSP and the decision to avail MSP. The conditional (recursive) mixed process regression equation was estimated using the cmp command which uses the mixed process estimator. The results showed that Maharashtra farmers were more enthusiastic in availing MSP despite of the fact that the information regarding MSP was highest among the farmers from Madhya Pradesh. However, farmers who had more diversified crop cultivation were not very enthusiastic in availing MSP. The majority of the farmers in Madhya Pradesh in our sample were large farmers and most probably they are more diversified. Market access came out to be as an important factor in information and in availing MSP. The risk faced by farmers also increased the chances to avail MSP and this points out how important MSP is in mitigating the negative effects of risk.

The supply response of two major pulses produced by 4 major states are analysed in chapter 10 using Nerlove's expectation framework. The results from our analysis indicated that lagged area under cultivation is significant in impacting the production of pigeon pea whereas the yield was significant in the case of chickpea. Prices of competing crops had a negative impact in both the models. The government policy variable-NFSM came out to be significant only in the case of pigeon pea. Interestingly, MSP was significant only in the case of pigeon pea and not for chickpea. This shows the government policies are not significant in influencing the production of chickpea.

To sum it up, the study provided evidences for non-competitive pricing behavior of importers. In the context of an increase in import dependency on the one side and the concentration of exporting countries on the other side, the non-competitive pricing behavior can have huge implications on the domestic price behavior and volatility. Additionally, the depreciation of Indian currency can make import costlier. Therefore, policies to enhance domestic production needs to be scaled up. As far as the policies are concerned there is a huge information asymmetry among the farmers. Most marginal and small farmers were deprived of the information, training and extension services whereas large farmers had greater access to all these. Another interesting observation was the lack of awareness of MSP among pulses producing farmers. Even those farmers who had information about MSP did not avail MSP due to the delay and uncertainty in price settlement. Additionally, the distance to procurement centers results in heavy transportation cost and thereby the distance to market and procurement centers reduced the probability of availing MSP.

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