Policy Paper 33

Understanding the Recurring Onion Price Shocks

Revelations from Production–Trade–Price Linkages

Raka Saxena
Ramesh Chand

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Dr Suresh Pal
Director
ICAR – National Institute of Agricultural Economics and Policy Research
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Foreword

The prices of some agricultural commodities like onion, potato and tomato are highly volatile, which largely originates from the production uncertainties and changes in nature of demand. These commodities are integral part of Indian diets and have become almost indispensable assuming the nature of necessity. These demand characteristics have made the prices vulnerable to violent fluctuations due to shocks in the production. The major concern of policy makers and stakeholders lies in the fact that how to manage or deal with such price shocks which are hitting the country almost every alternate year. Such a situation is not only creating domestic disturbances in the food economy, but also causing hardships to the farmers.

Onion crop has received greater attention because of extreme price volatility. In case of extreme price rise, the farmers shift the area under cultivation of onion from other competing crops. Such decisions lead to glut in the next season and farmers sometimes are not able to recover even the cost of production. Thus, the marketing and price scenario needs to be effectively examined and monitored to understand the linkages among markets and nature of volatility in onion prices. This study is an attempt in this direction.

ICAR-NIAP has timely come out with this publication which has important policy implications. I am sure that findings of this research will be useful to policymakers and stakeholders for controlling the marketing and price inefficiencies, particularly in sensitive commodities like onion.

N.S. Rathore
Deputy Director General (Agril. Edn.),
ICAR

December, 2017
New Delhi

Preface

Volatility in agricultural commodity markets is a major challenge. As the market surplus is increasing, volatility problem has been cascading to more and more commodities. This effect is high in horticultural crops which are highly sensitive to weather as well as market shocks. A notable example is onion which has attracted attention of policy makers, because of increasing instances of unexpected price spikes and falls. A part of the problem could be attributed to two different crops seasons (*kharif* and *rabi*) in a year and their price and production linkages. This issue was examined in a study by NIAP and the present paper is based on results of the study. The paper specifically presents major trends in onion economy and price trends in different markets in India. It also discusses the marketing practices and price transmission among major onion markets.

Effects of Government interventions and trade in onion are also examined in the context of price volatility management. The results have shown that a coherent policy comprising market interventions to stabilize supply, regulate stock and rationalise exports is essential to address the price volatility. This policy has also to be backed with sound market intelligence about price in major producing markets and likely effect of supply shocks, particularly during *rabi* season. The results are based on intensive data analysis using robust statistical methods. The present research work extends to applications of these methods for developing a reliable price stabilization scheme for perishable commodities.

The study is completed in collaboration with NITI Ayog and NIAP is grateful to Dr Ramesh Chand for timely initiative and successful completion of this study in spite of his busy schedule. There are some policy messages and suggestions which can be tested for other commodities. I am sure researchers, policy makers and students will find this publication useful. Thanks are due to the publication committee for timely publication of this paper.

Suresh Pal
Director

Acknowledgments

This study was undertaken to address the concern of the Ministry of Agriculture and Farmers' Welfare, GoI to examine the causes and identify the triggers in causing the extreme price volatility in onion. Following which, ICAR-NIAP was assigned the responsibility of preparing the base paper on various dimensions related to onion production and prices in the country. The study has made detailed investigations into the genesis of how and why such extreme situations are recurring, affecting the producers and consumers almost every alternate year.

During the course of this study, we have been benefitted from discussions held in the meeting at NITI Aayog. The market officials of APMCs, farmers and traders of Lasalgaon and Yeola markets of Maharashtra provided useful insights. NHRDF officials helped examine the storage and procurement of onion from Lasalgaon APMC. We would like to place on record the support of Director, ICAR-NIAP for the study. We acknowledge the help from Dr Deepika Joshi and Mr. Mohit Singh, research staff, ICAR-NIAP in compilation of data and analysis.

The comments provided by the two external experts were quite useful to revise and refine the contents of this paper. We are sure that the findings of this study will be useful to bring suitable policy changes to make the onion marketing more efficient and to curb the price volatility.

Raka Saxena
Ramesh Chand

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Executive Summary

Onion prices in India are highly volatile. The price spikes are turning frequent and severe over time, sometimes creating a situation of price crisis. The main reasons for severe and frequent price shocks are production fluctuations and changes in nature of demand for onion. Considering this, a study was conducted to analyse various dimensions related to production, trade, consumption, prices and price transmission in onion with a view to suggest suitable policy options to control or mitigate the recurring onion price shocks. The analysis is largely based on the secondary data obtained from various sources. Insights were also obtained from primary onion markets of Maharashtra. Price transmission analysis was applied to analyse the linkages and transmission of onion prices to different domestic markets, export and onion Wholesale Price Index (WPI). The market behaviour was studied using data on onion arrivals and prices in Azadpur market in Delhi; Lasalgaon, Pune and Solapur markets in Maharashtra; Bengaluru and Hubli markets in Karnataka; and Indore market in Madhya Pradesh.

Onion has become an almost indispensable part of the Indian diet. These characteristics of demand for onion together with shocks in production have made its price vulnerable to violent fluctuations. Per capita onion consumption among rural households witnessed increase of 121 per cent during 1987-88 and 2011-12. Due to differences in lifestyle and dietary patterns, onion consumption among urban households is usually higher than rural households. Onion consumption in urban households experienced 90 per cent increase during 1987-88 to 2011-12. Of the various periods, the highest growth in onion consumption has been observed during 2004-05 to 2011-12.

Despite strong growth in domestic demand, India remains a significant player in the global onion market. The share of India in world export of onion and shallots (HS code 070310) hovered between 10 and 15 per cent during 2005-2015. Much of the export takes place during March to August, coinciding with the arrival of *rabi* crop, which has good export potential. Because of its price sensitivity, onion is subject to frequent changes in trade policy. An examination of the onion prices and policy in recent years clearly brings out that domestic supply management needs to follow advance and well thought out plan in response to the signals

given by relevant organizations to check price spikes. The export policy relies heavily on the tool of Minimum Export Price (MEP) to curb the onion price inflation. Consequent to the extreme price spikes during 2013-15, higher MEPs were imposed on onion which yielded expected response in domestic prices. Imposition of higher MEP in November 2013, July 2014 and June 2015 were able to lower the onion WPI in subsequent months, i.e. December 2013, August 2014 and July 2015.

During the recent decade, particularly after 2002-03, onion area, production and productivity witnessed exponential growth. Onion productivity increased by about 60 per cent in ten years following 2002-03, which attracted area shift in favour of onion. The increase in area turned out to be much higher (more than double) in 10 years period. As a result, onion production tripled in less than 10 years since 2002-03. However, the production of onion faced sharp year to year fluctuations leading to the price shocks.

Maharashtra is the leading onion producing state and accounted for 34 per cent of onion area and 29 per cent of onion production in the country in triennium ending (TE) 2014-15. Onion area witnessed very high growth from TE 2006-07 to TE 2014-15 in Bihar, Madhya Pradesh and Maharashtra, which resulted in sharp increase in onion production during the above period. Though Maharashtra is the largest onion producing state in the country, it stands very low in terms of onion productivity. Within Maharashtra, onion is largely produced in Nashik, Pune and Ahmednagar districts. Three crops of onions are marketed in Maharashtra with about 10-15 per cent during *kharif*, 30-40 per cent as late *kharif* and 50-60 per cent *rabi* crop harvested during summer season.

The year-on-year (YoY) growth in production reveals that growth in output during the year preceding price crisis plays a determining role in price spikes. This becomes evident from close examination of the sequence of change in production, market arrival and prices during the crisis year and in the year preceding the price crisis for the state of Maharashtra. A very strong and significant association is seen between the production in any given year and market arrivals in the state in the following year. During the last 12 years period from 2005-06 to 2016-17, production of onion witnessed decline in four years, followed by a decline in the market arrivals in the subsequent year in each case. The next change was witnessed in domestic prices. In year 2007-08, the production declined by about 4 per cent leading to decline in arrivals in 2008-09 by about 9 per cent. This sequence got repeated in the same way in years 2009-10, 2012-13 and 2014-15, where production decline of about 20, 17 and 9 per cent led to 17, 16 and 12 per cent decline in arrivals,

respectively. Corresponding to this, onion prices in Maharashtra increased exorbitantly, by around 70 per cent in 2013. Similarly, an aggregate price increase of 4 per cent at the state level was observed in 2015. However, the disaggregate impacts were much higher. This sequence of fall in the production leading to decline in market arrivals and thus inducing increase in the prices can be generalised to say that the signal for increase in price in a given year are available much in advance from the decline in production in previous year. Therefore, if a system is put in place to get reliable estimate of production soon after the harvest, then occurrence of price spikes can be known in advance.

Lasalgaon, being the largest primary producer market, holds significant importance in onion marketing and price setting. Lasalgaon prices Granger cause prices in all the markets except Hubli and Solapur. That is because in terms of arrival, Solapur receives higher quantity as compared to Lasalgaon; thus, Solapur market Granger causes the prices in Lasalgaon, while the reverse is not found true. Also, prices in Hubli, Pune and Solapur Granger cause Lasalgaon while prices in Bengaluru and Delhi do not Granger cause prices in Lasalgaon. Thus, Lasalgaon shares bidirectional causal relationship with Pune only. Lasalgaon Granger causes WPI. Delhi, being a consuming market, is affected by the price changes emanating from other markets. It is observed that when Lasalgaon is considered to be dependent on other markets, the speed of adjustment is very low in general in Lasalgaon. This is probably due to the reason that only one way transaction exists in the market, i.e. Lasalgaon only supplies the produce to the other markets. The results of impulse response analysis indicated that when a standard deviation shock is given to Lasalgaon market, an immediate and a high response was noticed in almost all markets between second and fourth month reaching a peak at third month. After fourth month, the response starts to decline and reaches negative in case of Bengaluru, Delhi and Pune.

It is established that the price crisis originates in the primary onion markets and spreads throughout the country. The results of variance decomposition analysis indicated that Lasalgaon is the major influencing market for all the selected markets. As markets are co-integrated, the price signals are transmitted slowly to other markets as well. In case of Lasalgaon market, Lasalgaon prices are influenced by the changes in its own lagged price. This seems to be very logical as Lasalgaon is the biggest primary market of onion and does not receive produce from any other markets. Thus, only the changes on supply side in the surrounding production clusters will bring the change in Lasalgaon. Lasalgaon has been a major market in transmitting variation in other markets too, mainly in Pune,

Solapur and Indore markets.

Even the price spikes during October to December, 2017, are linked to production and market arrival pattern. Despite the increase in market arrival during October to December 2017 in Lasalgaon over 2016, the price jerks were experienced. Prices started increasing from late September and have continuously increased till December 2017. This happened due to untimely/erratic rainfall in Karnataka, when the *kharif* onion supply which usually starts in October, got delayed. Thus, immediate shortfalls in supply led to increasing pressure on Maharashtra market for higher demand. The markets behaved in consonance and the prices went up due to non-matching supply. The market arrivals in Bengaluru, which handles bulk of *kharif* Karnataka arrivals, were lower by 37 and 70 per cent during October and November 2017 than the corresponding months in 2016, respectively, which continued the price rise situation.

Though onion has been traditionally and largely produced in the states of Maharashtra and Karnataka, states like Bihar and Madhya Pradesh are emerging in onion production. The geographical diversification and distribution of the crop in new production pockets should definitely help in minimising the impact of production uncertainties on price volatility. The interventions in terms of onion cultivation and technology, by extending its cultivation beyond present seasons may really be useful. Suitable varieties need to be developed to suit various agro-climatic conditions so that the seasonal span of the onion crop can be expanded or adjusted to have continuous supply in the markets.

If some advanced signals regarding the production deficit are available, the market intervention becomes the need of the hour. Stabilisation through stock by public sector or parastatal like NAFED will also keep check on exploitation and market manipulation by private trade, besides price stabilization. Price shocks are usually triggered by the shortfall in production in Maharashtra. Timely regulation of exports and export prices is also important to prevent/control the crisis. Further, the export policy, in terms of fixation of minimum export prices, needs to be guided by the objective framework. Trade may be an appropriate resort to control the extreme situation. Facilitating exports during the price fall situation may help the farmers. We may rely on cheap imports from the neighbouring countries like Pakistan, Bangladesh etc. to meet the crisis situations. The public sector agency, like NAFED, has a crucial role in price stabilization through trade as well.

Markets are highly co-integrated with each other and thus prices are transmitted from one market to the other quickly. There should be

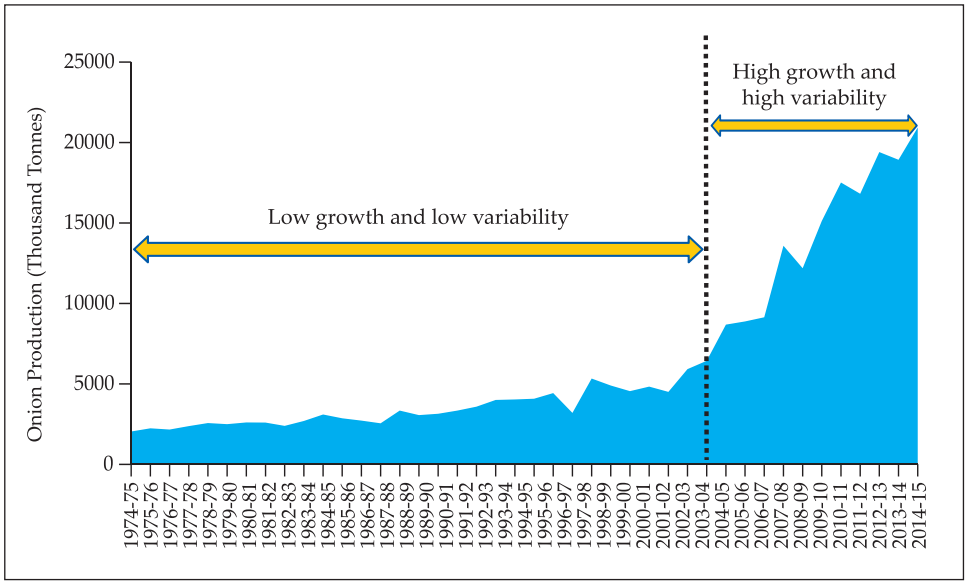
continuous monitoring of prices and market arrivals by some agency of the Central Government, which should also provide advance information to the Government about implications of production fluctuation on prices. This should be followed by appropriate and early action, based on market intelligence to regulate trade, like liberalising import, restriction on export and check on hoardings. The involved institutions have to make continuous efforts and keep an eye on the markets before reaching contingent situation. The advance production estimates released by the Ministry of Agriculture should be utilized effectively by NAFED, Ministry of Consumer Affairs and Ministry of Commerce (DGFT) for proper framing of the procurement plans and export policy. As soon as early signals are available, the information can be used to augment the domestic supply and regulate exports.

To mitigate hardships to consumers, a new central sector scheme with a corpus of "Price Stabilisation Fund" has been created for providing working capital and other incidental expenses for procurement and distribution of perishable horticultural commodities. The states should plan appropriate framework to optimally utilize this fund to minimise the price volatility.

Chapter 1
Backdrop

Agricultural production in India is getting increasingly commercialized with diversification towards horticultural crops, livestock and dairy products, along with other high value commodities. This is evident from the growth experienced in the horticultural and livestock products in the recent years. Demand diversification, market development, increasing liberalization, global interfaces and monetisation of economy are aiding this process (Chand *et al.,* 2015). Of the various high value products, onion has emerged among the fastest growing crops in recent years. Share of onion in total area under vegetable crops has increased from 8.1 per cent in 2001-02 to 12.8 per cent in the year 2013-14. Onion production in India can be broadly categorised into two phases – a) phase I with low growth and low variability in onion production continued till 2002-03, b) phase II is characterized by high growth and high variability in production which started with a turnaround in onion production after 2002-03 and continues till date (Figure 1).

Figure 1: Trends in onion production in India



Source: NHRDF.

Onion production increased at the rate of 3.13 per cent per year during 1974-75 to 2000-01 and the growth rate accelerated to 12.47 per cent per year thereafter. No other food crop has witnessed such kind of growth during the recent past. However, this high growth was accompanied with very high year to year fluctuations in output. The spectacular increase in production of onion not only increased per capita domestic availability and consumption, it also helped in raising onion exports from India from 330 thousand metric tonnes in year 2000-01 to 1115 thousand tonnes in 2015-16, involving annual growth rate of 8.16 per cent in volume and 15.56 per cent in value.

Despite very impressive growth in output, onion has remained the Achilles heel of the policy planners due to frequent and often violent price spikes. Onion price shocks have become a recurrent phenomenon hitting almost every alternate year. In turn, the price volatility hurts both the producing segment as well as consuming segment of the society.

This study was conducted to analyse various dimensions related to production, trade, consumption, prices and price transmission in the onion with a view to suggest suitable policy options to control or mitigate recurring onion price shocks. This Policy Paper has been organized in seven chapters including the backdrop. The second chapter presents the data and methodology used in the present study. Third chapter discusses the onion production and consumption trends in India. Fourth chapter delves on the domestic marketing and export pattern of onion from India. Fifth chapter illustrates the price behaviour in major onion markets along with price transmission. Recent onion price shocks in 2013 and 2015 have been examined in detail in chapter 6. Finally, conclusions and policy implications have been presented in the last chapter.

Chapter 2
Data and Methodology

The analysis is based on the secondary data obtained from various sources. Price transmission analysis was applied to analyse the linkages and transmission of onion prices to different domestic markets, export and WPI. The analysis of price linkages was done based on time series monthly data on prices and arrivals collected from four major onion producing and marketing states. The markets were selected on the basis of market arrivals of onion. These include Azadpur market in Delhi; Lasalgaon, Pune and Solapur markets in Maharashtra; Bengaluru and Hubli markets in Karnataka; and Indore market in Madhya Pradesh. Monthly price data of onion for these markets were obtained from the Agmarknet portal of Ministry of Agriculture and Farmers Welfare, GoI. Monthly data for India's onion exports were compiled from National Horticultural Research and Development Foundation (NHRDF) for period January 2005 to March 2017. Monthly WPI data, from Jan 2005 to Dec 2015, were taken from Office of the Economic Advisor. The analysis involved the following steps:

2.1 Checking the Stationarity of Data

The first step in the times series analysis, before testing for cointegration and Granger causality, is to examine the stationarity of each individual time series selected for the analysis. Augmented Dickey-Fuller (ADF) unit root test (Dickey and Fuller, 1979) and KPSS (Kwiatkowski–Phillips–Schmidt–Shin) test were considered to examine the stationarity. The Augmented Dickey-Fuller test was applied to check the order of integration by using the model (1):

$$\Delta Y_t = \alpha + \delta T + \beta_1 Y_{t-1} + \sum_{i=1}^{p} \beta_1 \Delta Y_{t-1} + \varepsilon_t \qquad (1)$$

where, $\Delta Y_t = Y_t - Y_{t-1}$, $\Delta Y_{t-1} = Y_{t-1} - Y_{t-2}$, *and* $\Delta Y_{t-2} = Y_{t-2} - Y_{t-3}$, *etc.*, ε_t is pure white noise term, α is the constant-term, T is the time trend effect, and p is the optimal lag value which is selected on the basis of Schwartz information criterion (SIC). The null hypothesis is that β_1, the coefficient of Y_{t-1} is zero. The alternative hypothesis is: $\beta_1 < 0$. A non-rejection of the null hypothesis suggests that the time series under consideration is non-stationary (Gujarati, 2010).

The KPSS test was applied to test the stationarity of price series. The series were found to be non-stationary at the level and became stationary after the first differencing. Thus, all the series were non-stationary at the level and were used for cointegration analysis. The stationarity of price series for Indore was tested using ADF test and was found stationery after first differencing. KPSS test estimates the following model:

$$y_t = \beta_o + \beta_1 t + u_t + u_t \quad (2)$$

$$\mu_t = \mu_t - _1 + \varepsilon_t \sim iid(0, \sigma_\varepsilon^2) \quad (3)$$

Where, β_0 is a constant, t is a trend, and μt is a random walk. The null hypothesis is specified as the variance of the error term in the random walk being equal to zero. Thus, the KPSS test tests the hypothesis that $\sigma_\varepsilon^2 = 0$.

2.2 Cointegration and Long-term Causality

The cointegration depicts long-term relationship between the variables. It means even if two or more series are non-stationary, they are said to be cointegrated if there exists a stationary linear combination of them.

For examining long-term causality, Granger causality test was applied. According to it, if a variable Y is Granger caused by variable X, it means that values of variable X help in predicting the values of variable Y and vice-versa. The Granger causality test conducted within the framework of a VAR model is used to test the existence and the direction of long-run causal price relationship between the markets (Granger, 1969). It is F-test of whether changes in one price series affect another price series. The causality relationship between two price series as an example, based on the following pairs of ordinary least square (OLS) regression equations through a bivariate vector autoregression (VAR) is given by equations below:

$$\ln X_t = \sum_{i=1}^{m} \alpha_i \; lnX_{t-i} + \sum_{i=1}^{m} \beta_j \, lnY_{t-j} + \varepsilon_{1t} \quad (4)$$

$$\ln Y_t = \sum_{i=1}^{m} \alpha_i \; lnY_{t-i} + \sum_{i=1}^{m} \beta_j \, lnX_{t-j} + \varepsilon_{2t} \quad (5)$$

Where, X and Y are two different market prices series, ln stands for price series in logarithm form and t is the time trend variable. The subscript stands for the number of lags of both variables in the system. The null hypothesis in Equation (4), and Equation (5) is a test that ln X_t does not Granger cause ln Y_t. In each case, a rejection of the null hypothesis will imply that there is Granger causality between the variables (Gujarati, 2010).

2.3 Estimating Error Correction Model for Short-term Relationship

The cointegration analysis reflects the long-run movement of two or more series, although in the short-run they may drift apart. Once the series are found to be cointegrated, then the next step is to find out the short-run relationship along with the speed of adjustment towards equilibrium using error correction model, represented by Equations (6) and (7):

$$\Delta \ln X_t = \alpha_0 + \sum \beta_{1i} \Delta \ln Y_{t-i} + \sum \beta_{2i} \Delta \ln X_{t-i} + \gamma ECT_{t-1} \quad (6)$$

$$\Delta \ln Y_t = \beta_0 + \sum \alpha_{1i} \Delta \ln X_{t-i} + \sum \alpha_{2i} \Delta \ln Y_{t-i} + \gamma ECT_{t-1} \quad (7)$$

where, ECT_{t-1} is the lagged error correction term; X_t and Y_t are the variables under consideration transformed through natural logarithm; and X_{t-i} and Y_{t-i} are the lagged values of variables X and Y. The parameter γ is the error correction coefficient that measures the response of the regressor in each period to departures from equilibrium. The negative and statistically significant values of γ depict the speed of adjustment in restoring equilibrium after disequilibria.

2.4 Impulse Response Function

Granger causality tests help establish the direction of price causation within the selected time span, but do not determine the relative strength of causality effects beyond the selected duration. The best way to interpret the implications of the models for patterns of price transmission, causality and adjustment are to consider the time paths of prices after exogenous shocks, i.e. impulse responses (Vavra and Goodwin, 2005). The impulse response function traces the effect of one standard deviation or one unit shock to one of the variables on current and future values of all the endogenous variables in a system over various time horizons (Rahman and Shahbaz, 2013). Generalized impulse response function (GIRF), originally developed by Koop *et al*. (1996) and suggested by Pesaran and Shin (1998) is used. The GIRF in the case of an arbitrary current shock, δ, and history, ω_{t-1} is given in Equation (8).

$$GIRF\ Y\ (h, \delta, \omega_{t-1}) = E\ [Y_t+h \mid \delta, \omega_{t-1}] - E\ [y_t+h \mid \omega_{t-1}]$$
$$\text{for } n = 0, 1,.... \quad (8)$$

2.5 Variance Decomposition

To identify the price triggers in major influencing markets, variance decomposition technique was applied. Variance decomposition separates

the variation in an endogenous variable into the shocks to the variables in VAR. The variance decomposition provides information about the relative importance of each random variables/shocks/innovation in affecting the variables in the VAR.

Variance decomposition separates the variation caused in an endogenous variable due to the shocks in other variables in the system. It provides information about the relative importance of each random innovation i.e. price change in one market in affecting the variables in the vector auto-regression i.e. price changes in other markets.

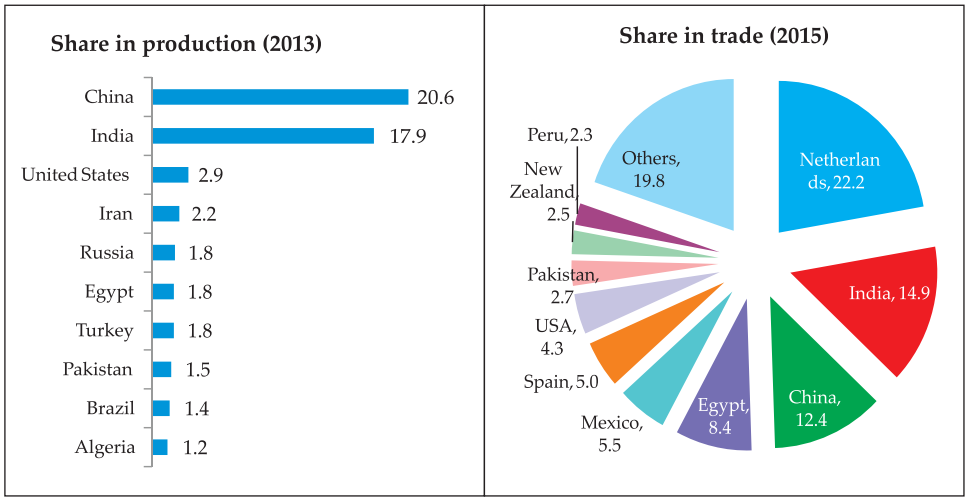
Impulse responses trace out the moving average of the system, i.e. they describe how $y_{it+\tau}$ responds to a shock in $e_{i',t}$; the variance decomposition measures the contribution of $e_{i',t}$ to the variability of $y_{it+\tau}$; the historical decomposition describes the contribution of shock $e_{i',t}$ to the deviations of $y_{it+\tau}$ from its baseline forecasted path (Canova, 2011).

Chapter 3

Onion Production and Consumption Trends

China is the largest onion producer in the World and produced around 23 million tonnes of onions during 2013. Interestingly, country shares in global trade do not follow production shares. Netherlands, a small country stands at the top in exports of onion (Figure 2). Netherlands exports more than 90 per cent of its onion produce and captures market share of more than 20 per cent. Though China's onion production is higher than India, the share of former in world export is about half of the share of latter. India is the second biggest player in global onion market, comprising around 15 per cent share in the global exports.

Figure 2: Major onion producing and exporting countries in the World



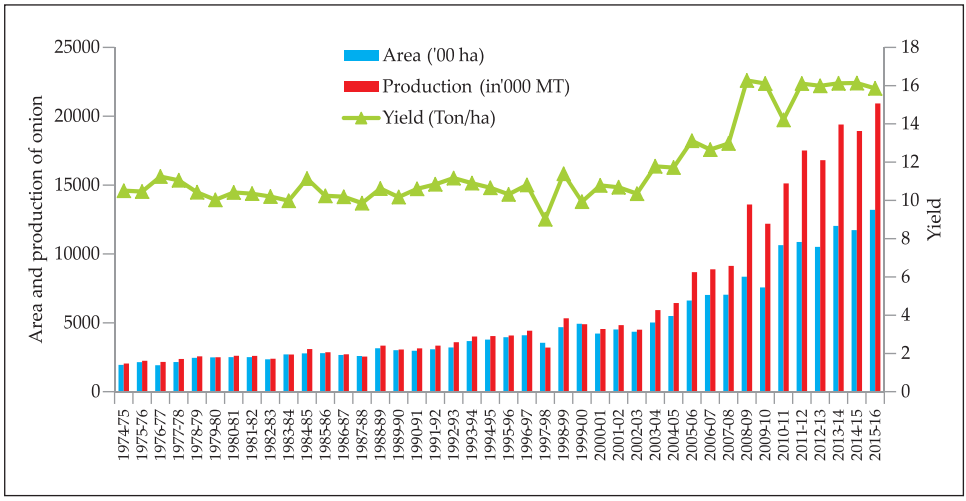
Source: FAOSTAT. *Source:* UN Comtrade.

3.1 Onion Production Trends in India

The trends in area, production and productivity of onion since 1974-75 are presented in Figure 3; the first phase from 1974-75 to 2002-03 witnessed gradual increase in production driven largely by area expansion. In this period, area under onion cultivation doubled from 0.2 million hectares to 0.4 million hectares and production also doubled (refer to 2003-04).

However, the yield levels remained stagnant at 100 quintals per hectare. After 2002-03, all three dimensions of production witnessed exponential growth. In ten years following 2002-03, onion productivity increased by about 60 per cent which attracted area shift in favour of onion. The increase in area turned out to be much higher (more than double) in 10 years period. As a result, onion production tripled in less than 10 years since 2002-03. Netting out for population growth, India's onion production increased from 4.6 kg/person/year during biennium 2000-01 and 2001-02 to 15.2 kg/person/year in years 2013-14 and 2014-15.

Figure 3: Area, production and productivity of onion in India (1974-75 to 2015-16)

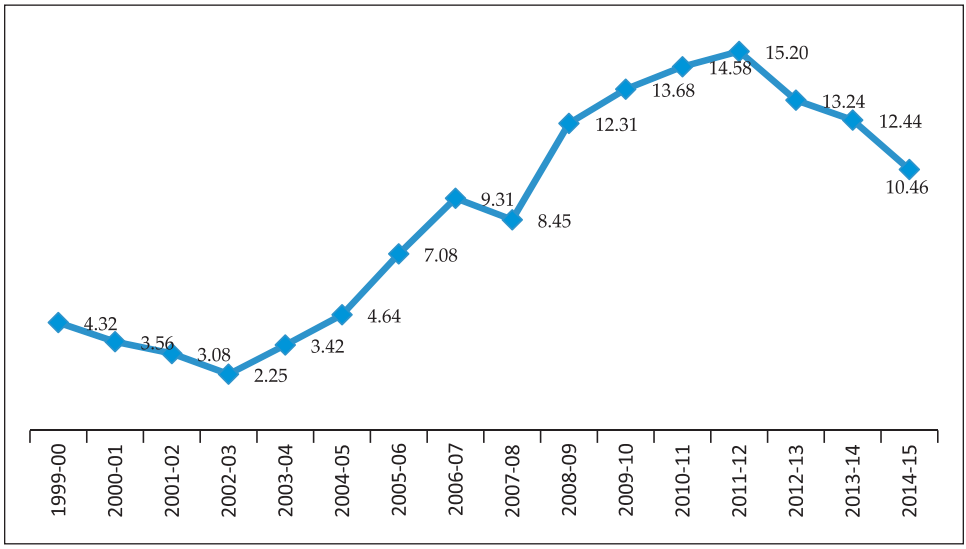


Source: NHRDF.

Like many other agricultural commodities, production of onion faced year to year fluctuations. This instability in production had forced the country to sometimes curb exports, affecting the reputation of India as a reliable global supplier in overseas market (Chand *et al.* 2015). In some years, the country had to even go for imports despite being a large surplus producer in normal years. As onion production in the country fluctuates widely, a single growth rate for a given period is likely to give an over or underestimate of rate of growth. To overcome this, we have computed the decadal growth in onion production by moving terminal and beginning year by one year. The growth trajectory, thus estimated, is presented in Figure 4. The figure presents the growth rates for the 10 years period, ending with the year mentioned in the graph. For example, year 1999-00 indicates the growth rate during 1990-91 and 1999-00. Year 2002-03 proved to be turnaround year in onion production history; the growth started improving beyond 2002-03. A consistently increasing growth in onion production was observed till 2011-12 (except 2006-07). The growth

in onion production has again witnessed a deceleration after 2011-12, but the growth rate remained above 10 per cent a year.

Figure 4: Trend growth rates in onion production during various decades ending with the mentioned year (%/year)



Source: Authors' computations.

Seasonality in Onion Production: Onion in India is grown in more than one season. Therefore, besides the annual change, seasonal trends also affect onion price formation and volatility. At national level, close to 50-60 per cent of the onions are produced in *rabi* season and remaining 40-50 per cent are produced in *kharif* and late *kharif*. Onions are usually grown in winter (*rabi*) season in the northern part of the country, however, it is grown in both *rabi* and *kharif* seasons in the southern and western states of India like Karnataka, Andhra Pradesh, Tamil Nadu, Maharashtra and Gujarat. Box 1 highlights the peak and lean seasons of onions in major producing states. A large proportion of the *rabi* onion comes from Maharashtra, the largest onion producing state in India. The *rabi* onion starts arriving in April and has better shelf life as compared to *kharif* onion. *Rabi* onion can be stored for 4-5 months and consumed till September before the arrival of *kharif* onions beyond September, majority of which comes from Andhra Pradesh and Karnataka.

Geographical Span of Onion: Maharashtra is the highest onion producing state in India contributing about 30 per cent of the total production in the country, followed by Karnataka. Figure 5 displays the spatial pattern of onion production in TE 2001-01 and TE 2014-15. Six states namely Andhra Pradesh, Bihar, Gujarat, Karnataka, Madhya Pradesh and Maharashtra

comprised of 73 per cent of onion production in 2001-02 which increased to 82 per cent in TE 2014-15. Onion is grown in varied agro-climatic conditions ranging from southern, western, and northern to central zone climatic conditions. Geographic concentration of onion production has changed in last 15 years. Bihar and Madhya Pradesh are the emerging states in onion production, the production in these states can further be boosted to tackle the increasing demand as these two states top in per capita consumption (highest MPCE) in 2011-12 after Punjab and Haryana.

Box 1: Harvesting seasons of onion in major producing states

State/UT's	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Andhra Pradesh												
Bihar												
Gujarat												
Haryana												
Karnataka												
Madhya Pradesh												
Maharashtra												
Odisha												
Punjab												
Rajasthan												
Uttar Pradesh												
		Peak Season							Lean Season			

Source: National Horticulture Board.

Figure 5: Leading onion producing states along with percentage shares

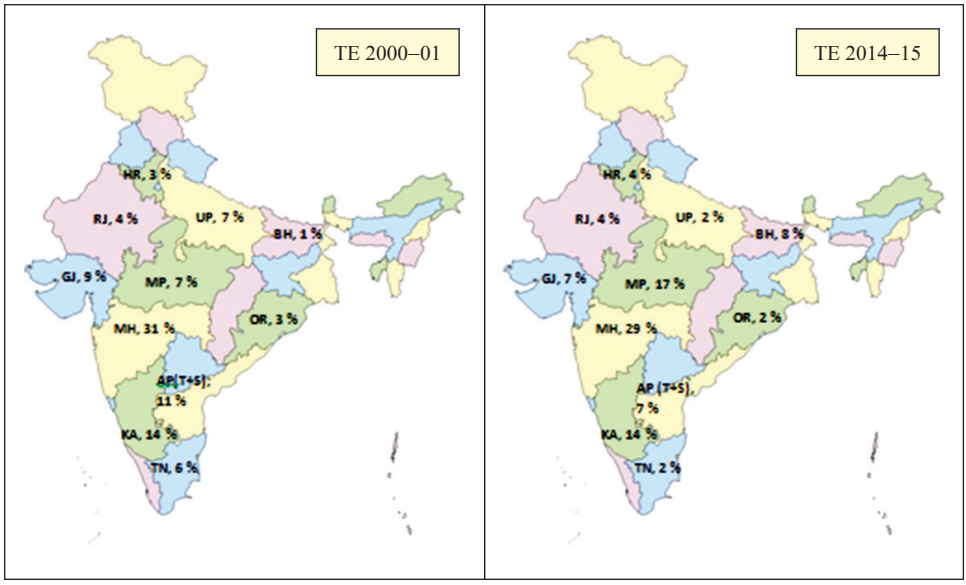


Table 1 presents the trends in area, production and productivity of onion across states. The changes have been presented for three points of time viz; TE 2000-01, TE 2006-07 and TE 2015-16. Maharashtra accounted for 39 per cent of the onion area and 30 per cent of the onion production in the country in TE 2015-16. Onion area witnessed tremendous growth from TE 2006-07 to TE 2015-16 in Bihar, Madhya Pradesh and Maharashtra, which resulted in sharp increase in onion production during the above period. Though Maharashtra is the largest onion producing state in the country, it stands very low in terms of onion productivity. Induced research and development efforts in the state will help enhance the productivity of onion.

Table 1: Trends in area, production and yield of onion across states

State	Area (Th ha)			Production (Th tons)			Yield (Tons/ha)		
	TE 2000	TE 2006	TE 2015	TE 2000	TE 2006	TE 2015	TE 2000	TE 2006	TE 2015
Andhra Pradesh	32	34	69	513	626	1245	15.9	18.6	18.0
Bihar	20	15	70	203	118	1566	10.0	7.9	22.4
Gujarat	26	65	57	681	1826	1445	26.0	28.0	25.4
Haryana	8	17	30	107	309	673	13.1	17.9	22.5
Karnataka	113	146	171	590	862	2663	5.2	5.9	15.5
Madhya Pradesh	24	37	118	326	579	2839	13.5	15.7	24.1
Maharashtra	112	180	477	1421	2309	5918	12.7	12.8	12.4
Odisha	32	27	34	251	249	402	7.8	9.1	11.8
Punjab	1	5	8	18	120	189	22.6	22.1	22.5
Rajasthan	23	42	68	153	382	1034	6.5	9.1	15.1
Tamil Nadu	36	28	34	303	250	371	8.5	8.8	10.9
Uttar Pradesh	26	24	29	345	298	455	13.4	12.6	15.9
West Bengal	-	-	28	-	-	423	-	-	15.3
All India	461	638	1232	4927	8001	19754	10.7	12.5	16.0

Source: Authors' computations based on NHRDF data.

Note: Data for Bihar, Madhya Pradesh and Uttar Pradesh refers to the data of undivided state.

3.2 Growth versus Instability in Onion Production

The variability in onion has been estimated using instability indices (standard deviation of annual rate of change) in area, production and yield of states (Table 2). The period of last four decades has been divided into three phases: 1974-75 to 1990-91, 1990-91 to 2000-01 and 2000-01 to 2015-16. Phase I (1974-75 to 1990-91) is characterized by low onion production growth largely coming from area expansion with no (rather negative) change in productivity. Phase II (1990-91 to 2000-01) may be

Table 2: Growth and variability in area, production and productivity of onion in major producing states

State	Area			Production			Yield		
	Period I	Period II	Period III	Period I	Period II	Period III	Period I	Period II	Period III
Growth									
Maharashtra	1.48	5.34	11.24	-1.06	4.62	11.88	-2.50	-0.68	0.58
Karnataka	5.35	11.80	2.85	3.80	7.68	13.83	-1.47	-3.69	10.68
Madhya Pradesh	3.52	4.18	15.12	4.29	5.92	19.14	0.75	1.67	4.19
Gujarat	2.61	-2.62	7.01	4.81	-3.08	6.64	2.15	-0.48	-0.35
Bihar	0.79	3.08	16.02	3.17	4.17	26.76	2.36	1.06	9.62
Variability									
Maharashtra	4.6	36.9	36.0	12.1	48.4	24.1	11.2	14.5	16.0
Karnataka	27.9	14.7	16.9	23.2	20.0	57.3	13.3	16.6	55.3
Madhya Pradesh	12.1	13.5	18.8	23.0	16.7	28.1	21.5	8.9	8.8
Gujarat	34.2	58.7	87.6	46.6	57.0	111.8	20.0	11.6	11.0
Bihar	7.2	13.6	68.7	21.2	20.9	168.4	17.2	11.1	30.2

Source: Authors' computations.

Note: Period I: 1974-75 to 1990-91; Period II: 1990-91 to 2000-01; and Period III: 2000-01 to 2015-16. The data for two years i.e. 2000-01 and 2001-02 were not available for Bihar; the computations have been done accordingly. The analysis for Bihar and Madhya Pradesh represent the scenario for undivided states.

treated as an extension of previous phase but with higher production growth. Phase III (2000-01 to 2015-16) is high growth phase accounted by both, area expansion as well as productivity improvement. The state wise pattern indicates negative growth in production in Maharashtra due to decline in productivity. Growth in production in Karnataka and Madhya Pradesh was due to area expansion; whereas, Bihar witnessed positive growth in onion production due to increase in productivity. Onion production in Gujarat resulted from area expansion as well as productivity growth.

Maharashtra and Bihar experienced the lowest variability in phase I. The negative production growth of Maharashtra in phase I was reversed in the next phase (1990-91 to 2000-01) due to rapid increase in area under onion cultivation. Karnataka witnessed highest growth in area and production of onion in phase II despite highest negative growth in productivity among other states. During 1990-91 to 2000-01, production growth in Maharashtra was accompanied with increased variability. The growth in production experienced big acceleration in all the states except in Gujarat. This was driven mainly by growth in area in Maharashtra and growth in productivity in Karnataka. Onion production in Madhya Pradesh and

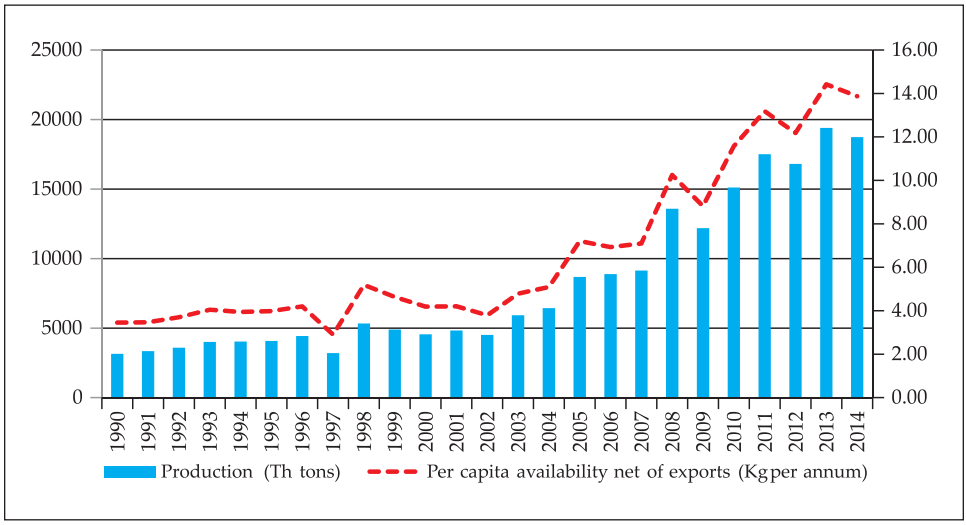
Bihar increased on account of rapid area expansion as well as steep growth in productivity. Gujarat witnessed negative productivity growth during the second and third phases. This requires serious attention of agronomists, breeders and entomologists working in the agricultural universities in the state and also the ICAR institutes in the relevant field to bring some technological breakthrough to raise onion productivity in the state.

3.3 Onion Consumption Scenario

As established, the composition of food consumption basket is changing in favour of the high value products, especially horticulture and livestock products. Changes in food demand are the result of increase in income of consumers, rising urbanisation, changing lifestyles and shifting tastes and preferences of the society. Such changes in demand patterns of certain commodities have altered the responsiveness of their demand to changes in price. Onions have witnessed an impressive growth in domestic and overseas demand. India has been meeting the overseas demand of onions by exporting onions to a number of nations.

The per capita availability of a commodity is a major indicator of its supply and also availability to meet demand and consumption. The per capita availability of onions has been worked out by considering the net availability after netting out for the exports, which quadrupled from 3.8 Kg in year 2002-03 to 14.73 Kg in year 2014-15 (Figure 6). The onion availability remained almost stagnant for many years till 2002-03; however, it grew to considerably higher levels after sharp increase in onion production.

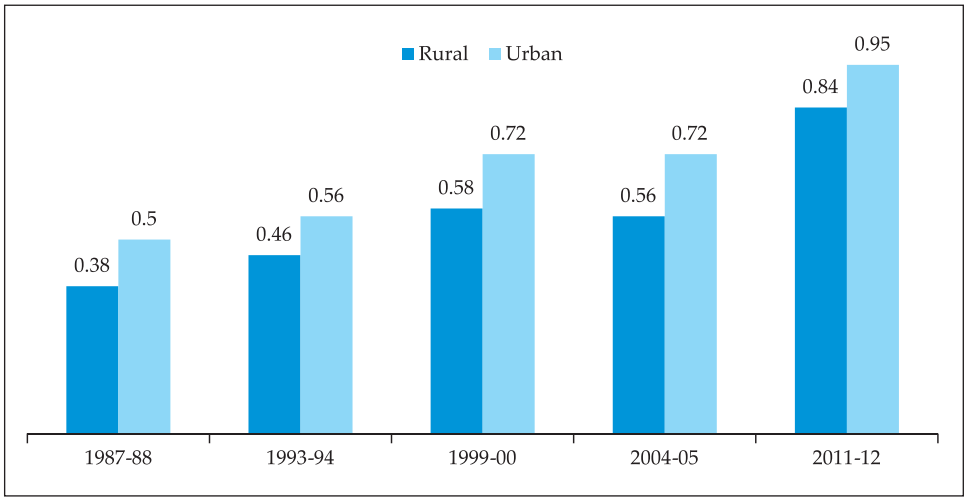
Figure 6: Trends in production and net availability of onion



Source: Authors' computations based on NHRDF data.

This growth in per capita onion demand, as revealed by net availability, reflects mind boggling preference of Indian consumers for onion. Despite increase in export, the net availability is increasing. Figure 7 provides information on the changes in household consumption pattern of onion in India. The data have been obtained from various rounds of National Sample Survey Office (NSSO). Per capita onion consumption among rural households witnessed increase of 121 per cent during 1987-88 to 2011-12, marking an annual increase of 3.36 per cent a year. Due to changing lifestyle and dietary patterns, the onion consumption among urban households is usually higher than rural households. Onion consumption in urban households experienced 90 per cent increase during 1987-88 to 2011-12. Among various periods, highest growth in onion consumption has been observed during 2004-05 to 2011-12.

Figure 7: Temporal changes in consumption of onion (Kg per month per person)



Source: NSSO Rounds on consumption expenditure (Various issues)

3.4 Capturing Onion Consumption: Evidence for Unaccounted Consumption/Utilization

The NSSO is publishing the data on consumption expenditure of various commodities in their quinquennial rounds and also the occasional rounds. If we account for onion consumption outside home, the consumption level and its growth will be much higher than the household level consumption data. Large expansion of eating joints, outside eateries, snack corners and restaurants in the recent years has added considerably to increase in per capita onion consumption as onion is the main ingredient for attracting consumers to spicy food. We have tried to find this gap, which is presented in Table 3.

Aggregate domestic consumption can be worked out by multiplying the monthly per capita consumption by the population. Exports can be treated as the foreign onion consumption/demand. The remaining quantity after adjusting for the consumption and wastages provides the quantity either stored or utilised by the industry for the value added products. This quantity is about 14 per cent of total onion production.

Table 3: Calculations for deriving the unaccounted onion consumption in India, 2011-12

Item	Unit	Source	Rural	Urban	Total
Production	Million tonnes	Ministry of Agriculture and NHRDF	-	-	17.51
Domestic onion consumption	Onion monthly per capita consumption (Kg)	NSSO	0.84	0.95	-
	Population (Millions)	Census of India	833.08	377.11	-
	Total consumption (Million tonnes)	-	8.40	4.30	12.70
Foreign onion consumption (Onion Exports)	Million tonnes	NHRDF	-	-	1.55
Wastage	Million tonnes	FAO	-	-	0.88
Consumption by industry/stocks	Million tonnes	Estimated	-	-	2.38

The price elasticity of demand for onion has been estimated as low as 0.1, which indicates rigidity in consumers' demand for onion (NCAER, 2012). It seems that the Indian consumers consider onion as a more important necessary good than even staple food. Onion has become integral part of Indian diet, almost indispensable by partly or wholly replacing its substitute spices which have become costlier. This explains the low price elasticity of demand for onion and implies that 10 per cent increase in price can result only in 1 per cent decline in demand for onion. Thus, effective procurement and distribution strategies would be helpful during the price shocks situations.

Chapter 4

Onion Marketing and Exports

4.1 Onion Marketing in Maharashtra

Within Maharashtra, onion is largely produced in Nashik, Pune and Ahmednagar districts of the state. As reported, three crops of onions are marketed in Maharashtra, with about 10-15 per cent during *kharif*, 30-40 per cent as late *kharif* and as much as 50-60 per cent *rabi* crop harvested during summer season. Like other agricultural commodities, marketing of onions in the country is also regulated through Agricultural Produce Market Committee (APMC) Act of respective states. The Maharashtra State Agricultural Marketing Board (MSAMB), Pune was established in 1984, under section 39A of Maharashtra Agricultural Produce Marketing (Development & Regulation) Act, 1963. Maharashtra has made suitable amendments in its Maharashtra Agricultural Produce Marketing (Regulation) Act, 1963.The State amended the Act in June 2006 and framed the rules in June 2007 with development led objectives. The amended Act was titled as "Maharashtra Agricultural Produce Marketing (Development and Regulation) (Amendment) Act, 2006". The Act has been amended to promote competitive marketing of agricultural commodities.

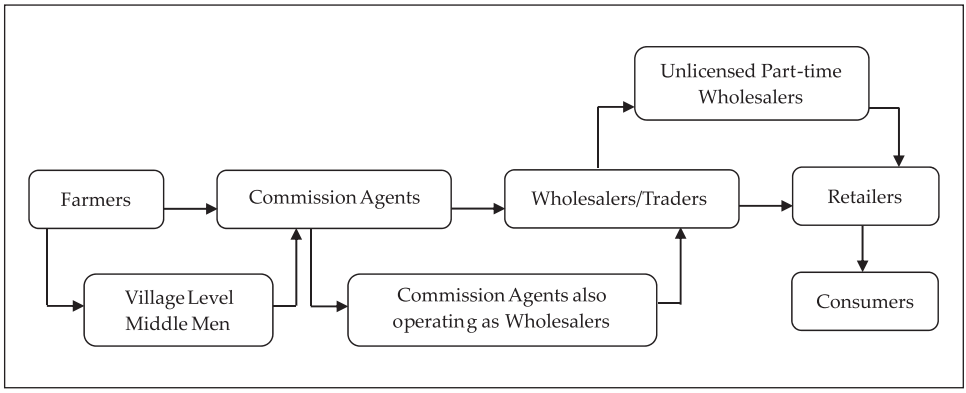
After the amendment, the State has issued 72 licenses under direct marketing, given approval to 7 private markets, identified 33 locations for farmer consumer markets, facilitated contract farming covering 1 Lakh hectares, organized 20 festivals for promoting special commodity markets and given licenses to 9 private players under Single License System (Gummagolmath, 2013). State has also made some efforts to promote public private partnership and has proposed to set up terminal market for fruits and vegetables at Mumbai, Nashik and Nagpur (Gummagolmath, 2013). To facilitate the electronic processes in marketing, the markets are being provided with requisite infrastructural facilities. Under Agmarknet project, computerization of 291 APMCs and 54 submarkets has been completed (Gummagolmath, 2013).

Lasalgaon mandi in Nashik district of Maharashtra is Asia's largest onion market. There are 550 licensed traders in Lasalgaon APMC which are categorised as A, B and C class traders with the license fee of 200, 100 and 20, respectively. There are 154 general commission agents and 9 godown

holders. As reported in the Lasalgaon Market Profile at Agmarknet, onion is traded through open auction system, with a commission of 4 per cent charged from farmers by the registered commission agents in the Lasalgaon APMC. A market cess of 1 per cent is levied on wholesalers by the APMC. The onions from Lasalgaon are supplied to many places in India and also exported to many countries. The APMC has close linkages with many organizations like NHRDF and Bhabha Atomic Research Center (BARC) for improving the quality of onions produced and marketed locally. NHRDF produces and distributes quality seed of onions to the farmers. BARC processes onions to keep them fresh for a longer time.

As *rabi* onion has a better shelf life, it is stored by the farmers on-farm in bamboo based conventional storage structures. Since *kharif* and late *kharif* onions are not good for storage, these are sold by the farmers within 15 days to 1 month after harvest. The onion marketing chain in Maharashtra is presented in Figure 8, presenting linkages among various stakeholders. The Nashik division of Maharashtra receives the produce largely from the producers. The APMCs like Lasalgaon, Pimpalgaon, Yeola etc. are purely primary markets. As informed by the mandi officials, there are around 40-45 onion traders in Lasalgaon market and 16-17 traders in Yeola market. A commission of 4 per cent is charged from the onion sellers by the Commission Agents. The farmers bring onions in loose form in trucks/trolleys to sell these to onion traders. The onions are sold through open auction method.

Figure 8: Onion marketing system in Maharashtra



Source: Chengappa *et al.* (2012).

In Karnataka and Maharashtra, the agricultural marketing is more or less entirely in the hands of the intermediate market functionaries, both the states do not have strong network of post-harvest services, infrastructural facilities, amenities and dynamic marketing system (Chengappa *et al*., 2012).

4.2 Onion Storage

NHRDF compiles the onion storage data based on the information provided by the states. In Maharashtra, Gujarat, Haryana and Western Uttar Pradesh, large-scale storage of onions is done in conventionally-designed structures (Gummagolmath, 2013). In other states, the storage is done only on small scale but now an increasing trend is seen after the post-harvest technology and improved storage structures have been popularized by NHRDF. The state-wise information on onion storage is provided in Table 4. On an average, 17 per cent of the onion produced was stored during TE 2012-13, with more than 50 per cent of it being stored in Maharashtra only. As Maharashtra *rabi* onions have better storage quality, the state stores around 30 per cent of its production. Due to increasing government intervention and support to the states, the onion storage in states like, Madhya Pradesh and Bihar has improved significantly during 2017. Though, Karnataka follows Maharashtra in onion production, the storage to production ratio is only 4-5 per cent as the state produces large quantity of *kharif* onions. Thus, Maharashtra's position in production and storage is quite strategic and will play an important role in managing the onion price volatility in the country.

Table 4: State-wise onion storage during 2010-12 (Quantity in lakh mt)

States	2010-11	2011-12	2012-13	2017
Maharashtra	14.50	15.50	15.00	18.00
Gujarat	2.00	1.80	0.85	1.25
Bihar & Jharkhand	1.50	1.50	1.65	3.75
Haryana	0.75	0.75	0.85	1.75
Karnataka	1.25	1.25	0.85	0.40
M.P. & Chhattisgarh	1.75	1.85	1.25	13.50
U.P. & Uttarakhand	1.85	1.80	1.75	3.50
Odisha	0.50	0.50	0.50	0.35
Rajasthan	1.75	1.75	1.85	1.00
Punjab	0.75	0.75	0.75	1.25
Tamil Nadu	1.00	1.00	1.00	0.18
Andhra Pradesh	0.30	0.45	0.45	–
Others	0.50	0.60	0.75	3.80
Total	28.40	29.50	27.50	48.73

Source: National Horticulture Mission and DAC&FW.

Storage facilities for onion require sufficient inflow of fresh air. NAFED has set up modern state-of-the-art storage facilities in Maharashtra, Gujarat

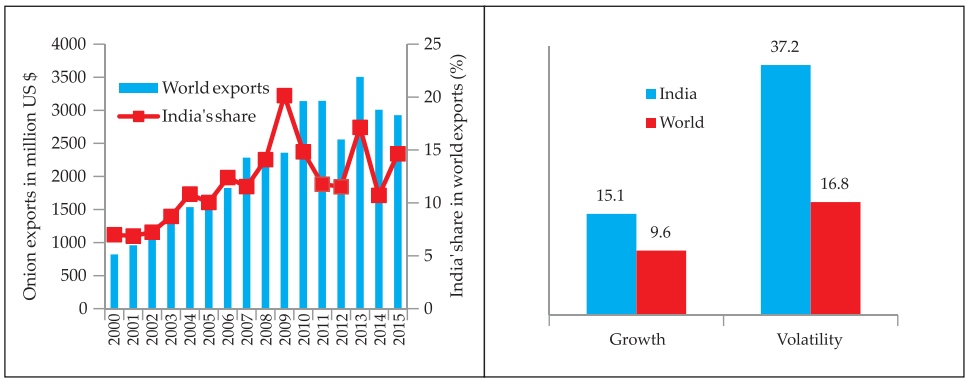
and Tamil Nadu near its major procurement centers; export consignments meant for long distance are transported by NAFED's associated shippers in specially equipped sea vessels in which air is blown in storage areas through fans and blowers (Chengappa *et al.*, 2012). Nashik district has 2.13 lakh MT of storage capacity for onions at farm level as well as around 87,000 MT storage capacities at market level (Asian Development Bank, 2010). As reported, conventional storage of onions witnesses several problems like weight loss, sprouting and bulb rotting. To reduce these losses, Maharashtra State Agricultural Marketing Board (MSAMB) with the help of NABARD and National Research Centre for Onion and Garlic, Rajgurunagar has developed a scientific onion storage structure (Asian Development Bank, 2010).

Government of Maharashtra launched a scheme to provide subsidy to the farmers at 25 per cent of the cost of construction for scientific onion storage under RKVY, Maharashtra State Agricultural Marketing Board (MSAMB) is entrusted with the responsibility of implementing the scheme in the state Governemtn of India (GoI). To cover all categories of farmers, especially small and marginal farmers, storage capacities ranging from 5 MT to 50 MT were planned and promoted under the scheme. Besides, an irradiation facility by MSAMB has been set up at Lasalgaon and another one by Hindustan Agro has been set up in Rahuri to control losses due to sprouting of onions during prolonged storage and enhance the shelf life. The facility was set up by Bhabha Atomic Research Centre in 2003, with an investment of Rs. 8 crore (Asian Development Bank, 2010). The plant can handle up to 10 MT of produce per hour and is approved by USDA.

4.3 Onion Exports from India

The share of India in world export of onion and shallots (HS code 070310) has hovered between 10 and 15 per cent during 2005-2015. It is interesting to note that value of global as well as Indian exports of onion has witnessed sharp increase during 2000 to 2015, and the increase has been much more pronounced after 2006-07 (Figure 9). However, the Indian exports moved almost in tandem with global exports, indicating close linkage between the two. A disquieting feature of the exports from India is, much higher volatility as compared to the global exports. The volatility in Indian exports may be attributed to the domestic production instability along with the policy uncertainty regarding the Indian onion exports. Surprisingly, the export shares from the country were higher in price shock years i.e. 2013 and 2015 as compared to the preceding years. It has been noted that the hike in minimum export prices of onions during the period of extreme spikes i.e. August to November/December in 2013 and 2015 have led to decline in onion exports during those months.

Figure 9: Trends and volatility (2000-14) in onion exports from World and India



Source: UN Comtrade.

Onion exports from India take place round the year, but it is not uniformly distributed. Onion exports increased enormously during 2016-17, which was around three times of the exports of onion from the country in 2015-16. Usually, much of the onion exports take place during March to August coinciding with the arrival of *rabi* crop, which has good export potential (Table 5) and little exports take place in the months of November and December; however the same did not happen in the recent year 2016-17. Further, exports of onion in the years 2010-11, 2013-14 and 2015-16, which faced onion price spikes, showed a decline over the previous years in months of August, September and October. Year 2016-17 was quite unique in the sense that relatively larger quantity of *kharif* crop was also exported, unlike the trend in recent years.

Table 5: Monthly exports of onion from India (Thousand tonnes)

Months	2009-10	2010-11	2012-13	2013-14	2014-15	2015-16	2016-17
April	238	187	159	204	127	117	143
May	191	172	176	193	138	119	166
June	160	150	183	143	127	104	279
July	205	175	177	126	60	77	201
August	186	159	156	39	59	43	276
September	141	92	151	24	78	27	292
October	178	104	155	58	78	23	278
November	84	80	111	66	65	66	376
December	99	18	138	133	43	120	389
January	108	128	133	121	112	133	321
February	115	45	102	150	82	152	348
March	168	159	183	100	116	134	424
Total	**1873**	**1469**	**1824**	**1357**	**1085**	**1115**	**3493**

Source: NHRDF.

Agricultural trade in India, contrary to the non-agricultural trade, remains highly volatile in nature as the agricultural sector is subject to many kinds of uncertainties like weather, production, policy uncertainty etc. Like many other agricultural commodities, onion has also been a sensitive commodity which has suffered from volatility in production and trade, resulting in volatility in its prices. Whenever there is steep increase in domestic prices, the pressure builds up for restricting or banning onion exports to ease domestic prices. It is, therefore, important to examine the linkages between domestic production of onion and its exports.

Table 6 presents scenario of onion production, exports and year on year change during the last sixteen years. As indicated in previous sections, onion production has witnessed tremendous growth during the recent years; the production grew at the CAGR of 12.03 from 2000-01 to 2015-16. Onion exports also exhibited impressive growth during the said period (CAGR, 8.16). Further, the growth in onion export has been lower than the growth in production, despite a spectacular growth in production. Since 2000-01, share of export in domestic production was lowest in the year 2015-16 due to the policy restrictions in terms of increase in minimum export prices of onion. Even when onion recorded bumper production in year 2013-14, the exports remained low again due to the policy restrictions in terms of imposition of very high MEPs and export bans.

When we look at the YoY growth in onion exports, broadly four types of patterns are observed. One, a quite obvious phenomenon that a positive increase in production leads to a positive change in exports; usually the gain in exports is much higher as compared to the gains in production. Second, an inconsistent pattern that the exports increased despite the decline in production; however, the loss in production was not that big. Third, the exports declined despite increase in production; such patterns were observed in the years, 2005-06, 2007-08, 2010-11 and 2013-14. Needless to mention that 2010-11 and 2013-14 were the years when the onion price shocks deepened in the domestic markets and hence the traders (exporters) did not export onions as the domestic market was also quite lucrative from the perspective of trade gains. Further, government policy in terms of higher MEP and export bans led to such a decline in onion exports. In 2014-15, a smaller decline in production (-3.43 per cent) led to much larger decline in exports (-20.04 per cent). The incongruent pattern between onion production and export may arise due to the fact that a sizeable proportion of onion produced in a year is marketed during the subsequent year of its production.

Table 6: Trends in onion production and exports

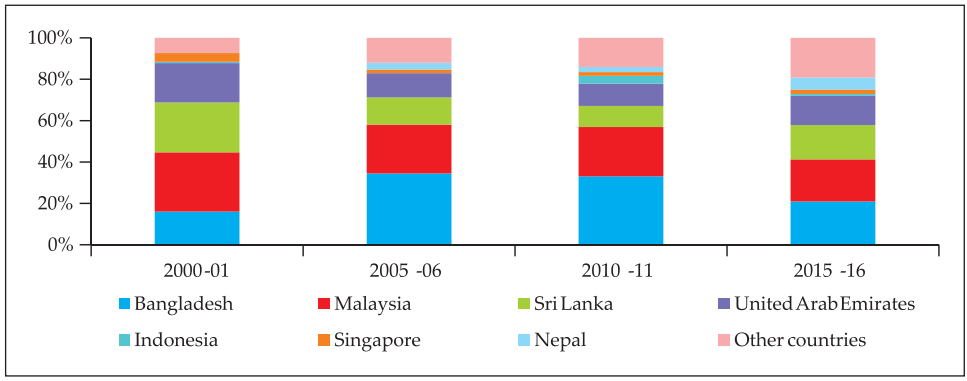
Years	Production (Th tons)	Exports (Th tons)	Share of onion exports to production (%)	YoY growth in production (%)	YoY growth in exports (%)
2000-01	4551	330	7.3		
2001-02	4831	507	10.5	6.16	53.52
2002-03	4506	545	12.1	-6.73	7.55
2003-04	5923	841	14.2	31.43	54.20
2004-05	6435	941	14.6	8.65	11.98
2005-06	8683	778	9.0	34.94	-17.35
2006-07	8885	1161	13.1	2.33	49.21
2007-08	9138	1101	12.1	2.85	-5.14
2008-09	13588	1783	13.1	48.70	61.91
2009-10	12191	1873	15.4	-10.28	5.03
2010-11	15118	1341	8.9	24.01	-28.42
2011-12	17511	1553	8.9	15.83	15.82
2012-13	16813	1823	10.8	-3.99	17.38
2013-14	19402	1358	7.0	15.40	-25.49
2014-15	18928	1086	5.7	-2.4	-20.04
2015-16	20931	1115	5.3	10.6	2.7
CAGR	12.03	8.16			

Source: Computed based on NHRDF data.

4.4 Major Onion Importing Nations from India

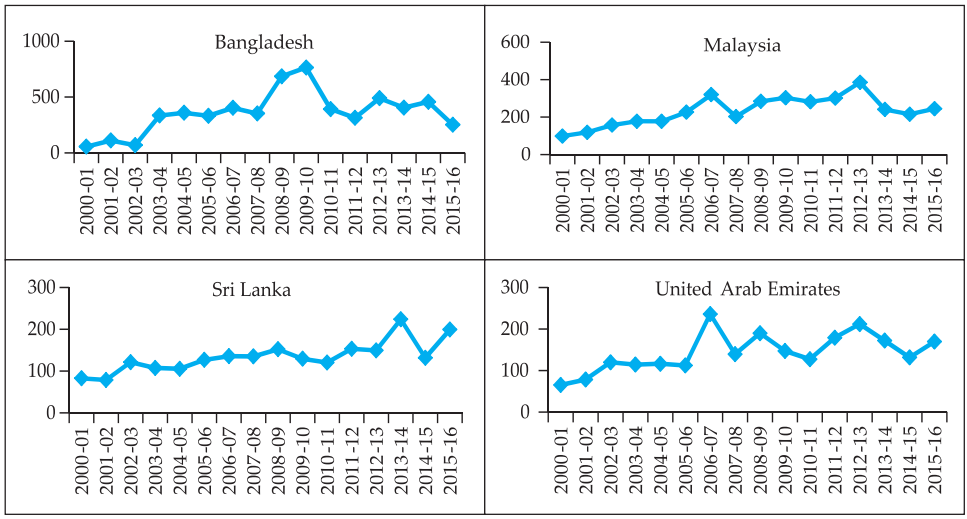
Onions from India are exported to a number of destinations in Asia. The important ones are Bangladesh, Malaysia, Sri Lanka, UAE and Indonesia. Bangladesh has been our consistent trading partner, which has been growing over a period of time. It accounted for around 15 per cent share of India's onion exports during 2000-01, which has increased to more than 21 per cent in 2015-16 (Figure 10). The share of Malaysia, Sri Lanka and UAE has continuously squeezed over a period of time. New markets are emerging in onion exports. Though Bangladesh is our important trading partner in onion, the trade trends with it have become quite volatile particularly after 2007-08 (Figure 11). Indonesia and Nepal are emerging as major markets for our exports, which can be noticed from their growth pattern also (Figure 12).

Figure 10: Major destinations for onion exports (Share in total Indian onion exports)



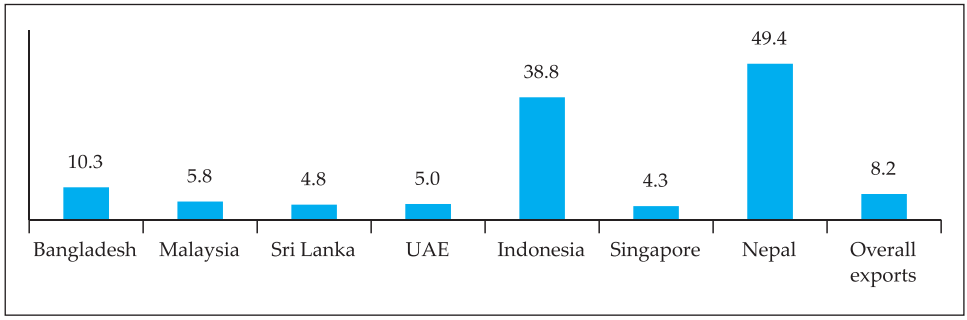
Source: International Trade Statistics.

Figure 11: Trends in onion exports to major destinations (Thousand tonnes)



Source: International Trade Statistics.

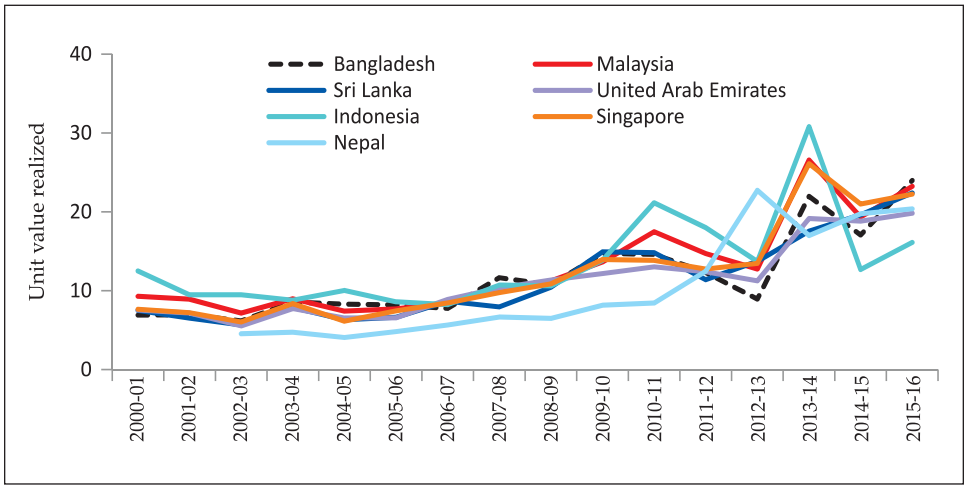
Figure 12: Growth in onion exports to major destinations (2000-01 to 2015-16)



Source: Authors' computations.

Figure 13 provides the unit value realized (UVR) from exports of onions to various destinations. It can be observed that the UVR varies a lot among the importing destinations. From Bangladesh, though being a major importing nation, the UVR is quite low as compared to other importing countries. The UVR from Malaysia and Indonesia are usually found to be higher as compared to other importing destinations. Chapter 5 discusses in detail the price transmission across major markets of onion. The results indicated that there is significant price transmission from the domestic markets to the export markets. The same is evident from Figure 13, where highest price spikes were noticed in UVR from different importing nations in 2010-11 and 2013-14. The mentioned years were characterised by the price spikes in domestic markets of onion.

Figure 13: Unit value realized from exports of onion to major destinations (Rs per kg of onion)



Source: Authors' computations.

4.5 Onion Export Policy in India

Trade facilitation from the country and making Indian exports more competitive remains the priority for the Government. The major policy instrument to regulate onion export and stabilise domestic market is MEP. The other policy instrument is physical restriction on exports through banning the exports or canalising (routing) the exports through state trading enterprises. The motive behind such policies remains the stabilisation of domestic supply of onion and to keep a check on domestic prices turning too high. In India, 40 price notifications regarding onion export policy have been issued by Directorate General of Foreign Trade during the last five years. Surprisingly, fifty per cent of these were issued in just one year

i.e. 2011 (Annexure 1). During the same year, onion exports were banned twice. Some varieties of onion like Bangalore rose onion and Krishnapuram onion having special attributes are treated differently in implementation of MEP policies. Bangalore rose onions are exclusively grown for the export markets in certain parts of Karnataka especially in Bengaluru rural, Kolar and Doddaballapur. The variety got the tag of Geographical Indication (GI) in 2014-15 due to its specific attributes like shape, deep scarlet red colour, nutrient content (anthocyanin, phenols) and high pungency.

Time series data on onion prices indicates that 2013 price situation was the most severe with intense price shock in the recent years. Such a situation needed immediate attention of policy makers, consequent upon which the MEPs were kept at the historically highest levels. As the crises became intense, the government responded by repeatedly raising the MEP which went up to $1150/MT. The situation eased only at the end of December. A similar price crises situation re-emerged in 2015 which appeared to be little less severe as compared to 2013 crises. An MEP level of $700/MT was notified in August 2015, which was 8 per cent higher as compared to August 2013 MEP. No further notifications were issued except in December 2015, when the price situation eased.

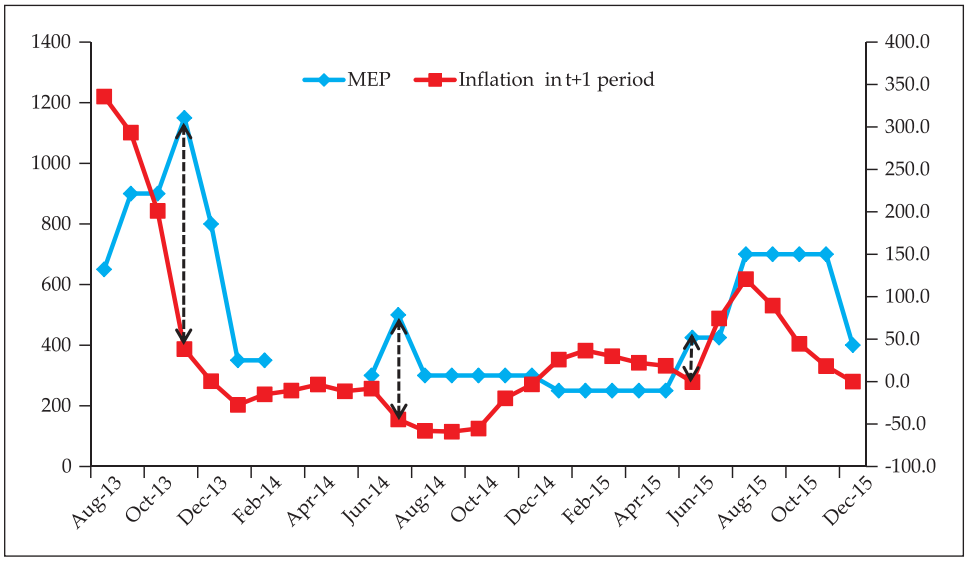
An examination of the onion prices and policy in recent years clearly brings out that domestic supply management needs to follow advance and well thought out plan in response to the signals given by relevant organizations to avert the price spike situations. An ideal approach demands proper market intelligence based on production and price forecast. Failing which, contingent management in terms of higher MEPs and export bans might affect the image of India as a credible nation as compared to the competing countries like China and Pakistan. According to onion traders in Maharashtra, foreign buyers often prefer reliable suppliers who can maintain their commitments and if traders fail on reliability, they loose customers and their loyalty in international markets (Chengappa *et al.*, 2012). Indications are emerging that our import destinations in South East Asia are also trying to increase their levels of self-sufficiency in onion by cultivating similar varieties which we export to them. Thus, a long term orientation in onion export policy is the need of the hour.

4.6 Impact of MEP on Curbing the Onion Inflation

As understood, the MEP should ease the domestic price situation of onion as the export policy relies heavily on the tool of MEP to correct the onion inflation. Thus, an attempt has been made to examine whether changes in MEP impacted the domestic prices measured through the WPI. It is assumed that MEP should correct the onion inflation with one time

lag. Figure 14 demonstrates the changes in MEP in a month and changes in onion inflation during the subsequent month.

Figure 14: Comparison of changes in minimum export prices and onion inflation



Source: Authors' computations.

The plots of both the series clearly demarcate that imposition of higher MEP in November 2013, July 2014 and June 2015 was able to lower the onion inflation in subsequent months i.e. December 2013, August 2014 and July 2015. However, MEP is just one factor in controlling the inflationary situation caused due to onion; it is largely governed by the management of domestic supply situation of onion.

Chapter 5

Price Transmission across Markets

Onion production and market arrivals are concentrated in a few months and states but they are consumed throughout the country and throughout the year. State wise market arrivals follow more or less similar pattern as production, but a large part of onion is distributed through the Azadpur market in Delhi. Bengaluru and Solapur are the most important onion markets in terms of secondary arrivals; however, Lasalgaon has its own importance due to its strategic location and being a primary producer market. The major markets for onion in various states and their share in total market arrivals in the state are given in Table 7. As evident, the strategic position of the markets has been changing specially during the price shock years.

Table 7: Major markets across major producing states

State	Market	Market Share (%)							
		2006/07-2015/16	Rank	2010-11	Rank	2013-14	Rank	2015-16	Rank
Maharashtra	Solapur	9.08	I	9.19	I	14.6	I	9.5	I
	Pune	8.39	II	7.14	III	9.0	II	7.5	II
	Lasalgaon	7.48	III	5.94	IV	7.4	III	5.0	VI
	Yeola	6.39	IV	5.30	VI	6.0	IV	4.7	VII
	Mumbai	6.08	V	8.14	II	4.0	IX	7.4	III
Karnataka	Bengaluru	66.32	I	67.22	I	70.9	I	67.1	I
	Hubli	11.63	II	12.54	II	10.9	II	12.3	II
	Belgaum	7.04	III	4.12	III	6.1	III	7.2	III
	Hassan	2.90	IV	3.97	IV	3.4	IV	3.1	IV
	Mysore	2.69	V	2.58	VI	1.5	VII	1.6	VIII
Gujarat	Gondal	18.58	I	8.90	IV	32.4	I	8.1	V
	Mahuva	18.19	II	33.90	I	25.5	II	-	-
	Bhavnagar	14.81	III	17.33	II	12.4	III	13.3	II
	Ahmedabad	12.02	IV	14.94	III	11.3	IV	11.5	III
	Mahuva (Station Road)	11.51	V	-	-	1.0	XI	35.6	I
Madhya Pradesh	Indore (F&V)	34.99	I	40.01	I	27.6	II	33.3	I
	Shujalpur	23.47	II	2.47	IV	37.7	I	20.9	II
	Sagar	6.20	III	6.29	III	8.0	III	-	
	Indore	5.02	IV	-		-		-	
	Ujjain	4.07	V	8.60	II	5.2	IV	-	

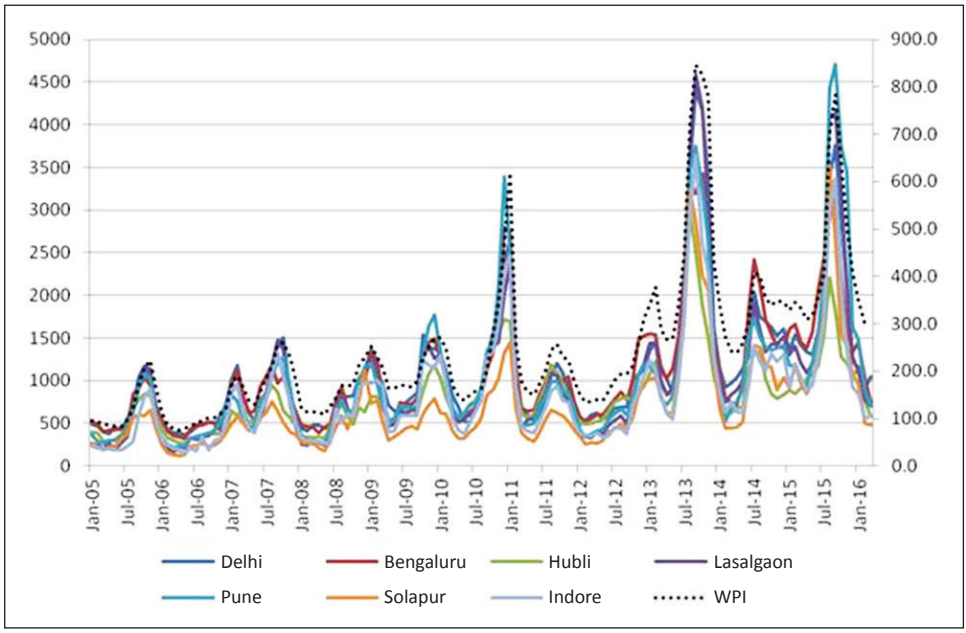
Source: Computed based on Agmarknet data.

5.1 Price Movements in Onion Prices

The onion price behaviour at aggregate level can be depicted from the WPI computed and published by the Office of Economic Advisor, Ministry of Industry, GoI. The volatility in onion prices has been much more pronounced after 2009 with price spikes becoming bigger and more frequent. India faced three recursive extreme price shocks during last five years with crises occurring every alternate year, followed by situation of price falls (extreme in 2016). Onion WPI touched the highest value of 619 in January 2011. In 2013, the highest ever onion WPI was recorded in September. Year 2015 also led the WPI to jump to an index of 758, which was lower than the previous shocks.

As indicated in the previous sections, Maharashtra, Madhya Pradesh, Karnataka and Delhi are the major onion marketing states; the price signals are also likely to flow across these states and to the other states as well. Figure 15 provides the movement of prices in selected markets of Maharashtra, Karnataka and Madhya Pradesh along with the WPI onion as well as the export price of onion. It is observed that the prices move in a similar fashion exhibiting similar up and down swings in prices. Major peaks in the prices were noticed in 2010, 2013 and 2015, which were the onion price shock years.

Figure 15: Movement of onion prices in selected markets
(Prices (Rs/q) on primary vertical axis and WPI on secondary vertical axis)



Source: Agmarknet and office of the Economic Advisor.

1. Prices in major onion markets, including the WPI, exhibit similar movements.
2. Onion prices in Bengaluru market remain at a higher level as compared to other markets probably due to trading of locally superior and export oriented varieties like Bangalore rose onions.
3. The prices in Solapur market remain at a lower level as compared to the prices in other selected markets.
4. As obvious, the export prices of onion remained higher than the prices prevailing in domestic markets.
5. Export prices usually followed/attained their peaks with one month lag of the peaks in domestic prices indicating that price spikes originate in domestic market and not in overseas market.

To establish the relationship between important onion markets, WPI and export price, we have computed correlation between the changes in monthly prices of onion. Table 8 reveals a high, positive and significant correlation coefficients stating that prices in selected markets are highly correlated with each other.

Table 8: Zero order correlation matrix for correlation in onion prices

	Delhi	Bengaluru	Hubli	Lasalgaon	Pune	Solapur	Indore	WPI
Delhi	1.000							
Bengaluru	0.805	1.000						
Hubli	0.700	0.769	1.000					
Lasalgaon	0.943	0.808	0.760	1.000				
Pune	0.858	0.824	0.772	0.889	1.000			
Solapur	0.729	0.689	0.849	0.799	0.801	1.000		
Indore	0.904	0.767	0.747	0.910	0.865	0.766	1.000	
WPI	0.928	0.813	0.706	0.901	0.835	0.743	0.871	1.000

Source: Authors' computations.

Note: All coefficients are significant at 1 per cent level.

5.2 Cointegration and Causality in Onion Prices

Cointegration Analysis: As Lasalgaon is the largest onion market in the country, two-step Engle-Granger method was used to check the cointegration between Lasalgaon and other domestic markets, exports and WPI. The cointegration equations were estimated using OLS and the residuals from the estimation were examined. The variables are considered co-integrated if the residuals generated from the equations are found to be

stationary. The following equations provide the estimates obtained from OLS equations.

ln L =	-1.61	+	1.21 ln D
	(0.000)		(0.000)
ln D =	1.75	+	0.76 ln L
	(0.000)		(0.000)
ln L =	-1.58	+	1.20 ln B
	(0.000)		(0.000)
ln B =	1.84	+	0.748 ln L
	(0.000)		(0.000)
ln L =	-2.15	+	1.33 ln H
	(0.000)		(0.000)
ln H =	2.21	+	0.65 ln L
	(0.000)		(0.000)
ln L =	-0.37	+	1.05 ln P
	(0.006)		(0.000)
ln P =	0.63	+	0.90 ln L
	(0.000)		(0.000)
ln L =	0.28	+	1.00 ln S
	(0.103)		(0.000)
ln S =	0.29	+	0.90 ln L
	(0.081)		(0.000)

where, ln L = log value of Lasalgaon prices;

ln D = log value of Delhi prices;

ln B= log value of Bengaluru prices;

ln H= log value of Hubli prices;

ln P= log value of Pune prices;

ln S= log value of Solapur prices

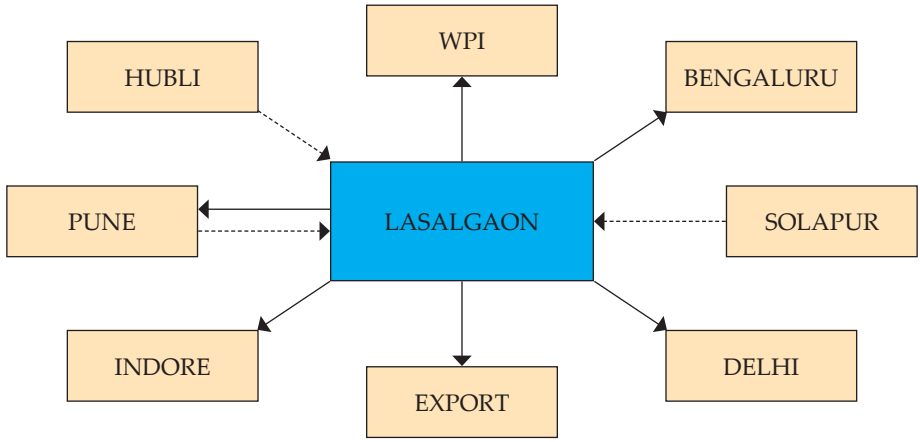
(Figures in parentheses indicate the probability value)

The residuals from the above equations were checked for stationarity using ADF unit root test and these were found stationary at level. Thus, Lasalgaon and all other market prices were cointegrated with each other.

Causality between the Export Prices and the Domestic Prices: Figure 16 presents the causal relation between prices in Lasalgaon and other

markets. Lasalgaon prices Granger cause prices in all the markets except Hubli and Solapur. In terms of arrival, Solapur receives higher quantity as compared to Lasalgaon, thus, Solapur market Granger causes the prices in Lasalgaon, while the reverse is not found true. Also, prices in Hubli, Pune and Solapur Granger cause Lasalgaon, while prices in Bengaluru and Delhi do not cause prices in Lasalgaon. Thus, Lasalgaon shares bidirectional causal relationship with Pune only. Lasalgaon Granger causes WPI.

Figure 16: Transmission of price signals between the producing market (Lasalgaon) and other markets



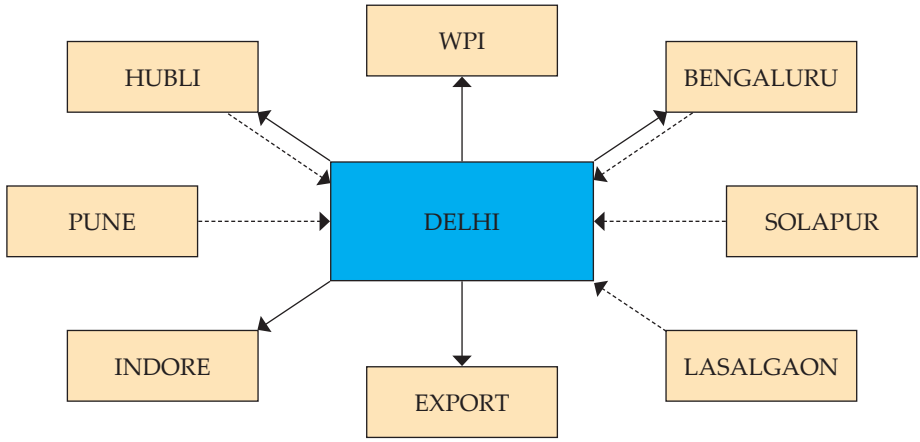
Drawn based on the probability level of below 0.05

Null Hypothesis	F-Statistic	Probability Value
Lasalgaon does not Granger cause Bengaluru	3.813	0.025
Lasalgaon does not Granger cause Delhi	10.748	0.000
Lasalgaon does not Granger cause Hubli	2.206	0.115
Lasalgaon does not Granger cause Pune	3.335	0.039
Lasalgaon does not Granger cause Solapur	2.581	0.080
Lasalgaon does not Granger cause WPI	8.878	0.000
Lasalgaon does not Granger cause Indore	19.352	0.000
Lasalgaon does not Granger cause Export price	38.920	0.000
Delhi does not Granger cause Lasalgaon	2.969	0.055
Hubli does not Granger cause Lasalgaon	6.447	0.002
Pune does not Granger cause Lasalgaon	17.565	0.000
Solapur does not Granger cause Lasalgaon	6.073	0.003
Export price does not Granger cause Lasalgaon	0.231	0.794
Indore does not Granger cause Lasalgaon	2.230	0.110
Bengaluru does not Granger cause Lasalgaon	2.119	0.125

Source: Authors' computations.

Figure 17 shows the causal relationship between prices in Delhi and other markets. Delhi, being a consuming market, is affected by the price changes emanating from other markets. Prices in Delhi Granger cause prices in Bengaluru, Hubli and WPI. It does not Granger cause prices in Lasalgaon, Pune and Solapur. However, prices in all the other markets Granger cause prices in Delhi. Delhi shares bidirectional causal relationship with Bengaluru and Hubli. Delhi Granger causes WPI.

Figure 17: Transmission of price signals between the consuming market (Delhi) and other markets



Drawn based on the probability level of below 0.05

Null Hypothesis	F-Statistic	Probability Value
Delhi does not Granger cause Bengaluru	4.713	0.011
Delhi does not Granger cause Hubli	3.273	0.041
Delhi does not Granger cause Lasalgaon	2.969	0.055
Delhi does not Granger cause Pune	0.734	0.482
Delhi does not Granger cause Solapur	1.581	0.210
Delhi does not Granger cause WPI	6.894	0.002
Delhi does not Granger cause Indore	7.552	0.000
Delhi does not Granger cause Export price	30.332	0.000
Bengaluru does not Granger cause Delhi	8.315	0.000
Hubli does not Granger cause Delhi	17.538	0.000
Lasalgaon does not Granger cause Delhi	10.748	0.000
Pune does not Granger cause Delhi	15.742	0.000
Solapur does not Granger cause Delhi	23.018	0.000
Indore does not Granger cause Delhi	2.131	0.120
Export price does not Granger cause Delhi	1.031	0.360

Source: Authors' computations.

Indore is affected by the prices in all other markets; whereas, it does not affect the prices in other markets except Solapur. Export prices neither Granger cause prices in any of the domestic markets nor WPI. However, prices in all the markets Granger cause export prices. So, there is unidirectional causal relationship between export prices and domestic market prices wherein, causality runs from domestic market prices towards export prices but not vice-versa. This is quite logical that if domestic prices are high, the traders will export only when sufficiently large margins are available over the domestic prices. Further, the Government would announce a relatively higher MEP to discourage the exports, so if some quantity is exported to meet the commitments, that would obviously be at the higher price.

5.3 Price Transmission between Lasalgaon and other Markets: ECM based Evidences

The coefficient of error correction term denotes the speed of adjustment; the higher the speed of adjustment, the higher is the chance of correction of any disequilibrium caused due to change in any phenomenon. It is observed that when Lasalgaon is considered to be dependent on other markets, the speed of adjustment is very low in general in Lasalgaon. This is probably due to the reason that only one way transaction exists between the markets i.e. Lasalgaon only supplies the produce to the other markets. However, in some cases, especially Solapur and Hubli, the speed of adjustment is found to be higher in Lasagaon. As Solapur is the nearby secondary market of onion, the stored quantity might be released due to which faster error correction mechanism takes place. The speed of adjustment is found to be highest (49 per cent) when the prices in Pune are affected by the prices in Lasalgaon. The speed of adjustment is very low (10 per cent), for prices in Lasalgaon to get adjusted to changes in prices in Delhi.

$$\Delta lnLasalgaon_t = -0.102\ ECT_{t-1} + 0.227 \sum \Delta lnDelhi_{t-1} + 0.279 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnDelhi_t = -0.607\ ECT_{t-1} + 0.056 \sum \Delta lnLasalgaon_{t-1} + 0.388 \sum \Delta lnDelhi_{t-1}$$

$$\Delta lnLasalgaon_t = -0.205\ ECT_{t-1} + 0.174 \sum \Delta lnBangalore_{t-1} + 0.319 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnBangalore_t = -0.414\ ECT_{t-1} + 0.026 \sum \Delta lnLasalgaon_{t-1} + 0.421 \sum \Delta lnBangalore_{t-1}$$

$$\Delta lnLasalgaon_t = -0.347\ ECT_{t-1} + 0.310 \sum \Delta lnHubli_{t-1} + 0.280 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnHubli_t = -0.111\ ECT_{t-1} + 0.119 \sum \Delta lnLasalgaon_{t-1} + 0.317 \sum \Delta lnHubli_{t-1}$$

$$\Delta lnLasalgaon_t = -0.124\ ECT_{t-1} + 0.919 \sum \Delta lnPune_{t-1} - 0.356 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnPune_t = -0.496\ ECT_{t-1} - 0.390 \sum \Delta lnLasalgaon_{t-1} + 0.965 \sum \Delta lnPune_{t-1}$$

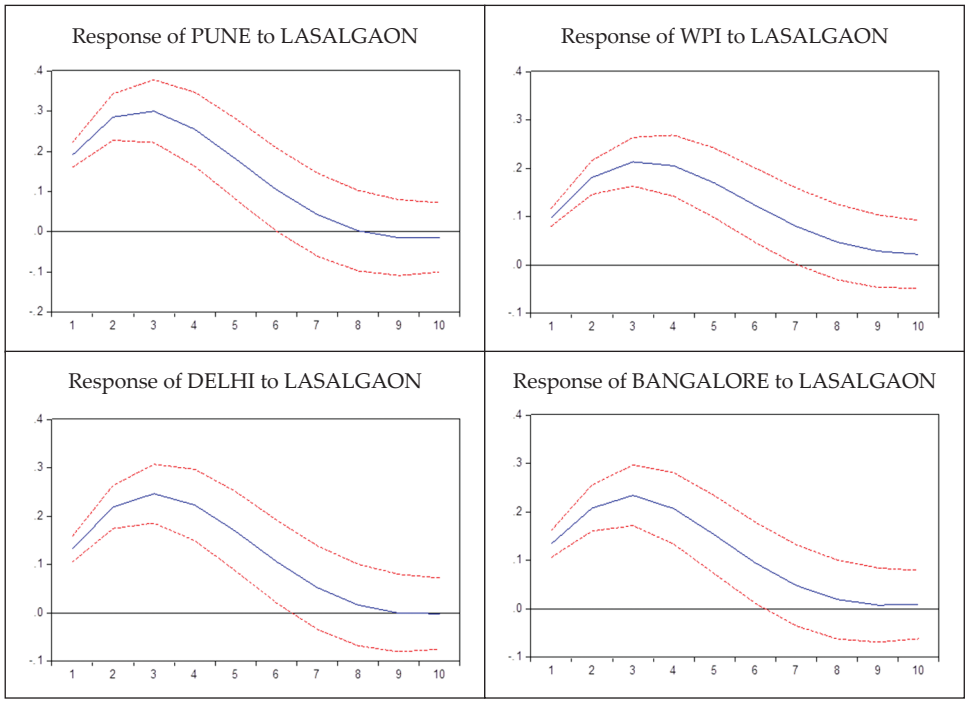
$$\Delta lnLasalgaon_t = -0.473\ ECT_{t-1} + 0.050 \sum \Delta lnSolapur_{t-1} + 0.419 \sum \Delta lnLasalgaon_{t-1}$$

$$\Delta lnSolapur_t = -0.127\ ECT_{t-1} + 0.211 \sum \Delta lnLasalgaon_{t-1} + 0.240 \sum \Delta lnSolapur_{t-1}$$

5.4 Impact of Price Shocks

Figure 18 shows the results of impulse response functions which describe how and to what extent a standard deviation shock in one of the onion market (Lasalgaon) affects the current as well as future prices in all the integrated markets over a period of ten months. It is observed that when a standard deviation shock is given to Lasalgaon market, an immediate and a high response was noticed in almost all markets between second and fourth month, reaching a peak in the third month. After fourth month, the response starts to decline and reaches negative in case of Bengaluru, Delhi and Pune. The increase and decline were steeper in case of Pune market.

Figure 18: Response of other markets to change in price in Lasalgaon market



Source: Authors' computations.

This shows that if a shock is arising in Lasalgaon market it gets transmitted to all other markets with a higher response in the approaching months, thus exhibiting a dominance of Lasalgaon market in onion price determination in the country. The response was found to be higher in case of Pune market.

Chapter 6

Dissecting the Onion Price Shocks

It is important to understand the production-arrival linkages along with price dynamics to understand the recurring price shocks in the country. As evident, the YoY growth in onion production reveals that previous year's growth plays a determining role during the price shock year. This becomes evident from close examination of the sequence of change in production, market arrival and prices during the crisis year and in the year preceding the price crisis. This is examined by using the evidence from the state of Maharashtra (Table 9).

Table 9: Trends in production, arrival and prices of onion in Maharashtra

Year	Production (Th tons)	Arrival (Th tons)	Price (Rs/ton)	Change in Production (%)	Change in Arrival (%)	Change in Price (%)
2005-06	2469	2321	396			
2006-07	2812	2417	537	13.9	4.1	35.6
2007-08	2713	2985	564	-3.5	23.5	5.0
2008-09	3933	2719	734	44.9	-8.9	30.1
2009-10	3146	4113	860	-20.0	51.3	17.2
2010-11	4905	3405	1051	55.9	-17.2	22.2
2011-12	5638	3308	594	14.9	-2.8	-43.5
2012-13	4660	3702	878	-17.3	11.9	47.8
2013-14	5864	3108	1489	25.8	-16.1	69.6
2014-15	5362	3548	1333	-8.6	14.2	-10.5
2015-16	6529	3132	1382	21.8	-11.7	3.7
2016-17	-	5603	660	-	78.9	-52.2

Source: Authors' computations based on NHRDF and Agmarknet data.

6.1 Production-Price Linkages in Maharashtra

A very strong and close association is seen between the production in year 't' and market arrivals in the year 't+1'. During the last 12 years from 2005-06 to 2016-17, production of onion witnessed decline in four years followed by a decline in the martket arrivals in the subsequent year in each

case. The next change was seen in domestic prices. In year 2007-08, the production declined by about 4 per cent leading to decline in arrivals in 2008-09 by about 9 per cent. This sequence got repeated in the years 2009-10, 2012-13 and 2014-15, where production decline of about 20, 17 and 9 per cent led to 17, 16 and 12 per cent decline in arrivals, respectively. The discussion with traders and farmers revealed that production decline not only resulted in the decline in market arrivals but also in the quality as the production shock resulted mainly due to untimely rains and thunderstorms. This further affected the sto*rabi*lity of *rabi* onion and reduced the shelf life of the crop. Corresponding to this, prices increased exorbitantly by around 70 per cent in Maharashtra in 2013. Similarly, an aggregate price increase of 4 per cent at the state level was observed in 2015. However, the disaggregate impacts were much higher.

Nashik division is the major cluster producing *rabi* onion in Maharashtra. Nashik, Ahmednagar, Dhulia, Jalgaon and Nandurgaon are major producing districts in the Nashik division. This cluster is the most important *rabi* producing onion cluster in the country and the shocks are triggered by the climate and production uncertainties in the region. Lasalgaon, Yeola and Pimpalgaon are the most important primary onion markets receiving arrival only from the onion producers. On the other hand, Solapur, Mumbai and Pune are the major secondary onion markets in the state.

An extreme situation of price fall was observed in 2016-17, where prices declined by about 52 per cent creating disastrous situation for onion farmers of the region. The farmers lost on two counts: a) the loss in revenue resulted from extreme price fall b) the loss of revenue from the competitive crop as area was shifted from other seasonal crops.

6.2 2013 Price Shocks: Sequence of Events and Triggers

This sequence of fall in production leading to decline in market arrivals and thus inducing increase in prices can be generalised as it happened in all the four years out of last 12 years. This implies that any timely signal about decline in production or signal emanating from market arrivals and initial change in price can be used as early warning for the likely shocks in prices.

Arrivals in 2013, in general, presented a dismal scenario since the start of the year, which resulted from 4 per cent decline in all India and close to 17 per cent decline in Maharashtra onion production in 2012-13. As established earlier, previous year's production shortages are evidenced in next year market crisis. Karnataka also witnessed the production shortage during 2011-12 and 2012-13. Maharashtra markets provided a clear indication of decline as early as April and May in 2013. Similarly,

Karnataka markets experienced a decline throughout starting of the year except April. Crisis was intense in Lasalgaon, Solapur and Pune from August onwards with varying intensity. Solapur was supplied larger quantity October onwards; however, the arrival crisis continued during the year in Lasalgaon. As a result of arrival crisis, the price crisis was clearly evident since the start of the year, and prices were much higher in almost all the markets as compared to the same month previous year (Table 10).

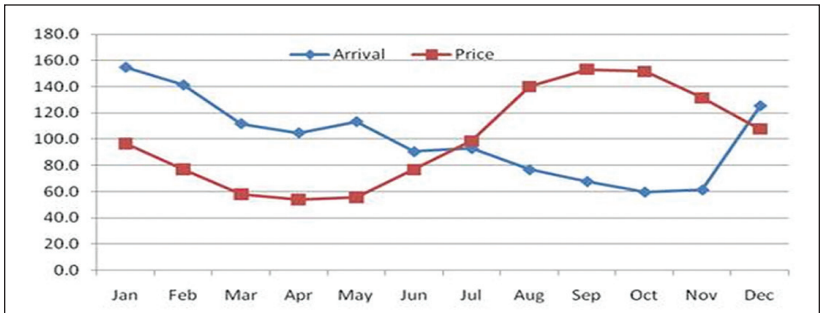
Table 10: Deviations in arrival and prices of onion during the price shock years for the major markets

Market	Item	Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lasalgaon	Arrival (Th tons)	2010	30.6	35.9	23.1	14.3	16.4	13.5	26.4	22.1	18.8	13.6	18.7	18.6
		2011	20.1	26.2	31.6	20.9	18.0	18.2	18.4	14.6	12.4	16.2	16.5	21.4
		2013	49.9	39.4	26.1	27.7	27.5	21.6	18.9	13.3	7.5	4.2	17.5	34.4
		2015	45.1	55.7	49.5	35.1	40.0	35.2	23.2	6.1	3.5	3.1	17.9	43.8
	Price (Rs/ kg)	2010	13.11	10	6.26	5.15	5.52	5.99	6.51	8.59	13.53	13.93	14.52	20.11
		2011	23.79	8.29	4.3	5.48	5.49	7.25	8.43	10.84	10.56	8.44	7.63	5.75
		2013	14.41	14.36	9.92	8.38	9.12	13.85	21.02	36.94	45.93	41.97	29.83	13.35
		2015	13.01	14.04	12.06	10.93	11.98	15.54	21.18	41.24	41.3	32.48	21.34	12.8
Solapur	Arrival (Th tons)	2010	61.8	35.4	32.9	36.0	29.5	20.0	17.3	15.7	10.2	14.9	25.2	32.1
		2011	37.5	31.0	36.8	28.2	24.6	22.6	14.4	12.0	13.4	10.4	34.0	71.9
		2013	69.6	34.4	24.9	21.5	16.7	9.6	8.9	5.7	4.8	30.2	62.9	85.5
		2015	67.2	25.9	33.2	30.5	26.4	18.1	15.3	7.6	14.9	50.8	65.3	61.1
	Price (Rs/ kg)	2010	6.28	6.08	4.1	3.18	3.19	4.03	4.59	5.66	8.31	8.93	10.3	13.22
		2011	14.49	6.64	3.89	3.25	2.86	4.04	5.42	6.51	6.23	5.89	5.18	4.19
		2013	10.13	10.37	8.21	6.11	6.29	11.02	18.2	32.42	28.7	22.32	20.68	12.22
		2015	9.18	11.93	9.65	8.48	9.77	13.13	17.98	35.2	26.55	15.45	14	10.69
Bengaluru	Arrival (Th tons)	2010	42.4	31.7	36.9	40.5	39.6	36.3	37.6	44.0	60.8	106.0	66.2	66.2
		2011	37.6	36.8	39.8	37.3	37.2	36.9	35.0	41.5	71.4	111.5	97.0	70.7
		2013	42.6	35.1	37.8	37.8	38.4	33.7	34.9	51.1	128.9	163.9	71.0	62.8
		2015	58.4	40.6	44.4	46.9	42.0	48.6	50.6	56.2	119.5	161.2	107.2	51.3
	Price (Rs/ kg)	2010	12.67	10.11	6.61	5.45	5.64	6.3	6.89	8.03	11.45	13.18	17.18	28.02
		2011	27.31	11.86	6.83	6.45	6.61	8.47	9.79	11.83	10.95	9.81	10.48	7.54
		2013	15.51	15.37	11.23	10.26	11.49	15.17	22.41	33.19	31.96	34.3	27.09	15.04
		2015	16.02	16.62	14.5	13.85	15.67	20.68	24.32	29.28	31.4	22.15	16.18	13.43
Delhi	Arrival (Th tons)	2010	18.6	21.2	27.1	35.1	31.2	36.8	34.0	30.1	29.5	22.3	30.4	34.6
		2011	21.0	21.7	29.8	26.1	31.9	35.3	29.4	26.2	29.1	25.1	37.0	43.3
		2013	32.5	26.1	32.2	35.4	35.4	32.5	29.8	22.9	20.2	19.0	27.8	29.9
		2015	25.0	22.8	29.0	30.3	32.5	28.8	29.3	22.2	26.1	27.2	28.6	25.5
	Price (Rs/ kg)	2010	13.31	11.09	8.2	6.94	5.24	5.07	6.72	8.46	12.94	15.49	18.42	23.88
		2011	26.57	10.39	6.77	6.05	5.4	5.76	8.18	10.69	12.01	10.96	8.99	6.11
		2013	13.51	14.64	11.55	10.13	8.6	11.72	19.9	35.1	44.07	41.59	33.95	16.32
		2015	13.53	15.42	14.13	13.35	13.09	15.69	18.8	33.81	37.63	29.13	20.9	12.23

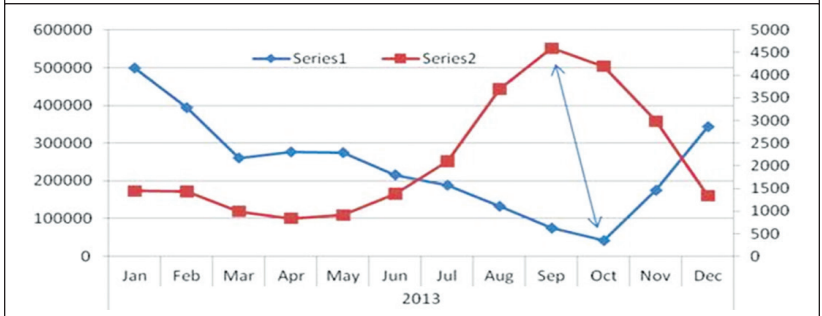
Source: NHRDF.

Onion arrivals went down to the lower level of 50000 quintals during October 2013. There were clear signals in the markets as early as in May 2013 that arrivals were significantly lower as compared to the previous year. The gap started burgeoning further. Arrivals in September and October 2013 were just 36 and 13 per cent of the previous year's (2012) arrival for the same months. One such dip was also noticed in November 2014, but fortunately, it was controlled. The long term price patterns indicate that onion prices attain their peaks during September and October months and remain lowest during March to May (Figure 19). The inverse price-arrival relationship is quite obvious; however, prices attain their maxima before arrivals attain their minima.

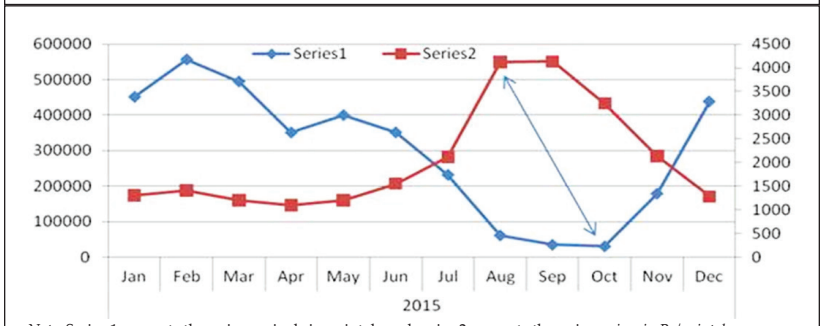
Figure 19: Seasonality in prices and arrival of onion in Lasalgaon (2005-15)



Note: Figures are seasonal indices for onion arrivals and prices.



Note: Series 1 presents the onion arrivals in quintals and series 2 presents the onion *prices in Rs/quintal*



Note: Series 1 presents the onion arrivals in quintals and series 2 presents the onion *prices in Rs/quintal*

Source: Authors' computations based on NHRDF data.

6.3 2015 Price Shocks: Sequence of Events and Triggers

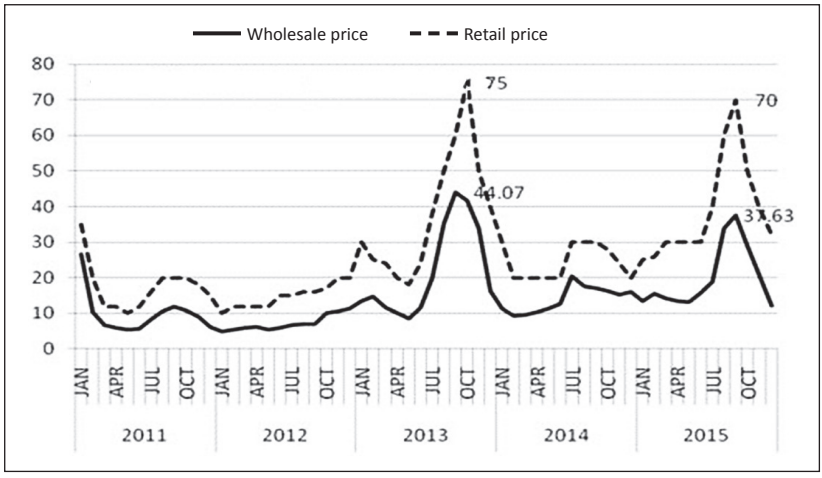
In 2015, the largest arrival receiving market of Solapur witnessed a decline since the start of the year. However, no such signals were available in Lasalgaon market. Karnataka markets also experienced a decline during initial months of 2015. As the markets are found to be highly cointegrated, the prices rose throughout the country. There was 70 per cent increase in average price of Maharashtra during 2013-14.

During 2015, arrivals till June were much ahead as compared to previous year's arrival during the same months. A slight decline of 0.7 per cent came to the notice in July 2015 and suddenly the produce did not reach the markets due to shortage. Arrivals in August 2015 were 75 per cent less than August 2014 and just 26 per cent of the arrivals in July 2015. The arrivals in September and October were just 12 and 20 per cent of the previous year's arrival. The gap between arrival and prices widened; the prices behaved according to the arrivals. Based on the experience of 2013, the arrivals reached below the level of 500 tonnes per day during August and September 2015. However, due to government intervention in terms of announcing higher MEP and import arrangements, the prices started falling after attaining the peak level in August 2015.

6.4 Crisis Intensification

The crisis further intensifies when we examine the margin over wholesale prices earned by the retailers (Figure 20). It may be noticed that retailers' margins were maximum during the shock situations.

Figure 20: Market margin between onion wholesale and retail prices in Delhi market (Rs/kg)



Source: Wholesale price from NHRDF and retail price from Ministry of Consumer Affairs.

The situation became awful for the consumers as they were further oppressed by the market dynamics and bore the brunt of market cartelization and private trade. Such situations need to be properly examined beforehand and controlled with suitable price stabilisation options.

6.5 Variance Decomposition in Onion Prices across Markets

As revealed that the shocks generate from the primary onion markets and spread throughout the markets in the country, the variance decomposition technique was applied for examining the price changes in other markets caused due to changes in Lasalgaon prices. As Delhi is a major consuming and distributing market, the time series onion wholesale price data were standardized by dividing with the Delhi wholesale price of onion (Table 11). After standardization, the series became stationary at the level. It can be observed that Lasalgaon is the major influencing market for all the selected markets. As markets are co-integrated, the price signals are transmitted slowly to other markets as well. In case of Lasalgaon market, Lasalgaon prices are influenced by the changes in its own price. This seems to be very logical as Lasalgaon is the biggest primary market of onion and does not receive produce from any other markets. Thus, only the changes on supply front in the surrounding producing clusters will bring the change in Lasalgaon.

Lasalgaon has been a major change agent in causing variation in other markets too, mainly in Pune, Solapur and Indore markets. Lasalgaon is located at the distance of 200-400 kms from these markets, so the physical movement of onion can easily take place between Lasalgaon and these markets. The long run impact of Lasalgaon in Indore has been quite significant. Hubli is the only market which seems to be least affected by its own price changes. Hubli dominates in terms of supply of *kharif* onions. *Kharif* onions comprise of more than 60 per cent of total long term annual arrivals of Hubli. Therefore, it has to maintain linkages with markets which can supply *rabi* onions and meet the consumption requirements throughout the year.

Table 11: Variance decomposition in onion prices for selected markets of India

Variance Decomposition	Markets	Periods (months)											
		1	2	3	4	5	6	7	8	9	10	11	12
Lasalgaon	S.E.	0.13	0.16	0.18	0.18	0.19	0.19	0.20	0.20	0.20	0.20	0.20	0.20
	Lasalgaon	100.0	97.8	89.8	87.6	85.0	80.5	77.0	75.8	75.2	74.5	74.0	73.7
	Bengaluru	0.0	0.0	0.1	0.3	0.5	2.8	4.9	5.3	5.3	5.3	5.2	5.2
	Solapur	0.0	0.0	0.7	2.2	2.9	2.8	2.6	2.6	2.6	2.6	2.6	2.6
	Indore	0.0	0.7	5.2	5.1	5.0	4.8	4.7	4.6	4.6	4.6	4.5	4.5
	Pune	0.0	1.4	3.9	3.7	5.4	7.7	8.4	8.5	8.8	9.3	9.7	10.0
	Hubli	0.0	0.2	0.3	1.1	1.2	1.5	2.4	3.2	3.6	3.7	3.8	3.9
Bengaluru	S.E.	0.14	0.17	0.18	0.18	0.19	0.20	0.20	0.20	0.20	0.20	0.20	0.21
	Lasalgaon	24.4	18.7	17.4	19.2	18.7	17.2	16.7	16.8	16.9	16.9	16.9	17.0
	Bengaluru	75.6	80.4	76.2	73.4	67.5	61.5	60.3	60.1	59.9	59.8	59.7	59.6
	Solapur	0.0	0.1	0.4	0.6	2.0	4.0	4.3	4.3	4.3	4.2	4.2	4.2
	Indore	0.0	0.5	5.5	5.3	6.4	8.8	9.5	9.6	9.6	9.6	9.5	9.5
	Pune	0.0	0.0	0.2	0.5	4.1	7.4	8.0	8.0	8.1	8.1	8.1	8.1
	Hubli	0.0	0.3	0.3	1.0	1.3	1.2	1.2	1.2	1.3	1.4	1.5	1.5
Solapur	S.E.	0.11	0.14	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.17
	Lasalgaon	30.1	29.6	26.1	25.6	25.2	24.1	23.1	22.6	22.3	22.3	22.2	22.1
	Bengaluru	11.5	18.7	18.9	18.5	18.8	18.0	18.1	19.0	19.2	19.1	19.0	18.9
	Solapur	58.4	49.8	46.3	45.5	44.9	43.2	41.5	40.4	40.0	39.8	39.6	39.4
	Indore	0.0	1.4	6.8	7.1	7.1	7.1	6.9	6.7	6.8	6.8	6.9	6.8
	Pune	0.0	0.2	0.5	1.2	2.0	5.4	7.8	8.3	8.6	8.8	9.2	9.5
	Hubli	0.0	0.2	1.5	2.0	2.0	2.2	2.6	3.0	3.1	3.2	3.2	3.2
Indore	S.E.	0.11	0.13	0.14	0.15	0.16	0.16	0.16	0.16	0.17	0.17	0.17	0.17
	Lasalgaon	33.4	43.4	47.7	47.9	48.8	48.9	48.7	48.6	48.5	48.5	48.4	48.3
	Bengaluru	0.6	2.7	3.0	3.3	3.8	3.7	4.4	5.1	5.2	5.2	5.2	5.2
	Solapur	0.0	1.3	1.1	2.5	2.7	2.6	2.5	2.5	2.6	2.6	2.6	2.6
	Indore	66.0	51.5	44.6	40.4	37.5	35.8	34.9	34.3	34.1	34.0	34.0	33.9
	Pune	0.0	0.8	3.1	3.6	3.4	4.9	5.5	5.5	5.6	5.7	5.9	6.0
	Hubli	0.0	0.2	0.5	2.3	3.7	4.1	4.0	4.0	3.9	3.9	3.9	4.0
Pune	S.E.	0.15	0.19	0.21	0.21	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.23
	Lasalgaon	47.5	44.0	40.5	38.2	38.2	37.2	36.1	35.8	35.8	35.6	35.5	35.5
	Bengaluru	4.7	2.9	4.8	6.9	6.9	8.1	10.5	11.1	11.1	11.2	11.2	11.1
	Solapur	4.3	3.4	3.0	4.2	4.5	4.4	4.2	4.2	4.2	4.3	4.3	4.3
	Indore	0.0	1.3	3.4	3.5	3.8	4.4	4.4	4.5	4.5	4.6	4.7	4.8
	Pune	43.4	48.5	48.3	46.5	45.4	44.6	43.3	43.0	42.9	42.9	42.8	42.8
	Hubli	0.0	0.0	0.0	0.8	1.3	1.2	1.4	1.5	1.5	1.5	1.5	1.5
Hubli	S.E.	0.13	0.16	0.17	0.18	0.19	0.19	0.20	0.20	0.20	0.21	0.21	0.21
	Lasalgaon	27.1	21.9	18.7	18.4	18.1	17.6	17.2	16.9	16.6	16.6	16.8	17.2
	Bengaluru	27.7	27.9	26.0	23.8	22.7	21.7	21.2	20.9	21.0	21.1	21.1	20.9
	Solapur	4.0	2.8	3.1	3.7	4.5	5.4	5.8	5.7	5.6	5.4	5.3	5.3
	Indore	1.9	4.6	7.5	7.1	7.2	9.1	10.4	11.0	10.8	10.5	10.2	10.0
	Pune	0.2	0.1	0.2	0.3	0.7	1.0	1.0	2.1	3.9	5.3	6.1	6.5
	Hubli	39.0	42.7	44.5	46.7	46.8	45.2	44.3	43.3	42.2	41.1	40.4	40.0

Source: Authors' computations.

Note: S.E. is the standard error.

Chapter 7

Conclusions and Implications

7.1 Major Conclusions

Onion price shocks in the country are largely caused by the fluctuations in production and changes in nature of demand. Onion has become an almost indispensable part of the Indian diet and it is consumed throughout the year in almost all households. After 2002-03, the onion area, production and productivity witnessed exponential growth. In ten years following 2002-03, onion productivity increased by about 60 per cent which induced area shift in favour of onion. The increase in area turned out to be much higher (more than double) in 10 years period. As a result, onion production tripled in less than 10 years since 2002-03. Alongwith this, year to year fluctuations in the production of onion also increased sharply. Maharashtra accounted for 34 per cent of the onion area and 29 per cent of the onion production in the country in TE 2014-15. Onion area witnessed very high growth from TE 2006-07 to TE 2014-15 in Bihar, Madhya Pradesh and Maharashtra, which resulted in very high growth in onion production during the above period.

Despite strong growth in domestic demand, India remains a significant player in the global onion market. The share of India in world export of onion and shallots (HS code 070310) has fluctuated between 10 and 15 per cent during 2005-2015. Much of the export takes place during March to August coinciding with the arrival of *rabi* crop, which has good export potential. Because of its price sensitivity, onion is subject to frequent changes in trade policy. An examination of the onion prices and policy in recent years clearly brings out that domestic supply management needs to follow advance and well thought out plan in response to the signals given by relevant organizations to check price spikes. The export policy relies heavily on the tool of MEP to curb the onion price inflation. Subsequent to the extreme price spikes during 2013-15, higher MEPs were imposed on onion which yielded expected response in domestic prices. Imposition of higher MEP in November 2013, July 2014 and June 2015 were able to lower the onion WPI in subsequent months i.e. December 2013, August 2014 and July 2015.

The YoY growth in production reveals that growth in output during the year preceding price shocks plays a determining role in price spikes.

This becomes evident from close examination of the sequence of change in production, market arrival and prices during the crisis year and in the year preceding the price crisis for the state of Maharashtra. A very strong and significant association is seen between the production in a given year and market arrivals in the state in the next year. During the last 12 years period from 2005-06 to 2016-17, production of onion witnessed decline in four years, followed by a decline in the market arrivals in the subsequent year in each case. This was followed by change in domestic prices. In year 2007-08, the production declined by about 4 per cent leading to decline in arrivals in 2008-09 by about 9 per cent. This sequence got repeated in the same way in years 2009-10, 2012-13 and 2014-15, where production decline of about 20, 17 and 9 per cent led to 17, 16 and 12 per cent decline in arrivals, respectively. Corresponding to this, onion prices in Maharashtra increased exorbitantly, by around 70 per cent in 2013. Similarly, an aggregate price increase of 4 per cent at the state level was observed in 2015. However, the disaggregate impacts were much higher. This sequence of fall in the production leading to decline in market arrivals and thus inducing increase in the prices can be generalised to say that the signal for increase in price in a given year are available much in advance from the decline in production in previous year. Therefore, if a system is put in place to get reliable estimate of production soon after the harvest, then occurrence of price spikes can be known in advance.

Onion prices in Lasalgaon Granger cause prices in all the markets except Hubli and Solapur. In terms of arrival, Solapur receives larger arrival as compared to Lasalgaon, thus, Solapur market Granger causes the prices in Lasalgaon, while the reverse is not found true. Also, prices in Hubli, Pune and Solapur Granger cause Lasalgaon while prices Bengaluru and Delhi do not cause prices in Lasalgaon. So, Lasalgaon shares bidirectional causal relationship with Pune only. Lasalgaon Granger causes WPI. Delhi, being a consuming market, is affected by the price changes emanating from other markets. It is observed that when Lasalgaon is considered to be dependent on other markets, the speed of adjustment is very low in general in Lasalgaon. This is probably due to the reason that only one way transaction exists in the market i.e. Lasalgaon only supplies the produce to the other markets. When a standard deviation price shock is given to Lasalgaon market, an immediate and a high response was noticed in almost all markets between second and fourth month reaching a peak at third month. After fourth month, the response starts to decline and reaches negative in case of Bengaluru, Delhi and Pune.

The crisis originates in the primary onion markets and spreads throughout the country. The results of variance decomposition analysis

indicated that Lasalgaon is the major influencing market for all the selected markets. As markets are co-integrated, the price signals are transmitted slowly to other markets as well. In case of Lasalgaon market, Lasalgaon prices are influenced by the changes in its own price. This seems to be very logical as Lasalgaon is the biggest primary market of onion and does not receive produce from any other markets. Thus, only the changes on supply front in the surrounding producing clusters will bring the change in Lasalgaon. Lasalgaon has been a major change agent in causing variation in other markets, mainly in Pune, Solapur and Indore markets.

7.2 Price Stabilisation Options

Production Planning through Geographical Expansion through focus on Emerging Pockets: Onion has been traditionally and largely produced in the states of Maharashtra and Karnataka. States like Bihar and Madhya Pradesh are emerging as significant onion producers. The geographical diversification and distribution of the crop in new pockets should definitely help in minimising the impact of production fluctuations on price volatility and lower the concentration of onion production in small region.

Expanding/Adjusting Seasons: The interventions in terms of extending onion cultivation beyond present seasons may really be useful. If *rabi* season is delayed by an appropriate duration say one month along with early *kharif* varieties, it will be useful in managing July-September price crisis. Such options require technological interventions. The suitable varieties need to be developed for various agro-climatic conditions so that the seasonal span of the onion crop can be expanded or adjusted to have continuous supply in the markets.

Stocking and Distribution: If some advanced signals regarding the production deficit are available, the market intervention becomes the need of the hour. Stabilisation through stock by public sector parastatal like NAFED will also keep check on exploitation and market manipulation by private trade, besides price stabilization. It needs to be particularly ensured that usually *rabi* arrivals/stocks start drying up July onwards, which is reflected in burgeoning prices of onion July onwards.

There is need to increase the storage capacity at the grass roots level. Maharashtra government should effectively design and implement the subsidy schemes for storage of onion at farm level. There is need for effective procurement strategies by NAFED and other agencies particularly in case of crisis. NAFED procured 1500 tonnes of onion from Lasalgaon market in 2015, which may be treated as a good start; however, a lot needs to be done

to upscale this. Even other states, like Andhra Pradesh the government procured lot of onion in 2015 from Yeola market in Maharashtra. Such initiatives would be helpful in creating desired buffers and help in mitigating the price crisis.

Stabilisation through Trade: Price crisis is triggered by the shortfall in production in Maharashtra. Timely regulation of exports and export prices is also important to prevent/control the crisis. Further, the export policy, in terms of fixation of minimum export prices, needs to be guided by the objective framework. Trade is an appropriate tool to control the extreme situation. Facilitating exports during the price fall situation will help the farmers. We may rely on cheap imports from the neighbouring countries to meet the crisis situations. The public sector agency, like NAFED, has a crucial role in price stabilization through trade as well.

Market Surveillance: Markets are highly co-integrated with each other and thus prices are quickly transmitted from one market to the other. There should be constant monitoring of prices and market arrivals by some agency of Central government, which should also provide advance information to government about implications of production fluctuation on prices. This should be followed by appropriate and early action based on market intelligence to regulate trade like liberalising import, restriction on export and check on hoardings. The involved institutions have to make continuous efforts and keep an eye on the markets before a contingent situation is reached.

Proper use of Price Signals: Strong coordination and linkages are needed in the work of various ministries and departments in the relevant area. The Ministry of Agriculture should use new technological tools for early and advance estimates of production which should be quickly passed on to the NAFED, Ministry of Consumer Affairs and Ministry of Commerce (DGFT) for proper framing of the procurement plans and export policy. The Market Intelligence Unit located at the Directorate of Economics and Statistics, MoAFW, GoI, should issue the price advisories to producers considering the domestic and global production environment along with the trade environment. The cohesive efforts on part of various institutions would help in advance planning and proper supply management. The effect of shortfall in *rabi* production translates into price crisis around July/August and is converted into extreme situation around September/ October. Therefore, when early signals are available either from production estimates or decline in arrivals during April/May, special steps should be taken to expand the area under *kharif* onion. A window is available to prevent/bridge the crisis situation. As soon as early signals are available,

the information can be used to augment the domestic production and regulate exports. To strengthen the production activity, there is need to tie-up with state government departments for providing seedlings to the farmers timely for quality production.

Proper utilization of Price Stabilisation Fund: To mitigate hardships to consumers, a new central sector scheme with a corpus of "Price Stabilisation Fund" has been created for providing working capital and other incidental expenses for procurement and distribution of perishable horticultural commodities. The intervention intends to address the price volatility especially in horticultural commodities through procurement by State and Central agencies for maintenance of buffer stocks and release into the market. The scheme would be initially supporting onions and potatoes only to promote direct purchase from farmers/farmers' associations at farm gate/ mandi and to maintain strategic buffer stocks and discourage hoarding and unscrupulous speculation. The states should plan appropriate framework to optimally utilize this fund to minimise the price volatility.

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Annexure I

Onion export policy in recent years as seen from MEP and export bans

Year	Months	MEP (US$)	Date imposed	Export Policy relevant to	Nature of restriction
2011	February	—	10-Feb-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions) excluding cut, sliced or broken in powder form	Export ban
2011	February		11-Feb-11	Onion in (a) cut form (b) sliced form & (c) broken in powder form can be exported freely	Export free
2011	February		15-Feb-11	Bangalore rose onion and Krishnapuram onions excluding cut, sliced or broken in powder form	Export permitted under licence subject to MEP of US$ 1400 per metric ton
2011	February	600	18-Feb-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions) excluding cut, sliced or broken in powder form	Export permitted
2011	March	450	01-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 1400 continued for Bangalore rose onions and Krishnapuram onions
2011	March	350	08-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 1400 continued for Bangalore rose onions and Krishnapuram onions
2011	March	275	16-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 1400 continued for Bangalore rose onions and Krishnapuram onions
2011	March	225	23-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of Bangalore rose onions and Krishnapuram onions at US$ 600 per Metric Ton F.O.B.

Annexure-I : Continued

2011	March	170	31-Mar-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 600 continued for Bangalore rose onions and Krishnapuram onions
2011	May	—	16-May-11	—	MEP of Bangalore rose onions and Krishnapuram onions at US$ 350 per Metric Ton F.O.B.
2011	June	200	08-Jun-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 350 continued for Bangalore rose onions and Krishnapuram onions
2011	July	230	15-Jul-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 350 continued for Bangalore rose onions and Krishnapuram onions
2011	August	275	12-Aug-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of Bangalore rose onions and Krishnapuram onions at US$ 400 per Metric Ton F.O.B.
2011	August	300	24-Aug-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 400 continued for Bangalore rose onions and Krishnapuram onions
2011	September	475	07-Sep-11	Onion all varieties including Bangalore rose onion and Krishnapuram onions	—
2011	September	—	09-Sep-11	Onions all varieties	Export prohibited
2011	September	475	20-Sep-11	Onions all varieties (except cut, sliced or powder form)	Prohibition withdrawn and exports allowed through STEs, Exports of cut, sliced or powder form made free
2011	November	350	18-Nov-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US$ 400 per MT F.O.B for Bangalore rose and Krishnapuram onions
2011	November	250	28-Nov-11	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US$ 300 per MT F.O.B for Bangalore rose and Krishnapuram onions
2012	January	150	11-Jan-12	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US$ 250 per MT F.O.B for Bangalore rose and Krishnapuram onions

Annexure-I : Continued

2012	February	125	15-Feb-12	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore rose onions and Krishnapuram onions
2012	May	—	08-May-12	The export of onion is allowed without any MEP up to 2nd July 2012.	—
2012	June	—	29-Jun-12	The export of onion is allowed without any MEP	Exports through STEs
2013	August	650	14-Aug-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore rose onions and Krishnapuram onions
2013	September	900	19-Sep-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore rose onions and Krishnapuram onions
2013	November	1150	01-Nov-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore rose onions and Krishnapuram onions
2013	December	800	16-Dec-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore rose onions and Krishnapuram onions
2013	December	350	19-Dec-13	Onion all varieties (except Bangalore rose onion and Krishnapuram onions)	MEP of US $ 250 continued for Bangalore rose onions and Krishnapuram onions
2014	March	—	06-Mar-14	Onion all varieties	MEP removed till further orders
2014	March	—	12-Mar-14	Onion all varieties	Export of onion made free, not channelized through STEs
2014	June	300	17-Jun-14	Onion all varieties	—
2014	July	500	02-Jul-14	Onion all varieties	—
2014	August	300	21-Aug-14	Onion all varieties	—
2015	April	250	07-Apr-15	Onion all varieties	—

2015	June	425	26-Jun-15	Onion all varieties	—
2015	August	700	24-Aug-15	Onion all varieties	—
2015	December	400	11 Dec-15	Onion all varieties	—
2015	December	—	24-Dec-15	Onion all varieties	No MEP
2017	June		27-Jun-17		
2017	June		30-Jun-17		

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ICAR – NATIONAL INSTITUTE OF AGRICULTURAL ECONOMICS AND POLICY RESEARCH

(Indian Council of Agricultural Research)

Dev Prakash Shastri Marg, Pusa, New Delhi-110 012, INDIA

Phone : 91-11-25847628, 25848731, Fax : 91-11-25842684 E-mail : director.niap@icar.gov.in

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