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RE-VISITING AGRICULTURAL POLICIES IN THE LIGHT OF GLOBALISATION EXPERIENCE: THE INDIAN CONTEXT

Edited by
Dinesh Marothia, Will Martin, A. Janaiah and C.L. Dadhich

INDIAN SOCIETY OF AGRICULTURAL ECONOMICS
in collaboration with
National Institute of Agricultural Extension Management (MANAGE)
Professor Jayashankar Telangana State Agricultural University (PJTSAU)
Acharya N.G. Ranga Agricultural University (ANGRAU)

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CONTENTS

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FOREWORD

The International Association of Agricultural Economists (IAAE) is a worldwide association of agricultural economists and others interested in agricultural issues. Major missions of IAAE are to advance knowledge of agricultural economics and to facilitate communication and information exchanges among agricultural economists all over the world. In order to achieve these missions, the IAAE convenes triennial international conferences and inter-conference symposia. Venues of recent International Conferences of Agricultural Economists have included Durban in South Africa in 2003, Beijing in China in 2009, and Iguazu Falls in Brazil in 2012, among developing countries. In the history of IAAE, India has been regarded as a critically important nation because of its size, diversity, and potential. But, of the 29 International Conferences of Agricultural Economists held since 1929, only one has been held in India—the tenth conference, held in Mysore in 1958.

For several years, it has been clear to core members of IAAE that it is time to begin thinking of the second International Conference in India. For this purpose, IAAE wished to strengthen the relationship with agricultural economists and agricultural economics organisations in India. Through intensive communications between leading Indian agricultural economists and core members of IAAE, including myself, we planned IAAE-ISAE (Indian Society of Agricultural Economics) Inter-Conference Symposium held at MANAGE, Hyderabad in October 2014. It was extremely well attended, productive, and, after all, highly successful, as presentations and discussions were extremely lively. This is evident in the excellent papers collected in this special publication of the *Indian Society of Agricultural Economics*. There is no doubt that diverse key issues are covered in this issue.

At the same time it is clear to me that there is a need for clearer policy implications to improve food security and livelihood of farmers in India. It is also clear that some key issues are missing, such as the future of small farms and land market reforms in this populous country. We must clearly recognise that how Indian agriculture performs affect not only the fate of farmers and consumers in India but also welfare of billions of people across the globe.

I firmly believe that this inter-conference symposium represents a landmark for strengthening the collaborative relationship between the Indian agricultural economics societies and IAAE. It is wholeheartedly hoped that this will lead to a truly productive International Conference of Agricultural Economists in New Delhi, India in 2021.

November 11, 2016

Keijiro Otsuka
Former President of
International Association of Agricultural Economists
and
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PREFACE

Indian Society of Agricultural Economics in collaboration with National Institute of Agricultural Extension Management (MANAGE), Professor Jayashankar Telangana State Agricultural University (PJTSAU) and Acharya N.G. Ranga Agricultural University (ANGRAU) and supported by International Association of Agricultural Economists organised an Inter-Conference Symposium on Re-visiting Agricultural Policies in the Light of Globalisation Experience: The Indian Context at MANAGE, Hyderabad from October12-13, 2014. The symposium was co-sponsored by National Bank for Agriculture and Rural Development (NABARD), Indian Council of Agricultural Research (ICAR), Reserve Bank of India (RBI) and International Rice Research Institute (IRRI). The symposium was organised under the supervision of a Programme Committee consisting of Dr. C. Ramasamy, the then President of Indian Society of Agricultural Economics, Prof Keijiro Otsuka, Past President, International Association of Agricultural Economists, Prof. A. Janaiah, PJTSAU, Dr. V.P. Sharma, MANAGE and Dr. C.L. Dadhich, Hon. Secretary and Treasurer of Indian Society of Agricultural Economics. Around one hundred participants from inter-related disciplines participated. As many as seventy six papers were selected for presentation and discussion in the Symposium on the recommendation of referees viz., Prof. Vasant P. Gandhi, Dr. K.R. Ashok, Dr. S.S. Raju and Dr. Seema Nath, besides 17 lead and Keynote presentations. The present special volume includes a Foreword by Dr. Keijiro Otsuka and sixteen papers covering the various aspects of the main theme.

We are grateful to Professor Otsuka for writing a Foreword to the volume, to the various lead paper-writers and keynote paper-writers for delivering the keynote addresses and to the paper-writers and to the participants for attending the symposium and making valuable contribution. Our thanks are due to the Chairman of the various sessions for moderating/guiding the discussion and to the Co-chairman for preparing the respective reports.

The papers were screened, selected and edited by Dr. Dinesh Marothia, Dr. Will Martin, Dr. A. Janaiah and Dr. C.L. Dadhich. We are thankful to them for the time and attention they have devoted in bringing out this publication.

We owe a deep debt of gratitude to National Institute of Agricultural Extension Management (MANAGE), Hyderabad and to Shri B. Srinivas, the Director General of the Institute and his colleagues for agreeing to organise the Symposium at MANAGE and for providing the necessary facilities.

The Society is grateful to a number of people who make it possible to organise the Symposium and provided help in bringing out the volume. The key proponents were Dr. C. Ramasamy, the then Society's President and Late Dr. N.A. Mujamdar, the then Editor of IJAE, Dr. Walt Armbuster and Dr. Johan Swinnen the then President of International Association of Agricultural Economists. The task of

processing the papers and technically editing them for publication was undertaken by Mrs. Vijaya Venkatesh, Honorary Joint Secretary of the Society. We are thankful to all of them for undertaking this responsibility.

We acknowledge our gratitude to the International Association of Agricultural Economists, National Bank for Agriculture and Rural Development, Reserve Bank of India and Indian Council of Agricultural Research, New Delhi for providing financial support to meet a part of the expenses of the Symposium as well as to the National Institute of Agricultural Extension Management (MANAGE), Prof. Jayashankar Telangana State Agricultural University and Acharya N.G. Ranga Agricultural University, Hyderabad for providing the necessary facilities.

November 9, 2016 Abhijit Sen
Mumbai President

DINESH MAROTHIA, WILL MARTIN, A. JANAIAH AND C.L. DADHICH

Introduction

BACKGROUND

The period since the 1990s has witnessed a significant shift in the macroeconomic policy environment around the globe, with India and the developing countries as a whole growing much more rapidly than the industrial countries. The new economic policy of India (1991) is based on the three elements, viz., liberalisation, globalisation and privatisation. Though India has been one of the fastest growing countries its growth has not been inclusive. One of the excluded sectors during the early reform period was agriculture that registered low growth. Similarly the problem of globalisation particularly for agriculture was not seriously addressed. In this backdrop, Government India's first agricultural policy statement NAP 2000 was drafted with a major objective of agricultural growth rate of 4 per cent per annum by increasing the efficiency of resource use. Sustainable and demand driven inclusive growth was envisaged. However, there has been considerable vacillation in policies on farm subsidies, market reforms, liberalisation of farm input sector, trade liberalisation and other areas.

Upcoming challenges at the national level include: the need for more investment in infrastructure; multi-land use planning including soil nutrient management under exponential growth in fertiliser subsidy; considerable gaps between the varieties released by the public sector institutions and the varieties adopted by the farmers; private sector research and seed industry focusing only on varieties and hybrids with large markets; rainfed crops getting less research attention; and controversies about transgenic food crops; under-funding of agricultural research; identifying cultivars with stress tolerance to climate change; under-performance of extension agencies; frequent failure in timely availability of quality seeds; inadequate fodder availability and poor access to animal health to support the dairy industry; lesser success in linking small producers with markets; and an urgent need to improve the productivity of common pool resources through workable technical and institutional arrangements including secure tenure (Marothia, 2010). To share global experiences a Symposium was organised so that the outcomes of discussion can be useful to closely look into the agricultural policy issues.

OBJECTIVES

The main objectives of the Symposium were:

- To facilitate interaction among researchers and stakeholders on agricultural policies in the context of globalisation.

- To document problems emanating from globalisation that have not been seriously addressed by government policies and strategies, and to suggest suitable policy options.

Organisers

Being a pioneering organisation in the field of agricultural economics, the Indian Society of Agricultural Economics took the lead and the Symposium was jointly organised by the Indian Society of Agricultural Economics, Mumbai; National Institute of Agricultural Extension Management (MANAGE), Hyderabad; Professor Jayashankar Telangana State Agricultural University, Hyderabad and Acharya N.G. Ranga Agricultural University, Hyderabad. The sponsors of the Symposium were the International Association of Agricultural Economists, U.S.A; National Bank for Agriculture and Rural Development, Mumbai, Reserve Bank of India and the Indian Council of Agricultural Research, New Delhi.

Papers

Accordingly papers were invited from researchers, academicians and professionals in the field of agricultural economics, agribusiness policy analysts, and key policy makers from India and abroad. More than 80 papers and posters were received. These papers/abstracts were referred to eminent experts for review. Based on these reviews, the best papers were considered for deliberation in the symposium.

Symposium

The symposium was organised at Hyderabad during 12-13 October 2014. It was attended by more than 100 delegates representing different countries.

To accomplish the objectives, the Symposium was divided into (a) plenary sessions; (b) technical sessions, (c) poster sessions and (d) round table sessions. A special session was organised by International Rice Research Institute, on *Distribution and Impacts of Stress Tolerant Varieties in South Asia*. Eminent experts were invited to share their knowledge and wisdom during the plenary sessions. The technical sessions were developed in such a way that they covered the key theme of Globalisation. It was also decided to publish some of these papers under the copyright of ISAE in the form of a volume for wider circulation. Of these papers only 16 papers with pointed focus, strong policy relevant to the theme and authors responsive to the suggestions made during deliberations and the editorial process were selected for inclusion in this volume.

Emerging Issues

As mentioned earlier this volume contains only 16 papers. These papers can be broadly grouped into seven areas: methodology; major sources of growth; lopsided

policy measures; impact of policy measures; viability trends; globalisation of Indian agriculture; and WTO regulations.

1. *Sources of Growth*

Pratap Birthal *et al*. evaluate 'how policy shifts have influenced patterns and sources of growth in Indian agriculture, and their implications for food security and poverty. Decomposition of agricultural growth shows technology as the main source of growth, followed by diversification towards high-value crops. The contributions of area expansion and price increases to overall growth have remained small and erratic suggesting that these cannot be sustainable sources of growth in the long-run. Diversification has been found to exhibit pro-poor bias, and also does not have any adverse effect on household food security. These results clearly suggest that in the long-run, growth in agriculture has to come from technological change and diversification, and to realise its growth and poverty-reduction potential it is essential to increase investment in agricultural research; prioritise research agenda considering emerging agricultural challenges and market opportunities; and to promote high-value agriculture through enabling policies, institutions and infrastructure.

A paper by Anita Kumari *et al*. shows that estimates of the real rate of growth of agricultural output based on the internationally standard methodology and India's national income accounting methods are largely similar. However, they are quite different at sub-sectoral levels. In this context, it is suggested that while making any comparison across countries it is desirable to use compatible methodologies.

2. *Lopsided Policy and Policy Measures*

Kiran Kumar *et al*. note that water policies at both State and National levels focus largely on the demand side of water management (drip/micro irrigation at farm level for instance) ignoring the supply side of groundwater (on-farm recharging well/borewell). They further add that policies lack focus on disciplining farmers towards sustainable use of groundwater, including both the demand and the supply side of natural resource use, i.e., in some areas, farmers are bearing more than 75 per cent of the cost of investment in groundwater; but they still treat investment as an implicit rather than an explicit cost. Incidentally the CACP methodology also treats the cost of groundwater with: (1) depreciation on irrigation well and irrigation pump set (IP) treated as a fixed cost (for a non-specified number of years) and (2) the number of hours of operation of IP payment as a variable cost.

Anjan Chakrabarti points out that during the reform era, the cost of production has increased. As a result a large share of the small and marginal farmers in West Bengal find it difficult to ensure livelihood from agriculture. Increase in incidence of land alienation of pattadars and increasing eviction of bargardars (share cropper) in the state has further aggravated the agrarian situation in the post reform period. The

absence of large scale manufacturing has adversely impacted employment opportunities outside agriculture. The study points out that the lack of alternative employment avenues to a large extent crippled the economic status of agrarian community in post-reform era.

Incidentally, efforts have been made to guarantee minimum rural employment during the last few years to the poor households in rural areas under the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA). MNREGA was also envisaged as helping develop rural infrastructure in the country. Using the framework of village-wide economy modellng with Village Social Accounting Matrixes (SAMs), P.S. Srikanthmurthy *et al*. analyse the direct and economy-wide impacts of MNREGA in two different dryland villages of Karnataka state by constructing village SAMs from primary and secondary data for the agricultural year 2012-13. Multiplier effects (feedback effects estimated using the SAMs) of MNREGA on the two villages (Markabinahalli and Belladamadugu) of Karnataka were very weak. This is due to already high market wage rate in the local economy, and MNREGA fund spent for more of materials and machines (diggers) than for labour, as these materials and machines were brought from outside of the village economy which benefited others outside the villages rather than the targeted poor agricultural labour households in the village. The village wide assessment of impacts and construction of village SAM contributes to the applied policy analysis on the topic of impact assessment.

An attempt was made by Rakesh Singh *et al*. to review the market reforms and their impact on agricultural growth in Uttar Pradesh. Farmers' perceptions and infrastructure were also examined. They noted that, although efforts have been made to change over from regulated marketing of agricultural produce to liberalised marketing, the impact at the farm level is not visible. The marketing of agricultural products in the state is still operated under the old APMC Act 1964. During the period 2003-2013 private corporate investment in agriculture has declined, which has adversely affected growth of agricultural sector. Farmers are highly dissatisfied with the present marketing system. Infrastructure is very weak in secondary markets, while most of the primary mandies are also lacking support and storage infrastructure.

Anjani Kumar *et al*. investigate the effect of food subsidies through the Public Distribution System (PDS) on poverty and food security in India. Analysis shows that the effectiveness of the PDS has improved over time and it has contributed significantly to tackle the twin problems of poverty and food insecurity in India.

Prem Chand *et al*. discuss the pattern of diversification and its determinants. They reveal that the composition of agriculture is changing and is shifting towards high value crops, livestock and fishery. The contribution of cereals declined while that of horticultural crops increased drastically from 10.49 per cent to 27.77, oilseeds from 8.26 per cent to 9.71 per cent, sugarcane from 3.49 to 5.83 per cent and fibres from 4.29 to 7.15 per cent during the reference period. In livestock sector also the share of eggs, milk, and meat group in total livestock output has increased while that of wool, hair, dung, and silkworm has decreased. Rural infrastructural facilities and scale of

holding were found to be the major determinants of diversification towards high value commodities.

3. *Impaired Viability of Indian Agriculture*

A study undertaken by Dipika Basu and Arun Kr Nanda reveals that 61 per cent of farm units earned profits. Important among the determinants of farm profitability were size of farm, quantity of chemical fertilisers used, use of high yielding variety of seeds, etc. They suggest development of organic farming, reduction in the use of high cost chemical technology, promotion of effective marketing facilities, higher utilisation of by-products, etc. will go a long way in augmenting farm profitability.

A study undertaken by A. Narayanamoorthy *et al*. brings to the fore that debilitating viability of agriculture is on account of rise in production cost on the one hand and unremunerative prices of produce on the other hand in recent years. Analysing the plight of sugarcane growers they reveal that the state government has failed to take into account rising cost of farm inputs when announcing fair and remunerative prices or state advised prices. A large number of bruised farmers were committing suicide every day.

N. Nagaraj *et al*. also points out that the net income derived from agriculture has been declining over the years, while income from non-farm sources has increased sharply. Small farmers are likely to remain unviable, if they do not get access to off-farm income. In order to enhance the viability of small farms, technology driven options to accelerate productivity and profitability are vital for policy intervention. In addition, non-farm diversification needs strong policy support towards infrastructure, transport, storage, credit and market.

4. *Globalisation of Indian Agriculture*

The share of foreign trade (export and import) to gross domestic product (GDP) is an important indicator of globalisation. The share of agricultural exports and imports of India increased from about 12.85 per cent of agriculture GDP in 2009-10 to 17.90 per cent in 2014-15 indicating growing degree of globalisation.

Purushotam Sharma brings to the fore that in the post-WTO period the growth rate of the majority of oilseed crops has witnessed declining trends. Liberalised import policy of edible oils under the WTO regime has adversely impacted oilseed production scenario. To assess the instability in area, production and yield of oilseed crops, the Cuddy-Della Valle Index was used. The analysis further revealed that production of oilseeds was more volatile than yield levels and found to be higher during the post-WTO period. The instability was greater for safflower, sunflower, soybean and castor crops. The decomposition analysis of output growth of soybean reveals that growth in production of oilseeds in India was due to changes in yields (59

per cent) and area (31 per cent). Analysis also points out that output growth during the post-WTO period was mainly on account of area effect, while the yield effect was found to be negative for some crops. Growth in total factor productivity of important oilseed crops was found to be low, and has slowed down during post-WTO period. Furthermore, the post-WTO phase witnessed an increase in import dependence which is currently about 50 per cent. Yield gap analysis reveals that there exists enough potential available to harness provided there is a consistent increase in research investment, policies upheaval and support services.

Sukhpal Singh examines the role of FDI Multi-Brand Retail Trade (MBRT) up to 51 per cent in improving the efficiency of food chains and its implications for various stakeholders in the chain, based on empirical evidence from the experience of Indian domestic food supermarkets and compares with the other developing countries. He concludes that the experience of food supermarkets in developing countries in general and in India particular is not an encouraging one. Farmers and suppliers especially small ones are likely to be left out unless appropriate mechanisms like farmers groups or associations with institutional framework to ensure effective governance regulations and monitoring operations of global retailers are put in place. Effective institutional frameworks with good governance are imperative for deriving full benefits of policies.

A case study of Greek co-operatives is somewhat relevant to take benefits of globalisation. P. Sergaki *et al*. demonstrates that re-engineered co-operatives have higher performance levels than traditional co-operatives. Moreover, traditional co-operatives are more prone to cost-reduction strategy while re-engineered co-operatives mostly adopt differentiation strategies. Policy-makers may advance their knowledge on how different kinds of agricultural institutions in the world impact fair growth of globalisation.

5. *Indian Agriculture and WTO Regulations*

World Trade Organization (WTO) was set up in the early 1990s as an apex institution in the world to regulate, negotiate, facilitate and to settle trade-related disputes for services and commodities including agricultural commodities across the trading countries.

As a member of the World Trade Organization (WTO), India is subject to the rules of the Agreement on Agriculture and the notification requirements of the Committee on Agriculture. The rules impose yearly ceiling limits on certain kinds of support to farmers. Exemptions apply for some kinds of support and support is calculated in a prescribed way. India has notified the WTO of its domestic support to agricultural producers only for the years 1995-2003. Lars Brink discusses the domestic support rules of the Agreement on Agriculture and reviews India's notifications, and summarises the key issues in India's domestic support. He calculates price gaps for rice, wheat, cotton and sugarcane in 1995 to 2013 under four

scenarios – one corresponding to the rules of the Agreement and three scenarios incorporating adjustments of the external reference price or the price gap itself. Accordingly, the amounts of WTO market price support, which are non-economic indicators, make up all or almost all of each year's Aggregate Measurements of Support (AMSs) for rice, wheat, cotton and sugarcane. The AMS's are compared to their limits, which are based on the year's value of production. The AMSs show large excesses above their limits in the 1995-2013 period in the base scenario, while the adjustment scenarios show no or smaller excesses. The differences among alternative interpretations of the Agreement suggest huge scope for negotiations.

This apart, development in other countries have, far reaching impact on agriculture in developing countries including India. In this context, developments in the U.S.A are worth mentioning. Sachin Kumar Sharma critically examines the commodity and insurance programmes of USA Farm Act 2014 with reference to domestic support under Agreement on Agriculture and Doha round negotiations with particular reference to developing countries. Interestingly, the USA Farm Act 2014 has repealed many programs related to different commodities. Apart from highlighting many trade distorting programmes like Price Loss Coverage (PLC), Agriculture Risk Coverage (ARC), Stacked Income Protection Plan (STAX) and Supplemental Coverage Option (SCO). The study discussed the shortcomings in US domestic support notification to the WTO and its impact on product-specific support to agriculture sector.

Important among the issues emerging from these papers include:

The major share of growth in agricultural output has been from increases in area rather than increase in yield. It is important to note that growth measurement methodology followed in India is internationally not compatible. Further, policy measures hugely focus on demand side and supply is relegated to secondary importance. Rising cost of production on the one hand and unremunerative prices of agricultural produce on the other hand have pushed many farmers out of agri based livelihood. Wage employment programmes have benefitted more the machine and material provider than labour class in the villages. Labour replaced by machines is being gainfully utilised in non-farm activities leading to poverty reduction.

Improvements in the efficiency of the public distribution system that has led to reduction in poverty incidence and augmented food security

Indian agriculture is being diversified towards high value crops. About two-fifths of farm holdings are running losses. Diversification alone may be necessary but not sufficient to improve viability of farms, support of non-farm activities is equally important.

At times, Government procurement policies do not take into account the rising cost of production leading to this state of affairs. Reforms always help in accelerating globalisation through increased exports of non-traditional commodities but at the cost

of higher imports that may lead to fall in domestic prices and lead to further fall in domestic production of imported commodities. Without proper regulatory frameworks in place, even the growing flow of FDI may not give the intended results. At times, higher the incidence of globalisation higher is the exposure to institutional innovations in trading countries. In order to ensure smooth negotiations, WTO needs to work out models with different scenarios before release of notifications.

Looking Ahead

Since globalisation in general leads to higher inequality, it is important to examine agricultural and trade policies from an equity perspective and that too in a differentiated manner meaning there should be separate treatment of dryland and irrigated agriculture and food and commercial crops besides special focus on small producers.

Further, since it is markets which determine viability of agriculture, there is a need to focus on policy reform in agricultural input and output markets especially output markets where new players are coming in and working with producers. The various implications of such interface need to be understood with empirical studies and need for more effective governance and regulation assessed.

There is very important role for collective agencies in smallholder context. Therefore, there is need to examine the institutional context of agri growth and development in terms of new institutions like farmer producer companies or contract farming. These would play a role in determining whether small farmers can participate in globalised markets. In the era of globalisation, where market solutions receive primacy, the restoration of common pool resources poses major research and policy challenges (Marothia, 2010).

Like policy formulations, policy review also needs constant and continuous attention to capture the trends and development on time. In this backdrop researchers and academicians should revisit agricultural policy at regular intervals if not on the regular basis. Being a pioneering organisation in the field of agricultural economics, the Indian Society of Agricultural Economics (ISAE) should visit agricultural policy every fifth year in its Annual Conferences. Similarly revisit to global experience on frequent intervals is imperative. In this context such symposia should be organised more frequently in India and other developing countries. However, sufficient time should be given to researchers for in-depth analysis. With a view to providing sufficient time for in-depth analysis of this theme, it is necessary that this topic is again selected by IAAE for its conference in 2021 in India.

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SELECTED PAPERS

SUBMITTED AT THE INTERCONFERENCE SYMPOSIUM

ANITA KUMARI, M. RAJESHWOR AND NILABJA GHOSH*

Revisiting the Growth Patterns in Indian Agriculture using Internationally Compatible Methodology[1]

I

INTRODUCTION

Agriculture plays a dominant role in the growth of Indian economy. This large sector will continue to be important for the Indian economy and for the integrated world. Increasingly, the structural changes, taking place within the sector, are influencing the earning potentials of the people engaged in farming. It has been observed that food habits undergo changes with economic growth and the inflow of knowledge on nutritional needs. The dynamics in the Indian agricultural sector which is facing crop specific food inflation, farm technology and demand coming from processing industries now make accounting globally important.

The agricultural sector supplies food to the country's large population, provides raw materials to industries including the emerging food processing industries and the surplus is exported to the deficit countries to enable attainment of food security across the world. Agriculture is also a market for industrial products that include farm inputs and consumer goods. The share of agriculture in India's GDP started declining in recent times because GDP of agricultural sector has grown at a slower rate than the entire economy. This is also not surprising in a growing economy. However, not only the growth rate but the pattern of this growth also occupies an important place in sustaining high GDP growth in India along with greater equity.

Literature has many studies on development of agriculture and growth related issues in India (Kannan and Sundaram, 2011, Balakrishnan, *et al*., 2008, Birthal *et al.,* 2007) largely dependent on the government databases and methods, National Accounts Statistics (NAS) by Central Statistics Organization (CSO) and Ministry of Agriculture. This study attempts to create an alternative product account in line with the state production accounts constructed for the US farm sector by U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) (Ball *et al*., 1999, Wang *et al*., 2015). Broadly in line with international standards but utilising data from the same government sources, the methodology will be useful for international comparisons. The product accounts thus created are used to estimate the growth rates and analyse the pattern of these growth rates of agricultural output in India for the period 1976-2008. The use of compatible methodology can also be potentially

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[1]The authors are affiliated to Institute of Economic Growth, Delhi. This study is part of a larger work on building up world agricultural output and input datasets (KLEMS) and estimating the total factor productivity. The authors acknowledge the team leader Dr. Eldon Ball of USDA for his advice in this study.

important for estimating accurately the growth of output of agriculture in different countries of the world in a coherent way towards attaining food and income security across the world. The rest of the paper is organised with methodology and sources of data in section 2, and review of agricultural growth in section 3 followed by conclusions in section 4.

II

METHODOLOGY AND SOURCES OF DATA

For international compatibility, we follow a method used by ERS (Economic Research Service) of USDA (United States Department of Agriculture (Ball et al. 1999, Wang *et al*., 2015). ERS uses Tornquist approach (Theil-Tornquist index) to construct aggregated output as implicit quantities based on detailed output information on agriculture consisting of field crops, horticulture and animal based products with revenue shares as weights. Thus, nominal output series valued at current prices and producer prices needs to be created for all products and sub-sectors broadly consistent with those of other countries of the world with calendar year as the unit of time. Then, the Theil-Tornquist method is applied on these modified categories of product groups to estimate price indices. The Theil-Tornquist Price index (TTI) for N products (or sub-sectors) is computed as follows:

$$TTI_{kt} = \prod_{i=1}^{N} \left(\frac{p_{it}}{p_{ik}} \right)^{\frac{w_{tj}+w_{ik}}{2}} \quad \ldots.(1)$$

where $w_{it} = \frac{(p_{it} q_{it})}{\left(\sum_i p_{it} q_{it}\right)}$ represents the weights, p_{it} and q_{it} represent price and quantity, respectively of the i^{th} product, and k is the base year. TTI_{kt} is the composite price index of t^{th} year with k^{th} base year weighted by average of value shares of current and base years. This approach of creating price indices has a merit of comparing two years separated by several years when the production basket may have changed (Prasad *et al*., 1995). Finally, we compute value of the real output as the ratio of nominal value of output to the estimated TTI price index with 2005 as the base year as in US Product Accounts.

Agriculture in our specification shall comprise of 62 products including field crops, horticulture and animal based products. To be broadly similar to the product accounts for other countries and also with India's national accounting protocols, these products are regrouped in eleven sub-sectors. These are Cereals (CER), Millets (MLT), Pulses (PLS), Oilseeds (OLS), Fibres and Materials (FM), Condiments and Spices (CS), Sugarcane (SCN), Beverages and Narcotics (BN), Fruits (F), Vegetables

(V) and Livestocks and Fisheries (LF). The data are mostly obtained from India's official sources, Ministry of Agriculture, Government of India, supplemented by FAOSTAT only if unavoidable. The sample period considered is 1976 to 2008 covering a span of 33 years. For the entire sector, price index is based on all the products whereas sub-sector level price indices are based exhaustively on products within the sub-sectors except in a few exceptional cases where price indices are based only on specific crops within the sub-sectors due to constraints on data availability. Details of crops in each sub-sector will be discussed later in the sub-sector level analysis. Production is attributed to the calendar year and valuation is based on prices in the marketing period, i.e., only when the producer income is realized from this production. Crop calendars in various regions in the country are used for the purpose. This is in line with the international standards.

For prices, first state level monthly prices are estimated by averaging corresponding prices reported across the major wholesale markets (*mandis*). Then, producer prices, used for valuation, are proxied by average prices only of months in the peak marketing season, i.e., three months immediately following the harvest as bulk of the produce is sold by farmers during this period. All India level estimates are then obtained as the weighted average of state level producer prices with production in the states as weights. For rice and wheat, public procurement at pre-announced prices called minimum support prices (MSP) by the Food Corporation of India play a major role in a few dominantly producing states. Producer prices of these crops are the averages of state level prices and the MSPs with the shares of sales in the two channels used as weights. For sugarcane, which has multiple organized sector uses including production of energy and biofuel, the MSP of cane is used to avoid the confusion created by prices reported by different agencies for various by-products. For minor crops and crops where price data is not reported regularly by the Ministry, current values of crops reported in the National Accounts Statistics deflated by quantities reported by the Ministry of Agriculture have been used as approximations with due adjustments for calendar year. The resultant series of real output of agriculture and its sub-sectors are used for computing growth rates.

III

REVIEW OF AGRICULTURAL GROWTH

All Products

For illustrating agricultural growth, compound annual growth rates (CAGR) of real output of agriculture i.e., output implicitly valued at 2005 prices have been computed. The entire period of 1976 to 2008 has been divided into sub-periods comprising of 5 years each to understand the growth patterns vis-a-vis various policies pertaining to a particular sector.

Table 1 shows the comparisons of growth rates estimated as per methodology in this study with those based on NAS (CSO's methodology) for the entire period, 1976-2008. Our estimates are almost same (3.25 per cent per annum) as those based on NAS. However, for the recent period 2001-08, our estimate at 2.90 per cent per annum is a little higher than 2.60 percent based on NAS. At the sub-sector level, for the entire period, our estimates exceed those based on NAS for MLT, BN, SCN and LF but are lower in magnitude for other sub-sectors. For 2001-08, our estimates, however, exceed the NAS estimates also in CER, PLS and CS. For the crops sector as a whole however our estimates are lower than those based on NAS in 1976-2008 as well as in 2001-08.

TABLE 1. AVERAGE COMPOUND ANNUAL GROWTH RATES (PER CENT) OF REAL VALUE OF OUTPUT IN AGRICULTURE

(1)	CER (2)	MLT (3)	PLS (4)	OLS (5)	FM (6)	CS (7)	F (8)	V (9)	BN (10)	SCN (11)	CROPS (12)	LF (13)	All products (14)
						Estimates#							
1976-80	4.27	-0.77	-6.47	-2.64	1.10	-4.21	7.28	3.69	2.25	-2.16	2.08	4.09	2.54
1981-85	3.96	-7.74	1.29	0.54	3.94	6.21	7.83	7.45	-0.30	2.50	3.92	6.01	4.43
1986-90	4.76	5.26	-0.22	9.35	9.92	3.15	2.12	5.76	2.52	7.23	4.84	4.60	4.77
1991-95	2.01	2.08	0.68	4.46	6.38	5.06	7.90	4.97	2.42	3.40	3.69	4.67	3.96
1996-00	2.48	-1.68	-0.63	-4.07	-5.51	0.87	-0.51	9.84	4.73	1.57	1.51	3.41	2.06
2001-08	1.33	0.06	1.54	3.92	6.91	3.62	4.40	-1.93	3.45	2.02	2.08	4.66	2.90
1976-08	2.58	0.52	0.24	3.00	3.41	2.55	3.73	3.13	3.45	2.80	2.73	4.60	3.25
						National Accounts Data@							
2001-08	1.24	-1.12	0.85	3.92	7.07	3.58	3.11*		0.47	-1.72	2.16	3.65	2.60
1976-08	2.61	0.42	0.83	3.81	3.68	4.65	3.73*		2.60	1.68	2.89	4.22	3.25

Notes: 1. # Estimates are authors computations as per the methodology in this study with TTI as the deflator (base=2005) and calendar year as the unit of analysis.
2. @ Estimates based on NAS are at constant prices 2004-05 and are for financial years 1976-77 TO 2008-09 and 2001-02 to 2008-09.
3. * includes vegetables.

Thus at the sub-sector level, the methodological variations may have yielded the differences in the estimates of growth rates. Differences may have emerged partly because of the calendar year used as the unit of analysis. In the following subsections we discuss in detail, the patterns in the growth rates of real output of agriculture computed by our methodology in this study.

Sub-Sector Level Performance and Policy Influences

Among the sub-sectors in the entire period 1976-08 (Figure 1), LF has registered the highest growth rate of 4.6 per cent followed by F, BN, FM, V and OLS with growth rate between 3 to 4 per cent. SCN with a growth rate of 2.8 per cent has been followed by CER and CS each with a growth rate of 2.6 per cent. MLT and PLS recorded the least growth rate of 0.5 per cent and 0.2 per cent only.

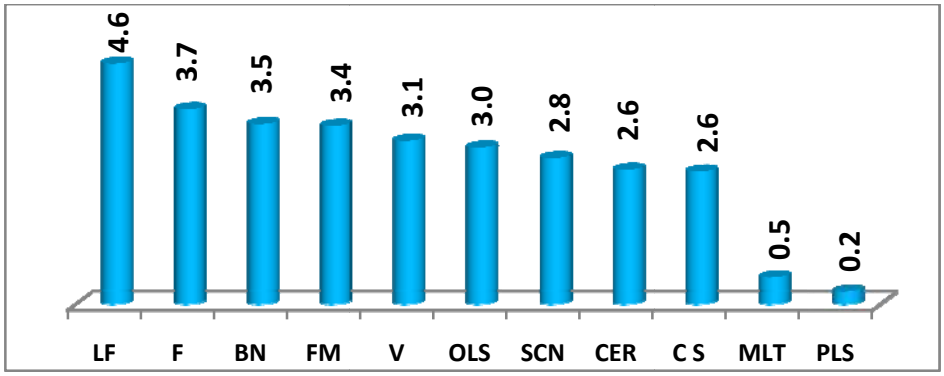

Figure 1. CAGR (per cent) of Real Output for Sub-Sectors in Agriculture in India (1976-2008)

Figure 2 suggests that behind the period averages there are considerable sub-period level variations in growth rates. The growth rate increased from 2.5 per cent in 1976-80 to an impressive growth rate of 4.8 per cent in 1986-90. But thereafter i.e., since 1991, the year of initiation of economic reforms, growth rate started declining and reached 2.1 per cent only in 1996-00 from where again growth rate started picking up and increased to 2.9 percent in the latest period of 2001-08. The sub-period 1996-00 can appear as a turning point indicative of an initial set back after launch of reforms and a reversal thereafter.

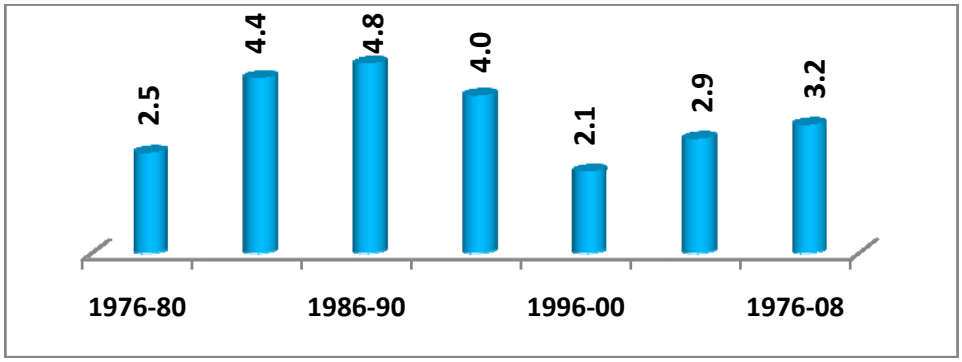

Figure 2. CAGR (per cent) of Real Output of all Products across Sub-Periods.

The large variations in the growth rates across various sub-periods for different sub-sectors may have been related to policy measures, changing food habits and sudden globalisation when India began losing her insulation from the world economy. The usual vagaries of weather, explaining around 60 per cent of the variation in the growth of agricultural output, are also accountable. Below we shall review in detail the patterns in output growth for the various sub-sectors over different sub-periods in view of the major policy programmes and other policy

interventions. Figure 3 depicts the annual variations in the growth rates of various sub-sectors.

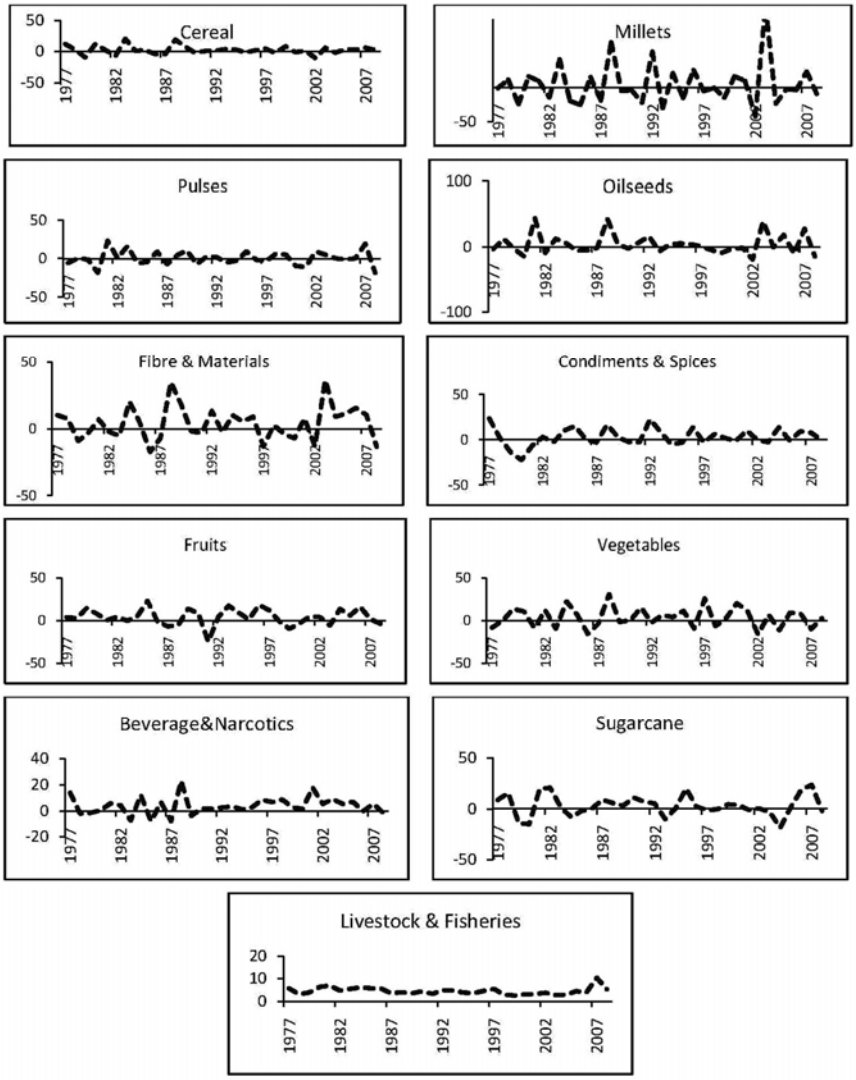

Figure 3. Annual Variations in Growth Rates (Per cent) across Sub-Sectors of Indian Agriculture.

Cereals

Growth of CER (Rice, Wheat, Jowar, Maize and Barley) output has been higher in the 1980s as compared to other years. The growth rates however stabilized over

time except for a pronounced negative shock observed only in 2002 (Figure 3). The probable reason for increase in the production of this group has been generally attributed to the green revolution and domestic agricultural price policy consisting of price support through open ended procurement that discourages production of coarse cereals and pulses (Karwasra, *et al*., 2003). The stagnation of growth in the later years is also a sign of saturation of green revolution.

Millets

In the MLT sector (Bajra, Ragi, and Small millets), though 'All India Co-ordinated Small Millets Improvement Project" launched in 1986 played a significant role in 1986-90 but decline in the area followed because of decreasing demand, low price, rising incomes and changing food habits despite being cheap sources of proteins and vitamins to the poor and deemed nutritionally superior to rice and wheat. Millets being sensitive to weather, the growth rate is highly volatile.

Given the fact that they can grow without irrigation and with very little external inputs, millets play an important role in reviving the agriculture sector while providing food and nutritional security. Various initiatives have been taken to promote millets. In 2007 and 2008, Millet Net Work of India (MINI) was initiated by Deccan Development Society and the workshop, National Consultation on Millets was also organized by MINI in Hyderabad where participants were given the option of millet based drinks, breakfast and lunch (National Institute of Rural Development, 2008). MLT may have also been facing competition in dry regions from other major cereals and cash crops that benefitted from government price support mechanisms (Pray and Nagarajan, 2009).

Pulses

Output of PLS (Arhar, Gram, Moong, Urad, Masoor, and Other Pulses) has grown at the rate of 0.24 per cent only over 1976-2008 which is even less than that for millets. Over the sub-periods also, the growth rate has been either negative or negligible positive. Fluctuating productivity of this rainfed crop is responsible along with stagnant area with farmer's preference to rice, wheat or other cash crops in irrigated areas. Thus various initiatives taken by the government to increase the pulses output have hardly been effective. Pulses imports are likely to increase further, even while sources of import of pulses are limited, if adequate measures are not taken.

Oilseeds

OLS (Groundnut, Rapeseed & Mustard, Soybean, Linseed, Sesamum, Castor, Nigerseed, Safflower and Sunflower) output moved from a growth rate of -2.6 per

cent in 1976-80 to 0.5 percent only in 1981-85. However, Technology Mission on Oilseeds in 1986 resulted in an impressive growth rate of oilseeds output after mid eighties except during 1996-00. This phenomenal increase in the production of oilseeds has even been called the 'yellow revolution' (Shenoi, 2003).

Fibres and Materials

Output of FM (Cotton, Jute, Mesta, Sunhemp, Rubber, Coconut and Gaurseed and Others) grew at an impressive rate throughout except in the initial period and negative rate in the period 1996-00. This trend can be explained by the area under the main crop cotton. The departure in 1996-00 seems to be because of attack of disease and pests on the cotton crop in 1997-98 and1998-99 and severe drought of 1999-2000 in almost all cotton growing states in the country. The approval of commercial cultivation of BT cotton seed in India during 2002 is possibly a factor behind the success in 2001-08. BT cotton is said to control worms and reduces the use of insecticides without compromising on yield (Manickam, *et al*., 2007).

Condiments and Spices

CS sector (Cardamom, Chillies, Black Pepper, Dry Ginger, Turmeric, Garlic and Coriander and Others) consisting of major commercial crops having dietary, medicinal and other uses earns a major part of foreign exchange annually. The sector has grown by 2.55 percent during 1976-08 but in the sub-periods, growth has been fluctuating though at positive levels except in 1976-80. The growth rate was high in 1977 but remained positive except the lowest level reached in 1980 and in 1996-2000 following India's signing the WTO treaty.

Fruits and Vegetables

India is the world's second largest producer of Fruits (Banana, Cashewnut Apple, Mango, Orange, Grape, Papaya and Others (Guava, Sapota, Citrous, Pineapple, Litchi, Mosambi, Lemon, etc.)) and Vegetables (Potato, Sweet Potato, Tapioca, Onion, Cabbage, Cauliflower, Tomato and Others (Brinjal, Ladyfinger, Peas and Mushroom etc.)) which had a growth rate of 3.73 per cent and 3.13 per cent respectively over 1976-2008. Increase in area is a major factor behind the performance. Vegetables like fruits also have the erratic pattern in the growth rates being largely dependent on seasonality.

Impressive growth of fruits and vegetables despite seasonality is the result of several initiatives taken by Government of India like flagship National Horticulture Mission (NHM) in 2005-06 and other area based regionally differentiated strategies. The agriculture ministry is also implementing market intervention scheme for procurement of various horticultural commodities to protect the growers from making

distress sales in the event of a bumper crop when there is glut in the market, causing prices to fall below economic levels.

Beverages and Narcotics

BN (Tea, Coffee, Tobacco and Arecanut and Others) shows an impressive growth rate over the 1976-08, though its share in the total output of agriculture is very low, being around 2 per cent only that has declined even further over the years. It may be noted that the growth rates in the initial period are marked by year to year volatility till 1989 since when growth rates scarcely fell to negative levels. Among the crops of this group, Tea production has been insignificant because of the negligible increase in area along with aging of tea bushes and consequent re-plantation/rejuvenation activities, labour shortages, pest attacks and vagaries of weather. Growth of coffee production has been more than the growth of tea production for the entire period as the demand for coffee increased driven by the expansion of coffee culture among the youth during recent times.

Growth of Arecanut has been the highest and that of tobacco has been the smallest as a result of policy measures. Arecanut has been habitual item with demand increasing further with the emergence of scented supari and ghutka. The decline in the tobacco production moved in tandem with public propaganda over health issues and the taxation policies on the manufacturing sector (Goyal *et al*., 2004).

Sugarcane

SCN is a long season (perennial) crop with the durations, seasons and cultivation practices varying across regions. The crop is sensitive to weather conditions at different points in the long growing season often exceeding a year. The erratic behaviour of India's sugarcane output is also driven by policy interventions such as government price support policies which remains in an unresolved state, trade policies and release of free sale sugar and buffer stocks. Thus, given the globalization, changing diet consciousness, new emerging uses such as ethanol for energy and the political sensitiveness of the sector, the government policy is yet nascent in meeting the challenges.

Livestocks and Fisheries

Growth of output of LF (Milk, Meat, Egg and Fish) of 4.6 per cent has been the highest among all sub-sectors in the entire period. Over the sub-periods also, growth has been in general stable relative to the other sub-sectors. The growth of this sector can be explained by the growth of output of milk which has the largest share. Shifts in demand towards dairy products as well as technological improvements on the supply side especially in genetic upgradation of animals and massive intervention by government of India through institutional and policy initiatives have contributed in

the growth of this sector. The cooperative movement known as Operation Flood started by Dr. Varghese Kurien, called Father of Milk Revolution in India, Technology Mission on Dairy Development (TMDD), an Integrated Dairy Development Programme (IDDP) in Non-Operation Flood, hilly, and backward areas have played a significant role. Further trade regulation policies to promote domestic production were responsible for the robust growth of this sector.

Production of fish, egg and poultry in India has also increased over the years especially since the 1990s due to a combination of several factors, easier access to modern technology facilitated by policy and liberalization. Rising incomes and a rapidly growing middle class encouraged consumption. The progress of poultry industry is also attributable to the efforts of Dr. B.V. Rao called Father of Indian Poultry Industry for providing world class facilities in the country along with promotional schemes like Poultry Venture Capital Fund and Poultry Performance Testing Centers, Marine Fisheries Development Scheme, Inland Fisheries Development Scheme and Fisherman Welfare Scheme.

IV

CONCLUSION

The growth rates of real output of agriculture in India estimated using internationally compatible methodology have been found to differ from those estimated using NAS based on CSO methodology at the sub-sectoral levels though consistent at an aggregate level. Thus, while making any comparison across countries, it is desirable to use a modified methodology.

Over the years, growth rate of agricultural output increased till 90s, started declining thereafter but recovered in 2000s. Among the sub-sectors, LF have had the highest growth rate and pulses the lowest growth rate. Over the sub-periods, growth rate of output has been fluctuating in most cases, it appears, on account of policy interventions besides usual vagaries of weather that affect short term fluctuations. The growth rates are subject to year to year variations often negative and sharp, livestocks and horticulture being exceptions. The country is challenged by the impatience over poverty, aspirations of people, changing food preferences, clamour of privatization in the face of welfare commitments, WTO compliance demands and weather vagaries. There is urgency for restructuring of the policy regime with a holistic perspective covering agriculture, industry, trade and welfare. In a globalised scenario, policy formulation will be facilitated by revisiting the product accounts and the methodology behind them in line with international conventions to achieve greater uniformity and easy comparisons.

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Whether Public Food Distribution System has Contributed in Reduction of Poverty and Food Insecurity in India?

I

INTRODUCTION

Despite ensuring adequate availability of food at national level, ensuring food security at the micro-level continued to remain a formidable challenge for India. The Government of India has embraced a number of strategies to improve the status of food security in the country, which include concerted efforts to increase food grain production, intervention in the grain markets, and setting up institution of public food distribution system (or PDS) and maintenance of buffer stocks of major foodgrains. The latest ammunition to attack the menace of food insecurity is the enactment of National Food Security Act (NFSA) in August 2013. This act aims to mark a paradigm shift in tackling the conundrum of food security—from the current welfare approach to an entitlements based approach. The central pivot of the Bill is large-scale subsidised grain distribution to almost two-thirds of the country's population of 1.25 billion.

The enactment and implementation of this NFSA has intensified the debate on approaches of ensuring the food security at grassroots level and consequently, functioning of Public Distribution System (PDS) came under further scrutiny. PDS is one of the most important public intervention programs to enhance food security in India. With an annual expenditure of about USD 13 billion, the Public Distribution System (PDS) in India is one of the largest welfare schemes globally. It provides social safety nets and food security to over 65 million households by entitling eligible households to selected commodities at subsidised prices through network of over 500,000 “fair price shops” all over the country.

PDS provides rationed amount of basic food items and other non-food items at subsidised prices to consumers. The coverage and functioning of PDS underwent several changes overtime but it essentially remained an instrument to augment food security. The access to PDS was universal until 1992 (at least in theory). Rampant corruption and high operational costs led to repackaging the program as Revamped Public Distribution System (RPDS) with focus in tribal, arid, hill and remote areas in 1992 and then to a Targeted Public Distribution System (TPDS) in 1997.The aim of

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the TPDS was to target the poorest households by differentiating the access quantities and prices at which one is allowed to buy. The differentiation was achieved by classifying the beneficiaries into Above Poverty Line (APL), Below Poverty Line (BPL) or Antyodaya households based their economic status, assessed based on the state-specific poverty lines. Antyodaya cards, which enjoy a larger subsidy than BPL households, are meant for the poorest of the poor.

In spite of the extensive coverage of PDS and its important role in ensuring food security, its relevance and effectiveness in reducing poverty and improving food security has been questioned frequently in India (Khera, 2011). A number of studies related to PDS have pointed out shortcoming and anomalies on effectiveness of PDS such as large-scale inclusion and exclusion errors (Swaminathan and Misra, 2001; Hirway, 2003; Khera, 2008; Mahamalikand Sahu, 2011), large-scale leakages (Jha and Ramaswami, 2010; Himanshu and Sen, 2011; Khera, 2011; Kumar *et al.*, 2012; among others) and so on. On the other hand, the critical role played by PDS in reducing poverty and food and nutrition insecurity were highlighted in a few other studies such as Radhakrishna *et al.,* 1997; Dreze and Khera, 2013; Tritah, 2003; Himanshu and Sen, 2013; and Kumar and Ayyappan, 2014. In this context, in this paper, we analyse contribution of PDS on reduction of poverty and food and nutrition insecurity of the beneficiary population separately for rural and urban sectors, and by covering large set of data sets for a longer period of time. The analysis covers temporal as well as spatial dimensions of the transformation that PDS has brought about in the country in terms of income gains, poverty reduction and nutritional (calorie) enhancements.

II

DATA AND METHODOLOGY

This study is based on the unit level data from 50th (1993-94), 61st (2004-05), 66th (2009-10) and 68th (2011-12) rounds of the Consumption and Expenditure Survey conducted by the National Sample Survey Organization (NSSO), of the Government of India (GoI). Each survey contains detailed information on values and quantities of household consumption along with other household specific information. The Planning Commission (now NITI Ayog), and several GOI agencies rely on these surveys to estimate poverty lines on a regular basis. We have used the same household data to compute the average per capita consumption expenditure. The calorie intake was computed by using the nutrient charts provided by the NSSO for each commodity (NSSO, 2012). The questionnaires used by the NSSO for data collection distinguishes consumption from the PDS and from other sources. It is therefore possible to estimate the price paid at the PDS and at the open market if the households have used both sources of provision. Thus, it allows estimating the share of PDS in consumption expenditure and calorie intake of each household.

Impact of PDS on Food Security and Poverty

The precise impact of PDS on poverty and food security is an important but a complex question. The question is difficult to be answered as the impact of PDS is pervasive in the Indian economy and have implications for the livelihood at all levels. The fiscal transfer method assesses the direct benefit impact of PDS as a distributive mechanism on poverty and food security. The approach has been widely used in estimating benefit impact of fiscal distribution. It has been used by Radhakrishna *et al.,* (1997), Tritah (2003), Himanshu and Sen (2013 a & b) to assess the impact of PDS.

The subsidy transfer or income gain due to PDS is defined as the additional expenditure that the household would have incurred in the absence of PDS. It is estimated by multiplying the quantity of purchases from PDS with the difference between open market price and PDS price. The income gain (ΔY) given to a household is defined as:

$$\Delta Y = Q_r(P_m - P_s)$$

where P_m and P_s are the open market and subsidized price. $Q_r$is the quantity purchased from the PDS. The open market and subsidized prices are estimated from NSS survey data on quantities and values of expenditure.

Official Poverty lines provided by the Planning Commission, GoI have been used to assess the impact of PDS on poverty in this study. The extent of poverty has been measured as head count ratio (HCR) in the total population and the depth of poverty is measured by the poverty gap index (PGI) which is constructed based on the following formula (Grusky and Kanbur, 2006):

$$PGI = (\frac{1}{N}) \sum_{i=1}^{m} (z - y_i / z)$$

where, N is the total population, m is the population who are living at or below poverty line, z is the poverty line and y_i is the income of the poor individual i. PGI by definition ranges between 0 and 100 per cent and is a measure to sense how poor the poor are?.

Similarly, the impact of PDS on calorie intake was estimated by assuming that without access to PDS, the household's budget allocation would have been the same. The quantity has been recalculated that the household would have bought in the absence of PDS. The adjusted quantity was then used to re-estimate the calorie consumption of the same household. This provides the average calorie consumption of the households without access to PDS. The difference between the two gives the gain in calorie intake (ΔC), which is defined as follows;

$$\Delta C = C_{pds} - C_{wpds}$$

where C_{pds} and C_{wpds} are the actual (including from PDS) and estimated (without PDS) per capita calorie intake. In the paper, the extent of calorie deficiency has been measured by head count ratio in the total population and the depth of deficiency is measured by the Deficiency Gap Ratio (DGR).[1] The minimum (threshold) food-energy requirement was taken as 1800 kcal/person/day for rural households and 1575 kcal for the urban households. They represented 75 per cent of the recommended values, 2400 kcal/person/day for rural and 2100 kcal/person/day for urban [for more information, see Dandekar 1996]. The households consuming below this level were treated as undernourished or deficient in calorie intake.

III

RESULTS AND DISCUSSION

Access to PDS

Table 1 provides a glimpse of the reach of people to PDS food grains during 1993-94, 2004-05, 2009-10 and 2011-12. The PDS coverage shrunk between 1993-94 and 2004-05. During this decade, the percentage of households accessing PDS cereals fell from 27.7 per cent to 23.3 per cent. The shrinkage was sharp in urban areas from 29.8 per cent to 14.7 per cent, whereas, the decline in rural area was negligible. This shrinkage may be attributed to the shift from universal to TPDS in 1997 along with sharp increase in PDS commodity prices for APL households. This shift in policy also eliminated the existing urban bias to a great extent, but appeared to have increased exclusion errors significantly (Himanshu and Sen, 2013). The share of PDS in consumption of cereals increased slightly from 8.5 per cent to 9.8 per cent during this period and the increase was confined to rural households only (from 7.7 per cent to 10.6 per cent). In urban households, it declined from 11.4 per cent to 7.3 per cent.

TABLE 1. CONTRIBUTION OF PDS IN HOUSEHOLD CONSUMPTION OF FOOD GRAINS

	Households accessing PDS for cereals (per cent)			Share of PDS in total cereal consumption (per cent)		
Year	Rural	Urban	All	Rural	Urban	All
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1993-94	26.6	29.1	27.3	7.7	11.4	8.5
2004-05	26.6	14.7	23.3	10.6	7.3	9.8
2009-10	44.9	26.2	39.4	19.3	13.2	17.8
2011-12	52.1	28.5	44.8	21.7	13.9	19.7

Source: Authors estimates based on unit level data from NSSO surveys.

The subsequent period after 2004-05 saw a reversal of the earlier shrinkage in terms of access to PDS. The percentage of people who accessed PDS cereals in 2011-12 was much higher than that in 2004-05 and 1993-94. In 2011-12, on an average, 44.7 per cent of the households at all India level had accessed PDS for purchase of cereals, with 52.1 per cent in rural areas and 28.5 per cent in urban areas. Even, in

terms of quantity, this increase was explicitly evident. PDS accounted for about one-fifth (19.7 per cent) of the total consumption of rice and wheat in 2011-12, with 21.7 per cent in rural areas and 13.9 per cent in urban areas. The expansion of PDS access was widespread and improvement was recorded in most of the Indian states. By 2009-10, a majority of households were accessing PDS cereals in 13 out of 30 states, up from only 6 states in 2004-05 (Table 2). The revival of PDS continued and access expanded significantly in 2011-12 during which period, 20 out of 30 states where the majority of households accessed the PDS for cereals.

TABLE 2. CONTRIBUTION OF PDS IN HOUSEHOLD CONSUMPTION OF FOOD GRAINS ACROSS STATES IN INDIA

	Per cent households accessing PDS for cereals				Share of PDS in cereal consumption (per cent)			
State	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	57.5	54.6	72.2	73.9	20.3	20.4	28.5	27.1
Arunachal Pradesh	77.3	40.2	46.7	52.3	50.2	25.8	28.3	31.0
Assam	20.9	8.4	27.2	50.4	4.1	3.5	10.0	22.1
Bihar	0.7	1.9	12.1	42.2	0.3	0.8	4.7	17.8
Chhattisgarh	11.8	22.7	62.2	58.8	3.2	11.3	37.8	34.3
Goa	74.9	11.0	47.8	60.8	42.7	7.5	17.8	25.3
Gujarat	35.5	24.0	26.1	21.6	15.0	9.3	11.4	7.6
Haryana	4.6	4.4	16.4	15.7	1.0	2.7	11.4	11.2
Himachal Pradesh	43.7	47.0	79.4	82.1	26.4	30.2	43.9	43.3
Jammu and Kashmir	20.3	37.4	63.5	76.2	12.1	28.6	46.9	47.1
Jharkhand	12.7	5.5	23.7	27.6	2.6	2.0	13.5	15.0
Karnataka	54.6	47.1	56.4	60.3	17.1	34.5	32.9	26.0
Kerala	78.3	36.7	57.1	76.8	44.8	18.7	26.3	34.0
Madhya Pradesh	1.2	0.9	42.3	35.6	3.3	11.2	19.2	16.6
Maharashtra	32.5	21.1	33.1	31.3	12.4	15.4	21.8	17.6
Manipur	3.7	0.5	8.5	5.3	2.1	0.3	2.4	1.4
Meghalaya	60.8	19.0	54.0	60.6	20.8	10.3	26.1	27.0
Mizoram	91.9	63.5	90.8	92.6	54.5	37.2	41.5	46.9
Nagaland	4.2	0.2	0.0	13.8	3.1	0.0	0.0	5.4
Odisha	6.4	19.4	49.9	58.3	1.2	6.0	22.3	27.2
Punjab	1.5	0.4	18.8	17.4	0.8	0.3	11.5	10.1
Rajasthan	14.2	10.1	16.4	26.0	10.6	8.1	9.0	10.4
Sikkim	47.1	38.4	38.5	45.9	47.9	28.7	31.3	36.5
Tamil Nadu	65.7	68.2	84.2	82.6	19.3	35.1	47.9	47.8
Tripura	57.0	33.7	72.0	81.3	19.8	20.7	31.9	40.1
Uttar Pradesh	1.6	5.7	21.5	24.7	0.6	2.4	10.0	12.4
Uttarakhand	56.3	20.3	28.3	63.4	44.1	13.1	16.0	25.9
West Bengal	16.4	12.7	32.2	43.4	3.9	2.9	8.3	12.3

Source: Same as in Table 1 provided earlier.

During the last few years, improvement in performances of PDS is particularly noteworthy in some of the states. . The most notable case is Bihar, until last few years considered being the worst performing states in terms of the functioning of PDS in the country. However, in 2011/12, more than 42 per cent of households in Bihar had

accessed PDS distributed cereals, which was only 14 per cent in 2009-10, and was less than 2 per cent in 2004-05. The share of PDS in consumption of cereals in Bihar was next to nil (0.2 per cent) in 1993-94, and less than 1percent in 2004-05, which went up to 17.8 per cent in 2011-12. Similarly, significant improvement in the expansion of PDS[2] access took place during this period also in Chhattisgarh, Uttarakhand, Tripura, Odisha, etc.

Factors for Expansion of PDS Access

The impressive improvement in beneficiaries' access to PDS food grains in many states can be attributed to several factors. However, consistent fall in the diversion of PDS food grains to non-target sectors and the widening divergence between market price and PDS price of food grains stand out to be the major factors for expanding the PDS outreach. The divergence between market and PDS prices of rice and wheat has widened and therefore PDS grains have become more lucrative for the population who are dependent upon PDS access for their basic food-items. In 1993-94, the average market price of rice was 1.4 times of the PDS rice and that of wheat was same for open market and PDS. However, the price advantage in availing PDS benefits was accentuated overtime. In 2011-12, the market price of rice was about five times higher than the PDS price, and open market price of wheat was about three times higher than the PDS wheat price (Figure 1). The growing price advantage of PDS food grains created demand side pressure to ensure availability of PDS food grains.

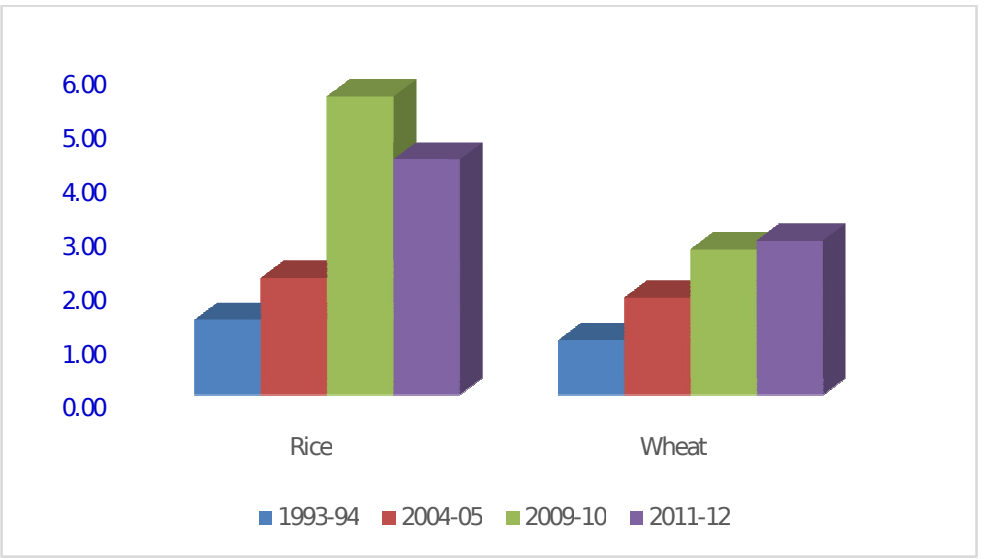

Figure 1. Ratio of Market and PDS Price.

In addition, in recent years, many states have taken several initiatives to revive PDS infrastructure and to plug the rampant leakages in PDS grains distribution. A number of studies report improvements in the functioning of PDS and reduction in leakages (for example, Khera, 2011a and 2011b; Himanshu and Sen, 2011; Kumar *et al.,* 2012). The estimated proportions of cereals diverted from PDS in 1993-94, 2004-05, 2009-10 and 2011-12 are depicted in Table 3.[3] At the all-India level, the leakages from the PDS have been consistently declining since 2004-05. It declined from 53 percent in 2004-05 to 39 percent in 2009-10, and further to 35 percent in 2011-12. Though there has been a decline on the extent of leakages from PDS in most of the states in 2011/12, leakages continue to be alarmingly high in Gujarat (62.2 per cent), Haryana (45.9 per cent), Manipur (95.4 per cent), Rajasthan (65.7 per cent), Uttar Pradesh (57.9 per cent), Uttarakhand (53.6 per cent) and West Bengal (68.7 per cent). Diversion of PDS grain was observed to be nil in Chhattisgarh, Jammu and Kashmir

TABLE 3. TRENDS IN DIVERSION OF PDS FOODGRAINS (PERCENTAGE)

State	1993-94	2004-05	2009-10	2011-12
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh[#]	8.7	24.6	9.9	-3.5
Arunachal Pradesh	25.4	46.6	39.8	21.2
Assam	73.1	88.1	66.5	37.9
Bihar	94.6	91.3	65.0	12.5
Chhattisgarh[#]	NA	49.6	-33.0	-17.9
Goa	30.7	-10.9	32.6	34.8
Gujarat	49.0	50.3	48.5	62.2
Haryana	91.2	83.5	35.5	45.9
Himachal Pradesh	56.0	24.4	19.0	17.3
Jammu and Kashmir[#]	83.9	17.3	-12.0	-21.2
Jharkhand	NA	84.2	41.7	30.9
Karnataka	40.3	27.4	20.8	17.6
Kerala	20.9	24.9	24.4	18.6
Madhya Pradesh	50.0	46.4	43.7	37.8
Maharashtra	56.6	47.6	39.1	37.1
Manipur	88.3	98.0	91.2	95.4
Meghalaya	61.7	64.9	35.6	45.5
Mizoram[##]	43.4	45.0	11.6	-18.0
Nagaland	94.4	100.0	100.0	87.8
Odisha	85.8	73.4	27.4	11.4
Punjab	84.6	94.2	65.0	55.7
Rajasthan	97.9	55.3	65.7	52.6
Sikkim	47.7	42.3	46.4	38.2
Tamil Nadu[#]	-12.6	-4.6	0.5	-3.4
Tripura	49.9	44.9	32.3	11.2
Uttar Pradesh	59.8	83.7	57.9	50.0
Uttaranchal	NA	19.5	53.6	16.8
West Bengal	80.8	84.5	68.7	53.1
India	46.7	52.9	39.3	28.5

Note: NA denotes 'not available' Source: Same as in Table 1.

[#]These states (possibly a few other also) augment centrally allocated grain through open market sales or open market purchase or "state pool" contributions. Using the allocation and off take figures reported in the monthly food grains bulletins leads to underestimation of grain bulletin diversion. For accurate estimation, the grain allocated to the PDS by the state from local procurement and other sources should be added to the off take figure. The lack of readily availability of data on contribution of state pool constrained further analysis in this article.

and Tamil Nadu. The extent of leakages in Andhra Pradesh (-3.5 per cent), Himachal Pradesh (17.3 per cent), Karnataka (17.6 per cent) and Kerala (18.6 per cent) was relatively less. Bihar's PDS grain leakages reduced to about 13 per cent in 2011-12 from 65 per cent in 2009-10 and 97 per cent in 2004-05. Assam, Tripura, Uttarakhand and West Bengal also recorded huge reduction in leakages of PDS grains in the recent years (Table 3).

The increasing contribution of PDS in foodgrains consumption and reducing PDS leakages over the years suggests that wider access reduces PDS leakages. Himanshu and Sen (2011) and Kumar *et al.* (2012) have also observed this earlier.

Trends in Income Transfers through PDS

The value of in-kind food transfers through PDS is summarised in Table 4. The value of per capita PDS food transfers is calculated as the excess, if any, of the market cost of PDS purchases over what was actually incurred as out of pocket expenditure on them. To maintain the temporal comparability, the PDS transfers were converted into real terms at 2004-05 prices. On an average, an amount of Rs. 286 per person at 2004-05 prices, was transferred to a household through PDS in 2011-12, up from Rs.86 in 1993-94. This transfer accounted for only 1.4 per cent of the per capita consumption expenditure of a household in 1993-94, which increased to 2.2 per cent in 2011-12. Such transfer was higher in rural areas (Rs. 313) than in urban areas (Rs. 217). However, the transfer was pro-urban in 1993-94, wherein income transfer to the rural household was only Rs. 86 per person in comparison to Rs. 146 per person in urban areas. The changing trends in PDS transfers explicitly reflect the waning urban-bias, and its renewed pro-rural inclination, where the concentration of poor is higher.

TABLE 4. TRENDS IN MONTHLY INCOME TRANSFER THROUGH PDS AT VALUE OF 2004-05 CONSTANT PRICES

	Rural		Urban		All	
Year	PDS Subsidy (Rs./person)	Share of subsidy in expenditure (per cent)	PDS Subsidy (Rs./person)	Share of subsidy in expenditure (per cent)	PDS Subsidy (Rs./person)	Share of subsidy in expenditure (per cent)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1993-94	86	1.3	146	1.4	101	1.4
2004-05	116	1.6	103	0.8	113	1.3
2009-10	329	3.3	262	1.4	310	2.5
2011-12	313	3.1	217	1.1	286	2.2

Source: Same as in Table 1.

The share of PDS transfers in monthly per capita expenditure (MPCE) increased over time in most of the states. The states like Assam, Bihar, Chhattisgarh, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Madhya Pradesh, Odisha and Sikkim registered remarkable increase in contribution of PDS subsidy to the monthly per capita expenditure (Table 5). In some states, the share of PDS subsidy in MPCE

increased 3-4 times and even more between 1993-94 and 2011-12. In Odisha, the share increased from 0.80 percent in 1993-94 to 5.6 percent by 2011-12. Similarly, Bihar and Chhattisgarh also provide strong evidence for improvement in PDS subsidy over time. On the other hand, the contribution of PDS subsidy in some other states showed either stagnation or slight decline. They include Goa, Gujarat, Haryana, Manipur, Nagaland, Punjab and Rajasthan. The extent of income transfer through PDS varies considerably across the states, though the level of variation (intensity) has declined over the time (Table 5). Evidently, the coefficient of variation in income transfer across different states declined from 92 per cent in 1993-94 to 73 percent in 2011-12.

TABLE 5. TRENDS IN INCOME TRANSFERS THROUGH PDS ACROSS DIFFERENT STATES IN INDIA

	PDS Subsidy (Rs./person/month) at 2004-05 prices				Share of PDS subsidy in expenditure (per cent)			
State	1993-94	2004-05	2009-10	2011-12	1993-94	2004-05	2009-10	2011-12
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Andhra Pradesh	202	194	627	523	2.7	2.2	4.3	3.5
Arunachal Pradesh	217	54	342	315	2.8	0.6	2.2	2.5
Assam	69	69	214	310	1.1	0.9	2.1	3.3
Bihar	43	47	127	232	0.8	0.8	1.6	2.9
Chhattisgarh	55	82	632	441	0.9	1.3	7.1	5.1
Goa	244	78	220	344	2.1	0.6	1	1.6
Gujarat	115	149	189	130	1.4	1.5	1.4	0.9
Haryana	66	23	104	79	0.7	0.2	0.6	0.4
Himachal Pradesh	105	163	613	583	1.2	1.5	4	3.8
Jammu and Kashmir	107	184	618	614	1.2	1.7	4.5	4.4
Jharkhand	50	35	215	279	0.9	0.5	2.3	3.1
Karnataka	106	263	467	415	1.5	3	3.5	2.8
Kerala	270	159	391	497	2.8	1.2	2.1	2.5
Madhya Pradesh	45	54	226	185	0.7	0.8	2.2	1.9
Maharashtra	76	87	221	196	0.9	0.8	1.4	1.2
Manipur	21	15	81	43	0.3	0.2	0.8	0.4
Meghalaya	138	67	294	281	1.6	0.7	2.6	2.3
Mizoram	387	217	544	736	3.8	1.8	3.7	5
Nagaland	51	0	0	58	0.5	0	0	0.4
Odisha	43	60	399	468	0.8	1	4.6	5.6
Punjab	50	8	108	80	0.5	0.1	0.6	0.4
Rajasthan	53	48	104	115	0.7	0.6	0.8	0.9
Sikkim	71	245	467	578	1	2.6	3.5	4.4
Tamil Nadu	262	474	1095	740	3.3	4.8	7.6	4.7
Tripura	213	203	562	599	2.6	2.9	4.6	5.7
Uttar Pradesh	37	49	164	145	0.5	0.7	1.7	1.4
Uttaranchal	271	98	222	450	3.4	1.1	1.3	3.2
West Bengal	99	93	197	238	1.3	1.1	1.7	2
India	101	113	310	286	1.4	1.3	2.5	2.2

Impact of PDS on Poverty

The increased access to PDS has contributed in reducing the poverty and the food and nutrition insecurity in the country. The PDS reduced poverty by 3.5 per cent points in 2011-12, with 4.2 per cent points in rural areas and 1.7 per cent points in

urban areas (Table 6). However, in percentage terms, the extent of poverty reduction may not appear much impressive, but in absolute terms, 40 million people have been able to escape poverty due to access to PDS. The impact of PDS transfers to poverty reduction has increased over time. The contribution of PDS transfers to poverty reduction rose from only 1.5 per cent in 1993-94 to 3.5 per cent in 2011-12. Furthermore, the contribution of PDS transfers in poverty reduction was higher in rural areas than in urban areas, except in 1993-94. The impact of PDS transfers is also discernible in reducing the poverty gap index. The poverty gap index was found declining over time with similar trends as that in the case of head count ratio. This implies that PDS resulted in not only reducing incidence of poverty but also the extent of poverty. The impact of PDS on poverty at disaggregate level are given in Appendix Table 1, which provides further insights on the distributional aspects of the PDS program across the states in India.

TABLE 6. IMPACT OF PDS ON POVERTY

Sector (1)	Poverty rate "with TPDS" (2)	Poverty rate "without TPDS" (3)	Average impact on HCR ("without"- "with") (4)	Average normalised poverty gap with PDS (5)	Average normalised poverty gap without PDS (6)	Average impact on PGI (7)
			Rural			
1993-94	55.3	56.7	1.4	13.47	14.28	0.81
2004-05	41.8	43.9	2.1	7.96	9.08	1.12
2009-10	33.3	38.0	4.7	5.53	7.89	2.35
2011-12	25.3	29.5	4.2	3.71	5.43	1.71
			Urban			
1993-94	36.1	37.9	1.8	7.44	8.15	0.71
2004-05	25.7	26.8	1.2	4.41	5.00	0.60
2009-10	20.8	23.4	2.5	3.26	4.41	1.15
2011-12	13.7	15.4	1.7	1.74	2.32	0.58
			All			
1993-94	50.5	52.0	1.5	9.72	10.41	0.69
2004-05	37.7	39.6	1.9	6.99	7.96	0.97
2009-10	29.9	34.0	4.1	4.86	6.86	2.00
2011-12	22.0	25.5	3.5	2.68	3.79	1.12

Source: Same as in Table 1.

Impact of PDS on Food Security

The improvement in physical access of food to the PDS beneficiaries has brought about commensurate changes in their nutritional status over time. The share of PDS in calorie consumption has been increasing continuously since 2004-05. The share of PDS in per capita calorie intake was 7 per cent in 1993-94, which slightly declined 5.8 per cent in 2004-05. Thereafter, it showed an increasing trend and in 2011-12, PDS accounted for about 12 per cent of calorie intake in India. This trend has been pervasive across states with notable outcomes in Bihar, Chhattisgarh, Jammu and Kashmir, Odisha, etc. (Appendix Table 2). The impact of PDS in improving the

nutritional security of its beneficiaries was further examined based on fiscal transfer method. The findings suggest to laudable performance of PDS in reducing the food insecurity of people in the country. At the country level, the incidence of nutrition deficiency in terms of calorie intake would have been 36 per cent in the absence of PDS in 2011-12, but PDS has been able to tame it to 20.8 per cent (Table 7). This translates to almost 50 per cent reduction in nutrition deficiency on account of interventions through PDS. As results indicate, the contribution of PDS in ensuring food security has been in increasing trend over the time. In 1993-94, 3.4 per cent points of the Indian population could escape the incidence of energy deficiency due to PDS. The impact kept on increasing with 4.5 per cent points of decline in nutrition deficiency in 2004-05 and 11.1 per cent points decline in 2009-10, and further by15.4 per cent points in 2011-12, the latest in the series. On similar lines, the depth of nutrition deficiency as measured by nutrition gap index (NGI) also kept on decreasing over years, with the average impact increasing for successive rounds of data. With increased access in rural areas, the impact of PDS on food security has been more than their counterparts in urban areas during all years under study except 1993-94.

TABLE 7. IMPACT OF PDS ON FOOD SECURITY

Sector (1)	Nutrition deficiency "with TPDS" (2)	Nutrition deficiency "without TPDS" (3)	Average impact on nutrition deficiency ("without"-"with") (4)	Average normalised nutrition gap with PDS (5)	Average normalised nutrition gap without PDS (6)	Average impact on NGI (7)
			Rural			
1993-94	31.2	34.2	3.1	4.97	5.96	0.99
2004-05	31.2	35.9	4.7	4.46	6.84	2.39
2009-10	27.4	39.4	12.0	3.17	7.86	4.69
2011-12	24.2	42.0	17.8	2.66	8.37	5.70
			Urban			
1993-94	19.1	23.3	4.2	2.96	3.77	0.81
2004-05	11.1	14.9	3.8	1.63	2.35	0.72
2009-10	16.1	24.6	8.5	1.72	3.83	2.11
2011-12	12.3	21.8	9.5	1.06	3.03	1.98
			All			
1993-94	28.2	31.5	3.4	3.66	4.53	0.86
2004-05	26.1	30.6	4.5	3.68	5.61	1.93
2009-10	24.3	35.4	11.1	2.74	6.67	3.93
2011-12	20.8	36.2	15.4	1.93	5.91	3.98

IV

CONCLUSIONS AND POLICY IMPLICATIONS

PDS in India is one of the largest welfare programmes in the world with the primary aim of improving food and nutrition security of the socially and economically deprived sections of population. Though, it has passed through the

innumerous challenges over decades, PDS is facing intense scrutiny in the midst of market oriented national policy, replacing it with alternative institutions such as food stamps, cash transfers, etc. In this context, this paper assessed the impact of PDS in improving the economic access of the poor to essential food grains and consequently improved calorie consumption. The study used fiscal transfer method to estimate the subsidy transfer through PDS and its indirect benefits as a window for the poor to escape poverty.

We have derived average impact of PDS on head count ratio of poverty as well as poverty gap index. The findings suggest that at All India level, poverty rate reduced by around 3.5 per cent points in 2011-12 because of PDS subsidy transfers. Such impact was pervasive across rural/urban and regional divide across the country. The effectiveness of PDS as a tool to alleviate poverty was found to increase over the years with observed maximum impact in 2011-12. The effectiveness of the program was also reflected in terms of decreasing the depth of poverty as measured by poverty gap index.

In addition to taming poverty, PDS also contributed substantially in improving nutrition intake of the beneficiaries. The study observed that, the decrease in nutrition deficiency at all India level was as high as 15.4 per cent points in 2011-12. The impact of PDS in tackling under-nutrition was found to deepen across successive rounds of the survey. The contribution of PDS in reducing poverty and improving food security has improved over time. However, persisting imperfections in the system still pose substantial challenges to be tackled for improving cost effectiveness of the PDS services. This necessitates proactive and systematic attempts to improve the functioning of the PDS through introduction of new technologies continually. No doubt, despite recent controversies on effectiveness of PDS, our analyses clearly suggest that PDS has contributed substantially in reducing poverty, food and nutrition insecurity in the country.

NOTES

1. Estimated with the same approach as used in the case of PGI.

2. The expansion of coverage of PDS took places in these states in the recent past, when the overall political governance and states institutions also improved in these states. The variation in governance of PDS across the states is an important policy issue for PDS but which needs a separate in-depth assessment.

3. Using NSS data on per capita monthly purchase of wheat and rice from the PDS, the aggregate purchase of PDS cereals in each state has been estimated. This total purchase by the consumers has been compared with the corresponding ‘off take’ figure for that state. The difference between 'off take' and purchase provides an estimate of the ‘diversion’ of PDS food grains to the open market.

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Sources of Growth in Indian Agriculture: Implications for Food Security and Poverty

I

INTRODUCTION

India's policymakers have been targeting 4 per cent growth for the agricultural sector ever since the 9th 5-year plan (1995/96-2000/2001); the target, however, has remained elusive. The sector grew at an annual rate of 3.2 per cent during 1980/81 to 1995/96, the peak of Green Revolution. However, it started showing signs of stress afterwards, with growth in it decelerating to less than 2 per cent during 1996/97 to 2004/05. The poor performance of agriculture was on account of numerous factors such as deceleration in yield growth of important crops such as rice and wheat, decline in public investment and increased frequency of extreme climate events, viz., droughts and floods. Subsequently, many corrective measures were taken to arrest the decline in agriculture and the growth recovered later on, reaching to 3.8 per cent during 2006/07-2011/12.

Agriculture remains a key sector of Indian economy because of its strategic importance to food security, employment generation and poverty reduction, despite a rapid decline in its income share to less than 15 per cent in 2012-13. Close to 70 per cent of India's population lives in rural areas and about 70 per cent of it depends on agriculture for its livelihood. By 2030 India's population will exceed 1.5 billion, and to feed this number the country will require approximately 320 million tonnes of food grains, 290 million tonnes of vegetables and fruits, 185 million tons of milk, 26 million tonnes of meat, eggs and fish and 23 million tonnes of edible oils (Joshi and Kumar, 2011). Balancing this demand with domestic supply, however, will not be an easy task. Agriculture will face a confluence of biotic and abiotic pressures. Land, water and energy will emerge as main limiting factors. India's net cropped area has been stagnating at around 140 million hectares; hence there is little scope to source growth through area expansion. Intensification of the existing production systems will be constrained by acute scarcity of water and energy. Moreover, climate change will pose a significant threat to the sustainable development of agriculture. Fostering rapid and sustainable growth in agriculture, thus, remains to be a major policy challenge.

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The paper is drawn from the author's unpublished work on 'Sources of Growth which was published as a Discussion Paper by International Food Policy Research Institute (IFPRI).

In this paper, we examine the sources of growth in Indian agriculture focusing on the crop sub-sector that accounts for two-third of the value of output of the agricultural production. A better understanding of the past sources of growth is essential to provide an empirical support to the policies and programmes as to address the emerging challenges and accelerate agricultural growth. Specifically, this paper (1) identifies and quantifies sources of growth in crop sub-sector in the past three decades; (2) discusses economic, institutional, and policy factors underlying these changes; and (3) examines implications for growth, food security and poverty.

Rest of the paper is organised as follows. In the next section, we describe the data and the analytical approach used to identify and quantify sources of agricultural growth. Section III discusses sources of growth. The likely impacts of changing sources of growth on food security, and poverty are discussed in section IV. Policy implications of the study are discussed in the final section.

II

ANALYTICAL APPROACH

The patterns and sources of agricultural growth are studied for the period 1980/81 to 2009/10. This period is further divided into three sub periods, 1980/81 to 1989/90 (the 1980s), 1990/91 to 1999/2000 (the 1990s), and 2000/01 to 2009/10 (the 2000s), so as to compare the transformation and sources of growth in response to various technological, institutional, and policy measures implemented during the different periods. In the 1980s, Green Revolution technologies had spread widely; hence, this period can be considered the "technological transformation phase" of Indian agriculture. The decade of the 1990s can be labeled as a period of "policy regime shift," when a number of economic reforms were undertaken focusing on macroeconomic policy, exchange rate and external trade, industrial licensing, privatisation, etc. Many of the reforms though did not have a direct focus on agriculture; some of these that indirectly impinged on it included deregulation of the agri-food industry, liberalisation of trade in agricultural commodities, and de-monopolisation of external trade from state control. The process of economic reforms continued beyond the 1990s, but with emphasis on "reforming domestic markets" in order to align these with the global markets. In the next decade, the reforms were strengthened to allow private investment in agricultural markets, direct transactions in agricultural commodities outside the state-regulated markets, and contract farming. Futures' trading was permitted, on and off, in agricultural commodities. The list of agricultural commodities reserved for cottage and small-scale industries was pruned to allow private investment for modernisation of food processing sector. The food industry was accorded the status of a priority sector for the purpose of institutional financing. Restrictions on interstate movement of agricultural commodities were removed to improve integration among spatially dispersed markets. This period was

also characterised by high frequency of extreme climatic events such as droughts and floods.

Data

In this paper we analyse sources of growth in the crop sector that accounts for close to two-third of the value of output of agricultural sector. For the purpose, we have used data on area, yields and prices of important crops, viz., cereals: rice, wheat, maize, sorghum, pearl millet, finger millet, barley, and small millets; pulses: chickpeas, pigeon peas, and other pulses; oilseeds: groundnut, sesame, rapeseed–mustard, soybean, linseed, sunflower, safflower, castor, and niger seed; fibers: cotton, jute, and sun hemp; spices: betel nut, cardamom, chilies, pepper, turmeric, ginger, garlic, and coriander; fruits: bananas, cashew nuts, and other fruits; vegetables: potatoes, sweet potatoes, onions, tapioca, and other vegetables; beverages: tea and coffee; and coconut, sugarcane, tobacco, rubber, and cluster bean. The selected crops account for more than 90 per cent of both the total cropped area and the value of the output of the crop sector.

The data on area, production, and yield of important crops were compiled from *Indian Agricultural Statistics* and *Agricultural Statistics at a Glance* published by the Ministry of Agriculture (India, Department of Agriculture and Cooperation, various years a, b), and , and *Indian Horticulture Database* (India, National Horticulture Board, various years). The data on value of main outputs of the selected crops (at their current prices) were compiled from the *Value of Output of Crop Sector* (India, Central Statistical Organization, various years, a, b). The farm harvest price of a commodity was estimated by dividing its value of output (at current prices) by its level of production.[1] The current prices were deflated by the general wholesale price index to convert them into real prices (at 1993/94 base). The time series on area, production, and prices were smoothed by applying Hodrick–Prescott (HP) filter.[2]

III

METHOD OF DECOMPOSITION OF GROWTH

To decompose agricultural growth by source and crop we followed the "growth accounting approach" as in Minot *et al.* (2006). According to this approach, the change in gross revenue from a single crop can be decomposed into (1) change in cropped area, (2) change in yield, (3) change in real price, and (4) a residual representing the interaction among the first three factors. The change in gross revenue from n crops can similarly be decomposed, except that there is one more source of change, the reallocation of area from lower-value to higher-value crops, based on comparative advantage.

If A_i is area under crop i, Y_i is its production per unit area, and P_i is the real price per unit of production, then the gross revenue R from n crops can be written as

$$R = \sum_{i=1}^{n} A_i Y_i P_i. \quad \ldots.(1)$$

A_i can be further expressed as the share of crop i in the total cropped area, $a_i = \left(\frac{A_i}{\sum_i A_i}\right)$, and substituting this expression in equation (1) we get

$$R = \left(\sum_{i=1}^{n} a_i Y_i P_i\right) \sum_{i=1}^{n} A_i. \quad \ldots.(2)$$

Total derivative of both sides of equation (2) provide the absolute contribution of changes in these components to the change in gross revenue:

$$dR \cong \left(\sum_{i=1}^{n} a_i Y_i P_i\right) d\left(\sum_{i=1}^{n} A_i\right) + \left(\sum_{i=1}^{n} A_i\right) d\left(\sum_{i=1}^{n} a_i Y_i P_i\right). \quad \ldots.(3)$$

Equation (3) is only an approximation, since it excludes interaction term. The second term on the right-hand side of this equation can be further decomposed from a change in sums to the sum of changes, as follows:

$$dR \cong \left(\sum_{i=1}^{n} a_i Y_i P_i\right) d\left(\sum_{i=1}^{n} A_i\right) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} d(a_i Y_i P_i). \quad \ldots.(4)$$

Further expansion of the second term of equation (4) results in the following expression:

$$dR \cong \left(\sum_{i=1}^{n} a_i Y_i P_i\right) d\left(\sum_{i=1}^{n} A_i\right) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} (a_i Y_i dP_i) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} (a_i P_i dY_i) + \sum_{i=1}^{n} A_i \sum_{i=1}^{n} (Y_i P_i da_i) \quad \ldots..(5)$$

Equation (5) decomposes change in gross revenue due to change in (1) total cropped area, (2) crop yields or technology, (3) real prices, and (4) land reallocation or diversification. The first term on the right-hand side of this equation represents the change in gross revenue due to change in total cropped area. The second term on the right-hand side captures the change in gross revenue due to a change in the real prices of commodities. The third term measures the change in gross revenue due to changes in crop yields or technology. The fourth term represents the change in gross revenue associated with changes in crop composition. A positive fourth term indicates a reallocation of land from lower-value to higher-value crops. Dividing both sides of equation (5) by the overall change in gross revenue (*dR*) gives us the proportionate share of each source in the overall change in gross revenue or agricultural growth.

This methodology can be used to discern the contribution of each crop or crop group to overall growth of agriculture.

IV

SOURCES OF GROWTH

Cereals, mainly rice and wheat, dominate the cropping pattern in India, despite their declining share in the total cropped area and also in the total value of output

(Table 1). In the decade from 2000/01 to 2009/10, cereals accounted for 54 per cent of the gross cropped area and 37 per cent of the value of output. The second most important group of crops, in value terms, comprises the horticultural crops (fruits, vegetables, plantation crops, and spices and condiments). These crops contributed more than one-third to the value of output in the decade of 2000/01 to 2009/10, from an area share of less than 10 per cent. Further, their share in the area as well as value of output has increased considerably over the past two decades. Oilseeds accounted for 12 per cent of the gross value of output and 14 per cent of the gross cropped area during that decade. Sugarcane, cotton, and pulses were other important crops.

TABLE 1. CONTRIBUTION OF DIFFERENT CROPS TO AGRICULTURAL GROWTH, 1980/81–2009/10

	Share in gross cropped area (per cent)			Share in real value of output (per cent)			Annual compound growth in real value of output (per cent)			Share in overall growth (per cent)		
Crop/crop group	1980s	1990s	2000/01 - 2009/10	1980s	1990s	2000/01 - 2009/10	1980s	1990s	2000/01 - 2009/10	1980s	1990s	2000/01 - 2009/10
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Rice	24.2	24.1	23.6	22.4	21.7	19.0	3.3	3.1	-0.2	23.1	20.5	-1.7
Wheat	14.2	14.6	15.1	12.0	12.7	12.6	2.4	5.5	1.2	10.2	20.7	4.6
Maize	3.5	3.4	4.1	2.1	1.9	2.1	0.5	3.1	5.0	0.7	1.9	3.2
Other cereals	20.0	14.6	11.6	5.8	4.1	3.2	-2.7	0.4	1.3	-3.2	-0.2	0.9
All cereals	61.9	56.7	54.5	42.4	40.4	37.0	2.0	3.6	0.7	30.7	43.0	6.9
Chickpeas	4.5	4.0	3.9	2.8	2.4	2.4	1.2	2.4	5.2	0.7	1.1	3.6
Pigeon peas	1.9	2.0	2.0	1.5	1.4	1.0	3.5	1.7	2.6	1.4	0.1	0.9
All pulses	14.0	13.0	12.5	7.3	6.2	5.2	2.6	1.0	3.0	4.6	0.3	4.8
Groundnut	4.5	4.4	3.5	5.2	4.4	3.0	3.2	-2.0	2.0	4.9	-4.2	1.1
Rapeseed & mustard	2.0	3.3	3.2	2.4	3.1	2.7	9.0	-1.5	6.1	6.9	-1.7	4.3
Soybean	0.7	2.8	4.3	0.5	2.0	2.4	30.0	8.7	9.1	4.2	3.7	6.6
Other oilseeds	4.3	6.6	7.4	4.3	4.8	4.1	8.7	-2.8	5.4	5.4	-0.5	1.0
All oilseeds	10.8	14.2	14.0	12.4	14.1	12.1	6.9	-0.7	5.4	21.4	-2.6	13.0
Cotton	4.5	4.8	4.9	3.9	5.0	5.0	1.4	2.8	10.7	4.0	1.7	14.5
Other fibers	0.7	0.6	0.6	0.7	0.5	0.4	3.7	1.1	1.4	0.8	0.1	0.2
All fibers	5.2	5.4	5.5	4.7	5.5	5.4	1.7	2.6	9.9	4.8	1.8	14.7
Plantation crops	1.3	1.6	1.8	1.7	1.8	1.6	5.6	2.7	5.0	6.8	0.0	1.1
Spices & condiments	1.1	1.3	1.3	2.8	3.8	3.9	8.5	6.8	3.8	4.8	5.1	5.4
Fruits	1.4	1.9	2.7	9.4	10.6	14.2	4.4	6.2	5.5	11.3	20.4	24.6
Vegetables	2.1	2.9	3.8	9.8	11.5	13.5	3.6	6.8	6.7	11.0	19.1	28.9
Horticultural crops	5.9	7.7	9.6	23.7	27.7	33.2	4.6	6.3	5.8	33.9	44.6	60.0
Sugarcane	1.9	2.3	2.5	8.1	8.6	8.8	1.2	5.0	0.0	3.8	13.1	-1.3
Other crops	1.6	1.5	1.9	1.0	0.9	0.9	0.9	1.0	6.8	0.8	-0.1	2.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	3.1	3.7	3.3	100.0	100.0	100.0

Source: Estimated by authors

Note: Value of output does not include the value of crop by-products (straws and fodders). 2. Sub-total of each group of crops is in italics.

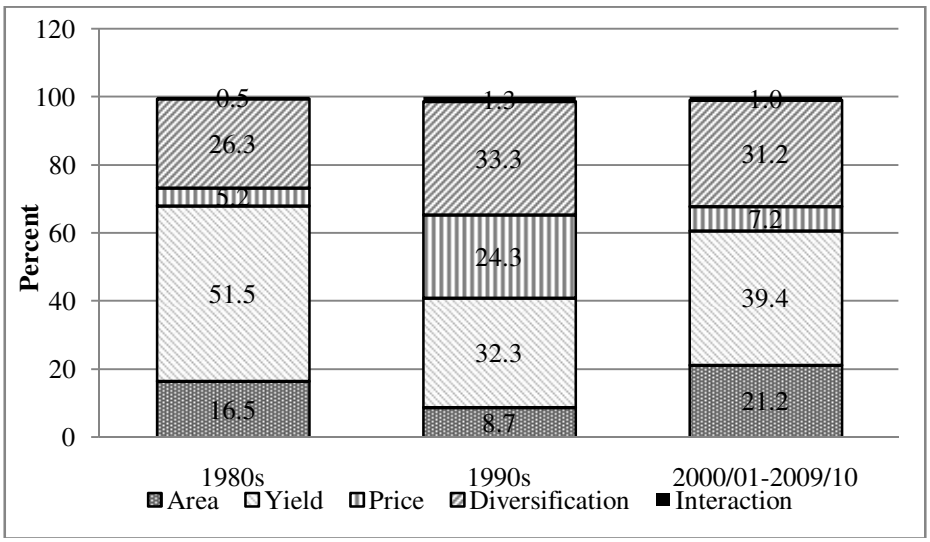
The crop sector grew at an annual rate of 3.1 per cent in the 1980s, which accelerated to 3.7 per cent in the 1990s. The rate of growth, however, decelerated marginally in the following decade. The growth patterns, however, are different for different crops or crop groups. Horticultural crops experienced a steady and relatively faster growth (around 6 per cent) in the 1990s and after as compared to a 4.6 per cent

growth in the 1980s. The value of output of oilseeds increased at a rate of more than 6 per cent a year in the 1980s. This momentum, however, could not be sustained in the 1990s, but it was followed by a strong recovery in the following decade. The value of output of wheat grew at an accelerated rate of 5.5 per cent a year in the 1990s, from 2.4 per cent in the 1980s. But, it decelerated significantly to 1.2 2000/01 to 2009/10. Rice, which has a higher share of the value of output than any other crop, experienced a strong decline in its growth. On the other hand, maize, cotton, and pulses experienced strong growth in this period.

Before presenting decomposition of growth by source we identify the crops or crop groups that have been important to overall growth of agriculture. The last three columns of Table 1 present the contribution of each crop or crop group to the overall growth of crop sector. In the 1980s, with a share of more than 21 per cent each, rice and oilseeds were the main contributors to agricultural growth, followed by fruits, vegetables and wheat (10 per cent). In the 1990s, wheat, sugarcane, fruits and vegetables gained in their shares of growth; rice lost marginally, and oilseeds ceased to be a driver of growth. In the following decade, the growth share of rice and wheat declined, leading to a drastic fall in the share of cereals. In contrast, fruits and vegetables emerged as important contributors to growth during 2000/01 to 2009/10; their combined share in overall growth increased to 53 per cent. Area under fruits and vegetables grew at an annual rate of more than 3 per cent in the 1990s and 4.5 per cent in the next decade. Oilseeds and cotton also emerged important contributors to overall growth during 2000/01-2009/10. These changes in the relative shares of crops provide a clear indication of the growing importance of high-value crops in Indian agriculture.

Figure 1 shows the changes in share of the contribution of area expansion, price increases, yield improvements or technological change, and area reallocation or diversification to the growth of agriculture over the past three decades. Technological change had been the dominant source of growth in the 1980s, accounting for more than half of the overall growth in the crop sector. More than one-fourth of the growth during this period was associated with land reallocation from lower- to higher-value crops. Area expansion contributed about 17 per cent to overall growth, while prices did not have a significant influence on overall growth during this period.

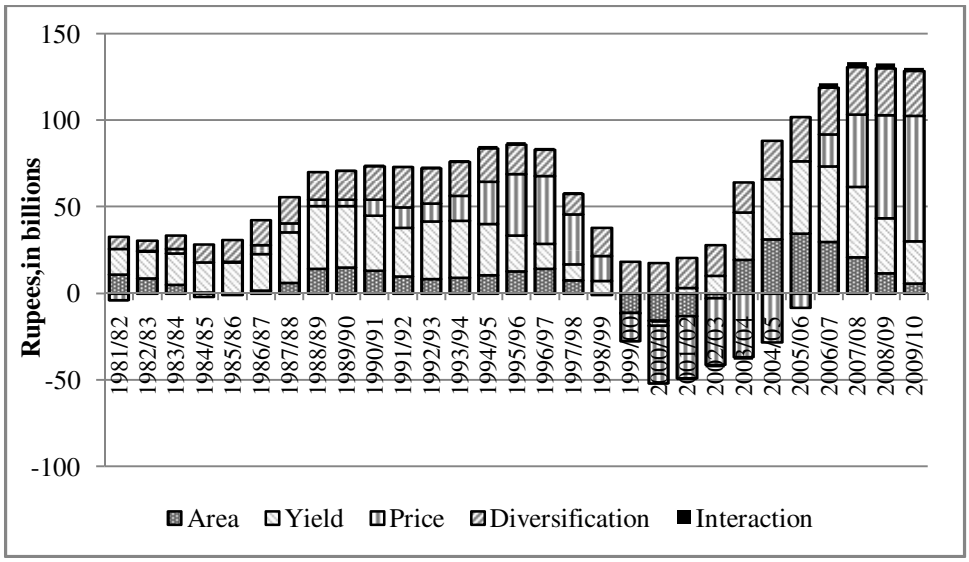
Sources of growth changed drastically in the 1990s. Effect of technology faded with its share in growth falling to one-third, while diversification consolidated its share equaling to that of technology. There was a drastic increase in the contribution of prices to 24.3 per cent in the 1990s, mainly due to a significant rise in the prices of rice and wheat. In the next decade, the contribution of technology improved, reaching to 39.4 per cent, while that of prices declined drastically to 7.2 per cent. During this period, the price effect on growth was driven by horticultural crops. Diversification maintained its share of around 30 per cent in the overall growth. Surprisingly, area expansion also turned out to be an important source of growth during this period.



Source: Estimated by authors

Figure 1. Contribution of Different Sources to Growth in the Crop Sector India, 1980/81–2009/10 (per cent).

For a deeper insight into the dynamics of growth sources, we now look at the year-over-year changes in their contribution to overall growth (Figure 2). The sum of these changes suggests that in the past three decades, agricultural growth behaved in



Source: Estimated by authors.

Figure 2. Annual Changes in Sources of Agricultural Growth, 1980/81–2009/10.

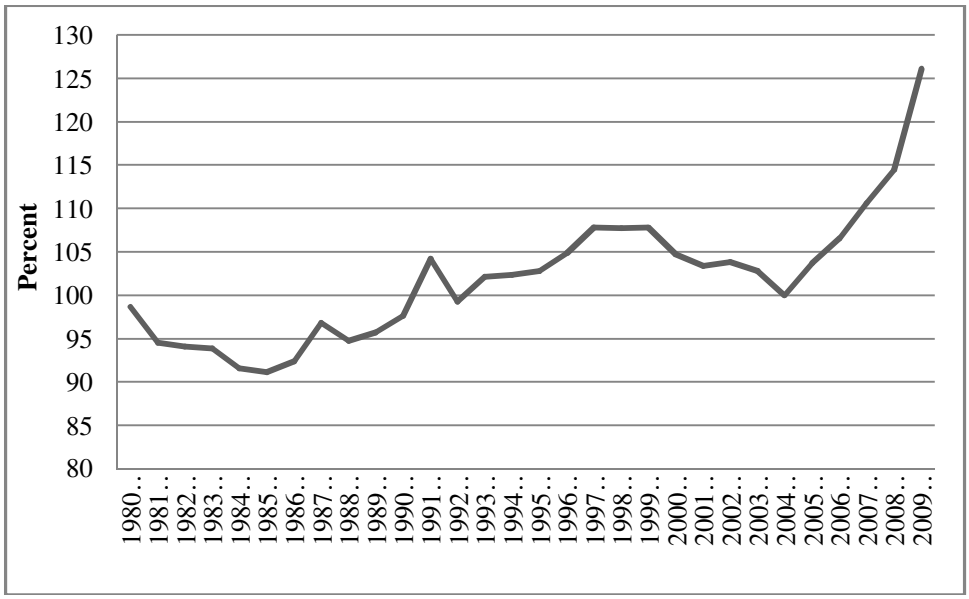
a cyclical manner, accelerating during 1980/81 to 1996/97, falling until 2001/02, and rising thereafter. Technology, as expected, had been the main source of growth until the mid-1990s. In the latter half of the 1990s, the growth became driven by prices, and the effect of technology started fading, having almost a negligible contribution between 1999/2000 and 2002/03. Later on, however, technology started regaining its lost position. Real prices of agricultural commodities declined in the first half of the decade 2000/01-2009/10, to the extent that these turned out to be a detractor of growth. However, in the second half of that decade, the prices of agricultural commodities started rising, which led to an improvement in their contribution to growth and also in overall growth. Interestingly, despite the erratic behavior of agricultural growth, diversification more or less maintained its share of growth throughout the past three decades, which leads us to conclude that diversification is a steady source of agricultural growth.

A number of policy and non-policy factors were responsible for the observed patterns of sources of growth. Demand-side factors played an important role. The observed changes in the production mix are consistent with changes in the consumption basket. Between 1983 and 2009, India's food basket underwent a significant transformation away from cereals and toward high-value commodities (Joshi and Kumar 2011). Export demand for fruits and vegetables also acted as a catalyst in the growth of high-value agriculture. India's exports of fruits and vegetables increased from US$202 million[3] in 1980–82 to $380 million in 1990–92 and took a drastic jump to $2.068 billion in 2008–10 (FAOSTAT: http://faostat.fao.org).

The demand-driven growth in the horticultural sector was facilitated by the improvements in roads, transportation, communication, and electricity (Joshi *et al*., 2004; Birthal *et al*., 2012) and development of retail chains (Birthal *et al*. 2005; Roy and Thorat 2008; Reardon and Minten, 2011).

In the 1990s, the terms of trade turned in favor of agriculture (Figure 3), which led to an increase in the contribution of prices to agricultural growth. The real prices of most agricultural commodities grew faster in the 1990s than in the 1980s. As a matter of policy most food grain crops in India are protected against price fluctuations through the policy of minimum support prices. The policy serves twin purposes as incentive to farmers to produce more and as a protection to the poor consumers against price volatility. The government procures huge quantities of rice and wheat for public distribution, welfare programmes, and buffer stocking at the minimum prices. In the 1990s, the wholesale prices of rice and wheat increased, respectively, at an annual rate of 1.3 per cent and 2.4 per cent in the 1990s, as compared with -0.3 per cent and -1.3 per cent in the 1980s. In the first decade of the 21st century, it was prices of wheat and rice that turned out to be the leading cause of erratic behaviour of agricultural growth. Starting in 2000/01, the prices of wheat (in real terms) declined continuously until 2005/06. The minimum support prices of both wheat and rice, however, were raised afterwards, when their international prices were

on the rising trend. But this could not compensate for the loss in their share of growth that occurred in first half of the decade.



Source: Estimated by authors using data from National Accounts Statistics

Figure 3. Terms of Trade for Indian Agriculture, 1980/81–2009/10

The declining share of technology in overall growth was due to the slowing down of growth in yield of most of crops in the 1990s and thereafter (Table 2). The yield of rice and wheat, which had been growing at an annual rate of more than 3 per cent in the 1980s, decelerated to less than 2 per cent during 2000/01-2009/10. The high-yielding seeds even though had spread widely by the mid-1990s, the growth in complementary inputs decelerated.[4]

TABLE 2. ANNUAL GROWTH IN YIELD OF IMPORTANT CROPS, 1980/81–2009/10

Crop / crop group	1980s	1990s	2000/2001–2009/2010
(1)	(2)	(3)	(4)
Rice	3.15	1.21	1.42
Wheat	3.24	1.82	0.73
Maize	2.04	2.22	2.27
Gram	2.48	1.53	1.16
Pigeon peas	0.07	0.13	0.94
Groundnut	1.74	1.34	1.76
Rapeseed & mustard	3.00	0.38	2.13
Soybean	5.27	1.91	1.71
Cotton	4.21	-1.40	10.29
Sugarcane	0.21	0.79	0.59
Fruits	-2.21	1.81	-1.48
Vegetables	-2.46	0.38	1.31

Source: Estimated by authors.

A large share of oilseeds in the overall growth in the 1980s was due to favourable incentives and protection structures. The government launched the Technology Mission on Oilseeds (TMO) in 1986 that provided a package of improved technology, high-quality inputs, and extension services to farmers for encouraging cultivation of oilseed crops. These incentives were supported by high tariff and nontariff barriers on imports of edible oils. Cotton production increased impressively during 2000/01-2009/10 mainly due to introduction of Bt cotton in 2002/03, and in 2009/10 it occupied 90 per cent of the total cotton area.

Rise in the share of area expansion in overall growth during 2000/01 – 2009/10 was an outcome of increased weather uncertainty, which led to considerable contraction as well as expansion of the cropped area in some years, depending on the quantum and distribution of rainfall.

Diversification remained an important source of growth throughout the past three decades, but more so in the 1990s. Land reallocation took place from less profitable foodgrain crops like millets, sorghum, and pulses, and toward vegetables, fruits, and spices (see Annexure Table 1). Note that there has been little, if any, diversion of area from wheat and rice. Fruits and vegetables together accounted for more than three-fourths of the diversification-induced growth in agriculture and not much from yield improvements.

These findings clearly reveal that (i) given the fixed supply of land there is a limited scope to enhance agricultural growth through area expansion, (ii) prices do stimulate agricultural growth but cannot be a sustainable source of growth, and (iii) in the long-run, growth in agriculture has to come from technological change and diversification towards high-value crops.

V

CHANGING GROWTH SOURCES, FOOD SECURITY AND POVERTY

Indian agriculture is predominantly small-farm agriculture; landholdings measuring less than or equal to 1 hectare comprise two-thirds of the total holdings. The question is: How are smallholder farmers will be impacted by the changing sources of growth? The changing growth sources offer opportunities and pose challenges to small landholders. For instance, the demand-driven growth in high-value agriculture is an opportunity for smallholders to enhance their income and utilise their resources particularly the family labour efficiently by diversifying their production portfolio toward high-value crops, but access to markets both for outputs and inputs could be a major challenge.

First we examine the extent to which smallholder farmers can benefit from diversification. Table 3 presents net returns from high value crops vis-à-vis other crops on different farm categories. High-value crops generate more net revenue per unit of land than do most other crops, almost twice the mean revenue from other crops. Interestingly, the size–productivity relationship is also stronger in the case of

horticultural crops, except floriculture. For other crops, especially rice and wheat, there is no definite relationship between farm size and productivity. An important reason for this is the increasing mechanisation of field operations in these crops, and more so on larger farms, which has helped improve their production efficiency. On the other hand, there has been little, if any, mechanisation of field operations in horticultural crops because many of the activities cannot be accomplished by machines and require human and animal labor. Most high-value crops are highly responsive to constant and careful monitoring of plant health; careful weeding, pruning, and irrigation; harvesting based on assessments of when individual pieces of fruit and vegetables are ripe; and careful, efficient handling (Collins, 1995). These findings indicate that small farmers have comparative advantage in production of high-value crops.

TABLE 3. NET REVENUE PER HECTARE FROM DIFFERENT CROPS BY FARM SIZE IN 2002-03

(*Rs./ha*)

Crops/crop groups	Marginal (≤1.0ha)	Small (1.0-2.0ha)	Medium (2.0-4.0ha)	Large (>4.0ha)	All
(1)	(2)	(3)	(4)	(5)	(6)
Rice	8594	8394	8919	9313	8734
Wheat	9497	9108	10614	9736	9711
Maize	4781	4769	4604	5140	4807
Other cereals	3375	3287	2415	2039	2611
Total cereals	7903	7298	7444	6611	7349
Pulses	5248	4393	5031	4187	4579
Oilseeds	8738	6759	6395	6150	6694
Fiber crops	7639	6999	7784	5731	6697
Sugar crops	22627	17780	23139	21279	21186
Fruits	32687	21004	19243	14881	21715
Vegetables	14182	12686	11752	12592	13103
Spices	21288	19340	18035	13061	17557
Plantation	23355	19678	18665	11449	19049
Flowers	20667	9508	10896	11585	13925
Medicinal and narcotic plants	13684	16822	14303	12351	14386
High-value crops	19220	16250	15699	13159	16444
Other crops	12421	10363	8622	4230	7350
All crops	9018	7944	8120	6668	7877

Source: India, National Sample Survey Organization (2005).

However, the capability of small farmers to grow high-value crops is often doubted on several counts. First, such farmers' average size of landholding is too small to permit them to divert more land out of staples at the cost of their household food grain security. Second, cultivation of high-value crops is capital-, and information-intensive,[5] which may restrict them to grow such crops. Third, most high-value crops are perishable and are prone to greater production and market risks, while small farmers are risk averse. Fourth, the marketable surplus of such crops may be too small to be remuneratively traded in the urban markets due to high transportation and transaction costs. Fifth, the modern marketing systems may exclude small farmers from the value chains because of their low marketable surplus and stricter food safety standards imposed by them.

The literature suggests that diversification of agriculture from lower- to higher-value crops offers significant opportunities to farmers to enhance their income and employment (Barghouti *et al*., 2005; Joshi *et al*., 2004; Weinberger and Lumpkin, 2007). Most high-value crops have short gestation periods, require low start-up capital, and generate a stream of outputs that can be easily liquidated for cash (Weinberger and Lumpkin 2007; Joshi *et al*., 2006). Thus, smallholder farmers are likely to benefit more from the diversification-led growth.

To assess the participation of smallholder farmers in high-value agriculture we compare area allocations to different crops by farm size (Table 4). Three important observations stand out prominently from this comparison. First, as compared with large farmers, smaller farmers allocate a larger proportion of their land to high-value crops. Second, smaller farms have a comparative advantage in production of vegetables over fruits and spices. This is expected, since vegetables generate quick and regular returns, and require more labour and less capital, which matches small-holders' resource endowments (Birthal *et al*., 2012). Further, most fruit crops and regular returns, and require more labour and less capital, which matches smallholders' resource endowments (Birthal *et al*., 2012). Further, most fruit crops and certain spices (betel nut and cardamom, for example) require more start-up capital and have longer gestation periods, which discourage small farmers from growing such crops. Third, compared with others, though the small farmers allocate a larger share of their area to high-value crops, they also allocate a larger proportion of their land to rice and wheat.

TABLE 4. AREA SHARE OF DIFFERENT CROPS BY FARM SIZE, 2002/03

(*per cent*)

Crops/crop groups	Marginal	Small	Medium	Large	Total
(1)	(2)	(3)	(4)	(5)	(6)
Rice	38.09	31.14	24.76	15.13	26.67
Wheat	20.90	17.21	15.83	14.16	16.92
Maize	5.66	5.45	4.38	2.89	4.50
Other cereals	9.26	12.85	14.76	17.69	13.82
Total cereals	73.90	66.64	59.73	49.87	61.90
Pulses	6.58	9.53	10.96	16.01	11.04
Oilseeds	6.20	8.31	12.13	15.44	10.78
Fiber crops	2.01	3.64	5.05	6.87	4.51
Sugar crops	2.20	3.30	3.47	2.88	2.93
Fruits	1.12	1.20	1.37	1.06	1.18
Vegetables	4.03	3.08	2.06	1.24	2.54
Spices	1.05	1.00	1.24	1.13	1.11
Plantation	0.98	0.70	0.52	0.49	0.67
Flowers	0.09	0.05	0.13	0.03	0.07
Medicinal and narcotic plants	0.20	0.27	0.39	0.16	0.25
High-value crops	7.46	6.29	5.71	4.11	5.81
Other crops	1.65	2.28	2.96	4.82	3.03

Source: India, National Sample Survey Organisation 2005.

These findings have an important implication for food security. Contrary to the perception that small farm diversification is not compatible with household food

security (Vyas, 1996, Jha, 2001) the evidence suggests that smallholders do take care of their household cereal requirement while diversifying toward market-oriented high-value crops. This is also supported by results of the decomposition of growth where it emerged that diversification has occurred displacing less profitable crops rather rice and wheat. Singh and Kumar (2002) conclude that agricultural diversification helps achieve food security and improved human nutrition and increased rural employment.

Agricultural growth has been proven to be more pro-poor than the growth in other economic sectors (Ravallion and Datt, 1996; Warr, 2003). With higher returns per unit of land and greater area allocation to high-value crops on smaller farms the diversification-led growth is expected to empower smallholders to escape poverty. Table 5 compares poverty rates among growers and non-growers of high-value crops by farm size. In general, the incidence of poverty is higher among farm households towards the bottom of land distribution, but it is less among the growers of high-value crops (19.6 per cent) as compared to the non-growers (25.4 per cent). By farm size, it is less among the growers at all scales than among the non-growers. The poverty gap that measures depth of poverty (how far households are from the poverty line) and squared poverty gap that measures severity of poverty (besides poverty gap it takes into account the inequality among the poor are smaller for growers of high-value crops at all scales.

TABLE 5. POVERTY STATUS OF FARM HOUSEHOLDS 2002-03

Farm class	Head count ratio	Poverty gap	Squared poverty gap
(1)	(2)	(3)	(4)
	Growers of high value crops		
Marginal (≤1ha)	0.241	0.044	0.012
Small (1-2ha)	0.169	0.025	0.007
Medium (2-4ha)	0.109	0.016	0.004
Large (>4ha)	0.072	0.015	0.005
All	0.196	0.034	0.01
	Non growers of high value crops		
Marginal (≤1ha)	0.302	0.056	0.016
Small (1-2ha)	0.203	0.035	0.009
Medium (2-4ha)	0.174	0.031	0.008
Large (>4ha)	0.105	0.017	0.005
All	0.254	0.046	0.013

Source: India, National Sample Survey Organization 2005.

These findings indicate that diversification toward high-value crops is more pro-poor. Though, in the short-run it may not help all the poor to come out of poverty, but may mitigate its severity and reduce the poverty gap. In the long-run given enabling policies, infrastructure and support services the growth in high-value agriculture will have a large positive impact on welfare of the farm households.

VI

POLICY IMPLICATIONS

Some important policy implications emerge from this study. First, prospects for growth through area expansion are limited. India's net cropped area has stagnated around 140 million ha. Competition for land is likely to intensify due to its increasing demand for residential and industrial purposes. The only possibility to expand cropped area is through intensification of the existing cropped land. This will require investment in irrigation and innovations in water management to improve water use efficiency.

Second, prices play an important role in stimulating agricultural growth; but price-led growth may not sustain for long. In India, the government sets a floor price (minimum support price) for most crops, but not for perishable high-value crops. A part of the price effect is due to changes in the administered prices, mainly of rice and wheat that the government procures for public distribution and buffer stocking. The administered price–led growth may widen interpersonal and regional disparities as the benefits of price increases accrue in proportion to the marketable surplus, which is obviously small for poor farmers and poorer states. This points towards the need for enhancing competition in the marketplace and improve market and transportation infrastructure to cut down marketing and transaction costs (Birthal *et al*., 2005) associated with small marketable surplus particularly of high-value crops.

Third, decline or stagnation in the relative contribution of technology to agricultural growth should be taken seriously. This could be due to factors, such as lack of investment in agriculture in general and agricultural research in particular, inefficiency in agricultural research, poor linkages between research and extension, weather uncertainty, etc. All these have implications for agricultural research and development. One such implication is the need to improve and sustain the level of public investment in agriculture that induces private investment also. Investment in agricultural research and extension is far from adequate. India spends only about 0.6 per cent of its agricultural gross domestic product on agricultural research and extension (Beintema *et al*., 2008). There is sufficient evidence to show that the payoff on investment in agricultural research is very attractive (Fan *et al*., 2007). A higher investment in agricultural research is, thus, required to keep yield frontiers upward or to reduce cost of production. Further, the agricultural research agenda needs to be revisited and prioritised as to tackle the emerging challenges of climate change, rising prices of agricultural commodities and energy inputs, increasing cost of production, labour shortages and degradation of natural resources, and also changing food preferences. While the focus of research is likely to remain on breeding for higher yields, the importance of research on management of biotic and abiotic stresses cannot be over emphasised. Research on horticultural crops also merits attention, since there have been few yield gains in most horticultural crops. Note that small farmers proportionally allocate more area to horticultural crops and also they are

more efficient in their production, investment in horticultural research would have a larger effect on income and poverty reduction. Finally, to harness benefits of research there is a need to effectively link with the technology and information dissemination systems, which otherwise would remain stunted.

Fourth, diversification toward high-value commodities is a sustainable source of growth and provides a cushion to agricultural growth. It also provides an opportunity to smallholders to enhance income and escape poverty as the demand for high-value food commodities is expected to accelerate. In the last few years, there has been some progress in dismantling policy and institutional barriers to the high-value agriculture and food industry, yet harnessing its potential of inclusive growth will require (1) increased investment in public infrastructure (roads, electricity, and communication) that reduces transportation and transaction costs and induces the private sector to invest in agro processing, cold storage facilities, refrigerated transportation, and retail chains to enhance efficiency of the value chains and minimise postharvest losses; (2) enhanced access of farmers to technology, credit, inputs, information, and services; and (3) appropriate policies that facilitate institutional arrangements like contract farming, producers' organisations, and cooperatives that provide farmers easy access to markets, distribute price risks, and reduce marketing and transaction costs.

NOTES

1. The Central Statistical Organisation uses farm harvest prices and production of agricultural commodities supplied by the Directorates of Economics and Statistics and the Departments of Agriculture of different states to estimate their monetary values. Since information on farm harvest prices of all the commodities at state level was not readily available, we estimated these by dividing the value of output of different commodities by their respective levels of production.

2. Hodrick–Prescott filter is a data smoothing technique, commonly applied to remove short-term fluctuations from time series data. It generates a smoothed nonlinear representation of a time series. The adjustment of the sensitivity of the trend to short-term fluctuations is done by applying a suitable adjustment factor.

3. All dollar amounts are in US dollars

4. Growth in gross irrigated area and fertiliser use per hectare during the period 1996/97 to 2004/05 was 0.4 per cent and 1.9 per cent, respectively, as against 2.5 per cent and 5.9 per cent from 1980/81 to 1995/96.

5. We estimated cost of cultivation for horticultural crops as aggregate, and these were higher on smaller farms. The unit cost of production, measured as paid out cost (excluding imputed cost of the family labour) to produce one unit of output in monetary terms, was almost similar (Rs. 37-41 to produce output worth Rs 100) across farm types. The gross revenue per ha on smaller farms, however, was higher enough to offset the cost disadvantage. Higher gross revenue on smaller farms could be attributed to the higher endowments of family labor on smaller farms per unit of arable land.

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ANNEXURE TABLE 1. AVERAGE ANNUAL CHANGE IN THE SOURCES OF AGRICULTURAL GROWTH, NATIONAL LEVEL (IN MILLION RUPEES), 1980/81–2009/10

Crop / crop group	1980s						1990s						2000/2001–2009/2010					
	A	Y	P	D	I	T	A	Y	P	D	I	T	A	Y	P	D	I	T
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(16)	(17)	(18)	(19)	(20)
Rice	1,714	9,205	-171	-81	30	1,0697	995	4,714	4,354	799	104	10,965	2,863	5,280	-5,097	-4,198	-109	-1,260
Wheat	919	5,285	-1,511	51	-29	4,715	518	4,012	4,235	2,134	194	11,093	1,896	2,179	-852	45	92	3,361
Maize	163	741	-345	-240	-10	308	85	809	-185	329	0	1,039	327	997	0	974	31	2,328
Other cereals	437	1,408	-1,349	-1,954	-46	-1,505	221	855	1,229	-2,331	-58	-85	491	1,121	1,022	-1,933	-67	635
All cereals	3,233	16,639	-3,377	-2,224	-55	14,216	1,818	10,390	9,633	931	241	23,012	5,578	9,577	-4,927	-5,112	-53	5,063
Chickpeas	215	704	228	-777	-54	316	120	568	207	-309	-2	585	361	751	226	1,249	49	2,636
Pigeon peas	114	-64	258	337	-10	634	67	-32	130	-123	-3	39	146	131	513	-154	-6	630
All pulses	568	1,417	801	-587	-68	2,131	318	-110	799	-826	-23	158	792	479	1,486	723	3	3,483
Groundnut	413	1,017	23	772	50	2,275	257	688	-1,192	-1,993	16	-2,225	479	851	1,049	-1,565	-27	788
Rapeseed & mustard	208	895	-555	2,627	32	3,208	171	406	-1,491	25	-26	-915	445	1,379	1,092	220	21	3,157
Soybean	46	347	204	1,223	119	1,939	81	268	-1,134	2,756	17	1,988	368	510	1,371	2,464	123	4,836
Other	196	727	751	810	24	2,507	144	277	-451	-248	14	-264	327	639	-310	71	-31	695
All oilseeds	863	2,987	424	5,431	225	9,929	653	1,639	-4,268	539	21	-1,415	1,619	3,379	3,202	1,189	86	9,475
Cotton	303	2,228	-67	-628	37	1,873	265	-1,507	728	1,242	158	886	766	8,797	-283	1,293	-2	10,571
Other fibers	45	251	256	-199	6	360	26	130	-178	82	-5	56	68	168	108	-173	-7	163
All fibers	349	2,479	189	-827	43	2,233	291	-1,377	550	1,324	153	942	833	8,965	-175	1,119	-9	10,734
Plantation	278	1,114	691	1,027	40	3,150	192	857	-2,241	1,225	-59	-25	434	23	141	180	27	804
Spices & condiments	170	872	848	297	40	2,226	115	1,503	706	356	23	2,703	468	2,084	1,303	76	-7	3,923
Fruits	716	-1,264	2,141	3,627	2	5,223	429	2,522	2,871	4,943	155	10,919	2,229	-2,096	392	17,369	59	17,954
Vegetables	753	-959	1,240	4,136	-53	5,117	444	1,451	1,133	7,110	103	10,240	1,995	4,908	6,283	7,267	635	21,088
Sugarcane	639	260	-747	1,564	40	1,756	365	405	3,907	2,274	79	7,029	1,412	819	-2,724	-376	-51	-921
Other crops	80	333	205	-251	6	372	47	23	-71	-36	-6	-43	125	611	276	361	57	1,429
Total	7,648	23,878	2,417	1,2192	219	46,353	4,672	17,302	13,017	17,841	687	53,519	15,484	28,748	5,257	22,797	747	73,033

Source: Estimated by authors

Notes: A = area; Y = yield; P = price; D = diversification; I = interaction; T = technology. Subtotal of each group of commodities is in italics

LARS BRINK*

Support to Agricultural Producers in India and the Rules of the WTO

I

INTRODUCTION

Members of the WTO (World Trade Organization) must comply with the Agreement on Agriculture ('Agreement') (WTO, 1994). It lays down rules and limits in domestic support such as payments and price regulations. Support provided through measures that are not exempt under the Agreement's rules faces upper limits. The rules are interpreted in different ways as seen in India's base data ('AGST') at the conclusion of the Uruguay Round (WTO, no date), India's subsequent reports to the WTO from 1995 to 2010 (WTO, various years), and, e.g., Hoda and Gulati (2007, 2013), Gopinath (2011, 2012), and Narayanan (2013).

This paper reviews the major issues with regard to how India classifies policies and measures support. It calculates support measurements for 1995 to 2013 under alternative readings of the Agreement and puts them in the context of India's obligations under the Agreement and the 2013 and 2014 WTO decisions on domestic support compliance.

II

DOMESTIC SUPPORT IN THE AGREEMENT ON AGRICULTURE

Under Article 1(a) of the Agreement, support in favour of the producers of basic agricultural products is measured through a number of product-specific Aggregate Measurements of Support (AMSs). Support in favour of agricultural producers in general is measured through a non-product-specific AMS. Support under policies that conform to the Agreement's Annex 2 (green box), can be excluded from the AMSs. Support through policies that meet certain other criteria is also exempted from the AMSs. The Agreement specifies how to calculate a market price support (MPS) component of an AMS if an administered price is applied. MPS uses the gap between the current administered price and the fixed external reference price (FERP),based on the years 1986-88. The gap is multiplied by the production eligible to receive the applied administered price.

India, like most countries, faces limits such that no single AMS may exceed its *de minimis* level of10 percent of the product's current value of production (10 percent of the value of total agricultural production for the non-product-specific AMS).

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III

INDIA'S SUPPORT MEASUREMENTS

India's WTO schedule refers to the AGST document for the 1986-88 base period. It expresses all data in Indian rupees or Rs.(In this paper INR means rupees, USD means United States dollars, 1986 means India's year 1986-87 etc. articles those of the Agreement). AGST shows 1986-88 AMSs for 19 of the 22 crops for which India operated MPS schemes. India calculated MPS using the minimum support price as its administered price. The 1986-88 FERPs were unit prices from the Monthly Trade Statistics of Foreign Trade of India, which reports import values and export values in INR.

The WTO Committee on Agriculture reviews the implementation of countries' commitments, using their notifications of measured support. India's latest notification is for 2010 (April 2016). A large notified Annex 2 item is 'Public stockholding for food security purposes'. Between 1995 and 1996 India reclassified its input subsidies from the non-product-specific AMS to the exempted Article 6.2 category. MPS is shown for fewer crops than in AGST. The notifications calculate the price gap in MPS from an administered price converted from INR/tonne to USD/tonne with the exchange rate of the current year, such as 1996 or 2010. The external reference price (ERP) is converted from the FERP in AGST with the 1986-88 exchange rate. Support is reported in USD. The price gaps for most crops are negative.

IV

REVIEW IN THE COMMITTEE ON AGRICULTURE

The following analysis invokes a literal reading of the Agreement, which differs from a legal analysis. Under Article 1(a) (ii) an AMS must be calculated 'in accordance with' the Agreement's rules and 'taking into account the constituent data and methodology' in AGST. The WTO Appellate Body explains that this means the constituent data and methodology must be considered in calculating Current AMS (WTO, 2000).

In the Committee, India has faced many questions (WTO 2016). Responding to questions about the varying sets of crops with a notified MPS, India replied that it calculates MPS only for crops procured by government agencies or for which market prices are below the minimum support prices. This does not explain the absence of a notified MPS for coarse grains in 2001, 2002, and 2003, when procurement ranged between 59,813 tonnes and 650,753 tonnes (Government of India, 2012).In sugarcane, the government acquires buffer stocks of sugar and regulates the price sugar mills pay to producers of sugarcane, but it does not procure sugarcane. India reported MPS for sugarcane in AGST and in 1995, and the absence of reported MPS for sugarcane in 1996 to 2010 contrasts against AGST. These absences of MPS

calculations seem to deviate from the need to take into account the constituent data and methodology of AGST.

India's used total production to calculate MPS in AGST but uses procured quantity in notifications. India argues that only the quantities procured receive support or only those farmers benefit whose produce is procured. This limited view of the economic effects of procurement is debatable. One objective of the Food Corporation of India is to provide farmers remunerative prices, and it procures wheat, paddy and coarse grains without limits: 'Whatever stocks which are brought to the Purchase centres … are purchased at the fixed support price' (http://fciweb.nic.in/procurements/view/20). The Cotton Corporation of India 'makes purchases of *kapas* at MSP [minimum support prices] without any quantitative limits'. (http://cotcorp.gov.in/procurement.aspx). The open-ended purchasing means that total production is eligible to receive the administered price. By switching from total production to procurement as the eligible production, India does not take into account the constituent data and methodology of AGST.

AGST showed support and prices only in INR and INR/tonne. The notifications show only USD and USD/tonne, converting the FERP to USD/tonne with the 1986-88 exchange rate. However, the current year's administered price is converted to USD/tonne with the current year's exchange rate. By using different exchange rates for the ERP and the administered price, India treats the ERP as if it had been fixed in USD/tonne, not in INR/tonne. The depreciation of the INR from 1986-88 makes the notified USD/tonne reference price correspond to much higher reference prices in INR/tonne, which makes the price gap negative or very small.

The Agreement's Annex 3 states that the FERP 'shall be based on the years 1986 to 1988' and it 'shall generally be the average [export or import unit value] in the base period'. India explains that it switched to a USD/tonne ERP in notifications because it seeks comparability between the notifications and AGST. However, since AGST compared international and domestic prices in INR/tonne and reported support in INR, comparability requires not switching from INR to USD. Converting the FERP from AGST to a USD/tonne reference price with the 1986-88 exchange rate effectively unfixes the FERP and seems not to take into account the constituent data and methodology of AGST. India claims it uses external reference prices from AGST (ID 67024, WTO, 2016). However, the notifications use external reference prices converted from those in AGST. The shift to not only express prices and support in USD/tonne and USD but also to calculate MPS with a reference price that increases in INR/tonne may contravene the need to take into account the AGST data and methodology.

Article 18.4 states that 'In the review process Members shall give due consideration to the influence of excessive rates of inflation on the ability of any Member to abide by its domestic support commitments'. The review process is the remit of the Committee on Agriculture, not that of individual countries. Article 18.4 does not give a country the right to unilaterally adjust its calculations in order to

offset the effect of inflation. It does not change the rules for calculating AMS and the use of FERP in calculating MPS. If the calculated AMSs exceed their limits, the members of the Committee – not the individual country - shall give due consideration to the influence of excessive rates of inflation on the country's ability to abide by its commitments.

Article 6.2 allows the exemption of 'investment subsidies which are generally available to agriculture' and 'input subsidies generally available to low-income or resource-poor producers'. The exemptible investment subsidies must be generally available to agriculture, and the exemptible input subsidy measures more narrowly available: generally available to low-income or resource-poor producers. The legitimacy of exempting input subsidies even if not legally targeted to low-income or resource-poor producers may be questioned (Brink, 2014).

V

AMS CALCULATIONS FOR INDIA FOR 1995 TO 2013

We calculate AMSs in INR for rice, wheat, cotton and sugarcane for 1995-2013underalternative readings of the Agreement and compare them to their 10 per cent limits. The calculations follow Brink (2011, 2014), using data from Hoda and Gulati (2013), Agricultural Statistics at a Glance, India's notifications, and reports of government agencies. A first step calculates the price gaps in INR/tonne under four scenarios.

- Scenario I: Subtract the 1986-88 FERP from the administered price in INR/tonne. Scenario I is a literal reading of the Agreement regarding the fixity of the ERP. Example: Assume FERP is 3,000 INR/tonne and 1995 AAP is 4,000 INR/tonne. The 1995 price gap is 1,000 INR/tonne.
- Scenario II: Deflate the price gap under scenario I by dividing the gap in INR/tonne by cumulative inflation since 1986-88, i.e., the price gap using FERP is expressed in terms of constant 1986-88 prices. Scenario II gauges the influence of inflation on India's ability to meet its 10 percent AMS limits. The AMS and the price gap are directly proportional, so deflating the price gap is equivalent to deflating AMS. This allows showing all scenarios as price gap scenarios. Example: Assume the inflation index is 100 in 1986-88 and 250 in 1995. The price gap from scenario I is deflated by dividing by 250 and multiplying by 100 to become 400 INR/tonne in 1995.
- Scenario III: Increase the 1986-88 FERP by multiplying it by cumulative inflation from 1986-88 and subtract it from the administered price. Increasing the FERP by inflation reduces the price gap by more than in the inverse proportion to inflation seen in scenario II. Example: Multiply the 1986-88 FERP of 3,000 INR/tonne by 250 and divide by 100 to give an adjusted 1995 ERP of 7,500 INR/tonne. With the administered price at 4,000 INR/tonne, the price gap is negative 3,500 INR/tonne.

- Scenario IV: Increase the 1986-88 FERP by converting it from INR/tonne to USD/tonne at the 1986-88 exchange rate and then back to INR/tonne at each year's exchange rate. This mirrors India's way of increasing FERPs in INR/tonne by keeping the reference price constant in USD/tonne, not in INR/tonne. The ERP in INR/tonne rises along with the depreciation of the INR. Notifications show only USD/tonne reference prices converted from INR/tonne with the 1986-88 exchange rate and administered prices converted at the current exchange rate. Example: Divide the FERP of 3,000 INR/tonne by the 1986-88 exchange rate of 13.409 INR/USD, which yields 223.73 USD/tonne. Multiply this by the 1995 exchange rate of 33.447 INR/USD, which yields 7,483 INR/tonne as the 1995 reference price. At an administered price of 4,000 INR/tonne, the price gap is negative 3,483 INR/tonne.

Figures 1, 2, 3, and 4 show the price gaps in INR/tonne from AGST in 1986-88 and from 1995 until 2013.

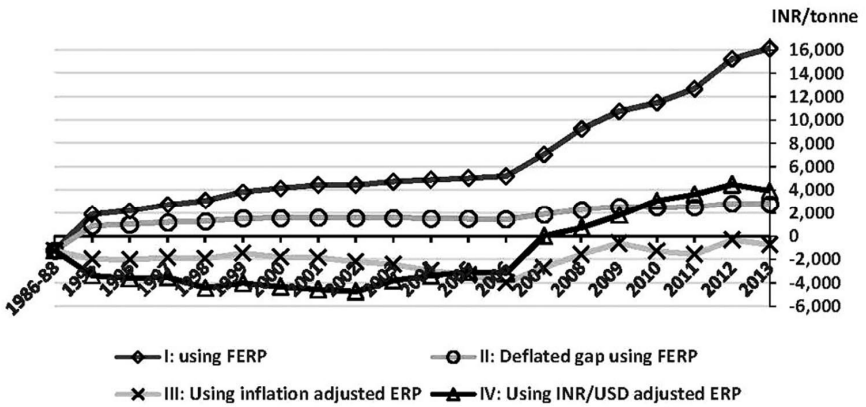

Figure 1. Price Gap: Rice

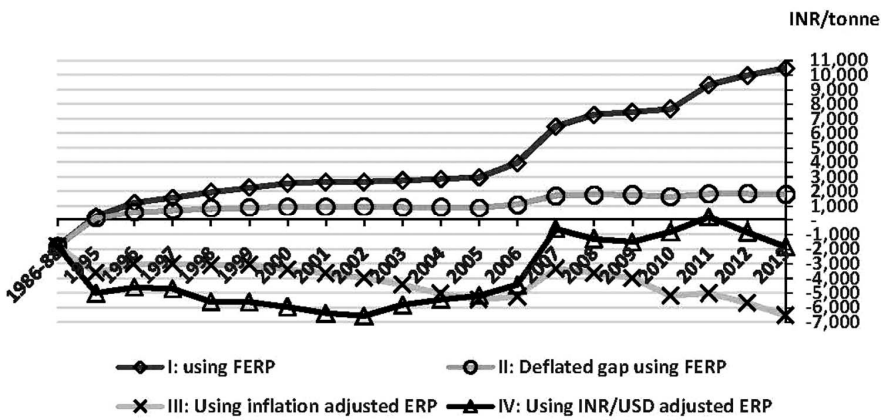

Figure 2. Price Gap: Wheat

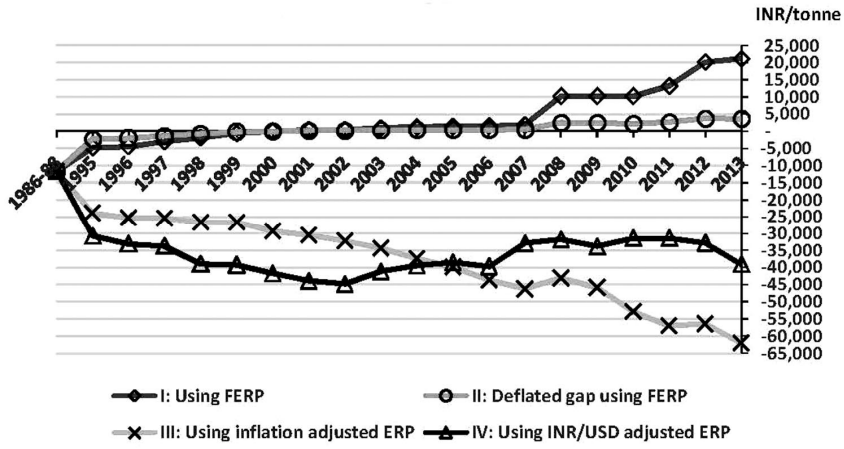

Figure 3. Price Gap: Cotton.

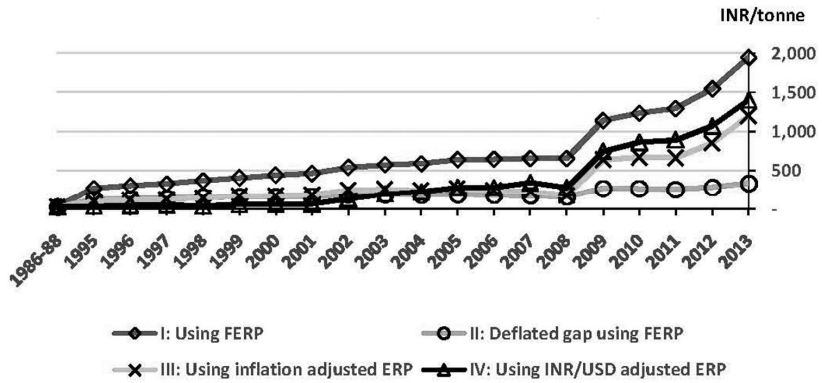

Figure 4. Price Gap: Sugarcane.

A second step multiplies some price gaps by two alternative production quantities (total production and procurement) to generate MPS in millions of INR. Only price gaps greater than zero for some of the years 1995 to 2013 are multiplied by a production quantity here. MPS is not calculated for rice, wheat and cotton under scenario III, nor for wheat and cotton under scenario IV, since those price gaps are negative in all years. No procurement applies to sugarcane, so its price gap is multiplied only by total production of sugarcane used for sugar production.

A third step calculates AMSs where the price gaps are positive. Non-exempt payments are assumed to be nil or use the Hoda and Gulati (2013) estimates for the small payments to producers of rice and wheat in 2007, 2008, 2009 and 2010 and, for later years, the average of the 2009 and 2010 payments. The sum of the payments and MPS is the product's AMS.

A fourth step estimates yearly limits for the AMSs of the four crops as 10 per cent of their values of production. This enables identifying when an AMS exceeds its limit and by how much (Table 2 and Figures 5, 6, 7, and 8).

TABLE 2. YEARS IN WHICH AN AMS EXCEEDS ITS LIMIT, BY PRODUCT AND BY ELIGIBLE PRODUCTION

	Price gap scenario			
	I	II	III	IV
AMS	FERP	Deflated FERP gap	Inflation-adjusted ERP	INR/USD-adjusted ERP
(1)	(2)	(3)	(4)	(5)
Rice				
• Production	1995-2013	1995-2013	–	2009-2013
• Procurement	2000-2013	–	–	–
Wheat				
• Production	1996-2013	1996-2013	–	–
• Procurement	2001-2002, 2008-2013	–	–	–
Cotton				
• Production	2008-2009, 2011-2013?	–	–	–
• Procurement	–	–	–	–
Sugarcane				
• Production	1995-2013	1995-2013	1995-2013	2002-2013
Non-product-specific AMS			2008	

Source: Author's analysis.

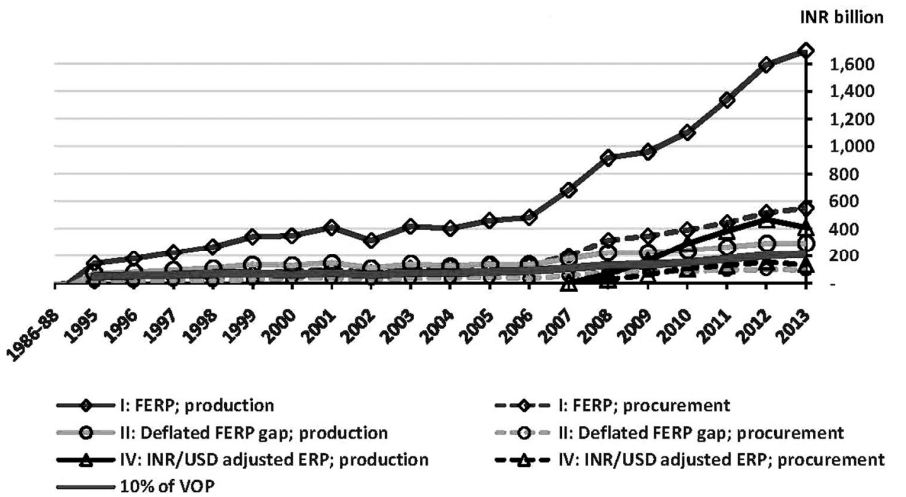

Figure 5. AMS: Rice.

The price gap for rice is positive only under the two FERP scenarios, while adjusting the ERP by inflation or by currency depreciation makes the price gap negative. However, from 2007 onwards the administered price of rice is large enough to generate a positive price gap even using the currency-adjusted reference price. The rice AMS in recent years is considerably larger than its 10 per cent limit when using the FERP, whether using total production or only procurement. The price gap for wheat is positive only when using the FERP.

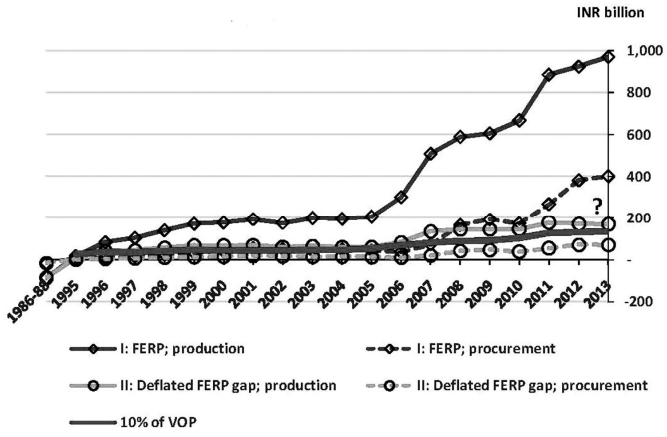

Figure 6. AMS: Wheat.

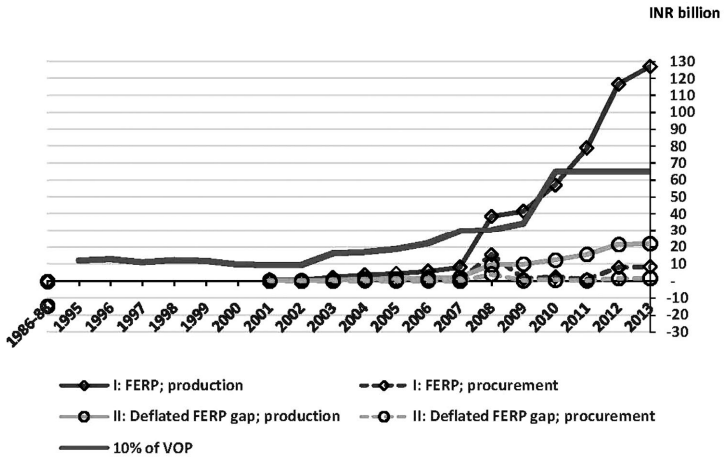

Figure 7. AMS: Cotton.

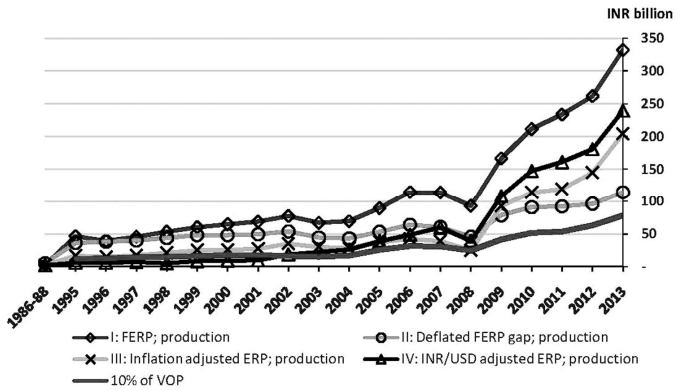

Figure 8. AMS: Sugarcane.

The wheat AMS, whether using total production or procurement, is larger than the 10 per cent limit in recent years – very much larger using total production.

For cotton the price gap was negative until 2001, even when using the FERP. The cotton AMS increased very rapidly from 2007 and may have exceeded its 10 percent limit in recent years (the question mark in Figure 7 indicates a lack of value of production data).The price gap for sugarcane is positive in all years under all price gap scenarios. The sugarcane AMS is large enough to exceed its 10 percent limit, except in the early years using the currency-adjusted external reference price.

A final step estimates non-product-specific AMS under a reading of Article 6.2 that does not exempt input subsidies from AMS unless they are generally available only to low-income or resource-poor producers. India's laws do not seem to target input subsidies this way. The data is from notifications, Gopinath (2012), and Hoda and Gulati (2013) up through 2010.The non-product-specific AMS is always below the 10 per cent limit except in 2008, with its large fertiliser subsidies. If value of production increases along trend, the 10 per cent limit on non-product-specific AMS accommodates much larger input subsidies.

VI

RELEVANCE FOR POLICY CHOICES

6.1 *Economic and WTO Measurements of Support*

WTO MPS is calculated very differently from economic MPS. Economic MPS uses two variables that the government does not control (current international reference price and total production) and one variable over which it may have some control (observed domestic price). WTO MPS uses the constant FERP and two variables which the government controls (administered price and eligible production). WTO MPS is thus a variable totally controlled by the government.

The calculations of AMS here follow a literal reading of the Agreement or deviate from it regarding the calculated price gap (FERP or not, inflation adjustment or not) or the eligible production (total production or procurement). The base case AMS takes into account the constituent data and methodology of AGST. Although India uses open-ended schemes without limit on the production eligible to receive the administered price, India nevertheless claims through its notification practice that only the procured quantity is eligible to receive the administered price.

The requirement to calculate MPS effectively penalizes the use of an administered price: the MPS must be included in the product's AMS, which raises the likelihood that it exceeds its 10 percent limit. In years past India has set administered prices at levels that provide no or little economic support to producers based on current international reference prices. However, in WTO MPS they are compared to the FERP, which makes some AMSs quite large.

Without an administered price, no MPS needs to be calculated for the AMS. Government purchases of foodstuffs at market prices for public stockholding would conform with the Annex 2 criteria. Many countries give economic support through price gaps without administered prices, maintaining domestic prices through import protection. This option is open also to India, whose bound ceilings on import tariffs are high and allow applied tariffs to be adjusted to make prices more stable.

6.2 *WTO decisions in 2013 and 2014*

A paragraph in the Agreement's Annex 2 is headed 'public stockholding for food security purposes', under which a footnote entitles developing countries to exempt expenditures under certain governmental stockholding programs from their AMSs, conditional on accounting for the difference between the acquisition price and the external reference price in the AMS. WTO ministers decided in 2013, without changing the Agreement's rules about calculating AMSs or the obligation not to exceed AMS limits, to nonetheless allow developing countries to exceed their AMS limits without facing challenge sunder WTO dispute settlement rules (WTO, 2013). The wording was slightly tightened in 2014. The decisions concern AMSs for certain food crops when meeting rules and conditions regarding notifications, transparency, anti-circumvention and consultations. This may apply to India's acquisition of rice and wheat at the minimum support price, but not to cotton, which is not a food crop. India has not notified any excess, but the present calculations indicate excesses for rice, wheat, cotton and sugarcane in many years in 1995-2013.

VII

CONCLUSIONS

The analysis highlight how different interpretations of the Agreement regarding the FERP and the production eligible to receive the applied administered price affect India's compliance with WTO rules. The MPS component of AMS is measured under four price gap scenarios. One scenario corresponds to India's method in notifications, although there it is masked by expressing all prices and support in USD/tonne or USD, contrary to the INR/tonne or INR in AGST. The four price gaps are multiplied by two quantities: total production and procurement.

India's minimum support prices can generate large price gaps under the Agreement. The product-specific AMSs indicate large excesses above their 10 percent limits over many years until 2013 under some scenarios. The non-product-specific AMS has been below its 10 percent limit in most years.

WTO decisions in 2013 and 2014 give some circumscribed and conditional shelter for developing countries that exceed their AMS limits. The decisions diminish or even eliminate the role of the Agreement in curbing the use of administered prices to generate price gaps so large that AMSs exceed their 10 percent limits.

The rules for calculating WTO MPS were designed to limit the large economic MPS provided through administered prices at the time of the Uruguay Round. The 2013 and 2014 decisions expand developing countries' room to increase administered prices in certain situations. It will be important to evaluate the consequences for other developing countries of a more wide-spread use of administered prices in developing country agriculture. The associated distortions would be felt by all, including developing countries not in a position to introduce or raise administered prices.

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Returns to Irrigation, Natural Resource Management, Research and Extension

Lack of awareness about optimal groundwater extraction and utilisation among farmers, policies pertinent to rural electrification, weak institutions and governance in relation to groundwater, increasing rate of initial and premature failure/s of borewells exacerbated the magnitude of reciprocal negative externality are the factors responsible for increasing farmer investments on new irrigation borewell/s striking groundwater at deeper depths. Studies at University of Agricultural Sciences, Bangalore have indicated a conservative estimate, groundwater irrigation costs around Rs. 500 per acre inch (or hectare centimeter) on volumetric basis and Rs. 10,000 per acre for less water intensive crop (vegetables/flowers) to Rs. 20,000 per acre for high water intensive crops (banana/paddy) on area basis. However, in the CACP/farm management surveys of the State Departments of Agriculture, irrigation cost is devoid of water cost in general and cost of groundwater irrigation in particular. The water rate charged for canal irrigation is also a poor reflector of the true cost of canal water (Nagaraj *et al.*, 2003).Thus, even though there is physical/economic scarcity of groundwater signaled through costs/prices, they are not reflected in MSP as well as market price. Hence output/input prices are distorted which correspondingly result in distorted crop pattern and net returns for farmers.

The resulting deterioration of groundwater resource has seriously impacted the over exploited hard rock areas (like Kolar district) and is continuing to damage other areas. This calls for rational water policy towards sustainable use of groundwater and land resources for shaping the economy of marginal and small farmers who bear the brunt of weak institutions, markets and policies. This paper deals with resource economic costing of irrigation for different crops demonstrating estimation of costs and returns groundwater irrigation and natural resource management with implications on research, extension and policy.

Costing Groundwater for Irrigation

Paradoxically, even with innumerable number of organisations on water – such as Central Water Commission, Ministry of Water Resources, Central Groundwater Board, National water development authority, State Water Resource Departments, State Departments of Mines and Geology, urban and rural water supply development boards, efforts towards volumetric measurement of water applied are still crude and approximate. Thus, irrigation water cost is not properly accounted in any of the costing procedures including the Commission on Agricultural Costs and Prices

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(CACP) which have no adequate information on water use in the RT forms.[1] Therefore there are no compelling reasons to accept that the costs of cultivation and the MSP are properly estimated, and they are grossly underestimated. The CACP methodology at best computes depreciation of irrigation structure over number of years which is subjective and left to the discretion of field assistant who obtains data from farmers. This study provides details of costing groundwater resource for irrigation considering the hard rock areas of Karnataka.

Limitations of the CACP Methodology on Costing Irrigation Water

To cost account irrigation water, the current methodology followed by CACP computes depreciation over number of years (which is subjective as it is not mentioned in the RT forms). For example, if an irrigation borewell is drilled in 2005 and is still yielding water, and if the data are collected in 2012, then the age at present will be 7 years. The remaining life of the irrigation borewell has to be estimated, for which no basis has been given. For instance in one of the RT forms, life of the well is recorded as 20 years and the remaining life is 20 – 7 years = 13 years. If the investment made on the borewell is Rs. 40000, the junk value is taken as 10 per cent of the investment as = Rs.4000. Thus, the value of borewell is taken as Rs. 40000 – Rs 4000 = Rs. 36000.The annual depreciation is calculated as 36000/20 = Rs.1800. The value of borewell at present (in 2012) is recorded as Rs. 1800 *13 years of remaining life = Rs. 23400. In the similar way, the value of IP set/s is worked out. Keeping apart the poor basis of computation of depreciation, the methodology ignores the ground reality of increasing cost of groundwater irrigation in hard rock areas due to increasing negative externalities exacerbated due to mushrooming of irrigation borewells in violation of the isolation distance.

Sampling

The sample farmers from Chitradurga and Kolar districts representing central dry zone and eastern dry zone, respectively were selected. Field data from 30 sample farmers each, representing supply side groundwater intervention (i.e. farms with on-farm or point borewell recharge) and groundwater institution (farms with shared irrigation borewell/s among heirs) were selected. To represent demand side interventions such as micro irrigation, 30 sample farms with drip irrigation for broad spaced crops and 30 sample farms with drip irrigation for narrow spaced crops were selected. Field data on cropping pattern, land holdings, source of irrigation, investment on irrigation borewell, investment on micro-irrigation structure, investment on recharge structure, cost and returns of various crop and livestock enterprises for the agricultural year 2012-13, considered as normal rainfall year was elicited.

Why and How to Cost Account Groundwater Irrigation

After 1990, increasing probability of initial and premature failure of borewells/tubewells have made it indispensible to treat investment on drilling and casing of irrigation wells as variable cost which was hitherto considered as fixed cost. Thus, total cost of groundwater irrigation can be divided into variable cost and fixed cost component. Though, farmers are not charged for electricity to pump groundwater for irrigation, they still incur the component of variable cost due to increased drilling of borewells on the farm due to high rate failures. The variable cost of groundwater represents the cost of drilling and casing since farmers are forced to invest on new borewells due to high probability of initial and premature failures. However, as the farmers use the irrigation pumpsets and accessories, conveyance structure, drip irrigation, borewell recharge, water storage structure, and electrical installation, investment on these are considered for depreciation for around ten years, irrespective of failure of irrigation wells. The variable cost and fixed cost is divided across volume of groundwater used for irrigation. The labour cost of irrigation is considered along with labour costs of other cultural operations. The annual cost of irrigation thus, pertains to amortised variable cost of all irrigation borewells on farm. This total cost of irrigation is then apportioned for each crop according to the volume of groundwater used in each crop. Thus, cost of irrigation per acre-inch or ha cm = [Total annual cost of irrigation]/ [volume of water used for the crop in acre inches of groundwater used].

Life of Well

Initial failure of borewell refers to a borewell which failed to yield any groundwater at the time of drilling and thereafter. Subsistence life of borewell refers to the number of years a borewell yielded groundwater for the Pay Back Period (PBP). The payback period is obtained by dividing the sum of the total investment on drilling, casing, IP set, conveyance structure, storage structure, drip/sprinkler structure, recharge structure, electrification charges of borewell by the annual returns per farm. The hypothesis is that an irrigation borewell is considered to have served its purpose. This implies that PBP indicates the period in which a borewell recovered the investment made. **Premature failure** refers to the borewell which served below the subsistence life or the PBP. **Economic life/age of borewell** refers to the number of years a borewell yielded groundwater beyond the PBP.

Amortised Cost of Borewell

The annual share of groundwater irrigation cost was obtained by amortization. The investment made on borewell exploration equal to the cost of drilling and casing renders as a variable cost and investment on IP sets and accessories and other costs of

electrification as a fixed cost. This variable cost or investment is amortized over the average life/economic life of the well whichever is pertinent. Thus, the amortized cost varies with amount of capital investment, age of the borewell, discount rate and year of construction/drilling of borewell. The amortisation methodology suggested by Palanisami employed by Diwakara and Chandrakanth (2007) is used in this study.

Compounding Investment on Borewells

Since, farmers invest on irrigation well/s during different time periods, their wells have different vintages. In the study, it was found that the investment on borewells is increasing at the compound growth rate of 2 per cent by comparing the investment made on the first well and the last well on farms. Thus, in order to bring all historical costs on borewells on par, investments made by different farmers in different years, were compounded to the present (2013) at a discount rate of two per cent. The compounded investment is later divided into the fixed cost component (= irrigation pumpsets plus conveyance structure, drip irrigation structure and so on) amortizing over ten years, plus the variable cost of drilling and casing the borewell, amortized over the actual life of borewell, since farmers lose drilling cost and casing cost once the well fails. Hence, these two costs are separately amortized to obtain the yearly variable cost and fixed cost of irrigation borewell.

The amortized cost of borewell was worked out as under:

Amortized cost of irrigation = (Amortized cost of Borewell + Amortized cost of pump set + Amortized cost of conveyance + Amortized cost of over ground structure + annual Repairs and maintenance cost of pump set and accessories) given by

$$\text{Amortized cost of BW} = (\text{Compounded cost of BW}) \times \frac{(1+i)^{AL} \times i}{(1+i)^{AL}-1]} \quad \ldots.(1)$$

where,

AL= Average Age or life of borewell, i = 2 per cent

$$\text{Compounded cost of B} = (\text{Historical investmenton BW}) \times (1+i)^{(2013-\text{year of drilling})}$$

$$\text{Amortized cost of Pumpsets and Accessories} = (\text{Compounded cost of P and A}) \times \frac{(1+i)^{10} \times i}{(1+i)^{10}-1]} \quad \ldots.(2)$$

The working life of Pumpsets (P) and Accessories (A) is considered to be ten years since farmers used them for at least 10 years.

$$\text{Compounded cost of Pumpset and Accessories} = (\text{Historical cost of P and A}) \times (1+i)^{(2013-\text{year of installation of P and A})}$$

$$\text{Amortized cost of conveyance structure (CS)} = (\text{Compounded cost of CS}) \times \frac{(1+i)^{10} \times i}{(1+i)^{10}-1]} \quad \ldots.(3)$$

The working life of conveyance structure (CS) is considered as 10 years. The usual mode of conveyance of groundwater is through PVC pipe

$$\text{Compounded cost of CS} = (\text{Historical cost of CS}) \times (1+i)^{(2013-\text{year of installationof CS})}$$

$$\text{Amortized cost of micro irrigation structure} = (\text{Compounded cost of MIS}) \times \frac{(1+i)^{10} \times i}{(1+i)^{10}-1]} \quad \ldots.(4)$$

The working life of micro (drip) irrigation structure (MIS) is considered to be 10 years since farmers usually replace them after 10 years. Here

$$\text{Compounded cost of} = (\text{Historical cost of MIS}) \times (1+i)^{(2013-\text{year of installation of MIS})}$$

As a coping mechanism to endure with the persistent problems imposed by variations in supply of voltage in electricity to run irrigation pumps and supply of electricity during off- peak load hours and low yields of borewell, farmers have built over ground storage structures. The amortized cost of over ground storage structure is estimated as under

$$\text{Amortized cost of overground storage structure} = (\text{Compounded cost of OSS}) \times \frac{(1+i)^{10} \times i}{(1+i)^{10}-1]} \quad \ldots.(5)$$

$$\text{Compounded cost of OSS} = (\text{Historical cost of OSS}) \times (1+i)^{(2013-\text{year of construction of OSS})}$$

$$\text{Amortized cost of borewell recharge structure} = (\text{Compounded cost of BRS}) \times \frac{(1+i)^{AL} \times i}{(1+i)^{AL}-1]} \quad \ldots.(6)$$

Here, AL= Average life/ age of borewell

$$\text{Compounded cost of Borewell recharge structure BRS} = (\text{Historical cost of BRS}) \times (1+i)^{(2013-\text{year of construction of BRS})}$$

Yield of Irrigation Borewell

The groundwater yield of borewells was calculated by recording the number of seconds taken to fill a bucket or over ground storage structure of known volume. Before recording, the borewell was put on for ten minutes so that the initial pump yield bias is avoided. This was linearly extrapolated to obtain the groundwater yield in gallons per hour.

Groundwater Use in Conventional Irrigation System

The acre-inches (or ha cms) of groundwater used for each crop in each season (summer, kharif, rabi) in conventional system of irrigation is estimated as = [(area irrigated in each crop) * (frequency or number of irrigations per month) * (number of months of crop) * (number of hours for one irrigation for the cropped area in question) * (Average yield of borewell in Gallons Per Hour)] /22611= groundwater use for each crop in acre inches.

Groundwater Use in Drip and Sprinkler Irrigation System

The groundwater used for irrigation in each crop (acre inches) in Drip irrigation = {Number of drips or emitters for the cropped area X groundwater discharged per emitter per hour (liters per hour) X No. of hours to drip irrigate the cropped area for one irrigation X frequency of irrigations per month (in number) X Duration of crop irrigated in months /4.54/22611}.

The groundwater used for irrigation in each crop (acre inches) in sprinkler irrigation = {Number of sprinklers for the cropped area X No. of hours to irrigate the cropped area for one irrigation X groundwater discharged per sprinkler (in liters per hour) X frequency of irrigation per month (in number) X Duration of crop irrigated in months /4.54/22611}.

One acre inch is equivalent to 22611 gallons or 3630 cubic feet and one cubic feet is equivalent to 28.32 litres. Total groundwater use per farm is total acre inches of groundwater used in all seasons across all crops including perennial crops.

Annual Cost of Irrigation

In Karnataka, farmers using irrigation pumpsets (below 10 hp capacities) for groundwater are not charged for electrical power. Government of Karnataka however, imposed a flat charge of Rs. 300 per hp per year up to 10 hp pump set since April 1997. However, the KPTCL/Government of Karnataka have been soft towards seeking electricity dues from farmers for the reasons of political economy. Hence,

there are no explicit payments towards electricity for pumping groundwater, other than annual operation and maintenance charges of the irrigation pump set and borewell up to 10 hp.

The electricity tariff for Irrigation Pumpsets: Instead of tariff, there is subsidy. The amount of subsidy to be paid by the Government towards free supply of electricity to 21.06 lakhs Irrigation Pumpsets below 10 hp, and 22.90 lakh Bhagyajyothi / Kuritjyothi households is increased to Rs.5381 crores for 2013-14 from Rs.4722 crores paid for 2012-13. The bulk of this increase is on account of the increase in the consumption of Irrigation Pumpsets users which are going up from 15318 million units estimated for 2012-13 to 16679 million units in 2013-14.[2]

However, the implicit cost of irrigation is relevant for farmers in hard rock areas due to high probability of initial and premature borewell failure, which forces farmers to invest in additional borewell(s) to at least remain on the original production possibility curve. The investment on failed borewells is increasing due to violation of isolation distance between irrigation borewells, over extraction or mining of groundwater, lack of efforts to recharge groundwater, and reciprocal negative externality. The resulting transaction costs are due to forced investment on drilling and casing of additional borewells, since borewells drilled failed initially or prematurely to yield groundwater**.**

Returns to Groundwater Irrigation

The cost of cultivation is obtained as the sum of cost of human labour, bullock labour, machine hours, seeds and fertilisers, application of manure, plant protection measures, bagging, and transporting, cost of irrigation for each crop, interest on working capital @ seven per cent, risk premium @ two per cent and management cost @ five per cent on variable cost. Gross return for each crop is the value of the output and the by product at the prices realised by farmers.

Net returns from borewell irrigation are the gross returns from gross irrigated area minus the cost of production of all crops. The cost of cultivation of all crops in this study accordingly includes the cost of irrigation explicitly since volumetric measurements of groundwater applied are made for all crops.

RESULTS

The average size of land holding was the highest among farmers who have artificially recharged irrigation well/s on the farm (15 acres) in Central Dry Zone followed by farms with drip irrigation connected to narrow spaced crops in Eastern Dry Zone. Accordingly, the gross irrigated area and net irrigated area was also the highest among borewell recharge farms compared with all other categories of sample farmers. The volume of groundwater extracted per farm was the highest among borewell recharge farms (140 acre inches) followed by shared well farms (88.75 acre inches).

The variable cost of groundwater per acre inch was the highest for farms connected to narrow spaced crops in Eastern Dry Zone (Rs. 2089 per acre inch) forming 71 per cent of the total water cost, while fixed cost component forms (Rs. 865 per acre inch) the remaining 29 per cent. The next in the hierarchy was the farms connected with drip serving broad spaced crops in Central Dry Zone, where the variable cost component formed 69 per cent and fixed cost component formed remaining 31 per cent. The total cost of water on borewell recharge farm was Rs. 586 per acre inch. Out of the total water cost, variable cost formed 43 per cent; the lowest among all the sample category and fixed cost formed remaining 57 per cent. The total cost of groundwater was lowest among shared well farmers which were to the tune of Rs. 358 per acre inch with variable and fixed cost forming 56 and 44 per cent, respectively.

Economics of Groundwater Irrigation

The cost of groundwater irrigation formed 11 to 22 per cent of the total cost of cultivation of broad spaced crops with drip irrigation (Table 1). In absolute terms the cost of groundwater irrigation varied from Rs. 7269 per acre of coconut to Rs. 23601 per acre in papaya. The cost of groundwater irrigation formed 13 to 36 percent of the total cost of cultivation considering drip irrigation for narrow spaced crops (Table 2). In absolute terms, the cost of groundwater irrigation ranged from Rs. 7321 per acre of cauliflower to Rs. 25944 per acre of beans. What is crucial to note is that the cost of groundwater forms substantially lower proportion of total cost in all crops on farms with on farm borewell recharge. For instance, the groundwater cost ranged from 4 to 9 per cent of the total cost of cultivation. In absolute terms, the groundwater cost ranged from Rs. 1416 per acre of onion to Rs. 9458 per acre of papaya (Table 3). The groundwater cost formed the lower proportion of the total cost in all the crops on farms sharing irrigation well water among siblings. The ground water cost ranged from 1 to 16 per cent of the total cost of cultivation. In absolute term, the groundwater cost ranged from Rs. 1175 per acre of maize to Rs. 10642 per acre of arecanut (Table 4).

The net returns per acre inch of groundwater used was the highest among those sample farmers with drip irrigation for narrow spaced crops (Rs. 7610) followed by farmers with drip irrigation for broad spaced crops (Rs. 7398). The net returns per acre inch were Rs.3674 on borewell recharge farms. The economic efficiency reflected in terms of net returns per rupee of irrigation water cost was the highest among farmers who shared their groundwater among their relatives (Rs. 10.83) followed by farms with on-farm borewell recharge technology (Rs. 8.17), whereas the net returns per rupee of groundwater cost was Rs. 5.08 for farms with drip irrigation for broad spaced crops (Rs. 5.08) and Rs. 2.57 for farms with drip irrigation for narrow spaced crops (Table 5).

TABLE 1. ECONOMICS OF CROPS WITH DRIP IRRIGATION FOR BROAD SPACED CROPS IN HARD ROCK AREAS OF KARNATAKA

(Rs. per acre)

Crop	Seed/Planting material (Kgs.)		Labour (mandays)		Machine Labour	FYM (tractor loads)		Soil (tractor loads)		Chemical Fertilisers	Plant protection chemicals	Marketing and commission charges	Water used in acre inches	Variable cost of water	Fixed cost of water
	Qty.	Rs.	Qty.	Rs.	Rs.	Qty.	Rs.	Qty.	Rs.	Rs.	Rs.	Rs.		Rs.	Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(!3)	(14)	(15)	(16)
Arecanut			96	24015	4490	3	8696	10	4412	3061		1402	12	8553	409
Coconut			25	6219	2629	1.5	4679	28	8341				8	6876	393
Papaya	1000	10000	78	19603	4875		20375		5500	19000	21300		14	21107	2494
Pomogranete	300	10500	120	30117		6	19684	12	5894	19203	30759		10	17250	514
Bannana	700	2000	54	13402	3625	3	8802	15	7448	18313		11453	32	18293	271

Crop	Total water cost	Proportion of groundwater cost	Consultation Charges	Stalking charges	Interest on working capital@7 per cent	Risk Premium @ 2 per cent	Management cost @ 5 per cent of operational cost	Total cost of cultivation	Output	Price per quintal	Gross returns	Net returns including water cost	Net returns excluding water cost
	Rs.		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Qtl.	Rs.	Rs.	Rs.	Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Arecanut	8962	14			3853	1101	2752	62743	9	13309	114824	52080	61043
Coconut	7269	22			2040	583	1457	33216	4635	8	36502	3286	10555
Papaya	23601	17			8698	2485	6213	141649	193	1213	233500	91851	115452
Pomogranete	17764	11	3204	11142	10379	2965	7413	169025	39	8734	340540	171515	189279
Bannana	18564	19			5852	1672	4180	95312	41	2798	114531	19219	37784

Note: Yield of coconut is measured as number of nuts per acre

TABLE 2. ECONOMICS OF CROPS WITH DRIP IRRIGATION FOR NARROW SPACED CROPS IN HARD ROCK AREAS OF KARNATAKA

(Rs. per acre)

Crop	Seed/planting material(grams /kgs/numbers)		Labour in mandays		Machine labour in hours	FYM (tractor load)		Fertilisers	Plant protection chemicals	Cost on stalking materials	Twining material	Drip fertigation	Marketing commission charges
	Qty.	Rs.	Qty.	Rs.	Rs.	Qty.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Coriander	15	3944	32	7878	4888			5700	822				9722
Potato	10	13795	42	10473	5346	1.3	6109	5732	5711				32462
Cabbage	17809	5000	75	18724	3714	3.5	5328	10695	29381			1548	34571
Knol kohl	1673	4466	50	12420	4800	0.6	1333	6016	7867				
Tomato	7298	3649	148	36902	4587	2.6	5832	4512	11618	9895	3113	3721	39268
Beans	8	5348	110	27479	2943			3427	5649	11227	1718	2236	21954
Capsicum	10000	10000	85	21250	10000	8.0	16000	6000	20000			5000	22500
Red onion	10	2065	50	12400	3867			2706	4400			5333	15589
Cauliflower	18545	6436	45	11291	2272	1.0	2272	5091	8909			4181	14909
Carrot	1	5000	39	9700	5428	2.4	4571	3357	1571			1754	17157

Crop	Water used in acre inches	Variable water cost	Fixed water cost	Total water cost	Proportion of ground-water cost to total cost	Interest on working capital @ 7 per cent	Risk premium @ 2 per cent	Management cost @ 5 per cent	Total cost	Crop yield	Gross returns	Net returns including water cost	Net returns excluding water cost
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Qtl.	Rs.	Rs.	Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Coriander	4.70	11765	7328	19093	32	3643	1041	2602	59334	150	75000	15666	34759
Potato	11.92	25778	762	26540	22	7432	2123	5308	121032	227	211012	89980	116520
Cabbage	10.05	24045	2304	26349	17	9472	2706	6766	154253	230	230476	76223	102572
Knol kohl	12.08	22324	3776	26100	36	4410	1260	3150	71822	155	90666	18844	44944
Tomato	12.16	20840	2107	22947	14	10223	2921	7302	166490	11	238689	72199	95146
Beans	10.31	25944	4251	30195	24	7852	2244	5609	127881	7	182500	54619	84814
Capasicum	8.18	17583	6067	23650	15	9408	2688	6720	153216	5	180000	26784	50434
Red onion	9.32	19034	5625	24659	30	4971	1420	3551	80962	96	136693	55731	80390
Cauliflower (No.)	8.54	7321	2308	9629	13	4549	1300	3250	74089	14545	118182	44093	53722
Carrot	7.59	17349	2120	19469	25	4760	1360	3400	77528	109	108571	31043	50512

TABLE 3. ECONOMICS OF CROPS ON BOREWELL IRRIGATION FARMS WITH ARTIFICIAL RECHARGE TO BOREWELL

(Rs./acre)

Crop	Seed /planting material		Labour in mandays		Machine labour in hours	Soil (tractor load)		FYM (tractor load)		Cost of chemical fertilisers	PP chemicals expenses	Stalking cost	Consultation charges	Marketing commission charges
	Qty.	Rs.	Qty.	Rs.	Rs.	Qty.	Rs.	Qty.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Pomegranate			154	38467		10	4968	8	19162	13200	24000	11616	2413	8516
Papaya	750	6000	84	20885	3000			4	9714	15714	12714	2476		14547
Banana	536	2145	62	15408	4363	6	2909	3.2	8000	8436				15712
Arecanut			117	29281	3402	9	4328	4.5	11178	2619				2000
Coconut			28	7040	2100	20	10000	1.6	4000					2880
Mango			63	15825	3706			8	20170	4170				10595
Sapota			75	18807	6071	3	1607	7	16892		2500			9643
Onion	5	4681	37	9280	2802			0.6	1385	5232	1034			8506
Maize	10	1346	33	8137	2750					4463				1600

Crop	Water used in acre inches	Variable water cost Rs.	Fixed water cost Rs.	Total water cost Rs.	Proportion of groundwater cost to total cost Per cent	Interest on working capital @ 7 per cent Rs.	Risk premium @ 2 per cent Rs.	Management cost @ 5 per cent Rs.	Total cost of cultivation Rs.	Crop yield Qtl..	Gross returns Rs.	Net returns including water cost Rs.	Net returns excluding water cost Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Pomegranate	11.46	9087	154	9241	6	9211	2632	6579	150005	2553	217982	67977	77218
Papaya	15.25	9359	189	9548	9	6622	1892	4730	107842	127	145476	37634	47182
Banana	36.24	4729	213	4942	7	4334	1238	3096	70583	44	157121	86538	91480
Arecanut	12.16	4910	285	5195	8	4060	1160	2900	66123	8	116726	50603	55798
Coconut	8.41	2490	355	2845	9	2021	577	1443	32906	4880	57600	24694	27539
Mango	12.36	2775	221	2996	5	4022	1149	2873	65507	29	105957	40450	43446
Sapota	12.03	2281	217	2498	4	4061	1160	2901	66141	102	96428	30287	32785
Onion	13.28	1476	265	1741	4	2426	693	1733	39514	71	85062	45548	47289
Maize	9.89	1616	182	1798	8	1407	402	1005	22907	24	32952	10045	11843

Note : Output of coconut is number of nuts per acre.

TABLE 4. ECONOMICS OF CROPS CULTIVATED ON BOREWELL IRRIGATION FARMS SHARING BOREWELL WATER AMONG SIBLINGS

(Rs./acre)

Crop	Seed/planting material (Kgs) Qty.	Rs.	Labour (mandays) Qty	Rs.	Machine Labour in hours Rs.	FYM (Tractor load) Qty.	Rs.	Soil (Tractor load) Qty.	Rs.	Chemical Fertilisers Rs.	Plant protection chemicals Rs.	Marketing and commission charges Rs.	Water used in acre inches
(1)	(2)	(3)	(4).	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Crossandra			990	247494		4	11631	28	14123	16468	12702	65288	22.89
Maize	10.00	1283	24	5998	2100					3198		1389	10.77
Palak	6.67	1333	49	12154		1.5	1538			2191	1333	7692	3.97
Menthe	10.66	586	22	5500	266	1	1111			2106	1066	2722	2.91
Onion	5.50	4909	50	12577	2319	1.5	1589			6890	1858	5375	16.19
Cucumber	0.25	500	55	13705	1888					1511	1444	4100	6.36
Arecanut			121	30228	3578	2.5	6325	11	5572	2861		1000	13.06
Chrysanthemum		4933	255	63687	2000	1.1	3200			5418	44000	40646	39.52

Crop	Variable cost of water Rs.	Fixed cost of water Rs.	Total water cost Rs.	Proportion of water cost to total cost Per cent	Interest on working capital @ 7 per cent Rs.	Management cost @ 5 per cent Rs.	Risk premium @ 2 per cent Rs.	Total cost of cultivation Rs.	Output Qtl	Price Rs.	Gross returns Rs.	Net returns including water cost Rs.	Net returns excluding water cost Rs.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Crossandra	4293	345	4638	1	26064	18617	7447	424472	26115	25	652885	228413	233051
Maize	1100	75	1175	7	1060	757	303	17263	24	1273	30198	12935	14110
Palak (bunches)	2079	1109	3187	10	2060	1471	589	33550	38462	2	57692	24143	27330
Menthe (bunches)	1549	658	2207	12	1089	778	311	17743	13333	2	21667	3924	6131
Onion	1952	95	2047	5	2629	1878	751	42823	95	1000	94989	52166	54213
Cucumber	672	739	1411	5	1719	1228	491	27997	86	819	70444	42447	43858
Arecanut	10443	199	10642	16	4214	3010	1204	68635	8	13734	112759	44124	54766
Chrysanthemum (stringed in metres)	4603	259	4862	3	11812	8437	3375	192370	19433	20	397000	204630	209492

TABLE 5. RETURNS TO GROUNDWATER IRRIGATION ACROSS GROUNDWATER INSTITUTIONS AND TECHNOLOGIES IN EASTERN AND CENTRAL DRY ZONE OF KARNATAKA

Particulars (1)	Drip farms connected to narrow spaced crops, Kolar (n=30) (2)	Drip farm connected to broad spaced crops, Chitradurga (n=30) (3)	Shared well farms, Chitradurga (n=30) (4)	Borewell recharge farms , Chitradurga (n=30) (5)
Average size of land holding (irrigated land area) (acres)	9.38 (4.61)	7.87 (6.07)	8.17 (4.77)	15 (9.89)
Gross irrigated area per farm (acre)	6.62 (1-26)	12.2 (2.4-43.4)	7.93 (0.75-21)	17.03 (4-47)
Net irrigated area per farm (acre)	3.01	6.44	3.40	8.08
Groundwater extracted per farm (acre inches per year)	72.94 (11-261)	69.21 (15.58-267)	88.75 (16 -238)	140 (26.18-397)
Variable cost of groundwater (Rs per ha cm or acre inch)	2089 (71%) (295-9255)	972 (69%) (68-9517)	199 (56%) (18.59-1874)	251 (43%) (43-1127)
Fixed cost of groundwater (Rs per acre inch or ha cm)	865 (29%) (317-3791)	428 (31%) (156-2046)	159 (44%) (39-875)	335 (57%) (97-1564)
Net returns per acre inch or ha cm of groundwater (Rs) Range	7610 (784-22603)	7398 (1470-37554)	3888 (1277-16418)	3674 (1859-14533)
Net returns per rupee of irrigation cost (Rs) Range	2.57 (0.08-15.75)	5.08 (1.74-28)	10.83 (1.6-61.88)	8.17(1.32-18.29)

Note : figures in the parenthesis indicate range

CONCLUSION

The groundwater irrigation cost ranges from 11 per cent to 36 per cent of the total cost across different crops cultivated. At present, since the groundwater irrigation cost is not computed while working out the cost of cultivation; the net returns are over estimated to the extent of the cost of groundwater. Hence, in hard rock areas, as groundwater is a vital source of irrigation, groundwater cost needs to be computed at least for food crops, in order that their MSP properly accounts for the cost of the natural resource and is accordingly paid for. It is crucial to revise the methodology followed by CACP, NABARD, Commercial Banks, Cooperatives and State Departments by properly accounting for cost of groundwater as suggested in this study. Further this calls for capacity building programmes for policy makers, farmers and stake holders regarding the costing methodology of groundwater as well as the need for wise use/sustainable use of groundwater in order that the cost of groundwater is well contained as in the case of borewell irrigation with recharge. This needs the support of agricultural extension/irrigation extension through creation of Irrigation Management Service (on lines of Arizona groundwater management) which can educate farmers and stake holders regarding all aspects of groundwater resource, extraction, sustainable use, irrigation as well as the recharge and the economics of irrigation. The band of agricultural engineering graduates from SAUs needs to be utilised for educating farmers in this regard.

NOTES

1. The RT 440 of CACP, has the information pertaining to type of well, number of wells, HP of pump, command area irrigated, percentage owned, year of drilling, age at present, remaining life, amount invested, value at present, salvage value. However there is no information on expected age or life of wells which is subjective and is assumed to be 10 or 20 years as left to the discretion / imagination of Field Assistant who collects the data. RT 441 deals with change in well, and indicates when the well destroyed (or failed), when new well was constructed. There is no information on volume of groundwater yield of well/s extracted by farmer.

2. https://www.karnataka.gov.in/kerc/court-orders/court-orders-2013/tariff_order_13-14/press_note/press_note_english.pdf browsed on 18th July 2014.

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What is the Scale of Multiplier Impacts of MGNREGS in India?: Village Social Accounting Matrix (SAM) in Two Villages of Karnataka

I

INTRODUCTION

The National Rural Employment Guarantee Act (NREGA) enacted on 2nd February 2006 with objectives of enhancing livelihood of poor and vulnerable section by ensuring a minimum of 100 days of employment guarantee to all rural households whose members are ready to do unskilled manual work. Gradually, the program was expanded to all India level, with wider and deeper coverage at all districts of the country. In 2009, it was renamed as Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and almost double funding allocation for the program in that year than that of the preceding year. MGNREGA is the first attempt of guaranteeing wage employment at all India scale with objective to ensure wage employment, and sustainable livelihood improvement, and natural resource management at local level. Besides, the MGNREGA interventions also envisage strengthening of democracy at the village and grass root levels, bringing transparency and accountability in governance by empowering the local panchayat and village level elected bodies through their active engagement in planning and execution of the local development activities.

In Karnataka, MGNREGS was implemented in three phases; the first phase (2006-07) covered five districts, the second phase, six districts, and third phase (from 2008-09) covered all the 27 districts. The MGNREGS provides not only wage employment during lean periods of agricultural year but also create durable assets with lasting effects and have a multiplier effect on different sectors of village economy, including at local economy. In this context, this study attempts to quantify both direct and indirect economic impacts of MGNREGA in a village economy, taking example from two villages in Karnataka. The direct and indirect economic impacts of MGNREGS arise in the economy due to its linkage with different sectors of the economy. That is, MGNREGS expected to produce economic multiplier effects in the local economy; measuring the various economic multiplier effects (income,

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employment and output multipliers) generated from the MGNREGS intervention is the central focus of this study.

After construction of village SAM, we have also carried out policy simulation exercises using the basic village SAM and analysed impact of alternate policy measures on different sector of the local economy. This involves analy sing synergies between safety nets activities of MGNREGS and agricultural and rural development interventions; MGNREGS impacts on labour wage rate, labour scarcity (and out migration), farm production activities, and other major changes brought in the village economy by the MGNREGS program.

Specific objectives of the study: The main purpose of this study is to assess direct and indirect impact of the MGNREGS intervention in a village economy, and assess the direct impact versus total impact of the program intervention. The specific objectives of the study are:

1) to construct Village SAM of a selected village and carry out impact assessment of direct and total economic impact of MGNREGS interventions in the selected villages in Karnataka,
2) to estimate investment multiplier effects of MGNREGS considering the village wide economic effects of the MGNREGS interventions in the selected villages, and
3) based on results of the SAM, derive policy recommendations for enhancing total multiplier effect and welfare of the low economic households in the village economy.

With this background, the next section provides a review of selected SAM studies carried out in India in the recent past. Then, the third section provides methodology used data used construction of Social accounting matrix, SAM model, derivation of the multiplier effects, and description of village economies of Markabinahalli and Belladamadugu villages selected for the analysis. Then, the results and discussion out of the village SAM analyses are provided in the fourth section. To save space and shorten the paper length, we have provided detailed descriptions and results for one village (Markabinahalli), and then only the key results of the second village, but in a comparative framework. The final section provides of conclusions and implications of the result findings.

II

LITERATURE

This section provides a summary of findings of the selected previous studies on village SAM carried out in India, and in other developing countries. In fact, there are only few hand counted empirical studies on village level SAM that have been carried out in India; some of the most notable of them are Subramanian 2007, Hirway *et al*., 2008 and Usami, 2008. Among then, the study by Hirway *et al*., 2008 is on impact

assessment of MGNREGA in selected sample villages in Gujarat state of India. A detailed comprehensive review on methodology used, details on activities and factors account of village SAM dealt in all of the three studies are provided in another study by the authors in Srikanthmurthy *et al*., 2014.

A Social Accounting Matrix SAM is the way of presentation of comprehensive economic flows and exchange that takes places in an economy in a matrix flow. In this sense, A SAM framework of representation incorporates the interaction among production activities, production factors, various institutions, capital accumulation, and rest of the world in an accounting framework (Osami, 2008, Taylor and Adelman, 1996). In the matrix, each row represents the receipts of the corresponding agent, and each column represents the expenditure. A SAM is also very flexible in terms of size and their dimension, which depends upon the level of disaggregation the researchers would like to carry out the analyses and the time and resources available for compilation of for disaggregated data level. Likewise, SAM can be constructed for a national level economy– macro SAM (large numbers in the past studies), regional SAM and village SAM The construction of village SAM is increasingly growing field of research, which also facilities modelling the interaction between natural resources flows and economy activities in a close economy of a village.

Using a village economy level SAM study for Kanzara village (ICRISAT project site) in Maharashtra, Subramanian (2007) analysed distributional effects of cultivation of Bt Cotton in a local economy context. The village selected for analysis, Kanzara, is also a predominantly cotton growing village in Maharashtra. He analyses impact of the technology household incomes, distributional of income across income class of households, and of farmers by farm size. He demonstrated that adoption of Bt cotton variety produced substantial rural employment, especially for hired female. While labour requirements for male labour decreased. This had a differential implication across different class of the households in the village economy. Cotton harvesting was largely carried out by hired female labourers, whose employment opportunities and returns (income) increased after adoption of Bt. Cotton. Whereas, pest control was predominantly the responsibility of male family members, by the use of Bt cotton, their employment has reduced.

Subramanian (2007) also showed that, under irrigated conditions, the return from Bt cotton was higher than with conventional varieties of cotton. Large farm households benefitted significantly from dry land Bt cotton adoption, much more than their small counterparts, this is largely due to indirect effects, especially the role of opportunity income from saved pest management time of large male farmers from the cotton field. The returns to saved management time in alternative activities appeared to be higher for large farmers than for small farmers due to different opportunities cost of saved time. He clearly demonstrated that large farmers benefitted much more from Bt adoption, when we analyse the issue in an economy-wide framework than the smallholding dryland farmers. In addition, due to scale

effect, large farmers had a bigger incentive to adopt the Bt technology than that of the smallholding farmers.

Likewise, Hirway *et al*., (2008) constructed comprehensive village level SAM for several villages in Gujarat for series of activities carried out undertaken under the MGNREGA program, and analysed impact of the program on key outcome indicators and gender issues in selected village in Gujarat state of India. They reported that the multiplier values will be (in terms of growth rates) of indirect effect of the NREGA interventions) in the village was 2.23, 1.17, and 1.65 per cent for output, income, and employment, respectively. That is, if Rs. 1 is spent under the NREGA activities in the village, there is total of Rs. 2.23 worth of outputs is generated in the village economy, that is, there is an indirect effect of another Rs. 1.23 Rs in the village economy. The multiplier coefficients/values reported in this study vary from 1.06 to 1.8 for output, from 0.37 to 1.23 for income, and from 0.07 to 1.19 for employment multipliers, depending upon the kind of interventions selected for the analyses (Hirway, *et al*., 2008). They have also estimated employment multiplier value for each of the crop production and other activities carried out in the village economy.

The multipliers derived from Hirway, *et al*. 2008 study were relatively smaller because of the leakages observed in the study sites. More than half of the backward and forward linkages of new demand generated were not absorbed within the village economy but were passed into nearest towns. For example, the commodities imported from outside the village were substantially high in the studied village. This study adopted static SAT, one period SAT, which would provide a snap shot of an economy. However, many of the changes brought by NGREGA intervention in the villages would also bring long-term impacts (de siltation of talk, increased water available, changes on cropping pattern due to better access to irrigation water). When a dynamic SAM is constructed, i.e., two SAMs for two different periods, which will allow to chapter such long term changes in the economy, but not by the one period static SAM.

Likewise, a Study by Usami (2008)has suggested construction of Regional Social Accounting Matrix by extending the basic structure of village SAM and by allowing to have a separate activities (flow of activities) for Natural Resource Accounts (water uses; : Linking Village/Industry Level Data to Regional Level Studies. However, limitation of huge data needed for construction of such regional (and meso-scale) SAM is a major limitation for practitioners and analysts working on the subject.

The multipliers impact on the activity in the village economy can be enhanced by village level manufacturing activities or through selection of other works with higher employment multipliers. For example, irrigation related work would enhance water supply, which will encourage farmers to grow high value crops. If MGNREGS activities would increase production of goods and services that are consumed within the village, which may eventually happens in a long run when the income of households increased, then the value of the multipliers will also likely to increase substantially. Likewise, the larger the share of the consumption of the goods and

services produced within the village, the larger will be the values of the multipliers. The larger the increase in interactions and exports value of the commodities produced, the larger will be the values of the multipliers. In case of MGNREGS activities, to have higher economic impacts in the local economy, the activities need to be targeted to activities that would generate higher multiplier value, which will occurs when the activities generate outputs that are consumed within village or shared/exchanged more or value added at maximum level in the village.

III

METHODOLOGY AND DATA

Social Accounting Matrix (SAM) is an organised matrix representation of all transactions and transfers between different production activities, factors of production and institutions (Like households, corporate sector and government) within the economy and with respect to the rest of the world (Saluja and Yadav, 2006). In the SAM, all the transactions in the economy are presented in the form of a square matrix. Each row of the SAM gives receipts of an account while the column gives the expenditures. The total of each row is supposed to be equal to total of each corresponding column. Detailed discussions on village SAM are in Murthy et al., 2014; Hirway, *et al*., 2008; and in Taylor and Adelman 1996.

In this study, village SAM was constructed to quantify the impacts of MGNREGA in the rural economy. It allows to analyse interactions across activities in a village, inter-villages interactions through trade in commodities, labour migration in and out of village, and impacts of local trade by household types (institutions). A village SAM also allows us to measure the induced effects from village to local markets, and to rest of the country (Hirway *et al*., 2008).

Using SAM multipliers, key sectors of the village economy were identified; The SAM multipliers were obtained following Bellù (2012) methodology from the village social accounting matrix. According to this methodology, if Y is a vector of total expenditure of the different endogenous accounts (also income of same account) in the SAM, and X is the exogenous expenditure made by residents of village, then the relation between Y and X can be illustrated by using 'identity matrix" (I), and 'A' as a coefficient matrix. That is,

$$Y=AY+X \quad \ldots.(1)$$

This equation (1) can be rearranged as following

$$Y= (I-A)^{1}Xeq \quad \ldots.(2)$$

where;
'A' = The coefficient matrix prepared from the SAM by dividing each cell value by its respective column total after excluding exogenous accounts from SAM.

$(I-A)^{-1}$ = It is the multiplier matrix and X is exogenous shock vector which after multiplication with multiplier matrix provides us with multiplier effect for that exogenous shock.

Output, employment and household income multipliers are sum of all cells in $(I-A)^{-1}X$ matrix for commodity account, labour services sub account and household account, respectively. In this sense, SAM methodology is very suitable for small economies such as the village economy (or a closed economy), where most economic transactions are tractable and verifiable. Therefore, a village SAM was designed to capture the complex inter-linkages among village production activities, village institutions and the rest of the world.

3.2 *Study Area*

This study was taken up in two villages of Karnataka, viz; 1) Markabinahalli village in Basavana Bagevadi Taluka of Bijapur district, and 2) Belladamadugu village in Madhugiri Taluk of Tumkur district. The Markabinhalli is a completely dry farming village (rain fed farming) with no bore well/dug well irrigation since the ground water is saline in this village. Only few farmers supplement irrigation from the riverside, whose lands are located nearby the river that is flowing nearby the village plot. ICRISAT, under Village Dynamics Studies in South Asia (VDSA) study in Karnataka, has chosen for long term monitoring and compilation of the village and households data across the stratified random sampling.

The village SAM constructed across the two villages was based on agricultural production activities, as well as other non-farm activities done in the village, so that we can estimate multiplier effect of each of the crop production activities across the village. The major crops produced by cropping seasons are provided in Table 1.

TABLE 1. CROPPING PATTERN IN THE VILLAGES SELECTED FOR THE STUDY (2012-13)

Season	Markabinahalli	Belladamadugu
(1)	(2)	(3)
Kharif	Pigeon pea, Cotton, Onion, Sunflower	Ground nut, Paddy, Finger millet, Horse gram, Cowpea, Flowers and Vegetables, Fodder Maize
Rabi /Summer	Wheat, Chickpea, Sorghum	Paddy, Ground nut, Flowers and Vegetables, Fodder Maize
Perennial	Mango	Arecanut, Coconut, Tamarind , Mango

3.3 *Data and Sampling Design*

An exhaustive list of different occupations of the households and the sample size by village are presented in Appendix Table 1. In Markabbinahalli village, total of 48 different activities were used construction of SAM. Taking purposive sampling framework, over 50per cent of samples entities are surveyed from each of the major activities for construction of village SAM analyses. Basic economic feature of both of the villages, and the variables and data types that were compiled in each of the

villages are provided in the following section, first for Markabinhalli village (Bijapur district) followed by Belladamadugu village (Tumkur district). ICRISAT-VDSA project has compiled high frequency monthly data in both the villages from 2009-15 on labour sectors activities, and agricultural production activities (cost of production). We have also taken the same data for deriving input and output of farming related activities.

3.3.1. *Village: Markabinahalli*

For the construction of SAM, both primary and secondary source of data were collected from the village for the agricultural year 2012-13 (1st June 2012 to 31st May 2013). Using census, all of the major households' types, and business entities/traders were listed. Then, data from the households and other business entities/agents in the village were collected using the purposive sampling. The actual sample size includes over 50 per cent of the total economic entities in the village.

The farm households were classified into five strata namely, landless households, and marginal, small, medium and large land holding households. The details procedures and descriptions are in Murthy *et al*., 2014.From each household stratum types, only five per cent of households (entities) were chosen as representative samples. They were chosen in such a way as to represent all occupations practiced villagers in this sub-category to and truly reflect the village economic conditions. Primary data were collected also from different economic agents including shops (Agricultural input shop, canteen, provision store) and service providers (tailor, barber, drivers, labourers and so on) regarding details of employment provided, receipts and expenditure by each entities. Secondary data were collected from Government institutions (Gram Panchayat, Anganwadi Centre, School, Post Office, Health Care Centre, financial institutions located in Devarhippargi and Satihal and ICRISAT-VDSA project database) and NREGA official websites http://nrega.nic.in/netnrega and http://panchamitra.kar.nic.in. Structured checklists were prepared and used to collect data from villagers and business entity. In the questionnaire information on the transaction both within and outside were recorded separately, and source- wise.

The sample households were included people belonging to different social groups like caste, religion, occupation, since the household groups have difference on their consumption pattern of foods, festival spending, expenditure on durables, etc. Both underestimation and overestimation of expenditure or income were avoided. Household consumption data were collected for one month and was multiplied by 12 to get the consumption for a year. Data on all items of consumption (durable and non-durable) was collected from representative households, and we constructed a SAM of 82 x 82 size, which was refined furthermore.

3.3.2. *Village: Belladamadugu*

The SAM for Belladamadugu village was constructed using primary data from 25 households, 21 farmers, 10 leaf plate makers, 4 luggage auto transport operators, 10 households involved in services, 22 participants of MGNREGA, and 35 non participants of MGNREGS (127 in total). Then, secondary data pertaining to village statistics and MGNREGA works undertaken in the village were obtained from panchayat, post office, government school, Anganwadi, SHGs and official website of MGNREGA. The SAM was developed to find key sectors contributing meaningfully to the village economy and to linkage of MGNREGA to the rural livelihoods.

Primary data were compiled from field survey by individually surveying 127 households representing different sectors of the local economy. Details are in appendix Table 1. They were chosen in such a way as to represent entities from all occupations available in the village, reflect the true village economy. In the structured questionnaire, information on the transaction, both within and outside, were recorded separately and source wise. The sampling size was chosen to take care of nearly all sectors of the rural economy. For this study, a 64 X 64 sector Social Accounting Matrix was constructed to identify the key sectors and their contribution of MGNREGA towards the village economy.

IV

RESULTS AND DISCUSSION

A village social accounting matrix was constructed for 2 sample villages of Karnataka namely Markabinahalli and Belldamadugu. Activities and service sectors of villages are identified and selected for construction of SAM, based on expenditures and receipts of the local economy, as noted in the previous section. The results from SAM analysis are summarised here, first for Markabinahalli then followed by Belldamadugu village. Discussions on SAM matrix, various assumptions used in construction of the SAM are provided in Murthy, *et al*., 2014.

4.1. MGNREGA Impact in Markabinahalli

For detailed SAM analyses, an aggregated SAM of 16X16 sizes for Markabinahalli village for the agricultural year 2012-13 was constructed containing two production activities viz; agriculture and charcoal making and two service sector activities, viz., trade and others; others included tailor, barber, SHG, transport service providers and so on (Table 2, and in appendix Table 1).Likewise, institutions (Households, Panchayat and Temple) and factors of production (labour and capital services), labour services sub-account - family and hired labour-were also included. All of them constituted endogenous accounts except for exogenous accounts comprised of Panchayat, savings and investment account and rest of the world

TABLE 2. AGGREGATED SOCIAL ACCOUNTING MATRIX FOR MARKABINAHALLI VILLAGE FOR 2012-13

(*value in Rs. Lakhs*)

	Activity					Commodity					Factor services						
	AGRI	CHAR	MGNREGP	TRD	OTH	AGRI	CHAR	MGNREGP	TRD	OTH	LABOUR	CAPITAL	HOUSE	INST	S&I	ROW	TOTAL
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
AGRI	0.0	0.0	0.0	0.0	0.0	342.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	342.4
CHAR	0.0	0.0	0.0	0.0	0.0	0.0	18.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.3
NREGP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0
TRD	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	174.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	174.2
OTH	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	265.4	0.0	0.0	0.0	0.0	0.0	0.0	265.4
AGRI	11.0	0.0	0.0	72.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	0.0	0.0	236.0	353.3
CHAR	0.0	0.0	0.0	8.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0	18.3
NREGP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	15.0
TRD	20.1	0.0	0.0	5.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.5	0.0	5.0	129.4	174.2
OTH	29.2	0.0	0.0	2.2	0.7	0.0	0.0	0.0	0.0	0.0	0.0	34.2	101.7	0.0	0.4	97.1	265.4
LABOUR	86.8	9.2	4.2	4.2	2.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4	3.6	0.0	52.1	172.8
CAPITAL	36.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	47.5	0.0	0.0	0.0	83.9
HOUSE	81.9	9.2	0.0	42.3	135.7	0.0	0.0	0.0	0.0	0.0	167.8	0.0	48.0	46.9	60.4	27.0	619.1
INST	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	65.1	65.6
S&I	58.5	0.0	0.0	0.0	2.6	11.0	0.0	0.0	0.0	0.0	0.0	2.1	117.0	15.1	0.0	0.0	206.2
ROW	18.7	0.0	10.8	40.1	123.3	0.0	0.0	0.0	0.0	0.0	5.0	47.5	235.9	0.1	125.3	0.0	606.7
TOTAL	342.4	18.3	15.0	174.2	265.4	353.3	18.3	15.0	174.2	265.4	172.8	83.9	619.1	65.6	206.2	606.7	

Exchange rate: 1 USD = Indian Rs. 57.5 (annual average for the year 2012-13).

Here, AGRI.: Agriculture, CHAR: Charcoal, TRD: Trade (includes both Agro-input and commodity), OTH: Other service providers, HOUSE: Households, INSTI: Institutions (Panchayat and Temple), S& I: Savings and Investment, ROW: Rest of the World.

account. Household account was the largest of all the accounts which revealed importance of household spending in the village economy. Agriculture was the second largest account showing its dominant role. MGNREGS was treated as a separate activity to assess the multiplier effect of investment under the scheme on village economy (Details are in Table 2).

The multiplier effects of MGNREGS are derived, and the results are summarized in Table 3; the multiplier effect of MGNREGS in Markabinahalli village economy was only 1.85 in magnitude, which is very weaker than we expected it earlier. Of the 44 individual endogenous accounts, income multiplier value was highest for hired labour services account (0.29) followed by landless family households (0.11), small family households (0.09), marginal family households (0.07), and large family households (0.06). A multiplier value of 0.29 implies that if the final demand for MGNREGS in the economy increases by 1 Rupee the demand for hired labour services in the economy increases by 28 paise. Of these 44 accounts, 11 accounts had zero or negligible multiplier value. The multiplier value of individual account of service providers and production activities were much lower than our expectations earlier. In addition to the multiplier value, for total impact of the MGNREGS in an economy, the actual size of each account and the actual size of MGNREGS work in the economy in the surveyed year is equally critical, which in fact, widely differed by account. Thereby, the change on value of these accounts when the final demand for MGNREGS in Markabinahalli would increases by Rs. 10 lakhs (a hypothetical value) is presented in Tables 2, 3 and appendix Table 1. Maximum impact was observed in Hired labour services; the increase on individual income was very small due to low intensity of MGNREGS works and very large size of agricultural labour services (Rs. 86.8 lakhs, 50 percent of total labour receipts in the village and very weak linkages of MGNREGS with rest of the accounts.

TABLE 3. SUMMARY OF IMPACT OF RS. 10 LAKH ADDITIONAL INVESTMENTS IN MGNREGS ON MARKABINAHALLI VILLAGE ECONOMY

Particulars	Base value for agriculture year 2012-13 (Rs.)	Multiplier value	Impact of investment in MGNREGS	
			Rs.	Per cent change
(1)	(2)	(3)	(4)	(5)
Output multiplier	8,15,28,134	1.14	11,39,000	1.40
Employment multiplier	6,19,07,445	0.30	2,98,000	0.48
Household income multiplier	1,72,76,525	0.39	3,88,000	2.25

Exchange rate: USD 1 = Indian Rs. 57.5 (average for the year 2012-13).

This 2.9 percent impact on labour account due to MGNREGS is equal to 960 labour days per annum, or which is equivalent to providing full employment to three households in a year @ 320 days of employment in a year, or 100 days of employment for 9 households. Second largest impact was observed on small households (1.02 per cent) followed by landless households (0.95 per cent), repair and maintenance shop (0.9 per cent), PDS shop (0.8 per cent) and Private School (0.77 per cent).

Overall impact of MGNREGS on village economy was only 1.1 per cent but in labour equivalents implies for 6184 labour days, or full time employment to 19 households at the rate of 320 days of employment per year per household. This is a very weak effect of MGNREGA on employment keeping in view the objective of livelihood security within framework of MGNREGS. In essence, indirect impact of MGNREGS on labour employment was 85percentage of total impact of MGNREGA (1.14).

In Table 3, multiplier effects of Rs. 10 lakhs investment in MGNREGS are presented as output, employment and household income multipliers. Of all the three multiplier effects, output had highest value of 1.14 followed by household income (0.39) and employment (0.3), but, the highest impact was on household income, which was to the tune of 2.25 per cent followed by output (1.4 per cent) and the least impact was on employment, to the tune of 0.48 per cent.

Low Impact of MGNREGS in Markabinahalli

MGNREGS was carried out on a very small-scale in the studied village *Markabinahalli*. Total outlay spent on MGNREGS in the year 2012-13 was of Rs. 15 lakhs, which was even lesser than the total monetary value (size) of charcoal making activity in the village, which provides employment throughout the year. We also found very weak linkages of MGNREGS with other accounts. Besides, MGNREGS spent fund only on hired labour services in the village, whereas, material components were procured from outside the village. Proportion of labour component in the overall outlay for MGNREGS was just 28 per cent as against 60 per cent mandated by the national NREGA authority. This was of value of Rs. 4.2 lakhs, just 2.4 per cent of total labour income in the village economy in the surveyed year.

In addition, the labour household income (wage) from MGNREGS wasn't so attractive in Markabbinahalli village; where agricultural wage rate was Rs. 300 per day; and non-farm wage rate was Rs. 350 per day, which are much higher than the average MGNREGA wage rate of Rs. 174 per day followed in the surveyed year. On an average, in a year, a family worked for 27 days under MGNREGS worked, 80 days in non-farm activities, and 253 days in agriculture sector. With the prevailing wage rates in different activities, the total family income of a labour household was Rs. 1,08,600 per annum. In this case, the income from MGNREGS (Rs.4698) would form only 4.32 per cent of the total annual income of the same labour household. Due to all of these factors the workers in the village were not so much attracted to MGNREGS works.

Instead of MGNREGS being demand driven, had this been driven with supply focus, then the program would be designed much effectively by the local panchayat. Since seasonal migration to nearby towns and far-off places like Solapur and Bangalore fetched higher returns to them, local people, the local leaders were not showing any significant zeal for successful implementation of the scheme. Income

flow into the village economy from temporary labour migration stood at Rs. 52.1 lakhs, 13 times higher that of labour earnings from MGNREGS.

TABLE 4. MGNREGS WORKS IN MARKABINAHALLI: 2012-13

	Official records		
Work	Total person days of work provided	Total amount disbursed (Rs.)	MGNREGA wage (Rs/ day)
(1)	(2)	(3)	(4)
RGSK construction	3996	10,07,000	155
Tree planting			
Weed removal			

1USD = Indian Rs. 57.5 (annual average for the year 2012-13).4.2. MGNREGA Impact in Belladamadugu.

Likewise, Social Accounting Matrix was constructed also for the Belladamadugu village. Then, output, employment and income multipliers of key sectors of Belladamadugu village are derived. Details results are in Table 5. Details on the Village SAM of Belladamadugu are in DVSA discussion paper no 26 (http://vdsa.icrisat.ac.in/Include/Discpapers/SEDPS_26.pdf

TABLE 5. OUTPUT, EMPLOYMENT AND INCOME MULTIPLIERS OF KEY SECTORS IN BELLADAMADUGU

Key sectors	Output multiplier	Employment multiplier	Income multiplier
(1)	(2)	(3)	(4)
Dairy (co-operative)	2.52	0.23	0.81
Milk Production	2.08	0.33	1.10
Rainfed groundnut cultivation	1.88	0.49	0.62
Paddy cultivation	1.50	0.23	0.98
Flower crops cultivation	1.50	0.28	1.03
Tamarind harvesting and processing	1.47	0.55	1.26
SHG	1.45	0.03	1.10
Leaf plate making	1.41	0.29	1.02
Sheep and goat rearing	1.39	0.42	1.12
Brick Making	1.37	0.28	0.91
MGNREGA	1.08	0.17	0.20

For Rs.1 increase in final demand of MGNREGA, this will lead to indirect impact on increasing income of households is Rs. 0.2, of which Rs 0.17 is for poor farm households and Rs. 0.03 is for middle-income households. This modest multiplier suggest MGNREGA was not able to make meaningful impact in the villages selected (Belladamadagu). However, dairy and dairy co-operative are the two key sectors exhibiting large multiplier value of 4.6. This has resulted in both efficiency and equity in income distribution. Thus, milk production and cooperative dairy together have the potential to empower economically the male farmers as well as women farmers. After that, Rainfed Groundnut cultivation was of higher multiplier effect with 1.88 values. This is followed by paddy cultivation (1.5), flower cultivation (1.5), then harvesting & processing of tamarind (1.47). MGNREGA has made a modest impact on village economy since the output multiplier is low (1.08).

Reasons for Weak SAM Multipliers for MGNREGA in Belladamadugu

The reasons for weak value of SAM multipliers of MGNREGA in Belladamadugu could be due to the same sets of factors as noted in case of Markabinahalli village earlier. Agricultural wage rate (Rs. 200 per day) and non-farm wage rate (Rs. 300 per day) in the study area are substantially higher than the MGNREGA wage rate of Rs. 174 per day by over 44 per cent. An average village family worked for 17 days under MGNREGA, 64 days in non-farm activities and 242 days in agriculture. At the current wage rates, the annual family wage income from all sources is Rs. 70,558. The wage income from MGNREGA (Rs. 2958) here forms a meagre 4.2 per cent of total annual family wage income. Therefore, even if the households were willing to work, their reservation wage to work in MGNREGA was much higher than the wage rate offered from the MGNREGS, which deters them to work for the MGNREGA activities.

V

CONCLUSIONS AND IMPLICATIONS

We have constructed a village level SAM for tracking direct and indirect impact of MGNREGS and other activities done in the two villages in Karnataka. The methodology and adopted in this study are different than most of the other studies dealing with impact of MGNREGS. The focus of here is on anlaysing direct and indirect impacts of the MGNREGS interventions, and quantify the multiplier effects of the MGNREGS in the village economy, taking together all other major economic activities (over 30-40) being taken in the village.

The village economy-wide multiplier value of MGNREGS and other activities (interventions), as estimated in one of the study village (Belladamadagu),was highest for dairy cooperative and dairy activities (4.6), and followed by rainfed ground nut cultivation (1.88), paddy cultivation (1.5), flower cultivation (1.5), and tamarind harvesting and processing (1.47) and so on. The output multiplier for MGNREGA was a very modest 1.08, which indicates that MGNREGA is yet to make an economic impact in the village economy of Belladamadagu. Almost same results were also obtained in another village of Markabinahalli.

SAM multiplier analysis indicated that in water starved dryland village of Belladamadagu, dairy and dairy co-operative have the highest potential to generate income for all categories of farmers followed by activities such as rainfed groundnut cultivation, paddy cultivation, flower cultivation, and followed by tamarind harvesting and processing, and so on.

At the two villages of Karnataka selected here, MGNREGA is yet to make economic impact in the village economy, as reflected in its poor multiplier effects. The role of MGNREGA should be certainly in different mode and different form these villages with the higher market wage rates. A different strategy on implementation of MGNREGA is needed than the standard methods of MGNREGS

implementation as practiced all over the country. For example, the Procedural complexities in MGNREGA implementation may also need to be simplified to reduce the transaction costs in its implication, and to increase the number of working days per year undertaken in a village under the MGNREGS. Mission mode culture needs to be inculcated to improve MGNREGA operation in the village. The additional local village expenditure on activities like supports for groundnut cultivation (may be thorough improving access to water), flower cultivation, tamarind processing and leaf plate making, would have higher output multiplier values than that of the output multiplier value of MGNREGA.

The works to be selected under the scheme need to address issues related to creating better community asset, improving quality of life and increasing farm productivity, including inter alia, better sanitation, improving rain water harvesting, tree planting, supply of good drinking water, rural connectivity, rejuvenation of traditional water bodies and land improvement on individual farms. Ensuring good quality in work execution and financial transparency would go a long way in motivating the local villagers to make the best use of MGNREGS and further strengthen the inter linkages and feedback effect of MGNREGS in the village economy.

Multiplier effects (feedback effects estimated using SAM) of MNGREGS on the villages of Markabinahalli and Belladamadugu was very weak. This is also due to leakage and use of more percentage of materials under the MNREGS activities than labor allocated under the schemes, these materials and machines were brought from outside of the village economy, which were leakage in the village economy). The village wide assessment of impacts and construction of village SAM contributes in the applied economic studies in India. This study provides policy measures for enhancing multiplier effects of the MGNREGS interventions in the local economy.

In addition, on a positive note, MGNREGA is playing the role of Social Safety Nets for some of the labourers who would not get observed by the normal labor markets such as ages women members, age male members in the village. In that sense, MGNREGS might have played a crucial role in providing the downward threshold for the wage rate, increasing the wage incomes for rural households. The low participation of labour for MGNREGS lead to weak MGNREGA output multipliers. With the higher wage earning from other activities compared with MGNREGA activities, the MGNREGA has limited effect in the village where the average rural wage rate is substantially higher than the MGNREGA wage rate. The methodology adapted validated for village SAM analyses in this study can be adapted to other villages and these analytical tools can be used for comparative assessment of several alternate government interventions in the village economy. This tools and methodology validated here would be also very useful to graduate students interesting to do research on quantifying direct, indirect, and total impact of large-scale public intervention in local and regional economy.

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APPENDIX TABLE 1. OCCUPATIONAL STRUCTURE AND SAMPLE SIZE IN THE SELECTED VILLAGES

Sl. No.	Occupation	Markabinahalli		Belladamadugu	
		Total	Sample	Total	Sample
(1)	(2)	(3)	(4)	(5)	(6)
1	Hotel (including small tea shops)	7	3	4	4
2	Gents tailors	2	1	1	1
3	Ladies tailor	9	2	0	1
4	Provision store	7	3	1	1
5	Cobbler	1	1	0	0
6	Chilly grinding mill	1	1	0	0
7	Rava grinding mill	1	1	0	0
8	Grinding mill	2	2	1	1
9	Agri-input and grain merchant	5	5	0	0
10	Charcoal trader	3	3	0	0
11	Cycle repair shop	1	1	0	0
12	Black smith and carpenter	2	2	0	0
13	Gold smith	1	1	0	0
14	Govt. school cook	4	4	3	3
15	Brick making	0	0	4	1
16	Leaf plate making	0	0	80	10
17	Bidi making	0	0	5	5
18	SHG(SKDRDP)	3	2	47	47
19	Dairy	0	0	99	15
20	Private salaried	#		6	2
21	Dairy secretary	0	0	1	1
22	Dairy tester	0	0	1	1
23	TV cable operator	0	0	1	1
24	Pigmi collector	0	0	1	1
25	painter	0	0	3	1
26	Drum player	0	0	1	1
27	Anganwadi workers	4	4	2	2
28	Government hospital worker	1	1	0	0
29	Tractor driver	12	2	3	1
30	Goods lorry driver	2	2	0	0
31	Passenger auto driver	4	3	0	0
32	Luggage auto driver	5	5	8	4
33	Truck driver	1	1	0	0
34	Panchayath employees	6	6	1	1
35	LIC Agent	1	1	0	0
36	Mason workers	10	6	0	0
37	Post office	1	1	0	0
38	Govt. School	3	3	1	1
39	Pvt. School	1	1	0	0
40	Pvt. Tuition	2	2	0	0
41	Anganwadi Centre	2	2	1	1
42	Barber	2	2	1	1
43	Registered doctors	2	2	0	0
44	Unregistered doctors	2	1	0	0
45	Unregistered liquor shop	2	0	2	0
46	Govt. Primary Health Centre (Ayu)	1	1	0	0
47	Public Distribution system shop	1	1	1	1
48	Kerosene supply shop	1	1	0	0

Source: *ICRISAT (2010); **Markabbinahalli Gram Panchayat records; ***Survey by authors.

N. NAGARAJ, UTTAM DEB, G.D. NAGESWARA RAO,
CYNTHIA BANTILAN AND R. ANUSHA*

Is Smallholder Farming Economically Viable? Evidences from Village Dynamics Studies in Karnataka, Peninsular India[1]

I

INTRODUCTION

Indian agriculture is numerically dominated by small and marginal farmers who constitute around 83 per cent of the total holdings and Karnataka state is no exception. Over 56 per cent of the state population depends on agriculture for their livelihood. A majority of these are small and marginal farmers with land less than 2 ha. Thus, small holder agriculture is expected to continue in the foreseeable future with rise in population pressure on land and demand for land for competing alternative uses. In this regard, the emerging challenges for small holder farmers include inadequate access to markets, infrastructure, and technology; high marketing and transport costs; and limited resources (Fan *et al*., 2003). Farmers to continue in the agriculture with declining resource base particularly land would require a steady flow of income from farming alone or farming along with other income generating activities. Of late, due to vagaries of climate change, rising labour costs and associate sharp fall in agricultural incomes, the viability of smallholder farms is threatened and is at stake, hence many small farmers are drifting out of agriculture to non-farm activities. The key challenge is how to improve the income of small farms with a focus on enhancing productivity and profitability which is sustainable on long-run so that small farmers can stay on their farming business. In this regard, this paper examines the economic viability of smallholders farming considering the average incomes generated from different sources in typical semi-arid villages of Karnataka.

Focus of the Study

The main focus of the study is to assess the economic viability of smallholder farming in typical semi-arid villages of Karnataka considering different sources of farm and non-farm income generated.

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II

METHODOLOGY

The ICRISAT Village Dynamics in South Asia, (VDSA) collects the panel data from the selected village households by employing resident field investigators who stay in the selected villages and collects the household data by personal interview. A sample of 40 respondent households was selected to represent four categories of household's landless labour, small farmers, medium farmers and large farmers. The farm household categories were defined on the basis of the pattern of landholding in each village. Ten households were randomly selected from each stratum inferring equal sampling fractions in each size group and for analysis purposes the cultivator sample is a uniform random sample. However, the labour category has not been included in the analysis as they do not have substantial crop based activities. The farmers have been further categorised into viable and non-viable based on average surplus income over costs generated for the past 3 years. Empirical estimation is done through analysis of household level panel data collected from 160 households located in four villages of Tumkur and Bijapur districts of Karnataka for four years (2009-2012) by ICRISAT under the Village Dynamics Studies in south Asia (VDSA) project.

Characterisation of Sample Districts and Villages

In Karnataka, Bijapur and Tumkur districts have been chosen for the VDSA project since 2009. The villages selected include Markabinahalli (Basavana Bagewadi, Taluk) and Kapanimbargi (Indi, Taluk) in Bijapur, Tharati (Korategere, Taluk) and Belladamadugu (Madhugiri, Taluk) in Tumkur district. Bijapur district is located in Northern maidan (plateau) region of Karnataka with semi-arid climate and a large proportion of this district is under marginal production environment with 37 rainy days in a year facing severe droughts. The district has high concentration of horticultural crops under groundwater irrigation. Both rainfed and groundwater based agriculture is heavily dependent on monsoons. Similar to Bijapur, Tumkur district lies in southern Karnataka, a typical semiarid region facing frequent droughts with hardly 33 rainy days in a year.

Contrasts between Bijapur and Tumkur Villages

The size of holdings are higher ranging between 4 – 8 ha in north Karnataka (Bijapur), on the contrary, the size of holdings are extremely small ranging between 0.25 – 2 ha in the southern Karnataka (Tumkur). In Bijapur, farmers are under investing in dry land agriculture due to risk and uncertainty in rainfed agriculture, while groundwater irrigated farmers are over investing on well irrigation and horticultural crops production and processing. On the contrary, in Tumkur villages due to small holdings, there is intensification of agriculture with the use of external

inputs. With access to bore-well irrigation, the cropping patter has changed from finger millet dominant mixed cropping to diversify commercial farming.

Key Features of VDSA Villages

The salient features of VDSA villages are provided in the table (Table 1)**.** The proportion of cultivated area out of the total geographical area is relatively higher in Bijapur district (94 – 95 per cent) as against Tumkur (44-73 per cent). With respect to size of holdings, the disparities are more discernible in Bijapur villages compare to Tumkur villages, as the proportion of landless households is more in Bijapur villages. Around 39 per cent of the area is irrigated in one of the villages in Bijapur and another village completely rainfed. While, the area under irrigation is slightly more Tharati village compare to Belladamadugu, because of extremely small size of holdings in Tharati of Tumkur district. The households in Bijapur have bigger family size and more literacy compare to Tumkur villages. Seasonal migration is observed in households belonging to Kapanimbargi village, as this village has highest number of landless households. Bijapur villages have black cotton and red soils, while Tumkur villages have red sandy soils. The cropping pattern shows a combination of food and commercial crops in all the 4 villages.

TABLE 1. SALIENT FEATURES OF VDSA VILLAGES IN KARNATAKA

	Bijapur		Tumkur	
Particulars/villages	Markabinahalli	Kapanimbargi	Belladamadugu	Tharati
(1)	(2)	(3)	(4)	(5)
# of HH's	392	320	276	401
Total geographical area (Ha)	1001	826	496	519
Per cent of net cultivated area	94	95	73	44
Per cent of Irrigated area	0	39	27	29
Per cent of landless households	28	33	10	28
Family size	6.47	6.23	4.43	4.24
Literacy	64	60	49	24
Size of holding (Ha)	3.29	3.6	1.45	1.03
Seasonal migration (per cent of HH)	-	12	-	-
	Bio physical features			
Annual Rainfall (mm)	412.4	376.5	472.2	735.4
Soil type	Deep to medium black	Red	Red sandy	Red sandy loam
Crops grown during Kharif	Pigeon pea, Cotton, Onion	Pigeon pea, Maize, Groundnut, Pearl millet, Onion	Groundnut, Paddy, finger millet, Pigeon pea, Horse gram	Finger millet Paddy, Cut flowers, Horse gram, Ground nut
Crops grown during Rabi	Chickpea, Sorghum, Wheat, Safflower	Sorghum, Wheat, Chickpea, Maize, Onion	Paddy, Groundnut, Flowers and Vegetables	Flowers, Vegetables, Sorghum fodder
Perennial crops	–	Grapes, Ber, Pomegranate	Arecanut	Arecanut, coconuts, Betelvine

General Characteristics of Sample Farmers in VDSA Villages of Karnataka:

The demographic features of the sample farmers in VDSA villages of Karnataka indicate that the average family size comprised of 5-6 members with a literacy level of 4-5 years (Table 2). In terms of social profile, barring Belladamadugu village, majority of the farmers (>80 per cent) belong to OBC. In terms of youth involvement in agriculture, only 5-8 per cent of the youth in Tumkur villages are engaged in agriculture as against 15 per cent in Bijapur villages. This indicates youth disinterest in agriculture. Age cohort indicates that around 1/3rd of the farmers are above 60 years age and more than 50 per cent of the farmers are in middle age in all the villages. The striking feature that differentiates between Bijapur and Tumkur villages is that of size of holdings, which are extremely small in Tumkur villages as compared to Bijapur.

TABLE 2. GENERAL CHARACTERISTICS OF SAMPLE FARMERS IN VDSA VILLAGES OF KARNATAKA

Particulars	Markabbinahalli	Kapanimbargi	Belladamadugu	Tharati
(1)	(2)	(3)	(4)	(5)
Family size	6	6	5	5
Literacy (yrs. of schooling)	5.6	4	3.9	4.8
	Social classification (% of farmers)			
1. SCs	7	7	20	6
2. STs	10	-	20	-
3. OBC	83	93	60	94
	Size of holdings (ha) (Base year)			
Large	9.40	9.36	2.45	0.98
Medium	2.30	2.27	1.04	0.43
Small	1.00	1.36	0.69	0.36
	Pattern of Holding (ha) (Base year)			
Dry	4.12	2.28	1.05	0.35
Irrigated	-	2.04	0.36	0.26
Total	4.12	4.32	1.41	0.61
	Age cohort of farmers			
1. Youth (< 35 years.) per cent	15 (30.5)	16 (30.7)	8 (31)	5 (32.5)
2.Middle aged (35-55 years) per cent	47 (43.9)	38 (43.9)	58 (44.1)	59 (44.2)
3. Aged farmers (> 55 years) per cent	38 (65.1)	46 (61.5)	34 (65.8)	36 (65.4)

Note: Figures in parenthesis indicates average age in years.

Cropping Pattern for Different Size of Holdings in VDSA Villages of Karnataka:

Cropping pattern across different size groups in VDSA villages of Karnataka is given in Table 3. The cropping pattern indicates a combination of food and commercial crops in all the 4 villages. In Bijapur villages, major share of the area was under pigeon pea and cotton in Kharif and sorghum and chick pea in post-rainy season. In Belladamadugu village, groundnut is the major crop in both the seasons, while in Tharati village the major crops grown are finger millet in *kharif* and flowers in all the 3 seasons. Grapes in Kapanimbargi village of Bijapur district and Chrysanthemum, areacanut and betelvine crops in Tharati village in Tumkur district are major horticultural crops. The cropping pattern shows that most of the small

farmers in Bijapur allocated their meager area towards food crops, while in Tumkur villages small farmers allocated their area for both for food and commercial crops. On the contrary, majority of the large and medium farmers allocated more area towards commercial crops. Thus, most of the small farmers are food security oriented, while most of the large farmers are economic security oriented.

TABLE 3. CROPPING PATTERN FOR DIFFERENT SIZE OF HOLDINGS IN BIJAPUR DISTRICT

	Village	Kapanimbargi			Markabinahalli		
Land holding	Kharif	Area covered (ha)	Per cent of GCA (ha)	Per cent of season area (ha)	Area covered (ha)	Per cent of GCA (ha)	Per cent of season area (ha)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Large	Pigeon pea	7.5	8.4	19.8	17.4	15.3	40.1
	Pearl millet	6.9	7.7	18.2	-	-	-
	Groundnut	3.5	3.9	9.2	-	-	-
	Cotton	-	-	-	4.2	3.7	9.8
	Maize	4.4	4.9	11.5	-	-	-
Medium	Pearl millet	5.5	6.2	14.5	-	-	-
	Groundnut	2.4	2.7	6.4	-	-	-
	Maize	1.2	1.4	3.2	-	-	-
	Green gram	1.3	1.4	3.3	-	-	-
	Cotton	-	-	-	2.9	2.6	6.7
	Pigeon pea	-	-	-	9.6	8.5	22.1
Small	Pearl millet	1.8	2.0	4.7	-	-	-
	Pigeon pea	2.6	2.9	6.8	5.6	5.0	13.0
	Groundnut	0.9	1.0	2.3	-	-	-
	Cotton	-	-	-	3.1	2.8	7.2
	Onion	-	-	-	0.5	0.4	1.2
	Total kharif area	38.1	42.5	100	43.4	38.2	100
		Rabi					
Large	Sorghum	17.8	19.9	48.4	20.0	17.6	28.4
	Wheat	3.8	4.2	10.3	8.7	7.6	12.3
	Chickpea	2.1	2.3	5.6	29.1	25.6	41.4
Medium	Sorghum	5.3	5.9	14.3	2.3	2.0	3.2
	Wheat	2.6	2.9	7.0	1.6	1.4	2.3
	Chickpea	0.7	0.8	2.0	2.7	2.4	3.9
Small	Sorghum	4.0	4.5	10.9	3.6	3.1	5.1
	Chickpea	0.6	0.6	1.5	1.0	0.9	1.5
	Wheat	-	-	-	1.4	1.2	2.0
	Total rabi area	36.8	41.1	100	70.3	61.8	100
		Annual					
Large	Sugarcane	3.78	4.21	100.0	-	-	-
	Total annual area	3.78	4.21	100	-	-	-
		Perennial					
Large	Grapes	7.99	8.9	73.1	-	-	-
	Jasmine	0.10	0.1	0.9	-	-	-
	Lemon	0.84	0.9	7.7	-	-	-
Medium	Ber	1.21	1.4	11.1	-	-	-
	Jasmine	0.20	0.2	1.9	-	-	-
	Lemon	0.40	0.5	3.7	-	-	-
Small	Ber	0.17	0.2	1.6	-	-	-
	Total perennial area	10.93	12.2	100	-	-	-
	GCA	89.6	100		113.7	100	

TABLE 4. CROPPING PATTERN DIFFERENT SIZE OF HOLDINGS IN TUMKUR DISTRICT

	Village	Belladamadugu			Tharati		
Land holding (1)	Kharif (2)	Area covered (ha) (3)	Per cent of GCA (4)	Per cent of season area (5)	Area covered (ha) (6)	Per cent of GCA (7)	Per cent of season area (8)
Large	Pigeonpea	1.9	5.2	6.0	0.7	4.6	6.8
	Groundnut	11.1	31.1	35.7	-	-	-
	Paddy	2.4	6.6	7.6	1.4	9.5	14.2
	Finger millet	1.1	3.1	3.6	2.1	14.6	21.7
	Chrysanthemum	-	-	-	0.6	3.9	5.9
Medium	Groundnut	5.6	15.7	18.1	-	-	-
	Pigeonpea	1.3	3.5	4.0	-	-	-
	Paddy	1.0	2.7	3.1	0.6	3.9	5.8
	Finger millet	0.7	1.9	2.2	1.7	11.4	16.9
	Chrysanthemum	-	-	-	0.4	3.1	4.5
Small	Pigeonpea	0.5	1.5	1.7	0.3	2.1	3.1
	Groundnut	3.8	10.6	12.2	-	-	-
	Paddy	1.3	3.7	4.2	-	-	-
	Finger millet	0.6	1.6	1.8	2.1	14.1	21.0
	Total kharif area	31.2	87.2	100	9.8	67.2	100
Rabi							
Large	Groundnut	0.8	2.4	22.2	-	-	-
	Paddy	0.8	2.3	21.3	-	-	-
	Chrysanthemum	-	-	-	0.5	3.4	64.2
Medium	Groundnut	0.4	1.1	9.9	-	-	-
	Paddy	0.5	1.5	14.2	-	-	-
	Chrysanthemum	-	-	-	0.2	1.4	27.1
Small	Groundnut	0.8	2.2	20.4	-	-	-
	Paddy	0.5	1.3	12.0	-	-	-
	Chrysanthemum	-	-	-	0.1	0.5	8.7
	Total rabi area	3.8	10.6	100	0.8	5.2	100
Annual							
Large	Acarus Calamus	-	-	-	0.20	1.4	57.1
	Banana	-	-	-	0.15	1.0	42.9
	Total annual area (ha)				0.35	2.4	100
Perennial							
Large	Arecanut	0.64	1.8	80.6	2.02	13.9	55.5
	Betel Vine	-	-	-	0.11	0.8	3.1
	Coconut	0.15	0.4	19.4	0.22	1.5	6.1
	Banana	-	-	-	0.06	0.4	1.7
Medium	Arecanut	-	-	-	0.86	5.9	23.5
	Betel Vine	-	-	-	0.04	0.3	1.1
	Jasmine	-	-	-	0.15	1.0	4.1
Small	Jasmine	-	-	-	0.18	1.3	5.0
	Total perennial area	0.8	2.2	100	3.7	25.1	100
	GCA	35.8	100		14.5	100	

Income from Crop, Livestock and Off Farm in VDSA Villages of Karnataka during 2009-11:

The income realised from crop, dairy and off farm is indicated in Tables 5-6 for all the 4 VDSA villages and it is represented in Figures 1 and 2. The economic

analysis of different sources of income across different size groups reveals a wide gap in all the 4 villages. In Markabinahalli, on an average, the total net return derived from crops by a large farmer is 7.5 times higher than a small holder farmer. However on hectare basis, the net returns realised is only 1.4 times higher. Similarly, in Kapanimbargi village, the total net return realised from crops by large farmer is 65 times higher than smallholder and on hectare basis, it is 14 times higher (Table 7). This disparity is mainly because of two factors. In Markabinahalli, entire cultivated area is under rainfed and farmers do not have any access to irrigation and hence the choice of cropping pattern is a combination of food and commercial crops, while in Kapanimbargi, around 40 per cent of the area is under irrigation and hence majority of the farmers grow high value horticultural crops like grapes under groundwater irrigation. The return to cost ratio for all the crops cultivated by farmers indicates that the ratio is quite significant for large farmers compared to small farmers in Kapanimbargi but not much variation in Markabinahalli, while in Tharati, the cost benefit ratio is very appreciable for most of the crops. This is due to the effect of horticultural crops grown in these two villages, which are more lucrative.

TABLE 5. INCOME FROM CROP, LIVESTOCK AND OFF FARM IN BIJAPUR DISTRICT DURING 2009-11

	Markabinahalli			Kapanimbargi		
Particulars	Large	Medium	Small	Large	Medium	Small
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Area (ha)	9.6	2.2	1.8	8.1	3.3	1.8
Gross income from crop (Rs. / farm)	243611	65261	47117	613323	74776	23735
Total cost of production (Rs. / farm)	153954	44920	35258	255568	50083	18289
Net income from crops (Rs./ farm)	89658	20341	11860	357754	24694	5447
Net income /ha	9339	9245	6588	44167	7483	3026
Return to cost ratio	1.58	1.45	1.34	2.4	1.49	1.3
Gross income from livestock (Rs.)	48715	3377	11892	78028	32311	6334
Total cost of livestock (Rs.)	14418	1223	4245	22421	9852	1992
Net income from livestock (Rs.)	34298	2154	7647	55607	22459	4343
Non-farm income (Rs.)	68321	47970	37431	118823	59512	57564
Total income from crops, livestock and off farm (Rs.)	192277	70464	56937	532184	106664	67353
Average expenditure for food and non-food per household	42862	34686	31085	147955	103134	77282
Net annual income (only crops)	46796	-14345	-19225	209799	-78440	-71835
Net annual income	149415	35778	25852	384229	3530	-9929
Per cent share of income from crops	47	29	21	67	23	8
Per cent share of income from livestock	18	3	13	10	21	6
Per cent share of income from non-farm	36	68	66	22	56	85

TABLE 6. INCOME FROM CROP, LIVESTOCK AND OFF FARM IN TUMKUR DISTRICT DURING 2009-11

Particulars	Belladamadugu			Tharati		
	Large	Medium	Small	Large	Medium	Small
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Area (ha)	2.54	1.16	0.95	1	0.5	0.4
Gross income from crop (Rs./farm)	52955	28447	34055	91449	39687	17754
Total cost of production (Rs./farm)	45566	25596	26052	45908	22493	10482
Net income from crops (Rs./farm)	7389	2851	8003	45541	17194	7272
Net income/ha	2909	2457	8424	45541	34388	18180
Return to cost ratio	1.16	1.11	1.31	1.99	1.76	1.69
Gross income from livestock (Rs.)	28336	25766	39253	29227	16605	24043
Total cost of livestock (Rs.)	17935	12927	15480	11406	6292	7250
Net income from livestock (Rs.)	10401	12839	23773	17821	10313	16793
Non-farm income (Rs.)	55196	38848	59768	78858	52078	64774
Total income from crops, livestock and off farm (Rs.)	67908	54538	91543	142220	79585	88840
Average expenditure for food and non-food per household	78340	52367	57790	82974	55143	46756
Net annual income (only crops)	-76029	-49516	-49787	-37433	-37949	-39484
Net annual income	-10432	2171	33753	59246	24442	42084
Per cent share of income from crops	10	5	9	32	22	8
Per cent share of income from livestock	14	24	26	13	13	19
Per cent share of income from non-farm	76	71	65	55	65	73

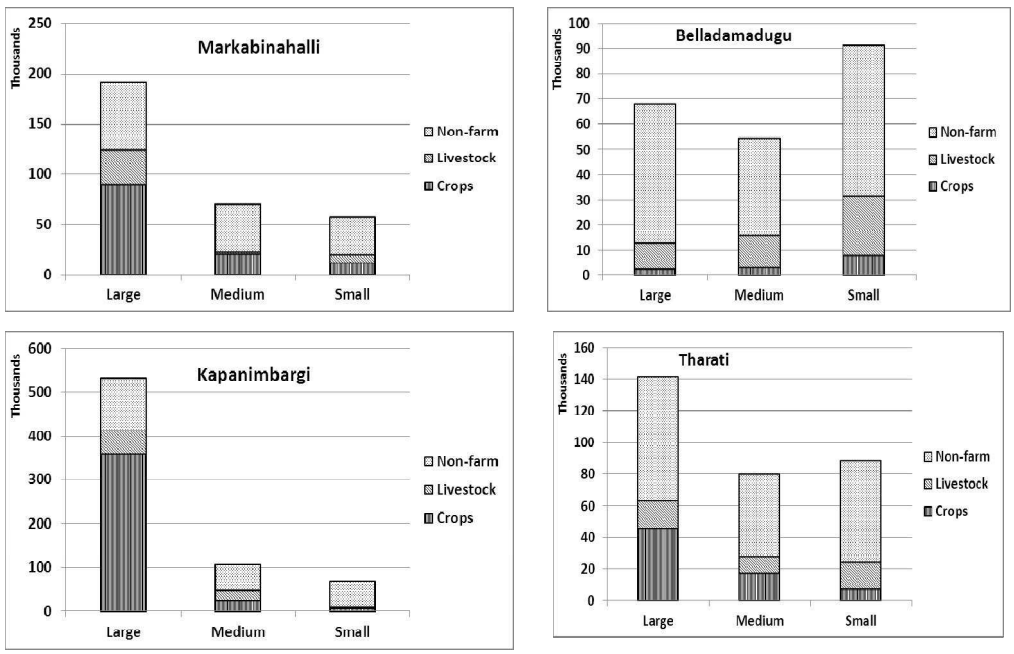

Figure 1: Sources of Household Income in Sample Villages, Karnataka.

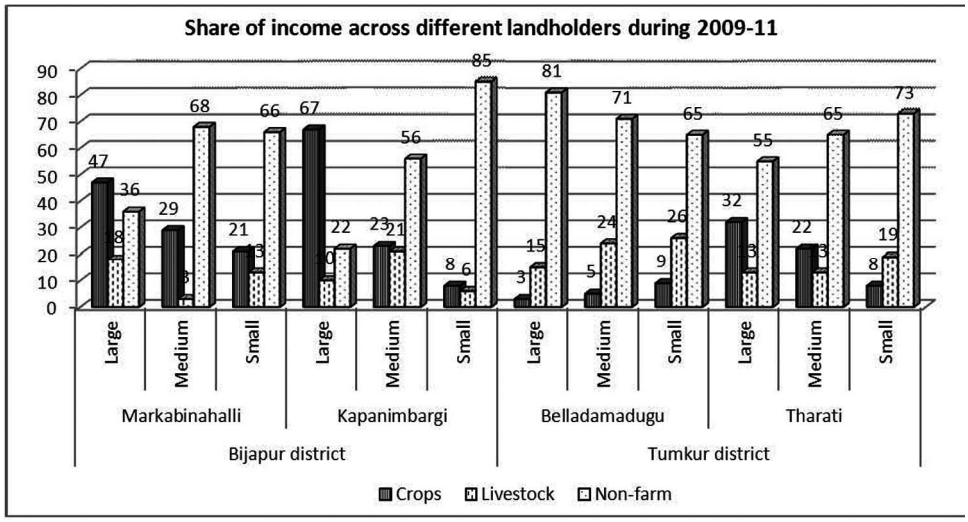

Figure 2. Share of Income across Different Landholders during 2009-11

TABLE 7. COMPARISON OF PER HECTARE RETURNS FOR DIFFERENT FARM SIZE GROUPS

Village	Ratio of Net return of large to small farmer (farm)	Ratio of Net return of large to small farmer (per ha)
(1)	(2)	(3)
Markabinahalli	7.5	1.4
Kapanimbargi	65	14
Belladamadugu	0.9	0.34
Tharati	6.2	2.5

The net income derived from crops per hectare by small farmers is almost 2.8 times higher than medium and large farmers in Belladamadugu, since the proportion of irrigated area of small farmers is much higher (40 per cent) than large farmer (20 per cent). While in Tharati, virtually all the farmers comes under small holders and their income realised is quite high per hectare, as they grow commercial flower crops under irrigation. Studies also indicated that the small farmers increased their income through diversification even under shrinking farm sizes (Hazell and Rahman, 2013). As evident, the income derived from crops/ha by the small holders is inadequate to meet their living. Thus, small farmers relay on diversified sources of income especially nonfarm in Bijapur villages. Hence seasonal migration is evident in Kapanimbargi village. On the contrary, the income derived from crops by small holders in Tumkur villages is quite significant. This is mainly because of intensive cultivation as well as the nature of crops grown.

In terms of total income from all the sources, it is substantially higher in Kapanimbargi when compared to Markabinahalli in Bijapur district for all the groups.

But in case of Tumkur district, total income was higher in Tharati than in Belladamadugu.

It is striking to note that the proportion of non-farm income realised by small farmers is much higher (66 to 85 per cent) in Bijapur villages, while the proportion of non-farm income is quite remarkable across all the groups in Tumkur villages (65 to 73 per cent). The percentage of households depending on non-agricultural activities is relatively more in Tumkur villages compared to Bijapur villages. This is due to; 1) in Tharati, land holdings are extremely small (0.2 to 1.5 ha) hence, many households depend on other non-agricultural activities 2) in Belladamadugu, groundnut based farming system is dominant, but its performance is highly uncertain due to vagaries of nature. Hence majority of the households are involved in non-agricultural activities like brick making, leaf plate making, and petty business. In Tumkur villages, the livestock and milk production are the major sources of income to the households especially in Belladamadugu village. Thus, small farmers are likely to remain unviable if they do not get access to off-farm income (Singh *et al*., 2009) In general, there has been sharp fall in the proportion of income derived from agriculture and rise in the non-farm income derived across all size groups (specifically in medium and small holders), particularly this is more evident with small holders under rainfed situation in Kapanimbargi and Belladamadugu. Considering annual expenditure for both food and non-food per household, net annual income realised from crops indicated negative surplus from medium and small farmers in Bijapur district and all the farmers realised negative surplus in Tumkur district. This result mystifies how the small farmers with less annual income from crops manage their livelihood. Thus it is evident that the agricultural income realised from small holder farmers is inadequate to meet their living and hence diversified sources of income especially non-farm income.

Income from Different Enterprises over the Years for Small Farmers

Income realised from different enterprises for small farmers in both dry and irrigated situations in VDSA villages of Karnataka is indicated in Table 8-10. The disaggregation analysis of dry and dry+irrigated is not analysed for village Markabinahalli from Bijapur district, since it is completely rainfed area. The results indicate that the net income derived from crops is relatively higher in irrigated situations than dry conditions. On an average, net returns realised from crops is negative being Rs. -1135 in dry land as against Rs. 10817 per farm in irrigated area in Kapanimbargi. In Belladamadugu, net returns realised from crops in rainfed situation is very low to the tune of Rs. 128 and Rs. 15316 per farm under irrigated area. In Tharati village, a net return realised under rainfed conditions is Rs. 5558 as against Rs. 8683 under irrigated conditions. This indicates that under dry land situations the farmers realised paltry returns which are less than the minimum wages (Rs.141 per day) prescribed for a decent living. The share of income from non-farm is more than half of the total income in all the villages in dry and irrigated conditions, which is

TABLE 8. INCOME FROM DIFFERENT ENTERPRISES OVER THE YEARS FOR SMALL FARMERS IN KAPANIMBARGI

Particulars	2009	2010	2011	Average
(1)	(2)	(3)	(4)	(5)
	Dry(n=12)			
Area (ha)	1.05	0.88	0.71	0.89
Net income from crops	-5313 (-8)	4453 (6)	-101 (0)	-1135 (-2)
Net income from livestock	8832(13)	7818(11)	5880(11)	7510 (12)
Non-farm income	67063 (95)	61636 (83)	46077 (89)	58259 (90)
Total income	70582	73906	51857	64634
	Dry+irrigated (n=15)			
Area (ha)	1.64	3.27	2.41	2.44
Net income from crops	10785 (21)	10456 (16)	11209 (14)	10817 (16)
Net income from livestock	1168 (2)	2072 (3)	3120 (4)	2120 (3)
Non-farm income	38937 (77)	52560 (81)	67923 (83)	53140 (80)
Total income	50890	65088	82252	66077

Note: Figures in parenthesis indicate per cent of income over total income.

TABLE 9. INCOME FROM DIFFERENT ENTERPRISES OVER THE YEARS FOR SMALL FARMERS IN BELLADAMADUGU

Particulars	2009	2010	2011	Average
(1)	(2)	(3)	(4)	(5)
	Dry (n=13)			
Area (ha)	0.51	0.83	0.91	0.72
Net income from crops	3719 (5)	-179 (-0.2)	-5346 (-5)	128 (0.1)
Net income from livestock	10243 (15)	32079 (33)	18056 (16)	21684 (24)
Non-farm income	55544 (80)	64268 (67)	98777 (89)	68876 (76)
Total income	69506	96168	111487	90688
	Dry+Irrigated (n=14)			
Area (ha)	0.91	1.14	1.35	1.16
Net income from crops	32581 (32)	16077 (14)	3298 (3)	15316 (14)
Net income from livestock	30906 (30)	35304 (30)	44644 (39)	38050 (34)
Non-farm income	38825 (38)	65175 (56)	66133 (58)	58057 (52)
Total income	102312	116556	114074	111423

Note: Figures in parenthesis indicate per cent of income over total income.

TABLE 10. INCOME FROM DIFFERENT ENTERPRISES OVER THE YEARS FOR SMALL FARMERS IN THARATI

Particulars	2009	2010	2011	Average
(1)	(2)	(3)	(4)	(5)
	Dry (n=14)			
Area (ha)	0.26	0.43	0.56	0.39
Net income from crops	2121 (2)	5194(7)	9360(9)	5558(6)
Net income from livestock	16248 (17)	18454(25)	24397(24)	19700(22)
Non-farm income	76220 (81)	50994(68)	66125(66)	64446(72)
Total income	94589	74642	99881	89704
	Dry+irrigated(n=13)			
Area (ha)	0.66	0.33	0.33	0.38
Net income from crops	4017 (6)	14821 (16)	7212 (8)	8683 (10)
Net income from livestock	7403 (12)	13546 (14)	16752 (18)	12567 (15)
Non-farm income	51780 (82)	67005 (70)	69875 (74)	62887 (75)
Total income	63200	95372	93839	84137

Note: Figures in parenthesis indicate per cent of income over total income.

Crops cultivated: wheat, pearl millet, sorghum, maize, ground nut, pigeon pea, chickpea, green gram, cotton etc.

supported by the study by Hazell, 2003. Barring Tharati village, on an average, the total income is higher for farmers with irrigation facility compared to the farmers without irrigation in other two villages. The share of non-farm income of irrigated farmers is slightly less compared to dry farmers. In Belladamadugu village, it is observed that total income is relatively higher for irrigated farmers than dry farmers.

Number of Viable and Non-Viable Farmers with Crop and Livestock Income

The economic viability of farm defined by the surplus income derived from crop enterprises after deducting all costs is provided in the Table 11 and represented in the Figures 3-4. Considering the surplus income over costs from crops alone, all the large and small farmers and 50 per cent of the medium farmers are viable in Markabinahalli, while 50 per cent of the small, 40 per cent of the medium and 75 per cent of the large farmers are viable in Kapanimbargi. Similarly, in Belladamadugu, and Tharati most of the small farmers are viable. It is intriguing to note that even by considering both crop and livestock incomes, around 22-29 per cent of the medium and large farmers in Belladamadugu are not viable, while most of the small farmers are viable with livestock income across all the villages.

TABLE 11. PERCENTAGE OF VIABLE AND NON-VIABLE FARMERS WITH INCOME

Class of holdings	Bijapur district				Tumkur district			
	Markabbinahalli		Kapanimbargi		Belladamadugu		Tharati	
	Viable	Non-viable	Viable	Non-viable	Viable	Non-viable	Viable	Non-viable
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				Crop income				
Large	89658	-	368152	-9474	13000	-10994	45508	-
	(100)		(75)	(25)	(29)	(71)	(100)	
Medium	25341	-4400	40160	-16109	8039	-5092	22285	-5107
	(50)	(50)	(43)	(57)	(33)	(67)	(71)	(29)
Small	11860	-	7404	-1810	13527	-5184	13037	-5538
	(100)		(50)	(50)	(63)	(37)	(87)	(13)
				Crop + Livestock income				
Large	123956	-	413361	-	20379	-8249	63362	-
	(100)		(100)		(71)	(29)	(100)	
Medium	26285	-4192	58686	-10922	18962	-3770	27507	-
	(50)	(50)	(86)	(14)	(78)	(22)	(100)	
Small	19507	-	12261	-2610	31776	-	24065	-
	(100)		(88)	(12)	(100)		(100)	

Note: Figures in parentheses are percentage of farmers.

Specifically for small holder farmers, considering economic surplus generated on the farm all farmers are viable in Markabinahalli, while 50 per cent of small farmers in Kapanimbargi, 63 per cent of small farmers in Belladamadugu and 71 per cent of small farmers in Tharati are viable with crop income per se. When considered both crop and livestock income, barring Kapanimbargi (88 per cent) village 100 per cent of small holder farmers are viable in Markabinahalli, Belladamadugu and Tharati villages.

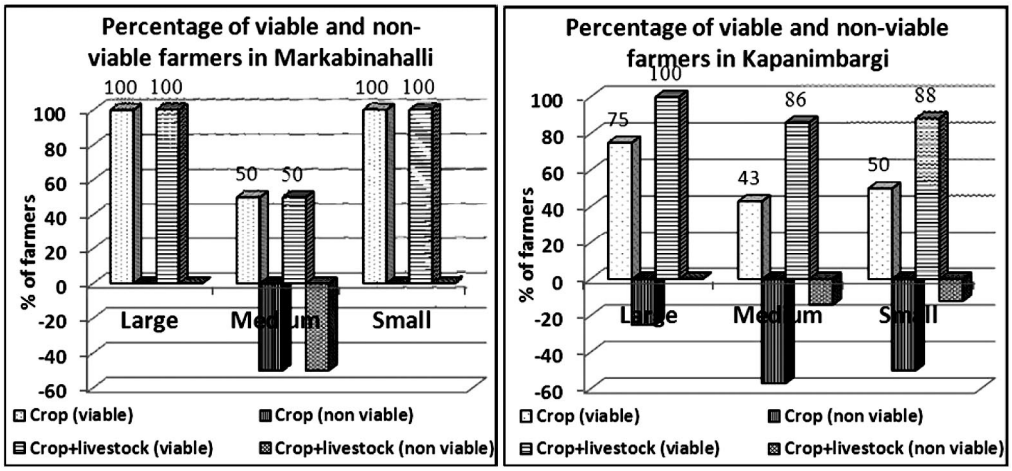

Figure 3. Percentage of Viable and Non-viable Farmers during 2009-11 in Bijapur District

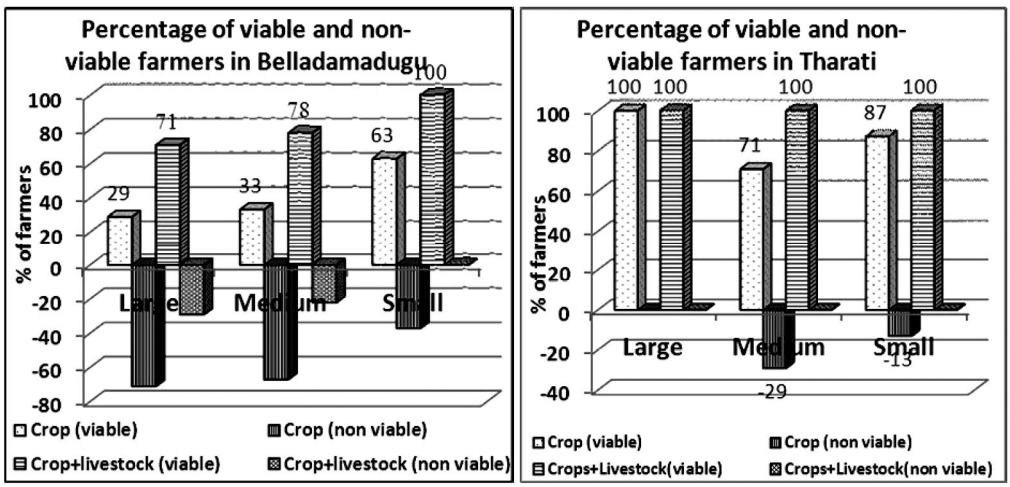

Figure 4. Percentage of Viable and Non-viable Farmers during 2009-11 in Tumkur District

Viability of Small Farmers with Crop Income under Dry and Dry + Irrigated Conditions

Considering average economic surplus generated on the farm for the past 3 years by crops alone in rainfed situation, most of the smallholdings are not economically viable in Kapanimbargi (Rs. -1135) village of Bijapur district, while 50 per cent of

them are not viable in Belladamadugu (Rs. -4900) and 17 per cent them are non-viable in Tharati (Rs. -1504) villages of Tumkur district. However, all the smallholdings are viable in Markabinahalli (Rs. 11860) of Bijapur district, as the rainfed agriculture in this village is characterised by low input use intensity with a combination of food and commercial crops like rabi sorghum, cotton, chickpea, safflower and onion. However, even with access to irrigation, 25 per cent of the small farmers in Kapanimbargi (Rs. -6819), 33 per cent in Belladamadugu (Rs. -3777) are non-viable. However all the smallholders are economically viable in Tharati (Rs. 9647) with access to irrigation, as they are specialised in growing flower crops, areca and betel-nut with emerging water markets (Table 12). Though small holder farmers are viable, but the size of net margin (surplus income) generated per hectare is very meager and virtually not adequate to meet their livelihood, hence, they heavily rely on non-farm income. Unless the crop based productivity and profitability increase substantially, the viability of small holders is threatened.

TABLE 12. VIABILITY OF SMALL FARMERS WITH CROP INCOME UNDER DRY AND DRY+IRRIGATED CONDITIONS

		Dry		Dry + Irrigated	
Region	Particulars	Viable	Non-viable	Viable	Non-viable
(1)	(2)	(3)	(4)	(6)	(7)
Kapanimbargi	Percentage	0	100	75	25
	Income		-1135	17062	-6819
Belladamadugu	Percentage	50	50	67	33
	Income	5028	-4901	19660	-3777
Tharati	Percentage	83	17	100	0
	Income	6584	-1504	9647	

III

CONCLUSIONS

Cropping pattern across different size groups in VDSA villages of Karnataka indicates a combination of food and commercial crops. Most of the small farmers in Bijapur allocated their meager cultivated area towards food crops, while in Tumkur villages small farmers allocated their area for both for food and commercial crops. There has been sharp fall in the proportion of income derived from agriculture and rise in the non-farm income derived across all size groups. In Kapanimbargi village, large and medium farmers derived a significant proportion of income from horticultural enterprises like grapes, while small farmers did not derive any income from horticulture crops, as they are highly capital intensive and need irrigation. Considering average economic surplus generated on the farm for the past 3 years by crops alone in rainfed situation, most of the smallholdings are not economically viable in Kapanimbargi, while 50 per cent of them are not viable in Belladamadugu and 17 per cent them are non-viable in villages of Tumkur district. However, all the smallholdings are viable in Markabinahalli of Bijapur district. However, even with

access to irrigation, 25 per cent of the small farmers in Kapanimbargi and 33 per cent in Belladamadugu are non-viable. However all the smallholders are economically viable in Tharati with access to irrigation, as they are specialised in growing flower crops with emerging water markets. Though some of the small farmers are economically viable in terms of surplus income generated from crops, yet the size of the net margin realised per hectare is very low. Considering annual expenditure for both food and non-food per household, net annual income realised from crops indicated negative surplus from medium and small farmers in Bijapur district and all the farmers realised negative surplus in Tumkur district. Thus the agricultural income realised from small holder farmers is inadequate to meet their living and hence diversified sources of income especially nonfarm income. It is puzzling to note that most of the small holdings are not economically viable under rainfed conditions that constitute around 80 per cent of the total agricultural holdings and mange to live with such paltry income. Overwhelmingly, small farmers live at the margins, and survive through a large range of nonfarm income. Small farmers are likely to remain unviable if they do not get access to off-farm income. In order to enhance the viability of small farms, technology driven options to accelerate productivity, profitability and pro-small farmer value chains are vital for policy intervention. Further, smallholder farmers need appropriate risk mitigation and coping strategies along with social safety net measures. In addition, non-farm diversification needs strong policy support towards infrastructure, transport, storage, credit and market.

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SUKHPAL SINGH*

Understanding the Role and Implications of FDI in Agri-Food Markets from a Value Chain Perspective: Case of Multi-Brand Retail Trade (MBRT) FDI in India

I

INTRODUCTION

In developing countries, food supply chains, especially the perishable produce chains are seen as inefficient in comparison with those in the developed countries. This leads to policy prescription on the improvement needed and role of foreign direct investment (FDI) to deal with the problem of lack of adequate capital in domestic economy and nature of local players which are small and capital deficient (Singh, 2012). In India too, this kind of analysis of fresh fruit and vegetable chains has led to arguments for FDI in retail trade in the last few years. As a result, the Government of India in November 2011 allowed majority (51 per cent) FDI equity stake in Multi-Brand Retail Trade (MBRT) enterprises and up to 100 per cent in single brand retail trade (SBRT) entities. This was protested by different stakeholders in the sector and the government had to withdraw the Union Cabinet decision on MBRT at that time. But, it was reintroduced in late 2012. The issue of FDI in retail trade had been hanging fire for the last 15 years ever since 100 per cent FDI in wholesale cash 'n' carry trade was permitted in January 1997 on a case- by-case basis. After that, the N K Singh Committee on FDI in retail trade in 2002 suggested the ban to be continued, which led to the Tenth Plan dropping the proposed recommendation on FDI in retail trade. Metro- a German supermarket chain was the first one to enter India as cash 'n' carry wholesaler in 2003 with a store in Bangalore. Then, in early 2006, 51 per cent FDI in SBRT was allowed. Since 2007, all the major wholesale cash 'n' carry players like Walmart, Metro and Carrefour have set up shop in India and have multiple outlets ranging from two to as many as 20. Reliance Retail-an Indian corporate, made an entry into wholesale cash 'n' carry sector with a store 'Reliance Market' in Ahmedabad in 2011and now has 32 such stores across India. Global food supermarkets chains have also been present in India in retail through licensing/franchising arrangements like SPAR (global supermarket with more than 12000 stores in 33 countries) had a licensee -Max Hypermarkets of Dubai based Landmark Group with 13 hypermarket stores in India which ended in December, 2012. Trent Hyper market which runs Tata Star Bazaar chain of stores in India entered into a franchise arrangement with Tesco PLC and wholesale supply

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arrangement with its (Tesco's) wholly owned subsidiary in India (Rao and Dhar, 2013). On the other hand, domestic corporate players have been present in supermarket retail since the early 2000s with hundreds of stores each especially in the southern and the northern Indian cities though most have shut shop in the western Indian cities. In food and grocery segment, in 2011-12, the Future group of Kishore Biyani with four different formats (Big Bazaar, Food Bazaar, KB's Fair Price and Food Hall) was the largest player followed by Reliance Retail with three formats-Mart, Super and Fresh (Singh, 2012).Many domestic food supermarkets have scaled back more ambitious and optimistic plans and now welcome rather than resist FDI to help sustain shaky operations with new capital infusions. More importantly, Indian supermarkets chains have made significant inroads in selling fresh fruits and vegetables and fresh produce already makes 10-15 per cent of grocery sales in leading supermarket chains which is a percentage that was achieved in 15-20 years in Mexico and 40 years in the United States. Therefore, the spread of supermarkets in India stands to have potentially significant consequence for agricultural production and livelihoods of small growers (Cohen, 2013).

The conditions for 51 per cent FDI in MBRT include minimum investment of US$ 100 million by each player, 50 per cent of it in backend infrastructure, 30 per cent procurement from micro, small and medium enterprises (MSMEs with investment up to US$ 2 million when set up which was earlier US $ 1 million),), and the government right to procure the farm produce first. The revised policy provides for 50 per cent of the investment in backend infrastructure to be achieved within three years, not one year, where backend includes all except front end units (stores) and includes processing, manufacturing, distribution, quality, design, packaging, logistics, storage, warehousing, agricultural market infrastructure, but not land or its rental. The 30 per cent of procurement of processed/manufactured products from Indian MSMEs includes procurement also from agri/farmer co-operatives now, and over five years on average to begin with and later, annually. This condition also applies to single brand retail FDI players. The fruit and vegetable produce can be sold unbranded. Further, the revised policy has opened up cities with > I million population, or even smaller ones, if state government wants, and those areas up to 10 kms. around the city limits. The FDI players can self-certify the compliance with minimum US$ 100 million investment, 50 per cent investment in backend and 30 per cent procurement from MSMEs conditions.

In this context, it is important to understand the implications of FDI in food retail for various stakeholders as it is being permitted in the name of farmers, supply chain efficiency and employment generation. The three important questions to be asked on the issue of FDI in retail are: does it really help farmers or more importantly small farmers who are 85 per cent of all cultivators in India? Does it improve efficiency of food chains and help lower food inflation which India is grappling with? And how does it impact traditional food retailers' livelihoods? These questions are important to examine as the Ministry of Commerce and Industry placed full-page adverts in all

national newspapers to defend and justify the decision by highlighting the employment, the farmer and the consumer benefits. The advertisement claimed that 10 million more jobs would be created and there would be no significant negative impact on traditional retail sector. It further claimed that the policy has distinct Indian imprint as unlike 100 per cent FDI in some other Asian countries, India only allowed 51 per cent FDI, and, only 53 cities were covered under the provision and every state could follow its own policies and laws on FDI in MBRT (Singh, 2012).

It is argued that FDI in the retail sector can expand markets by reducing transaction and transformation costs of business through adoption of advanced supply chain and reduction of intermediaries and benefit consumers and suppliers, including farmers (Table 1). This is known as 'buying higher' and 'selling lower' in supermarket terminology. This can also result in net gains in employment at the aggregate level. It is also suggested that any technological and organisational changes have disruptive effects – some losers in the short run and larger number of gainers in the long run. As the presence of large retailer increases, government tax revenues will increase which can be used to compensate the losers (Patibandla, 2012).

TABLE 1. SUPPLY CHAIN EFFICIENCY IN MODERN RETAIL VIS-À-VIS TRADITIONAL RETAIL

Link in the chain (1)	Percentage share traditional retail (2)	Percentage share in modern retail (3)	Remarks (4)
Consumer pays	100	94	Benefit to consumer: 6 per cent
Retailer wastage	5	6	1 per cent higher
Retailer margin	22	25	Retail margin higher by 3 per cent
Semi-wholesaler	5	0	No semi-wholesaler
Wholesale wastage	3	5	Higher cost of cold chain/storage
Wholesale commission	8	0	No wholesaler
Transit wastage	5	2	Reduced by 3 per cent
Village consolidation	2	2	no change as consolidation by modern retailer
Post-harvest wastage	8	4	Reduced by 4 per cent
Net to farmer	42	50	8 per cent higher share
Total	100	94	

Source: NABARD, 2011.

There perhaps is nothing more fundamental to human well-being than food and no more dramatic consequence of globalisation than the transformation of the law and economics of food supply (or value) chains (Cohen, 2013, p.20). In this perspective, this paper analyses the role of FDI in MBRT in terms of improving the efficiency of food supply chains in India and its implications for various stakeholders, from a value chain perspective. It uses empirical evidence from the experience of domestic retail supermarkets and wholesale cash 'n' carry supermarkets as well as evidences from other developing countries to examine the role FDI can play. The paper also examines various mechanisms which could be used to leverage the presence of FDI in supermarkets and explores the role of policy and regulation and institutions in promoting the small farmer interest in such value chains. Section 2

provides an analytical framework to assess the supermarket chain impacts and section 3 examines the small producer dimension, section 4 the traditional retail and employment aspect, section 5 the inflation angle- all in the Indian retail context, section 6 assesses some policy and practice mechanisms and section 7 concludes the paper.

II

ROLE AND IMPACTS OF FDI:AN ANALYTICAL FRAMEWORK

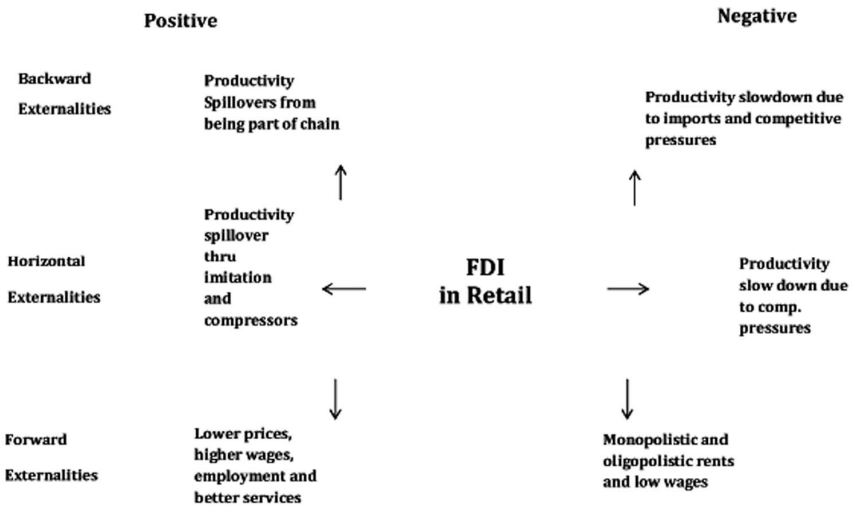
The concept of value chain has many variants such as commodity chain, value system, production network, supply chain, value network, 'complex' and 'filerie' approach which are also, sometimes, used interchangeably. A value system is a set of interlinked complete firms that have all the business functions (Gereffi *et al*., 2001). In fact, a value chain describes the full range of activities, which are required to bring a product or service from conception, through the intermediary phases of production and delivery, to final consumers and final disposal after use. It was only during the 1990s that the commodity chain concept has become widely used mainly because of the writings of Michel Porter, Womack and Jones, and Gereffi. There are three key elements of value chain analysis - barrier to entry and rent, governance, and systemic efficiency (Kaplinsky, 2000). The measurement of value in a chain involves looking at distribution of profits, value added, and price mark ups (Gereffi, *et al*., 2001). One important contribution of value chain analysis is its focus on distribution and marketing which has been traditionally ignored by economics. Further, it helps to look at stages of activity within the chain, which involves costs and which was seen by economists as a costless co-ordination. The analysis in value chain framework helps to identify ways to improve markets, products, and technologies (Wood, 2001). The most important contribution of value chain analysis is that it provides a comprehensive framework for a 'joined-up' series of responses by a number of stakeholders which force analysis into a wider, dynamic, and more strategic consideration of these issues (Kaplinsky, 2000).

Value chain framework addresses the issue of who controls global/national markets and how agents locked into lower value segments can break out of this situation. It is a method of analysing how and for whom such market conduits operate. It is a tool for understanding who benefits how, and how those patterns of benefit distribution can be changed. It has both empirical as well as theoretical focus on markets instead of formal abstract modelling. Secondly, it pays attention to power, its sources, uses, and effects in a socially differentiated environment. It is also an approach to politics and political institution as endogenous to the existence and functioning of markets with attention to differentiated market agents involved in collective action. Finally, regulation, both state and non-state is also an endogenous feature of markets. It insists on an integrated examination of production and circulation of commodities. Therefore, as against other models of global economy,

which focus on trade, this framework gives equal importance to production aspects. Further, it takes into account internal factors, in particular, class relations. It is also independent of center-periphery type of relations and neutral in terms of affiliation to any ideological framework-capitalist or socialist. It points to the possibility of redrawing the chains without recommending any particular model (Rammohan and Sundaresan, 2003). Chain co-ordination reinforces or enhances barriers to entry and allows driving agents to institute measures which reduce costs and risk while increasing the speed and reliability of supply or increasing sales (Gibbon, 2001a). The value chain analysis reveals the nature of insertion in to global value chains that influences the functions that local firms can undertake and the options for upgrading available to local producers and their ability to capture a larger share of value added (Nadvi *et al*., 2004).

Global value chains allow the supermarkets to operate without incurring the high costs and risk of ownership of facilities or franchising, and lower transaction costs but still retaining global access to supplies. The buyers (supermarkets) in these chains dominate and govern quality through production standards (Barrientos and Kritzinger, 2004). Major issues in value chain framework include: how chains are organised and managed; who are the winners and losers in the process; how the benefits can be increased to larger number of players involved in these chains; and how to devise mechanism of regulation that can make upgrading opportunities more socially broad based.

The impacts of supermarkets with FDI can be expected across the value chains in which they operate. It includes effects on the backend and the front end in terms of backward and forward linages or externalities. The linkage impacts- both positive and negative- can be expected when the various other stakeholders are part of the given supermarket value chain which is driven by it as the major partner or player. On the other hand, for those who are not part of the given supermarket's value chain, the impacts can be seen more of externalities, both backward and forward. Whereas positive impacts of externalities include spillovers on the backward side for suppliers due to new technology and management systems, and lower prices, higher employment or better services on the forward side, the negative ones are in the nature of productivity slow down due to competition and import threat due to global sourcing strategies of global supermarket players on the backward side of chain, and monopolistic and oligopolistic rents and low wages on the forward side for employees and workers and higher prices for consumers in such market conditions. Further, there are also horizontal impacts or externalities as the supermarkets also affect existing competition. On the positive side, there is productivity spillover due to imitation and partnerships and competitive pressures for existing domestic players and on the negative side, the existing and new entrants face entry barriers and practices of supermarkets which are predatory (Figure 1).



Source: Durand, 2007

Figure 1. Potential Externalities of FDI in Retail Trade in a Developing Economy

Three major issues of impact of supermarket on local economies include: market concentration and, therefore, producer and consumer interest; downward pressure on producer prices with higher costs and responsibilities; exclusion of small producers and impact on small local retailers. The procurement practices of supermarkets and large processors have a huge impact on farmers and present them with an important challenge. Through their coordinating institutions and mechanisms such as contracts, private standards, sourcing networks and distribution centres, they are reformulating the rules of the game for farmers and first-stage processors (Reardon and Berdegue, 2002). There is also supplier farmer rationalisation due to the larger supplier preference of big retailers (Ghezan *et al*., 2002; Farina *et al*., 2005). Though supermarkets initially offered higher prices to producers than those offered by traditional channels, but farmers incurred extra costs like processing and packaging, marketing, transport, and other transaction costs unlike their counterparts in traditional channels (Cadilhon *et al*., 2006). For a comprehensive review of the practices and impacts of supermarkets across developing world, see Singh (2012) and Singh and Singla (2011).

III

MBRT AND SMALL FARMERS

It is important to recognise that India is not the first country in the world or even the Asian region to permit FDI in MBRT. There is plenty of experience from Latin Amercia, Africa and Asia. Traditional retail density in India is also the highest in the world: 11-15 shops per 1000 population; and the sector employs 40 million people.

Further, the Indian modern retail sector grew by 49 per cent per annum during six years of 2000s. But, it did not evolve as it was more of large business houses/players merging with or taking over smaller chains/supermarkets. Also, the issue of domestic versus foreign retailers is not of ownership, but of size and scale which creates entry barriers and higher cost of entry for new players (Peddi, 2012).

One of the arguments for bringing FDI in MBRT is that it will help reduce wastages in the farm produce sector. Here, it is important to point out that this aspect of wastages is exaggerated as there is no absolute wastage and some wastage in perishable produce is inevitable. For example, one recent working paper on the topic just mentions without any reference to any study or data source that about 40 per cent of vegetables and fruits are destroyed before they come to the market (Patibandla, 2012). It is value loss across the chain as finally all qualities/grades of produce sell in the market at some price. In fact, one of the corporates had planned to use a perishable produce like tomato for different uses i.e. fresh produce sales in supermarkets, fresh produce sales in local markets, and for processing into paste. Further, wastages in major vegetables like potato and onion which account for large proportion of the total vegetable produce is not more than 10 per cent and only 10-12 per cent in cabbage and cauliflower (Singh, 2012).Thus, only 10-20 per cent of vegetable production is lost due to poor post-harvest practices and some of it is inevitable as shown by the experience of domestic supermarkets. Another study of the post-harvest losses (PHL) reports only 6.8 per cent losses in cabbage and 12.5 per cent in tomato and 5.8 per cent and 18 per cent respectively in fruits of sapota and guava. It reports only 6 per cent PHL in wheat and black gram and 2.8 per cent in cottonseed oil and 10 per cent in groundnut (Nanda *et al.*, 2010).Yet, another study reports these post-harvest losses in the F&V chain from farmers to processors to be between 10-25 per cent (Ernest and Young, 2009).

In fruits, the wastage ranged from 14.4 per cent in case of grapes in local markets to 21 per cent in distant markets and 29-35 per cent in mango, banana and pomegranate while only 18 per cent in co-operative channel. 50 per cent of total wastage in mango and grapes in case of local markets was at the field level whereas in banana and pomegranate, 40-50 of the total wastage was in the retail part of the channels irrespective of whether it was wholesale or distant or co-operative channel (Murthy *et al.*, 2009).

But, it is also accepted that supermarkets cannot generate cost savings for consumers simply by upgrading and modernising supply chain. The supermarkets need to figure out how much actual profit does the attempt to reduce wastages cost. So far as the economic value which is lost is concerned, the supermarkets can save as much as 21 per cent of the produce but they may still not make money out of it. The reason for this is that the traditional supply chains are really efficient with small intermediaries rapidly moving goods all over the place and the fresh produce does not come with a brand. Therefore, the supermarkets can't give a perceived value addition

to justify higher retail prices and end up competing with traditional channels (Cohen, 2013).

If the operations of domestic fresh food supermarkets in India and those of the global supermarkets are any indication, they will not make any difference to the producer's share in consumer's rupee as claimed by many proponents of the liberal FDI in MBRT policy, other than lowering the cost of marketing of the producers, as supermarkets have collection centres (CCs) in producing areas, in contrast to the traditional Agricultural Produce Market Committee (APMC) markets (*mandis)*which are in distant cities. The supermarkets procure from 'contact' (not contract) farmers without any commitment to buy regularly as they do not want to share the risk of the growers. They procure only part of the produce from farmers directly and rest from APMC mandis directly or through traders (Table 2).

TABLE 2. CHANNELS OF PROCUREMENT OF MAJOR SUPERMARKET FOOD RETAILERS IN INDIA (PRODUCT CATEGORY WISE PROCUREMENT PER CENT IN TOTAL PROCUREMENT)

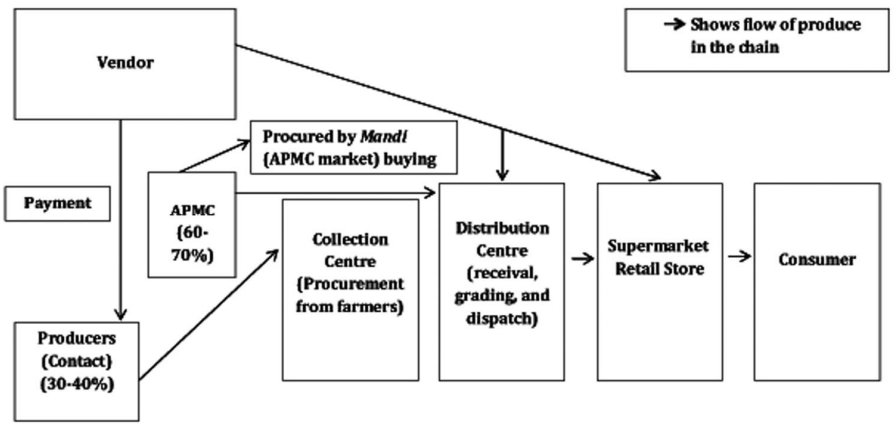
Supermarket chain (1)	Grains (2)	Pulses (3)	Oil (4)	Fresh Fruits (5)	Vegetables (6)
Smart	Processor-90, Appointed agent-10	Processor-80, Appointed agent-20	Processor-90, Trader-10	Appointed agent-30, Trader-70,	Appointed agent-80, Trader-20,
Home store India retail	Consolidator-60; Trader-40	Consolidator-60; Trader-40	Processor- 100	Consolidator-60, Trader-40	Consolidator -70, Trader-30
Namdhari	Trader-100	Trader-100	Trader-100	Trader-70, Own farm-30	Own Farm-70, Contract Farming-15, Trader- 10- 15
Mother dairy (Safal)	Trader-100	Processor-50, Trader-50	Processor-90, Trader-10	Appointed agent-60, Trader-40,	Informal farmer associations-60, Trader-40,
Birla's More	Trader-80 Processor-10, Job work after procuring the raw material from farmers- 10	Trader-60 Processor-20 Job work after procuring the raw material from farmers-20	-	Appointed agent-35, Trader-65,	Appointed agent-35 Trader-65
Star Bazaar	Trader-100	Trader-100	Trader-100	Trader-95, Appointed agent-5	Trader-95, Appointed agent-5
Spencer's	Trader-50 Processor-50	Trader-100	Trader-100	Farmer-70 per cent	Farmer-70 per cent

Source: NABARD, 2011.

Thus, the involvement of supermarket chains with producers in India is low and there is no delivery of supply chain efficiency as many of them have already wound up e.g. in Gujarat. None of them- domestic retail players as well as whole cash 'n' carry players- have made any significant back end investments so far other than setting up small CCs in procurement regions and some distribution centres (DCs) in cities/markets during the last decade. They have mostly focused on opening stores as a drive to capture market share, rather than on supply chain improvements and

operational efficiencies. This may not change with FDI in MBRT, though 50 per cent investments in back end infrastructure is a reasonable condition (Singh, 2012).

The chains offered market price based procurement prices and procured only a limited proportion of the grower's crop without any firm commitment and, more, on a day-to-day basis (Figure 2). They made no provision for any input and did not have any formal contract arrangement. The rejected produce was left for the farmer to dispose of elsewhere as the chains procured only 'A' grade produce (Pritchard *et al.*, 2010) and there was no sharing of any risk –production or market- of the grower suppliers (Sulaiman *et al.*, 2010).



Source: based on Singh and Singla, 2011.

Figure 2. Typical F&V Supply Chain of a Supermarket in India

Further, due to the sheer size and buying power of foreign supermarkets, the producer prices may be depressed. In UK, there was a negative relation between relative market share of a supermarket and price paid to the suppliers in relation to the average price as they procure from wherever it is cheaper and thus in the UK, they procured only 5 per cent of their total food locally (Boycott, 2008). The UK supermarket chain Tesco paid its suppliers 4 per cent below the average price paid by retailers. There have been a large number of supermarket malpractices across the globe which include: payment to be on the supplier list (listing fees); threats of delisting if supplier price is not low enough; payment and discounts from suppliers for promotions/opening of new stores; rebate from producers as a percentage of their supermarket sales; minus margins whereby suppliers are not allowed to supply at prices higher than the competitor price; delayed payments; lowering prices at the last minute when supplier has no alternative; changing quantity/quality standards without notice; just-in-time systems to avoid storage/inventory costs; removing suppliers from list without good reason; charging high interest on credit; using tough contracts, and penalties for failing to supply. Supermarkets also resort to unfair and unethical practices like just in time procurement from suppliers who have to bear the carrying

costs and price and quality risks (Boycott, 2008; Singh, 2012). In fact, supermarkets break so many rules that they have become a target of various stakeholders in agriculture and food like environmentalists, foodies, animal lovers and anyone who cares and is concerned about the plight of the countryside, farmers, and food miles (Boycott, 2008).

There is no assurance that farmers will receive higher prices, as prices are more about bargaining power of the supermarkets and the suppliers (Boycott, 2008) as in the context of the UK supermarkets as stated above, it was found that as the share of major supermarkets in retail sales went up, the producer share in consumer rupee went down (Singh, 2012). Table 3 shows the farmer benefit when domestic supermarkets directly procured from them across Indian states. It is not unrealistic to imagine future global markets in which the sale of food will be controlled by 4 to 5 global firms and the handful of regional and national companies. In India, with 11 to 15 million retail outlets, the traditional retail sector employs an estimated 40 million people and 60 per cent of them sell food (Cohen, 2013). It is also known that problems of Indian farming are not about market risk alone but also production risk and structural factors such as irrigation, technology, credit and so on which MBRT players may not address (Singh, 2012).

TABLE 3. FARMERS NET BENEFIT OF SUPERMARKET PROCUREMENT AND REJECTIONS*

	Net benefit over APMC price (per cent)**			Rejection by modern retailers (per cent)**		
Commodity	Chikballapur (Karnataka)	Kurnool (Andhra Pradesh)	Sultanpur (Uttar Pradesh)	Chikballapur	Kurnool	Sultanpur
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Beetroot	13	-	-	50	-	-
Bitter gourd	14	-	1	40	-	15
Bottle gourd	-	-	6	-	-	15
Brinjal	29	17	10	55	50	15
Capsicum	23	-	1	40	-	20
Carrot	6		3	50	-	15
Cauliflower	14	-	2	60	-	15
Cabbage	-	-	3	-	-	20
Chilly	5	3	-	60	40	-
Cucumber	8	-	-	50	-	-
Onion	31	7	-	45	50	-
Tomato	9	4	-	60	60	-
Okra	-	9	-		50	-

Source: NABARD, 2011

*Rejected produce sold at APMC and/or village or farmers' markets; **As on November 2009.

Further, it is also claimed that there will be export benefit of supermarkets as they would supply to their global markets by buying from India. Citing the case of Wal-Mart in China where it operates 352 stores in 130 cities, it is pointed out that about 20,000 Chinese suppliers provide Wal-Mart with 70 per cent of its global sales and Wal-Mart accounts for 30 per cent of China's export (Patibandla, 2012). But, the important issue to understand is: Why are FDI supermarkets seeking an entry in India-for export or targeting domestic growing market? If there is export logic, then,

why has the policy provided for a mandatory procurement from MSMEs (30 per cent) as part of the FDI conditions? In fact, the Mexican experience shows that FDI in the modern retail sector in Mexico accelerated the transformation of the sector as a whole by reducing the market share, productivity and margins of traditional retailers. Moreover, these modern (transnational) retailers were better connected to global value chains, thus, importing more than their local counterparts. So, the net effect on the local producers was negative. The modern retailing sector was characterised by a low skilled, unstable and weakly unionised labour force. FDI flows in retailing had a negative effect on remuneration since wages in retailing were still far lower than the average wage in the economy (50 per cent). In the context of aggressive competition among the main retailers, attracting skilled labour was less important than reducing costs in order to gain market share by lowering prices. Thus, FDI did not produce positive effects in terms of wages for workers. Significant backward externalities were also observed. Following Wal-Mart's lead, local retailers had reorganised significantly by internalising the distribution of goods within distribution centres, centralising their purchases and pursuing a permanent low prices strategy. Using new informational technologies, buyers had increased their ability to exert governance on value chains. These changes had affected local suppliers negatively, as they lost negotiating power and suffered higher pressures on their margins leading to the asymmetries between local firms; diminishing their capacity to learn and grow. Wal-Mart even became the main contributor to the Mexican commercial deficit. The growing pressure of imports and the increasing governance power of retailers led to the elimination of some local suppliers and a concentration process in supply chains with a risk of immiserising growth for the surviving firms (Durand, 2007).Finally, farmer benefit is not independent of the class question. If these players are going to rope in mostly large and medium farmers, then the issue of exclusion of small into those value chains and networks will remain and the leveraging of FDI presence will not happen as seen in case of contract farming experience in India (Singh, 2012).

In fact, policy makers give right examples of value chains for wrong reasons to defend the FDI policy in the name of farmer benefit. For example, the former chairperson of the Economic Advisory Council to the Prime Minister of India states "The successes of AMUL and Mother Dairy (*fruit and vegetable project in Delhi*) clearly bring out how organised retail can be very beneficial not only to the consumer but also to the farmer. Operation flood pioneered by Dr. Verghese Kurien changed the entire dimension of the dairy sector in India.----Safalis an example of successful organised retail of fruits and vegetables" (Rangarajan, 2012, p. 4). On the other hand, there are other scholars who, based on previous experience, argue: "If what FDI has done to the indigenous dairy industry in Sri Lanka and Bangladesh is any indication, FDI in multi-brand retail may not augur well for Indian agriculture unless there is some way to ensure that the new players source the bulk of their farm products locally" (Shah, 2012, p.31). In fact, the impact of retail liberalisation on agribusiness can be higher than the impact of international trade liberlisation as seen in S-E Asia.

It is surprising that no restrictions on procurement of farm/allied produce were proposed to be put to protect the primary producer or smallholder interest when 85 per cent farmers are small or marginal land operators. In fact, there are not even any incentives to encourage small farmer inclusion. The supermarkets are known to prefer large suppliers of farm produce. Further, there was no provision for formal registered contract farming being mandatory in the decision. After many years of presence of wholesale cash 'n' carry players and that of domestic supermarkets in India, 60-70 per cent of their procurement was still from wholesale markets, not directly from farmers. All these evidences indicate that FDI in MBRT might produce no benefit to small farmers (Singh, 2012).

VI

MBRT, TRADITIONAL RETAIL AND EMPLOYMENT

FDI in the modern retailing sector in Mexico accelerated the transformation of the sector by reducing the market share, productivity, and margins of traditional retailers. FDI flows in retailing had a negative effect on remuneration since wages in retailing were still far lower than the average wage in the economy (Durand, 2007). But, there is paucity of literature on the issue of impact of modern retail on traditional retail unlike the impact on farmers and agriculture in India (Singh and Singla, 2011 and 2012).

In fact, the supermarket expansion leads to a phenomenon of 'retail Darwinism' in which only the fittest survive. Thus, there is employment loss in the value chain. For example, as compared to 18 jobs created by a street vendor, 10 by a traditional retailer and eight by a shop vendor in Vietnam, a supermarket like Big C needed just four persons for the same volume of produce handled. Metro Cash & Carry employed 1.2 workers per tonne of tomatoes sold in Vietnam compared with 2.9 persons employed by traditional wholesale channel for the same quantity sold. The spread of supermarkets led to 14 per cent reduction in the share of 'mom and pop' stores in Thailand within four years of FDI permission (Singh, 2012). In the UK, a superstore led to loss of 276 full time local jobs. Tesco store opening in a town of the UK (Cirencester) led to local food shops share down by 38 per cent, in another town, it was down by 75 per cent and yet another it was lower by 64 per cent,. In Hove, in 2003, local greengrocer lost sales by 30 per cent and the post office lost 25 per cent of its turnover (Boycott, 2008).

India's wholesale and retail trade sector provides employment to 44 million people who are 10 per cent of the workforce and it is the second largest employer of workforce after agriculture. More than half (60 per cent) of this employment is in urban areas. Further, more than one third of the service sector jobs in urban areas are in retail and wholesale trade sector. It is being claimed that 10 million new jobs will be created. But, it is not clear from where these jobs will come. This is similar to the argument made when Pepsi was brought in Punjab in 1989 and it was claimed that

50,000 new jobs will be created by its various projects. But, later, it was found that it was counting potential supplying farmers also in that number!

In India, in Mumbai, 71 per cent of the traditional retailers and all of the F&V retailers reported decline in sales with the emergence of the modern retail. The decline in sales had most frequently impacted larger shops (400-500 sq ft and 300-400 sq ft) and least commonly the size range of 100-200 sq ft. 63 per cent of the retailers felt threatened by malls and 16 per cent felt threatened with closure (Kalhan, 2007). 39 per cent of the fixed F&V sellers and 34 per cent F&V hawkers reported decline in turnover. The annualised closure of the traditional retailers due to the competition from modern chain retailers was the highest in the Western (3.2 per cent), 1.5 per cent each in Northern and Southern regions and the least in the East Indian region (0.4 per cent); the overall in India being 1.7 per cent (Joseph and Soundrarajan, 2009).

Another survey based study reported 78-89 per cent traditional retailers reporting decline in sales, profits and customers across cities in Haryana, Tamil Nadu, Uttar Pradesh, Karnataka and Delhi. They reported 17-29 per cent decline in sales, 16-23 per cent in profits and 13-25 per cent decline in customers and 49 per cent were aware of closure of some traditional outlets (Kalirajan and Singh, 2009).Singh and Singla (2011) also found that with the emergence of modern retail chains, number of footfalls in traditional outlets declined across all locations. The per centage decline in footfalls was the highest in Bangalore (35.5 per cent during week-days and 27 per cent during week-ends), which is one of the most supermarket penetrated cities in India, followed by Ahmedabad (32 per cent during week-days and 26.6 per cent during week-ends) and Chandigarh (17 per cent during week-days and 14.9 per cent during week-ends). Further, number of regular customers visiting the outlets also came down everywhere after the entry of modern retail chains, more so in Ahmedabad (23 per cent) and Bangalore (19 per cent) and only 8 per cent in Chandigarh. In Ahmedabad 60 per cent traditional retailers reported decline in sales compared with only 45 per cent in Bangalore and 33 per cent in Chandigarh. Thus, 46 per cent traditional retailers across cities reported decline in sales due to the presence of retail chain outlets. Bangalore traditional retail sellers reported the largest decline in their turnover (22.5 per cent) and income (31 per cent) followed by Ahmedabad (12.3 per cent and 27.8 per cent respectively) and Chandigarh (9.7 per cent and 19.6 per cent respectively). Further, about 35 per cent of traditional retailers across cities were aware of the push cart vendors/F&V outlets which had gone out of business in their vicinity. Majority of the traditional retailers reported the decline in sales due to presence of the retail chain outlets, though the entire sales decline can't be attributed to the modern retail chains as other factors like reduced household income, high prices, and recession have might also impacted their sales.

The turnover for employee at Wal-Mart is 29 times that of the unorganised sector in India. This will mean foreign players with 10 per cent share of retail market employing 19,000 persons will replace 0.55 million persons in the traditional sector

(Patibandla, 2012).Therefore, it is important to include the potential employment loss in traditional retail sector when calculating the employment benefits from modern retail and net employment effect should be considered in policy decision. Further, as supermarkets use modern technology, not many jobs may be forthcoming from their operations even with 50 per cent investment in back end operations.

Another proposed condition proposed was that FDI in retail would be permitted in all cities with population of more than one million. This will impact a large majority of traditional retailers as they are concentrated in large cities. Another question to be asked is: how many cites in India are really below one million population and for how long? It is reported that there are 53 cities with population of more than one million and they are across the country and account for 42 per cent of urban population in India. Further, given the size of the supermarket retail stores, they may be located in one city but their coverage in terms of potential clientele will extend to neighbouring towns as well. It is reported that just 39 cities have 120 million population which is almost one third of India's urban population (Singh, 2012).

It is accepted by the architects and proponents of the FDI in MBRT policy that 'Once the share of overall modern retail in food reaches about 25-30 per cent, it is bound to affect the *kirana* (grocery) traders first and then the small and marginal traders. These *kirana* stores, street hawkers etc. can also become a part of the modern retail change story if they (a) can be assimilated into organised retail; (b) are upgraded through infusion of capital, better training etc.; and (c) can organise themselves under their banner through franchises etc' (Rangarajan, 2012; p.3). But, it is not recognised that the modern supermarket share has already reached that percentage in cities like Bangalore and Hyderabad, and expected to reach 21 per cent nationally by 2020. Also, each category is important, not total volumes as these traditional small retailers deal with specific products. Further, competition is regional, not national (contrasting examples of Gujarat and Karnataka). Entry of Reliance Fresh led to closure of middle scale grocery stores in south and *kirana* stores and traditional F&V retailers reported 20 per cent decline in sales (Patibandla, 2012).

V

MBRT AND FOOD INFLATION

So far as role of FDI driven food supermarkets in containing food inflation is concerned, the evidences from Latin American (Mexico, Nicaragua, Argentina), African (Kenya, Madagascar) and Asian countries (Thailand, Vietnam, India) show that the supermarket prices for fruits and vegetables and other basic foods were higher than those in traditional markets. In fact, in China, where large global retailers like Walmart, Tesco and Carrefour have hundreds of stores, food inflation has been an issue since 2004 and some local governments have offered subsidy even through the supermarkets, to lessen its effect on consumers. Further, the products which are offered at a lower price by modern retail are less relevant for the poor who buy them

loose in small quantities. Poor can't access supermarkets for reasons of distance, mobility and even higher prices by supermarkets in poor areas. Thus, there is no direct correspondence between modern retail and lower food prices and, thus, better food security of the poor consumers. Therefore, the inflation containment logic for FDI in food retail does not stand ground given the empirical evidence from across the globe. Thus, supermarkets would lead to concentration of market power, with upstream suppliers facing buyer power in terms of lower prices and consumers (buyers) facing higher prices due to lower competition besides traditional retailers suffering a decline in their business (Singh, 2012).

In Mexico, where 80 per cent retail was modern and 5 major players had 80 per cent of all modern retail sales, Walmart was found 10 per cent costlier in same basket of goods compared with regional or local supermarket players and 25 per cent costlier than municipal markets in Mexico (Bales, 2008). Further, the margins of supermarkets whether domestic or foreign are much higher than those of the smaller regional or traditional players (Table 4). When there is supermarket market share concentration, prices paid to suppliers and charged from buyers suffer negatively (Singh, 2012). Finally, price advantage is not above other concerns like livleihoods and employment and competitive markets as Biles puts it in the context of Mexico: "Mexican households may have won the battle for low prices while losing the war to improve their livelihoods" (Biles, 2008, 49).

TABLE 4. CATEGORY WISE MARGINS (PER CENT) OF SUPERMARKETSAND REGIONAL RETAILERS

	Supermarkets									Regional retailers					
Product category	Mother dairy	Home store	Smart retail	Namdhari	Margin free	More	Star bazaar	Food world	Super-market average	Vijaya K super	Apna bazaar	Triveni	Varkeys	C-3	Regional average
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Grains	25	20	13	18	18	10	12	15	15.9	10	10	5	10	20	11.0
Pulses	25	15	13	15	18	10	10	15	14.8	10	10	5	3	20	9.6
Oil	25	5	8	6	20	6	4	9	9.7	4	5	5	15	11	8.0
Fresh fruits	20	12	15	25	30	12	15	18	18.4	-	10	10	15	20	13.8
Vegetables	20	12	15	25	25	10	15	18	17.5	-	10	12	20	20	15.5

Source: NABARD, 2011.

VI

POLICY ISSUES AND MECHANISMS

The biggest fear in India is not that the FDI in MBRT per se is worse than domestic corporate investment in it for farmers or traditional retailers though size/scale will certainly be bigger and, therefore, will have more severe impacts, it is that there may not be adequate institutions and effective governance mechanisms to regulate and monitor the operations of the global retailers to ensure fair prices for farmers and end consumers, as well as generate jobs. If the monitoring of wholesale 'cash n carry' stores so far is anything to go by, there is no regulation and the norms are being flouted openly at the store level by the existing players. Thus, leveraging of

FDI requires effective local institutions to benefit larger sections of the stakeholders in the long run (Singh, 2012).

The so called freedom being given to states on FDI decision is not a good step as it may fragment the market and benefits of FDI will be undermined. This is evident from experience of freedom given to states to amend the Agricultural Produce Market Committee (APMC) Act which has taken 12 years and still there are a few states which have not amended the Act and many others have done it in their own way and this has become a thorny issue in agribusiness policy and practice. Further, given that FDI is an important global issue in terms of WTO negotiations, and involves foreign relations, it is important to treat it as a national, and not a regional issue. So far as protection of traditional retail interest is concerned, if there could be Milk and Milk Products Order (MMPO; which restricted private entry into certain milk sheds created by co-operatives) in the dairy sector to protect dairy co-operatives in India from private and multi-national onslaught in post-1991 deregulation phase of Indian dairy sector, why can't there be protection of traditional retail for some time to give it the breathing space? The example of China is quoted to justify the FDI permission. But, China took over 12 years to liberalise its FDI regime, and in stages. China adopted a policy of caution and 'hurrying slowly'. It first allowed only 26 per cent FDI in retail in 1992, took another 10 years to raise the limit to 49 per cent, and allowed full foreign ownership in 2004, but only in certain cities. It even revoked some previously granted approvals, to reduce the foreign retailers' footprint (Singh, 2012).As a result, today, of top 10 supermarkets in China, 8 are Chinese, and Wal-Mart and Carrefour shares are only 5-6 per cent even after 5 years.

Given the global and the Indian experiences of supermarkets so far, it was important to slow down supermarket expansion by introducing mechanisms such as zoning within cities, business licenses, and trading restrictions. Further, there is need to limit buying power of the supermarkets by strengthening the competition laws like the legal protection given under the Delayed Payments Prevention Law, 1956 to subcontracting industries in Japan in their relations with large firms wherein large procuring firms could not undertake certain forbidden acts like refusal to receive delivery of commissioned goods, delay in payment beyond agreed period, returning delivered goods without good reason, forced price reduction, compulsory purchase of parent firm's good by subcontractor, and discounting payment after prices have been agreed. These provisions are monitored by the Fair Trade Commission and the Small and Medium Enterprise Agency (SMEA). If contract farming is only another name for subcontracting prevalent in industry, then it is only logical to extend such legal provisions with necessary modifications to farming contracts (Singh, 2012).

Also, provisions for legally binding and clearly worded rules for fair treatment of suppliers, and an independent authority like a retail commission to supervise and regulate supermarkets for supplier, consumer, and labour aspects and support to local retailers, are required. This authority should ban buying of products below cost and selling below cost, make contract farming must, improve local traditional markets for

small growers, slow the pace of supermarket expansion, establish multi-stakeholder initiatives in the chains and provide support to small producers and traditional food retailers. Producers' organisations and the NGOs need to monitor and negotiate more equitable contracts with the supermarkets. Government should play an enabling role by legal provisions and institutional mechanisms, like helping farmer co-operatives, producer companies and producer groups, to facilitate smooth functioning of the supermarket linkage and avoid its ill-effects. These entities have a potential to deal with supermarkets on behalf of smallholders whom supermarkets will also find attractive to work with (Singh and Singh, 2014).

Finally, the food markets should be structured in a manner which allows economic actors to generate maximum amount of welfare for consumers and some of the gains are re-distributed via political means to compensate those who found themselves newly unemployed (Cohen, 2013). Further, Cohen quoting Timmer (2009) writes: "In fact, the ultimate impact of supermarkets in developing countries will be on the level and distribution of improved welfare for the consumers…. What happens to other stakeholders like small farmers and traditional retailers will be factors in both the size of the welfare gain and its distribution but also many other factors will come into play" (Cohen, 2013, p.82-83). Finally, as a class question, the interest of consumers who are wealthy and the primary producers and others depending on the existing supply chains who are poor have to be traded off in a manner that the individual consumer interest does not override the responsibility of any society to provide economic security to its population (Cohen, 2013).

VII

CONCLUSIONS

The above experience of food supermarkets in various developing countries shows that the primary producer benefits from such retail linkage are not automatic and farmers or suppliers especially small ones are likely to be left out or not able to sustain the linkage, if appropriate mechanisms like farmer groups or policies to protect them from supermarket practices are not in place. Even traditional retail sector has suffered from the onslaught of supermarkets in various Asian countries and given India's large traditional retail sector which is so crucial for livelihoods of poor, steps outlined above are needed to protect the traditional sector or assist them in competing with the supermarkets. Finally, supermarkets are not about providing cheaper food to the buyers in general and, therefore, the inflation containment logic does not hold water. What is needed is preparedness to leverage the supermarket presence for better smallholder and traditional retail livelihoods in terms of producer institutions, regulation, and well-tailored incentives for inclusiveness.

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Is Farm Profitability Declining in India?: The Case of Sugarcane Crop

I

INTRODUCTION

The major aim of this paper is to find out the real status of profitability in sugarcane cultivation in India and not to suggest increased sugar prices for better remuneration from its cultivation. India has been witnessing an unprecedented unrest among the sugarcane farmers of the major growing areas. There have been instances wherein agricultural labourers went on strikes demanding for enhanced wages and farmers agitating in an organised manner for higher output prices (see, Oommen, 1971; Swamy and Gulati, 1986). However, when the news of the suicide of sugarcane crop growers of Tamil Nadu hit the country's headlines in 2012, the entire farming community was driven to a state of shock. And when a sugarcane farmer in Maharashtra was shot dead in a police firing during the same year, the entire country was clueless as to what is happening in the fields of the country's most viable crop (Narayanamoorthy and Alli, 2013). Compounding to the distressed scenario, the sugarcane farmers of Andhra Pradesh unanimously contemplated to go in for a crop holiday. Although the issue of profitability in crop cultivation has been intensively discussed in the context of agrarian crisis in the recent years (Deshpande, 2002; Government of India, 2007; Narayanamoorthy, 2007; Reddy and Mishra, 2009; Deshpande and Arora, 2010; Mahendra dev and Rao, 2010), this unique and unprecedented incidents are never heard in the history of Indian farming. Why are the sugarcane farmers in these states which are incidentally the major sugarcane growing regions of the country in an unparalleled turmoil? What is wrong with the sugarcane crop which is universally claimed to substantially augment the farmers' income? Under what circumstances were the sugarcane farmers prompted to commit suicide or agitate? Is it due to the perpetual erosion of their income from sugarcane crop cultivation? Could paucity of water and absence of assured irrigation in these water stressed regions be the reason behind such turmoil? In the recent years, these factors have been silently creating turbulences in the Indian farming sector, but the likelihood that any of these factors being pivotal towards the ongoing depressing scenario can be known only by a thorough investigation which is attempted in this study. But before that it becomes pertinent to know as to what is the genesis of this

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abominable scenario? Let us have a look at how the events unfolded before the issue assumed serious propositions.

The sugarcane farmers from the major sugarcane producing states have been relentlessly lamenting that after spending about 40 per cent of their cultivation cost on harvesting, they seldom get adequate returns from the mills. They have been making repeated requests to increase the procurement price for the crop. During the sugar season 2012-13, in the state of Maharashtra which is one of the largest sugarcane growing regions of the country, the sugarcane farmers demanded about Rs. 4,500 per tonne from sugar factories. The latter reportedly resisted to the formers' demands and were ready to buy sugarcane only between Rs. 2,100 and Rs. 2,300 per tonne. In response to such a distressed situation, the Centre came forward with a hike in FRP for the season 2013-14 to the tune of about Rs. 40 per quintal over the last year's price of sugarcane. However, various farmers' organisations expressed their discontentment over such a hike as they stated that the final payments which comes to around Rs. 2100 per tonne is arrived at by deducting the cost of transportation and harvesting, barely enough to cover their cost of cultivation. At the backdrop of this situation, does it eventually mean that the rising cost of cultivation is afflicting these farmers? Is the cost of cultivation of sugarcane rising over a period of years? What is the trend in the cost of cultivation across the major producing states in India? Is sugarcane cultivation not remunerative to the cultivators across different states?

Quite a few studies have analysed the economic aspects of sugarcane cultivation in India using both primary and secondary data. While Dhawan (1968) found that greater irrigation coverage has rendered sugarcane crop remunerative in Uttar Pradesh, Ramasamy and Kumar (2011) have identified increased demand for human labour and high wage rate[1] have escalated the cost of cultivation of sugarcane crop in its major growing areas resulting in negative returns. Utilising farm level data from Maharashtra, Narayanamoorthy (2004) found that sugarcane cultivated under drip method of irrigation was highly profitable as compared to the same crop cultivated under flood method of irrigation. While studying the agricultural growth in the context of technology fatigue, a study based on cost of cultivation data specific to Maharashtra state showed drastic reduction in profitability of sugarcane between 1975-76 and 2001-02 (Narayanamoorthy, 2007). Despite the fact that the pattern of cultivation of sugarcane varies from one state to another, Vishandass and Lukka (2013), by taking the average data of various states from the cost of cultivation survey for the period from 2000-01 to 2010-11 asserted that "Gross returns per hectare as percentage of paid out cost plus family labour, i.e., (A2+FL) was the highest in case of sugarcane" (p.9). Although the sugarcane cultivation has been in intensive discussion for various reasons including its profitability in the recent years, there seem to be not many studies available utilising cost of cultivation data of various states covering longer period with a specific focus on its returns.[2] Cost of cultivation survey data published by the Commission for Agricultural Costs and Prices (CACP) contains rich information on the cost and output on various crops on a

temporal basis, which can throw bright signals on the trends in income and expenditures of crops cultivation over a period (see; Rao, 2001; Sen and Bhatia, 2004).[3] Keeping this in view, an attempt is made in this study to find out the trends in profitability of sugarcane crop cultivated in six different states utilising the cost of cultivation survey data published by the Commission for Agricultural Costs and Prices (CACP) from 1973-74 to 2010-11.

This study is organised into four sections. Following the introductory section, data sources and methodology followed for this study are presented in section two. Utilising the data on cost of cultivation survey, the profitability of sugarcane crop in high, medium and low productivity states are analysed in section three. The last section presents the findings and policy pointers.

II

DATA AND METHODOLOGY

Secondary data covering period from 1950-51 to 2010-11 has been entirely used for carrying out this study. Although the main objective of the study is to find out the profitability of sugarcane crop cultivation, it also studies the overall state of sugarcane crop cultivation in India. The data utilised for this study has been compiled from various government sources. For studying the state of sugarcane cultivation in India, related data has been culled and compiled mainly from publications such as *Agricultural Statistics at a Glance* and the *Area and Production of Principal Crops*, both published by the Ministry of Agriculture (MOA), Government of India and *Handbook of Statistics on Indian Economy*, published by Reserve Bank of India. For studying the profitability of sugarcane crop, all the cost and income related data on sugarcane cultivation has been compiled from the CACP's publication on *Report on Price Policy for Sugarcane* of different years and also from its website. Our major objective of the study is to find out whether the profitability of sugarcane varies with the states having high and low productivity of the crop. Therefore, based on the productivity data of TE 2010-11[4], a total of six states belonging to the category of high area with low productivity (Uttar Pradesh), medium area with high productivity (Maharashtra, Tamil Nadu and Karnataka) and low area with medium productivity (Haryana and Andhra Pradesh) have been considered for studying the aspect of profitability. CACP has been using nine different cost concepts (A1, A2, A2+FL, B1, B2, C1, C2, C2* and C3) for measuring the economics of various crops cultivation. For this study, cost C2 has been considered for computing the profitability of sugarcane as it covers all the variable and fixed costs needed for crop cultivation. In order to study whether the profitability of sugarcane cultivated in different states is increased or not, all the cost and income related data of the crop have been converted into constant prices using CPIAL deflator at 1986-87 prices. Profit level of the crop is computed by deducting the cost C2 from the value of output.

III

TRENDS IN PROFITABILITY IN SUGARCANE

The farmers from the traditionally sugarcane growing states of Maharashtra and Uttar Pradesh have been vehemently demanding for a higher price for the sugarcane crop in the recent years. The sugarcane farmers of Tamil Nadu, Andhra Pradesh and Haryana also followed the suit. For quite some time now, the sugarcane farmers from different parts of the country have also been urging their respective state governments to raise the sugarcane price as suggested by the National Commission on Farmers headed by M.S. Swaminathan, which recommended a price of 50 per cent more than the cost of cultivation (cost C2). Because of such repeated demands of the sugarcane farmers, the government hiked the Fair and Remunerative Price (FRP) from Rs. 170 per quintal in 2012-13 to Rs. 210 per quintal for the sugar year 2013-14. However, it was reported that the sugarcane farmers were not satisfied with such a hike and their agitation saw no respite. Why all of a sudden the country's sugarcane farmers have come about with such demands? Why such a hike in FRP could not contain the agitation of the sugarcane farmers? The sugarcane farmers of these states argued that the steep escalation in the cost of cultivation demands a higher price for the sugarcane crop. Is this claim genuine? Has the sugarcane crop been profitable to the farmers as has been widely believed? Or are profits squeezed similar to their foodgrains counterparts? All these can be examined only by studying as to whether or not the farmers have reaped profits over the years, which forms the central focus of this paper. In order to answer these questions, cost and income related data on sugarcane crop have been used from the cost of cultivation survey published by the CACP covering period from 1973-74 to 2010-11, which are presented in the following sections.

IV

RETURNS FROM SUGARCANE IN HALP STATES

The statistics on cost C2, value of output (VOP) and profit (all at 1986-87 prices) for sugarcane cultivation belonging to HALP state of Uttar Pradesh from 1973-74 to 2010-11 is presented in Table 1. Uttar Pradesh state which accounts for 43.64 per cent of the total area under sugarcane in 2010-11 is by far the largest sugarcane growing state of the country (see, Government of India, 2012a). Uttar Pradesh forms the focus of our study of analysing the profitability of sugarcane crop which is characterised as the largest sugarcane acreage with low crop yield. The state has irrigation coverage of 93 per cent in 2009-10 which eventually indicates the state's discrimination in favour of sugarcane crop in allocating this scarce vital input among crops. Irrigation is one such vital input that can bring about a substantial difference in crop returns, which is also proved by many credible studies. And for a crop such as sugarcane which is an extremely thirsty crop, a greater irrigation coverage enhances

the prospects of a noticeable increase in the net income per hectare. Studies by Rao (1965) and Dhawan (1968) have clearly demonstrated that the largely irrigated sugarcane crop is remunerative in Uttar Pradesh. In our study, by employing an entirely newer data set from CACP, let us now analyse as to whether the sugarcane crop continues to be remunerative to the farmers of Uttar Pradesh or not. The results reveal that the sugarcane farmers of Uttar Pradesh are reaping profits (value of output minus cost C2) from sugarcane cultivation in most time points (period) considered for analysis. Although cost C2 has sharply increased from Rs. 7255/ha in 1973-74 to Rs. 11844/ha in 2010-11, the VOP from sugarcane crop has moved at a relatively faster pace from Rs. 9853/ha to Rs. 17859/ha during this period, outstripping the increase in cost C2. This has enabled the farmers to reap decent profits from sugarcane (see, Table 1). The profits from sugarcane crop cultivation is found to have risen from Rs. 2598/ha in 1973-74 to Rs. 6016/ha in 2010-11. This finding then begs to question as to why then the sugarcane farmers of the state are making noise of not getting adequate profits from the crop? When the data was put to keen observation, it was indeed worrisome to note that the profits realised by the sugarcane farmers of Uttar Pradesh were not consistent throughout the period of analysis. In each of the time periods with although the value of agriculture output is found to have outstripped the cost C2 considerably, yet profits from sugarcane crop fluctuated every alternate year.

TABLE 1. PROFITABILITY IN SUGARCANE CULTIVATION IN HALP STATE, 1973-74 TO 2010-11
(*Rs./ha at 1986-87 prices*)

	High Area with Low Productivity (HALP) state		
	Uttar Pradesh		
Year	Cost C2	VOP	Profit (VOP-C2)
(1)	(2)	(3)	(4)
1973-74	7255	9854	2598
1977-78	5861	7134	1272
1982-83	5301	8679	3378
1987-88	6797	10544	3747
1991-92	6766	9895	3129
1995-96	8843	11565	2722
1999-2000	8982	11936	2954
2004-05	10608	15770	5162
2009-10	10971	24983	14011
2010-11	11844	17859	6016

Sources: Computed using data from CACP (various years).

Notes: VOP – value of output; Due to non-availability of data for some specified years, data from the nearest point is used for the analysis.

The fluctuation in profit was in the nature of a rise in one year and a fall in the following year. For instance, profits from sugarcane during 1991-92 was Rs. 3129/ha but fell to Rs. 2722/ha in 1995-96 and again rose to Rs. 2954/ha during 1999-2000. This depressing inconsistency in profits marks the onset of the ACP (1995-96 to 2010-11). Fluctuation in profit of such a scale does have a serious ramification on farmers' income, because an erosion of cultivators' profit margin every alternate year

almost wipes out whatever profit margins they enjoyed in the previous time period. It can be noted that the fluctuation in profits is more pronounced in the post-1990s than in pre-1990s. Fluctuating cost C2 could be one reason for such a trend. It is observed that from 1991-92 onwards the cost C2 is found to be rising consistently without showing any signs of respite in any of the time periods. The cost C2 which was Rs. 6766/ha in 1991-92 rose unimaginably to Rs. 11844/ha in 2010-11, an increase of Rs. 5111/ha. It is astonishing to note that the profits from sugarcane crop which were hovering between Rs. 2954 – 5160/ha between 1999-2000 and 2004-05, jumped all of a sudden to a record high of Rs. 14011/ha in 2009-10. Have the profits from sugarcane really improved during 2009-10 or is it an inflated bubble? The following year that is, during 2010-11, the profits declined sharply to Rs. 6016/ha, sparking off speculation about the validity of CACP data.[5]

V

RETURNS FROM SUGARCANE IN MAHP STATES

As mentioned earlier, states like Maharashtra, Karnataka and Tamil Nadu are considered as medium area with high productivity states (MAHP) in this study. These states together accounted for 35.04 per cent of total area of sugarcane of which Maharashtra state alone accounted for about 20 per cent of the total area in 2010-11 (see, Government of India, 2012a). The yield from sugarcane crop is found to be higher in each of these three states in spite of allocating a relatively lesser area for sugarcane crop cultivation. Hence studying the profitability of sugarcane crop in states with medium area and high productivity forms our next task. Although caught in the midst of a severe regional hydro-politics, the sugarcane crop in each of these three states has an irrigation coverage of 100 per cent in 2009-10. Albeit the sugarcane crop is not a principal crop in any of these three states, yet a cent per cent irrigation coverage for the crop indicates that the sugarcane crop is given a preferential treatment in the allocation of the scarce water resource in relation to other competing crops. From the point of view of acreage although these states have allocated a lesser area for the sugarcane crop and are far behind Uttar Pradesh, yet the per hectare yield is found to be robust in these states (Government of India, 2012a). If greater irrigation coverage has been a determining factor for the higher yields in these three states, then the obvious question is as to whether higher yields resulted in augmenting the income of these sugarcane farmers?

An impressive picture emerges from Table 2 which illustrates that the sugarcane farmers of Maharashtra are enjoying a positive return over cost C2 in all the time points taken up for the study. However, an intense observation into the profitability trend unravels the genuineness of this impressive picture. The profit over cost C2 is found to have fluctuated devastatingly throughout the period of analysis and more particularly between 1995-96 and 1999-2000 where the profits are observed to be hovering between Rs. 2650/ha and Rs. 1600/ha. The prime cause behind this sharp

fluctuation is the plummeting of VOP from sugarcane crop cultivation from Rs. 17507/ha to Rs. 16906/ha with a steep rise in cost C2 from Rs. 14856/ha to Rs. 15306/ha. The period 2009-10 is subject to astonishing trend. The profit from sugarcane was Rs. 8071/ha during 2004-05 which zoomed to Rs. 16596/ha during 2009-10 and then it declined drastically to Rs. 8678/ha during 2010-11.

TABLE 2. PROFITABILITY IN SUGARCANE CULTIVATION IN MAHP STATES, 1973-74 TO 2010-11

(*Rs./ha at 1986-87 prices*)

	Medium Area with High Productivity States (MAHP)								
	Cost C2			VOP			Profit (VOP-C2)		
Year	MAH	KAR	TN	MAH	KAR	TN	MAH	KAR	TN
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1973-74	13171	DNA	DNA	22752	DNA	DNA	9580	DNA	DNA
1977-78	12142	DNA	DNA	16866	DNA	DNA	4725	DNA	DNA
1982-83	14940	7698	12347	15081	17402	17925	141	9704	5578
1987-88	13296	11014	12004	17757	18673	19410	4461	7659	7406
1991-92	12588	DNA	DNA	15688	DNA	DNA	3100	DNA	DNA
1995-96	14856	14206	13748	17507	27935	26125	2650	13729	12378
1999-2000	15306	14224	21654	16906	22138	29192	1600	7914	7538
2004-05	21095	17461	18270	29166	27318	22836	8071	9857	4566
2009-10	24816	17969	18974	41412	40104	31860	16596	22135	12886
2010-11	22872	15297	20046	31549	30559	33856	8678	15261	13810

Sources: Same as in Table 3.

Notes: MAH – Maharashtra; KAR – Karnataka; TN – Tamil Nadu; VOP – value of output; DNA – data not available; Due to non-availability of data for some specified years, data from the nearest point is used for the analysis.

Further, our in-depth analysis deciphered that Maharashtra is the only state in our study that has recorded negative returns during the agrarian crisis period. Why only the farmers of Maharashtra are found to be incurring continuous negative returns from 2000-01 to 2003-04?[6] The CACP data explicitly reveals that although the cost of cultivation of sugarcane has been rising for all the states during the period of analysis, it is found to have risen at an alarming rate in case of Maharashtra state. It is observed that during the period of continuous negative returns from sugarcane cultivation, the cost C2 has risen by about 25 per cent while the VOP has risen only by merely about 14 per cent. Another plausible reason for the negative returns from sugarcane crop in Maharashtra is the dwindling yield from the crop that was observed during the aforementioned period. Leaving no room for a steady flow of income, an unanimous resentment among the sugarcane cultivators across the state is indeed obvious.

Shifting our focus from Maharashtra, let us now be exploring the costs and profitability trends emerging from the sugarcane fields of Karnataka and Tamil Nadu. Table 2 shows that unlike the Maharashtra's farmers, sugarcane farmers of Karnataka and Tamil Nadu were able to reap relatively higher profits in all the seven time points for which the data was available. What is disappointing to note is that these profits are not at all increasing steadily the over the years (see, Acharya, 1992). The profits from the sugarcane crop are observed to be extremely fluctuating for the farmers of Karnataka when the returns over cost C2 fluctuated between Rs. 13729/ha in 1995-96

to Rs. 7914 in 1999-2000. Similar to Maharashtra state, the period 2009-10 stands out with a spectacular yet surprising rise in profit by Rs. 12278/ha over its preceding time period.

The profits are equally fluctuating for sugarcane farmers of Tamil Nadu where it declined sharply from Rs. 12378/ha in 1995-96 to Rs. 7538/ha in 1999-2000. Although the VOP from sugarcane increased at a faster pace than cost C2, yet a persistent increase in cost eluded the sugarcane farmers of these three states of a steady flow of profits from sugarcane crop. A very crucial issue comes out from this analysis on MAHP states is that the sugarcane farmers of Maharashtra, Karnataka and Tamil Nadu have suffered sharp decline in profits from the crop between 1995-96 and 1999-2000 in spite of a cent percentage coverage of irrigation. This sends out a clear signal that water is a supplementary farm input and not the only farm input that can contribute to enhance farm profit. It also suggests that if escalating price of farm inputs are not contained, then even the complete irrigation coverage will fail to provide the desired profitability to farmers in the future.

VI

RETURNS FROM SUGARCANE IN LAMP STATES

So far in this study we have analysed the profitability trends of states that have a higher and medium productivity of sugarcane. While the results of the profitability analysis till now seem to be not very encouraging, we will now proceed further with our analysis to the states of Haryana and Andhra Pradesh which have been selected as the states having a relatively lower area with medium productivity of sugarcane crop. These two states together account for 5.73 per cent of total area under sugarcane in 2010-11 and possess an irrigation coverage of 92 to 99 per cent (see, Government of India, 2012a). Similar to the high and medium productivity states, a continuous rise in cost C2 resulting in fluctuating profits has scarred the face of the sugarcane economy of Haryana and Andhra Pradesh. Table 3 reveals that the sugarcane crop is profitable to the farmers of Haryana in all eight time points, whereas the farmers from AP have reaped profit in 8 out of 9 time points. However, as was observed in case of the other states that were taken up for study, the profits reaped by the sugarcane farmers of these states also did not move in a definite path. Profits proved to have widely fluctuated to sugarcane farmers of Haryana between 1991-92 and 1999-2000, where it varied from Rs. 6020/ha to Rs. 5397/ha. It is observed that during this period the cost C2 sharply escalated from Rs. 9030/ha in to Rs. 15373/ha.

Fluctuating profits did not spare the sugarcane farmers of Andhra Pradesh too where one notices a marked variation in profits of Rs. 4004/ha in 1995-96 and Rs. 1634/ha in 1999-2000. Although there occurred a marginal slump in cost C2 from Rs. 16367/ha in 1995-96 to Rs. 15501 in 1999-2000, a drastic decline in the VOP from Rs. 20371/ha to Rs. 17135/ha during the same period proved to be pivotal for such damaging profits. A sharp escalation in cost C2 and its detrimental effect on profits during 1995-96 and 1999-2000 forms the basic characteristic of all the six sugarcane

TABLE 3. PROFITABILITY IN SUGARCANE CULTIVATION IN LAMP STATES, 1973-74 TO 2010-11

(*Rs./ha at 1986-87 prices*)

	Low Area with Medium Productivity (LAMP) States					
	Cost C2		VOP		Profit (VOP-C2)	
Year	HAR	AP	HAR	AP	HAR	AP
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1973-74	DNA	DNA	DNA	DNA	DNA	DNA
1977-78	DNA	12825	DNA	12661	DNA	-164
1982-83	5251	12278	8449	13623	3198	1344
1987-88	5805	12849	11315	14636	5510	1787
1991-92	9030	13899	15050	16362	6020	2463
1995-96	12002	16367	17728	20371	5726	4004
1999-2000	15373	15501	20770	17135	5397	1634
2004-05	13990	15490	21382	18531	7391	3041
2009-10	17076	20109	34007	28461	16931	8353
2010-11	15376	22574	22030	29545	6654	6971

Source: Same as in Table 4.

Notes: HAR – Haryana; AP – Andhra Pradesh; others the same as in Table 4.

growing states taken up for study. Surprisingly, the profit realised by the sugarcane farmers has not increased consistently even during 2000s in any of the six states selected for the analysis. It becomes very much evident that the period 1995-96 marks the onset of the ACP when the grave issue of discontentment among the sugarcane farmers across the country began to rear its head. Were the sugarcane farmers across the country with their desperate loud and clear wake-up call trying to hint at this pitiable scenario of inconsistent profits?

VII

NUMBER OF YEARS PROFIT REAPED FROM 1973-74 TO 2010-11

Besides analysing the trends in profitability of sugarcane cultivation, we have looked at how many times (years) sugarcane cultivators are able to reap profit during the entire period of analysis from 1973-74 to 2010-11 in all the six states considered for the analysis. Some studies have pointed out that the profitability of foodgrains and non-foodgrains crops have been witnessing a depressing trend especially from the early 1990s (see, Narayanamoorthy, 2006; 2006a; 2007 and 2013). Therefore, attempt is also made to find out whether any wide difference exists in the profitability of sugarcane before and after 1990-91 among the selected states. As considered earlier, here too the VOP and cost C2 are considered for computing profitability in sugarcane cultivation. Table 4 shows the ratio of VOP to cost C2 for different time periods for high, medium and low productivity states. If the ratio is more than 1.30, it means that the farmers are reaping appreciable profit from sugarcane cultivation and if the ratio lies within the range of <1.30 to >1.00 then farmers are realising moderate profit. If the ratio is less than one, then it means that sugarcane farmers are not reaping profit or possibly the profit is squeezed considerably to the extent incurring losses.

TABLE 4. NUMBER OF YEARS PROFIT REAPED OR LOSS INCURRED BY THE SUGARCANE FARMERS FROM 1973-74 TO 2010-11

State's category	States	Green revolution period (1973-74 to 1990-91) Ratio VOP to C2			Agrarian crisis period (1991-92 to 2010-11) Ratio VOP to C2			Entire period of analysis (1973-74 to 2010-11) Ratio VOP to C2		
		> 1.30	< 1.30	<1.00	> 1.30	< 1.30	<1.00	> 1.30	< 1.30	<1.00
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
HALP	Uttar Pradesh	14/16 (87.50)	2/16 (12.50)	0/16 (0.00)	19/20 (95.00)	1/20 (5.00)	0/20 (0.00)	33/36 (91.66)	3/36 (8.33)	0/36 (0.00)
MAHP	Maharashtra	8/14 (57.14)	6/14 (42.85)	0/14 (0.00)	4/18 (22.22)	8/18 (44.44)	6/18 (33.33)	12/32 (37.50)	14/32 (43.75)	6/32 (18.75)
	Karnataka	9/9 (100.00)	0/9 (0.00)	0/9 (0.00)	16/16 (100.00)	0/16 (0.00)	0/16 (0.00)	25/25 (100.00)	0/25 (0.00)	0/25 (0.00)
	Tamil Nadu	4/4 (100.00)	0/4 (0.00)	0/4 (0.00)	10/14 (71.42)	4/14 (28.57)	0/14 (0.00)	14/18 (77.77)	4/18 (22.22)	0/18 (0.00)
LAMP	Haryana	6/7 (85.71)	1/7 (14.28)	0/7 (0.00)	13/16 (81.25)	3/16 (18.75)	0/16 (0.00)	19/23 (82.60)	4/23 (17.39)	0/23 (0.00)
	Andhra Pradesh	4/11 (36.36)	6/11 (54.54)	1/11 (9.09)	2/16 (12.50)	13/16 (81.25)	1/16 (6.25)	6/27 (22.22)	19/27 (70.37)	2/27 (7.41)

Source: Computed using data from CACP (various years).
Notes: Figures in brackets are percentage to total number of years.

As noted earlier in the profitability analysis, except in Maharashtra, the ratio of VOP to cost C2 is found to be more than one (>1.00) in more number of years in all the other five states including the medium and low productivity states. Of the total 32 years (from 1973-74 to 2010-11)[7] for which we have got data for Maharashtra, farmers were able to reap profit for 26 years (81.25 per cent). That is, of the total 32 years the farmers of Maharashtra have not reaped any appreciable profits in relation to cost C2 in six years (18.75 per cent); this has occurred mainly during the ACP. Such a reduced income is not observed in any of the remaining five states considered for the analysis. Farmers from Uttar Pradesh, which is considered as one of the low productivity states for the analysis, is found to have made profit in all the years taken up for study. For instance, out of 36 years considered for the analysis, the ratio of VOP to cost C2 turned out to be more than one (>1.00) in 36 years for Uttar Pradesh, which is 100 per cent of total number of years. In a similar fashion, the farmers in other states like Tamil Nadu, Karnataka and Haryana have also reaped profit of 100 per cent of time periods considered for the analysis. Has the profitability varied between the green revolution period (1973-74 and 1990-91) and agrarian crisis period (1991-92 to 2010-11)? We had hypothesised that the farmers would have reaped profit less number of years during the agrarian crisis period (ACP) owing to the increased cost of cultivation. However, as per our analysis except the farmers of Maharashtra and Andhra Pradesh, the farmers of all the other states have not suffered any losses in the ACP which is indeed contradictory to the relentless battle being waged by the sugarcane farmers with respect to rising cost of cultivation and dwindling price for their agricultural produce. The fact that needs to be reiterated here is that the ratio of VOP to cost C2 is no doubt expected to give a true picture of the profitability of the crop. But this is not the case in our analysis. This is because

although as per the analysis almost all the states exhibit a ratio that is greater than one, yet as mentioned previously a closer look at the data would reveal that the profits in each year for all the states has in fact fluctuated dramatically. A sharp fluctuation in profit across the study period does explicitly put forth the stark reality that sugarcane farmers across the major growing states are not getting consistent remunerative prices. On the whole, taking last decade data from 2000-01 to 2010-11, the fluctuations apart, there was a trend increase in profitability that shows a steep decline in 2010-11. But this seems to be largely the fudged data for 2009-10! If the spike in profits in 2009-10 is ignored, the trend increase in profits remains, leaving the question as to what explains the growing concern of sugarcane farmers' 'crisis'!

VIII

FINDINGS AND POLICY POINTERS

The study has been undertaken at the backdrop of an obvious query by the country's disgruntled sugarcane farmers as to why to cultivate sugarcane if they are denied a reasonable return for the crop. An analysis was undertaken to cross-check with the data from CACP as to whether the noise from the sugarcane belts of the country is justifiable or not. The ongoing fury among the country's sugarcane farmers is somewhat reflected in our analysis on the profitability. It shows that although the profit has been realised by the farmers across all states taken up for study at constant prices, yet the farmers were struggling to get consistent profits throughout the period of analysis. While the sugarcane farmers are fuming over the non-remunerativeness of the crop, our analysis reveals that the VOP from sugarcane cultivation in almost all the states has increased at much faster rate as compared to cost C2 implying that higher income has helped the farmers in reaping profits from sugarcane cultivation. A deeper analysis on the profitability across the states revealed that the situation is worrisome in the farming horizon of one of the country's leading sugar producing state namely Maharashtra. A scenario of negative returns for consecutive four years viz. from 2000-01 to 2003-04 and a vicious concoction of dwindling yield, soaring farm inputs and incessant drought has compelled the farmers of Maharashtra to echo in a distressed tone as to why should they continue to afford the recurring effects of financial and crop losses. Further, when we analysed as to how many times the sugarcane farmers were able to reap profits during the period of analysis, it was really surprising to see that except Maharashtra and Andhra Pradesh all other states have made profits in all the years taken up for study. More particularly, our analysis vividly shows that the sugarcane farmers of Uttar Pradesh, Karnataka, Tamil Nadu and Haryana have even reaped profits during the ACP. If as per the CACP data all is well with the sugarcane farmers of the major growing states then why should they agitate violently and commit suicide? Why are they intending to observe a Crop Holiday? Does it mean that the data compiled by CACP is deceptive and ambiguous?[8]

Besides, the catastrophe of rising cost of cultivation, an accumulation of sugarcane arrears[9] to the tune of Rs. 5495 crore for the sugar season 2011-12 is hammering the sugarcane farmers' income. Unlike wheat and paddy, sugarcane is an annual crop and farmers wait for a year to get a remunerative price. The one-time payment that they receive for their crop forms the sole source of their livelihood. If arrears to such an extent go on accumulating, the sugarcane farmers have got no option but to go in for alternate crops. Anticipating that this would further affect the fresh plantings in the forthcoming season, the Rangarajan (see, Government of India, 2012b) Committee on the Regulation of Sugar Sector in India proposed a series of recommendations, the vital one being the removal of the sale of sugar under levy quota thereby enabling the mills to pay their dues to farmers on time. While the recent budget proposals found no mention of these recommendations, it was only on April 4, 2013 that the government announced the scrapping of levy system. While the scrapping of the release mechanism is bound to help millers with better cash flows, will the millers give a commensurate share of profits to the sugarcane farmers is a million dollar question? In this context the government should have also approved the profit sharing formula recommended by the Rangarajan Committee. Unhappy with the announcement, various farmers' organisations seem to be skeptical over the millers passing on the gains to them. They continue to lament that instead of providing bailout to millers the government should have passed on the benefit directly to them.

Amidst such a perpetuating conundrum with no signs of respite, what can be done to put the sugarcane farmers back on the track? First and foremost is that more credible field level studies on the profitability of the sugarcane crop need to be undertaken by researchers to cross-check with data of CACP. Amidst the hue and cry over soaring input prices, studies need to be also undertaken towards identifying the basic reasons behind the sharp rise in the cost of cultivation of sugarcane crop in the recent years. Productivity of sugarcane during the last one decade or so has not increased in major growing states, which is one of the reasons for low profitability. Increased productivity of sugarcane can reduce the cost of production that will ultimately help increasing the profitability of sugarcane growers. While field level research studies (see, Narayanamoorthy, 2004; 2005) have proved that drip method of irrigation (DMI) can considerably increase the productivity of sugarcane with reduced cost of cultivation, a spectrum of researchers also feel that by the approach of Sustainable Sugarcane Initiative (SSI) farmers will be able to produce at least 20 per cent more sugarcane while reducing water consumption by 30 per cent and chemical inputs by 25 per cent (see, WWF, 2009). Besides popularising DMI and SSI among the sugarcane farmers, the centre and the respective state agencies need to take concerted efforts on a war footing in devising cost reduction measures so as to increase productivity of sugarcane and farm income.

NOTES

1. The guaranteed employment under MGNREGS has in the recent years come under the scanner. It is primarily accused of causing acute shortage of labour for agriculture especially during the peak and crucial time of harvesting. More particularly it is hurting the cultivation of labour-intensive crops like sugarcane. Ashok Gulati, then Chairman of the Commission for Agricultural Costs and Prices (CACP), pointed out that between 2008 and 2011, labour cost increased by about 74 per cent at the all-India level. In order to lure the labourers to the fields, the farmers are forced to pay double the rates prevailing during the previous seasons.

2. Quite a few studies are available for foodgrains crops especially for paddy and wheat utilising cost of cultivation survey data covering different states and long period of time. Recently, Mahendra Dev and Rao (2010) have brought out an excellent analysis on the returns over cost of cultivation in paddy and wheat utilising temporal data from cost of cultivation survey. Ironically, although sugarcane is an important commercial crop, it has not attracted the attention of the researchers in India.

3. Cost of cultivation survey data is generated through the cost of cultivation scheme controlled by the Directorate of Economics and Statistics, Ministry of Agriculture. It contains detailed information on costs and its components and the income for different crops. This data is collected annually from 9000 farmers covering different regions in India and is used for deciding minimum support prices for different crops. Unfortunately, not many scholars have analysed this rich source of information in the context of agrarian crisis. The importance of cost of cultivation survey data has also been highlighted by Acharya, 1992; Rao, 2001; Sen and Bhatia, 2004 and Mahendra Dev and Rao, 2010.

4. The average area and productivity of sugarcane pertaining to the six selected states for the period TE 2010-11 are presented below for the purpose of readers:

State	Category of State	Area ('000 ha)	Yield (kg/ha)
(1)	(2)	(3)	(4)
Uttar Pradesh	High Area with Low Productivity	2062	56102
Maharashtra	High Area with High Productivity	830	82900
Tamil Nadu	High Area with High Productivity	306	105347
Karnataka	High Area with High Productivity	347	89035
Haryana	Low Area with Medium Productivity	83	66726
Andhra Pradesh	Low Area with Medium Productivity	182	76836

5. The data for the year 2009-10 appears to be fudged. Despite no significant change in productivity of sugarcane, the profitability has jumped in most states we have taken for the analysis. Unfortunately, we have no option except using cost of cultivation survey data for analysing the issue we have addressed in the paper. For quite some time now, the farmers' organisations working in different parts of the country have been arguing that the cost of cultivation survey data of CACP is not reliable and largely underestimated. The problems about the cost of cultivation data have also been underlined in the reports of Farmers' Commission headed by M.S. Swaminathan. Recently, several farmers' organisations in Andhra Pradesh have also reported this problem to the Mohan Kanda Committee, which was appointed to look into the issue of unprecedented crop holiday. For more details on this issue see, GOAP (2011).

6. While a rapid increase in the area under sugarcane is observed in Maharashtra between 1990-91 and 2000-2001 as compared to the period of 2000-01 to 2011-12, its yield and profit are found to be dwindling dramatically from 2000-01 to 2003-04 as per the CACP data. For further clarification for the readers, we have given table below that gives detailed information on yield, cost C2, profit (at current prices) and ratio of profit.

Period	Yield (Quintal/ha)	Cost C2 (Rs/ha in current prices)	Profit (VOP-Cost C2) in Rs/ha in current prices	Ratio of Profit (VOP/Cost C2)
(1)	(2)	(3)	(4)	(5)
2000-01	775	48304	-5568	0.88
2001-02	761	52660	-3078	0.94
2002-03	946	70744	-8550	0.87
2003-04	715	60155	-11148	0.81

7. For this study, we have covered the period from 1973-74 to 2010-11. However, the data on cost and income of sugarcane crop were not available from CACP's publications consistently for all the years for any of the six selected

states. Only for those years where data were available considered for the analysis and therefore, the total number of years (data time points) considered for the analysis is varied considerably from one state to another.

8. The arrears to be paid to the sugarcane farmers by the sugar industry in different states are huge as on 31.05.2012. The details of the sugarcane arrears (in Rs. Crore) extracted from the "*Report of the Committee on the Regulation of Sugar Sector in India – The Way Forward*" are given below:

State	Cane price payable 2011-12	Cane price paid 2011-12	Cane price arrears 2011-12	Cane price arrears 2010-11	Cane price arrears 2009-10 and earlier periods	Total cane price arrears
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Punjab	967.32	870.58	96.74	0	0	96.74
Haryana	1221.06	1074.35	146.71	0	0	146.71
UP	18066.03	14904.5	3161.53	7.30	134.98	3303.81
Uttarakhand	905.46	669.34	236.12	17.97	6.30	260.39
MP	132.77	132.77	0	2.05	11.34	13.39
Gujarat	1586.41	1550.15	36.26	0	13.41	49.67
Maharashtra	13251.39	13080.82	170.57	32.54	17.37	220.48
Bihar	1054.80	956.78	98.02	1.67	31.94	131.63
AP	2366.50	2085.02	281.48	0	33.09	314.57
Karnataka	6257.50	5857.05	400.45	38.77	20.29	459.51
Tamil Nadu	3790.82	3342.77	448.05	0	2.15	450.2
India	4976.51	44636.64	5123.87	100.30	270.87	5495.04

9. It is worth mentioning here that during the so called crisis period, the overall area under sugarcane is on the increase across the states, with the exception of Punjab, Haryana and AP. We see no link between changes in productivity, cost or profitability with the changes in area. The two states, U.P and Maharashtra, which account for a little over 60 per cent of the total area under the crop and which show continued increase in the area, have polar opposite characteristics in terms of costs, yields and returns from this study. The state which shows decline or stagnation in the yield and also very high increase in the costs (Maharashtra) is also the state which shows steepest increase in the area under sugarcane during the last decade. Given that cane price is determined centrally by CACP (with marginal additions at the state level), the returns depend on the cost and yield levels. With more disaggregated data, it would be interesting to focus on Maharashtra and UP to find out the differences in the nature of costs and the factors that would make a difference to productivity.

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Impact of Market Reforms on Agricultural Growth: A Case of Uttar Pradesh

I

INTRODUCTION

An efficient agricultural marketing system plays vital role in stabilising consumer prices, reducing post harvest losses and improving farmer's income. It also optimises resource use, and facilitates growth of agro-based industry and enhancing value addition. The essential component of improving marketing efficiency is linking the farm gate with retail outlets. In India the marketing system is also changing from traditional retail to modern organised retail. The essential difference between traditional retail and modern organised retail is that in traditional retail, marketing passes through a number of intermediaries, whereas direct procurement or procurement through big procurement agencies is the practice followed by modern organised retail. The success of modern organised retail in agricultural sector depends on strong forward and backward linkages. The high food inflation during the recent year has both supply and demand side explanations and it calls for increased production and also investments in post-harvest marketing, and management of food commodities to reduce losses and improve efficiency of supply chains through favorable policies. Supply chain management is more important in the sector of agribusiness because most of the agricultural products are perishable and have a very short shelf life.

Agriculture being state subject, federal government only suggests state government on various policy issues and state government has to implement the policies/reforms in agricultural sector. Agricultural marketing in the country was regulated under government control, which continued after independence also. Realising the imperfection in agricultural marketing system, Government of India circulated a Mandi Model 2003 to all states with suggestion to amend APMC Act in line with the Mandi Model Act. The proposed Model 2003 proposed, direct purchase of agricultural produce from producers, Public Private Partnership in management and development of agricultural markets, Consumer/farmer market (Direct sale by the producer), Contract farming, unified license, establishment of specialised markets and single point levy of market fee etc. Marketing of agricultural produce in the state is regulated under Agricultural Produce Market Committee (APMC) Act 1964.

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Government of Uttar Pradesh has not amended its APMC Act in line with the Model Act 2003. Therefore it becomes necessary to examine the policy changes and perceptions of farmers, traders regarding present marketing system of agricultural produce, so that the necessary policy reforms can be brought out to improve the competitiveness in the market which is required for efficient functioning of modern organised retail. Keeping in view the above conditions, this study was undertaken with following major objectives:

Objectives

(i) To review the changes in APMC policy of the state since its inception and market access in the state,
(ii) To examine the growth in arrival and revenue of APMC,
(iii) To analyse the growth in corporate investment in agriculture and agricultural growth,
(iv) To study farmers' perception regarding present marketing system and consumer's perceptions regarding modern retail outlet,
(v) To examine the market infrastructure across different markets in U.P.

II

METHODOLOGY

Sampling Design, Data Sources & Period

There are 29 states in India and Uttar Pradesh being the largest agrarian state of the country was selected purposively.

To examine the farmer's perception, primary data was collected from randomly selected 70 farmers and 20 consumers from Varanasi and Azamgarh district of Uttar Pradesh. Secondary data on total arrival of agricultural commodities in APMC market and revenue of Mandi Board Uttar Pradesh was collected from State Marketing Board for 40 years period i.e. 1972-2012. Data was divided into two time periods, pre liberalisation period (1972-1991) and post liberalisation period (1992-2012).

The data related to infrastructure was collected from six primary markets and 12 secondary markets. Two primary markets, viz., Varanasi and Azamgarh from eastern Uttar Pradesh and two from western zone, viz., Agra and Bareilly, Jhansi from bundelkhand, Kanpur from central zone along with two secondary markets from the area of each selected primary markets were selected randomly.

Analytical Tools

The exponential function ($Y = ab^t$) was used to examine the growth in arrival and revenue of Mandi Board. Where Y = dependent variable (it may be arrival or revenue), t = independent variable (it is a rank given to the year concerned. Ranking

of year was done in ascending order), a = functional coefficient used in exponential function, and b = compounding coefficient.

To find out the infrastructure index, the infrastructure was categorised into following three categories and the related data was collected from concerned mandi offices : trade related infrastructure: common covered auction halls, common open auction platforms, common drying yards, weighing equipments, grading equipments, rate display boards. Infrastructure for storage and processing: warehouses, cold storage, processing units, storage godowns, support infrastructure**,** farmers rest rooms, canteen/tea shops, common utility (washrooms etc), water supply, parking facilities, banks, post office, police and security posts.

Infrastructure development index was computed as a weighted average of various components of infrastructure services where the weights vary inversely to the variation of the components.

$$Yij = \frac{Xij - Min\ j\ Xij}{Max\ j\ Xij - Min\ j\ Xij}$$

where, Yij is the standardised value of a marketing infrastructure indicator. X_{ij} represent the value of the i-th infrastructure development indicator in j-th mandi.

$$Y_j = W_1Y_{1j} + W_2Y_{2j} + \ldots. + W_mY_{mj}$$

where the weights W_i vary inversely as the variation in the respective indicator of the infrastructure services:

$$0 < W_i < 1 \text{ and } W_1 + W_2 + W_3 + \ldots + W_m = 1$$

$$Wi = \frac{K}{\sqrt{Variance}\ Yi}$$

$$K = \left[\sum \frac{1}{\sqrt{Variance} Yj}\right]^{-1}$$

III

RESULTS AND DISCUSSION

Review of APMC Policy of the State:

Marketing of farm produce is governed by Agriculture Produce Market Committee Act (APMC) 1964. As per this policy, no bulk purchaser can purchase farm produce in bulk directly from producer. The producers have to bring their produce in APMC mandi, where the buying and selling between farmers and

registered traders is done through commission agent. In this exchange process, government collects mandi fee, which is a source of revenue.

Realising the required changes in agricultural marketing policies, in the era of Liberalisation, Privatisation and Globalisation (LPG), the Government of India circulated a Mandi Model 2003 to all states with suggestion to amend APMC Act in line with the Mandi Model Act. The proposed Model 2003 includes, direct purchase of agricultural produce from producers, Public Private Partnership in management and development of agricultural markets, Consumer/farmer market (Direct sale by the producer), Contract farming, unified license, establishment of specialised markets and single point levy of market fee etc. Government of Uttar Pradesh has not amended its APMC Act in line with the Model Act 2003. A critical review of all provisions of existing APMC Act 1964 indicated that no visible modification in the policy has been made during last 50 years in order to exploit the opportunities of trade liberalisation. Only selected two/three bulk purchasers have been permitted to procure wheat and rice directly from farmers. There are modern organised food retail format like Big Bazar, Spencers, Vishal Mega Mart, etc., operating in the state, but they are not permitted fruits and vegetables directly from farmers (Mishra 2012). Therefore, they are not able to reduce the number of intermediaries in the new system rather, the number of intermediaries have increased in the system.

It is evident from Table 1 that on an average one market caters the need of more than 42000 farmers and the geographical area covered by each market is more 400 sq kilometer. It increases the marketing costs of farmers, who are forced to sell their produce in the APMC market only. Producers in the state have no access to alternative marketing channels, which has given a scope to the emergence of large number of intermediaries and pre harvest contractors of the farm output.

TABLE 1. COMPOUND ANNUAL GROWTH RATE (PER CENT) OF ARRIVAL AND REVENUE DURING 1985-2012

Period	Arrival	Revenue
(1)	(2)	(3)
1985-1999	2.81	15.58
2000-2013	4.74	12.16
1972-1991	9.40	16.30
1992-2012	3.84	10.70

Source: Compiled and calculated from Data of Mandi Board Uttar Pradesh.

It is concluded that presently the market is functioning under imperfect condition which is not capable to improve efficiency of agricultural marketing system in the state.

Growth in Arrival of Agricultural Commodities and Revenue of Mandi Board of Uttar Pradesh India

Analysis of 40 years data (1972-2012), which was divided into two phases is presented through figure 1 to 4. It is revealed from Figure 1 and 3 that the Compound

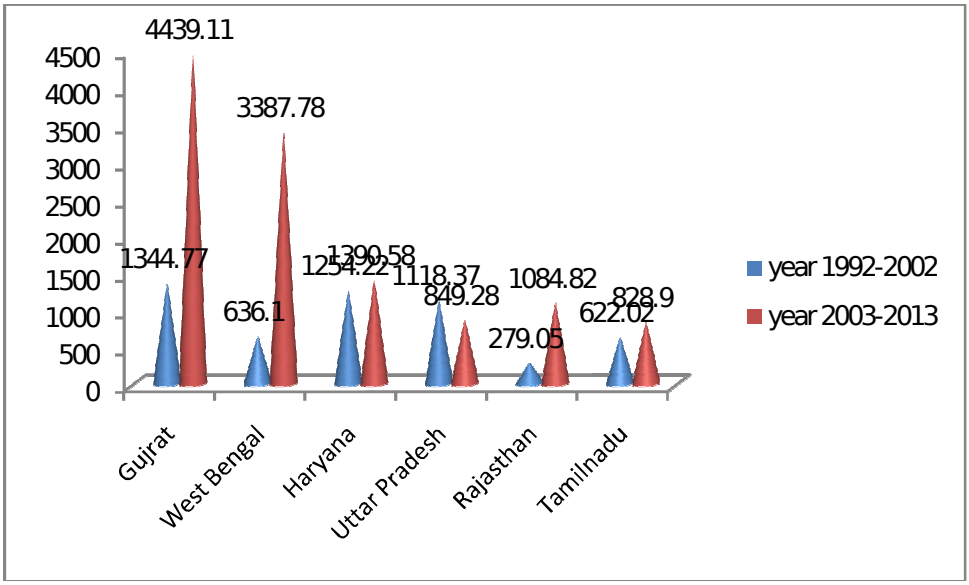
Annual Growth Rate (CAGR) of total arrival of agricultural commodities in all APMC markets of state was lower (3.84 per cent) during the era of liberalisation as compared to pre liberalisation era when CAGR was found to be 9.41 per cent. It may be because the small and marginal farmers prefered to sell village bania rather than going to APMC market located far away from the production area. The markeatable surplus during the period of post liberalisation was higher than the preliberalisation period. It was well reflected in the growth of revenue realised by Mandi Board Uttar Pradesh. The CAGR of total revenue was also found lower (10.72 per cent) during post liberalisation period as compared to 16.30 per cent CAGR during pre liberaliastion period. Since the agricultural marketing policies in the state were not amended during post liberalisation period, thereore it created an scope of the emergence of illegal trade by unregistered traders out of notified area of Mandi Board resulting increase in the number of intermediaries in the supply chain. Even sometimes farmers do not get minimum support price announced by government. A nexus of local traders with farmers have been developed and traders fulfill the credit needs of farmers resulting farmers sell their output to traders at lower and unremunerative price.

Therefore, it was concluded that the restrictive policy does not lead the growth of mandi board revenue and arrival.

Private Corporate Investment in Agriculture and Agricultural Growth in Uttar Pradesh

With a view to attract corporate investment and imrove competetivness in the market, Government of India has permitted FDI in retail sector and is planning to set up a National Agricultural Market. The growth in employment and income is directly related to investment (public or private). In this study the corporate investment in agricultural sector was analysed for two time period and it was found that the coporate invetsment in agriculture has declined during 2003-2013 as comapred to 1992-2002. It is evident from Figure 1 that corporate investment in agriculture has increased in states like Gujarat, Rajsthan, Tamil Nadu, West Bengal and Haryana where policies have been liberalised. It was also found that investment made by corporates in Uttar Pradesh are mainly consentrated towards the field of dairy and vegetable oils only. Investment by corporate sector is adversely affected by government policies and other environment. In 2007 Relaince retail a major corporate player moved from the this state because of restrictive practices adopted under APMC Act, which did not allow any bulk purchaser to procure agricultural commodities directly from producers. It had negative impact on corporate investment (Singh *et al*., 2009).

Uttar Pradesh, with an area of 2,40,928 sq. kilometer is the fifth largest state in India and occupies 7.3 per cent of the total area of the country. The state ranks first in the country with a population of 199.5 million and population density of 828 per sq.



Source: Calculated from data of Udyog Bandhu (Ministry of Industry Uttar Pradesh).

Figure 1: Corporate Investment in Agricultural Sector During 1992-2013

kilometer. The state is divided into 75 administrative districts under 18 divisions which are broadly classified into four economic regions, viz., the Eastern, Western, Central and Bundelkhand regions. There are 216.68 lakh operational holdings in the state of which, proportion of small and marginal farmers are 14.5 and 76.9 per cent. The average size of operational holdings is only 0.75 ha which is lower than the country's average of 1.16 ha. The economy of the state is predominantly agrarian with 77.7 per cent of population living in rural areas, mainly dependent on agriculture for their livelihood. The state is a large contributor to the food basket of the country has an economy characterised by low productivity, high incidence of poverty and wide gap between the state and national per capita income.

As evident from Table 2 that economy of Uttar Pradesh, India is agrarian based where more than 23 per cent of Gross State Domestic Product (GSDP) comes from primary sector. The average annual growth rate (AAGR) of agricultural GSDP in the state during 2000-2011 is only 2.1 as compared to national average of 3.2 per cent. It may be concluded that growth of agricultural sector has been affected adversely because of low investmnet in this sector.

Farmer's, Consumer's and Modern Retailer's Perception

Farmers are the main stakeholders of any agricultural marketing systems and we documented the perceptions of farmers on various issues which are summarised in Table 4. Majority of farmers (92 per cent) were found highly dissatisfied with the present marketing sysyetm. More than 96 per cent farmers claimed that the prcatices

TABLE 2. MARKET ACCESS IN UTTAR PRADESH, INDIA

Indicators	Numbers
(1)	(2)
No. of farmers per primary Mandi	91716
No. of farmers per secondary Mandi	77726
No. of farmers per total Mandi	42072
Area (ha) covered by one primary Mandi	96682
Area (ha) covered by one secondary Mandi	81934
Area (ha) covered per Mandi	44350
Coverage of geographical area (sq. km)/primary Mandi	964
Coverage of geographical area (sq. km)/ secondary Mandi	817
Coverage of geographical area (sq. km) Mandi	442

TABLE 3. GROWTH OF AGRICULTURAL SECTOR (2000-2011)

State	AAGR of agriculture GSDP	Share of agriculture in overall GSDP
(1)	(2)	(3)
Maharashtra	5.0	8.5
Haryana	3.4	16.7
Gujarat	9.6	12.7
Andhra Pradesh	4.7	20.8
Karnataka	3.1	16.6
Chhattisgarh	9.0	19.2
Rajasthan	9.9	22.7
Odisha	4.7	17.6
Jharkhand	6.8	15.1
Madhya Pradesh	6.6	22.6
Uttar Pradesh	2.1	23.0
Bihar	2.5	26.6
All India	3.2	14.5

Source: www.agricoop.nic.in.

TABLE 4. FARMER'S PERCEPTION REGARDING MARKETING SYSTEM (N=70)

Particulars	Highly satisfied	Satisfied	Highly dissatisfied	Undecided
(1)	(2)	(3)	(4)	(5)
Marketing procedure and mechanism	0	8	92	0
Weighing of produce (weighing system)	2	98	0	0
Auction platform	10	90	0	0
Cleaning and grading mechanism	0	4	78	18
Marketing fee	0	98	2	0
Behaviour of market officials	0	0	68	32
Availability of storage and godowns	0	36	38	26
Cold storage/ware houses	0	40	36	24
Marketing Mgmt during rainy season	0	94	6	0
Payment mechanism	0	86	14	0
Transparency regarding prices	0	2	98	0
Exploitative practices by traders, if any	0	4	96	0
Boarding/lodging	0	18	64	18
Cleanness in the market	0	0	86	14
Market information sharing among the farmers	0	20	72	8

Source: Authors' own calculation based on surveyed data.

followed by trader under present marketing system wrere exploitative and prices were not transperent. They were found satisfied with the payment system, weighing mechanisms, auction platform and the prevailing market fee (2.5 per cent of the value of the produce borne by traders).

One of the leading food retail 'Spencer' has its outlet in the study area without backward linkages with farmers (not permitted in the state) and have a good number of consumers. The establishment of backward linkages with farmers has a capacity to improve the economic condition of small and marginal farmers in India (Mangla and Chengappa 2008). Consumers, which are second important stakeholders of agricultural marketing system were interviewed for their perception about modern organised retail outlets and the results are summarised in Table 5. It is evident from Table 5 that consumers were most influenced to reasons like proximity (90 per cent), good services rendered by modern retail outlet (85 per cent), visual merchandising and store design (85 per cent), quality of produce (80 per cent) and reasonable price (70 per cent).

TABLE 5. CONSUMER'S PERCEPTION REGARDING MODERN ORGANISED RETAIL

		Modern (n=20)	
S. No.	Reasons	Total number of consumers	Percentage to total number of Consumers
(1)	(2)	(3)	(4)
1.	Timely availability	16	80
2.	Proximity	18	90
3.	Quality of produce	16	80
4.	Timing	8	40
5.	Common phobia to enter multinational stores		
6.	Visual merchandising and store design	17	85
7.	Promoted by promotional tools	10	50
8.	Advertisement	6	30
9.	Wide range of products are available	11	55
10.	Reasonable Price	14	70
11.	Discount price	2	10
12.	Good services rendered by the outlets	17	85
13.	Better packed Vegetables which are very good	12	60
14.	Better suited time	4	20

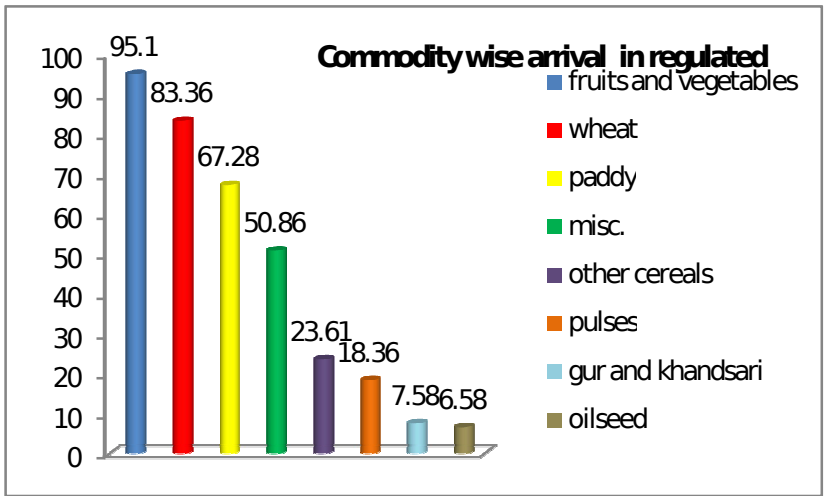
Source: Authors' own calculation based on surveyed data.

Therefore, it was concluded that the farmers were highly dissatisfied with the present agricultural marketing system and consumers prefererence towards modern retail outlets are high.

Availability of Major Market Infrastructure and Market Infrastructure Index in APMC Markets, Uttar Pradesh

Fruits and vegetables are among the major agricultural commodities traded in regulated mandi (Figure 2). Post harvest losses are between 30- 40 per cent in fruits and vegetables (Murthy *et al*., 2004 and Patnaik 2011). Being perishable in nature, fruits and vegetables require specialised infrastructure. However, no cold storage was found in any regulated mandi, where unsold fruits and vegetables can be stored. Prices of agricultural commoditeis were also not displyed on the board. State needs an addional storage capacity of more than 8 million tonnes to reduce the post harvest

losses. These godowns should be established in rural area, which will reduce the trnsportation cost and post harvest losses.



Source: Report of Mandi Board Uttar Pradesh 2013.

Figure 2: Commodity Wise Arrival in Regulated Mandies (2012-13).

It is evident from the Table 6 that Varanasi primary market possesed highest trade and support infrasructure followed by Agra and Kanpur. However in storage infrastrucure index is highest in Bareily followed by Agra. It aws found that the all secondary markets are very weak in all kind of infrasrutures, viz., trade, storage and support.

TABLE 6. MARKET INFRASTRUCURE INDEX IN APMC MARKETS, UTTAR PRADESH

Name of Market (1)	Trade (2)	Storage and Processing (3)	Support (4)
Kanpur*	0.55	0.24	0.50
Kidwainagar**	0.34	0.07	0.50
Uttaripura**	0.33	0.14	0.48
Varanasi*	0.80	0.33	0.95
Adalpura**	0.16	0.04	0.36
Danganj**	0.25	0.04	0.41
Azamgarh*	0.51	0.31	0.54
Lalganj**	0.18	0.05	0.18
Atrauliya**	0.16	0.05	0.32
Jhansi*	0.45	0.15	0.34
Chirgaon**	0.11	0.05	0.18
Ranipur**	0.25	0.03	0.26
Agra*	0.71	0.36	0.24
Irdatnagar**	0.25	0.16	0.40
Kagraul**	0.12	0.08	0.25
Bareilly*	0.40	0.48	0.70
Faridpur**	0.13	0.17	0.18
Nawabganj**	0.14	0.11	0.33

Source: Authors' own calculation

*Represents Regional Primary Mandi (RPM), **Represents Regional Secondary Mandi (RSM).

It is suggested to improve infrasructure in all secondary markets so that post harvest losses can be minimised and efficiency can be improved.

IV

SUGESSTION

On the basis of the findigs of this study it is suggested that the state government should ammend its APMC Act in order to improve the competeivness in the market, attract corporate investment in agriculture. The establishment of backward linkages through policy changes will facilitate the functioning of modern reatil system which will finally satisfy the producers as well as consumers.

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SACHIN KUMAR SHARMA*

WTO and Domestic Support under USA Farm Act 2014: Implications for Developing Countries

I

INTRODUCTION

Agriculture subsidies in developed countries have been a major stumbling block in Doha Round negotiations. Developed countries are providing huge subsidies to agriculture sector and thereby create distortions in the international market. Some of the developed countries are enjoying comparative advantage due to large amount of subsidies and thus, adversely affecting the welfare of millions of farmers in developing countries like India. Among the developed countries, USA is one of the prominent providers of trade distorting support to agriculture sector. Agricultural support in USA led to fall in international prices of agricultural commodities. USA is giving huge support to farmers under various programmes which are governed by USA Farm Act. The agricultural and food policy in USA is governed under a multi-year farm Act. The Farm Act 2008 governed policy for various aspects of agriculture sector like farm commodity support, nutrition assistance, trade and international food aid, agricultural research, farm credit, rural development, bio energy, and forestry etc., which was scheduled to expire in 2012. After three years of discussions and deliberations, Farm Act 2014 was enacted. The 2008 Farm Act has cost $284 billion over five years. The Farm Act 2014 is projected to cost $956 billion over next 10 years (Chite, 2014). The USA Farm Act 2014 has restructured as well as repealed many programs related to different commodities. Direct Payments, Counter-Cyclical Payments (CCPs), Average Crop Revenue Election (ACRE) Program, are repealed under Farm Act 2014. This Act introduced new programs like Agriculture Risk Coverage (ARC) and Price Loss coverage (PLC) to protect farmers in terms of revenue and price loss respectively. This Act makes several changes to the existing federal crop insurance program. With cotton not covered by the ARC or PLC program, a new crop insurance policy called Stacked Income Protection Plan (STAX) is made available for cotton producers. For other crops, a similar type of policy called Supplemental Coverage Option (SCO) is introduced by Farm Act 2104.

In this context, the main objective of this paper is to critically examine the commodity and insurance programmes of USA Farm Act 2014 with reference to domestic support under Agreement on Agriculture and Doha round negotiations. First section of the paper deals with introduction, while Section 2 is related to AoA

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Provision and Methodology. Section 3 shows the trend in domestic support to USA agriculture sector. Section 4 highlights the main provisions of USA Farm Act. Section 5 is related to mapping of various programmes under different boxes and implications for the developing countries. Section 6 summarises the main findings of this study.

II

METHODOLOGY AND PROVISIONS RELATED TO DOMESTIC SUPPORT

AoA provides the methodology to estimate domestic support to agriculture sector. The key aim of reducing domestic support is to correct trade distortions with a view to promote efficient allocation and use of world resources. The Aggregate Measurement of Support (AMS) is the annual level of support in monetary terms extended to the agricultural sector. All domestic support measures, except exempt measures, provided in favour of agricultural producer are to be measured as the 'Aggregate Measurement of Support' (AMS). The subsidies provided to farmers include (1) non-product specific subsidies such as those provided for irrigation, electricity, credit, fertilisers, seed etc. (2) product-specific subsidies, which are, calculated as domestic prices minus fixed external reference price. The sum of these two is termed as Aggregate Measurement of Support (AMS) also called Amber Box. A member is not required to include product-specific and non-product specific support if it is below de-minims limit.[1] The de minimis limit for product specific support is fixed at 5 per cent (developed countries) and 10 per cent (developing countries) of that Member's total value of production of a basic agricultural product during the relevant year (Article 6.3). In case of non-product specific support, de minimis limit is fixed at 5 per cent (developed) and 10 per cent (developing) of that Member's total value of agricultural production. The Amber Box subsidies are considered to be trade distorting and subject to progressive reduction commitments from base year 1986-88 level. Domestic support exceeding the maximum limit in the base year 1986-88 was to be reduced by 13.3 per cent for developing countries and 20 per cent for developed countries over an implementation period of six year for developed countries ending 2001 and ten years for developing countries ending 2005. It is noteworthy that reduction commitments are applicable only at aggregate level not at product specific level. There are some subsidies, which are required in the long term interest of maintaining natural resources, environmental protection and improving the farmer's income. These are not to be included in the AMS and are grouped in 'Green Box'. However, these should meet the fundamental requirement of having minimal trade distorting effects. Direct payments under production-limiting programmes (Blue Box: Article 6.5[2]) are also exempted from reduction.

In this study, domestic support data on various boxes like Amber, Blue and Green Box is collected from USA's notification to WTO. This study is descriptive in nature and uses descriptive statistic. It involves economic and legal analysis of various

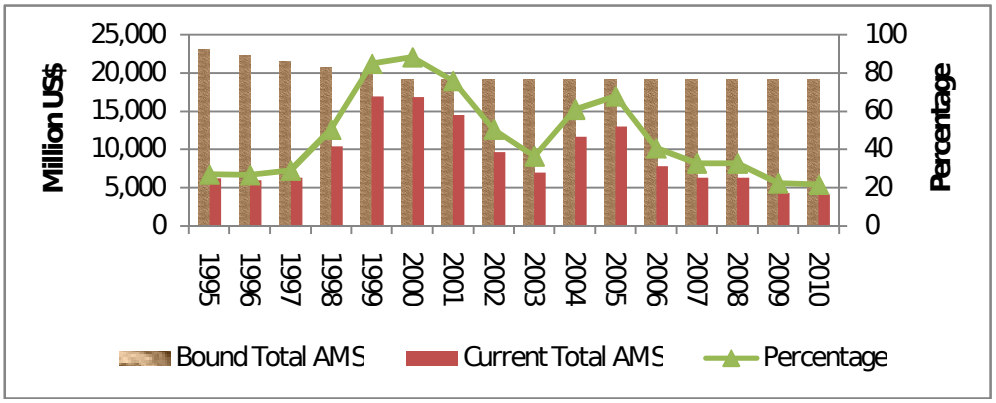
provisions of USA Farm Act 2014. It reviews domestic support notifications of USA for various years. This study highlights the shortcoming in USA's domestic support notification to WTO and its impact on product-specific support to agriculture sector. Various programs under USA farm Act are also mapped into various boxes of AoA.

III

TREND IN DOMESTIC SUPPORT TO AGRICULTURE IN USA

Being a developed nation, USA has reduction commitments related to Amber Box subsidies with base period being 1986-88. During the base period (1986-88), USA provided $23 billion Amber Box support to agriculture sector and therefore, USA committed to reduce base year domestic support to $19 billion by 2001. As Doha negotiations still continue, the final bound AMS for USA is remain at the same level of year 2001 i.e., $19 billion and current AMS of USA should remain within the limit of final bound AMS. USA can provide AMS above the de-minimis limit but should remain within final bound AMS. In that sense, USA got more flexibility in comparison to the countries where AMS was below the de-minimis level during the base period 1986-88.

About the component of current AMS of USA, non-product specific support always remain within the de-minimis level, i.e., 5 per cent of value of production, but product specific support for many products was higher than the de-minims limit. However, current AMS which is the sum of product and non-product specific support remains within the limit of final bound AMS and it accounted for 22 per cent of bound AMS in 2010 (Figure 1).



Source: USA's domestic support notifications to WTO. (http://www.wto.org)

Figure 1. Trend in Current AMS in Comparison to Bound AMS for USA.

The composition of domestic support reveals that USA mainly provides domestic support in the form of Amber Box and Green Box. USA provided Blue Box support only for one year and after that it discontinue this support. Green Box support, which

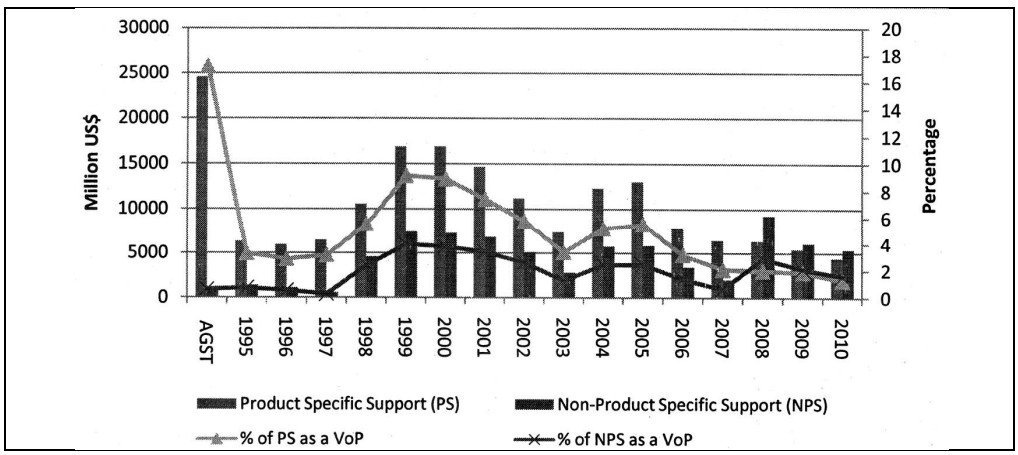
is considered as minimal trade distorting support, has shown upward trend during 1995-2010 (Table 1). Current AMS has declined in recent years. Aggregate product specific and non-product specific support both in absolute terms as well as value of production (VoP) has shown downward trend due to high international prices of agricultural commodities in recent years (Figure 2).

TABLE 1. TREND OF DOMESTIC SUPPORT TO AGRICULTURE SECTOR IN USA

(Millions US $)

Year (1)	Current total AMS (2)	Green box (3)	Blue box (4)	Year (5)	Current total AMS (6)	Green box (7)	Blue box (8)
1995	6214	46041	7030	2003	6950	64062	
1996	5898	51825	-	2004	11629	67425	-
1997	6238	51252	-	2005	12943	72328	-
1998	10392	49820	-	2006	7742	76035	-
1999	16862	49750	-	2007	6260	76162	-
2000	16843	50057	-	2008	6255	86218	-
2001	14482	50672	-	2009	4267	103213	-
2002	9637	58322	-	2010	4120	120531	-

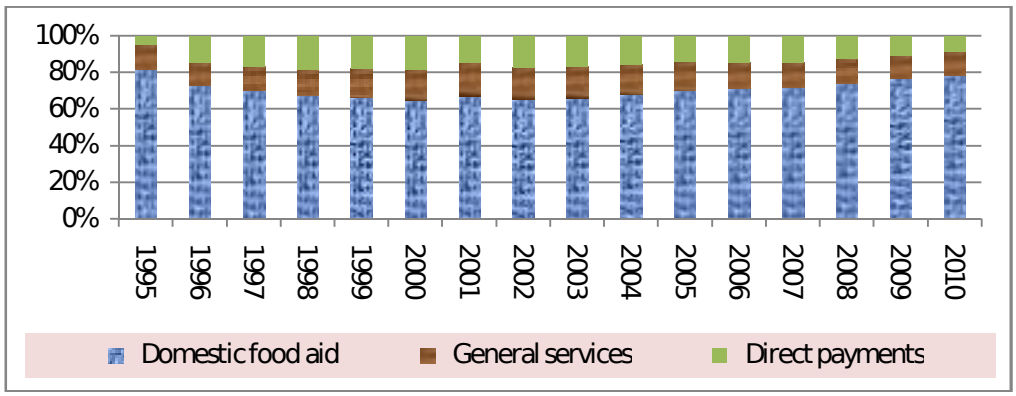
Source: USA's domestic support notifications to WTO. (http://www.wto.org).



Source: USA's domestic support notifications to WTO. (http://www.wto.org).

Figure 2. Trend in Product and Non-Product Specific Support in USA.

Green Box support is dominated by domestic food aid as it accounted for about 78.7 per cent of USA's Green Box in 2010 (Figure 3). General services which includes research, extension, inspection, marketing and others comes at a second position with a share of about 12.6 per cent during 1995-2010. Direct payments in the form of decoupled income support, payment for relief from natural disasters, resource retirement programmes, investment aids and environmental has shown upward trend. Within direct payments, decoupled income support and environmental programmes have major share during 1995-2010.



Source: USA's domestic support notifications to WTO. (http://www.wto.org).

Figure 3. Components of Green Box.

Reduction commitment related to domestic support is applicable at the aggregate level and therefore a member can concentrate or give domestic support mainly to few products/ crops provided the aggregate support remain within the final bound AMS limit. Due to absence of any rule related to cap on product-specific support, many developed countries concentrated domestic support only on few products. This led to huge impact of domestic support on the international prices of few crops/products.

Trend of product specific support reveals that USA's product specific support was mainly concentrated on few crops. Product specific support as a percentage of calculated AMS was highest for the dairy product followed by sugar. Support to eight products namely dairy, corn cotton, rice, wheat, soybean and sugar accounted for 99 per cent of total product specific support in 2010 (Table 2). Product-specific support as a percentage of value of production also provides the evidence of highly subsidised agriculture sector of USA in the past which is creating trade distortion in international trade (Table 3).

For cotton, this percentage was 0.44 in 1995, which increased to 74.16 per cent in 2001 but decline to 1 per cent in 2010. One of the reasons for decline in product-specific support was due to notifying Counter-Cyclical Payments (CCPs) as a non-product specific support rather than as product specific support. In case of sugar, this percentage was more than 50 per cent for the most of years during 1995-2009. USA's dairy sector is also highly subsidised in terms of product-specific support as a percentage of value of production as well as calculated AMS. Concentration of domestic support in USA is creating havoc in the international market for agriculture goods. Overall, given the current AMS is much below the bound AMS and the fact that there is no product specific cap under AoA, USA has still enough flexibility to increase trade distorting support.

TABLE 2. TREND IN DOMESTIC SUPPORT FOR SELECTED CROPS

(*per cent of aggregate product specific support*)

Years (1)	Aggregate product specific support Million US$ (2)	Dairy (3)	Peanuts (4)	Corn (5)	Rice (6)	Wheat (7)	Soybeans (8)	Sugar (9)	Cotton (10)	Total (11)
					Per cent					
AGST	24569	23	1	32	4	17	1	4	10	92
1995	6313	74	7	1	0	0	0	17	1	99
1996	5959	79	5	0	0	0	0	15	0	100
1997	6482	69	5	2	0	1	1	16	7	100
1998	10558	43	3	15	0	5	12	10	9	97
1999	16891	28	2	15	3	6	17	7	14	91
2000	16906	30	3	16	4	5	21	7	6	92
2001	14708	30	2	9	5	1	25	7	19	99
2002	11227	56	1	2	6	0	0	12	11	88
2003	7386	64	0	3	7	1	0	17	6	99
2004	12309	38	0	25	1	1	4	10	18	98
2005	13061	39	1	34	1	0	1	9	12	98
2006	7913	64	0	0	0	0	1	16	17	99
2007	6497	77	0	0	0	0	0	19	3	100
2008	6374	62	0	0	0	0	0	18	18	99
2009	5451	55	0	2	0	8	4	23	3	95
2010	4398	65	0	0	0	3	0	29	2	99

Source: USA's domestic support notifications to WTO. (http://www.wto.org).

TABLE 3. TREND IN DOMESTIC SUPPORT FOR SELECTED CROPS

(*per cent of value of production*)

Year (1)	Dairy (2)	Peanuts (3)	Corn (4)	Rice (5)	Wheat (6)	Soybeans (7)	Sugar (8)	Cotton (9)
AGST								
1995	23.1	40.7	0.1	0.8	0.1	0.1	51.1	0.4
1996	20.3	29.0	0.1	0.3	0.1	0.1	44.4	0.0
1997	21.0	30.5	0.7	0.4	0.4	0.3	49.3	6.8
1998	18.7	30.2	8.1	1.2	7.6	9.5	49.6	19.4
1999	19.9	35.9	14.9	35.3	17.4	23.4	56.3	53.9
2000	24.4	48.8	15.1	59.5	14.7	29.0	57.3	21.3
2001	18.0	30.4	7.0	82.5	3.5	28.7	52.3	74.2
2002	30.4	11.0	0.9	72.6	0.4	0.3	63.1	27.0
2003	22.2	2.6	1.0	30.9	1.4	0.1	55.1	6.9
2004	16.9	4.0	12.5	7.7	1.2	2.8	66.5	39.1
2005	19.2	10.6	20.2	7.6	0.4	0.4	61.6	28.5
2006	21.4	3.0	0.1	0.1	0.0	0.3	52.8	27.2
2007	14.1	0.3	0.0	0.2		0.0	58.2	4.0
2008	11.3	1.2	0.0	0.1	0.0	0.0	54.5	28.4
2009	12.3	0.9	0.3	0.8	4.0	0.7	48.7	3.3
2010	9.0	0.7	0.0	0.3	0.9	0.0	38.7	1.0

Source: USA's domestic support notifications to WTO. (http://www.wto.org).

IV

COMMODITY AND INSURANCE PROGRAMME UNDER USA FARM ACT 2014

The Farm Act 2014 is projected to cost $956 billion over next 10 years. The Congressional Budget Office (CBO) projected that if the mandatory programs of the

Farm Act 2008 were to continue, they would cost $973 billion over the next 10 years (2014-23). Compared to the baseline, the Farm Act 2014 reduces projected spending and the deficit by $16.6 billion over 10 years (Chite, 2014). Nutrition or expenditure related to food security will account for 79 per cent under this Act. Share of commodities programme had declined under this Act but expenditure on crop insurance increased in comparison to CBO projection. Recent domestic support notifications show that the share of commodities programmes had declined due to high prices of agricultural commodities in international market.

TABLE 4. BUDGET FOR FARM ACT 2014: BASELINE AND PROJECTED OUTLAYS

(*Million US$*)

2014 Farm Bill Titles (1)	CBO baseline May 2013 (2)	Share in CBO baseline (per cent) (3)	Projected outlays (2014 Farm Act) (4)	Share in projected outlay (percent) (5)	CBO score (change to outline) 2014 Farm Act (6)
Commodities	58,765	6.04	44,458	4.65	-14,307
Conservation	61,567	6.33	57,600	6.02	-3,967
Trade	3,435	0.35	3,574	0.37	139
Nutrition	7,64,432	78.57	7,56,432	79.09	-8,000
Credit	-2,240	-0.23	-2,240	-0.23	0
Rural development	13	0.00	241	0.03	228
Research	111	0.01	1,256	0.13	1,145
Forestry	3	0.00	13	0.00	10
Energy	243	0.02	1,122	0.12	879
Horticulture	1,061	0.11	1,755	0.18	694
Crop insurance	84,105	8.64	89,827	9.39	5,722
Miscellaneous (incl. NAP)	1,140	0.12	2,363	0.25	953
Total, direct spending	9,72,905	100	9,56,401	100	-16,504
Change in revenue					104
Net impact on the deficit					-16,608

Source: Congressional Budget Office (CBO).

TABLE 5. REPEALED PROGRAMMES

Programme (1)	Notified (2)
Repeal of Direct Payments: effective 2013	Green Box
Repeal of Counter-Cyclical Payments: effective 2013	Amber Box: non-product specific support
Repeal of Average Crop Revenue Election Program: effective 2013	Amber Box: non-exempt product specific direct payments

Source: USA Farm Act 2014 and USA's domestic support notifications to WTO. (http://www.wto.org)

The Farm Act 2014 eliminated direct payments, CCPs (Box 1), and ACRE[3] program to address the budget constraints facing the U.S. Government by reducing overall agricultural spending and better targeting farm programs. USA notified direct payments as Green Box support, whereas CCP and ACRE were treated as Amber Box support on the basis of provisions provided under Agreement on Agriculture (AoA) and trade distorting nature of these programmes. Though, it seems that USA eliminated trade distorting support to agriculture, but USA introduced new trade

distorting support. ARC and PLC programmes are introduced to protect farmers in terms of revenue and price loss respectively. A farmer can choose between these two programs linked to a decline in either price or revenue.

BOX 1: COUNTER CYCLICAL PAYMENTS (CCPS)

Under the 2008 Farm Act, CCPs are available whenever the commodity's effective price is less than the target price. the counter cyclical payment for a particular commodity is determined as:
Payment rate = (Target price) – (Direct Payment Rate) – (Higher of Commodity Price or Loan rate)

CCP = ([Base Acres] x 0.85) x (Payment Yield) x (Payment Rate)

The Direct Payments are made to producers on the farms for which certain payment yields and base acres are established. Since they depend on the acreage bases and yields, instead of the current production choice of a producer, they were thought to be providing no incentive to increase production of a particular commodity. The term 'Commodity Price' signifies the national average market price that is received by the producers during the marketing year. The target price was announced under Farm Act 2008 for covered commodities. Loan rate is the price per unit (pound, bushel, bale, or hundredweight) at which the Commodity Credit Corporation provides commodity-secured loans to farmers for a specified period of time. The CCPs rate is highest when the market price is below the loan rate and is equal to the target price minus the direct payment rate minus the loan rate. Base acreage and payment yields are based on the historical parameters specified in the Farm Act 2002.

Source: Farm Act 2008.

PLC is a price protection programme which makes a farm payment when farm price for a covered crop declines below its "reference price" set in Farm Act. PLC replaced CCP programme which was introduced under Farm Act 2002. The reference prices under PLC are higher than the prices under CCP. The payments are issued when the effective price or market price of a covered commodity is less than the respective reference price for that commodity. The payment is equal to 85 per cent of the base acres of the covered commodity times the difference between the reference price and the effective price times the program payment yield for the covered commodity. It allows updating the base acres and yield. The potential trade distortions caused by the PLC program relative to the CCPs have increased because of updation of base acres and payment yield. It sets higher target prices for the covered crops to raising the possibility of expand production if a crop's target price is above market prices. It is to be noted that cotton crop is not covered by PLC though cotton farmers received payments under CCPs.

Farm Act 2014 introduced a revenue-based program, called Agriculture Risk Coverage (ARC), which is designed to cover a portion of loss to a farmer when crop revenues decline. Farmers may select ARC as an alternative to PLC. Like the PLC program, ARC payments are made on 85 per cent of base acres. The first step for commodity programme sign up under Farm Act 2014, famers have to give information for base acre and programs yield to receive payments under various programmes of Farm Act. Payments are triggered when actual crop revenue drops below 86 per cent of historical or "benchmark" revenue. Farmers can select coverage at either the county or individual farm level. Under ARC, the revenue guarantee is set at 86 per cent of historical revenue (i.e., the producer absorbs the first 14 per cent of

the shortfall) at either the county or farm level (to cover more localized losses). The government then pays for the next 10 per cent of the loss. Any remaining losses are backstopped by crop insurance if purchased by the producer. ARC and PLC are separate from a producer's decision to purchase crop insurance. However, farmers selecting the PLC (but not ARC) are also eligible to purchase an additional subsidised crop insurance policy to protect against "shallow losses" called the Supplemental Coverage Option (SCO). Farmers in USA will continued to receive loan at subsidized rate under Marketing Assistance Loans programme to avoid distress sell. Loan rate for the covered commodities are more and less same as in Farm Act 2008 except for adjustment to upland cotton. The Farm Act 2014 sets a $125,000 per person cap on the total of PLC, ARC, marketing loan gains and loan deficiency payments. There is also an eligibility requirement based on adjusted gross income (AGI). For AGI limits, the Farm Act changes the AGI limit to a single, total AGI limit of $900,000.

The Farm Act 2014 increases funding for crop insurance relative to baseline levels by an additional $5.7 billion over 10 years due to two new insurance products i.e. (1) STAX for cotton and (2) SCO for other crops. STAX for producers of upland cotton where a new section to the Federal Crop Insurance Act is added that provides farmers with an extra revenue loss coverage option. Similarly, for other crops, the Farm Act 2014 makes available an additional policy called SCO, based on expected county yields or revenue, to cover part of the deductible under the producer's underlying policy.

V

DOHA ROUND NEGOTIATIONS AND USA FARM ACT 2014: SOME CONCERN FOR DEVELOPING COUNTRIES

As mentioned in section 3, USA's current AMS was 4.12 billion US$ for year 2010, whereas bound AMS was 19 billion US$. Therefore, USA has enough flexibility to increase Amber Box under Farm Act without breaching commitment related to domestic support under AoA. However, USA Farm Act has major implications for commitments related to domestic support under Doha Round negotiations.

5.1. *Provisions Related to Domestic Support under Doha Round Negotiations*

During the Doha negotiations, various modalities were discussed since 2001. WTO document, TN/AG/W/4/Rev.4 provides the latest provisions to reduce domestic support in agriculture sector. It is to be noted that these are the proposals on the negotiating table and has no binding effect until Doha Round concludes. About domestic support, Doha negotiations aim at substantial reductions in trade-distorting domestic support by (1) Setting limits where they do not exist (except for Green Box and Art.6.2 subsidies) for example, overall Blue Box, product specific Blue Box,

product specific AMS; (2) Reducing limits where they exist, for example, AMS, de minimis (3) Establishing a new constraint – Overall Trade Distorting Support (OTDS) and (4) Clarifying the Green Box criteria. In Doha round, all developed countries will have to substantially reduce trade distorting support and those with higher levels of support have to make deeper cuts from the "bound" or ceiling levels. Blue Box support will also be capped. If after taking cuts in individual components, the overall support exceeds the ceiling, then additional cuts will have to be made in the individual components. The 6th December 2008 draft modalities text proposes a tiered formula for reduction of OTDS and final bound AMS. It also suggests a range of cuts in each tier as indicated in Table 6. These reductions are to be made in six equal steps over a period of five years. Similarly, there are provisions for the product specific support, de minimis and Blue Box support.

TABLE 6. REDUCTION IN OTDS AND FINAL BOUND AMS

	OTDS		Final Bound AMS	
Tier	Threshold (US$ billions)	Cuts	Threshold (US$ billions)	Cuts
(1)	(2)	(3)	(4)	(5)
1	> 60	80 per cent	> 40	70 per cent
2	10-60	70 per cent	15 - 40	60 per cent
3	< 10	55 per cent	< 15	45 per cent

Source: WTO document, TN/AG/W/4/Rev.4.

5.2 *USA Domestic Support and Doha Round Negotiations*

Final bound OTDS of USA is about $48 billion and would have to reduce final OTDS by 70 per cent to bring down it to $14 billion in six steps over a period of five years after the conclusion of Doha Round (Table 7). USA's final bound total AMS specified in part IV of a member schedule is $19 billion and therefore, USA comes under second tiered of Final bound AMS. As the applicable cut on final bound AMS of USA is 60 per cent, thus it would be reduced to $7.6 billion over a period of five years.

TABLE 7. CALCULATION OF FINAL BOUND OTDS OF USA

(1)	(*Million $*) (2)
Final Bound Total AMS specified in Part IV of a Member's Schedule; plus	19,103.29
10 per cent of the average total value of agricultural production in the 1995-2000 base period; plus	19,413.93
higher of average Blue Box payments as notified to the Committee on Agriculture, or 5 per cent of the average total value of agricultural production, in the 1995-2000 base period.	9,706.96
Final bound OTDS	48,224.19
Applicable cut	70 per cent

Source: Calculation on the basis of USA's notification to WTO and WTO document, TN/AG/W/4/Rev.4

A major loophole in AoA was related to unbound product specific domestic support provided. Therefore, a member has discretion to concentrate its domestic support only on few products. During the Doha negotiations, product-specific support

limit is now applicable and thus it will check concentration of domestic support to agriculture sector. De-minimis limit is also reduced from 5 per cent to 2.5 per cent for the developed countries. Doha negotiations also put a cap on Blue Box subsidy in comparison to uncapped support in AoA. It seems that USA would undertake substantial cut in domestic support to agriculture sector. However, USA seeks carve out in Doha round to escape from reduction commitment.

5.3 *Carve-out for USA under Doha Negotiations for Blue Box and Farm Act 2014*

With the provisions related to OTDS, bound AMS and product specific cap under Doha round negotiations, it would be difficult for USA to provide huge domestic support to agriculture sector. To get more flexibility, USA seeks to broaden the definition of Blue Box support to agriculture sector given under Art 6.5 of AoA. As a result, general council's decisions of I August 2004 expanded the criteria to include in Blue Box direct payments that do not require production.

BOX 2. NEW DEFINITION OF BLUE BOX

Agriculture modalities dated 6 December, 2008 broaden the definition of Blue Box.

Para 35 The value of the following domestic support, provided that it is consistent also with the limits as provided for in the paragraphs below, shall be excluded from a Member's calculation of its Current Total AMS but shall count for purposes of that Member's Blue Box commitments and OTDS:

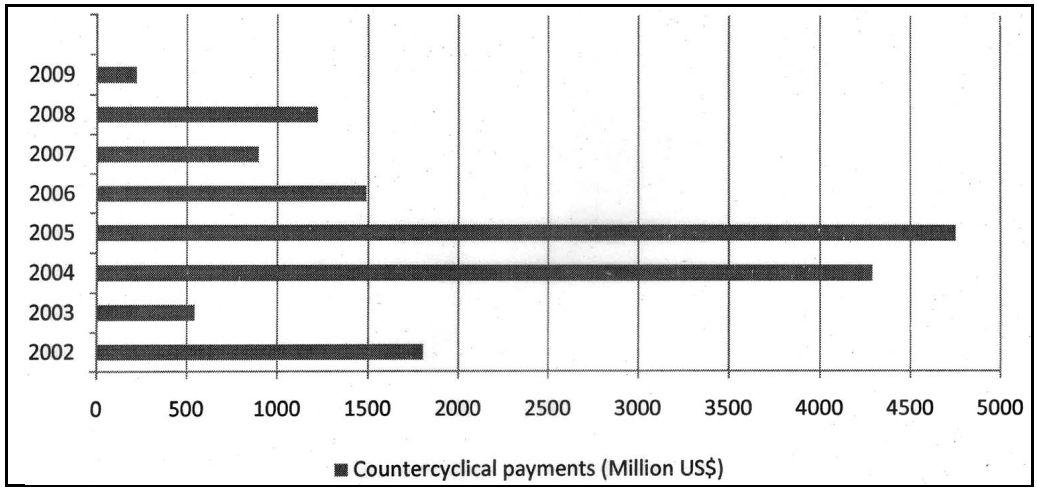
B Direct payments that do not require production if:

- such payments are based on fixed and unchanging bases and yields; or
- livestock payments are made on a fixed and unchanging number of head; and
- Such payments are made on 85 per cent or less of a fixed and unchanging base level of production.

Source: WTO document, TN/AG/W/4/Rev.4.

This is a new addition to Blue Box for the USA. USA wanted to notify CCPs under Doha Round as Blue Box. It is to be noted that USA has not given any Blue Box support (except in 1995) and now with the new text, the definition of Blue Box will be widened only to allow USA to shift its support from Amber Box to Blue Box. USA has notified its CCPs as non-product specific support under Amber Box. Initially USA claimed that CCPs are decoupled and therefore, does not provide any incentive to farmers. However, in "United States – Subsidies Upland Cotton Case", Brazil successfully challenged the trade distorting subsidy of USA. Due to upland cotton case, USA has notified CCPs in Amber Box as a non-product specific support to agriculture sector. CCPs increased from $1.8 billion in 2002 to $4.7 billion in 2005 but decline in recent years due to increase in international prices of agricultural commodities in recent past (see Figure 4).

USA argues that CCPs are reported as non-product specific because payments are based on fixed historical area and yield (i.e. production), not current production. Recipients are not required to produce any product to receive payments. Because any crop can be grown on the base acre, payments cannot be ascribed to a specific product. But provisions of CCPs clearly show that there payments are product-



Source: USA's domestic support notifications to WTO. (http://www.wto.org).

Figure 4. Trend in Countercyclical Payment (Million Dollars).

specific as the target price is related to a particular product. In Doha negotiations, USA is treating CCPs as Blue Box support and on that basis determining product specific Blue Box cap. In WTO notifications, USA is treating CCPs as non-product specific, but in Doha negotiations demanding product specific cap for the same programme. In other words, notification of CCPs as non-product specific support is questionable and USA should notify this programme as product specific support. It is to be noted that domestic support to specific product declined after 2002 because CCPs were treated as non-product specific support. Many developing countries raise this issue and argued that USA is under estimating product specific support. By broadening the definition of Blue Box, USA wants to shift this programme to Blue Box. USA seeks product specific flexibly because modality set deminimis limit as 2.5 per cent and also cap product specific support. By seeking new definition of Blue Box, USA seeks the flexibility given under Table 8. Without broadening the definition of Blue Box, USA would not able to support farmers under this Box.

TABLE 8. PRODUCT-SPECIFIC BLUE BOX CAPS UNDER ANNEX A

(Million $)

Crop	110 per cent	120 per cent
(1)	(2)	(3)
Corn	2,359.80	2,574.30
Grain sorghum	106.80	116.50
Barley	32.00	34.90
Oats	5.30	5.80
Wheat	1,041.10	1,135.70
Soybeans	400.40	436.80
Upland cotton	1,009.00	1,100.80
Rice	234.90	256.30
Peanuts	149.50	163.10

Source: WTO document TN/AG/W/4/Rev.4.

USA Farm Act 2014 repealed CCPs and introduced PLC which is similar to CCPs but more trade distorting support. The target price under PLC is much higher than CCPs and therefore it will create more trade distortion. Given the past trend, USA most probably will notify PLC as non-product specific support. Developing country should oppose it as PLC is a product specific support due to product specific target price as given under Table 9. It is most likely that USA will still seek to broaden the definition of Blue Box to shift PLC from Amber Box to Blue Box. This move will dilute the main objective of Doha round i.e. effective reduction in trade distorting support to agriculture sector and it will adversely affect the welfare of low income or resource poor farmers in developing and least developing countries. Besides PLC, ARC and Market loan assistance programme will distort international trade in agriculture sector. ARC most likely will be notified as non-exempt product specific support. Market loan assistance programme will continue to be notified as product specific support.

TABLE 9. TARGET PRICE OF VARIOUS CROPS UNDER CCP AND PLC

(in US$)

Commodity (1)	Quantity measure (2)	Target prices under CCP (3)	Target prices under PLC (4)
Wheat	Bushel	4.17	5.50
Corn	Bushel	2.63	3.70
Grain sorghum	Bushel	2.63	3.95
Barely	Bushel	2.63	4.95
Oats	Bushel	1.79	2.40
Upland cotton	Pound	0.71	n.a
Long-grain rice	Hundredweight	10.50	14.00
Medium-grain rice	Hundredweight	10.50	14.00
Peanuts	Ton	495.00	535.00
Soybeans	Bushel	6.00	8.40
Other oilseeds	Hundredweight	12.68	20.15
Dry peas	Hundredweight	8.32	11.00
Lentils	Hundredweight	12.81	19.97
Small chickpeas	Hundredweight	10.36	19.04
Large chickpeas	Hundredweight	12.81	21.54

Source: Farm Act 2014 and 2008.

5.4: *USA Farm Act and Crops Insurance*

Responding to the concerns of farmers across America, this Act strengthens and improves insurance coverage for agricultural crops. The federal Crop Insurance Program (CIP) makes available subsidized crop insurance to producers who purchase a policy to protect against individual farm losses in yield, crop revenue, or whole farm revenue. With cotton not covered by the ARC program a new crop insurance policy called STAX is made available for cotton producers. STAX sets a revenue guarantee based on expected county revenue. For other crops, a similar type of policy called Supplemental Coverage Option (SCO), based on expected county yields or revenue, is made available. The farmer subsidy as a share of the policy premium is set at 80 per cent for STAX and 65 per cent for SCO. STAX is a revenue insurance

programme and can be used with the existing Crop Insurance program (CIP). The USA has removed all the direct and CCPs for the cotton sector in the recent Farm Act that caused serious injustice to the other developing countries. The key question will be whether the decline in the distortionary support by elimination of DP's and CCP's will offset the effects of the new programs introduced. The STAX is a coupled payment because the subsidies are based on the changes in the market revenues with the changes in the prices and yields and is based on the planted acres. The STAX program was introduced in response to the increased international pressures within the ambit of WTO commitments. The STAX program gives the farmer an extra revenue loss coverage option as it require farmers to pay just 20 per cent of the Premium subsidy while rest 80 per cent would be paid by USA government. The STAX program can be used in addition to the regular CIP and makes up for the "shallow losses" that are not covered under CIP. Similarly, SCO can be treated as coupled support to agriculture sector.

About the WTO provisions, crop insurance premium subsidy is treated as non-product specific AMS in USA notifications. Annex 2, Para 7 (c) of AoA prescribe that amount of any such payments (Government financial participation in income insurance and income safety-net programmes) shall relate solely to income; it shall not relate to the type or volume of production (including livestock units) undertaken by the producer; or to the prices, domestic or international, applying to such production; or to the factors of production employed. But STAX and SCO are differentiating between different crops. Therefore, these programmes are not satisfying the conditions of Annex 2 (Green Box). These payments should be treated as Amber Box support. As STAX is cotton specific, all the payment including premium subsidy should be come under product specific support. Similarly, SCO payments will come under Amber Box support. Though USA, repealed direct payment, counter-cyclical and ACRE programme, farmers will get support as usual under the insurance programmes, ARC, PLC and Market assistance programme. These programmes will influence the production decisions of farmers and thus distort the international prices, which in turn will have implication for agriculture sector in developing countries.

VI

CONCLUSION

Agricultural policy of USA under various Farm Act has adversely affected the welfare of millions of resource-less and poor farmers in the developing countries. Huge domestic support to agriculture sector has led to the artificial comparative advantage for the USA. The USA very effectively exploits the loopholes in AoA and concentrated domestic support in few agricultural products. For example current AMS always remain within the bound AMS limit. However, product specific support of eight products, i.e., dairy, corn cotton, rice, wheat, soybean, peanut and sugar accounted for more than 90 per cent of calculated AMS. It led to decline in

international prices of agricultural products like cotton, which was a major factor for farmers' distress in cotton producing developing countries. During the Doha negotiations new concepts and provisions related to domestic support are discussed and still on the negotiating table. Doha negotiations aim at substantial reductions in trade-distorting domestic support. However, USA seeks some special provisions related to domestic support.

Though, Farm Act 2014 has repealed Direct Payments, CCPs, ACRE but agriculture sector in USA will continue to get trade distorting support under commodity programmes like PLC, Agriculture ARC and Market Loan Assistance programme. By introducing premium subsidy under new insurance programmes i.e. STAX and SCO, USA Farm Act 2014 will distort international trade. As USA seeks to shift Amber Box support to Blue Box under Doha Round negotiations to escape from effective reduction in domestic support to agriculture sector, developing countries should oppose the carve out related Blue Box.

NOTES

1. De minimis limit is the minimal amounts of domestic support that are allowed even though they distort trade — up to 5 per cent of the value of production for developed countries, 10 per cent for developing countries.

2. Part IV, Art 6 (para 5) of AoA define blue box as: Direct payments under production-limiting programmes shall not be subject to the commitment to reduce domestic support if:

(i) Such payments are based on fixed area and yields; or

(ii) Such payments are made on 85 per cent or less of the base level of production; or

(iii) Livestock payments are made on a fixed number of head.

Any member country can provide domestic support under blue box without any limit provided the programme should be compatible with Art 6.5 of AoA.

3. As authorised by the 2008 Farm Bill (Food, Conservation, and Energy Act of 2008), producers on eligible farms may elect to participate in the Average Crop Revenue Election (ACRE) Program. Under the ACRE Program, producers may receive revenue-based payments as an alternative to receiving price-based counter-cyclical payments. Wheat, barley, and oats, grain sorghum and corn, upland cotton, Rice (medium and long grain), soybeans, other oilseeds, peanuts and pulse crops are eligible for ACRE payments.

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ANJAN CHAKRABARTI*

A Disaggregated Study on Trends in Growth of Agricultural Production and Productivity in West Bengal in Pre and Post Economic Reform Period: Investigating Impact on Economy and Employment

I

INTRODUCTION

India resorted to a policy of comprehensive economic reforms in June 1991. Contemporary researches argue that economic reforms primarily emphasised on price factors and infrastructure, however, institutional aspect of agriculture has grossly been neglected and as a consequence, deceleration in agricultural growth as well as decline in growth of output were accentuated since 1991 (Chadha, 2002 ; Majumdar, 2002; Bhalla, 2002 ; Kumar, 2002). In this regard, West Bengal becomes a point of interest among the researchers, it is more so because in West Bengal, overwhelming agricultural growth took off after the 1980s. It became a leading state in India in terms of performance in foodgrain and rice production.

During the reform era, cost of production has increased because of the withdrawal of subsidy on fertiliser and price determination has been left to the market, and secondly, public investment has declined (Reddy, 2006). For West Bengal, doubts may be raised that rise in the growth of agricultural productivity that was achieved during eighties, if it is not sustained, may have some serious negative impact on agricultural income, employment and economy at large. And, lack of alternative employment and income opportunities outside agricultural may further complicate the situation (Ghosh, 1998: 2988). It may lead to possible marginalisation of rural work force.

Aforementioned scenario has prompted to make an attempt to study the trends in growth of production and productivity of foodgrain in West Bengal, disaggregated at districts level and its likely impact on employment and economy. In this empirical exercise, 1970-71 has been chosen as the starting point and the time series continued till 2011-12. To measure the impact of change in growth of production and productivity on income and employment and to understand the simultaneous interplay of various sectors of economy, contribution of various sectors to Gross State Domestic Product (GSDP at current prices) during 1980-81 to 2013-14 have been analysed. Industrial scenario and employment generation in non-agricultural sector have also been scrutinised.

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The paper is organised as follows: Section II describes the data and methodology used in the paper. Section III starts with a brief exposition of dominance of rice in food grain production in the state and carries on inter-district comparison of growth in production and productivity of foodgrain in West Bengal. Section IV critically analyses the agriculture and economy interface. Concluding remarks have been placed in Section V.

II

DATA AND METHODOLOGY

The study is completely based on secondary data and information collected from various issues of West Bengal Economic Review, District Statistical Handbook, and Census Report etc. The empirical analysis evolved around 15 districts over time.[1]

The study period (1970-71 to 2011-12) has been divided in four sub-periods, 1970-71 to 1979-80, 1980-81 to 1989-90, 1990-91 to 1999-2000 and 2000-2001 to 2011-12. The period between introduction of economic reforms in 1991 and its onward journey was divided in two sub-periods, 1990-91 to 1999-2000 and 2000-2001 to 2011-12 to unearth the initial euphoria or pessimism that the introduction of economic reforms created in India and to capture the impact of second generation reforms.

To calculate sub-periods growth rates 'kink exponential model' has been used. A time series for the period t = 1, 2, …, *n* can be disaggregated at a single point *k* and can be expressed in a single equation as follows:

$$\ln Y_t = a_1 D_1 + a_2 D_2 + (b_1 D_1 + b_2 D_2)t + u_t \quad \text{....(1)}$$

$\ln Y_t$ or log values of food grain production and productivity over time. D_j is a dummy variable which takes the value 1 in the j^{th} sub-period and 0 otherwise.

Three kinks (k_1, k_2, and k_3) are introduced to measure the growth rates of four pre-specified sub-periods. The kinked exponential model can also be specified by re-normalizing time such that t = 0 at the break point k_1, t =10 at the second break point k_2 and t =20 at the third break point k_3, then equation can take the following form and which can be used to estimate the growth rates for four sub-periods with a joint intercept:

$$\ln Y_t = a_1 + b_1 D_1 t + b_2 D_2 t + b_3 D_3 t + b_4 D_4 t + u_t \quad \text{....(2)}$$

(Boyce, 1987: 267,268)

where, D_1 = 1 for 1970-1971 to 1979-1980,
= 0 elsewhere.
D_2 = 1 for 1980-81 to 1989-90,
= 0 elsewhere.

D_3 = 1 for 1990-91 to 1999-00,
= 0 elsewhere.
D_4 = 1 for 2000-01 to 2011-12,
= 0 elsewhere.

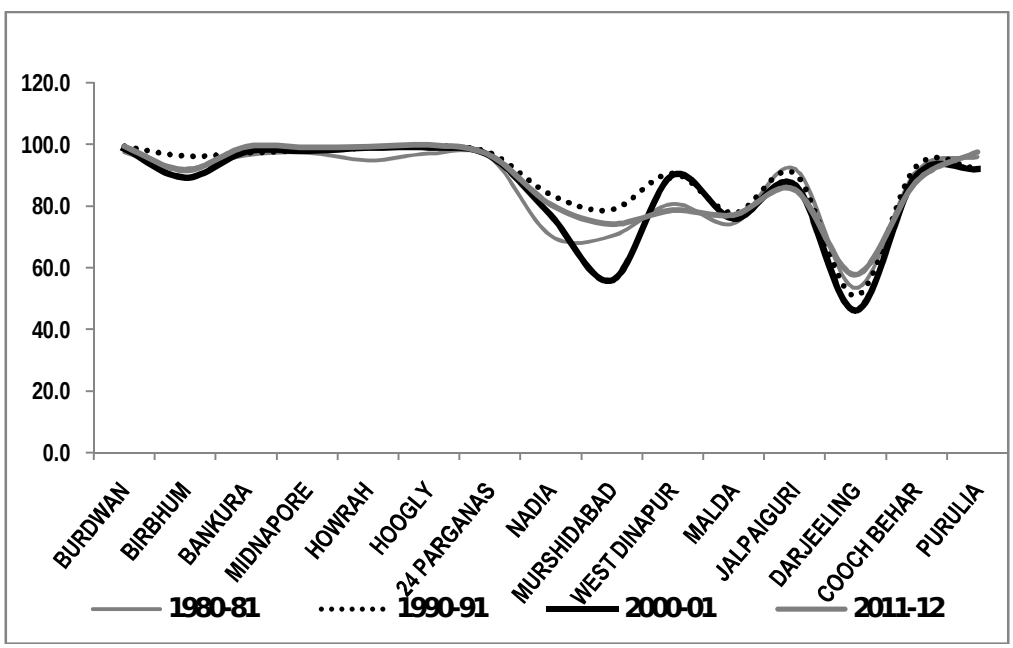
Multiplying estimated values of D_1t, D_2t, D_3t, and D_4t, we shall be having growth rates for four sub-periods.

Sectoral shares of GSDP at current prices have been used to capture the changing economic structure of West Bengal between 1980-81 and 2013-14.

III

DOMINANCE OF RICE IN FOOD GRAIN PRODUCTION AND INTER DISTRICT COMPARISON OF GROWTH IN PRODUCTION AND PRODUCTIVITY OF FOODGRAIN IN WEST BENGAL

West Bengal and the central Gangetic Bengal is the oldest agricultural settlement in India. Except the western region (Birbhum and Bankura) which contained laterite formation, rest of the West Bengal and central Bengal was identified as 'semi-aquatic rice plain' (Bose, 1987: 37-38). In fact, two-thirds of the total geographical area comes under flat alluvial plains created by the river Ganges that makes the region favourable for rice cultivation. It is clear from Graph 1, that production of rice as



Source: Compiled from the data collected from various volumes of West Bengal Economic Review, Government of West Bengal.

Graph 1. Districtwise Production of Rice as Percentage of Districtwise Foodgrain Production.

percentage of foodgrain production has been increased from 82 per cent to 92 per cent between 1970-71 and 2011-12. It has been observed that in West Bengal, in terms of contribution to total foodgrain production in all the districts, rice has absolute dominance in most of the districts. For most of the districts, the production of rice as percentage of foodgrain was varying between 80 percent and closer to 96 percent. But the exceptional districts were Nadia, Murshidabad, Malda and Darjeeling where the production of rice as percentage of foodgrain was varying between 52 per cent and 62 per cent.

IV

INTER-DISTRICT COMPARISON OF GROWTH IN PRODUCTION AND PRODUCTIVITY OF FOODGRAIN IN WEST BENGAL

Over the whole period 1970-71 to 2011-12, the exponential growth of foodgrain production for West Bengal stood at 2.4 per cent per annum and significant at 1 per cent level (Table 1). District-wise exponential growth rates of foodgrain production from 1970-71 to 2011-12, reveal that Burdwan, Midnapore, Nadia and West Dinajpur achieved more than 2.4 per cent growth per annum and are statistically significant at 1 per cent level. Again, foodgrain production grew at an exponential rate between 2 to 2.4 per cent in rest of the districts excepting Jalpaiguri and Darjeeling. While measuring changes in growth rates over different sub-periods for foodgrain production in the districts, it is observed that in sub-period I, the growth rates are negative for most of the districts excepting Howrah and 24 Parganas, Nadia and Darjeeling. This period has unanimously been identified by all the researchers as the period of absolute agricultural stagnation.

A massive turnaround has been observed in the growth rate in foodgrain production since 1980-81. In sub-period II, foodgrain production in West Bengal grew at an exponential rate of 4 per cent per annum. Among the districts, most impressive growth was achieved by Purulia and Howrah where foodgrain production grew at a rate of 5.6 percent. Lowest growth rate was achieved by Jalpaiguri district (less than 2 per cent).

The values of trend break help us to specify the extent of gain or loss in growth rates for a particular sub-period in comparison to previous sub-period. Trend break-I reveals that in sub-period II, highest gain in growth of foodgrain production over sub-period I was achieved by Purulia (8.8 percent). Significant gains in growth rates were also achieved by Bankura and Midnapore. All the districts in West Bengal had experienced positive trend break in sub-period II over sub-period I. For West Bengal a net gain of 3.9 per cent was achieved in sub-period II in comparison to sub-period I. However, in sub-period III and IV, like the state, majority of the districts failed to maintain the high growth rates in foodgrain production as achieved in sub-period II.

TABLE 1. DISTRICTWISE KINKED EXPONENTIAL GROWTH IN PRODUCTION OF FOODGRAIN IN WEST BENGAL FOR (1970-71 TO 2008-09), (1970-71 TO 1979-80), (1980-81 TO 1989-90), (1990-91 TO 1999-2000) AND (2000-01 TO 2011-12)

Dist/sub-period growth (1)	Whole period (1970-71 to 2011-12) (2)	Sub-period I (1970-71 to 1979-80) (3)	Sub-period II (1980-81 to 1989-90) (4)	Sub-period III (1990-91 to 1999-2000) (5)	Sub-period IV (2000-01 to 2012-13) (6)	Trend break I (7)	Trend break II (8)	Trend break III (9)	DW (10)	R^2 (11)
Burdwan	2.5	0.8	3.5	3.9	2.6	2.8	0.4	-1.3	1.3	0.9
	(13.9)*	-0.7	(3.8)*	(9.9)*	(11.6)*					
Birbhum	2.2	-1.7	3.2	3.2	2.6	4.9	0.0	-0.6	1.4	0.7
	(7.4)*	(-1.0)	(2.3)**	(5.5)*	(7.9)*					
Bankura	2.1	-1.2	4.8	4.5	2.6	6.0	-0.3	-1.9	1.8	0.7
	(9.0)*	(-0.64)	(2.8)*	(6.4)*	(6.4)*					
Midnapore	2.9	-0.9	5.1	4.3	3.4	6.0	-0.8	-0.9	1.6	0.9
	(15.2)*	(-0.7)	(5.0)*	(9.9)*	(13.6)*					
Howrah	2.3	1.3	5.6	3.7	2.4	4.3	-1.9	-1.3	1.3	0.7
	(8.3)*	(-0.7)	(3.6)*	(5.7)*	(6.4)*					
Hoogly	2.1	-0.4	2.6	3.2	2.4	3.1	0.6	-0.7	2.1	0.8
	(12.6)*	(-0.4)	(2.7)*	(7.9)*	(10.6)*					
24 Parganas	2.3	2.1	3.2	3.3	2.3	1.0	0.1	-1.0	1.3	0.8
	(11.5)*	(-1.6)	(2.6)*	(6.6)*	(7.9)*					
Nadia	2.6	1.7	5.3	4.3	2.7	3.7	-1.0	-1.6	0.9	0.9
	(11.4)*	(-1.3)	(4.6)*	(8.8)*	(9.5)*					
Murshidabad	2.4	0.0	2.6	3.3	2.7	2.7	0.7	-0.6	1.4	0.8
	(13.2)*	(-0.0)	(2.5)*	(7.4)*	(10.5)*					
West Dinajpur	2.9	-0.8	3.5	3.8	3.4	4.3	0.3	-0.4	1.9	0.9
	(19.9)*	(-0.1)	(4.9)*	(12.8)*	(19.9)*					
Malda	2.4	1.0	3.4	3.4	2.5	2.4	0.0	-0.9	1.5	0.9
	(17.5)*	(-1.2)	(4.6)*	(11.0)*	(14.0)*					
Jalpaiguri	1.5	-1.3	1.4	1.3	2.0	2.7	-0.1	0.6	1.9	0.7
	(8.0)*	(-1.1)	(-1.4)	(3.1)*	(8.2)*					
Darjeeling	1.0	2.8	2.7	2.5	0.6	0.0	-0.2	-1.9	1.2	0.6
	(3.5)*	(1.7)***	(1.9)**	(4.2)*	(1.7)***					
Cooch Behar	2.1	0.5	3.1	2.1	2.4	2.6	-1.0	0.3	1.4	0.9
	(15.3)*	(-0.6)	(3.8)*	(6.0)*	(12.2)*					
Purulia	2.3	-3.1	5.6	3.9	3.2	8.8	-1.8	-0.7	2.1	0.6
	(6.6)*	(-1.3)	(2.6)*	(4.3)*	(6.2)*					
West Bengal	2.4	-0.1	3.8	3.6	2.7	3.9	-0.2	-0.9	1.2	0.9
	(16.0)*	(-0.1)	(4.5)*	(10.4)*	(13.6)*					

Source*:* Calculation based on data collected from various volumes of West Bengal Economic Review, Government of West Bengal.

Note: T stats are shown in parenthesis.

*, ** and ***Significant at 1, 5 and 10 per cent level.

During 1970-71 to 2011-12, foodgrain productivity (Table 2) in West Bengal grew at an exponential rate of 2.3 per cent per annum and found statistically significant. However, in first sub-period only the districts, Burdwan, 24 Parganas, Nadia and Malda achieved positive and significant growth rates of productivity. For the state, as a whole, the growth rate in productivity was only 0.3 per cent and insignificant. Major breakthrough in growth in foodgrain productivity was observed for sub-period II Midnapore, Howrah and Nadia experienced significant exponential growth rate which was more than 5 per cent per annum. Darjeeling achieved lowest

growth rate of 1.8 per cent among all the districts of West Bengal. In West Bengal, the growth of productivity increased from 0.3 per cent to 3.7 per cent from sub-period I to sub-period II. Significant rise in growth of foodgrain was observed during this period and increase in productivity thus a natural corollary.

TABLE 2. DISTRICTWISE KINKED EXPONENTIAL GROWTH IN PRODUCTIVITY OF FOODGRAIN IN WEST BENGAL FOR (1970-71 TO 2008-09), (1970-71 TO 1979-80), (1980-81 TO 1989-90), (1990-91 TO 1999-2000) AND (2000-01 TO 2011-12)

Dist/sub-period growth (1)	Whole period (1970-71 to 2011-12) (2)	Sub-period I (1970-71 to 1979-80) (3)	Sub-period II (1980-81 to 1989-90) (4)	Sub-period III (1990-91 to 1999-2000) (5)	Sub-period IV (2000-01 to 2012-13) (6)	Trend break I (7)	Trend break II (8)	Trend break III (9)	DW (10)	R^2 (11)
Burdwan	2.0	1.7	3.0	2.9	2.0	1.3	-0.1	-0.9	1.2	0.9
	(14.8)*	(2.1)**	(4.2)*	(9.7)*	(11.5.)*					
Birbhum	2.2	-0.5	4.2	3.3	2.6	4.6	-0.9	-0.8	1.3	0.9
	(13.1)*	(-0.43)	(4.4)*	(8.3)*	(11.1)*					
Bankura	2.5	-0.7	4.8	3.9	2.9	5.5	-0.8	-1.0	1.7	0.9
	(13.5)*	(-0.6)	(4.7)*	(9.3)*	(12.0)*					
Midnapore	2.5	-0.5	5.0	3.6	2.9	5.6	-1.4	-0.7	1.5	0.9
	(15.3)*	(-0.5)	(5.6)*	9.6*	13.5*					
Howrah	1.8	-0.1	5.1	2.9	2.1	5.2	-2.3	-0.7	1.7	0.7
	(8.7)*	(-0.0)	(4.3)*	(5.7)*	(7.4)*					
Hoogly	1.8	0.3	2.8	2.5	2.0	2.5	-0.2	-0.6	2.2	0.9
	(15.7)*	(-0.4)	(4.2)*	(9.1)*	(12.3)*					
24 Parganas	2.3	1.8	3.1	2.9	2.4	1.3	-0.3	-0.5	1.6	0.9
	(14.5)*	-1.6	(3.2)*	(6.9)*	(9.9)*					
Nadia	2.7	2.4	5.0	3.8	2.7	2.6	-1.2	-1.2	1.4	0.9
	(16.5)*	(2.7)*	(6.6)*	(12.0)*	(14.6)*					
Murshidabad	2.3	0.6	3.1	3.4	2.5	2.5	0.4	-0.9	1.6	0.9
	(17.1)*	-0.7	(4.2)*	(11.3)*	(14.3)*					
West Dinajpur	3.0	-0.8	3.9	4.0	3.5	4.8	0.1	-0.5	2.1	1.0
	(21.2)*	(-1.1)	(5.9)*	(14.5)*	(21.9)*					
Malda	3.2	2.8	3.5	3.5	3.2	0.6	0.1	-0.4	1.5	1.0
	(33.7)*	(4.3)*	(6.0)*	(14.6)*	(22.8)*					
Jalpaiguri	1.8	-2.6	2.1	2.0	2.5	4.7	-0.1	0.4	2.3	0.8
	(9.3)*	(-2.6)*	(2.4)*	(5.5)*	(11.6)*					
Darjeeling	1.7	1.6	1.8	2.9	1.6	0.1	1.2	-1.3	1.6	0.7
	(8.0)*	(-1.1)	(-1.5)	(5.8)*	(5.5)*					
Cooch Behar	2.2	-0.8	2.7	2.2	2.7	3.5	-0.5	0.5	1.7	0.9
	(15.9)*	(-1.1)	(4.3)*	(8.3)*	(17.4)*					
Purulia	2.3	-1.7	4.4	2.9	3.0	6.1	-1.6	0.1	2.3	0.8
	(9.7)*	(-1.1)	(3.2)*	(4.9)*	(8.9)*					
West Bengal	2.3	0.3	3.7	3.3	2.6	3.4	-0.5	-0.7	1.4	0.9
	(19.7)*	(-0.4)	(5.7)*	(11.9)*	(16.5)*					

Source: Calculation based on data collected from various volumes of West Bengal Economic Review, Government of West Bengal.

Note: T stats are shown in parenthesis.

*, ** and ***Significant at 1, 5 and 10 per cent level.

Therefore, the empirical results as depicted above reaffirmed three major observations on agriculture in West Bengal. First, the persistence of stagnation due to negligible growth in agricultural production and productivity from 1970-71 to 1980-

81; second, an overwhelming turnaround from stagnation in agricultural production and productivity in West Bengal since late-eighties. Third, during post-1990 period, the state as well as for the districts growth rates in production and productivity have been declining.

V

AGRICULTURE AND ECONOMY INTERFACE: A FEW CRITICAL ISSUES

For West Bengal, the rise in the growth of agricultural productivity in the eighties, subsequent fall in the nineties and rise in cost of production in post-reform period may have some negative impact on agricultural income, employment and economy at large. And, lack of alternative employment and income opportunities outside agriculture may further complicate the situation. It may lead to possible marginalisation of rural work force.

Taking sectoral share into consideration (Table 3), it is observed that from 1980-81 to 1995-1996, the share of agriculture to GSDP experienced a gradual increase and thereafter it started declining in subsequent years. The decline became sharp since 2000-01. However, contribution of the secondary sector to GSDP failed to surpass the share of primary sector from 1980-81 to 2013-2014 and decline in share

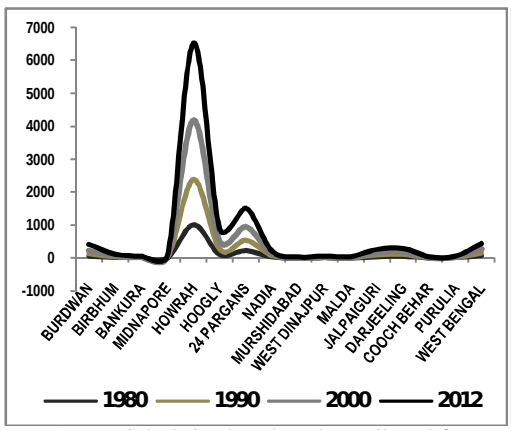
TABLE 3. SHARE OF VARIOUS SECTORS (IN PERCENTAGE) IN GSDP (AT CURRENT PRICES) FROM 1980-81 TO 2013-14

Year/sectors	1980-81	1985-86	1990-91	1995-96	2000-01	2005-06	2009-10	2013-14
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Agriculture	26.0	27.2	26.1	30.1	25.0	19.3	18.9	16.90
Forestry and logging	1.1	1.1	1.0	0.9	0.8	1.1	1.1	1.26
Fishing	3.0	3.5	3.4	3.7	3.8	3.6	3.5	3.54
Mining and quarrying	1.2	1.3	1.2	0.8	1.4	1.3	0.8	1.28
Sub total of primary	31.2	33.1	31.8	35.5	30.9	25.3	24.3	22.98
Manufacturing	21.7	17.9	18.6	15.4	12.7	10.2	9.6	8.28
Registered	12.9	9.9	10.6	8.3	4.9	5.1	4.8	4.45
Unregistered	8.8	7.9	8.0	7.1	7.7	5.1	4.8	3.83
Construction	7.3	7.6	7.0	5.4	5.1	7.5	6.1	5.30
Electricity, gas and water supply	1.0	1.9	1.6	2.0	1.9	2.0	1.9	2.35
Sub total of secondary	30.0	27.3	27.2	22.8	19.6	19.8	17.7	15.93
Transport, storage and communication	4.8	5.9	7.2	7.3	6.5	8.5	8.9	8.91
Trade, hotels and restaurants	11.7	12.4	11.6	13.1	10.8	16.1	15.1	14.87
Banking and insurance	5.0	5.2	5.4	7.4	11.0	6.0	5.7	6.09
Real estate and etc.	8.1	6.7	5.1	4.1	7.6	8.0	9.3	9.83
Public administration	3.0	3.7	4.8	4.2	5.6	5.5	6.0	4.62
Other services	6.1	5.7	6.9	5.6	8.0	10.9	13.2	16.77
Sub total of tertiary	38.7	39.6	41.0	41.6	49.5	55.0	58.1	61.09
Gross state domestic product (gsdp)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100

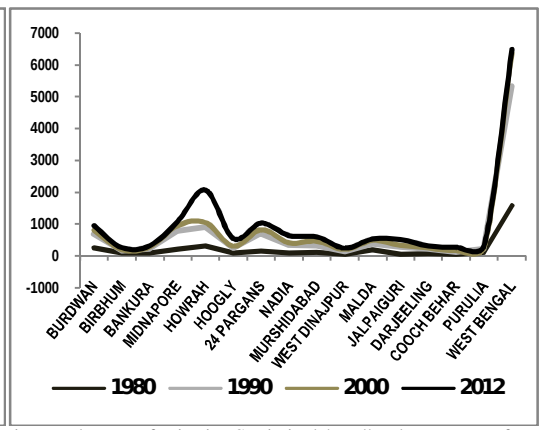
Source: Calculation based on GSDP data collected from Ministry of Statistics and Programme Implementation, Government of India [www.mospi.nic.in] and Department of Planning, Government of West Bengal [www.wbplan.gov.in].

became faster since 1990-91. Within the secondary sector, the secular fall in share of contribution of both registered and unregistered manufacturing sectors has also been observed. It became sluggish during the eighties and picked up during nineties and onwards. Share of registered industries started declining since 2000-01 and from 2005-06 and the share of unregistered industries was also declining sharply. This indicates that the number of units in operation must have declined or closed down during this period.

It is clearly evident from Figure 3, that concentration of registered factories remained high in the districts of Howrah, Hoogly and 24 Parganas. Moderate concentration was observed in Burdwan, Darjeeling and Jalpaiguri. But since 1990, barring the district of Howrah, number of small-scale units registered with Directorate of Micro and Small-Scale Enterprises of the state have declined for all the other districts (Figure 4). Though the number of registered factories per thousand sq-km increased for all the districts of West Bengal, it however remains low in the districts e.g. Cooch Behar, Purulia, Murshidabad, Malda, Nadia, West Dinajpur, Bankura and Birbhum between 1980 and 2012.



Graph 2. District-Wise No. of Registered Factories in Per '000 Sq-Km Area



Graph 3. District-Wise No. of Small Scale Units in Per '000 Sq-Km Area

Source: Calculation based on data collected from various volumes of District Statistical handbook, Bureau of Applied Economics and Statistics, Government of West Bengal.

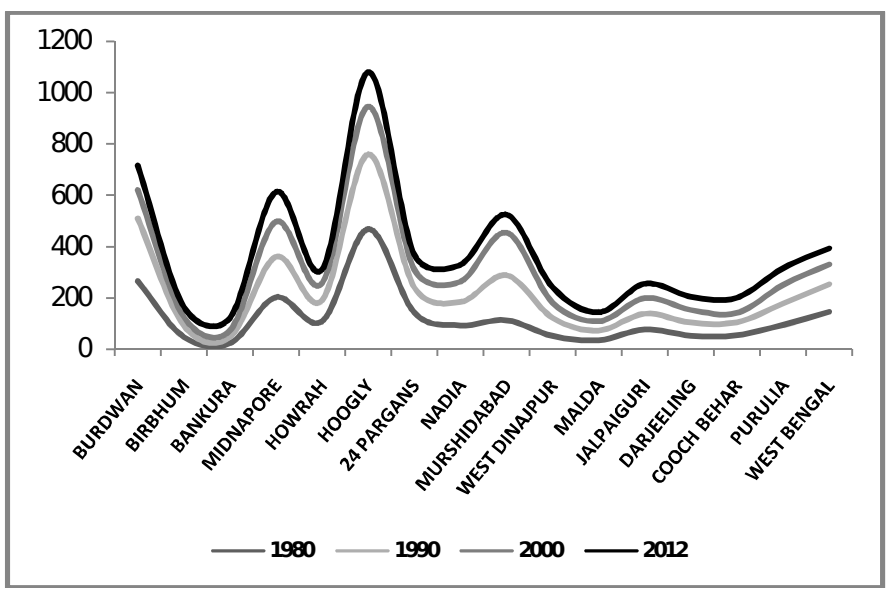
Simultaneously, contribution of manufacturing sector to GSDP declined sharply. Hence, scope of workforce to move from agricultural to industry remained a contentious issue. The major contribution to GSDP is thus coming from the tertiary sector. Within tertiary sector, trade, hotels and restaurant, real estate and other services contributed significantly.

Increase in incidence of land alienation of *pattadars* and eviction of *bargadars* has also been observed in various districts of West Bengal. A study conducted by the State Institute of *Panchayat* and Rural Development observed that by 2001, on an

average, almost 13 per cent of the *pattadars* had lost their land and around 14 per cent of *bargadars* were evicted from their land.

The extent of dispossession widely varied across the districts. More than 30 per cent of the *bargadars* lost possession of their land in relatively backward districts like Cooch Behar, Dinajpur and Jalpaiguri. Land alienation remained high in Dinajpur and South 24 Parganas. Extension of tea estates in North Dinajpur and proliferation of brackish water fish cultivation and appropriation of arable land for such purposes in Sundarban regions of south 24 Parganas were identified as few possible causes, among many, for high incidence of land alienation (West Bengal Human Development Report, 2004: 41).

It has been observed that the number of registered factories increased over the years but average daily employment per factory has substantially declined between 1990 and 2012 for most of the districts (Graph 4). Situation is becoming more complicated with the introduction of economic reform in 1991 that altogether altered the basis of the input supply system facing a farmer. Since, majority of the districts overwhelmingly produces rice (mostly aman as winter crop and boro as summer crop), the rise in input cost bound to affect adversely the small and marginal farmers of the state. Further, the rise in cost of inputs like seeds, fertiliser, irrigation charges have become much sharp in post-economic reform periods (Table 4). Therefore, poor tenants, small and marginal farmers are facing a difficult situation not only in procuring the complementary inputs at affordable prices but also realizing the optimum value for the output produced.



Source: Calculation based on data collected from various issues of West Bengal Economic Review, Government of West Bengal

Graph 4. Per-Factory (Registered) Average Daily Employment.

TABLE 4. AVERAGE INCREASE OF COST FOR RICE PRODUCTION

(1)	CAGR of cost of seed (2)	CAGR of cost of fertiliser (3)	CAGR of irrigation charges (4)	CAGR of cost per acre production (5)
Aman Rice				
1980-81 TO 1989-90	8.04	6.25	6.24	8.01
1990-91 TO 2011-12	14.6	13.18	7.8	15.3
Boro Rice				
1980-81 TO 1989-90	7.25	7.00	8.78	9.98
1990-91 TO 2011-12	18.2	16.6	16.0	15.8

Source: Data on Farm Management, Various Issues, Govt. of West Bengal.

VI

CONCLUSION

In relation to trends in agricultural production and productivity in West Bengal and in her districts, couple of important issues have emerged.

Growth of production and productivity of food grain was primarily driven by rice and increase in yield contributed most to the growth of productivity and production.

As expansion of area in the lower Gangetic region is not virtually possible; therefore, yield expansion is the only alternative to augment production. Failure to do so would make the state vulnerable not only in foodgrain production, but also the economic status of the population.

Absence of large-scale manufacturing sector has elongated industrial backwardness of the state and a secular fall in share of contribution to GSDP of both registered and unregistered manufacturing sectors became a matter of concern. These have reduced the employment opportunities outside agriculture.

Increase of incidence of land alienation of pattadars and increasing eviction of bargardars in the state and her districts has further complicated the agrarian situation. The corroborative inadequacies in thriving for alternative employment avenues in a large extent crippled the economic status of agrarian community of Bengal in post-economic reform.

NOTE

1. To maintain temporal continuity of data, the districts of 24 Parganas, West Dinajpur and Midnapore have been taken as an undivided unit and Kolkata has been excluded in this study because of its non availability of agricultural areas. The erstwhile district of 24 Parganas was split into two districts- South and North 24 Parganas in 1986, West Dianjpur was divided into North and South Dinajpur in 1992 and the district of Midnapore was divided into West and East Midnapore in 2002.

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DIPIKA BASU* AND ARUN KR. NANDI**

Strategies for Viable Profitability of Indian Agriculture: An Empirical Study Based on Reality during Reforms Era

I

INTRODUCTION

Economic viability of farming is considered as one of the core agricultural policy issues in the context of globalisation experiences and economic reforms in India (IJAE, 2013, pp.631). It is recognised that agriculture sector is not only an important source of rural livelihoods but also it ensures food security and this sector has vast potentiality to reduce rural poverty in India. The contribution of agriculture to economic growth and development largely depends on its total factor productivity growth and sustained rise in profitability or farm income. Productivity and profitability of agriculture in turn depends on how effectively and efficiently farmers use agricultural resources to maximise their production and total farm income. One of the important features of Indian farming system is that it is dominated by small and marginal farmers. Marginal and small farms constitute the overwhelming majority of farmers of more than 96 percent in West Bengal during 2010-11. The present study is a modest attempt to explore some clues or answers to the following research questions: (i) What is the pattern and extent of farm profitability of Indian agriculture? (ii) Is farm profitability declining during economic reforms era? (iii) Why are Indian farmers carrying their business with persistent losses? (iv) Are the small and marginal farmers under distress today? (v) What are the factors affecting the farm profitability? (vi) Is farm level productive efficiency a matter to increase profitability? (vii) What are the appropriate strategies or policy-instruments for sustainable profitability of agriculture in India?

The novelty of this paper is that it distinguishes between 'profit earning farms' and 'loss incurring farms' in terms of their resource use efficiency. It follows modern frontier techniques and system approach covering wide ranges of crops and regions in India. The study analyses trends in profitability of Indian agriculture with particular focus on West Bengal paddy during 2000-01 to 2012-13 based on large sample of plot-level (unit) data under cost of cultivation scheme. The paper also analyses plight of marginal farmers. The present study identifies some major concerns of Indian farmers and suggests some innovative strategies for sustainable profitability of Indian agriculture.

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We are very grateful to our respected teacher Prof. Pranab Kumar Chatterjee, Retired Professor of Economics, Kalyani University for his valuable suggestions.

II

ANALYTICAL FRAMEWORK

Let us examine the inter-relationship between productivity, cost and profit of farms. If y_j is the yield rate (per hectare), p_j is the unit price and c_j is the unit cost of the j-th crop then, $(p_j - c_j)$ is termed as unit profit and the profit per hectare from the j-th crop (π_j) is defined as:

$$\pi_j = y_j (p_j - c_j) = y_j p_j - y_j c_j \quad \ldots.(1)$$

That is, net profit per hectare = value of output per hectare – total cost per hectare. The gross profit per hectare = value of output per hectare – total paid-out cost per hectare.

Multiply both sides of (1) by a_j and summing over all j, we get profit from farming system,

$\Sigma a_j \pi_j = \Sigma a_j y_j p_j - \Sigma a_j y_j c_j$, where a_j is the proportion of area under the j-th crop.

Further, c_j (= C_j/Q_j, where C_j = total cost and Q_j = total output of the crop j) is a composite term because C_j includes costs for different fixed and variable inputs (k) as:

$$C_j = \sum_k X_{jk} P_k, \quad \ldots.(2)$$

where X_{jk} = quantity of the k-th input for production of crop j and P_k is price of the kth input.

Therefore, yield rates, rate of input use, input structure, and prices of inputs are the crucial determinants of unit cost (c_j) of production which in turn influence farm profitability.

A profit function relates maximised profits to the prices of products (p_y), prices of inputs (p_1, p_2, ….p_m), and as also to other exogenous variables such as fixed inputs, or agro-climatic characteristics and social variables (say, z_1, z_2,…., z_n) (Sankhayan, 1988, pp. 85-86). In the short run, the producer needs only to maximise variable profits (= sales value of output minus cost of variable inputs), because the opportunity cost of the fixed inputs is zero. The profit function may be written as:

$$\pi = \pi (p_y, p_1, p_2, \ldots. p_m, z_1, z_2, \ldots., z_n) \quad \ldots.(3)$$

It is expected that yield rate and price of product promote profit or farmer's income but farm profitability is inversely related to the price of inputs. Generally, price of output and price of inputs are not under direct control of farmers. With proper selection, combination of input resources and management of crops, farmers can increase productivity and reduce unit cost of production to enhance rate of return

or profit from farming. Again, higher farm income or profitability increases potential investment in agriculture and increase use of modern technology and inputs resulting to increase land productivity. Thus, there is simultaneous relationship between productivity, cost and profitability in agriculture.

It is assumed that there is significant difference between profit earning farms and loss incurring farms in respect of efficient and effective resource utilisation in agriculture. Farm level efficient use of resources is crucial for increase in agricultural production (Farrell, 1957, pp. 253-290). In a study, Lau and Yotopoulos (1971, pp. 94-109) have developed dual profit function model to measure both allocative efficiency and technical efficiency of groups of farms. If increase of price of inputs (particularly imported inputs) is greater than that of price of outputs then cost of production will increase and profit will decrease. Prof. V. S. Vyas (2003, pp.266) has observed that the share of purchased inputs in the input structure has increased significantly over the period of time in Indian agriculture and this is partly due to subsidy policy of the government. But the subsidy induced increase in inputs has not resulted in more efficient use of inputs. He has found that small farms used inputs like fertiliser and irrigation more intensively but because of their meager land base, and low value cropping pattern, activity-mix, and the bias of the supportive systems they are not able to generate enough incomes. M. S. Bhatia (2006, pp. 89-100) pointed out that because of decline in the real minimum support prices and stagnant or marginal change in yield rate along with no spectacular improvement in technology since 1980s in Indian agriculture, the economic condition of the farmers has deteriorated.

III

DATA BASE AND METHODOLOGY

3.1 *Data Base*

The present study is mainly based on plot level summary data on various crops with particular focus on paddy production during 2000-01 to 2012-13. A plot[1] is considered as a unit (farm) of the study. The secondary data are collected from the Directorate of Economics and Statistics, Ministry of Agriculture and Farmers welfare, Government of India (website: http://eands.dacnet.nic.in).

3.2 *Indicators of Farm Profitability*

Following different costs concepts under cost of cultivation scheme (COC), we have considered farm profitability indicators as: (i) Net profit = Surplus (or deficit) over total cost (i.e., Output – C2, where Output = sum of values of 'Main product' and 'By product' and C2 is the total cost of production), (ii) Gross profit = Surplus (or deficit) over paid-out cost (= Output - A2), (iii) Normalised profit= profit per unit

of price, (iv) Percentage of profit (loss) earning (incurring) plots to total number of plots under cultivation, (v) Benefit-Cost Ratio (BCR=Output/C2), (vi) unit profit = price-unit cost of production.

3.3. *Hypothesis and Analytical Tools*

We have considered following hypothesis for the present study:

H1: Farm profitability is declining during reforms era in India.

H2: There is a great variation in farm profitability across size groups of farms, crops, states, and agro-climatic zones.

H3: There is a significant difference in respect of resources utilisation between two groups of farms: profit earning units (PMU) and loss incurring units (LIU).

H4: The probability of profit earning from production of a principal crop (paddy) will be significantly lower due to climate change in agriculture.

H5: Marginal and small farmers are under distress in Indian agriculture.

H6: Price of output, land productivity and farm level resource use efficiency are the crucial determinants of farm profitability in India. Increase in unit cost reduces farm profitability.

In addition to simple analytical approach (Table, Graph and Annual average compound growth rate by using semi-logarithmic stochastic regression equation) we have used following analytical tools to test these hypotheses: simultaneous regression equations (system approach) to assess interrelationship between productivity, cost and profitability, Binary Logit Model and dummy (explanatory) variable regression to examine impact of climate change and time trend on profitability, and two steps frontier regression techniques to examine role of farm level resource use efficiency in increase profitability.

The Logit model is specified as:

$$P_i = P(Y_i = 1) = F(Z_i) = 1/(1+e^{-Z_i})$$

where P_i = probability of $Y_i = 1$ (when farm has earned positive net profit from farming i.e., farm is economically viable), and $(1-P_i)$ = probability that $Y_i = 0$ (when farm has incurred losses (negative net profit) from farming); $F(Z_i)$ = CDF of the logistic function; e= base of natural logarithms; and Z is a predictor variable defined as:

$$Z = \alpha + \sum\beta_k X_k + \gamma T + \theta D,$$

where T represents time period, D represents agro-climatic zone wise dummy variable and X_k represent other explanatory variables.

So, Log $(P_i/1-P_i) = Z_i = \alpha + \sum\beta_k X_{ik} + \gamma T + \theta D$

The marginal effects after logit indicate the rate of change in the probability of the event occurring with respect to a unit change in explanatory variable or change in agro-climatic dummy variable. To examine profitability of West Bengal paddy due to climate change we have defined agro-climatic dummy variable (D) as

D = 1 for climate prone zones (Zone 6-coastal, Zone 2- Terai, Zone 5-Red Laterite)

= 0 for normal zones (zone 3, 4- old and new alluvial zones are considered as base)

Two-steps regression exercise is as follows:

Step 1. Stochastic frontier production function of the following form estimates farm level technical efficiency scores.

Suppose Y_i is the actual output for the ith farm, X_i represents input vector used by farm i and β is a vector of unknown parameters to be estimated. Then, the stochastic production frontier production function can be written as

$$Y_i = f(X_i, \beta) \exp.(\varepsilon_i)$$

where, $\varepsilon_i = v_i - u_i$

Such that $v_i \sim N(0, \sigma_v^2)$, for $-\infty < v_i < \infty$ (Normal distribution) and

$u_i \sim |N(0, \sigma_u^2)|$, for $u_i \geq 0$, (half normal distribution)

The specific model of this function in terms of Cobb Douglas Production function is:

$$\text{Log } Y_i = \text{Log } A + \sum \beta_j \text{ Log } X_{ij} + v_i - u_i$$

Technical efficiency for the i-th farm $(TE_i) = Y_i / Y_i^*$

= actual output/maximum possible output.

$$TE_i = \frac{Yi}{f(X_i, \beta) \exp.(v)} = \exp.(-u_i)$$

Therefore, technical inefficiency of the farm i = $1 - \exp.(-u_i)$

$= 1 - (Y_i / Y_i^*)$,

where Y_i^* is the maximum possible output.

Step 2. Farm level technical efficiency score (TE_i) is used as an explanatory variable in the following profit function:

Profit = f (price, variable input prices, productivity, efficiency (i.e. estimated TE_i), and other shift factors like, technology, agro-climatic zones, farm size).

IV

RESULTS AND DISCUSSION

4.1 *Patterns and Trends in Profitability of Indian Agriculture*

Figure 1 and Table 1 present that there is a great variation in profitability of Indian agriculture in terms of net profit and gross profit across different crops and over different time periods. The study reveals that out of total sample of 32742 plots of different major and minor crops under cultivation during 2012-13, only 61 per cent plots have earned profits (surplus over total cost) and the remaining 39 per cent plots have incurred losses (deficit over total cost) from farming in India. The share of such profit earning plots in total number of plots increases from 51.4 per cent during 2000-01 to 51.4 per cent in 2004-05, and 66.1 per cent in 2010-11. There is a positive growth of number of profit earning units in almost all crops grown during 2000-01 to 2012-13. Thus, on an average, there is an increasing trend in farm profitability in terms of net profit in India.

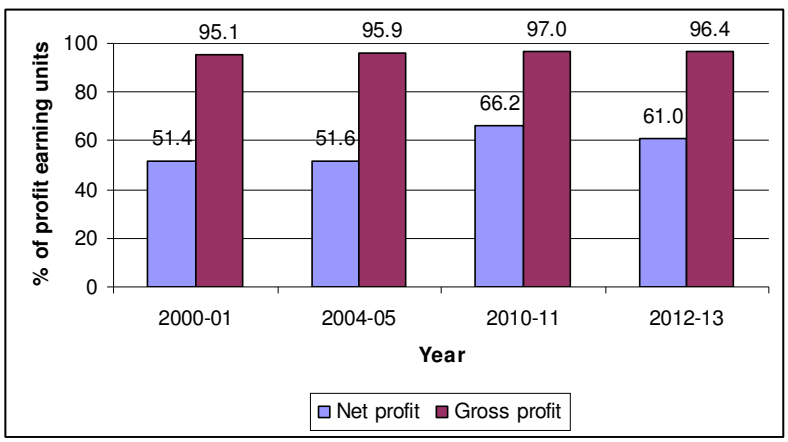

Figure 1. Changes in Profitability of Indian Agriculture, 2000-01 to 2012-13 (in terms of per cent of farms which have earned positive profit from all crops).

TABLE 1. CHANGES IN PROFITABILITY OF INDIAN AGRICULTURE DURING 2000-01 TO 2012-13

	Per cent of farms (plots) have earned positive profit from farming					
Basis	(Net Profit) 2000-01	(Net Profit) 2004-05	(Net Profit) 2010-11	(Net Profit) 2012-13	Growth rate (per cent) 2000-01 to 2012-13	(Gross Profit) 2012-13
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Arhar, Redgram	55.2	53.1	57.3	48.7	-0.5	93.9
Bajra	37.8	41.9	56.9	52.9	3.4	94.9
Barley	56.1	51.9	69.5	74.2	2.8	100.0
Cotton	44.1	60.6	83.9	62.4	3.8	93.9

Contd.

TABLE 1. CONCLD.

	Per cent of farms (plots) have earned positive profit from farming					
Basis	(Net Profit) 2000-01	(Net Profit) 2004-05	(Net Profit) 2010-11	(Net Profit) 2012-13	Growth rate (per cent) 2000-01 to 2012-13	(Gross Profit) 2012-13
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Gram	76.7	64.7	66.5	72.0	-0.5	95.1
Groundnut	32.8	45.5	58.0	57.6	4.8	89.5
Jowar	44.1	44.1	45.9	39.7	-0.5	89.9
Jute	28.6	20.2	78.4	46.0	8.0	99.0
Lentil	65.1	67.2	70.4	70.5	0.7	99.3
Maize	29.5	39.3	54.2	48.7	4.7	94.6
Moong, Greengram	34.8	14.6	45.6	42.9	4.8	93.2
Mustard, Rapeseed	48.6	58.5	65.5	67.7	2.7	96.3
Nigerseed	NA	50.0	43.8	41.9	-2.2	100.0
Onion	66.0	37.0	87.5	85.6	4.3	93.9
Paddy	48.4	44.1	58.0	48.3	0.9	96.9
Pea	NA	31.5	43.8	43.7	4.5	92.0
Potato	57.7	53.9	66.2	52.0	0.1	87.5
Ragi	11.0	17.6	18.8	22.9	5.3	86.2
Safflower	35.7	51.2	40.0	20.0	-4.0	100.0
Sesamum (Til)	33.1	42.9	38.4	48.2	2.1	93.7
Soyabean	45.4	61.8	74.6	91.4	5.4	99.2
Sugarcane	83.4	87.0	91.8	93.1	0.9	99.2
Sunflower	23.1	36.9	49.1	49.2	6.4	92.3
Urad, Blackgram	44.1	31.5	61.8	34.1	0.7	91.7
Wheat	70.3	71.7	84.3	81.4	1.5	98.8
All	51.4	51.6	66.2	61.0	2.0	96.4
(CV)	(38.3)	(36.3)	(29.2)	(35.1)		(4.2)
Sample size (No. of plots)	30314	31853	33525	32742		32742

Note: Net profit = Surplus over total cost, Gross profit = Surplus over paid out cost.

An analysis of farm profitability measured in terms of benefit – cost ratio (BCR) also shows that there is an increasing trend in farm profitability during 2000-01 to 2010-11 (Table 2).

TABLE 2. ANNUAL AVERAGE COMPOUND GROWTH RATE (PER CENT) OF BENEFIT COST RATIO (BCR) DURING 2000-01 TO 2010-11

		LIU		PMU	
States	Crops	Growth rate of BCR	Sd.	Growth rate of BCR	Sd.
(1)	(2)	(3)	(4)	(5)	(6)
Andhra Pradesh	Paddy	0.38	0.034	0.62	0.037
	Sugarcane	-0.10	0.092	0.20	0.071
	Cotton	0.95	0.094	0.24	0.087
	Groundnut	-0.04	0.052	-0.16	0.074
	Jowar	1.43	0.061	0.79	0.121
	Maize	0.55	0.058	-0.12	0.076
	Moong, Greengram	1.01	0.059	0.06	0.117
	Ragi	5.66	0.150	-0.57	0.051
Gujarat	Cotton	1.84	0.061	1.81	0.169

Contd.

TABLE 2. CONCLD.

States	Crops	LIU		PMU	
		Growth rate of BCR	Sd.	Growth rate of BCR	Sd.
(1)	(2)	(3)	(4)	(5)	(6)
Maharashtra	Sugarcane	-1.27	0.047	2.54	0.241
Punjab	Paddy	0.68	0.040	1.12	0.113
	Wheat	0.65	0.039	0.68	0.073
	Cotton	2.94	0.098	1.38	0.092
Rajasthan	Mustard, Rapeseed	2.38	0.070	1.08	0.122
Uttar Pradesh	Paddy	0.78	0.027	1.75	0.103
	Potato	1.46	0.057	2.02	0.161
	Sugarcane	-0.03	0.066	2.42	0.275
	Wheat	0.51	0.018	1.10	0.088
	Mustard, Rapeseed	0.44	0.046	0.85	0.080
	Maize	1.75	0.050	0.10	0.087
	Masur, Lentil	0.64	0.060	1.39	0.198
West Bengal	Paddy	0.56	0.020	0.62	0.036
	Jute	0.71	0.033	2.89	0.154
	Potato	0.97	0.098	0.29	0.058

Source: Same as Table 1.

Note: sd = Standard deviation. LIU=Loss incurring units, PMU= Profit making units.

There is significantly positive growth rate of profitability indicator of benefit-cost ratio (BCR) in all crops except in sugarcane, groundnut, ragi and maize during this period. A close perusal of Standard Deviation (sd) value of BCR shows that there is a year-wise fluctuations in farm profitability particularly in production of sugarcane, potato, jute, pulses and course cereals which may be due to inherent nature of Indian agriculture (largely depends on agro-climatic conditions), inefficient farm resource use, lack of controlled irrigation facilities, shortage of investment and support systems including effective marketing system, lack of proper agricultural development policies, and impact of globalisation. What is alarming is that the gap between profit making farms (PMU) and loss incurring farms (LIU) is found to be increasing in Indian agriculture which is observed from an analysis of differential growth rates of BCR. Thus, overall impression regarding farm profitability of Indian agriculture is not satisfactory.

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growth rates of BCR. Thus, overall impression regarding farm profitability of Indian agriculture is not satisfactory.

In case of paddy (other than Basmati) production, there is a deficit over total cost (negative net profit) in most of the plots under cultivation during study period (for example, 56 per cent of paddy plots in 2004-05 and during 2012-13 it is about 52 per cent). The share of loss incurring units in total production units varies significantly across states: from about 7 per cent in Punjab and Haryana to 85.4 per cent in Assam; 75.4 per cent in Jharkand, 70.9 per cent in Orissa, 69.7 per cent in West Bengal, 59.1 per cent in Uttarakhand, and 58.2 per cent in Bihar during 2012-13 (Table 3). This is a serious concern of the government or policy makers particularly in the context of sustainable agriculture, food security and regional inequality. There is an urgent need of reduction of number of loss incurring farm units. Naturally, the question may arise that why Indian farmers are continuing their farming even with such huge losses in terms of net profit. Reasons may be: (i) farmers have earned gross profit i.e., surplus over paid out cost (last column of Table 1), (ii) agriculture is mostly self-employed enterprise. The share of labour cost still remains at about 53 per cent of total operational cost of paddy even after WTO while the cost of machine use increases from 6.2 per cent in 1996-97 to 13.5 per cent in 2010-11 (Table 4). (iii) low opportunity cost of family labour, (iv) expectation – farmers expect to earn positive net profits from other plots of the same crop or different crops, and (v) lack of alternative avenues to the farmers. It is very unfortunate that Indian farmers have also experienced with negative gross profit (that means they did not recover even

TABLE 3. VULNERABILITY OF PADDY PRODUCTION IN TERMS OF LOSSES BY STATES

	Per cent of loss units (plots) to total plots			
States	2012-13	2010-11	2004-05	2000-01
(1)	(2)	(3)	(4)	(5)
Andhra Pradesh	25.2	36.6	27.0	34.1
Assam	85.4	52.3	71.2	49.6
Bihar	58.2	43.5	62.1	57.1
Chhattisgarh	14.5	18.3	29.2	
Gujarat	41.4	5.7		
Haryana	7.1	5.5	26.7	
Pradesh	43.1	30.2		
Jharkand	75.4	85.8	78.7	
Karnataka	26.3	42.3	50.3	36.6
Kerala	23.2	30.2	53.4	38.7
Madhya Pradesh	8.5	30.4	59.7	61.9
Maharashtra	41.9	87.4		
Orissa	70.9	58.4	60.5	55.2
Punjab	7.0	8.2	14.9	23.4
Tamil Nadu	26.0	37.8	51.3	47.7
Uttar Pradesh	39.1	30.7	57.3	52.0
Uttarakhand	59.1	14.5		
West Bengal	69.7	47.1	64.6	66.0
All India	51.7	42.0	55.9	51.6
Sample size	11891	12253	11675	12695

Source: Same as Table 1.

Note: Loss = deficit over total cost.

paid-out cost from farming; for example, 13 per cent plots of potato in 2012-13 to 23 per cent plots of onion in 2004-05) resulting to persistent indebtedness and undesirable incidences like, farmers' suicide in Indian agriculture.

TABLE 4. CHANGES IN INPUT STRUCTURE OF PADDY PRODUCTION IN INDIA

	1996-97*		2004-05		2010-11	
	Input share (per cent) in total operational cost of paddy production					
Inputs	Mean	CV	Mean	CV	Mean	CV
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Human Labour	53.0	17.7	49.1	20.5	53.1	14.1
Machine	6.2	75.6	9.1	61.0	13.5	45.8
Fertiliser	11.2	40.7	9.9	39.1	8.2	34.6
Irrigation	4.4	121.8	5.7	108.7	3.6	103.4

Source: Estimated from state level aggregated data
Note: CV = coefficient of variation (per cent).

The changes in prices of input and output of paddy in India during reforms era are shown in Table 5 and Table 6. Increase in price of inputs is found to be greater than that of price of output during post-WTO period. The growth rate of Minimum Support Price (nominal MSP) of different crops is estimated to be declined during post-WTO period as compared with pre-WTO period. Real growth of MSP may be found negative (due to spiral effects of general price inflation) in some cases. Government policy of supply of food at a cheaper rate may lower market price of food grains. But Indian farmers are the net sellers and they will be most sufferers. One the one hand, lower output price (due to ineffective agriculture marketing system, lack of proper implementation of MSP at the appropriate time and level) and on the other hand, high cost of labour along with (farm) labour scarcity (particularly due to impact of MGNREGA and food security policy), increasing cost of irrigation, seeds, pesticides, and requirement of higher dose of fertiliser without soil testing, etc. (i.e., the policy of openness to input markets but restricted output market) are making agriculture as unprofitable business among Indian farmers. Such uneven changes in input prices and output prices in Indian agriculture is one of the important factor responsible for slow progress of farm profitability and high incidences of farmers' indebtedness, rural poverty resulting to Indian farmers quit from agriculture or even worse 'quit their lives'.

TABLE 5. CHANGES IN UNIT PRICES OF INPUTS AND OUTPUT OF PADDY IN INDIA AFTER WTO
(BASE: 1996-97=100)

Rate per unit (Rs.)	1996-97	2004-05	2010-11
(1)	(2)	(3)	(4)
Seed (kg.)	100	131	247
Fertiliser (kg. nutrients)	100	121	139
Manure (qtl.)	100	142	231
Human labour (man Hrs.)	100	139	291
Animal labour (pair Hrs.)	100	196	368
Price-implicit rate (Rs./qtl.)	100	121	231

Source: Estimated from data under cost of cultivation scheme.

TABLE 6. GROWTH OF MSP DURING PRE-WTO AND POST-WTO PERIODS

MSP	Growth (per cent) 1985-2014	Growth (per cent) 1985-1995	Growth (per cent) 1996-2014
(1)	(2)	(3)	(4)
Paddy common	8.1	11.0	7.5
Coarse cereals	8.3	9.9	8.0
Wheat	8.1	10.4	6.8
Gram	8.7	11.7	8.1
Arhar (Tur)	9.3	11.6	9.8
Moong	9.8	11.6	10.6
Urad	9.6	11.6	10.2
Sugarcane	8.8	10.5	8.7
Cotton	7.2	10.4	6.0
Jute	8.3	9.6	8.4
Groundnut(in shell)	8.0	11.1	8.2
Soyabean black	7.6	10.5	7.8
Soyabean yellow	7.2	10.4	7.1
Sunflower seed	7.8	12.3	8.2
Rapeseed mustard	7.1	9.2	6.9
Safflower	7.0	8.5	6.8

Source: Estimated from data, RBI website statistics (time series).

4.2 *Plight of marginal farmers in India*

An analysis of incidence of loss units from farming across size groups of farms reveals that there is a positive relationship between farm size and profitability of Indian agriculture (Figure 2 and Figure 3). The incidence of loss units is found to be highest among marginal farmers (holding land below one hectare) during 2012-13 (50.7 per cent of plots of all crops and 64.3 per cent of paddy plots of marginal farmers). Table 7 presents productivity, profitability and resource use patterns across size groups of paddy plots between the two groups of farms: loss units (LIU) and profit units (PMU). It is observed that: (i) there is a very high incidence of losses (68.4 per cent) in the size group of plots of below 0.5 hectare of land, and (ii) there is significant difference between the groups of loss units and profit units in respect of productivity, profitability, price of output, quantity and quality of inputs use in paddy production during 2012-13. It is important to note that yield rate and the rate of gross profit may not be so low for marginal farmers because they have use resources (irrigation, manure) intensively with more family labour as compared to others. The mean technical efficiency score of paddy in West Bengal is estimated as high as 0.902 during 2012-13. Mean efficiency score for the loss units is estimated as 0.881 compared with 0.957 for the profit earning units. Efficiency is essential for their survival; they have no choice. The farm size group wise mean efficiency scores are found to be: Marginal farmers (0.866), Small (0.901), Semi-medium (0.904), Medium (0.947), and Large farmers (0.950). The plight of a farmer depends not only on his rate of earning per hectare or efficiency but also on the area of land holdings at his disposal (average size of holding for marginal farmers is only 0.39 hectare in India and 0.49 hectare in West Bengal as per Agricultural Census of 2010-11). Their

size holding is so low that even their total farm income may not exceed existing poverty line income. In India, the number of agricultural workers increases from 27.3 million (28.1 per cent of rural population) in 1951 to 144.3 million (54.9 per cent) in 2011, and the number of cultivators decreases from 127.3 million (54.4 per cent) in 2001 to 118.7 million (45.1 per cent) in 2011 (Pocket book on Agricultural Statistics, 2013). Increasing marginalisation may jeopardise the prospect of Indian agriculture.

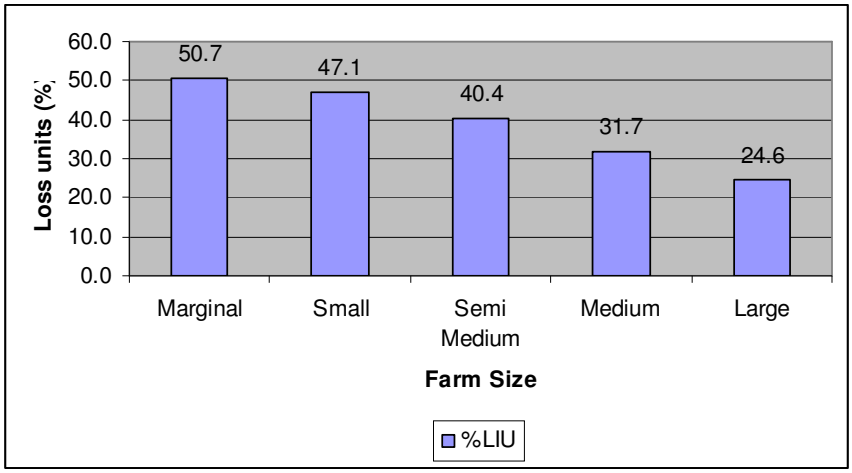

Figure 2. Incidence of Loss units by farm size groups, all crops, India, 2012-13 (sample size = 32742)
(per cent of Loss units (LIU) to total units)

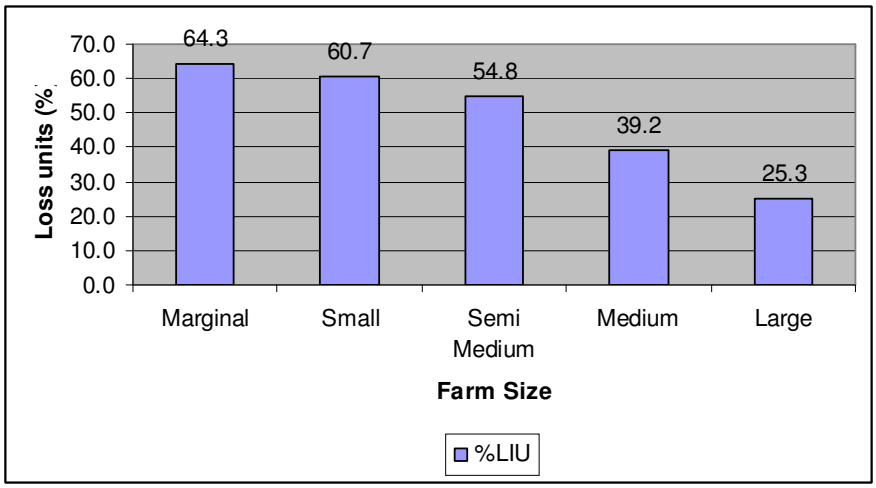

Figure 3. Incidence of Loss units by farm size groups, Paddy, India, 2012-13 (sample size = 11891) (per cent of Loss units (LIU) to total units).

TABLE 7. PLIGHT OF MARGINAL FARMERS (PLOTS) IN TERMS OF PROFITABILITY AND RESOURCE USE PATTERNS IN PADDY, 2012-13

	Size groups of paddy plots in hectare			
	Below 0.5 ha	0.5 -1 ha.	1ha and above	Total
(1)	(2)	(3)	(4)	(5)
Items (mean)	Loss incurring units (LIU)			
Yield (qtls/ha)	33.6	29.6	28.2	31.9
Price (Rs./qtl)	1075.6	1019.0	1024.1	1054.5
Unit cost (Rs.)	1540.3	1351.2	1295.2	1462.3
Rental (Rs/ha)	10106.4	8768.5	8662.0	9584.0
Unit profit (Rs.)	-464.7	-332.2	-271.1	-407.8
Gross profit/ha (Rs.)	18409.5	13630.6	10207.1	16232.5
Net profit/ha (Rs.)	-13268.4	-7869.9	-6353.3	-11049.4
Irrigation exp/ha (Rs.)	1741.1	858.3	592.0	1376.3
Manure (kg/ha)	18.5	14.2	8.6	16.3
Machine hrs/ha	9.2	8.9	11.5	9.3
Bullock hrs/ha	100.5	107.5	58.1	98.1
Per cent of family labour	54.9	43.3	30.0	49.1
Insecticides (Rs/ha)	404.8	308.9	602.2	398.1
	Profit making units (PMU)			
Yield (Qtls/ha)	43.4	42.9	47.9	44.9
Price (Rs./Qtl)	1314.8	1256.6	1334.5	1302.8
Unit cost (Rs.)	1033.5	951.0	927.7	967.7
Rental (Rs/ha)	13697.8	13735.3	16923.1	14887.4
Unit profit (Rs.)	281.3	305.7	406.7	335.1
Gross profit/ha (Rs.)	38773.3	36164.4	42923.9	39429.6
Net profit/ha (Rs.)	12639.1	13865.5	20257.4	15823.6
Irrigation exp/ha (Rs.)	1762.5	1285.9	1216.0	1406.1
Manure (kg/ha)	14.4	14.9	11.6	13.5
Machine hrs/ha	11.2	11.4	13.1	12.0
Bullock hrs/ha	37.1	37.5	16.8	29.8
Per cent of family labour	44.1	35.9	28.3	35.7
Insecticides (Rs/ha)	716.7	737.7	1449.2	991.0
Per cent of LIU	68.4	47.6	23.0	51.7

Source: same as Table 1.
Note: LIU= loss units.

Within West Bengal, agro-climatic zone wise profitability analysis shows that there is a high rate of incidence of losses from paddy production in the Coastal and Saline Zone (88.8 per cent), Terai Zone (79.9 per cent) and Red and Laterite zone (69.7 per cent) during 2012-13. Climate change in agriculture is an important factor to explain variation in production, productivity and profitability of Indian agriculture (Basu and Nandi, 2015). Table 8 reveals that on an average, only 25.7 per cent farms under coastal saline zone have earned profit and remaining 74.3 percent have incurred loss from paddy production during 2000-01 to 2012-13. In case oilseeds (Mustard and Rapeseed) the profit earning units are estimated to be only 15.6 per cent in coastal zone 6. Terai zone 2 and Red and Laterite Zone 5 have also experienced with great economic failure of agricultural resources utilisations in wheat, Jute, potato, mustard and rapeseed, and paddy production. Thus, area specific and crop-wise proper plan of farming is important to reduce number of loss units in agriculture. Increase in the well being of the farming community seems to require that the number

of marginal farmers be reduced mainly by absorbing a substantial portion of them in more remunerative non-agricultural occupations, to be promoted not by taking away productive agricultural land but by developing agro-based industries and production of mass consumption goods by the mass in the vicinity of rural areas.

TABLE 8. PERCENTAGE OF UNITS INCURRED LOSSES FROM FARMING IN WEST BENGAL (DURING 2000-01 TO 2012-13)

Agr-climatic zones	Paddy	Mustard, Rapeseed	Potato	Jute	Wheat
(1)	(2)	(3)	(4)	(5)	(6)
Zone1-Hill	---	---	---	---	---
Zone2-Terai	69.8	76.1	44.3	56.0	78.6
Zone3-Old Alluvial	58.0	37.8	36.7	47.9	68.3
Zone4-New Alluvial	57.9	66.0	53.2	57.6	84.4
Zone5-Red and Laterite	64.0	75.8	62.9	76.4	96.1
Zone6-Coastal Saline	74.3	84.4	49.5	---	---
West Bengal	62.9	55.0	50.7	51.2	77.8

Source: Same as Table 1.

The regression results (Binary Logit model: =1 for profit and =0 for loss units) on West Bengal paddy across different agro-climatic zones are summarised in Table 9. We have observed that the probability of profit earning from paddy production decreases about 4.5 per cent in the climate prone zones as compared to normal alluvial zones due to climate change (coefficient of climate dummy (D) is estimated as -0.338 and marginal effect = dy/dx = -0.045). It is observed that as farm size and yield rate increase, probability of profit earning from farming will increase about 14.6 per cent and 0.35 per cent respectively, but increase in unit cost may decrease 0.16 per cent profitability of agriculture. The positive coefficient of time variable (2000-01 to 2012-13) signifies that there is a potentiality to increase profit from paddy farming in West Bengal at about 9 per cent per year.

TABLE 9. REGRESSION RESULTS ON PROFITABILITY OF PADDY IN WEST BENGAL (BINARY LOGIT MODEL: Y= 1 FOR PROFIT AND 0 FOR LOSS IN PADDY PRODUCTION)

Explanatory variables	Coef. (marginal effects)
(1)	(2)
Area	1.082 (0.146)
Yield	0.026 (0.0035)
Unit cost	-0.012 (-0.0016)
Time trend (T)	0.683 (0.0923)
Constant	1.939
Agro-climatic dummy (D)	-0.338 (-0.045)
Pseudo R^2	0.447
No. of Obs.	29332

Note: All coefficients are statistically significant (p- value= 0.000). D= 0 for normal alluvial zones and D= 1 for Climate prone zones.

4.3 *Determinants of Farm Profitability*

Results of *three stage least-squares regression* of productivity (yield rate), cost (unit cost of production) and profitability (benefit-cost ratio) of agriculture based on

686 plot level data on paddy production in West Bengal during 2012-13 are summarised in Table 10. It is found that: (i) productivity and profitability increases with farm size but unit cost of production decreases with farm size significantly, (ii) Use of improve variety seeds, machine use, irrigation promote land productivity (yield rate) significantly along with the use of labour and chemical fertiliser, (iii) Dummy variable (Dbcr = 0 for loss units and 1 for profit earning units) in productivity equation signifies that there is significant difference between loss units (LIU) and profit rearing units (PIU) in respect of resource (land) utilisation. The

TABLE 10. DETERMINANTS OF PRODUCTIVITY, UNIT COST AND PROFITABILITY OF PADDY (WEST BENGAL, 2012-13) THREE-STAGE LEAST-SQUARES REGRESSION RESULTS

		Coef.	z	P > z
Endogenous variables	Exogenous variables	(Number of obs = 687)		
(1)	(2)	(3)	(4)	(5)
1. lyld				
(productivity)	zcode	-0.022	-1.9	0.054
R-sq = 0.281	sg	0.021	2.4	0.016
	lhlabph	0.086	2.5	0.013
chi2 =277.3	lmachph	0.023	2.3	0.022
	lfertph	0.031	1.7	0.087
P = 0.000	ltirrrsph	0.013	2.9	0.003
	variety	0.010	8.0	0.000
	Dbcr	0.241	13.1	0.000
	_cons	2.385	9.3	0.000
2. luc				
(unit cost)	zcode	0.022	2.1	0.040
R-sq=0.527	sg	-0.022	-3.0	0.003
	lplab	0.357	11.5	0.000
chi2=785.4	lpmach	0.011	1.2	0.239
	lpfert	0.081	1.7	0.085
P=0.000	lyld	-0.690	-19.7	0.000
	lossnf	-0.048	-3.5	0.000
	_cons	8.338	42.1	0.000
3. lbcr				
(profitability)	zcode	-0.048	-4.9	0.000
R-sq=0.654	sg	0.012	1.7	0.089
	lplab	-0.325	-12.6	0.000
chi2=2010.2	lpmach	-0.006	-0.7	0.485
	lpfert	-0.009	-0.2	0.820
P=0.000	lyld	0.382	6.6	0.000
	ltec	0.013	3.8	0.000
	lprice	0.793	29.2	0.000
	leff	0.615	5.5	0.000
	_cons	-5.849	-17.4	0.000

Source: Same as Table 1.

Note: l stands for log.

Endo. Variables: yld = yield rate, uc = unit cost, bcr=benefit-cost ratio (=O/C2)

Exo. Variables: zcode= zone code (terai-2, old alluvial-3, new alluvial-4, Red laterite-5, coastal & saline-6). sg= size groups of farms (marginal-1, small-2, semi-medium -3, medium-4, large-5)., hlabph, machph, fertph, and tirrrsph are the per hectare inputs use of human labour (hrs), machine (hrs), chemical fertiliser (kg) and irrigation (Rs.) respectively. Variety= seeds variety code (local-10, improve-50, hybrid-60).

Dbcr= dummy variable defined as 0 for loss units (BCR<1) and 1 for profit units (BCR>1).

plab, pmach, pfert are the input prices of labour, machine and fertiliser respectively.

price=price of output, eff= efficiency score, tec=technology (ratio of machine use to labour use).

estimated dummy variable coefficient of 0.241 implies that yield rate would have increased about 24 per cent if there were no loss units in paddy production, (iv) Increase in yield rate reduces unit cost of production but average wage rate, and price of chemical fertiliser increase unit cost significantly, (v) the analysis of partial elasticity coefficients of profit function reveals that price of output (0.793), farm level resource use efficiency (0.615), land productivity (0.382), and technology use i.e, farm mechanisation (0.013) have played significant role to improve profitability of agriculture. On the other hand, increase in average wage rate significantly reduces farm profitability to the extent of 32.5 per cent.

V

CONCLUSION AND POLICY IMPLICATIONS

Economic viability of India agriculture in terms of profitability is considered as one of the key policy issues, today. On the basis of plot level data under cost of cultivation scheme, the present study has estimated that 61 per cent farms (plots) have earned profits and the remaining 39 per cent farms have incurred losses from farming of different crops during 2012-13 in India. In case of paddy, the share of loss incurring units in total number of plots is estimated as high as 52 per cent for the country and such rate of loss units varies significantly from about 7 per cent in Punjab and Haryana to 70 per cent and above in Assam, Jharkand, Orissa, and West Bengal. There is a palpable indication of increasing farm profitability during 2000-01 to 2012-13 with some degree of instability. Farm profitability also varies significantly across crops, states, farm sizes, and agro-climatic zones. The incidence of losses from farming is observed quite high among marginal farmers and small farmers as well as in climate-prone zones. A significant number of farms even experiences with deficit over paid-out cost in almost all crops resulting to persistent indebtedness and undesirable incidences among Indian farmers. There is no rational use of existing resources to maximise profit in Indian agriculture. Decreasing size of cultivated plots and increasing marginalisation may jeopardise the prospect of Indian agriculture and aggravate rural poverty. The gap between profit earning farms and loss incurring farms in respect of resource utilisation in agriculture is increasing during the reforms era. This is a matter of grave concern. There is an urgent need of reduction of number of loss incurring units in agriculture.

Increase in yield rate reduces unit cost of production but average wage rate, and price of chemical fertiliser increase unit cost significantly. Increase in unit cost of production and average wage rate significantly reduces farm profitability. Price of output, farm level resource use efficiency, land productivity, and farm mechanisation have played significant role to improve profitability of agriculture. Farm mechanisation, effective use of water resources and use of improved variety seeds enhance land productivity which in turn increase profitability. Enhancement of yield rate in a system of multiple cropping is crucial for increase in farm profitability. An appropriate strategy should be evolved to reduce unit cost of production and increase

land and labour productivity. Organic farming that has employment generating potentiality may be developed. The choice of remunerative cropping pattern is another significant aspect of increase in farm income. Effective agricultural marketing system should be developed so that farmers get incentive price and consumers pay fair price. The farmers may also get higher income even at stable price if an appropriate productivity increasing low cost technology can be evolved through the intensive research and investment in agriculture. Viable extraction of 'by-products' is another option to increase farm profitability. Agro-based industries of production of mass consumption goods in and around rural areas should be developed. Sustained growth of agricultural output is very crucial for sustainable profitability and stable rate of labour absorption in agriculture. Since yield rate of traditional crops in Indian agriculture reaching a plateau in most of the areas and wage rate is very much sensitive to the standard of living of rural people, then the agricultural development policies should be directed to minimise unit cost of production and increase land and labour productivity through multi-pronged strategies: expansion of irrigation facilities and effective use of water resources, implementation of suitable farm mechanisation, efficient use of existing resources, reduction of use of high cost chemical technology, development of organic farming, expansion of agricultural extension services and credit facilities, enhancement of production and utilisation of 'by products', area-specific appropriate selection and combination of multiple crops, and by ensuring free mobility of agricultural inputs and products through the development of rural infrastructures and agricultural support systems, strengthening linkages to non-farm sectors of the economy, and to promote effective agricultural marketing facilities at both domestic and international levels.

NOTE

1. A plot is a part of a parcel devoted to one activity. A parcel is one piece of land with identical tenure and physical characteristics (vide, Manual on Cost of Cultivation Surveys).

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Agriculture Diversification in India: Pattern and Determinants

I

INTRODUCTION

The Indian economy has undergone wide structural changes over time with the anticipated decline in the share of agriculture in its GDP. Despite a fall in its share from 56.53 per cent in 1950-51 to 14.0 per cent in 2012-13, agriculture still continues to be the main sector of Indian economy as it provides livelihood to majority of the people. Average number of Indians still spends almost half of their total income on food, while roughly half of India's work force is still engaged in agriculture for their livelihood. The global experience of growth and poverty reduction shows that GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture. Agriculture is and will continue to be the engine of the national growth and development.

Agricultural policies in the past have witnessed a series of interactive changes following the economic reforms during 1990s that marked significant departure from the past. Though many of the reform process were not initiated to directly affect the agriculture sector, it was affected indirectly (Chand, 2004). A sustained economic growth, rising per capita income and growing urbanization are apparently causing a shift in the consumption patterns in favour of high value food commodities like fruits, vegetables, dairy, poultry, meat and fish products from staple food such as rice, wheat and coarse cereals (Haque *et al.,* 2010). Further it has also been suggested that India should diversify its agriculture and get a foothold in the world market (Radhakrishna and Reddy, 2004). The diversified and accelerated agricultural growth would enhance the food security by improving the purchasing power of the poor in the perplexing situation of shrinkage in agricultural holdings, declining new investments in agriculture and increasing degradation of natural resources (Joshi *et al.,* 2004). This study basically aims at analysing the trends and patterns of agricultural diversification and its determinants in India.

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II

METHODOLOGY

Data base: The study is entirely based on both secondary collected from different departments/agencies/publications relating to different variables/parameters. The data were collected for the 1950-51 to 2012-13.

Analytical tools: Agricultural diversification was gauged from share of various sub-sectors in GDP as well as total value of output from agriculture & allied activities and cropping pattern. Further, the Simpson Index (SID) was also calculated to find the extent of diversification.

Several factors can induce a shift in the crops grown. On the supply side, diversification is influenced by improvement in infrastructure: (roads and markets) and technology (Joshi *et al.,* 2007). These factors and the speed with which the changes occur vary under different situations (Vyas, 1996). In the innumerable studies on crop-acreage response; infrastructure, technology and institutions are important non-price factors that influence acreage under a crop. Though there are numerous infrastructures, that affect acreage under a crop, network of road is one of the most important factors. Technology has different dimensions among which intensive agricultural practices is the most important while assured irrigation is important for the adoption of intensive agricultural practices.

Since, the results of Simpson Index indicated that there is no variability in the index, the percentage of area under non foodgrain crops in gross cropped area (NON FOODGRAIN) was regressed on intensity of irrigation is percent of gross irrigated to gross sown area (IRIP), percentage of electrified villages (VE), size of holding nn ha (SIZE), percentage of marginal and small holdings in total holdings (SMH), number of regulated markets/1000ha gross cropped area (MARKET), per capita income (PCA) and length of rural road (km) per km of geographical area (ROAD).

III

RESULTS AND DISCUSSION

Growth in Agriculture

During the pre-green revolution period, from independence to 1967-1968, and green revolution period from 1968-69 to 1980-81, the agricultural sector has grown at an annual average of around 2 per cent (Table 1). The major driving forces during the pre-green revolution period were land reforms and the infrastructural development such as irrigation, road, etc. while during green revolution these were high-yielding varieties of major cereals, viz. wheat and rice. The growth rate picked up to 3 per cent during post green revolution period from 1981-82 to 1990-91 which was characterised by input intensification period and the major policy reformers increased the supply of agricultural inputs such as chemical fertilisers and pesticides,

development of major and minor irrigation facilities, introduction of minimum support prices for major crops, and provision of agricultural credit (Acharya, 1998). Thereafter, the sector increased nearly at the rate of around 4 per cent/annum, except during IX Plan.

TABLE 1. AVERAGE GDP GROWTH RATE OF AGRICULTURE AND OTHER SECTORS (AT 2004-05 PRICES)

(*per cent/annum*)

Periods	Agriculture and allied sector	Crop and livestock	Total economy
(1)	(2)	(3)	(4)	(5)
Pre-green revolution	1951-52 to 1967-68	2.05	2.03	3.70
Green revolution period	1968-69 to 1980-81	2.01	2.23	3.67
Wider technology dissemination period	1981-82 to 1990-91	3.10	3.18	3.67
Early reform period	1991-92 to 1996-97	4.13	4.15	3.68
IX plan	1997-98 to 2001-02	3.23	3.21	6.05
X plan	2002-03 to 2006-07	4.19	4.60	8.46
XI plan	2007-08 to 2011-12	3.78	3.92	7.93

Source: Estimated from National Accounts Statistics, Government of India.

An important feature of progress in agriculture is its success in eradication of its critical dependence on imported foodgrains. During pre-green revolution, India was a net importer of foodgains. During the 1960's, more than seven percent of the total availability of foodgrains had to be imported and the situation was further worst in two severe drought years i.e. 1966 and 1967. But today our country is a net exporter of the foodgrains. The foodgrain production increased to nearly five times during the last six decades and touched all time high of around 260 million tonnes during 2012-13 (Table 2). Similarly, the oilseed, cotton and sugarcane production increased by six times while, jute and mesta by 3.4 times during the reference period. The production of oilseeds has drastically increased from 1990's.

TABLE 2. AGRICULTURAL PRODUCTION IN INDIA

Year	1950/51	1960/61	1970/71	1980/81	1990/91	2000/01	2012/13
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Foodgrains	50.83	82.02	108.42	129.59	176.39	196.81	255.36
Oilseeds	5.16	6.98	9.67	9.37	16.61	18.44	31.01
Cotton	5.88	5.6	4.8	7.01	9.84	9.54	34.00
Sugarcane	57.05	100.00	126.20	154.25	241.04	296.55	338.96
Raw jute and mesta	3.31	5.3	6.2	8.16	9.23	10.50	11.30

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Government of India.

Sectoral Composition of Agriculture

The composition of income from agriculture and allied sector of economy has changed during the last six decades. A temporal comparison of various constituents of agricultural income at 2004-05 prices shows that after the 1980s, share of livestock is continuously increasing. As a result of high growth, livestock now accounts for around 1/3rd of agricultural (crop and plantation) output which was less than 20 per

cent initially. The contribution of fisheries has been 1.71 to 5.39 per cent during the reference period. Forestry, another sub-sector of agriculture presents an opposite picture. In absolute terms also, livestock and fishery sectors have increased much faster than the others sectors. During 1950-51 to 2012-13, livestock increased by nearly seven times from Rs. 37880 crore to Rs. 261771 crore and fishery by 15 times from Rs. 2732 crore to 41222 crore as against merely two times increase in forestry sector during the concerned period (Tables 3A and B). This clearly indicates diversification towards the livestock and fishery sector in terms of income contribution. In a study, Singh *et al.* (2006) also found the same observations.

TABLE 3A. VALUE OF SELECTED AGGREGATED OF AGRICULTURE SECTOR IN INDIA
(AT 2004-05 PRICES)

(*Rs. Crore*)

	Value of output		Gross Domestic Product				
Period	Crop	Livestock	Agriculture	Forestry	Fisheries	Agriculture and allied sector	Aggregate economy
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1950-51	118540	37880	116959	40107	2732	159798	279618
1960-61	166206	44061	161708	41175	4647	207530	410279
1970-71	212947	47467	201455	55499	6572	263526	589787
1980-81	262541	68093	238102	50513	8646	297260	798506
1990-91	345678	108489	336176	52061	14959	403196	1347889
2000-01	429505	156050	439432	58836	24487	522755	2348481
2010-11	579233	240166	610905	70509	36400	717814	4918533
2011-12	609352	251831	643543	71816	38473	753832	5247530
2012-13	609126	261771	649424	73864	41222	764510	5482111

Source: National Accounts Statistics.

TABLE 3B. COMPOSITIONAL CHANGES IN AGRICULTURE AND ALLIED SECTOR (SELECTED RATIONS)

	Ratios of value of output		Ratios of gross domestic product			
Period	Crop/ agriculture	Livestock/ agriculture	Agriculture/ agriculture+	Forestry/ agriculture+	Fisheries/ agriculture+	Agriculture+/ economy
(1)	(2)	(3)	(4)	(5)	(6)	97)
1950-51	76.03	24.30	73.19	25.10	1.71	57.15
1960-61	79.00	20.94	77.92	19.84	2.24	50.58
1970-71	81.45	18.16	76.45	21.06	2.49	44.68
1980-81	79.32	20.57	80.10	16.99	2.91	37.23
1990-91	76.07	23.87	83.38	12.91	3.71	29.91
2000-01	73.35	26.65	84.06	11.25	4.68	22.26
2010-11	70.69	29.31	85.11	9.82	5.07	14.59
2011-12	70.76	29.24	85.37	9.53	5.10	14.37
2012-13	69.94	30.06	84.95	9.66	5.39	13.95

Note: Agriculture+ stands for agriculture and allies; Computed from figures as available from National Accounts Statistics.

IV

DIVERSIFICATION WITH THE CROP SECTOR

Changes in Cropping Pattern

The cropping pattern in India has undergone significant changes over time. Since the cultivated area remains more or less constant, crop intensification could be

undertaken to meet the increased demand for food due to the growing population and urbanisation. The food crops are being substituted by high value/commercial crops (Table 4). During triennium ending (TE) 1970-71 to TE 2009-10, the per cent area under oilseeds increased from 9.85 to 14.92, horticultural crops from 3.28 to 6.92 per cent and sugarcane from 1.62 to 2.51 per cent. Favourable market conditions for refined oil and protein-rich soya food might have been responsible for inducing farmers to allocate larger areas for oilseed crops (Srinivasan, 2005) while growing demand for high value crops might be the driving force for increasing area under fruits and vegetables. It is interesting to note that area under food grains in gross cropped area (GCA) declined by more than 10 per cent mainly due to the fall in area under coarse cereals between TE 1970-71 and TE 2009-10. Wheat has gained importance with area allocation of only 10.42 per cent in TE 1970-71, and it steadily increased to 14.62 per cent in TE 2009-10, while per cent area under rice is almost stagnant.

TABLE 4. SHARE OF AREA UNDER MAJOR CROPS IN INDIA

(*per cent of GCA*)

Crops	TE 1970-71	TE 1980-81	TE-1990-91	TE 2000-01	TE 2009-10
(1)	(2)	(3)	(4)	(5)	(6)
Rice	23.02	23.18	23.00	23.82	22.51
Wheat	10.42	12.98	13.04	14.28	14.62
Total cereals	61.93	60.41	56.53	54.27	51.57
Total pulses	13.50	13.23	12.94	11.49	12.45
Oilseeds	9.85	10.11	12.51	12.96	14.92
Total fibres	5.41	5.08	4.64	5.27	5.46
Sugarcane	1.62	1.62	1.90	2.23	2.51
Horticultural crops	3.28	4.00	4.89	5.87	6.92
Total non-food crops	19.39	20.13	23.60	25.44	26.49
Cross cropped area (GCA)	100.00	100.00	100.00	100.00	100.00

Income Diversification in Crop Sector

The agricultural commodity basket has changed significantly during the last sixty years. The contribution of different crops in total value of output takes into account both physical outputs as well as prices and given in Table 5. From the table it shows that cereals accounted for the largest share of total output followed by horticultural crops, oilseeds and fibres. Whereas, the contribution of cereals declined from 38.13 per cent in 1950-51 to 29.02 per cent in 2011-12, the share of horticultural crops increased drastically from 10.49 per cent to 27.77, oilseeds from 8.26 per cent to 9.71 per cent, sugarcane from 3.49 to 5.83 per cent and fibres from 4.29 to 7.15 per cent during the reference period. The diversification of value of output from cereals to high value crops is a good sign towards sustainability of the sector. The changing share was determined both by quantity as well as prices, but the contribution of prices was more as the prices were high in case in horticultural crops in the beginning of current decade (Chand *et al.,* 2011).

TABLE 5. STRUCTURAL CHANGES WITHIN CROP OUTPUT

Items	1950-51	1960-61	1970-71	1980-81	1990-91	2000-01	2010-11	2011-12
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Cereals	38.13	42.64	43.43	37.32	34.69	33.10	28.56	29.02
Pulses	6.34	6.31	5.42	6.46	6.86	4.61	4.82	4.30
Oilseeds	8.26	8.01	9.55	8.34	12.86	6.88	9.52	9.71
Sugars	3.49	4.45	4.25	6.06	5.08	7.33	6.50	5.83
Fibres	4.29	5.48	4.93	4.09	4.26	2.99	6.64	7.15
Drugs and narcotics	3.02	2.81	2.48	2.35	2.48	3.11	3.49	3.99
Horticultural crops	10.49	12.93	16.89	17.59	19.45	28.72	28.26	27.77
Others	25.97	17.37	13.05	17.78	14.33	13.25	12.21	12.22

Income Diversification in Livestock Sector

Livestock is an important sector of agriculture and accounted for 30 per cent of agricultural output in the country and it is increasing continuously during last six decades. The absolute value of livestock output is also growing faster than any other agricultural sub-sectors. The sector is considered as pro-poor sector and is often considered as a new source of agricultural growth in the country. The relative share of different components of livestock calculated based on the data from Central Statistical Organisation indicates that milk group is the major constitute of the livestock accounting for more than 2/3rd to the total value of output from livestock (Table 6). Second important component is meat group (18.87 per cent) followed by dung (7.88 per cent) and eggs (3.45 per cent). Over 1950/51 to 2012/13, the share of eggs, milk, and meat group in total livestock output has increased while that of wool, hair, dung, and silkworm has decreased.

TABLE 6. PERCENTAGE SHARE OF DIFFERENT COMPONENTS OF LIVESTOCK IN INDIA (AT 2004-05 PRICES)

Components	1950's	1960's	1970's	1980's	1990's	2000's	2010's*
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Milk group	53.44	53.97	59.03	64.45	67.64	69.49	68.62
Meat group	19.86	19.95	17.37	16.39	17.36	17.46	18.87
Eggs	1.19	1.58	1.90	2.59	2.97	3.26	3.45
Wool and hair	0.67	0.63	0.57	0.25	0.21	0.18	0.14
Dung	24.42	23.31	20.24	15.28	10.75	8.64	7.88
Silk worm cocoons and honey	0.42	0.56	0.90	1.04	1.07	0.97	1.05

Note: Figures are calculated based on the average value of the decade. For current decade, it calculated from the average value from 2010-11 to 2012-13; Source: National Account Statistics, MOSPI, Government of India

Diversification and Agricultural Trade

The agricultural export basket has also changed in the country. The value of agricultural export is given in Table 7. During 1960-61, the major export earning was from Tea and mate, sugar and molasses, cashew kernels, etc,. The country was net importers of cereals during the sixties. The agricultural revolutions like green revolution, white revolution, yellow revolution, brown revolution impacted the

agricultural production and as a result, in the current years the major exporter earning items are rice, particularly Basmati rice, raw cotton, livestock and fish products, processes horticultural products, etc. A large share of export earnings came from non traditional items in the export basket, namely rice, fruits, vegetables, livestock and marine products. The progress in export of these items achieved during 1990s clearly signifies the positive impact of diversification. The globalisation of agricultural trade has brought to the forefront access to markets, new market opportunities for employment and income generation; productivity gains and increased flow of investments into sustainable agriculture and rural development (Singh *et al.,* 2006).

TABLE 7. AGRICULTURAL EXPORT FROM INDIA (VALUE IN $ MILLION)

(1)	1960-61 (2)	1970-71 (3)	1980-81 (4)	1990-91 (5)	2000-01 (6)	2010-11 (7)	2011-12 (8)
Agricultural and allied products:	596	644	2601	3521	6256	24448	37618
Coffee	15	33	271	141	259	662	953
Tea and mate	260	196	538	596	433	736	848
Oil cakes	29	73	158	339	448	2438	2420
Tobacco	34	43	178	147	191	875	836
Cashew kernels	40	76	177	249	412	627	928
Spices	36	51	14	133	354	1768	2750
Sugar and molasses	60	39	50	21	112	1246	1881
Raw cotton	25	19	209	471	49	2910	4328
Rice	0	7	283	257	644	2545	4940
Fish and fish preparations	10	40	274	535	1394	2623	3444
Meat and meat preparations	2	4	70	78	322	1971	2921
Fruits, vegetables and pulses (excl. cashew kernels, processed fruits and juices)	13	16	101	120	352	1397	1579
Miscellaneous processed foods (incl. processed fruits and juices)	2	6	45	119	239	806	1139
Total Exports	1346	2031	8486	18143	44076	251136	304624

Source: Government of India, 2013.

Factors Affecting Crop Diversification

Since, the results of Simpson Index indicated that there is no variability in the index, the percentage of area under other than foodgrain crops in gross cropped area was used as dependant variable instead of diversification index. The results of correlation and regression are given in Tables 8 and 9.

The perusal of correlation table shows that all the variables were in accordance with the expected hypothesis, i.e. area under high value crops increases with increase in irrigation potential, infrastructural facilities such as rural electrification, marketing facilities and rural roads and per capita income. The percentage area under non-foodgrain crops was inversely correlated with size of holdings. Differences in the quantity and quality of resource basis were largely responsible for variation in diversification. Gupta *et al.* (1985) also found that irrigation intensity, farm net

worth, price risk, and farm size were strong variables affecting the level of crop diversification.

TABLE 8. CORRELATION COEFFICIENT BETWEEN PER CENT AREA UNDER NON FOODGRAIN CROPS AND OTHER VARIABLES

Variables (1)	NON-FOODGAIN (2)	IRIP (3)	VE (4)	MARKET (5)	SIZE (6)	SMH (7)	PCA (8)	ROAD (9)
NON-FOODGAIN	1.00							
IRIP	0.98	1.00						
VE	0.94	0.95	1.00					
MARKET	0.91	0.91	0.98	1.00				
SIZE	-0.97	-0.99	-0.98	-0.95	1.00			
SMH	0.98	0.99	0.97	0.93	-0.99	1.00		
PCA	0.86	0.90	0.79	0.69	-0.85	0.89	1.00	
ROAD	0.94	0.97	0.95	0.91	-0.97	0.97	0.86	1.00

TABLE 9. FACTORS AFFECTING DIVERSIFICATION OF AGRICULTURE

Variable (1)	Coefficients (2)	Standard error (3)
Intercept	-435.7376	90.2143
IRIP	0.1923	0.1775
VE	0.1231*	0.0439
MARKET	-0.1141	0.0745
SIZE	53.2843*	10.4119
SMH	4.8348*	1.0080
PCA	-0.0005*	0.0001
ROAD	0.2660	3.3568
R2	0.98	No. of observations (42)

Note: *Denotes significance at 1 per cent level.

The influence of rural electrification on increasing area under high value crops was also justified by the regression results. These results were contradictory with the results of Singh *et al*., (2006) where the study found the presence of electricity and road density were negatively associated with crop diversification, as the tended to influence farmers for income enhancing activities, owing to the presence of developed market led by specialized farming while fertilizer consumption per hectare was positively associated with diversification. However, the comparison of road density only with crop diversification index may not sufficient to interpret in terms of non-influence of road density on crop diversification. This is because of the reason that the diversification index takes into account the crops only and role of high value crops/ enterprises like livestock/fishery, etc are not taken into account exclusively. If diversification is about increase in percent area under non-food crops and enterprises, then the road density may have a positive effect on diversification. A study by Jha *et al.* (2009) substantiates the fact as road density has positive effect on percentage of area under non-food crops. Similarly, though income has a negative effect on the diversification index, it was found directly affecting the percentage area under non-food crops in his study.

Though the variable size of holding was found to be directly related with area under high value crops, it was also found to be directly related with proportion of small and marginal holdings in total holdings which indicates that diversification increases with decreasing size of holdings. The results of correlation also substantiate the facts. In number of studies also, it was observed that the size of holding is inversely related with diversification and interpreted that small farmers are more risk averse than the large farmers (Jha *et al.,* 2009, Jha and Jha 1995). The availability of technological inputs and technology also determined the diversification towards non-food crops and enterprises other than crop. The dietary pattern is also a cause of diversification of production portfolio (Barghouti *et al.*, 2003).

V

CONCLUSION AND POLICY IMPLICATIONS

India, being a vast country of continental dimensions, presents wide variations in agro-climatic conditions leading to evolution of regional niches for various crops. In the past, regions were generally associated with the crops in which they specialize for various agronomic, climatic, hydro-geological, and even, historical reasons. But, as a consequence of technological changes, these niches are undergoing significant changes without much disturbance in output level. Therefore, the diversification is considered as one of the strategy for reducing risk in agriculture and augmenting income of farmers. The present study is therefore an attempt to identify whether the diversifying is taking place or not. The result shows that foodgrain production increased to nearly five times during the last six decades and touched all time high of around 260 million tonnes during 2011-12. Similarly, the oilseed, cotton and sugarcane production increased by six times while, jute and mesta by 3.4 times during the reference period. Over the years the composition of agriculture is changing and it is shifting towards livestock and fishery. Within the sector also, the composition is changing over the period. The contribution of cereals declined from 38.13 per cent in 1950-51 to 29.02 per cent in 2011-12 while the share of horticultural crops increased drastically from 10.49 per cent to 27.77, oilseeds from 8.26 per cent to 9.71 per cent, sugarcane from 3.49 to 5.83 per cent and fibres from 4.29 to 7.15 per cent during the reference period. In livestock sector also the share of eggs, milk, and meat group in total livestock output has increased while that of wool, hair, dung, and silkworm has decreased during 1950/51 to 2012/13. The diversification of value of output from cereals to high value crops is a good sign towards sustainability of the sector. The changing share was determined both by quantity as well as prices, but the contribution of prices was more as the prices were high in case in horticultural crops in the beginning of current decade. The agricultural export basket has also changed in the country. During 1960-61, the major export earning was from Tea and mate, sugar and molasses, cashew kernels, etc while in the current years the major export earning items are rice, particularly Basmati rice, raw cotton, livestock and fish products, processes horticultural products, etc. The study

recommends that for harnessing the potential of diversification there is need of strengthen infrastructural facilities like road connectivity, markets, etc as the high value crops are more perishable. The policy interventions are also required for providing the minimum support prices of fruits and vegetables.

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PURUSHOTTAM SHARMA*

Development Programmes and Performance of Oilseeds Sector in India

I

INTRODUCTION

Oilseeds and edible oils are one of the most sensitive essential commodities and had gone through several phases of development policies since 1980 mainly driven by consumer interests. This sector occupies an important position in the agricultural economy of the country. Oilseed crops accounts for 13 per cent of gross cropped area, 3 per cent of gross national product, 10 per cent of total value of output from agricultural crops and 6.0 per cent of value of output from agriculture and allied sector. In terms of acreage, production and economic value, these crops are second only to foodgrains. Indian Vegetable oil economy is world's fourth largest after USA, China and Brazil. India accounts for about 14 per cent of global oilseeds area, 8 per cent of oil crops production, 6-7 per cent of vegetable oils production, 13.5 per cent of vegetable oils import, 6.5 per cent of oilcakes export and 10.7 per cent of the global edible oils consumption. The per capita availability of edible oils had increased from 3.5 kg/person/year in 1970-71 to 15.8 kg in 2012-13 (Government of India, 2014).

Low productivity of oilseed crops, fragmented and under-utilised processing facilities, and lack of technological inputs hampered the edible oil production in the country (EPW, 2003), resulting in heavy reliance on imports of edible oils. Country has now become largest edible oil importer, and import of edible oils emerged as the second largest items of country's imports after petroleum products. The cultivation of oilseeds in the country is mostly in high risk regions with minimum use of productive inputs. They are mostly grown under rain-fed conditions which are characterized with extreme variations in rainfall both in time and space, poor soil quality, etc. It has resulted in a high degree of variation in production of oilseeds annually. Though, the oilseeds area under irrigation has increased from 7.4 per cent in 1970-71 to 25.9 per cent in 2009-10, this has been mainly concentrated for *rabi* oilseed crops.

The efforts were continuously being diverted by government towards increasing the production and productivity of oilseeds in the country to enhance availability of edible oils. The efforts includes both developmental policies targeted towards increasing and sustaining yield levels of oilseeds through technological interventions, and through trade policies to meet the growing edible oil demand of the consumers.

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As the demand of edible oils is highly income elastic, the increase in per capita income pushes demand significantly (Chand *et al.*, 2004).

To increase the availability of edible oils for the ever increasing population, enduring policy efforts were initiated by government through TMO, OPP, ISOPOM, etc. with an overall view to increase oilseed productivity. Under this backdrop, this paper intends to review oilseed production and policy scenario, pricing, and international trade and their role in changing oilseeds scenario in India.

II

METHODOLOGY

The paper is mainly based on secondary data. The data on area, production and yield of oilseeds and other requisite information were collected from publications and website of Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India. Growth and instability of oilseeds were analysed during different phases of development policies, the data were divided in different periods, like Pre-TMO (1970-71 to 1985-86), post-TMO (1986-87 to 1994-95), Post-WTO (1995-96 to 2003-04), and post-ISOPOM (2004-05 to 2012-13). Compound annual growth rates for different periods were calculated.

To measure the relative contribution of area and yield to the total output change for individual crop, the component analysis model was followed (Narula and Vidysagar, 1973; Singh and Sisodia, 1989; Bastine and Palanisami, 1994; and Singh and Ashokan, 2000).

$$\Delta P = A_0 \Delta Y + Y_0 \Delta A + \Delta A \Delta Y \quad \ldots.(1)$$

Change in Production = Yield effect + Area effect + Interaction effect.

The total change in production can be decomposed into three effects such as; yield effect, area effect and interaction effect due to change in yield and area.

Coefficient of variation around the trend (Instability index) was worked out as suggested by Cuddy and Della Valle (1978) as:

A linear trend $y=a+bt+e$ was fitted to the indices of area, production and yield for different period and trend co-efficient "b" was tested for significance. Whenever the trend co-efficient was found significant, the index of instability was constructed as follows:

$$\text{Instability Index} = (CV) \times \text{sqrt}\,(1-R^2) \quad \ldots.(2)$$

Yield gap for oilseed crops for the present study was calculated as follows:

$$YG = Y_t - Y_a$$

where, Y_t is the average yield of crop realised at farmers' field in Frontline Demonstrations (FLDs), and Y_a is the national level average yield in a particular year.

For analysing change in yield gap of oilseed crops over the years, yield gap for the period 1990-91 to 1994-95 was taken from Bansil, 1997. The yield gap for the period 2007-08 to 2011-12 was calculated from the data collected from publication on FLD results of Directorate of Oilseed Research, Hyderabad.

III

OILSEED DEVELOPMENT POLICIES IN INDIA

To augment the production of oilseed crops during early plan periods, persistent efforts were made by state governments through implementing a number of schemes under state sector. These included popularisation of basic oilseed production technology such as providing improved quality seeds, use of recommended fertilisers and plant protection measures. Thereafter, Government of India launched a centrally sponsored scheme called Intensive Oilseeds Development Programme during 1969-70 (Government of India, 1981). The growth performance of oilseeds in terms of production was lower during post-green revolution (1967-68 to 1986-87) as compared to pre-green revolution (Gulati *et al.*, 1996). The slow growth in production and rise in edible oil demand due to high expenditure elasticity for edible oils resulted in heavy dependence on imported edible oils to meet domestic requirements (Ninan, 1995; Bansil, 1997). Responding to the mounting edible oil import bills under chronic shortage of foreign exchange India decided to adopt an import substitution strategy in edible oils, and launched the National Oilseeds Development Project (NODP) in 1985-86 by integrating all the centrally sponsored schemes for oilseed development. Further towards making concerted effort in coordination of technology delivery for crops and oilseed processing, price support and support services under mission mode led to the launch of Technology Mission on Oilseeds (TMO) in 1986. The goal of TMO was to achieve complete self- sufficiency in edible oils by 1990. A special three years scheme called Oilseed Production Thrust Programme (OPTP) targeting four major oilseed crops was also launched in 1987-88 which ran concurrently with TMO. The assurance of fair and stable prices for oilseeds was the key to achieving desirable shift in cropping area in favour of oilseed crops and for inducing private investments in oilseed crops. Price support operations in oilseeds were undertaken as a part of this strategy. For undertaking price support operations in oilseeds, National Agricultural Cooperative Marketing Federation (NAFED) was designated as the nodal agency during 1985-86 (Bansil, 1997; Ninan, 1995; Thomas *et al*. 2012).

To avoid duplicity and bring in better coordination, Oilseed Production Programme (OPP) was launched in 1990-91 by merging ongoing OPTP and NODP into a single window programme. The National Dairy Development Board (NDDB) was also involved in stabilisation of supplies and prices of edible oils through its

Market Intervention Operations (MIO). The market intervention operations by NDDB between 1989 and 1994 were the first major attempt by the government to stabilise oilseed/edible oil prices with a pre-determined price-band. The NDDB did this through buffer stocks and imports of both oilseeds and oil (Srinivasan, 2004 a,b). During this period the imports of edible oils were kept under the negative list and only State Trading Corporations (STCs) and designated public sector agencies like NAFED were allowed to import edible oils. During 1994, liberalisation era started in edible oils sector by placing palmolein imports under Open General Licence, and the imports and tariff rates on other edible oils and oilseeds were liberalised in a phased manner. The import of all edible oils (except coconut oil, palm kernel oil, RBD palm oil, RBD palm stearin) was placed on OGL with 30 per cent import duty from March, 1995 (Thomas, *et al*. 2012). The edible oil import/export policy has been changed about 30 times in a span of 18 years.

To provide flexibility to the states in implementation of these programmes on the basis of regionally differentiated approach, in view of the suggestions of the Planning Commission, all schemes have been modified and merged into one Centrally Sponsored Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM) during the 10th Five Year Plan, which is under implementation from 2004-05. The ISOPOM is under implementation in 427 districts of 14 potential States viz., Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal for oilseeds production programme.

IV

GROWTH AND INSTABILITY IN OILSEEDS DURING DIFFERENT PHASES OF DEVELOPMENT POLICY

The area, production and yield of oilseeds in India have grown at a compound annual rate of 1.4 per cent, 3.4 per cent and 2 per cent, respectively, during the period 1970-71 to 2012-13 (Table 1). Growth in area and production of soybean and sunflower, the oilseed crops introduced in India during 70's, was found to be higher as compared to other oilseed crops. The area and production growth of crops like linseed, nigerseed and safflower was negative during the overall period. Growth analysis was worked out for different periods representing different phases of oilseed development policies in the country to elucidate the impact of those policies and programmes. The area, production and yield of total oilseed crops with an exception of linseed and safflower, witnessed accelerated growth during post-TMO period. With the concerted efforts for realising self-sufficiency through increasing oilseeds production in the country resulted in higher growth in oilseeds production.

Consequent upon the setting up of Technology Mission on Oilseeds, a major breakthrough in increasing Oilseeds production was achieved through an integrated approach like introduction of new crop production technologies, better supply of inputs, extension services, support for marketing, post-harvest technologies and

TABLE 1. ANNUAL COMPOUND GROWTH RATES OF OILSEEDS IN INDIA

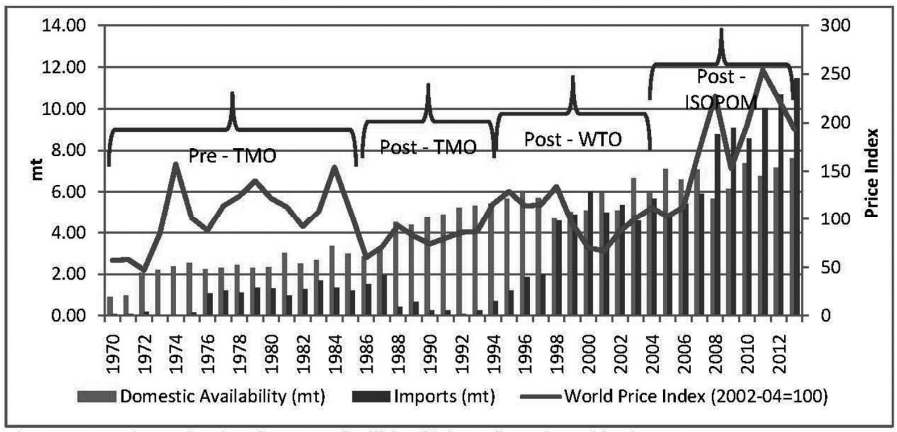
Crop	APY	Pre-TMO	Post-TMO	Post-WTO	Post-ISOPOM	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Area	0.9	4.3	-2.3	-0.5	1.4
Oilseeds	Prod	2.2	7.7	-2.0	2.6	3.4
	Yield	1.2	3.3	0.4	3.1	2.0
	Area	0.03	1.6	-3.3	-3.5	-0.6
Groundnut	Prod	0.6	3.0	-3.3	-2.2	0.5
	Yield	0.6	1.3	0.1	1.4	1.1
	Area	1.4	6.3	-4.7	-2.0	1.8
R&M	Prod	3.3	8.7	-2.6	-0.1	4.2
	Yield	1.9	2.3	2.2	1.9	2.3
	Area	33.0	16.6	2.5	4.5	14.8
Soybean	Prod	36.0	23.8	1.4	8.4	16.6
	Yield	1.4	6.2	-1.1	3.7	1.5
	Area	10.4	10.5	-3.3	-14.3	6.5
Sunflower	Prod	6.8	17.1	-5.2	-12.5	6.7
	Yield	-3.1	6.0	-1.9	2.1	0.2
	Area	2.4	4.0	-0.7	7.3	1.9
Castor	Prod	7.2	17.5	-4.2	12.8	5.7
	Yield	4.6	12.9	-3.5	5.2	3.7
	Area	-2.5	-3.6	-8.2	-5.3	-4.7
Linseed	Prod	-2.0	-1.8	-6.2	-2.0	-3.2
	Yield	0.5	1.8	2.2	3.5	1.6
	Area	1.2	-0.3	-4.2	-3.7	-1.0
Nigerseed	Prod	2.4	2.6	-7.0	-1.7	-0.5
	Yield	1.2	2.9	-2.9	2.0	0.5
	Area	-0.3	-0.8	-1.9	0.8	-0.9
Sesame	Prod	1.1	1.9	1.4	2.1	1.1
	Yield	1.4	2.7	3.4	1.3	2.1
	Area	3.5	-3.4	-8.5	-7.8	-2.4
Safflower	Prod	9.9	-0.5	-9.4	-7.1	-0.6
	Yield	6.2	3.0	-0.9	0.8	1.8

Source: Authors calculation.

excellent co-ordination/co-operation between various concerned organizations/ departments and Ministries (Acharya, 1993; World Bank 1997; Bansil, 1997; Ramasamy and Selvraj, 2002; Reddy, 2009; Government of India, 2014). This increased the oilseed production and India became self-sufficient by early 1990s. Import of edible oils was almost negligible (2 per cent of total consumption) during 1992 (Figure 1).

The improved technologies emanated through research by ICAR and SAUs helped in enhancing productivity of oilseeds, in addition to market support and high edible oil import tariffs, incentivised farmers for expanding area under oilseeds and improve in input use. Although, the tempo of growth in oilseeds production could not be sustained during post-WTO period, mainly on account of liberalisation of edible oil trade by reducing import tariffs under WTO commitments. During the post-WTO period, most of the oilseed crops witnessed negative growth in area and production. During this period there was a surge in imports of edible oils and domestic production of these started to decline due to fall in real prices (Chand, *et al.* 2004). During the post-ISOPOM, the production of soybean, castor and sesame increased

positively, while growth in production of groundnut, R&M, sunflower, linseed, nigerseed and safflower continued to decline.



Data Source: FAS, USDA, World Price Index from FAO Data.

Figure 1. Domestic Production, Imports of Edible Oils in India and World Prices.

The Cuddy-Della Valle index of instability was worked out for area, production and yield of oilseeds for different phases of developmental policies and programmes and the results are presented in Table 2. The results clearly indicated that the instability in area, production and yield was higher for soybean, sunflower and safflower for the overall period. Overall instability in area under oilseed crops was found to be 8 per cent, while fluctuation in production was 14 per cent and yield instability was 9.5 per cent during the period 1970-71 to 2012-13. The production and yield instability declined during post-TMO and post-ISOPOM periods for most of the oilseed crops. The instability in area under oilseed crops had increased during post-WTO phase, while during post-ISOPOM phase the area has almost stabilised.

TABLE 2. INSTABILITY IN AREA, PRODUCTION AND YIELD OF OILSEEDS IN INDIA

Crop	APY	Pre-TMO	Post-TMO	Post-WTO	Post-ISOPOM	Overall
(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Area	2.8	4.5	4.1	2.0	8.0
Oilseeds	Prod	11.1	8.8	14.2	8.1	14.1
	Yield	9.2	7.3	11.8	6.9	9.5
	Area	2.9	7.5	2.7	5.9	10.4
Groundnut	Prod	14.0	14.0	19.8	22.1	19.9
	Yield	12.2	10.5	20.1	17.5	15.5
	Area	6.6	7.9	10.3	8.1	14.2
R&M	Prod	17.2	11.9	16.5	11.1	19.0
	Yield	15.1	7.9	13.3	4.8	12.0
	Area	17.0	7.0	5.3	2.7	31.3
Soybean	Prod	23.1	13.9	17.4	7.8	33.7
	Yield	22.5	13.5	13.9	8.6	17.6
	Area	58.4	18.3	21.4	14.3	43.8
Sunflower	Prod	55.5	19.4	20.0	16.9	42.9
	Yield	8.9	11.9	8.6	9.7	16.6

Contd.

TABLE 2. CONCLD.

Crop (1)	APY (2)	Pre-TMO (3)	Post-TMO (4)	Post-WTO (5)	Post-ISOPOM (6)	Overall (7)
	Area	14.3	11.0	18.7	20.3	18.2
Castor	Prod	19.4	19.8	16.4	20.0	27.3
	Yield	14.0	12.2	16.3	2.7	17.4
	Area	9.5	6.6	5.8	6.5	10.5
Linseed	Prod	16.1	9.1	8.0	2.9	13.0
	Yield	11.3	6.4	7.5	6.9	10.0
	Area	7.9	3.3	4.1	5.6	12.6
Nigerseed	Prod	15.3	9.1	11.1	5.4	21.8
	Yield	12.3	7.5	8.0	5.7	11.6
	Area	5.2	9.1	7.5	6.5	10.2
Sesame	Prod	13.8	17.6	18.6	12.9	17.1
	Yield	13.7	13.8	13.8	10.3	13.1
	Area	8.6	15.9	9.8	7.3	25.9
Safflower	Prod	21.9	25.0	35.4	14.9	45.1
	Yield	19.0	17.2	27.5	10.0	22.0

Source: Authors calculation.

In case of groundnut, yield instability has doubled during post-WTO period compared to the post-TMO period. Although, groundnut yield instability declined marginally during post-ISOPOM period, but still was at an elevated level. This may be one of the reasons for negative growth in area under groundnut during post-WTO and post-ISOPOM period. Area under soybean had stabilised in the country, as indicated by the low (2.7 per cent) instability index during post-ISOPOM period. Similarly, yield levels of mustard and castor had shown stability during post-ISOPOM period. Production and yield of minor oilseed crops like sesame and safflower continued to be highly instable, though during post-ISOPOM period instability index had declined. Overall, increasing trend in yield of total oilseeds and declining instability signifies the sustainable development of oilseeds in the country.

V

DETERMINANTS OF CHANGE IN OUTPUT OF OILSEEDS

Production of total oilseeds in the country was 8210.9 thousand tons during triennium average ending (TE) 1970-71, and has increased to 31079.2 thousand tons during TE 2012-13, resulting in enhancement of 278.4 per cent. Of the total change in production of oilseeds in the country, about 59 per cent is contributed by expansion in yield level, 31 per cent due to area affect and 10 per cent by area and yield interaction (Table 3). The effect of yield in production increase of oilseeds was found to be lower during post-TMO period and even negative during post-WTO period. However, the situation improved during post-ISOPOM period. This can be ascertained to the concerted research in technological developments by ICAR and SAUs along with the use of modern and productive inputs by farmers thereby helping in realising higher yield and resulted in increased production of oilseeds in the

country. However, yield gap analysis indicated large exploitable yield reservoir is yet to be realised (Kiresur *et al.* 2001, Chand *et al.* 2004, Jha, *et al.* 2011). The effect of change in yield to change in production of linseed was found to be negative during all the periods.

TABLE 3. DECOMPOSITION OF CHANGE IN PRODUCTION IN OILSEEDS (per cent)

Crop (1)	Due to (2)	Pre-TMO (3)	Post-TMO (4)	Post-WTO (5)	Post-ISOPOM (6)	Overall (7)
Oilseeds	Prod Change	44.7	76.6	-3.6	53.6	278.4
	Area Effect	34.3	52.0	348.0	33.7	30.7
	Yield Effect	56.9	34.3	-283.3	56.2	58.8
	AY Interaction	8.7	13.7	35.3	10.1	10.5
Groundnut	Prod Change	18.5	30.1	-21.2	3.4	25.5
	Area Effect	9.6	36.7	119.8	-379.5	-155.9
	Yield Effect	88.8	57.0	-26.6	549.7	265.8
	AY Interaction	1.6	6.3	6.7	-70.2	-9.9
R&M	Prod Change	61.5	101.4	-4.0	49.5	366.9
	Area Effect	40.3	57.8	471.4	55.2	39.1
	Yield Effect	47.8	26.6	-457.7	35.2	51.0
	AY Interaction	11.9	15.6	86.3	9.6	9.9
Soybean	Prod Change	4020.2	485.6	52.8	114.9	79132.6
	Area Effect	45.3	69.6	99.0	52.9	64.1
	Yield Effect	1.7	6.9	0.6	29.3	17.6
	AY Interaction	53.0	23.5	0.3	17.8	18.2
Sunflower	Prod Change	303.4	287.3	-33.8	-31.0	86.0
	Area Effect	149.5	83.1	84.6	155.7	613.2
	Yield Effect	-8.9	5.0	21.6	-107.8	42.8
	AY Interaction	-40.5	11.9	-6.2	52.1	-19.6
Castor	Prod Change	225.2	72.6	-10.8	198.8	1396.5
	Area Effect	23.0	18.3	46.5	39.1	32.7
	Yield Effect	50.7	72.1	56.3	34.3	42.4
	AY Interaction	26.3	9.6	-2.8	26.6	25.0
Linseed	Prod Change	-5.0	-23.0	-37.4	-23.1	-64.8
	Area Effect	411.5	151.1	127.4	143.1	159.9
	Yield Effect	-392.1	-78.4	-52.5	-64.5	-89.4
	AY Interaction	80.7	27.2	25.0	21.4	29.5
Nigerseed	Prod Change	40.2	23.9	-40.6	-5.7	-2.7
	Area Effect	48.5	21.8	62.5	371.0	1427.9
	Yield Effect	43.1	74.3	50.2	-343.2	-981.1
	AY Interaction	8.4	3.9	-12.8	72.1	-346.8
Sesame	Prod Change	13.8	17.0	0.7	24.3	66.7
	Area Effect	-63.2	-19.8	-3630.9	74.8	-29.8
	Yield Effect	178.9	124.0	4894.8	21.4	147.6
	AY Interaction	-15.7	-4.2	-1163.9	3.9	-17.8
Safflower	Prod Change	262.1	-8.4	-58.7	-24.3	3.7
	Area Effect	17.2	99.8	86.8	166.4	-5732.9
	Yield Effect	57.1	0.2	27.0	-111.5	3669.8
	AY Interaction	25.7	0.0	-13.7	45.1	2163.1

Source: Authors calculation.

Exploitable yield reservoir of oilseeds

The average realisable yield, i.e. yield realised at farmers' field with improved package of practices under FLDs, had increased for the oilseed crops like groundnut, mustard, sunflower, safflower, nigerseed and soybean, while it declined in case of

castorseed and linseed (Table 4). The average yield at the national level also increased for all the oilseed crops with linseed being an exception. The yield gap has also increased for the crops like groundnut, sunflower, safflower and nigerseed, however it decreased in the case of crops like mustard, soybean, sesamum, castorseed and linseed. The potential gap in production of oilseeds has been worked out at 14.66 million tonnes during five year average ending (FE) 1994-95, and had increased to 16.86 million tonnes during FE 2011-12. If the yield gap of the oilseed crops can be reduced to half the current level, an additional 8.5 million tonnes of oilseeds can be produced in the country. This will also improve the efficiency of land and labour use, reduces production costs and increases sustainability. The higher yield gap is mainly due to lower adoption of improved crop production technology; moreover, other factors that cause exploitable yield gaps in oilseeds include physical, biological, socio-economic and institutional constraints, and can be effectively improved through participatory research and government interventions. Low potential and high gap states require concerted extension efforts to enhance adoption level of crop-specific technologies among the farmers (Chand *et al.,* 2004; Venkatkumar, *et al.*, 2009 and Jha, *et al.* 2011). Adoption level for several components of the improved technology is considerably low, emphasising need for better dissemination (Kiresur *et al.,* 2001).

TABLE 4. YIELD GAP ANALYSIS OF OILSEED CROPS

	1990-91 to 1994-95*				2007-08 to 2011-12			
Crop	Mean realisable yield with IT (kg/ha)	Av. yield (kg/ha)	Realisable yield gap (kg/ha)	Potential gap (million tonnes)	Mean realisable yield with IT (kg/ha)	Av. yield (kg/ha)	Realisable yield gap (kg/ha)	Potential gap (million tonnes)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Groundnut	1724	950.8	773.8	4.80	2200	1274	926	5.38
R&M	1326	873	453	2.81	1453	1128	325	1.98
Soybean	1850	939	911	3.26	1882	1166	716	6.85
Sunflower	1175	557	618	1.29	1504	676	828	1.14
Sesamum	614	303	311	0.71	669	387	282	0.54
Safflower	781	494	287	0.21	1240	636	604	0.17
Nigerseed	409	302	107	0.65	1269	413	856	0.33
Castorseed	1854	929	925	0.68	1784	1451	333	0.32
Linseed	852	325	257	0.25	694	278	416	0.16
Oilseeds				14.66				16.86

Source: * Bansil, 1997, yield gap for the period 2007-08 to 2011-12 was calculated from the data collected from reports on Frontline Demonstrations for Oilseeds, various years, DOR, Hyderabad.

IT= Improved Technology

Total Factor Productivity Growth of Oilseeds

The total factor productivity (TFP) growth for soybean during post-TMO period was 0.83 and declined to 0.62 during post-WTO period. In the case of groundnut, TFP increased during post-WTO period (1.30) compared to post-TMO period (0.55). There was no growth in TFP during post WTO period (0.08). The value of marginal product of oilseed research stock was found to be less than Rs. 1 during all the

periods, and started declining during post-TMO and continued to decline during post-WTO periods. The internal rate of returns through oilseeds research investment was around 18 per cent for groundnut during all the periods, while it continuously declined for mustard crop from 27 per cent during pre-TMO period, 17 per cent during post-TMO period and 13 per cent during post-WTO period (Chand *et al.* 2011). The lower growth in total factor productivity for oilseeds can be attributed to lower investment in oilseeds research. Indian research system invests merely 4.2 per cent of total agricultural research investment on oilseeds research (Chandel and Rao, 2003), whereas oilseeds contribute about 10 per cent of total value of output from agriculture crops. Even within oilseed crops research resource allocation was found to be disproportionate. The share of research investment for mustard and sesame had increased, while share of all other oilseed crops had declined. The research investments for crops like rapeseed and mustard, groundnut and soybean were lower than their contribution in value of output (Chandel and Rao, 2003).

TABLE 5. TOTAL FACTOR PRODUCTIVITY GROWTH OF OILSEED CROPS

Crops	1975-85	1986-95	1996-05	1975-05
(1)	(2)	(3)	(4)	(5)
TFP Growth				
Soybean		0.83	0.62	0.71
Groundnut	0.49	0.55	1.30	0.77
R & M	1.88	0.74	0.08	0.79
VMP of Research stock (Rs.)				
Groundnut	0.73	0.78	0.63	0.71
R & M	1.64	0.62	0.40	0.89
IRR (per cent)				
Groundnut	18	19	17	18
R & M	27	17	13	20

Source: Chand *et al.* (2011).

Trade Policies, Prices and Edible Oil import

Import of edible oils was negligible in India till 1975-76 (5 to 8 per cent of total edible oil consumption), but there was a sudden spurt in import during the period 1976-77 to 1988-89, on account of faster growing demand (high expenditure elasticity of edible oils) and decrease in domestic production (Figure 1). Import policies of edible oils prior to 1994 were governed by quantitative restrictions, that is, imports were controlled directly by State Trading Corporation (STC) and subject to state-imposed import quotas. Edible oil import levels were determined by the government, and had been the monopoly of STCs, on the basis of domestic and international market conditions, producer versus consumer interests, and foreign exchange availability. With the initiation of import substitution policy and launching of TMO, the goal of self-sufficiency in edible oils was achieved in early 1990s (Gulati, *et al.* 1996; Persaud and Landes, 2006). However, edible oils trade policy reforms in the mid-1990s followed by declining domestic oilseed production fuelled the resurgence of imports (Dohlman *et al.* 2003).

In the year 1994 the country eliminated the state monopoly on imports and placed imports under a privatised open general license (OGL) system, and also agreed to eliminate import quotas and placed upper 'bound' (maximum) limits on tariff levels. These changes made the rules governing edible oil imports more transparent and imports more responsive to market forces (Chand *et al*. 2004; Reddy, 2009; Thomas *et al*. 2012). After placing edible oil imports under the OGL system in 1994, permission had been given to private traders to import any quantity of vegetable oils, subject only to a tariff. The tariff was initially set at 65 per cent on all edible oils, but was significantly below the implied tariff when imports were under quantitative controls.

India's tariff structure was relatively simple and increasingly liberal until 1998 with a common applied *ad valorem* tariff for all oils and that was progressively lowered to a uniform rate of 16.5 per cent by the middle of 1998. To protect the domestic oilseed producers and processors from imports and to smother the effect of international price variations on domestic market, India started making frequent tariff adjustments in 1998. The applied tariff was changed several times in a short span of time, initially from high rates (65-85 per cent) during 1994-95 to lower rates (20-30 per cent) during 1996-2000 and again high tariffs (60-80 per cent) during 2001-04. Currently, the tariffs are at a lower side (2.5-10 per cent). There were several cases of under-reporting of edible oils imports (and also crude v/s refined) to take advantage of tariff complexities by importers (EPW, 2003). To curb this phenomenon government established a tariff rate value (TRV) system for palm oil in August 2001 and for soybean oil in September 2002, and also established government reference price for tariff calculations. The reference prices are being revised periodically to reflect actual market prices may be with some delay.

With the setting up of Technology Mission on Oilseeds, production of oilseeds increased and India became self-sufficient during early 1990s. Import of edible oils was almost negligible (2 per cent of total consumption) during 1992 (World Bank 1997; Bansil, 1997; Ramasamy and Selvraj, 2002 and Reddy, 2009). This increased the oilseed production and made India self-sufficient by early 1990s. During the post-WTO period, import started increasing and the domestic production of edible oils started to decline due to fall in real prices (Chand, *et al.* 2004). During the post-ISOPOM, there was a surge in imports and currently country imports about 60 per cent of its total edible oil consumption requirement due to fast increasing consumer demand with the increase in income. The increased dependence of of India on edible oil imports exerted pressure on world prices and the real world edible oil price index had increased from 67 in 2001 to 254 in 2011 (Figure. 1).

Oilseeds production in India, particularly rapeseed and soybean, were found to be fairly competitive, while oils are on a shakey ground (World Bank, 1997 and Chand *et al.*, 2004). Expected prices and price risks are important determinants of oilseed production. The price elasticities of oilseed production were positive varing between 0.26 for Soybean in Madhya Pradesh to 0.88 for Sunflower in Maharashtra and for

Mustard in Rajasthan (Pandey *et al.*, 2005). The world prices of edible oils are more volatile than the domestic prices (Srinivasan, 2004b).

VI

CONCLUSIONS AND POLICY IMPLICATIONS

The oilseeds production in India has grown at a compound annual rate of 2 per cent during the period 1970-71 to 2012-13. The growth in area, production and yield of oilseeds, except linseed and safflower, increased during post-TMO period leading to decline in edible oil imports to almost negligible (2 per cent of total consumption) during 1992. During post-WTO period most of the oilseed crops witnessed negative growth in area and production, due mainly to lower real prices and edible oil import surge. During the post-ISOPOM, the production of soybean, castor and sesame increased positively, while growth of other oilseed crops continued to decline. Instability in area, production and yield of oilseed crops was found to be 8 per cent, 14 per cent and 9.5 per cent, respectively for the period 1970-71 to 2012-13. The production and yield instability had declined post-TMO and Post-ISOPOM periods for most of the oilseed crops. The expansion in yield levels have contributed nearly 60 per cent of the total increase in oilseeds production from TE 1970-71 to TE 2012-13, which was found to be lower during post-TMO period and even negative during post-WTO period and improved during post-ISOPOM period. Yield gap analysis revealed enough potention to be tapped provided consistent increase in research investment, policies upheaval and support services.

Edible oils import policies prior to 1994 were governed by quantitative restrictions and controlled by STC. Subsequently, the country placed edible oil imports under a privatised OGL system by removing import quotas. The applied tariff was changed several times in a short span of time, initially from high rates (65-85 per cent) during 1994-95 to lower rates (20-30 per cent) during 1996-2000 and again increasing tariffs (60-80 per cent) during 2001-04, and again lower rate (2.5-10 per cent) presently. Import of edible oils started increasing post-WTO and surged during the post-ISOPOM. Currently country imports about 60 per cent of its total edible oil consumption requirement due to fast increasing consumer demand coincided with the increase in income. The increased dependence of India on edible oil imports exerted pressure on world prices. To reduce the import dependence and encourage oilseeds producers the policy measures like, (1). Strategies to improve productivity like use of improved agro-techniques and improvements in input-use efficiency, protective irrigation, quality seed, effective technology dissemination, IPM, etc. needs to be promoted; and (2). To improve efficiency of oilseed production and to improve competitiveness, higher allocation of funds for oilseed research is required, planning for the long-term requirements needs to be implemented.

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Linking Strategic Orientations with Performance Levels: A Case of Greek Agricultural Cooperatives

I

INTRODUCTION

Agricultural cooperatives (co-ops), are trying to adapt to the rapid market changes in order to remain competitive. Strategic re-structuring is one fundamental weapon for market access and increasing financial indicators (Cechin *et al*., 2013; Salavou *et al*., 2013; Bijman *et al*., 2009). However, the serious capital constraints as well as the inefficient decision-making procedures create obstacles towards the adoption of the appropriate strategic attributes (Kalogeras *et al*., 2013; Karantininis *et al*., 2007). For this reason, the board of directors (BoD) of several agricultural co-ops decided to move from the traditional characteristics towards more "re-engineered" ones (Kalogeras *et al.*, 2007; Chaddad *et al*., 2004).

According to Salavou *et al*. (2013), traditional co-ops in Greece should change their organizational attributes and strategic orientation and move towards more re-engineered models following differentiation and focus strategies in order to become more competitive. However, despite their efforts to become more flexible, their marketing approaches continue to be generally weak, with products far less differentiated than those of large, competitive, private food firms.

The main objective of this paper is to extend the co-op literature by examining how the organizational attributes are related with the strategic orientation, the performance and the size of the co-op. We approach this question by using Porter's original model of three distinctive generic business-level strategies (low cost, differentiation and focus). Data for this study were collected from a survey conducted in 15 agricultural co-ops in Northern Greece in 2012. During 2011, a new legal Act (no 4015) was enforced in Greece that further permitted the re-engineering of co-op attributes.

The paper is divided into five major sections. After the introductory section, the research framework is presented, followed by a part for the sample and the data used in this study. The fourth section presents the analysis and the results. The final section concludes with implications for researchers and practitioners.

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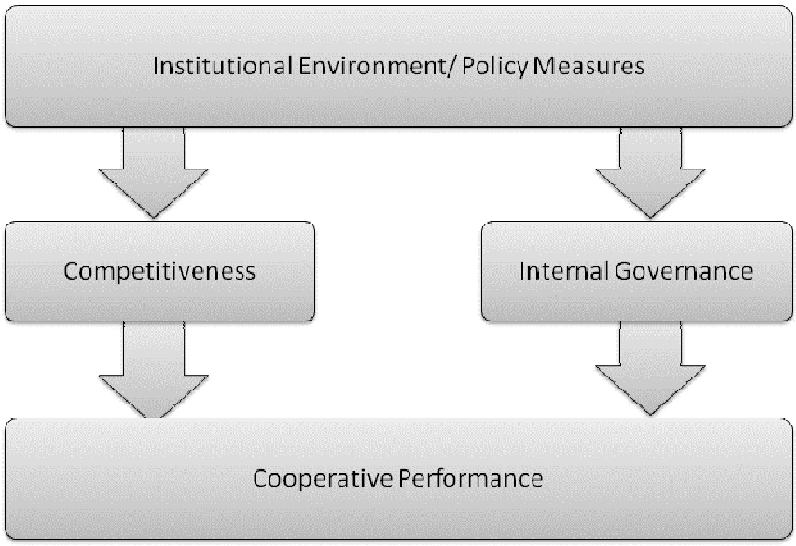
II

RESEARCH FRAMEWORK

The theoretical framework of this research is that there are at least three main factors that determine the success of co-ops (performance) in the market. These factors are related to (a) the institutional environment, (b) the competitiveness and (c) the internal governance.



Source: *adopted from Bijman et al., (2012, p. 8).*

Figure 1. Interrelation between Core Concepts for Cooperative Performance.

The Institutional environment refers to the social (e.g. social capital and trust), cultural, political and legal (e.g. taxation and competition laws) framework in which co-op operates and which seems to facilitate or create obstacles to the co-op's performance. Competitiveness refers to the strategic attributes that the co-op follows in order to retain or improve its position in the food chain. Internal governance refers to the organizational structure, the decision-making process as well as the allocation of control rights to members, BoD and professional management. Table 1 presents the main intra-organisational attributes (control, ownership, and cost/benefit) of Traditional (TC) and Re-engineered (RC) co-ops.

Regarding the strategic attributes of traditional and re-engineered co-ops, Ohlsson (2004: p.14) states that "…*Traditional co-operatives have collective internal structures. They generally engage mainly in primary processing, selling undifferentiated products. They follow the cost leadership strategy, thus volumes are large and economies of scale are maximised.* For the Re-engineered co-ops Ohlsson (2004: p.16) refers that "…*they have a more individualised internal structure than*

traditional cooperatives. The degree of unallocated capital is very low. This leads to an incentive structure for shareholders that makes collective traits less predominant or even negligible". Moreover, they usually adopt a highly commercial attitude with elements mainly from differentiation strategy (Salavou *et al*., 2013). Therefore, the organisational attributes are strongly related with the strategic attributes of co-ops.

TABLE 1. STRUCTURAL FACTORS AND OF COOPERATIVE MODELS

Organisational Attributes (1)	Traditional Co-op (2)	Re-engineered Co-op (3)
1. Control (Governance)		
Voting rights	Only members	Minority of non-members
Voting principle	Democratic control	Proportional
2. Ownership (Investments)		
Quality of stocks	Only members	Non-members as minority
Type of equity	Collective	Individualized i.e. shares
Entry fees	Limited fees	Proportional
Equity redemption	Nominal value	Tradeable shares or regular redemption plans
Net income allocation	Through prices	Prices and personal shares
3. Cost/Benefit Allocation (Transactions)		
Pricing policy	Equal	Equitable
Costs allocation	Volume neutral	Volume related

Source: adopted from Kyriakopoulos *et al*., (2004, p. 382).

Table 2 summarises Porter's generic strategy, market characteristics along with the main organisational structure attributes of the Traditional and Re-engineered co-ops.

Based on this theoretical framework the present study addresses three questions:

- What is the direct effect of organisational attributes on the co-op performance?
- How the organisational attributes are related with the size of the co-op?
- How the organisational attributes are related with the strategic orientation of the co-op?

Answering these questions is crucial, since Greece has limited empirical evidence on strategic issues in relation with organisational attributes for the agri-food sector. Several researches empirically examine the strategic and organisational preferences of agricultural co-ops and their relation with performance and size (Bijman *et al*., 2012). However, despite the fact that the re-engineered co-ops outperform traditional ones, less than 20 per cent of the European co-ops use some of the organizational or strategic elements of the re-engineered co-ops (e.g. a holding structure, proportional voting or professional managers serve on the BoD). Kalogeras *et al*. (2013) argues that despite the fact that organisational attributes are very important for co-ops performance level, there also exist other attributes that determine co-op and member performance. Additionally, there is no "a best organisational form" for co-ops since organisational structure depends on several attributes: the member enterprise, the institutional environment, the nature of the market and the external conditions that affect market structure.

TABLE 2. MATCHING OF CO-OP ORGANISATIONAL STRUCTURE, STRATEGY AND MARKET CHARACTERISTICS

	Traditional co-ops	Re-engineered co-ops		
Strategy (1)	Service at cost (2)	External investor cooperative (3)	Member-investor cooperative closed membership (4)	Market characteristics (5)
Overall cost leadership	Good prospects due to large volumes and simple operations (economies of scale)	Investors would hardly accept volume maximisation as a target as the profits become too small.	The co-op's volume hardly reaches satisfactorily competitive level.	- Collection of primary products, primary processing - Large market with stable demand, fluctuating prices - Economies of scale
Differentiation	Governance problems and capital problems may occur.	Good prospects for diversified business due to large capital for high investments.	Not sufficient capital to act on large markets (capital constraints)	- Further processing, value-added products - Large, dynamic markets - Large need of investment per produced unit - Market adjustment
Focus	The cooperative has mostly property rights problems	A focus strategy is appropriate but only for a minor part of the cooperative's business operation(s). (Waste of resources)	Good prospects for success in niche markets	- Further processing, value added products - Limited, dynamic markets - Smaller need of investment per produced unit -Market adjustment

Source: *adopted from Nilsson and Bjorklund (2003, p. 60).*

III

SAMPLE AND DATA COLLECTION

The sample consists of fifteen agricultural co-ops established and operating in Northern Greece (see Table 3).

TABLE 3. SAMPLE CHARACTERISTICS

Co-op (1)	Member co-ops (2)	Members-farmers (3)	Permanent personnel (4)	Seasonal personnel (5)	Products (6)
Kilkis	67	-	60	5	Bread, pastry, flour
Chalkidiki	60	6.500	24	36	Durum wheat, table olives, olive oil
Rodopi	83	6.442	77	58	Feta cheese, feeding stuff, tomatoes
Axiopouli	47	3.800	13	4	Seeds, feeding stuff, tobacco, processed tomatoes
Didimoticho	39	3.700	30	10	Seeds, cotton
Kavala	46	8.300	55	200	Table olives, olive oil, asparagus, kiwis, vegetable oils, rice, beans, legumes

Contd.

TABLE 3. CONCLD.

Co-op (1)	Member co-ops (2)	Members-farmers (3)	Permanent personnel (4)	Seasonal personnel (5)	Products (6)
Arnea	29	2.210	10	3	Forrestal products
Orestiada	43	4.532	55	27	Cereal, corn, asparagus, sugar beets, garlic
Paggeo	37	2.840	19	0	Corn, barley, wheat, olive oil, nuts, grapes
NEOGAL	70	220	12	4	Dairy, meat
Xanthi	78	5.800	30	72	Cereal, kiwis, pomegranates, tomatoes, tobacco
Giannitsa	82	9.000	58	600	Cotton, cotton oil, peach juice and sweets, horticultural products
Evros	93	8.000	39	39	Cheese, spirits, table olives, cotton
Serres	180	10.500	60	150	Feeding stuff, rice, cotton, vegetable oils, cereal, processed tomatoes
Drama	122	1.289	36	40	Potatoes, wheat, corn

IV

DATA ANALYSIS AND RESULTS

The main scope of this research is to examine and acquire a more fundamental understanding of the interrelationship between organisational attributes, strategic orientation, performance and size through a qualitative study. It uses a case study approach in line with Sterns *et al.* (1998), Cotterill (2001) and Kalogeras *et al.* (2009). Our analysis is held in three key themes which are presented in details further down.

First Step: Co-ops Classification as Traditional or Re-Engineered

In order to examine the effect of organisational structure on co-op performance, we categorised each cooperative in "traditional" or "re-engineered" according to the degree of adoption of the organisational attributes presented in Table 1. If a co-op scores more than half of the organisational attributes of Table 1 it is characterised as Re-engineered (RC) while less than half it is characterised as Traditional (TC).

According to this categorisation, eight co-ops are characterised as "Re-engineered" and the rest seven as "Traditional". Examining the profile of the re-engineered co-ops, six of them use the "proportional voting" and only three of them the "rights transferability". Almost one third of all co-ops have introduced preferred shares and issued penalties for those members that do not follow their delivery agreements. More than half of the fifteen co-ops have established subsidiaries. Additionally, almost half co-ops have exit barriers. Finally, commitment issues are enhanced by several attributes. As a concluding remark, the majority of them have adopted specific re-engineered elements in order to come not only closer to the market but also to the members' needs. From the members' side this situation constitutes condition for the reinforcement of trust, commitment and reciprocity in their relationship.

Second Step: The Effect of Organizational Attributes on Co-op Performance and Size

Performance was measured both objectively (based on accounting data from balance sheets and income statements) of each co-op and subjectively by using a single item scale in the questionnaire distributed to members of the BoD, scaled from 1 up to 7 (Table 4). One means very poor and seven very good. TC stands for Traditional co-ops while RC for re-engineered co-ops.

TABLE 4. SUBJECTIVE PERFORMANCE AND SIZE INDICATORS OF CO-OPS

Co-op	Type	Subjective performance	Sales [a]	Total assets [a]	Net profit [a]
(1)	(2)	(3)	(4)	(5)	(6)
Kilkis	TC	4	5,236,293	6,567,027	-1,305,992
Chalkidiki	TC	4	4,299,956	5,832,370	-258,217
Rodopi	TC	3	18,528,920	15,648,661	-5,140,017
Axiopouli	RC	1	1,832,145	45,600	-48,568
Didimoticho	RC	3	6,519,747	385,032€	-617,711
Kavala	RC	5	30,651,787	1,348,300	49,520
Arnea	TC	3	1,906,964	30,500	84,052
Orestiada	RC	3	19,338,788	690,000	-1,049,440
Paggeo	RC	6	1,053,757	3,300,293	27,431
NEOGAL	RC	5	17,107,610	25,405,249	428,229
Xanthi	RC	4	--	--	--
Giannitsa	TC	3	13,843,585.76	26,902,616.67	-1,918,823
Evros	TC	1	2,309,500.16	3,340,229.29	-1,963,992
Serres	TC	6	10,842,844	26,622,238	5,863
Drama	RC	5	13,052,318	18,350,445	26,644

[a] *in €uro for 2010.*

The findings demonstrate that in terms of both subjective and objective performance the evidence is mixed. When profitability is taken into account, in general their financial performance is quite low, often negative, as it has been proven also by other studies (i.e. Sergaki and Semos, 2006). Our results indicate that although the highest profitability is illustrated by the highest re-engineered co-op (NEOGAL, Kavala, Paggeo, Drama), there also exist re-engineered co-ops that fail to have a good performance (Orestiada, Didimoticho, Axioupouli). Regarding the group of traditional co-ops, only one co-op seems to perform well, while the others perform relatively poor. These results are also in line with the subjective (perceived) performance. Of course, perceived performance is not always matched with profitability figures, yet, it seems that overall, reflects the actual objective performance to a good extent.

In addition an ANOVA analysis was performed in order to examine if there are any statistically significant differences among size (sales and total assets) indicators and performance (Table 5). Our results indicate that both traditional and re-engineered co-ops are facing poor performance with re-engineered co-ops a better net profit index even though a negative one.

TABLE 5. ANOVA ANALYSIS FOR CO-OPS' SIZE INDICATORS AND PERFORMANCE

(1)	Organisational attributes (2)	Mean value (3)	(4)	Df (5)	F (6)	Sig. (7)
Sales	Traditional	8,138,295	Between groups	1	.988	.34
	Re-engineered	12,793,736	Within groups	12		
	Total	10,466,015	Total	13		
Total assets	Traditional	10,934,120	Between groups	1	.779	.39
	Re-engineered	6,970,066	Within groups	12		
	Total	8,621,755	Total	13		
Net profit	Traditional	-1,499,589	Between groups	1	1,359	.26
	Re-engineered	-175,495	Within groups	12		
	Total	-837,542	Total	13		
Net profit /sales	Traditional	-0.21	Between groups	1	4,739	.05
	Re-engineered	-0.017	Within groups	12		
	Total	-0.11	Total	13		

These findings demonstrate that in terms of their size the largest co-ops have applied re-engineered attributes in their management. However, this is not a clear trend since there are quite large co-ops that insist on traditional management.

Third Step: Organisational Attributes and the Co-Ops' Strategic Orientation

Table 6 presents the different competitive strategies applied by the co-ops in Greece. The findings indicate that co-ops that apply "differentiation" strategy are more likely to adopt re-engineered management attributes.

Most traditional co-ops in Greece are not focusing on differentiation strategy through the "brand building" strategy and the "advertisement" strategy as main attributes of their strategy. Traditional co-ops are trying to forecast demand and market growth (followers of low cost strategy) for the markets they operate in an effort to identify and maintain their market shares. At the same time cooperative exports are rather low for all co-ops.

Co-ops (both Traditional and Re-engineered) participating in this study focus on quality through the ISO certification. This could imply that co-ops are trying to differentiate their products through their quality. However, it is our belief that this is a defensive technique in order to maintain their customers that demand this certification and at the same time to comply with the European Legislation that imposes ISO certification (ISO 22000) for food and feed companies. In this survey only one co-op produces local specialty products (under the PDO and PGI – Geographical Identification –schemes promoted by the European Union).

Over all, by inspecting the differences among strategies implemented by both co-op types, our findings infer that the vast majority of co-ops indeed maintained a defensive focus by applying cost-leadership strategies.

TABLE 6. STRATEGIC ATTRIBUTES OF THE PARTICIPATING CO-OPS

Co-op (1)	Type (2)	Exports [a] (3)	Focus on brands and advertising [b] (4)	Focus on quality (ISO) [b] (5)	Focus on customer [b] (6)	Forecasting demand and market growth [b] (7)	Specialty local products (8)	Strategic orientation [c] (9)
Kilkis	TC	0.0 per cent	6	4	6	2	No	Low cost
Chalkidiki	TC	60.0 per cent	2	2	1	5	No	Focus low cost
Rodopi	TC	0.0 per cent	3	6	7	5	No	Low cost
Axiopouli	RC	0.0 per cent	3	6	4	2	No	Focus low cost
Didimoticho	RC	0.0 per cent	3	6	6	3	No	Differentiation
Kavala	RC	30.0 per cent	3	4	2	6	No	Differentiation
Arnea	TC	0.0 per cent	1	1	1	1	No	Low cost
Orestiada	RC	20.0 per cent	3	5	4	6	No	--
Paggeo	RC	0.0 per cent	2	6	5	2	No	Differentiation
NEOGAL	RC	0.0 per cent	6	6	6	1	No	Differentiation
Xanthi	RC	20.0 per cent	6	1	6	3	No	Focus low cost
Giannitsa	TC	90.0 per cent	2	6	1	6	No	Low cost
Evros	TC	0.0 per cent	2	4	1	2	No	Low cost
Serres	TC	5.0 per cent	3	2	3	5	No	Differentiation
Drama	RC	10.0 per cent	6	6	6	5	Yes (1 product)	Low cost

[a] as a percentage of their sales, [b] 7 item scale ranging from 1 (min) to 7 (max), [c] According to Porter's typology. The answers were gathered from the oral interviews with BoD.

TABLE 7. CROSS-TABULATION BETWEEN ORGANISATIONAL ATTRIBUTES AND STRATEGIC ORIENTATION.

Organisational attributes (1)	Strategic Orientation (according to Porter's typology) Low Cost (2)	Differentiation (3)	Focus on low cost (4)	Total (5)
Traditional	5 (35.7 per cent)	1 (7.1 per cent)	1 (7.1 per cent)	7
Re-engineered	1 (7.1 per cent)	4 (28.4 per cent)	2 (14.2)	7
Total	6	5	3	14

V

CONCLUSIONS

In this study an effort was made to identify the generic strategies followed by the agricultural co-ops in Greece by using Porter's typology of strategies. The findings

demonstrate that substantial efforts have been made to re-engineer their structure but still it is very difficult to change their strategy. The majority of them prefer to apply defensive strategies (cost leadership) than offensive (differentiation, focus) mainly as a result of the lack of a well-developed strategic focus (market-driven) plan. However, this strategic orientation does not seem to influence positively co-ops performance.

In terms of size, the largest co-ops have applied re-engineered attributes in their management. Similarly, the most profitable co-op has achieved the highest re-engineered score. The identified relation between re-engineered attributes and aggressive strategies supports the assumption that co-ops are challenged to adapt to market changes by re-engineering their structure and strategic behavior.

Greek co-ops have to adapt their organisational attributes and strategic orientation in a coherent way. Otherwise, it is very difficult to correspond successfully to the market challenges and to compete with the private food firms. In any case, agricultural co-ops should survive because their role in the Greek economy is important as they promote the economic organizations of farmers, contributing actively to the economic viability in rural areas, especially for the less favored regions in Greece (Salavou *et al*., 2013).

This study explores and inspects the nature of the relationships among co-ops structure, strategy, size and performance by using several empirical observations derived from both archived sources and survey questions. Nevertheless, an empirical study accounting for casual influences among these relationships is needed in order to illustrate co-ops structure and strategic behavior over time.

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