India - Reforming Farm Support Policies for Grains

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ABSTRACT

The objective of this study is to analyze some of the recent reforms proposed in the operation of government buffer stocks and provision of price support to wheat and rice farmers in India. Based on the Indian grain market scenario and the recent policy initiatives this study estimates the potential impacts of reforms in India's farm support policies on producers, consumers and traders in various regions of the country. The results are based on a multi commodity partial equilibrium simulation model of regional supplies and demands of grains by different economic classes. In particular, the study focuses on the decentralization of procurement of grains by the individual states where the latter are free to fix their minimum support prices for wheat and rice and the purchase of grain for the public distribution system (PDS) is from the open market.

The results show that a switch to decentralized PDS and procurement and removal of rice levy leads to a fall in both procurement and buffer stocks of grains. We also consider implications of reducing minimum support prices (MSP) from their current exorbitant levels. Since in a decentralized scenario the PDS requirements are purchased from the open market, costs of operating the PDS tend to go up. But, when the states reduce the MSP from its current high level, these costs go down. This, in fact, results in a fall in market prices leading to higher consumption by all income classes with consequent rise in consumer welfare. Adding across all agents, total surplus from rice and wheat policy reform is positive in net consuming states and negative in major surplus states. But at the aggregate national level, there are net gains.

Price support to farmers could also be offered to farmers in the form of cash subsidy or 'deficiency payment'. That is, farmers are compensated through deficiency payments when market prices fall below an insured price floor. This results in great cost savings to the government (as it no longer needs to undertake storage and physical handling of grains) while at same time benefiting consumers of all economic classes.

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1. INTRODUCTION

Since production is concentrated in a few states of India, there is a large regional mismatch between supply and demand of food grains, which is eliminated by movement of grains between surplus and deficit states. The Government of India (GOI) plays an important role in procuring grains from surplus states at "minimum support price" (MSP) to sell at subsidized prices (including in deficit states) through its agency, the Food Corporation of India (FCI). In the case of wheat, the government offers to buy all grain that comes forth for sale at its MSP. For rice, part of the procurement is in the form of paddy at its MSP, which is custom milled and the rest, which is the major part, is procured in the form of rice as a statutory levy imposed by states on rice millers/dealers.

In the past, prices were in general suppressed for producers. This was due to several reasons: (1) industrial protection through import-substitution strategy that discriminated against agriculture, (2) export controls on agricultural commodities, (3) levy/ coercive procurement at low prices for the subsidized public distribution system (PDS) and (4) restrictions on internal trade. Since output prices were kept low in the interest of consumers and food security, farm

inputs were subsidized to compensate the farmers. Thus distortions were created in both input and output markets.

The recent years have witnessed an unprecedented rise in MSP due to pressures from powerful farm lobbies in surplus states. As a result, the difference between MSP and 'C2 cost of production' escalated through the 1990s with MSP rising to 140%-150% of this cost by 2000.[2] The resulting high procurement together with a decline in PDS sales and in international prices resulted in a sudden jump in government buffer stocks. The MSP program and buffer stock operations resulted not only in the emergence of large government stocks, but also in even larger amounts of bank credit tied up in these stocks and enormous budgetary outlays to cover the costs of procurement, storage, and distribution. In recent years, the stocks are down to manageable levels due to heightened activity through reforms in PDS, export subsidy on grains and higher utilization for food-based employment and other welfare programs.

While MSP policy proved effective in maintaining producer incentives and assuring supplies of food grain at stable prices as India progressed from a deficit to surplus position in food grains, experience suggests that this price intervention distorted output crop-mix. Between 1998-99 and 2000-01, area under wheat increased by 0.53 million ha in Haryana, Punjab and Uttar Pradesh. A study by the Department of Agriculture and Cooperation showed that between 1990-91 and 1999-2000 the area under rice in Punjab increased from 2 million ha to 2.6 million ha, presumably in response to high procurement prices, whereas that under maize, cotton and oilseeds declined [Chand (2003), GOI (2002) and World Bank (2003)]. As a side effect, excessive water use for paddy cultivation led to a decline in ground water table by 20 to 30 ft.

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[2] The 'C2 cost' is the comprehensive cost of production and takes into account all the cost components other than management cost. It includes rental on leased land, imputed value of family labor and interest on the value of owned capital.

It is now increasingly recognized that the MSP policy is neither fiscally sustainable nor conducive to efficient use of resources. GOI is exploring alternative policy options that provide farm support at lower public costs. A High Level Committee on Long-Term Grain Policy made recommendations regarding reforms related to MSP (Box 1). It examined the cost effectiveness and liabilities arising from some alternative programs to support farmers in lieu of the MSP scheme. Among other things, the Committee proposed removal of rice levy and restrictions on grain trade with their possible usage in emergencies.

Box 1.   Recommendations of High Level Committee on Long-Term Grain Policy: GOI (2002)

1. MSP policy should extend to all regions.
2. MSP should be national level floor price, rather than remaining confined to surplus regions.
3. MSP should be reduced to levels of average capital costs (i.e. all costs including imputed costs of family labour, owned capital and rental on land).
4. To compensate farmers, governments should provide combination of: direct per hectare transfers, subsidized premiums on insurance schemes on crop income/prices, specification of crop diversification schemes and other credit/input linked schemes to offset cost, including electricity.
5. MSP policy should be supplemented by a system of warehouse receipts and market based insurance against price and income fluctuation.
6. Procurement should be at market prices and levy procurement of rice should be eliminated.
7. MSP should be supplemented with variable import and export tariff for effective price stabilization.
8. When market price is greater than MSP, government imports or makes open market purchases.
9. There should be stable and predictable policy regarding open market sales.
10. Private trade should be encouraged.

In this study we examine the potential impact of alternative policy scenarios concerning the PDS and provision of price support to farmers. We focus, in particular, on the decentralized procurement policy proposed by GOI, removal of rice levy, reduction of MSP and deficiency payment (cash subsidy) in lieu of physical procurement of grain. We obtain the potential impacts of these reforms on producers, consumers and traders in various regions of the country. We also examine the robustness of the results in the light of domestic supply shocks and external price shocks. Most of the existing studies use a single commodity framework at the aggregate national

level. They fail to capture the direct benefits from trade to farmers, consumers and traders in different regions. This study attempts to fill these gaps through the use of a regional multi-commodity partial equilibrium model. It takes into account substitution possibilities between crops and competitive domestic and external trade.

The rest of the report is organized as follows. Section 2 briefly describes the Indian policy scenario. This is followed in Section 3 by a description of the computational model used to analyze policy alternatives. The alternative scenarios analyzed in the paper are described in Section 4. Results of the model based analyses are presented in Section 5. Section 6 provides concluding remarks.

2.   FOOD POLICY INTERVENTION IN INDIA

The Indian farm policy has evolved with the changing economic environment. The main policy objectives include stabilizing prices for agricultural produce to even out effects of seasonality and ensuring remunerative prices to growers with a view to encouraging higher investment and production. The government uses buffer stocks of food grains and carries out import and export through its agencies (usually referred to as canalized trade with restricted private external trade) to stabilize prices.

To support farmers, the government announces minimum support prices (MSP) for selected *kharif* and *rabi* crops.[3] The MSP for major agricultural products is fixed on the basis of recommendations of the Commission for Agricultural Costs and Prices (CACP) though at times the announced prices exceed recommended levels. In recent years, this trend has been noticed particularly for wheat, among other crops. While recommending these prices the CACP takes

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[3] In India, there are two rice harvests – May-June and October-December. But wheat has a single harvest from May-June.

into account various factors apart from the cost of production. They include changes in input prices, trends in market prices, inter-crop price parity, demand and supply situation, effect on industrial cost structure, effect on general price level, effect on cost of living, international market price situation and parity between prices paid and prices received by farmers.

The Food Corporation of India (FCI) purchases food grains for the central pool at procurement prices fixed by the central government from time to time. These grains are issued to states at Central Issue Prices (CIP) for Targeted Public Distribution System (TPDS) to serve families Below Poverty Line (BPL) and Above Poverty Line (APL) at rates fixed by Government.[4] The difference between the economic cost (purchase cost of grain plus incidental expenses on procurement and administration) and the CIP is reimbursed to FCI as food subsidy. FCI also carries buffer stock on behalf of the government and is reimbursed the cost of carrying this stock, which includes handling, storage, interest and administrative charges.

In the case of wheat, procurement takes place to provide price support to farmers and to service TPDS and other welfare schemes of GOI, as also to build up buffer stocks of food grains to meet food security needs. The grains are procured in Purchase Centers opened in Surplus States by FCI/ State Agencies. Quantities procured by the state governments/ agencies are taken over by FCI on payment of incidental charges. Rice procurement for the Central Pool by some States/ Union Territories (UTs) takes place under statutory levy imposed on rice millers/ dealers. After obtaining prior concurrence of the central government, state governments/ UTs administrations issue Levy Orders under the powers delegated to them under Essential Commodities Act. Under the Levy Orders issued by the state governments, a certain percentage

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[4] TPDS is operated as a joint responsibility of the central and the state governments. While the central government is responsible for procurement, storage, transport and allocation of rice and wheat, the states take the responsibility for distribution to consumers.

of rice milled by millers is handed over to FCI. The levy percentage varies from 10% in Pondicherry to 75% in Haryana, Punjab and Orissa. In view of local production, storage constraints with FCI and open market availability, requests are received from States/ UTs to increase or decrease the levy or to scrap the system for a specified period. Taking into account the overall food situation, States/ UTs are advised to either increase or decrease the levy percentage. Rice millers are paid levy rice prices fixed by the Government. These prices are announced well before the Kharif Marketing Season, which begins on 1ˢᵗ October every year.

As mentioned earlier, MSP of rice and wheat to support farmers has been raised substantially in recent years. During 1992-93 to 1999-2000, the annual increase in MSP exceeded annual average inflation [Economic Survey (2000-2001)]. For example, against the annual inflation of 7% measured in terms of wholesale price index, the MSP for rice and wheat grew at the rate of about 10% and 11% respectively. In 2000-01, MSP constituted 57% of the economic cost of FCI for rice and 70% for wheat.[5] Such high and rising support prices resulted in large public stocks – that exceeded 60 million tonnes in 2002 – adding further to FCI's costs and government's subsidy bills. A recent *National Policy on Handling and Storage of Food Grains,* among other things, envisages encouragement of private sector for building storage capacities and also development of infrastructure for integrated bulk handling, storage and transportation of food grains.

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[5] The economic cost comprises acquisition cost and distribution cost. In 2000-01, these two components constituted respectively 84% and 16% of the total. The acquisition cost consists of procurement cost, state taxes, transportation, handling and storage.

2.1. Recent GOI Initiatives

GOI is considering steps to reform the existing system and introduce ways of providing farm support that create fewer market distortions. One of the steps under consideration is the revival of crop insurance as a mechanism to support farmers. The original schemes of crop insurance were group insurance schemes aimed at farmers taking crop loans from banks. However, most of these schemes failed to estimate the actuarial probability of the risk covered resulting in claims paid being as high as six times the premiums collected. In 1999-2000, the government introduced the National Agricultural Insurance Scheme (NAIS) or the Rashtriya Krishi Bima Yojana replacing the Comprehensive Crop Insurance Scheme (CCIS) of 1985. It aims to cover all farmers growing all types of crops. The premium rates are higher for riskier crops as compared to those exposed to fewer hazards like wheat and *rabi* crops in general. Small and marginal farmers are eligible for 50% subsidy on the premium. To make NAIS more user-friendly, the government is proposing some modifications. These include rationalization of premium rates, reduction in unit area of insurance to the Gram Panchayat level (village government), and voluntary participation of loan-taking farmers and early settlement of claims. Budget 2002-03 proposed the setting up of a separate corporation for agriculture insurance to be promoted by the existing public sector general insurance companies. There is also effort towards rationalization of premium rates, voluntary participation of farmers and early settlement of claims.

To overcome the problems associated with the existing centralized procurement and distribution of food grains the government proposed decentralization of the procurement process by dispersing procurement centres to different parts of the country, encouraging local procurement to the maximum extent. It has been noted by several committees, e.g., GOI (1991,

2002), that the operations of FCI tended to become costly due to certain inefficiencies. For example, since the major food deficit states are located in the north-east and far south, transportation of food grains from Punjab and Haryana to these states put enormous pressure on rail traffic besides causing huge expenditure on transportation cost and losses on account of transit, storage and pilferage. The proposal of decentralized procurement is mainly aimed at providing a greater role for state governments and private traders enhancing efficiency gains. It was felt that by encouraging states to take up procurement operations the benefits of MSP can accrue to farmers throughout the country. Under "decentralized procurement" scheme the designated states will locally procure, store and distribute food grains as per allotments indicated by the central government under PDS. The GOI will compensate the states for the difference between the economic cost of procurement and CIP (price at which grain is sold through PDS) in the form of a subsidy. The states however cannot claim any arbitrary amount as economic cost. It would be fixed by the centre based on some norms. This has a built in incentive for individual states to be efficient. In effect the states purchase grains for the PDS at market price. In the surplus states this market price is, however, likely to be at the level of MSP the support price. This policy allows private trade to play a greater role in agriculture marketing.

As government intervention requiring physical handling of foodgrain is found to be expensive GoI is also considering the alternative of "deficiency payment" where farmers would be reimbursed the positive difference between market equilibrium price and a predetermined MSP. This scheme can however be even more expensive if the MSP is equated to the cost of cultivation. The choice of MSP should therefore be limited to meeting the objective of stabilizing the price variations created by the vagaries of weather.

3. DESCRIPTION OF THE MODEL USED

Given the wide variation in regional production patterns in India, welfare impacts of domestic reforms in agricultural markets can best be analyzed using a spatial equilibrium model. We therefore use a multi-regional and multi-commodity partial equilibrium model to analyze the impact of selected alternative farm support programs for grain markets (for rice and wheat) in India. In the spatial trade equilibrium model we consider 18 major states (regions) that account for 99% of total production of these grains. Demand and supply functions for rice and wheat are specified for each state based on elasticity estimates available from the existing literature. These functions are calibrated for the base year 2000-01 using data for that year on all exogenous and endogenous variables.[6] In the model, regional demands and supplies of rice and wheat interact with each other through their substitution possibilities both in consumption and in production. Equilibrium prices and other variables are obtained as a solution to the commodity balance equations subject to the constraints imposed due to government interventions.[7]

3.1. Demand and Supply Functions

We divide the total population into 6 income groups – 3 for rural areas, viz. rural poor, rural middle class and rural rich and 3 for urban areas; urban poor, urban middle class and urban rich. Demand functions are specified for each of the six income groups. The aggregate demand in each state is obtained as the sum total of group demands weighted by the population size of each income group. The data on parameters are presented in the Appendix. We consider linear demand functions, which incorporate the effects of own price, cross price and income. For each region i, the open market demand function for each category of consumers is specified as follows:

$$D_i = \alpha_i + \beta_i \, pr_i + \gamma_i \, qr_i + \lambda_i \, y_i \tag{1}$$

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[6] Details on data and calibration of parameters are found in Jha and Srinivasan (2004).

[7] Computation of equilibrium prices is formulated as a Mixed Complementarity Problem (MCP). The market equilibrium that satisfies the commodity balance equations and the set of inequalities depicting government interventions is obtained as a solution to the MCP using PATH Solver in Generalized Algebraic Modelling Systems (GAMS) software.

where

pr$_i$ = Own retail price

qr$_i$ = Retail price of the other crop

y$_i$ = Per capita income

The supply function is also assumed linear. It depends on the weighted average of market and

procurement prices received by the farmers[8]:

$$S_i = a_i + b_i \, wap_i + c_i \, qf_i \qquad (2)$$

where

S$_i$ = Production

wap $_i$ = {λ pf$_i$ + (1 − λ) lvp$_i$} = weighted average of procurement and market prices

pf$_i$ = Farm harvest price

lvp   = Levy price (MSP in case of wheat and levy procurement price in case of rice)

qf$_i$ = Weighted average farm harvest price of substitute crop

3.2. Interstate Trade

Aggregate regional imports are defined as the difference between free market demand, i.e., total
consumption net of PDS consumption, and free market supply, i.e., production net of procurement. In
addition to transport costs, private traders incur other transaction costs that manifest in the form of policy
induced market restrictions, infrastructure bottlenecks, other trade obstacles etc. These transaction costs
are modelled as implicit tariff on interstate trade.[9] In the absence of such transaction costs, spatial
arbitrage possibilities are determined by transport costs alone.

Trade from Region i to Region j is determined by the following complementarity (no spatial
arbitrage) condition

$$T_{ij} \geq 0 \qquad \perp \quad [p_i + tc_{ij} + tm] \geq p_j \qquad (3b)$$

where

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[8] Depending on the production patterns in different states, rice and wheat can be substituted for each other in
production only in some states. However, from the available literature we could not get any significant cross-price
elasticity estimates and had to drop this variable from the supply equations for all states.

[9] See Jha and Srinivasan (2004) for details.

T_{ij} = Trade from region i to region j

tc_{ij} = the transportation cost from state i to j

p_i = wholesale price

tm   = traders' margins.

The above complementarity condition says that trade will not take place ($T_{ij} = 0$) so long as the sum of purchase cost in state i, cost of transporting grains to state j and the traders' margin inflated by the implicit tariff exceeds the returns, the open market price in state j, i.e., $(p_i + tc_{ij} + tm) > p_j$. Trade takes place so long as the reverse inequality holds. Perfectly competitive markets imply that trade from state i to j will continue to grow until all the arbitrage benefits are exhausted and total cost equals the open market price in the destination state. Thus, $T_{ij} > 0$ implies that $(p_i + tc_{ij} + tm) = p_j$. Transport costs are assumed to be exogenous (constant average unit costs).

3.3. Foreign Trade

External trade is modeled by treating the rest of the world as another region with which individual states can directly trade by incurring the additional costs of transport from the nearest/ cheapest port. Given that the world rice market is thin, we make the large country assumption. Imports, e.g., would tend to become costlier as the magnitude of imports goes up. Similarly, the price received for exports would decline as quantity traded goes down.

Exports take place so long as the price received remains higher than the cost of purchasing the grains plus transport cost from the state center to the port. Imports take place if it is cheaper to import than to buy in the domestic local market. Exports/ imports are therefore obtained from the following complementarity conditions:

$$x_{i,ROW} \geq 0 \quad \perp \quad [p_i + tc_{i,ROW} + \text{traders' margins}] \geq p_x \tag{4a}$$

$$m_{i,ROW} \geq 0 \quad \perp \quad [p_m + tc_{i,ROW} + \text{traders' margins}] \geq p_i \tag{4b}$$

where x and m denote exports and imports and p_x and p_m denote their respective prices.

$$p_x = \text{border price} - \text{port clearance charges} - (ec \times x)$$

$$p_m = \text{border price} + \text{port clearance charges} + (ic \times m)$$

where border price is expressed in domestic currency, *ic* is the import coefficient and *ec* the export coefficient. The coefficients ic and ec are obtained from their respective price elasticities of exports (imports) with respect to exports (imports), evaluated at the base year values.

3.4. Price Relationships

Equilibrium prices computed in our model are at the wholesale level. However, consumers face the retail price, which enters in the demand equation:

$$pr_i = p_i * (1 + \text{retail margin})^{10} \tag{5}$$

Farmers receive the farm harvest price pf_i, which enters the supply equation:

$$pf_i = p_i / (1 + \text{wholesale margin} + \text{marketing cost}) \tag{6}$$

Prices:

The Public Distribution System (PDS) price in state i for both rice and wheat is expressed as a fixed percentage lower than the market price: PDSPi = vi pi

Procurement Price is assumed to be the same for all states and it is exogenous. For rice it is a fixed Levy Price whereas for wheat it is a fixed Minimum Support Price (MSP)

3.5. Public Intervention

PDS:

Quantities distributed through the PDS are fixed exogenously for each state.

Procurement of grains under MSP:

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[10] Since we do not have data on retail profit margins, we assume it to be the same percentage as the wholesale margin applied on farm harvest prices to derive wholesale prices.

In all the scenarios where MSP policy is implemented by physical procurement of grain the quantities procured of both rice and wheat is determined endogenously based on the complementarity conditions.

$$\text{Proc}_{Ri} \geq 0 \qquad \perp \qquad p_{Ri} \geq \text{MSP}_{Ri}$$

$$\text{proc}_{Wi} \geq 0 \qquad \perp \qquad p_{Wi} \geq \text{MSP}_{Wi} \tag{7}$$

where proc_{Ri} and proc_{Wi} denote quantities procured of rice and wheat respectively.

The above complementarity conditions imply that quantities procured will be zero when open market price is higher than MSP. Moreover, whenever quantity procured is positive, open market price equals MSP.

The exception is in scenario 1 where rice procurement is in the form of levy. That is, rice procurement in this scenario is taken as an exogenously fixed percentage of production $\text{proc}_{Ri} = \mu_i S_{Ri}$ where μ_i is the levy fraction of output in state i

3.6. Market Equilibrium

The market clearing condition equates net availability to demand in each state. Since PDS quantities are exogenously specified, the condition reduces to equating open market demand with net supply, which caters to the domestic open market demand. The net grain available for consumption within a state through open market purchase is obtained by subtracting from production the outflows from the state, which consist of net regional imports, government procurement and net foreign exports. Thus the equilibrium condition for each state i is

$$S_i + (\Sigma_j T_{ij} - \Sigma_j T_{ji}) - \text{proc}_i - (E_i - M_i) = D_i \tag{8}$$

Markets are cleared by the adjustment of price p_i.

The level of MSP is such that the quantity procured is more than enough to cover the PDS requirements. Similarly, the levy fraction for rice is such that PDS needs are met. The difference between the quantity procured and PDS is taken to be the stocks held by the government.

4.   MODEL SIMULATIONS

Model simulations are used to obtain welfare implications of alternative scenarios under decentralized PDS/ procurement policies as compared to the centralized PDS/procurement scenario. In all cases it is assumed that there are no restrictions on domestic trade of grains.

4.1.   Centralized PDS/Procurement scenario (Reference Scenario):

The base or reference scenario (Scenario 1) is assumed to be a situation where the operations relating to PDS/ procurement are centralized. In this scenario, grain is procured by a central agency (FCI). In the case of wheat, procurement is made to defend the MSP policy of GOI, whereas in the case of rice it is in the form of compulsory levy. The levy prices as well as levy fractions (the fraction of output procured) are different in different states. Such procurement also serves the requirements for PDS. Part of the quantity procured is distributed to states for PDS purpose at CIP and the rest is kept as buffer stocks. The difference between the quantity procured and the quantity distributed through PDS constitutes buffer stocks.

4.2.   Decentralized PDS/ Procurement Scenarios

The alternative scenarios in the analysis consider decentralization of both procurement and PDS operations in order to reduce the role of government/FCI and increase the role of private traders in moving grains between regions (Table 1). In this set of scenarios (scenarios 2-5), the system of rice levy is removed and each state operates a policy of price support by specifying MSPs for both rice and wheat. In surplus states, the equilibrium market price would equal MSP, which provides a lower bound. In deficit states, free market price is likely to be above MSP with the quantity procured under price support operations amounting to zero. Note that procurement by states is not for the purpose of serving the PDS but for providing price

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support to farmers. Grain requirement for PDS is assumed to be purchased in the open market. Hence the entire quantity procured under the MSP policy goes to form government stocks. For comparability between scenarios we fix the state level MSP in the Decentralized Scenario at the same level as in the Reference (Centralized) Scenario. In the case of rice, the state level MSP is assumed to be the same as the prevailing levy prices.

Table 1. Scenarios for Simulation

Scenario	Wheat Procurement	Rice Procurement	PDS requirements	Buffer Stocks
1: Scenario 1. Centralized Procurement/ PDS	Grain procured under GOI's MSP policy	Grain procured under Compulsory levy	Met from GOI procurement	Procurement less PDS quantity
2: Scenario 2. Decentralized Procurement/ PDS	Grain procured under States' MSP policy	Grain procured under States' MSP policy	Met from open market purchases	Grain procured by all states under MSP
3: Scenario 3. 10% lower MSP	Same as scenario 2, but with 10% lower MSP			
4: Scenario 4. 20% lower MSP	Same as scenario 2, but with 20% lower MSP			
5. Scenario 5. Deficiency payment	Same as scenario 2, but with cash subsidy (deficiency payment) in place of physical procurement of grain.			

Note: In all the scenarios it is assumed that there are no restrictions on domestic trade of grains.

We assume that grain required for PDS purposes is purchased at local market prices by individual states. The difference between the market price (the price at which they procure grain) and the PDS issue price times the quantity distributed through PDS will be the subsidy provided by the central government to the state governments for running their PDS. Since market price at which PDS purchases are made in the decentralized scenario is likely to be higher than the MSP/ levy price in the centralized scenario, the cost of PDS operations can rise. However, there can be a significant reduction in distribution costs when procurement is decentralized. A large fraction

of the distribution costs (as much as 61.5%) is due to interest charges and freight [Acharya (2001) pp. 157-58]. In our simulations we assume that the distribution costs are lower by 60% in the decentralized procurement case compared to the reference scenario of centralized procurement.

An effective measure to reduce government costs would be to reduce the level of MSP, for which there is now a consensus. In the past, GOI fixed it at the level of "C2 cost of production". However, in recent years political compulsions have led to setting of MSP at much higher levels than C2 cost. This has benefited farmers in surplus states tremendously. For instance, according to one estimate, in 2001-02 this benefit amounted to about Rs.20 billion for farmers in Punjab. Moreover, large farmers in surplus states gained as much as 10 times the marginal farmers.

Various mechanisms are now being suggested for setting MSP, i.e., the level at which MSP should be fixed. GOI (2002) recommended basing it again on C2 cost of production. Other suggestions are to link MSP to market prices. US experience shows linking MSP not to cost of production or market prices (e,g., moving average of market prices) can tilt the balance from consumer vs. producer to only producer. For instance, the FAIR Act used Olympic average of market prices to set loan rates for the entire duration of 1995-2000; not related to cost of production. Which prices would then be appropriate? Should MSP be linked to domestic market prices (which are affected by policy choices) or to world prices? Or should it be based on a moving, say five-year, average with a gradually reducing support? However, evidence (from India and the USA) suggests tying prices to cost of production can escalate factor prices, e.g., price of land. Another argument is to base MSP on technological considerations. There is also a

concern that "weakening MSP" will threaten food security by impacting on output growth and farm incomes.

Irrespective of the rationale for setting the level of MSP, we simulate the effects of fixing MSP at different levels. Thus, we consider in turn in scenarios 3 and 4 respectively reductions of 10% and 20% in state-level MSPs.

In scenario 5, we consider Deficiency Payment, a cash subsidy to farmers to insure price at the level of MSP. That is, if the market price is lower than MSP, the farmer receives the difference between MSP and market price as cash subsidy, thus effectively receiving a price equal to MSP. The subsidy cost to the government is obtained as the product of net production and the positive difference between MSP and market prices. By design, deficiency payment will be activated only when market price falls below the announced MSP. Note that the government does not procure grain in this scenario and hence there will be no buffer stocks with the centre.

5. IMPACT OF REFORMS: RESULTS FROM MODEL SIMULATIONS

The gains from suggested reforms are analyzed in terms of their impacts on government costs and welfare of different agents: consumers, producers and traders. We also see how state-wise consumption, production, procurement and prices get affected by these reforms.

5.1. Decentralization of Procurement/ PDS

Let us first consider the case of rice. Due to decentralized PDS/ procurement and the removal of levy procurement, open market prices in most surplus states rise resulting in a fall in consumption (compare scenario 2 with 1). The opposite is the case in deficit states. Tables 2 and 3 provide respectively data on quantities and prices corresponding to various scenarios. The

magnitudes of changes depend on price elasticities of demand. These elasticities are such that even though on an average, open market prices rise slightly, the aggregate national consumption of rice increases by about 0.3 million tonnes. The increase in consumption is met partly from imports (see Figure 1) and partly from a rise in production as rice farmers in most states receive prices higher than the pre-decentralization levels. The average price across states also rises. Removal of rice levy allows farmers to sell their produce in the open market. Since the market price in the absence of levy procurement is greater than the weighted average price under levy procurement it makes them better off. The table of trade flows shows that in the decentralized scenario the pattern of trade is different from what it was in the centralized case when PDS quantities were distributed by FCI to states (Table 4). In the absence of centralized procurement and distribution of rice, private trade takes place among more states. We also find that the dispersion of prices across regions is reduced due to decentralization of PDS and procurement. That is, decentralisation helps to stabilise prices across territories.

In the case of wheat, there is no change in state-wide prices (either for consumers or producers) due to decentralization of procurement/PDS operations. This happens because MSP continues to be fixed at a high level as in the centralized case. As the MSP is set at a high level even in the decentralized scenario market prices are equal to MSP. Since there is no change in prices, there is no change in consumption or production of wheat and hence in consumer and producer surplus. However, since PDS requirements are purchased at the free market in the decentralized scenario there is more scope for private trade across states. Inter-state trade in wheat goes up by as much as 2.3 million tonnes while imports from abroad account for about 0.1 million tonnes.

Effects on Public Operations and Costs

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Decentralization of government operations of procurement and PDS to states, leads to a reduction in procurement and central stockholding (Table 5). In the decentralized scenario, since grain requirement for PDS is met by market purchases, grain procured by each state is only for the purpose of providing price support to farmers (the MSP program). The quantity procured by each state is thus treated as government buffer stocks. Rice procurement under price support operations is expected to be positive mainly in surplus states. And among these surplus states procurement is likely to be lower for those that have relatively higher PDS requirements since their over-all market demand increases through PDS-related purchase. For example, among surplus states procurement decreases in Uttar Pradesh compared to Punjab and Haryana since its PDS requirements are relatively higher.

Figure 1. Foreign Trade: Imports by States
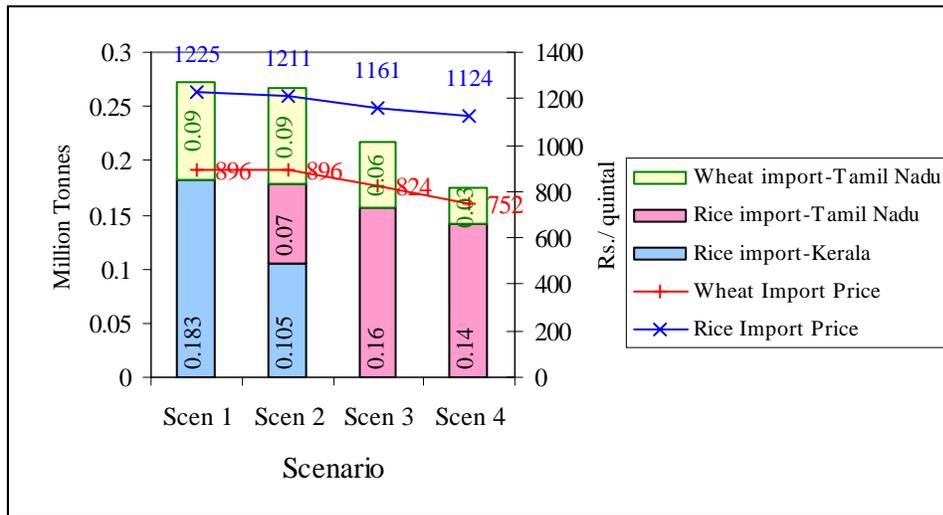
Notes:
Under the 'large country' assumption, import prices increase as imports rise.
Scenario 1: Centralized Procurement/ PDS
Scenario 2: Decentralized Procurement/ PDS
Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP
Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Due to decentralization we find that the cost of running PDS increases as PDS quantities are purchased at market prices that are higher than the issue prices in the centralized case (Table

6). Even though we assume that the distribution costs are lower by 60% in the decentralized case there is a net increase in PDS costs. However, as storage costs and the costs of procuring grain for price support decline, there is a reduction in total government costs.

Table 2. Aggregate Consumption and Production: Decentralization and Lower MSP (Mil Tonnes)

Commodity	Rice								Wheat							
Variable	Total Consumption (including PDS)				Production				Total Consumption (including PDS)				Production			
State	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	10.41	10.57	11.31	11.76	11.44	11.49	11.45	11.43	0.38	0.38	0.41	0.45	0.01	0.01	0.01	0.01
Assam	4.05	4.11	4.44	4.63	3.88	3.88	3.87	3.86	0.25	0.25	0.26	0.27	0.09	0.09	0.09	0.09
Bihar	7.90	7.84	8.62	9.09	5.41	5.41	5.38	5.36	5.58	5.59	5.86	6.11	4.47	4.47	4.44	4.41
Goa	0.13	0.13	0.13	0.14	0.15	0.15	0.15	0.15	0.04	0.04	0.05	0.05	0.00	0.00	0.00	0.00
Gujarat	1.24	1.22	1.26	1.28	1.02	1.02	1.01	1.01	2.72	2.73	3.02	3.33	0.65	0.65	0.64	0.64
Haryana	0.24	0.23	0.27	0.29	2.69	2.69	2.67	2.67	2.49	2.50	2.69	2.90	9.63	9.63	9.55	9.46
Himachal Pradesh	0.31	0.30	0.32	0.34	1.12	1.13	1.12	1.11	0.43	0.43	0.48	0.53	0.59	0.59	0.59	0.58
Jammu & Kashmir	1.05	1.02	1.10	1.15	0.41	0.41	0.41	0.41	0.60	0.60	0.64	0.68	0.14	0.14	0.14	0.14
Karnataka	3.79	3.73	3.77	4.05	3.72	3.73	3.73	3.71	0.82	0.82	0.87	0.93	0.24	0.24	0.24	0.24
Kerala	3.24	3.27	3.43	3.57	0.75	0.75	0.75	0.74	0.41	0.41	0.44	0.46	0.00	0.00	0.00	0.00
Madhya Pradesh	3.19	3.05	3.70	4.08	0.97	0.97	0.96	0.95	4.90	4.91	5.30	5.70	3.88	3.88	3.85	3.82
Maharashtra	3.69	3.67	3.94	4.14	1.95	1.95	1.94	1.93	4.90	4.90	5.41	5.93	0.98	0.98	0.98	0.97
Orissa	5.56	5.66	6.26	6.76	4.64	4.65	4.62	4.59	0.39	0.39	0.43	0.48	0.01	0.01	0.01	0.01
Punjab	0.22	0.21	0.23	0.25	9.16	9.17	9.11	9.08	2.66	2.67	2.90	3.15	15.52	15.52	15.38	15.24
Rajasthan	0.19	0.18	0.20	0.21	0.16	0.16	0.16	0.16	7.87	7.89	8.15	8.45	5.44	5.44	5.41	5.37
Tamil Nadu	7.03	7.11	7.38	7.57	7.22	7.25	7.22	7.20	0.35	0.35	0.37	0.40	0.00	0.00	0.00	0.00
Uttar Pradesh	6.65	6.58	7.49	8.04	11.60	11.61	11.56	11.53	20.36	20.37	21.22	22.00	24.48	24.48	24.31	24.17
West Bengal	8.51	8.81	10.22	11.08	12.51	12.50	12.45	12.42	1.36	1.36	1.45	1.53	1.07	1.07	1.06	1.06
Total	67.39	67.68	74.07	78.43	78.80	78.91	78.54	78.29	56.52	56.58	59.95	63.32	67.20	67.20	66.69	66.21

Notes:

Scenario 1: Centralized Procurement/ PDS

Scenario 2: Decentralized Procurement/ PDS

Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP

Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

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Table 3. State-Wise Prices: Decentralization and Lower MSP (Rs./ Quintal)

Commodity	Rice								Wheat							
Variable	Consumer price (wholesale price)				Producer price (Farm-gate price)				Consumer price (wholesale price)				Producer price (Farm-gate price)			
State	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	1273	1259	1190	1147	945	1013	958	924	957	957	885	813	791	791	732	672
Assam	1272	1259	1190	1147	1024	1013	958	924	1018	1018	946	874	842	842	782	723
Bihar	1236	1242	1173	1130	995	1000	944	910	895	895	823	760	740	740	681	628
Goa	1219	1217	1196	1136	982	979	963	914	954	954	882	810	789	789	729	670
Gujarat	1213	1243	1131	1071	977	1001	910	862	842	842	770	698	696	696	637	577
Haryana	1091	1121	1009	949	892	902	812	764	720	720	648	576	595	595	536	476
Himachal Pradesh	1072	1121	1009	930	863	902	812	749	795	795	723	651	657	657	598	538
Jammu & Kashmir	1114	1163	1051	972	897	936	846	782	837	837	765	693	692	692	633	573
Karnataka	1236	1249	1238	1178	985	1005	996	948	949	949	877	805	785	785	725	666
Kerala	1347	1334	1265	1205	1085	1074	1018	970	976	976	904	832	807	807	748	688
Madhya Pradesh	1219	1242	1137	1077	956	1000	915	867	848	848	776	704	701	701	642	582
Maharashtra	1253	1259	1190	1141	1006	1013	958	918	912	912	840	768	754	754	695	635
Orissa	1253	1242	1171	1111	981	1000	943	894	882	882	810	738	729	729	670	610
Punjab	1091	1121	1009	949	897	902	812	764	720	720	648	576	595	595	536	476
Rajasthan	1158	1188	1076	1016	923	956	866	818	787	787	715	643	651	651	591	532
Tamil Nadu	1305	1292	1242	1205	997	1040	999	970	976	976	904	832	807	807	748	688
Uttar Pradesh	1125	1131	1062	1019	902	910	855	821	784	784	712	649	648	648	589	537
West Bengal	1145	1131	1062	1019	921	910	855	821	895	895	823	760	740	740	681	628
Total	1201	1212	1133	1078	957	975	912	868	875	875	803	732	723	723	664	606

Notes:
Farm gate price in the case of rice is the weighted average price received by farmers from sales in the market and the government levy price. 'Total' refers to the simple (un weighted) average across states.

Scenario 1: Centralized Procurement/ PDS
Scenario 2: Decentralized Procurement/ PDS
Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP
Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Table 4. **Pattern of Inter-State Trade: Decentralization and Lower MSP (Million Tonnes)**

RICE						WHEAT				
FROM.TO	Scen 1	Scen 2	Scen 3	Scen 4		FROM.TO	Scen 1	Scen 2	Scen 3	Scen 4
AP .KER		2.204	0.642			HAR.ASS	0.079	0.084		
GOA.KAR			0.017	0.009		HAR.GUJ	0.936	1.039	0.771	0.979
GOA.KER	0.041					HAR.HP	0.088	0.15		
GOA.MAH		0.020				HAR.MP	0.661	0.851	0.68	0.99
HAR.GUJ	0.038	0.101				HAR.MAH	0.166	0.626	1.178	2.138
HAR.MP	0.815		0.721	1.253		HAR.ORI	0.331	0.375		
HAR.MAH				0.970		HAR.RAJ	1.387	1.511	1.271	1.516
HAR.ORI	0.197		0.039	0.153		HP .JK	0.396	0.458	0.499	0.54
HAR.RAJ	0.028	0.012				MP .KER	0.271	0.41	0.435	0.459
HP .JK	0.422	0.604	0.688	0.745		MP .TN	0.13	0.259	0.313	0.368
HP .KER	0.472			0.009		MAH.GOA	0.034	0.044	0.046	0.048
HP .TN				0.013		ORI.AP	0.317	0.376	0.407	0.439
KAR.KER	0.235					PUN.ASS	0.079	0.084	0.177	0.187
MP .KER	0.104		2.044	2.820		PUN.GUJ	0.936	1.039	1.607	1.709
MP .TN				0.214		PUN.HP	0.088	0.15	0.392	0.487
PUN.GUJ	0.037	0.101	0.251	0.275		PUN.MP	0.661	0.851	1.516	1.72
PUN.MP	1.532		4.067	4.903		PUN.MAH	0.166	0.626	2.014	2.868
PUN.MAH				1.237		PUN.ORI	0.331	0.375	0.825	0.901
PUN.ORI	0.914		1.604	2.022		PUN.RAJ	1.387	1.511	2.107	2.246
PUN.RAJ	0.027	0.012	0.074	0.397		RAJ.KAR	0.434	0.575	0.631	0.686
RAJ.KAR			0.028	0.340		UP .BIH	0.994	1.116	1.419	1.692
TN .KER	0.293	0.213				UP .MAH	3.179	2.71	1.288	
UP .BIH	2.396	1.253	2.069	3.492		UP .WB	0.147	0.286	0.386	0.476
UP .MP		2.075				**TOTAL**	13.198	15.506	17.962	20.449
UP .MAH	1.442	1.696	2.004							
UP .ORI	0.185									
WB .AP	4.230	1.279	0.498	0.329						
WB .ASS		0.235	0.570	0.773						
WB .BIH		1.168	1.167	0.242						
WB .ORI		1.011								
TOTAL	13.408	11.984	16.483	20.196						

State wise and Aggregate Welfare Effects

We first analyze the impact of decentralizing PDS and procurement on consumption of rice and wheat by different economic classes. Tables 7 and 8 provided the results for rural and urban rice consumption while Tables 9 and 10 present the corresponding results for wheat. While rice consumption (PDS quantities remain fixed in the different scenarios) goes down slightly in states that face higher market prices, the rise in consumption in the other states outweighs this reduction to yield a net increase in total consumption of all states put together. This pattern is common to all income classes. For wheat the changes in consumption are negligible as open

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market prices remain unchanged. As a consequence, there are no welfare implications due to

changes in wheat consumption.

Table 5. Procurement and Public Stocks: Decentralization and Lower MSP (Million Tonnes)

Crop	Rice				Wheat				Total			
States	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	6.66								6.66			
Haryana	1.37	2.34	1.64		3.51	2.50	2.96	0.94	4.87	4.84	4.60	0.94
Himachal Pradesh		0.23	0.11							0.23	0.11	
Karnataka	0.21								0.21			
Madhya Pradesh	0.16								0.16			
Maharashtra	0.03								0.03			
Orissa	0.86								0.86			
Punjab	6.43	8.84	2.88		9.21	8.21	3.84	1.98	15.64	17.05	6.72	1.98
Rajasthan	0.03								0.03			
Tamil Nadu	1.60								1.60			
Uttar Pradesh	1.07								1.07			
Total Procurement	18.42	11.41	4.63		12.71	10.71	6.80	2.92	31.13	22.12	11.42	2.92
Central PDS Requirement*	6.82				1.94				8.76			
Stocks	11.60	11.41	4.63		10.77	10.71	6.80	2.92	22.37	22.12	11.42	2.92

Notes:
* Under Centralized Scenario (Scen 1), PDS requirements are met from centralized procurement. But with decentralization, states meet their PDS obligations (set here at the base-level) through open market purchases. State procurement operations are then carried out only to provide price support to farmers while procured quantities are added to stocks.

Scenario 1: Centralized Procurement/ PDS
Scenario 2: Decentralized Procurement/ PDS
Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP
Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Table 6. Government Costs: Decentralization and Lower MSP (Rs. Billion)

VARIABLE	Rice				Wheat				Total			
	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Net PDS Costs	20.6	36.2	31.9	28.6	7.2	8.6	7.2	5.8	27.8	44.8	39.1	34.4
Procurement + Incidental Costs of Closing Stocks	210.1	131.5	49.2	0.0	111.0	93.6	55.3	22.0	321.1	225.0	104.5	22.0
Storage Costs	12.5	12.3	5.0	0.0	11.6	11.6	7.3	3.2	24.2	23.9	12.3	3.2

Notes:
Scenario 1: Centralized Procurement/ PDS
Scenario 2: Decentralized Procurement/ PDS
Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP
Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Figure 2. Welfare impact of decentralizing Procurement/ PDS
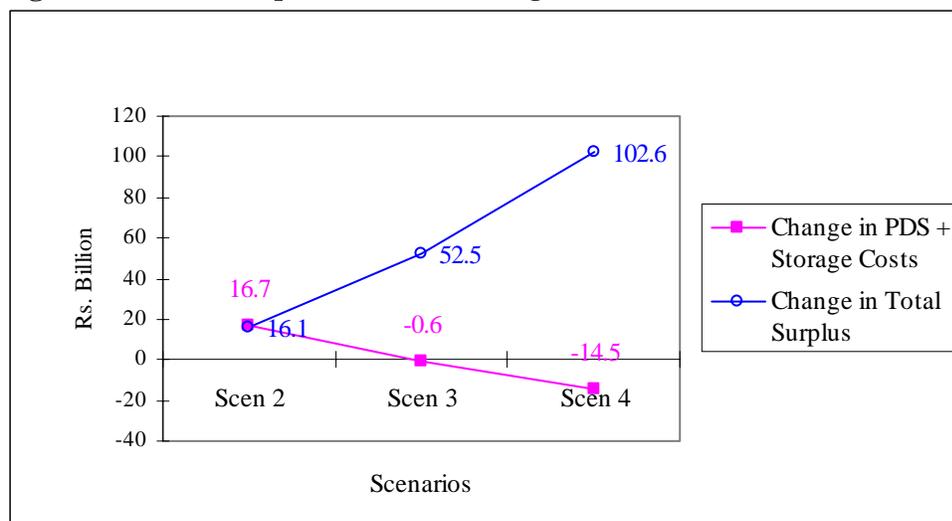
Notes:
Changes are measured with respect to scenario 1: centralized PDS and Procurement.
Scenario 2: Decentralized Procurement/ PDS
Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP
Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

The increase in aggregate rice consumption does not necessarily amount to an increase in welfare for all classes. This is due to differences in demand price elasticities.

The largest gains to rice farmers occur in Punjab, Haryana and Uttar Pradesh and largest losses to those in West Bengal, Tamil Nadu, Orissa and Assam. Figure 2 shows the aggregate impact in terms of change in public costs and social welfare, both of which move in the right direction.

5.2. Effects of Lowering MSP

Effects on Consumption, Procurement and Stocks

In addition to decentralization of PDS/ procurement when MSP is reduced by 10% or 20% market prices fall across all states with the national average declining by 11% for rice and 16% for wheat (Table 3). This results in a rise in consumption (10.7 million tonnes for rice and 6.7 million tonnes for wheat) but a reduction in production (0.62 million tonnes for rice and 1

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million tonnes for wheat) as both rice and wheat farmers receive lower weighted average prices (Table 2). When MSP is reduced, it is no longer attractive for farmers in surplus states to sell grain to procurement agencies. There is thus a reduction in local procurement and buffer stocks. No rice comes forth for procurement with a 20% drop in MSP. Government grain stockholding declines from about 22 to 11 million tonnes with 10% MSP reduction and then to barely 3 million tonnes (comprising only wheat stocks) as MSP is reduced by another 10% (Table 5).

Decentralization combined with a lowering of MSP, leads to a decline in the imports of rice and wheat. While there is a decline in imports from abroad, the increase in consumption is supported by a large fall in buffer stocks and by grain flowing from surplus to deficit states through private trade. (Figure 1). For example, from Haryana and Punjab there are larger flows of rice to Madhya Pradesh, Maharashtra and Orissa and of wheat to Gujarat, Maharashtra and Rajasthan (Table 4). At the country-level, inter-state trade in rice doubles and that in wheat increases by more than 30%.

Table 7. RICE-Class-wise Rural Market Consumption: Decentralization and Lower MSP

Class	Poor				Middle				Rich			
State	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	1.783	1.824	2.024	2.145	4.451	4.534	4.930	5.170	0.534	0.540	0.571	0.589
Assam	0.946	0.965	1.063	1.122	2.345	2.383	2.578	2.697	0.140	0.141	0.149	0.153
Bihar	3.054	3.025	3.389	3.611	3.833	3.804	4.166	4.386	0.232	0.230	0.245	0.253
Goa	0.002	0.002	0.002	0.003	0.036	0.036	0.037	0.040	0.029	0.029	0.030	0.032
Gujarat	0.089	0.086	0.095	0.100	0.453	0.446	0.472	0.485	0.128	0.128	0.127	0.127
Haryana	0.005	0.005	0.006	0.007	0.085	0.080	0.098	0.107	0.072	0.070	0.079	0.084
Himachal Pradesh	0.006	0.006	0.007	0.008	0.143	0.135	0.154	0.168	0.055	0.053	0.057	0.060
Jammu & Kashmir	0.003	0.003	0.004	0.004	0.507	0.480	0.540	0.582	0.156	0.151	0.162	0.169
Karnataka	0.268	0.261	0.266	0.298	1.378	1.348	1.370	1.509	0.348	0.342	0.346	0.373
Kerala	0.069	0.071	0.079	0.086	0.969	0.988	1.081	1.162	0.525	0.531	0.564	0.592
Madhya Pradesh	1.136	1.070	1.374	1.546	1.205	1.149	1.407	1.552	0.106	0.102	0.118	0.126
Maharashtra	0.458	0.453	0.514	0.557	1.089	1.079	1.194	1.274	0.239	0.238	0.254	0.265
Orissa	2.103	2.155	2.460	2.717	2.083	2.123	2.356	2.552	0.172	0.174	0.186	0.196
Punjab	0.002	0.002	0.002	0.002	0.064	0.061	0.073	0.078	0.058	0.056	0.062	0.064
Rajasthan	0.010	0.009	0.011	0.012	0.072	0.069	0.080	0.086	0.026	0.026	0.028	0.029
Tamil Nadu	0.673	0.689	0.744	0.783	1.819	1.853	1.970	2.054	0.362	0.366	0.381	0.392
Uttar Pradesh	1.552	1.529	1.823	2.003	3.424	3.385	3.871	4.168	0.488	0.485	0.527	0.552
West Bengal	1.455	1.527	1.872	2.084	4.434	4.604	5.411	5.905	0.497	0.509	0.567	0.603
Total	13.614	13.682	15.735	17.088	28.390	28.557	31.788	33.975	4.167	4.171	4.453	4.659

Notes:

Consumption is measured in Million Tonnes

Scenario 1: Centralized Procurement/ PDS

Scenario 2: Decentralized Procurement/ PDS

Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP

Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Table 8. RICE- Class-wise Urban Market Consumption: Decentralization and Lower MSP

Class	Poor				Middle				Rich			
State	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	1.046	1.061	1.130	1.172	1.049	1.059	1.103	1.130	0.149	0.150	0.151	0.152
Assam	0.182	0.184	0.195	0.202	0.233	0.235	0.245	0.251	0.034	0.034	0.035	0.035
Bihar	0.444	0.441	0.473	0.492	0.222	0.221	0.231	0.238	0.023	0.023	0.023	0.023
Goa	0.003	0.003	0.003	0.004	0.031	0.031	0.031	0.033	0.007	0.007	0.007	0.008
Gujarat	0.114	0.113	0.115	0.115	0.258	0.256	0.262	0.265	0.054	0.056	0.051	0.048
Haryana	0.013	0.012	0.014	0.015	0.057	0.055	0.061	0.063	0.012	0.012	0.012	0.012
Himachal Pradesh	0.002	0.002	0.002	0.002	0.016	0.016	0.017	0.017	0.006	0.006	0.006	0.006
Jammu & Kashmir	0.028	0.027	0.029	0.031	0.132	0.130	0.136	0.140	0.007	0.007	0.007	0.007
Karnataka	0.385	0.378	0.383	0.415	0.750	0.740	0.746	0.794	0.151	0.150	0.150	0.156
Kerala	0.181	0.183	0.196	0.207	0.291	0.294	0.307	0.319	0.046	0.046	0.046	0.047
Madhya Pradesh	0.295	0.284	0.332	0.359	0.276	0.269	0.301	0.319	0.031	0.031	0.032	0.033
Maharashtra	0.423	0.420	0.453	0.476	0.950	0.946	0.995	1.028	0.202	0.202	0.205	0.207
Orissa	0.466	0.473	0.510	0.542	0.236	0.238	0.251	0.261	0.015	0.015	0.015	0.015
Punjab	0.025	0.024	0.027	0.029	0.056	0.055	0.058	0.060	0.012	0.012	0.012	0.012
Rajasthan	0.018	0.017	0.019	0.020	0.050	0.049	0.052	0.053	0.011	0.011	0.011	0.011
Tamil Nadu	0.859	0.871	0.912	0.940	1.371	1.384	1.425	1.454	0.241	0.242	0.244	0.245
Uttar Pradesh	0.519	0.515	0.567	0.599	0.461	0.459	0.488	0.505	0.060	0.060	0.061	0.061
West Bengal	0.782	0.804	0.908	0.972	0.946	0.964	1.050	1.103	0.169	0.171	0.178	0.182
Total	5.785	5.812	6.268	6.592	7.385	7.401	7.759	8.033	1.230	1.235	1.246	1.260

Notes:

Consumption is measured in Million Tonnes

Scenario 1: Centralized Procurement/ PDS

Scenario 2: Decentralized Procurement/ PDS

Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP

Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Table 9. WHEAT- Class-wise Rural Market Consumption: Decentralization and Lower MSP

Class	Poor				Middle				Rich			
State	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	0.018	0.018	0.020	0.023	0.097	0.097	0.111	0.124	0.040	0.040	0.045	0.050
Assam	0.060	0.060	0.064	0.068	0.116	0.116	0.122	0.128	0.014	0.014	0.015	0.015
Bihar	1.925	1.926	2.059	2.179	2.736	2.737	2.876	3.001	0.183	0.183	0.190	0.197
Goa	0.000	0.000	0.000	0.000	0.003	0.003	0.004	0.004	0.012	0.012	0.013	0.014
Gujarat	0.101	0.101	0.120	0.139	0.905	0.907	1.055	1.206	0.284	0.284	0.327	0.371
Haryana	0.088	0.088	0.100	0.112	1.154	1.157	1.282	1.413	0.637	0.639	0.699	0.762
Himachal Pradesh	0.013	0.013	0.015	0.018	0.232	0.233	0.267	0.301	0.085	0.085	0.096	0.106
Jammu & Kashmir	0.012	0.012	0.013	0.014	0.316	0.317	0.346	0.375	0.116	0.116	0.125	0.135
Karnataka	0.047	0.047	0.053	0.059	0.229	0.230	0.255	0.280	0.075	0.075	0.083	0.090
Kerala	0.000	0.000	0.000	0.000	0.079	0.079	0.088	0.097	0.109	0.109	0.120	0.131
Madhya Pradesh	1.023	1.025	1.153	1.285	2.080	2.084	2.300	2.523	0.261	0.261	0.285	0.310
Maharashtra	0.394	0.395	0.465	0.536	1.346	1.346	1.560	1.777	0.372	0.372	0.427	0.483
Orissa	0.026	0.026	0.031	0.036	0.152	0.152	0.175	0.199	0.042	0.042	0.047	0.052
Punjab	0.060	0.060	0.069	0.078	1.157	1.160	1.301	1.448	0.718	0.720	0.797	0.877
Rajasthan	0.595	0.597	0.633	0.672	4.667	4.678	4.905	5.151	0.916	0.918	0.955	0.996
Tamil Nadu	0.001	0.001	0.001	0.002	0.018	0.018	0.025	0.032	0.021	0.021	0.027	0.034
Uttar Pradesh	4.792	4.794	5.070	5.318	10.171	10.175	10.611	11.009	1.614	1.615	1.669	1.720
West Bengal	0.095	0.095	0.113	0.129	0.378	0.378	0.433	0.483	0.071	0.071	0.080	0.088
Total	9.250	9.258	9.979	10.668	25.836	25.867	27.716	29.551	5.570	5.577	6.000	6.431

Notes:
Consumption is measured in Million Tonnes
Scenario 1: Centralized Procurement/ PDS
Scenario 2: Decentralized Procurement/ PDS
Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP
Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Table 10.   WHEAT- Class-wise Urban Market Consumption: Decentralization and Lower MSP

Class	Poor				Middle				Rich			
State	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4	Scen 1	Scen 2	Scen 3	Scen 4
Andhra Pradesh	0.041	0.041	0.044	0.047	0.098	0.097	0.103	0.109	0.029	0.029	0.030	0.031
Assam	0.016	0.016	0.016	0.016	0.030	0.030	0.028	0.027	0.008	0.008	0.007	0.007
Bihar	0.384	0.384	0.387	0.391	0.211	0.211	0.202	0.194	0.026	0.026	0.024	0.023
Goa	0.001	0.001	0.001	0.001	0.013	0.013	0.014	0.014	0.005	0.005	0.005	0.005
Gujarat	0.325	0.326	0.354	0.384	0.785	0.787	0.838	0.893	0.120	0.120	0.126	0.133
Haryana	0.169	0.170	0.172	0.176	0.372	0.373	0.369	0.367	0.058	0.058	0.057	0.056
Himachal Pradesh	0.006	0.006	0.006	0.007	0.027	0.027	0.027	0.027	0.010	0.010	0.010	0.010
Jammu & Kashmir	0.013	0.013	0.014	0.015	0.070	0.071	0.071	0.071	0.013	0.013	0.013	0.013
Karnataka	0.074	0.074	0.084	0.093	0.201	0.202	0.207	0.211	0.050	0.050	0.051	0.052
Kerala	0.020	0.020	0.022	0.024	0.047	0.047	0.049	0.051	0.015	0.015	0.016	0.016
Madhya Pradesh	0.713	0.714	0.733	0.754	0.658	0.659	0.661	0.665	0.067	0.067	0.067	0.066
Maharashtra	0.677	0.677	0.737	0.798	1.321	1.322	1.412	1.504	0.348	0.348	0.368	0.388
Orissa	0.055	0.055	0.059	0.064	0.075	0.075	0.079	0.084	0.008	0.008	0.009	0.009
Punjab	0.216	0.216	0.223	0.230	0.418	0.419	0.421	0.424	0.092	0.092	0.091	0.090
Rajasthan	0.626	0.628	0.622	0.619	0.877	0.879	0.851	0.828	0.100	0.100	0.095	0.091
Tamil Nadu	0.027	0.027	0.029	0.032	0.100	0.100	0.106	0.112	0.053	0.053	0.055	0.058
Uttar Pradesh	2.188	2.189	2.345	2.485	1.212	1.212	1.157	1.111	0.180	0.180	0.169	0.160
West Bengal	0.212	0.212	0.219	0.226	0.385	0.385	0.387	0.390	0.077	0.077	0.076	0.076
Total	5.763	5.769	6.067	6.362	6.900	6.909	6.982	7.082	1.259	1.259	1.269	1.284

Notes:

Consumption is measured in Million Tonnes

Scenario 1: Centralized Procurement/ PDS

Scenario 2: Decentralized Procurement/ PDS

Scenario 3: Decentralized Procurement/ PDS with 10% lower MSP

Scenario 4: Decentralized Procurement/ PDS with 20% lower MSP

Effects on Public Operations and Costs

A general fall in government procurement and stocks with a reduction in MSP, leads to reduction in all components of government cost (Table 6). Costs of distribution, incidental administrative expenses and price subsidy associated with PDS too fall as PDS grains are bought at now lower market prices. Compared to the case when procurement and PDS are merely decentralized (Scenario 2), the sum total of PDS, procurement and storage costs drop by 80% when MSP is cut down by 20% (Scenario 4).

As market prices fall, there is higher consumption by all income classes with consequent rise in consumer welfare. Greater private trade (due to decentralization) increases wholesale traders' surplus. This is however, offset due to lower market prices when MSP is decreased. For a 10% reduction in MSP the net effect on welfare is still positive, but for a 20% reduction it becomes negative.

5.3. Deficiency Payment: Supporting Farmer Prices through cash subsidy

Effects on Prices received by Farmers

Scenario 5 represents the case when farmer price is supported through deficiency payment. This is similar to scenario 2, where PDS/procurement is decentralized but instead of physically procuring grain, the government compensates farmers through cash subsidy whenever the market price falls below MSP. The effective price received by farmers equals the prevailing market price or MSP, whichever is higher. The state-level MSPs are fixed at the same levels as in scenario 2.

Since MSP for rice and wheat is fixed at a high level the effective price received by the farmers is equal to the MSP. It results in the highest deficiency payment in Punjab followed by UP, Haryana, HP and West Bengal in that order (Table 11).

Since deficiency payment does not involve procurement of grain the costs of procurement and storage of both rice and wheat are zero in scenario 5 (Table 12). On the whole there is a great saving in government cost on account of the suggested reforms.

Compared to the centralized case with levy/ MSP procurement (scenario 1) in the deficiency payments case (scenario 5) market price is lower in all states and correspondingly welfare is higher for consumers of all economic classes in both urban and rural areas (Tables 13 and 14). Rice producers lose revenue in almost all states while opposite is the case with wholesale and retail rice traders (Table 13). The largest losses to producers occur in large consuming areas while those in major producing areas make some gains, though marginal. Adding across all rice agents in the economy, there is net welfare gain. For wheat, producers and wholesale and retail traders all lose small amounts (Table 14). However, as in the case of rice, gains to consumers are far larger to outweigh the losses to the other agents.

Table 11.   Deficiency Payment: State-wise Cost of supporting Farmers' Price (Rs. Crores)

	Rice	Wheat	Total
States			
Andhra Pradesh	0	0	0
Assam	0	0	0
Bihar	0	24	24
Goa	0	0	0
Gujarat	0	54	54
Haryana	387	1782	2169
Himachal Pradesh	179	72	251
Jammu & Kashmir	52	13	64
Karnataka	0	0	0
Kerala	0	0	0
Madhya Pradesh	0	303	303
Maharashtra	0	25	25
Orissa	0	1	1
Punjab	1318	2871	4189
Rajasthan	10	701	711
Tamil Nadu	0	0	0
Uttar Pradesh	564	2369	2933
West Bengal	85	6	91
Total	2596	8219	10815

Table 12.   Government Costs in Centralized vs. Decentralized Scenarios (Rs. Billion)

	Rice			Wheat			Total		
	Scen 1	Scen 2	Scen 5	Scen 1	Scen 2	Scen 5	Scen 1	Scen 2	Scen 5
Net PDS Costs	21	36	28	7	9	4	28	45	33
Procurement Cost	210	132	0	111	94	0	321	226	0
Storage Costs	13	12	0	12	12	0	24	24	0
Cost of Deficiency Payment	0	0	26	0	0	82	0	0	108
Total	243	180	54	130	87	87	373	295	141

Notes:

Scenario 1: Centralized Procurement/ PDS

Scenario 2: Decentralized PDS/ price support to farmers (MSP through physical procurement of grain)

Scenario 5: Decentralized PDS/price support to farmers (MSP through cash subsidy)

Procurement Cost refers to procurement, distribution and incidental cost of total quantity procured (including closing stocks and PDS sales)

In Scenarios 1 and 2 total government costs equal procurement cost plus storage cost less sales realization from PDS sales.

Total government cost in Scenario 5 is the sum of net PDS cost and deficiency payment to farmers.

Table 13. RICE – State-Wise Prices and Welfare: Deficiency Payment (Scenario 5)

State	% Change in prices	Change in Consumer Surplus (CS)							Change in Producer Surplus	Change in Wholesale Traders Surplus	Change in Retail Traders Surplus	Total Surplus (rice)	Total Surplus (rice + wheat)
		Rural Areas			Urban Areas			Total					
		Poor	Middle	Rich	Poor	Middle	Rich						
AP	-10.0	348.3	821.9	90.9	182.3	171.9	22.4	1638	-266	57.6	12.7	1442	1569
ASS	-10.0	185.0	435.0	24.0	32.0	38.8	5.3	720	-392	10.7	5.9	345	404
BIH	-8.8	475.9	567.1	31.9	62.4	29.6	2.8	1170	-465	17.8	16.5	739	1487
GOA	-7.4	0.3	4.5	3.4	0.4	3.5	0.8	13	-11	0.7	0.1	3	16
GUJ	-12.3	19.6	92.3	23.2	21.3	49.3	8.3	214	-120	0.9	-4.2	91	1200
HAR	-13.7	1.4	21.3	16.0	2.9	11.9	2.2	56	29	0.2	0.2	85	1030
HP	-13.9	1.6	32.8	11.2	0.4	3.2	1.0	50	44	2.0	-0.1	96	226
JK	-13.4	1.3	176.9	49.4	9.2	40.1	1.9	279	2	5.4	-1.4	285	476
KAR	-5.3	22.5	112.5	27.3	30.5	57.7	11.1	262	-156	20.8	3.8	130	321
KER	-11.1	16.2	212.2	104.4	36.9	55.4	7.8	433	-89	43.2	3.2	391	494
MP	-12.2	293.1	286.8	22.5	64.6	55.8	5.6	728	-89	19.6	16.6	675	1996
MAH	-9.5	83.1	186.2	37.6	68.0	143.7	28.0	547	-178	14.4	4.0	387	2286
ORI	-11.9	500.3	457.9	33.9	94.7	44.5	2.5	1134	-418	33.2	19.4	768	914
PUN	-13.7	0.5	15.3	12.0	5.5	11.0	2.1	46	52	-0.2	-0.2	98	1155
RAJ	-12.9	2.4	16.0	5.2	3.6	9.3	1.8	38	-7	-0.1	-0.1	31	2130
TN	-8.2	106.9	275.2	51.1	123.6	187.4	30.7	775	-236	61.9	3.2	604	689
UP	-9.6	276.0	562.1	72.4	79.1	65.3	7.7	1063	-400	25.3	23.8	712	4355
WB	-11.2	326.9	905.2	89.4	145.5	161.1	25.6	1654	-1188	52.4	48.8	567	718
INDIA	-10.4	2661.3	5181.2	705.7	963.0	1139.4	167.5	10818	-3887	366.0	152.2	7449	21465

Note: The change is measured with respect to Scenario 1: Centralized PDS and Procurement.

Table 14. **WHEAT – State-Wise Prices and Welfare: Deficiency Payment (Scenario 5)**

State	% Change in prices	Change in Consumer Surplus (CS)						Total	Change in Producer Surplus	Change in Wholesale Traders Surplus	Change in Retail Traders Surplus	Total Surplus (rice)	Total Surplus (rice + wheat)
		Rural Areas			Urban Areas								
		Poor	Middle	Rich	Poor	Middle	Rich						
AP	-23.4	8.6	44.6	17.8	14.8	32.5	9.2	127	-1	1.2	0.0	128	1569
ASS	-22.0	21.3	38.2	4.4	4.4	6.5	1.6	77	-15	-0.7	-1.0	59	404
BIH	-20.3	529.3	703.6	45.2	84.7	37.9	4.4	1405	-631	-11.1	-15.7	748	1487
GOA	-23.5	0.0	1.4	5.0	0.4	4.1	1.5	12	0	0.1	-0.1	12	16
GUJ	-26.6	58.8	490.0	147.4	133.5	295.7	42.8	1168	-64	4.3	1.0	1109	1200
HAR	-31.1	41.5	496.7	259.6	50.1	97.3	14.1	959	0	-6.4	-7.7	945	1030
HP	-28.1	6.7	108.4	37.1	2.2	7.4	2.6	164	-36	1.1	0.1	129	226
JK	-26.7	5.1	128.9	45.1	4.8	19.5	3.4	207	-14	-0.1	-1.3	192	476
KAR	-23.6	19.5	88.4	27.7	30.6	54.4	12.9	234	-44	2.1	-0.8	191	321
KER	-22.9	0.0	32.2	42.8	7.4	14.0	4.3	101	0	2.9	-0.1	103	494
MP	-26.4	434.3	815.6	97.5	204.2	169.4	16.3	1737	-402	-6.0	-8.6	1320	1996
MAH	-24.5	224.0	715.2	190.1	278.5	501.1	125.8	2035	-152	11.7	4.0	1899	2286
ORI	-25.4	13.1	69.9	17.1	19.3	24.2	2.5	146	-2	0.8	0.3	146	914
PUN	-31.1	29.6	523.6	307.1	67.9	116.9	23.8	1069	0	-5.9	-7.0	1056	1155
RAJ	-28.4	215.6	1579.7	297.4	157.6	197.0	20.9	2468	-299	-32.5	-38.6	2099	2130
TN	-22.9	0.6	11.8	12.2	9.6	31.4	15.6	81	0	3.1	0.4	85	689
UP	-23.2	1273.7	2541.6	388.4	617.0	209.9	29.3	5060	-1283	-60.9	-72.8	3643	4355
WB	-20.3	31.6	113.9	20.3	46.1	76.2	14.5	303	-151	1.3	-1.6	152	718
INDIA	-26.4	2913.3	8503.7	1962.3	1733.1	1895.5	345.3	17353	-3093	-95.0	-149.5	14016	21465

Note: The change is measured with respect to Scenario 1: Centralized PDS and Procurement.

6. SUMMARY AND CONCLUSIONS

The price support policies of the central and state governments in recent years have come under sharp criticism for the market distortions they create. The high and rising minimum support prices (MSP) provided by GOI for wheat and more recently for paddy resulted in a steep rise in the area allocated to these crops with greater income transfers accruing to large farmers confined mainly to surplus states. This, along with distorted prices of inputs such as fertilizers, power and irrigation, has had an added detrimental effect not only on the production of other crops but also in terms of decline in water tables. These adverse fiscal and environmental implications led to increased recognition of the need to reform farm support policies. The GOI announced several policy measures towards correcting the situation. In this study we analyzed the impact of some alternative mechanisms for price support compared to the existing one.

We examined a scenario of decentralized procurement/ PDS where the state governments operate farm support policy through their MSP announcements and purchase PDS requirements from the open market. Here the GOI withdraws its MSP policy for wheat and paddy and abolishes the levy on rice. The difference between the open market price and the PDS issue price is provided as subsidy to state governments by the central government. Our simulation exercises reveal that a switch to decentralized procurement/ PDS and removal of rice levy leads to a fall in both procurement and buffer stocks of grains. Although total welfare from rice policy changes rises for most classes in both rural and urban areas, the rural rich are an exception with a net aggregate welfare loss when procurement and PDS are decentralized. The favorable directions of change in public costs and social welfare are due to improved economic efficiency.

We also consider another important policy change that of reducing MSP. Since PDS requirements in a decentralized scenario are purchased from the open market, costs of operating

the PDS go up at first. But, these costs go down with a reduction in state-level MSP as open market price falls. Moreover, fall in market prices leads to higher consumption by all income classes with resultant rise in consumer welfare. There is also a reduction in local procurement and buffer stocks while some states choose to depend partly on imports from abroad. In terms of distribution of gains, the results from MSP reduction show a gain to consumers and loss to producers for both rice and wheat in all states. Adding across all agents and both commodities, the total surplus is positive in net consuming states and negative in major surplus states. But the aggregate across all states at the national level gives net potential gains from the scenarios analyzed.

As a new initiative, there has been a discussion of replacing procurement-based price support with a deficiency payment to farmers with a price floor insured in case market prices falls below this level. With our model we also examine a scenario where deficiency payment (cash subsidy) is used in place of physical procurement of grain in order to support farmers' prices. Price support at the current level of MSP, which is higher than market price, results in the highest deficiency payment in Punjab followed by UP, Haryana, HP and West Bengal. The magnitude of these payments however declines as MSP is reduced. Since deficiency payment does not involve any procurement or stocks, the costs of procurement and stocks both fall to zero.

To sum up, substantial gains are possible in the short term from reforming India's farm support policies. This can reduce government costs and generate net welfare gains through improved economic efficiency. It will also provide improved price signals to farmers and thereby help reduce distortions in production patterns in Indian agriculture.

DATA AND WELFARE MEASURES

Quantities and Prices

Supply is taken to be production net of seed, feed and wastage. The ratio of net to gross production is 0.924 for rice and 0.879 for wheat. Rice and wheat consumption is obtained from National Sample Survey statistics, 55th Round Survey. PDS quantities are also taken from the same source and are assumed fixed in the model. Procurement is carried out under price-support for wheat and as a levy for rice in the base scenario. Table A1 presents the base year data, which satisfy commodity balances across states by appropriately adjusting for inter-state trade.

Table A1.   Base-Year Quantities: Million Tonnes

State	Supply		Open Market Demand		Procurement		PDS	
	Rice	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**	**Rice**	**Wheat**
Andhra Pradesh	11.45	0.01	8.82	0.30	7.173	0.000	1.395	0.056
Assam	3.89	0.09	3.61	0.24	0.000	0.000	0.168	0.007
Bihar	5.42	4.50	7.71	5.21	0.008	0.000	0.092	0.122
Goa	0.15	0.00	0.10	0.03	0.000	0.000	0.025	0.013
Gujarat	1.01	0.65	1.12	2.41	0.000	0.000	0.137	0.200
Haryana	2.68	9.65	0.26	2.41	1.477	4.498	0.001	0.006
Himachal Pradesh	0.12	0.59	0.22	0.41	0.001	0.000	0.082	0.063
Jammu & Kashmir	0.41	0.15	0.76	0.49	0.000	0.000	0.219	0.057
Karnataka	3.73	0.24	3.09	0.65	0.230	0.000	0.506	0.139
Kerala	0.75	0.00	2.16	0.25	0.000	0.000	1.161	0.139
Madhya Pradesh	0.96	3.89	3.45	4.66	1.030	0.351	0.138	0.100
Maharashtra	1.95	0.98	3.50	4.30	0.036	0.000	0.332	0.444
Orissa	4.61	0.01	5.62	0.34	0.918	0.000	0.476	0.028
Punjab	9.15	15.55	0.23	2.58	6.935	9.424	0.000	0.000
Rajasthan	0.16	5.55	0.20	6.69	0.026	0.539	0.002	0.090
Tamil Nadu	7.22	0.00	5.25	0.30	1.720	0.000	1.699	0.133
Uttar Pradesh	11.54	24.94	7.89	17.25	1.212	1.545	0.155	0.201
West Bengal	12.43	1.06	10.68	1.35	0.000	0.000	0.232	0.140
Total	77.64	67.86	64.66	49.87	20.766	16.357	6.819	1.939

Sources: Chand (2003), www.indiastat.com, *Level and Pattern of Consumer Expenditure in India* and *Household Consumption in India*, 1999-2000, NSS 55th Round

Consumer demand is modeled in terms of retail price, which is obtained by applying the retail margin to inflate wholesale price, taken from Chand (2003). In the model equilibrium solution is derived in terms of wholesale price. But since levy prices and MSP are fixed in terms of farm-gate prices, they are inflated using wholesale margins to make them comparable to the wholesale level prices. For this purpose, margins pertaining to surplus states from where the government makes procurement are used. Data on MSP for wheat and levy rice prices are taken from Bulletin of Food Statistics, Ministry of Agriculture, Government of India and http://www.indiastat.com/. See Table A2 for price data in the base-year

Table A2.   Base-Year Prices: Rs. per Quintal

State	Retail price		Wholesale Price		Rice Levy Farm Gate Price
	Rice	Wheat	Rice	Wheat	
Andhra Pradesh	1477	1146	1291	1002	900
Assam	1554	1216	1328	1038	846
Bihar	1378	1108	1247	957	861
Goa	1465	1261	1305	1016	831
Gujarat	1418	1062	1152	863	827
Haryana	1218	876	1028	739	904
Himachal Pradesh	1310	876	1105	739	904
Jammu & Kashmir	1442	1098	1216	927	904
Karnataka	1368	1058	1277	988	830
Kerala	1459	1138	1317	1027	830
Madhya Pradesh	1261	960	1158	868	840
Maharashtra	1372	1157	1222	932	831
Orissa	1292	978	1192	902	869
Punjab	1218	876	1028	739	904
Rajasthan	1248	840	1097	1016	881
Tamil Nadu	1515	1114	1305	752	830
Uttar Pradesh	1176	852	1028	988	869
West Bengal	1100	1040	1028	791	827

Sources: Chand (2003) and http://www.indiastat.com/

Notes: The ratio of retail to wholesale price is from Chand (2003). Wheat MSP at wholesale level is Rs.720 per quintal. Rice levy price at wholesale level is 1.24 times the farm gate levy price.

Demand Functions

Aggregate demand is disaggregated into 6 different income groups based on their Monthly Per Capita Consumption Expenditure (MPCE) from *Level and Pattern of Consumer expenditure in India*, 1999-2000, NSS 55th Round. The groups considered are Rural Poor, Rural Middle, Rural Rich Class and

Urban Poor, Urban Middle, Urban Rich class. The procedures used for calibration of group-wise per capita incomes, price and income elasticities are described below. In the model, the open market demand function for each group is calibrated using the state-wise group elasticities. The aggregate open market demand is the sum of all group demands.

Per capita expenditure: The data on group-wise per capita expenditure is obtained from total expenditure for 1993-94 as given in Murty (2001). The latter are used to calculate per-capita income for 2000-01 for all the income groups using Consumer price index (CPI) for 2000-01 with base 1986. CPI data is taken from from Agricultural Prices in India, Directorate of Economics and Statistics, Department of Agriculture, Ministry of Agriculture, GOI and Statistical Pocket Book, C.S.O., Ministry of Statistics and Program Implementation, GOI. See Table A3.

Table A3.   Class-wise Per-capita Consumption Expenditure: Rs. per annum

States	Rural			Urban		
Expenditure Classes	**Poor**	**Middle**	**Rich**	**Poor**	**Middle**	**Rich**
MPCE (from NSS)	(0-340)	(340-775)	(775 +)	(0-340)	(340-775)	(775 +)
Population Share (%)	**22%**	**44%**	**7%**	**8%**	**16%**	**3%**
Andhra Pradesh	2528	3732	7843	4343	6339	14352
Assam	2827	4550	8883	4361	6015	13071
Bihar	2521	4058	7921	4049	5846	12705
Goa	2754	4155	7724	4206	6506	13998
Gujarat	2917	4537	8302	4715	7461	16537
Haryana	3463	5385	11169	3959	5702	12122
Himachal Pradesh	3078	4948	10607	4135	5790	13581
Jammu & Kashmir	3479	5593	11989	4501	6268	14704
Karnataka	2824	4261	7922	4119	6746	14515
Kerala	2612	4203	9278	4761	7637	19059
Madhya Pradesh	2570	3906	7760	4514	6956	15959
Maharashtra	2911	4691	9218	4007	7582	17710
Orissa	2779	4103	8622	4299	6703	15176
Punjab	3287	5285	11329	3885	6474	15187
Rajasthan	3026	4697	8921	4864	6829	13129
Tamil Nadu	2725	4385	9680	5008	7745	19327
Uttar Pradesh	2647	4260	8317	3994	6204	13483
West Bengal	2455	3731	7414	4753	7185	16485

Source: Author's calculations based on *Level and Pattern of Consumer Expenditure in India*, 1999-2000, NSS 55th Round

Open market demand: To estimate open market demand for the 6 groups, we first collected data on 'Per 1000 distributions of persons in the rural and urban sector over 12 MPCE classes for different

states' and also 'Per 1000 distributions of households in the rural and urban sector over 12 MPCE classes for different states' from *Level and Pattern of Consumer Expenditure in India, 1999-2000, NSS 55th Round*. From these we estimated the total number of persons and the total number of households in each state in both rural and urban areas, using total population. The population in different states is taken from http://www.mp.nic.in/des/census2001/STAT~1~1.xls. After that we collected data on 'Quantity of consumption of rice and wheat per person for a period of 30 days for each MPCE Class' from the same NSS source. Multiplying per capita consumption with total population in each income group gave us the total consumption of each class. The data on PDS demand was collected from 'Average monthly household purchase of rice and wheat supplied through PDS' from *Sources of Household Consumption in India, 1999-2000, NSS 55th Round.* Subtracting PDS demand from total consumption gave the open market demand (Tables A4 and A5).

Table A4.   Rice and Wheat Consumption: Million Tonnes

Region	Commodity	Rice			Wheat		
	Expenditure Classes	PDS consumption	Open market demand	Total demand	PDS consumption	Open market demand	Total demand
Rural	Poor	1.27	14.93	16.19	0.32	8.04	8.36
	Middle	3.27	30.52	33.78	0.87	23.13	24.01
	Rich	0.93	4.33	5.27	0.23	5.14	5.37
	All	**5.46**	**49.78**	**55.24**	**1.42**	**36.32**	**37.74**
Urban	Poor	0.28	6.07	6.35	0.11	5.22	5.33
	Middle	0.87	7.57	8.45	0.33	7.03	7.36
	Rich	0.20	1.24	1.44	0.08	1.29	1.37
	All	**1.35**	**14.88**	**16.23**	**0.52**	**13.54**	**14.06**
Total (rural + urban)	Poor	1.54	21.00	22.54	0.43	13.27	13.69
	Middle	4.14	38.09	42.23	1.21	30.16	31.37
	Rich	1.14	5.57	6.71	0.31	6.43	6.74
	All	**6.82**	**64.66**	**71.47**	**1.94**	**49.87**	**51.80**

Sources: Author's calculations based on *Level and Pattern of Consumer Expenditure in India* and 'Average monthly household purchase of rice and wheat supplied through PDS' from *Sources of Household Consumption in India*, 1999-2000, NSS 55th Round; and http://www.mp.nic.in/des/census2001/STAT~1~1.xls.

Table A5.   **State-wise Open Market Demand: Million Tonnes**

Grain	Rice			Wheat		
States	Rural	Urban	Total	Rural	Urban	Total
Andhra Pradesh	6.606	2.215	8.821	0.142	0.161	0.302
Assam	3.178	0.430	3.608	0.187	0.054	0.242
Bihar	7.023	0.684	7.707	4.584	0.624	5.207
Goa	0.059	0.037	0.096	0.014	0.020	0.034
Gujarat	0.691	0.428	1.118	1.219	1.195	2.414
Haryana	0.179	0.085	0.264	1.811	0.596	2.407
Himachal Pradesh	0.197	0.024	0.221	0.370	0.042	0.412
Jammu & Kashmir	0.603	0.160	0.763	0.395	0.096	0.490
Karnataka	1.858	1.228	3.085	0.331	0.318	0.649
Kerala	1.629	0.531	2.159	0.172	0.081	0.252
Madhya Pradesh	2.795	0.651	3.446	3.235	1.421	4.656
Maharashtra	1.878	1.617	3.495	2.008	2.288	4.296
Orissa	4.856	0.764	5.620	0.209	0.134	0.343
Punjab	0.134	0.097	0.231	1.859	0.717	2.576
Rajasthan	0.118	0.082	0.199	5.028	1.660	6.688
Tamil Nadu	2.814	2.437	5.251	0.084	0.218	0.302
Uttar Pradesh	6.717	1.172	7.889	14.011	3.235	17.246
West Bengal	8.448	2.234	10.682	0.663	0.686	1.349
Total	49.78	14.88	64.66	36.32	13.54	49.87

Source: *Level and Pattern of Consumer Expenditure in India*, 1999-2000, NSS 55th Round

Table A6.   **Rice – Price Elasticities of Demand**

Elasticity	Own-Price						Cross-
States	Rural			Urban			Price
Expenditure Class	Poor	Middle	Rich	Poor	Middle	Rich	(R-W)
Andhra Pradesh	-2.22	-1.77	-1.15	-1.32	-0.87	-0.26	0.045
Assam	-2.25	-1.79	-1.18	-1.35	-0.90	-0.28	0.044
Bihar	-2.25	-1.79	-1.18	-1.35	-0.90	-0.28	0.044
Goa	-2.84	-2.39	-1.77	-1.94	-1.49	-0.87	0.046
Gujarat	-1.07	-0.62	0.00	-0.17	-0.28	0.90	0.046
Haryana	-2.21	-1.75	-1.14	-1.31	-0.86	-0.24	0.045
Himachal Pradesh	-1.92	-1.47	-0.85	-1.02	-0.57	0.05	0.046
Jammu & Kashmir	-1.92	-1.47	-0.85	-1.02	-0.57	0.05	0.046
Karnataka	-2.84	-2.39	-1.77	-1.94	-1.49	-0.87	0.047
Kerala	-2.27	-1.82	-1.20	-1.37	-0.92	-0.30	0.045
Madhya Pradesh	-2.59	-2.14	-1.52	-1.69	-1.24	-0.62	0.047
Maharashtra	-2.29	-1.84	-1.22	-1.39	-0.94	-0.33	0.045
Orissa	-2.22	-1.77	-1.15	-1.32	-0.90	-0.26	0.045
Punjab	-1.92	-1.47	-0.85	-1.02	-0.57	0.05	0.046
Rajasthan	-1.87	-1.42	-0.80	-0.97	-0.52	0.10	0.044
Tamil Nadu	-2.27	-1.82	-1.20	-1.37	-0.92	-0.30	0.047
Uttar Pradesh	-2.25	-1.79	-1.18	-1.35	-0.90	-0.28	0.044
West Bengal	-2.59	-2.14	-1.52	-1.69	-1.24	-0.62	0.045

Source: Murty (1997) and Gulati and Kelly (1999)

Table A7.   Wheat – Price Elasticities of Demand

| Elasticity | Own-Price | | | | | | Cross- |
| States | Rural | | | Urban | | | Price |
Expenditure Class	Poor	Middle	Rich	Poor	Middle	Rich	(W-R)
Andhra Pradesh	-2.43	-2.15	-1.99	-1.17	-0.88	-0.72	0.101
Assam	-1.06	-0.78	-0.62	-0.20	0.48	0.64	0.100
Bihar	-1.06	-0.78	-0.62	-0.20	0.48	0.64	0.100
Goa	-1.93	-1.65	-1.48	-0.66	-0.38	-0.22	0.102
Gujarat	-2.47	-2.19	-2.03	-1.20	-0.92	-0.76	0.103
Haryana	-1.55	-1.27	-1.11	-0.28	0.00	0.16	0.101
Himachal Pradesh	-1.70	-1.42	-1.25	-1.02	-0.15	0.01	0.102
Jammu & Kashmir	-1.70	-1.42	-1.25	-1.02	-0.15	0.01	0.102
Karnataka	-1.93	-1.65	-1.48	-1.94	-0.38	-0.22	0.102
Kerala	-2.14	-1.86	-1.70	-1.37	-0.59	-0.43	0.104
Madhya Pradesh	-1.69	-1.41	-1.25	-0.43	-0.14	0.02	0.101
Maharashtra	-2.52	-2.24	-2.08	-1.26	-0.98	-0.82	0.103
Orissa	-2.43	-2.15	-1.70	-1.17	-0.88	-0.72	0.101
Punjab	-1.70	-1.42	-1.25	-0.43	-0.15	0.01	0.102
Rajasthan	-1.27	-0.99	-0.83	-0.01	0.28	0.44	0.100
Tamil Nadu	-2.14	-1.86	-1.70	-0.88	-0.59	-0.43	0.104
Uttar Pradesh	-1.06	-0.78	-0.62	-1.35	0.48	0.64	0.100
West Bengal	-1.69	-1.41	-1.25	-0.43	-0.14	0.02	0.101

Source: Murty (1997) and Gulati and Kelly (1999)

Table A8.   Rice – Income Elasticities of Demand

| State | Rural | | | Urban | | |
Expenditure Class	Poor	Middle	Rich	Poor	Middle	Rich
Andhra Pradesh	1.34	0.77	0.34	1.23	0.66	0.23
Assam	1.23	0.66	0.23	1.12	0.55	0.12
Bihar	1.23	0.66	0.23	1.12	0.55	0.12
Goa	1.54	0.98	0.55	1.43	0.87	0.44
Gujarat	1.26	0.69	0.26	1.15	0.58	0.15
Haryana	1.35	0.79	0.36	1.24	0.68	0.25
Himachal Pradesh	1.40	0.83	0.40	1.29	0.72	0.29
Jammu & Kashmir	1.40	0.83	0.40	1.29	0.72	0.29
Karnataka	1.54	0.98	0.55	1.43	0.87	0.44
Kerala	1.20	0.64	0.21	1.09	0.53	0.10
Madhya Pradesh	1.05	0.49	0.06	0.94	0.38	-0.05
Maharashtra	1.35	0.79	0.36	1.24	0.68	0.25
Orissa	1.34	0.77	0.34	1.23	0.66	0.23
Punjab	1.40	0.83	0.40	1.29	0.72	0.29
Rajasthan	1.86	1.29	0.86	1.75	1.18	0.75
Tamil Nadu	1.20	0.64	0.21	1.09	0.53	0.10
Uttar Pradesh	1.23	0.66	0.23	1.12	0.55	0.12
West Bengal	1.05	0.49	0.06	0.94	0.38	-0.05

Source: Murty (1997)

Table A9.   Wheat – Income Elasticities of Demand

State	Rural			Urban		
Expenditure Class	Poor	Middle	Rich	Poor	Middle	Rich
Andhra Pradesh	2.06	1.92	1.53	1.75	1.61	1.21
Assam	0.79	0.65	0.25	0.47	0.33	-0.06
Bihar	0.79	0.65	0.25	0.47	0.33	-0.06
Goa	1.22	1.08	0.68	0.90	0.76	0.36
Gujarat	1.18	1.04	0.65	0.87	0.73	0.33
Haryana	0.79	0.65	0.25	0.47	0.33	-0.07
Himachal Pradesh	0.79	0.65	0.25	0.47	0.34	-0.06
Jammu & Kashmir	0.79	0.65	0.25	0.47	0.34	-0.06
Karnataka	1.22	1.08	0.68	0.90	0.76	0.36
Kerala	1.89	1.75	1.35	1.57	1.43	1.04
Madhya Pradesh	1.24	1.10	0.70	0.92	0.78	0.39
Maharashtra	0.99	0.85	0.45	0.68	0.54	0.14
Orissa	2.06	1.92	1.53	1.75	1.61	1.21
Punjab	0.79	0.65	0.25	0.47	0.34	-0.06
Rajasthan	1.11	0.97	0.57	0.80	0.66	0.26
Tamil Nadu	1.89	1.75	1.35	1.57	1.43	1.04
Uttar Pradesh	0.79	0.65	0.25	0.47	0.33	-0.06
West Bengal	1.24	1.10	0.70	0.92	0.78	0.39

Source: Murty (1997)

Table A10.   Elasticities of Supply

States	Wheat	Rice
Andhra Pradesh	0.09	0.06
Assam	0.09	0.06
Bihar	0.09	0.115
Goa	0.09	0.09
Gujarat	0.09	0.115
Haryana	0.09	0.06
Himachal Pradesh	0.09	0.09
Jammu & Kashmir	0.09	0.09
Karnataka	0.09	0.115
Kerala	0.09	0.115
Madhya Pradesh	0.09	0.115
Maharashtra	0.09	0.115
Orissa	0.09	0.115
Punjab	0.09	0.06
Rajasthan	0.09	0.115
Tamil Nadu	0.09	0.09
Uttar Pradesh	0.09	0.06
West Bengal	0.09	0.06

Sources: Jha and Srinivasan (1999) and Mythili (2001)

Elasticities of Demand:

We use data from Murty (1997) on own price elasticity of demand for rural and urban areas and income and cross price elasticity of demand from Gulati and Kelly (1999, page no.148 and 149). See Tables A6-A9.

Supply Function

The supply functions are estimated in terms of net production obtained after adjusting for seed, feed and wastage. For wheat we use all India elasticity due to non-availability of state-wise data (Table A10). As the available data shows no substitution in production of rice and wheat in major producing states, in calibrating supply functions, we do not incorporate cross-price elasticities. The own price elasticity estimates are taken from Jha and Srinivasan (1999).

Welfare Measures

Change in Producer Surplus

$$PS = S_i (wap_1 - wap_0) + \tfrac{1}{2} (spe) S_i (wap_1 - wap_0)^2 / wap_0$$

where

   wap_0 = weighted average of procurement and market prices in the base year scenario,
   wap_1 = weighted average of procurement and market prices in the alternative scenarios.
   spe = price elasticity of supply.

Change in Consumer Surplus

$$CS = - D_i (pr_1 - pr_0) - \tfrac{1}{2} (dpe) D_i (pr_1 - pr_0)^2 / pr_0$$

where

   pr_0 = own retail base year price,
   pr_1 = own retail current year price.
   Dpe = price elasticity of demand.

Gains to Traders

Apart from consumers and producers, other agents in the economy also experience welfare changes. They include traders who earn profit margins by trading within state from farm to wholesale market (*wholesale traders*) and from wholesale to retail market (*retail traders*) and *inter-state traders*. The surplus of these traders arises from different sources. 1) If production goes up, more grain is brought from farm gate to wholesale market and hence increases their surplus. 2) If more grain is traded across states, inter-state traders gain. 3) If more grain is consumed then retailers' surplus goes up. The entire amount of difference between prices at the two points of trade does not constitute the income of traders as they incur some costs to provide services (e.g., finding a buyer and arranging payments etc). Wholesalers help in the delivery of grain from farm gate to the wholesale markets (within state transaction) or between wholesale markets in different states.

Using data on profit margins in trading from farm to wholesale market and from wholesale to retail market, we can calculate the gains from trade accruing to traders in each state. The gains from trade are obtained by comparing the surpluses in different scenarios as compared to that in the base scenario.

Wholesale Traders' Surplus (from farm to wholesale markets)

To get this surplus, we multiply the margin with the wholesale price and local production net of procurement, net exports abroad and net exports to other states. This captures the margins of wholesalers both from within and without the state i.

$$\text{WTS}_i = \text{margin} * p_i * [S_i - \text{proc}_i - \{E_i - M_i\} - \{\Sigma_j T_{ij} - \Sigma_j Tj_i\}]$$

Retail Traders' Surplus (from wholesale to retail markets)

The retail traders' surplus is obtained by applying the margin to the free market demand times the retail price.

$$\text{RTS}_i = \text{margin} \times \text{pr}_i \times D_i$$

Savings in Government Costs

Total government cost = purchase cost + procurement incidental cost + storage cost + distribution cost

where

Purchase cost = government procurement × MSP in the case of wheat,

Purchase cost = government procurement × levy price in the case of rice,

Procurement incidental cost = government procurement × incidental cost,

Storage cost = (procurement – PDS) × storage cost,

Distribution = PDS × distribution cost

Sale realization = PDS × central issue price

Net government cost = total government expenditure – sales realization

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