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Economic Effects of Government Intervention on Production and Consumption of Major Dry Land Crops in Karnataka, India

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ABSTRACT. *Government intervention in agriculture is widespread in India. The state controls output prices of agricultural commodities and inputs through mechanism such as restriction on movement, price intervention and input subsidies. With agriculture been brought under the realm of GATT and the WTO, the freedom of the government to support the agriculture sector beyond a point is limited. Trade regimes will become more free and therefore the likely impact on the agriculture sector needs to be assessed.*

This paper evaluates the impact of government intervention affecting producers and consumers of major dry land crops (jowar, maize, groundnut and sunflower) of the Karnataka state, India is examined using the nominal protection coefficient and partial equilibrium method by calculating the welfare gain/loss of producers and consumers and change in the government revenue. The welfare gain of producers is very high in case of maize (Rs. Mn 2059), followed by jowar (Rs. Mn 1221) and sunflower (Rs. Mn 924) due to higher international prices. However, the lower international price of groundnut would result in a welfare loss to producers amounting to Rs. Mn 2005. The consumers in the state would incur welfare loss due to price increase in jowar (Rs. Mn 1244) and maize (Rs. Mn 869). Thus, the change in government revenue in the state would be substantial amounting to Rs. Mn 29 in jowar and Rs. Mn 1377 in maize.

The welfare gains in all cases are much larger than the respective welfare losses. A greater integration of the agriculture sector of the country with world economy through removal of barriers can be beneficial to the agricultural economy of the country.

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INTRODUCTION

A wide range of policy changes covering trade, finance and industry is sweeping India, which is bound to affect the agricultural sector in due course. The new economic policy aims at economic stability, which entails structural adjustment. The market orientation of the economy has resulted in commercialization of agriculture where supply is determined by the market forces. The policy thrust is veering around from the view of self-sufficiency to food security and exports/imports based on comparative advantage. Domestic production could be threatened when trade barriers are lowered. Under such circumstances, a favorable policy environment needs to be created.

Government intervention in India's agriculture is highly pervasive. Though agriculture is a state subject, agricultural policy is formulated at the national level and states formulates their policy accordingly. The government policy starts from announcing a minimum support price, supporting it and procuring food grains from the market through the Food Corporation of India, imposing a levy on food grains from surplus producers and distributing them through the public distribution system, ostensibly for the weaker sections of society.

One of the major objectives of price intervention policies in agricultural product markets is to obtain government revenues. A second reason for intervention derives from the fact that some countries would like to achieve internal price stability. A third reason for intervention applies only to food commodities, and governments provides low cost food for consumers-mainly those in urban areas.

Price distortions in the domestic markets are often attributed to faulty domestic agricultural policies, which have an adverse affect on incomes of producers, consumers and government revenues simultaneously. These distortions are often created on account of protectionistic policies followed by the governments. With liberalization, these policy distortions are bound to change, which could have far reaching effects on the producers. This paper quantifies the economic implications of market intervention policies on agricultural commodities produced in the dry lands of Karnataka, India. The study attempts to project the changes in domestic prices of commodities, if global prices were to prevail in the state, and study the attendant changes in production and consumption.

THE ANALYTICAL MODEL

International border prices have been used as the point of reference to measure the impact of globalization in agriculture. International prices reflect the opportunities open to the country through trade and have widely been considered in literature as being the equilibrium price. However, distortions due to international prices are not easy to measure since even relatively homogeneous commodities often exhibit a wide range in international prices. Further, these prices may be fluctuating widely and may themselves be affected by domestic distortions. Thus, while the world markets are the natural forum to appraise the value of tradable goods, care has to be exercised in selecting a system of border prices that would meaningfully apply to a specific country.

Once a system of border prices are selected, the discrepancy with domestic (distorted) prices can be estimated for any particular good by computing the Nominal Protection Coefficients (NPCs) a straight forward measure of disparity between domestic and international prices.

Nominal protection coefficient

The nominal protection coefficient is defined as the ratio of the domestic price to the world reference price of the commodity under consideration (Sharma and Gulati, 1995).

Symbolically, $NPC_i = P_i^d / P_i^w$

Where, NPC_i = Nominal Protection Coefficient of the commodity i
P_i^d = Domestic price of commodity i
P_i^w = World reference price (Border Price–equivalent) of commodity i

In this study, the domestic price is approximated by what the cultivators of the relevant commodity receive. The world reference price is derived from the international price adjusted for transport cost (both foreign and domestic), marketing and trading margins including any processing necessary to make the domestic commodity equivalent to the internationally traded form (Gulati *et al.*, 1990).

NPC can be estimated under two main scenarios, namely importable and exportable scenarios. If one is interested in knowing whether a particular

commodity is an efficient import substitute, it is the importable scenario, which is relevant. If the NPC under this scenario is less than unity, the commodity is an efficient import substitute. If one is interested in knowing whether a particular commodity is an efficient exportable commodity, it is the exportable scenario, which is relevant.

For the importable hypothesis, NPC is P_i^d / P_i^w where P_i^w is equal to cif price of the commodity imported from an international market and under the exportable hypothesis it is the cif price in the international market of the domestic commodity adjusted for export cost. These calculations have been presented in Appendix I.

The international prices of the crops were collected from the various issues of FAO Production Year Books for jowar, maize, groundnut and sunflower. The maritime freight rates used to compute the transport cost were obtained from FAO Trade Year Book (1994).

The effects of market distortions: A partial equilibrium analysis

The impact of intervention on the producers and consumers due to the price distortion has been assessed using the partial equilibrium analysis of protection (Lutz and Scandizzo, 1980).

The analytic structure of the partial equilibrium model employed is detailed below:

(A) *Net social loss in production (NSLp)*
$= \frac{1}{2}(Qw - Q)(Pw - Pp) = \frac{1}{2}\,\Omega p\, ns V$

(B) *Net social loss in consumption (NSLc)*
$= \frac{1}{2}(C - Cw)(Pw - Pc) = \frac{1}{2}\,\Omega C\, nd W$

(C) *Total net social loss (NSL)* $= NSLp + NSLc$

(D) *Welfare gain of Producers* $= (Wgp)$
$= Qw\,(Pw - Pp) - NSLp$

(E) *Welfare gain of Consumers* $= (WGc)$
$= C\,(Pw - Pc) - NSLc$

(F) *Change in government revenue*
$= Qw\,(Pw - Pp) - C\,(Pw - Pc)$

where,

Qw	= Production at world prices
Q	= Production at domestic prices
Pw	= Border prices
Pp	= Price faced by domestic producers
Pc	= Price faced by domestic consumers
tc, tp	= Proportion of tariff in domestic price at the consumer (tc) or the producer (tp) level
ns	= Elasticity of domestic supply
nd	= Elasticity of domestic demand
v	= Value of production at Pp
w	= Value of consumption at Pc
Cw	= Consumption at world prices
C	= Consumption at domestic prices

The model essentially tries to isolate the production and consumption effects due to the price distortions. An increase in price P_P due to liberalization of trade leads to a loss in production due to inefficiency with which the additional production is achieved. This is termed net social loss in production (NSLp), also called dead weight loss which is equal to the area CHG in Figure 1.(a). Similarly, a loss in consumption could be visualized due to a rise in the price as depicted by the triangle EFB in Figure 1 (b). Therefore, the net loss is the sum total of the loss in production and the loss in consumption due to the price rise and is termed as dead weight loss. The important effects of the price changes are captured by the model D and E, which measure the net welfare gain of producers (ACHD) and net welfare gain of consumers (ABED). Consequently, the changes in government revenue will be the order of $C_wCFE + QQ_wHG$. For an increase in the price, the former is positive and the latter is negative. Obviously, the net effects should be positive for a desirable policy of price liberalization.

For better conceptualization, an illustration of the components is provided in Figure 1. The line SS_1 indicates the domestic supply function and DD_1 the domestic demand function. The world market price is OD and the domestic price is OA and AD represents an increase in price. For simplicity, the producer and consumer prices are assumed to be the same. At the bottom of Figure 1, the welfare gains and losses determined in equations (A) to (F) are related to the corresponding segments in the Figure 1.

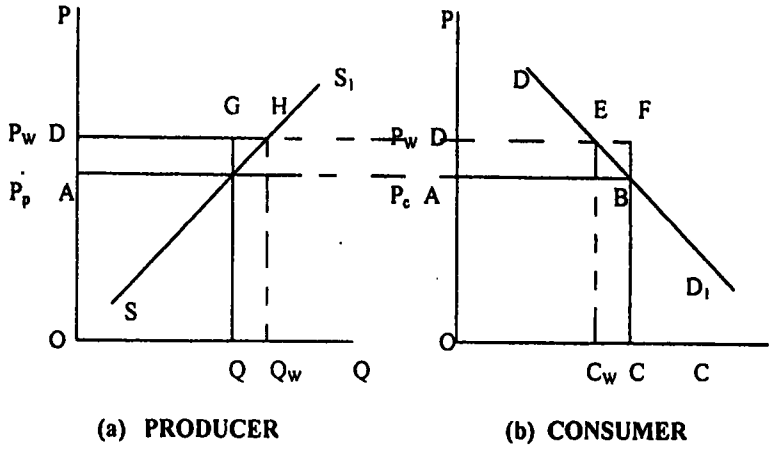

Figure 1. Effect of price distortions.
[Note: (A) NSL_p = CHG, (B) NSL_c = BFE, (C) NSL = CHG + BFE, (D) WG_p = ACHD, (E) WG_c = ABED (Loss), (F) Change in government revenue = $C_wCFE + QQ_wHG$]

The basic parameters needed for this evaluation are the price elasticities of supply and demand. Numerous studies have made econometric estimates of demand and supply elasticities. In the context of this study, the determinant of the area and the determinant of yield are slightly different. Hence, the production, which is a product of area and yield, was not used. For instance, the area depends on the lagged price whereas yield depends on current price. Again, pre-monsoon rainfall is a determinant of area whereas monsoon rainfall would influence the yield levels in dry land crops. Unfortunately, the evidence on agricultural supply elasticity is weak and diverse. Most of the successful attempts have reported the acreage response in terms of elasticities in the range of 0.1 to 0.8 for short run and 0.3 to 1.2 for the long run. Yield responses tend to have lower ranges and reported estimates appear much less reliable (Lutz and Scandizzo, 1980). In the present analysis, the supply elasticities for the crops under study were derived from a study by Reddy (1997). Multiple linear regression models were used to estimate the supply equations. They were fitted by the method of Ordinary Least Squares (OLS) and the results are presented in Appendix II. Similarly, the price elasticities of demand for the commodities were derived for rural and urban population, separately by using the published data of the National

Sample Survey (NSS). The estimated elasticities used in the analysis were presented in Table 1.

Table 1. Net monetary effects of price distortions in selected dry land commodities grown in Karnataka (amount in Rupees Million).

Sl. No.	Commodity	Price elasticities used in the analysis		NSL_P	NSL_C	NSL	Estimated welfare gain of Producers (WG_P)	Estimated welfare loss of consumer (WG_C)	Net effect of liberalization on welfare in the state
		Supply	Demand						
1	Jowar	0.0143	-0.032	31.75	29.99	52.15	1220.95	1243.78	29.32
2	Maize	0.0266	-0.048	172.91	37.41	210.32	2059.16	869.19	1376.96
3	Groundnut	0.0348	-	67.67	-	-	-2004.56	-	-
4	Sunflower	0.0921	-	128.33	-	-	924.29	-	-

The changes in supply and demand were computed using the wholesale and the retail prices of the commodities. However, the consumption gains and losses could not be calculated for groundnut and sunflower as these commodities undergo considerable transformation before ultimate consumption and the data on average consumption of each type of oil is not available, and usually reported as an aggregate.

RESULTS AND DISCUSSION

The results of partial equilibrium analysis carried out to capture the real and monetary effects of price intervention in jowar, maize, groundnut and sunflower produced in Karnataka, India are presented in Tables 1 and 2. The supply elasticities used for analysis were 0.1428 for jowar, 0.2655 for maize, 0.3477 for groundnut and 0.9214 for sunflower. The price elasticity of demand used in the analysis were -0.32 for jowar and -0.48 for maize (Table 1). The net effects of liberalization on production, consumption and changes in government revenue has been estimated for each year 1991-92 through 1993-94 and then averaged. Hence, the analysis gives an average picture of the impact.

Table 2. Production and consumption effects of free trade induced price changes of selected dry land commodities in Karnataka (1991-92 to 1993-94).

Sl. No.	Commodity	Border price Rs/10^3kg	Domestic price Rs./10^3kg	NPC^I	NPC^E	Production (Mn kg)	Consumption (Mn kg)	Estimated change in production (Mn kg)	Estimated change in consumption (Mn kg)
1.	Jowar	49075	42756	87	221	19076	17834	432	-784
2.	Maize	49271	29890	61	174	9633	7457	1673	-559
3.	Groundnut	79107	96524	122	182	11943	-	-749	-
4.	Sunflower	116970	100900	88	113	4925	-	766	-

NPC^I - Nominal Protection Coefficient (Importable Hypothesis)
NPC^E - Nominal Protection Coefficient (Exportable Hypothesis)

Since there is a restriction on the export and import of these commodities, the prices in the domestic market are at a deviance from the international market prices, even with adjustment for transfer cost. Effectively, the border prices are the relevant international prices of these commodities. If trade in the agricultural commodities were to be permitted and takes place, the international price and the domestic price would tend to coincide based on the 'law of one price'. Hence, the domestic prices would lean towards the international prices, *i.e.*, the border prices, since the world quantities are substantially higher than the domestic quantities. Obviously, border prices would prevail.

Economic theory suggests that consumers will react positively (negatively) to decrease (increase) in prices. Correspondingly the producer reacts positively (negatively) to increase (decrease) in prices. Therefore, when changes occur in prices due to the correction of distortions it will bring forth an appropriate reaction from the market players. The changes in these quantities are presented in Table 2.

The equilibrium price were higher than the domestic price in the case of jowar (13%), maize (39%) and sunflower (12%) during the period of the study. The higher world prices would result in an increase in domestic production of jowar (0.43 Mn Mt Tons), maize (1.67 Mn Mt Tons) and

sunflower (0.77 Mn Mt Tons), due to the positive supply response. Conversely, since the world prices of groundnut are 22 per cent lower than the domestic prices, would result in a decrease in production of groundnut (0.75 Mn Mt Tons). However, higher international prices will have a negative impact on the consumption of jowar (0.78 Mn Mt Tons) and maize (0.56 Mn Mt Tons).

The monetary effects of price distortions are presented in Table 1. The net social losses in production and consumption critically depend on the extent of protection and their elasticities. The net social loss in production due to inefficiency exceeds six per cent of its current value of production (Rs. Mn 172.9) in maize and the net social loss in consumption is about 8 per cent of its value of consumption (Rs. Mn 37.4). The net social loss in the production and consumption was less than one per cent of its respective values for jowar. The net social loss in production of sunflower was Rs. Mn 128.8, while in groundnut it was Rs. Mn 67.7.

The distortion in domestic prices would no doubt result in a change in revenue to producers and consumers. As observed in Tables 2 and 3, the effect of intervention was comparatively higher on the producer side when compared to the consumers. The liberalization of agriculture will have a positive impact on producers of those commodities, which commands a higher international price. In the case of consumers, the increase in price of a commodity would lead to a higher consumer price resulting in a loss of consumer surplus.

From Tables 2 and 3, it is evident that the welfare gain of the producers will be very high in the case of maize amounting to 71 per cent (Rs. Mn 2059.2) of the total value of production. The producer gain in jowar was also substantial at 15 per cent (Rs. Mn 1221) of the total value of production. The higher international price of sunflower which the farmers of the state will receive if a more liberalized trade regime is ushered in, will result in welfare gain to producers to the extent of 19 per cent (Rs. Mn 924.3) of the value of production. However, the lower international price of groundnut would result in a welfare loss to producers amounting to Rs. Mn 2004.6. The consumers in the state would incur substantial welfare loss due to price increase in jowar (Rs. Mn 1243.8) and maize (Rs. Mn 869.2). Thus, the net effect of correcting the price distortions on welfare in the state would be substantial amounting to Rs. Mn 29.3 in jowar and Rs. Mn 1377 in maize.

Consumption gains and losses have not been calculated for groundnut and sunflower. However, it can be inferred based on price

Table 3. Gains and losses due to projected changes in prices resulting from globalization (amount in Rupees Million).

Sl. No.	Commodity	Value of production at P_P (V)	Percentage of WG_P to value of production	Value of consumption at P_C (W)	Percentage of WG_C to value of consumption
1	Jowar	8219.50	1.49	7478.39	1.66
2	Maize	2883.30	7.14	2744.18	3.18
3	Groundnut	11546.78	-1.74	-	-
4	Sunflower	4913.17	1.88	-	-

distortions that the welfare loss of consumers in sunflower could be substantial as indicated by the higher level of international price. The consumers of groundnut will be benefited due to free trade because the world price of groundnut at the time of study was 22 per cent lower than the domestic price.

The results of this study have certain limitations. Firstly, the analysis has been done for the period between 1991-92 and 1993-94, since the liberalization was effected in the early 1990s and only partially for agricultural commodities. Therefore, it is too early to assess the impact. The impact could be better assessed if the period of study covered a longer period. Secondly, the quality parameters have not been explicitly taken into consideration. Normally, high quality products in the domestic market will attract a higher price, which will increase domestic price, there by increasing the NPC and altering the comparative advantage scenario. In this study average prices have been used. Thirdly, a single estimated elasticity has been used for calculation of welfare gains and losses. However, a range of elasticities would have provided better results for comparison.

The cross substitution effects both in production as well as consumption have not been considered while determining the gains and losses. Hence, the adverse impact on consumption due to a price increase would be exaggerated, as substitution in consumption would take place reducing the intensity of impact. Similarly, when prices fall, farmers substitute crops in

production, thereby reducing the adverse impact. In general, the net loss in consumption and production could be exaggerated due to the omission of the substitution effects. However, substitution possibilities in production are limited in dry land agriculture. Thus, the results may not be too far from the reality. Finally, the NSS data was used relate to average expenditure and quantities consumed in different expenditure groups. It is true that the average price is derived and therefore crude. Further, the significance of the coefficients could not be conclusively established, as the degree of freedom was less than 10.

CONCLUSIONS

The possibility of welfare gains accruing to the producers of jowar, maize and sunflower appeared to be high in a free trade regime. Consequently, there will be welfare losses to the consumers of these commodities. However, the results indicated that the gains clearly outweigh the losses. Further, in case of oilseeds, especially groundnut, free trade will result in reduction in prices received by the farmers, which as a consequence will lead to welfare loss to the producers. Here again, the welfare gain to the consumers will outweigh the welfare loss to the producers. There is evidence to show that the system of intervention has caused welfare loss to the producer, there by affecting the ability to invest in production. To correct this anomaly, the consumers will have to bear some of the burden. It is possible that the burden will not be as severe, since consumers could substitute between products, for example replacing costlier jowar with relatively cheaper rice.

A greater integration of the agriculture sector of the country with world economy through removal of non-tariff barriers can improve the profitability of dry land agriculture. This would help in phasing out of non-merit subsidies in agriculture, which is having a crowding out effect on investment in productive infrastructure, like irrigation, watershed development, research and other development activities. This alone can strengthen the agriculture base of the state, which could otherwise be threatened by the trade liberalization measures envisaged under WTO.

The state should gear up to meet the challenges of liberalization which is desirable, but could create problems to the producers in the dry land areas in the short run. The producer problems could be associated with inability to develop products of international standards, absence of an effective marketing system, small scale of production and poor technical

guidance on production and marketing. These problems will have to be addressed if the state has to convert globalization in to a profitable opportunity. Though the study has not addressed the issue of infrastructure, the poor level of infrastructure development in the agriculture sector both in the country as well as in the state could act as a serious impediment in making a break through in exports. This aspect also requires urgent policy action.

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APPENDICES

Appendix 1. Karnataka: Nominal Protection Coefficients 1991-92 to 1993-94.

(Importable Hypothesis)

No.	Particulars	Unit	Jowar	Maize	Groundnut	Sunflower
1.	FOB price in exporting country	$/Qtl	10.37	10.43	382.18	365.00
2.	Plus freight	$/Qtl	4.18	4.18	28.41	17.76
3.	Plus insurance @ 1% of price	$/Qtl	0.10	0.10	3.82	3.65
4.	Equals CIF price	$/Qtl	14.65	14.72	414.41	386.41
5.	Exchange rate	1$=Rs	28.33	28.33	28.33	28.33
6.	Equals CIF price (Row 4×Row 5)	Rs/Qtl	414.58	416.43	1168.09	1102.52
7.	Plus port clearing charges	Rs/Qtl	60.00	60.00	60.00	60.00
8.	Equals landed cost	Rs/Qtl	474.58	476.43	1228.09	1162.52
9.	Plus transport cost	Rs/Qtl	16.18	16.28	7.18	7.18
10.	Equals landed cost	Rs/Qtl	490.76	492.71	1235.26	1169.70
11.	Reference price	Rs/Qtl	490.76	492.71	791.06	1169.70
12.	Whole sale price in Karnataka	Rs/Qtl	427.56	298.90	965.24	1009.00
13.	**NPCs (Row 12/Row 11)**		**0.87**	**0.61**	**1.22**	**0.88**

(Exportable Hypothesis)

No.	Particulars	Unit	Jowar	Maize	Groundnut	Sunflower
1.	Wholesale price in Karnataka	Rs/Qtl	427.56	298.90	965.24	1009.00
2.	Plus transport cost	Rs/Qtl	16.18	16.18	7.18	7.18
3.	Plus marketing margins @ 5%	Rs/Qtl	21.38	14.94	48.26	50.45
4.	Plus port clearing charges	Rs/Qtl	60.00	60.00	60.00	60.00
5.	Equals FOB price	Rs/Qtl	525.11	390.02	1080.68	1126.63
6.	Plus freight	Rs/Qtl	118.55	118.55	80.72	17.76
7.	Plus insurance @ 1% of price	Rs/Qtl	4.28	2.99	9.65	10.09
8.	Equals landed price	Rs/Qtl	647.93	511.55	117.05	1154.48
9.	Exchange rate	1$=Rs	28.33	28.33	28.33	28.33
10.	CIF price (Row 8/Row 9) at destination	$/Qtl	22.93	18.17	415.80	409.41
11.	Reference price	$/Qtl	10.37	10.43	229.82	365.00
12.	**NPCs (Row 10/ Row 11)**		**2.21**	**1.74**	**1.81**	**1.12**

Appendix 2. Results of Supply Response Models.

No.	Crop	Constant	Own price of the crop	Price of the competing crop	Name of the competing crop	Rain fall			Gross cropped area	Gross irrigated area	Trend	R^2	Durbin Watson 'd'	Own price elasticity	Cross price elasticity
						Pre monsoon	South west monsoon	Annual							
1	Jowar	141910	2029.3*** (3.012)	-947.7*** (-3.166)	Cotton			249.31 (1.621)	0.1876*** (2.715)			0.66	1.92N	0.1428	-0.1978
2	Maize	-137100	331.47** (2.427)	-63.42 (-1.162)	Groundnut			39.671* (1.856)		0.0939*** (3.193)	4039.5*** (2.932)	0.98	1.87N	0.2655	-0.1453
3	Groundnut	1131800	887.31*** (4.507)	-746.36 (-1.507)	Maize		-226.51*** (-2.708)				-11282*** (-1.68)	0.88	2.12N	0.3477	-0.1023
4	Sunflower	-1483300	1157.1*** (7.126)	-0.0316 (-0.0452)	Jowar	1146.4 (1.495)			0.1197 (1.504)			0.93	1.96N	0.9214	-0.0124

***, **, * - Denote significance at 1, 5 and 10% respectively
Figures in parenthesis are the 't' values
N - no auto correlation