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MANAGING PRICE VOLATILITY IN AN OPEN ECONOMY ENVIRONMENT: THE CASE OF EDIBLE OILS AND OILSEEDS IN INDIA

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ABSTRACT

This study examines the impact of alternative price stabilization policies for edible oils and oilseeds in India on the farmers growing oilseeds, the consumers of edible oils and the processing sector with the help of a multi market equilibrium dynamic simulation model. Price stability in the edible oil sector is important at least for two reasons. It can help realize the growth potential in the production of edible oils and improve the nutritional security of Indian households. While efficiency considerations suggest the linking of domestic to world prices, extreme fluctuations in price have to be avoided, for they can lead to undesirable consequences both at the macro and micro levels.

The questions addressed in this study include the following. What is the effectiveness of alternative price stabilization mechanisms in stabilizing oilseed/ edible oil prices? Can variable levies that vary within the bound tariff level provide adequate protection against world price fluctuations? What are the costs to the government, benefits to producers and consumers? What is the impact on prices of oilseeds due to the operation of variable levies edible oil imports and vice versa?

The following are some of the results obtained from the model. Higher import tariffs on edible oils lead to more variable domestic prices. This indicates that a fixed level of tariff even at a higher level is not useful in stabilizing oil prices. A system of variable levies which adjust to international price and domestic supply situation is what would be required. Tariff protection on oils mainly benefits the processing sector and the benefits to oilseed growers are relatively smaller. Tariff protection to growers by

increasing tariffs on oilseed imports helps the producers of oilseeds, but at the cost of consumers and the processing sector. The distribution of benefits to different agents varies with the different alternative mechanisms used for price stabilization. As the bound rates of tariffs under WTO are fixed quite high for all edible oils with the exception of soy oil, there is enough room to adjust import duties for price stabilization purposes. The maximum import tariff rate required to stabilize prices within a reasonable price band is as low as 25%.

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MANAGING PRICE VOLATILITY IN AN OPEN ECONOMY ENVIRONMENT: THE CASE OF EDIBLE OILS AND OILSEEDS IN INDIA

P.V. Srinivasan[1]

1. INTRODUCTION

Economic globalization and increased trade liberalization makes it imperative to look for instruments that can effectively protect producers and consumers from the highly volatile international commodity prices. In India, currently the Central Government fixes Minimum Support Prices (MSP) for major agricultural commodities to ensure remunerative prices to farmers and prevent distress sales by the farmers. The MSP is linked to several factors, including the cost of production as estimated periodically by Commission on Agricultural Costs & Prices (CACP). These prices are administered through public and cooperative marketing agencies. With the opening up of the economy to external markets price support would be provided mostly through appropriate tariff on imports. Aligning the domestic prices with world prices could pose several challenges particularly due to high volatility of world prices. The adjustment costs are often much higher for the small and marginal farmers, small scale processors, and vulnerable consumers.

In the absence of any coping strategy, or adequate protection the damage to their interests can be significant, which often results in blanket opposition to liberalization. To make the transition from a closed to open economy environment smooth, it is important

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to examine the role of alternative policy instruments, domestic and external, and institutional reforms required to cope with the risks associated with a more open economy than what has been the case in the past. This would help a gradual adjustment in cropping patterns taking advantage of country's comparative advantage in a globalizing world.

This study examines alternative price stabilization policies for edible oils and oilseeds in India. The impact of price stabilization on different agents, the farmers growing oilseeds, the consumers of edible oil and the processing sector is examined with the help of a multi market equilibrium model. This involves simulation exercises assuming different shocks to domestic production and world prices. Different alternative scenarios are considered in order to examine their relative influence on different agents.

The importance of price stability in the edible oil sector can hardly be over emphasized. Production of oilseeds is a good avenue for agricultural diversification. Since production of oilseeds takes place in predominantly rainfed regions it is likely to have favorable distributional implications and also lead to more regionally balanced agricultural growth. While the current low levels of yields of most oilseeds compared to international levels can be increased through technological improvements, ensuring a more stable price environment would help realize this growth potential. The rising share of edible oils in Indian household budgets in recent years and the role it plays in nutritional security also underscores the importance of price stability.

While efficiency considerations suggest the linking of domestic to world prices, extreme fluctuations in price have undesirable consequences both at the macro and micro levels. High food prices through their impact on wages and inflation can have a

destabilizing influence on the macro economy. At the micro level risk-averse farmers could decrease their investments thereby reducing output. Price support to farmers and tariff and other trade protection to the processing industry over the years implied there was less of a need to manage price risk. Moreover, in a policy controlled regime risk management markets and instruments such as futures and options contracts failed to develop. In order to provide greater role to the private sector the government has in recent years enlarged the coverage of futures markets to minimize the wide fluctuations in commodity prices and for hedging their risks. Extremely high prices are harmful to consumers especially in a poor country like India where share of food in household budgets is high and malnutrition is widespread. Hence price stabilization through appropriate measures becomes necessary to avoid the problems associated with commodity price fluctuations.

The plan of the paper is as follows. The next section provides the policy background, past policies and recent developments. It also gives a description of the issues currently faced by the oilseed and edible oils economy and of questions that are addressed in this paper. Section 3 provides a description of the model used. The subsequent section describes the alternative scenarios considered and the impacts of price stabilization obtained from model simulations under each of these scenarios. Section 5 provides concluding remarks.

2. BACKGROUND

2.1 TRENDS IN PRODUCTION AND CONSUMPTION

Improved access to new technology, better access to markets and favorable policy environment (e.g. Soybean and Sunflower are exempt from the small scale industry reservation policy) has led to substantial growth in domestic production of oilseeds. A major part of the increase in output is due to area expansion while the contribution from yield increases has been relatively lower. Import substitution policies also helped in providing favorable price incentives with higher prices relative to competing crops. Nominal protection coefficients calculated for the major oilseeds, groundnut, rapeseed, soybean and sunflower were very high in most of the years (Gulati et al, 1996). Between 1981-82 and 1993-94 the average annual growth rate oilseed production was more than twice that of food grains (Figure 1). Yield increases have mainly been due to technological changes such as development of shorter duration varieties and improved resistance to pests and moisture stress. Over the years yield variability has been on the decline mainly due to greater regional diversification of oilseed production and increased diversification across oilseeds. However, production and yields of oilseeds appear to have reached a state of stagnation in recent years (Figures 2 and 3). Yield levels for most oilseeds are less than half the level of other major oilseed producers in the world (World Bank, 1997). This is another reason for the low comparative advantage seen in the production of oilseeds.

Figure 1—Trends in oilseed production

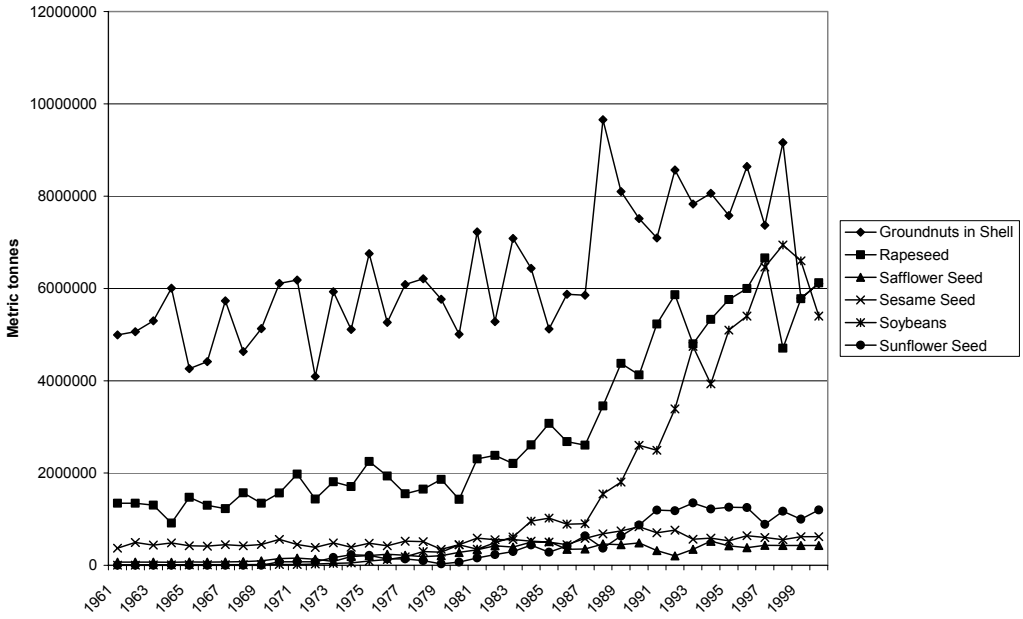


Figure 2—Oilseeds: Trends in area and production

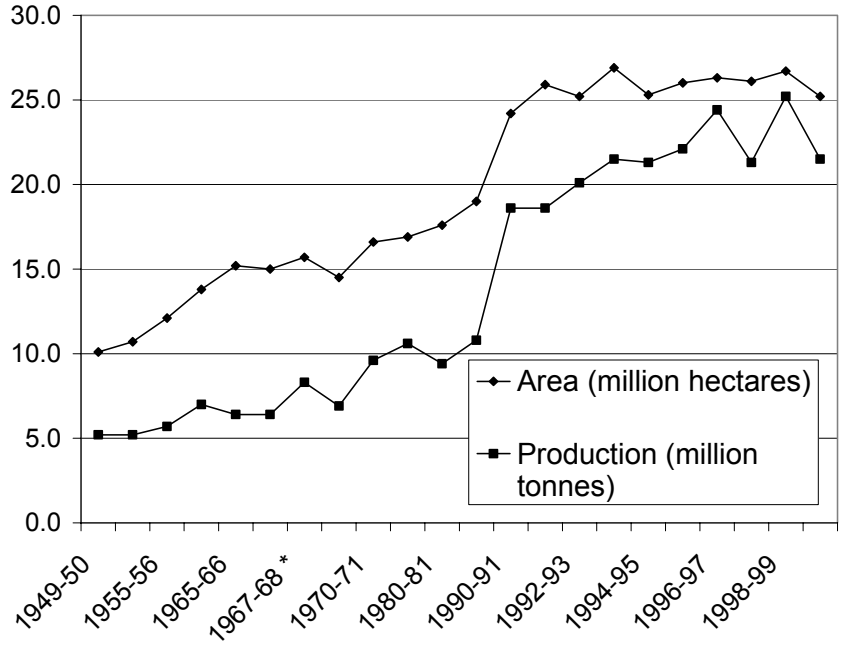
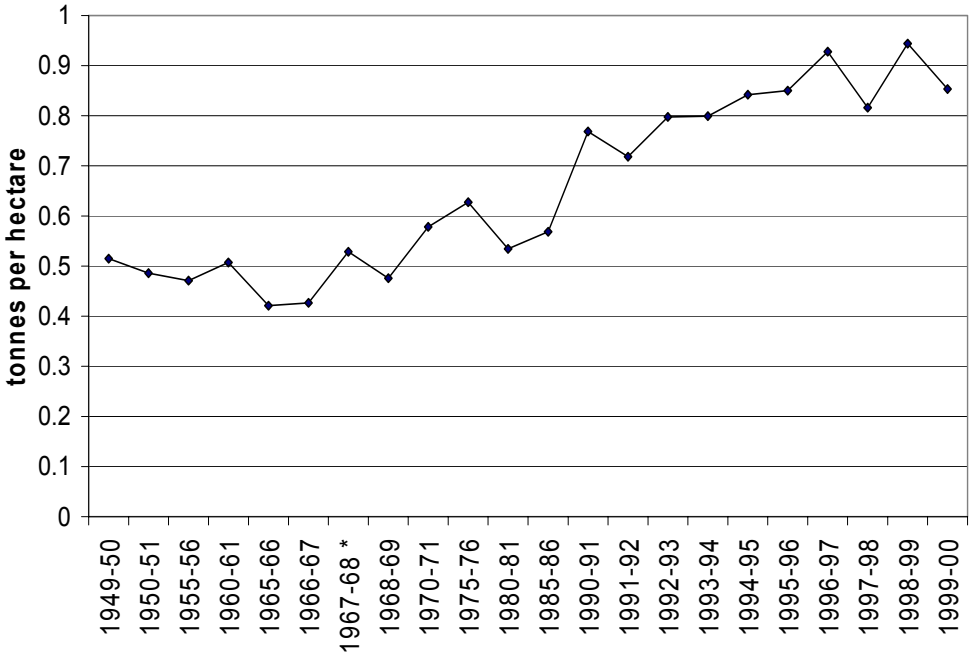


Figure 3—Oilseeds: Trend in Yields



The demand for oils however, has been on the rise, partly due to rise in household incomes and partly due to reduction in prices as a result of trade liberalization. Price of edible oils relative to all food articles as well as the general wholesale price index has been on the decline since 1991-92 (Figure 4). Thus a large fraction of domestic demand is met by imports (Figure 5). While virtually the entire palm oil consumption is met through imports, large demand supply gaps are visible in Soybean and Rapeseed and Mustard oil (Figures 6 and 7). This tends to increase the vulnerability of domestic consumers and producers to fluctuations in world prices. World prices of edible oils are more volatile than domestic prices (Figure 8).

Figure 4—Edible oil price trends

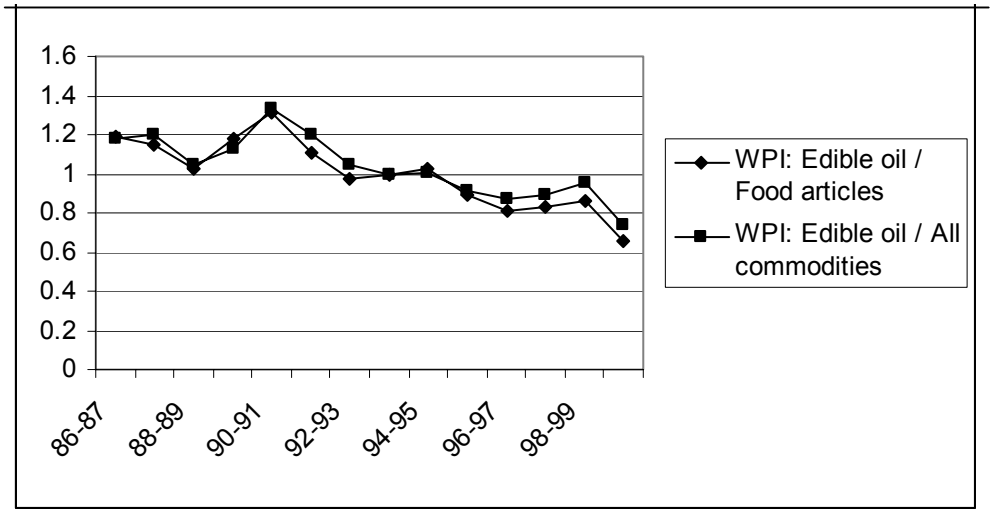


Figure 5—Edible oil import dependence

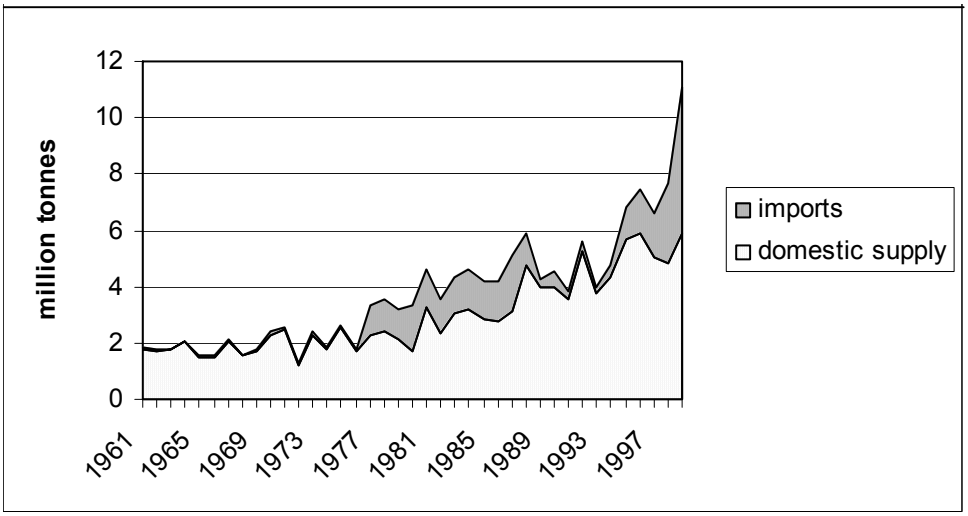


Figure 6—Soybean Oil

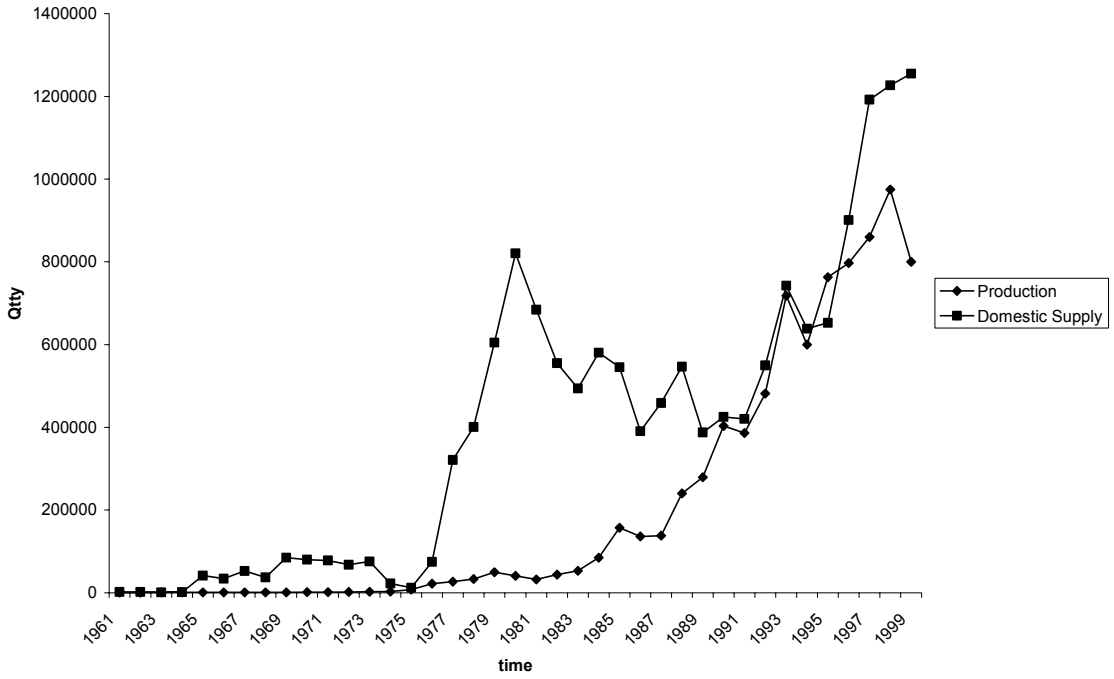


Figure 7—Rape and Mustard Oil

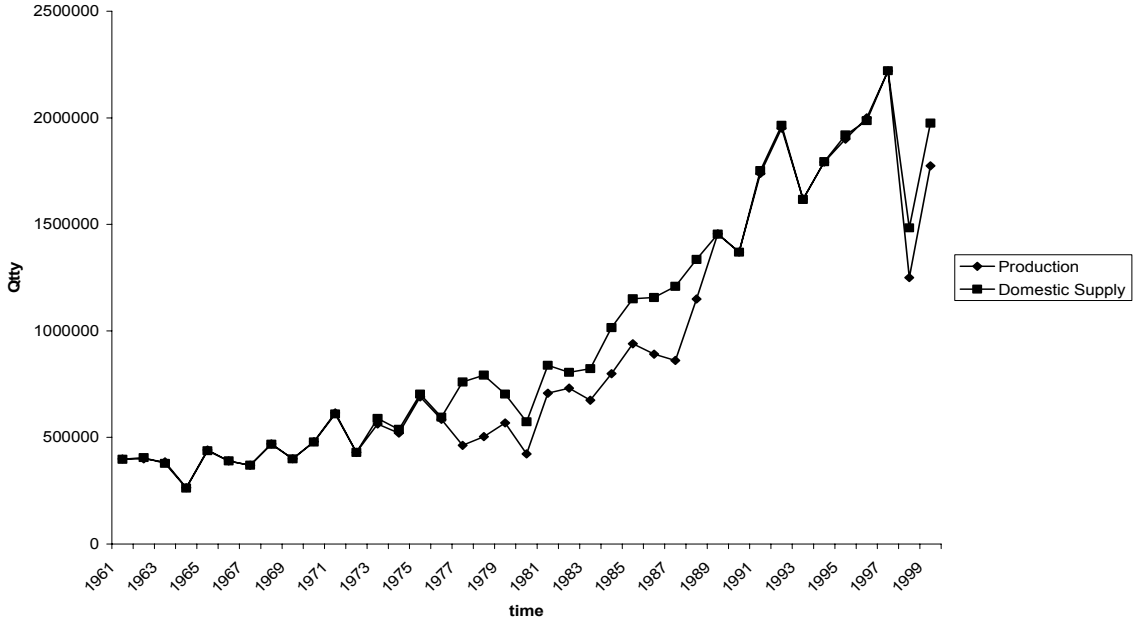
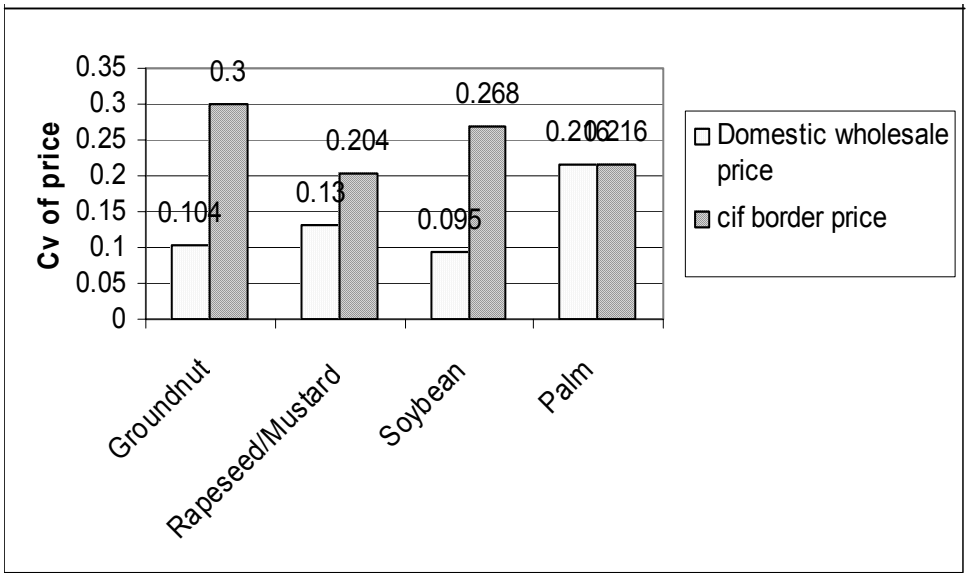


Figure 8—Price variability: Domestic vs International



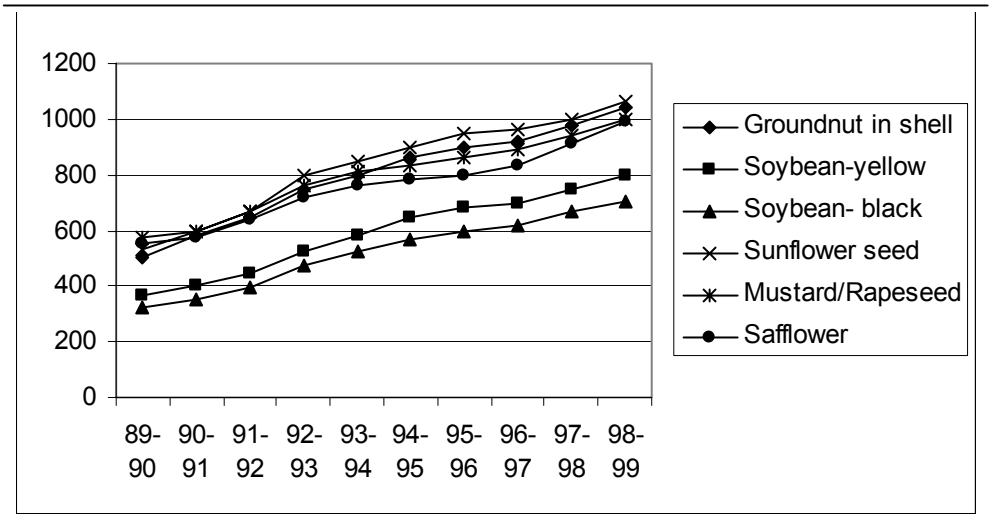
2.2 POLICY TRENDS

Market intervention in the case of edible oils has taken several forms. As the demand for edible oils far outstripped the supply, the government felt that the high dependence on imports is not desirable from the food security perspective. This led to the strategy of import substitution and infant industry protection. Imports of edible oils were only through the state trading agencies (canalized trade) until 1994. The high protection given to the industry was at the cost of oilseed growers and consumers. The restriction on oilseed exports until 1995 in fact hurt the growers and helped the processors.[2] The less efficient domestic processing industry is, due to protection and small scale reservations etc, the less would farmers receive as price for their output. The government fixes floor prices (MSP) to protect oilseed producers. The trends in MSP over the years suggest that

[2] Exports of sunflower, rapeseed-mustard seeds were allowed in 1995.

these are periodically revised upwards to reflect changes in input costs (Figure 9). The MSP is effective only in those years when the market prices tend to fall very much. Market intervention operations by the National Dairy Development Board (NDDB) between 1989 and 1994 were the first major attempt by the government to stabilize oilseed/edible oil prices with a predetermined price-band. NDDB did this through buffer stocks and imports (of both oilseed and oil).[3] Given the importance of edible oils in the dietary requirements of households the Department of Food and Public Distribution under the Ministry of Consumer Affairs, Food and Public Distribution, distributes edible oil under PDS at lower than market prices.

Figure 9—Minimum Support price – oilseeds



[3] The involvement of NDDB in oil price stabilization is not due to the fact that edible oils are substitute products for butter and ghee. The government wanted to extend the success of the cooperative movement to edible oil sector so that oilseed farmers' income increased and production of oilseeds encouraged (see Box 1).

With the opening up of trade the government fixed import duties on edible oils in order to protect the domestic industry. In practice the import tariffs are fixed at varying levels not exceeding the bound rate committed to under the trade agreement. In order to prevent under invoicing of imports the government fixes a tariff value, which may be different from the actual price at which the imports take place. For example in the case of soybean oil the tariff value was fixed at $600 per tonne even though the actual price in the international market was in the range of $510 to $520 per tonne.[4] Due to this the effective duty on Soy oil at times can even exceed the bound rate. Price intervention by the government tries to strike a balance between the producer and consumer interests. While high tariffs on import of edible oils are in the interest of the edible oil industry and perhaps oilseed growers, it could be at the expense of consumers who pay a higher price. The oilseeds sector comes under the Essential commodities Act, which imposes legal controls on interstate movement and storage of oilseeds. The small-scale sector reservation for the edible oils industry has been responsible for inefficiencies in production. Most (60-70 percent) of the crude edible oil refining units are small with capacity utilization as low as 40 percent.

In the recent years however, due to India's commitments made under the WTO, quantitative restrictions on import of edible oils have been removed. The import of refined palm oil was put under open general license (OGL) in March 1994, which means that it can be imported without seeking any government approval. Other edible oils were put under OGL in April 1995. Recently duties have been reduced drastically on both

[4] Business Standard, April 2, 2003, Mumbai.

refined and non-refined (crude) edible oil.[5] Although India's share in world oilseed production is quite substantial (Table 2) and it is a big exporter of groundnuts and sesame (Table 3) it fails to meet the domestic consumption requirements of edible oils. India's oil imports form a big share in world trade especially in Palm and Soy oil. It ranks among the top ten importers of Palm, Soya and Rapeseed/Mustard oil (Tables 4 and 5). Bulk of the edible oil imports under the Open General License (OGL) is RBD palmolein of Malaysian and Indonesian origin (Table 6). A major proportion of Soy oil imports are from Argentina. Brazil, South Africa and USA are the other countries from which we import larger quantities (Table 7). Palm oil accounts for 60 percent of imports, while soybean and sunflower seed oil accounted for 20 and 13 percent respectively. The import duty rates on edible oils are revised periodically depending on the demand supply gap and the level of international prices. The bound rates of tariffs under WTO are fixed quite high for all edible oils with the exception of soybean oil (Table 8). There is thus enough room to adjust import duties for price stabilization purposes.

For Rape, Colza or Mustard oil, up to an aggregate of 150000 tonnes of total Imports in a financial year (under Tariff Rate Quota) a lower the import duty applies (45% instead of 75%).

Recently the government has also permitted futures trading in several edible oils and oilseeds. Producers, traders as well as consumers are expected to benefit from this measure. The importers of edible oils who are exposed to risks arising out of unprecedented price fluctuations in the international market can hedge their risk though the futures market. The wholesalers who buy from importers for distant deliveries can

[5] See Table 1 for recent policy trends on import of edible oils.

cover their risks against their forward purchases. The price discovery made in the futures markets can help farmers plan their sowing operations and decide on the commodity that will fetch remunerative prices. Crushers can also hedge the oil by entering into forward purchases in the futures market. Futures trading will bring in stability in prices, which would help in reducing the government's burden of price stabilization.

Table 1—Import Policy for Edible Oils and Oilseeds

Edible oils	
April, 1994	Import of RBD Palmolein Placed on OGL with 65% Import Duty.
March, 1995	Import of all edible oils (except coconut oil) placed on OGL with 30% Import Duty.
1996-97 (In Regular Budget)	Further Reduction in Import Duty to 20% + 2% Surcharge. Another Surcharge of 3% was Later Imposed Bringing the Total Import to 25%
July, 1998	Import Duty Further Reduced to 15%
1999-2000 (Budget)	Import Duty Revised to 15% (Basic) + 10% (Surcharge) =16.5%.
December, 1999	Import Duty on Crude Oils Raised to 25% (Basic)+10% (Surcharge) = 27.5% In Addition 4% SAD Levied on Refined Oils.
June, 2000	Import Duty on Crude Oils to 25% (Basic) + 10% (Surcharge) = 27.5% and on Refined Oils Raised to 35% (Basic) +10% (Surcharge) + 4% (SAD) = 44.04% Import Duty on Crude Palm Oil (CPO) for Manufacture of Vanaspati Retained at 15% (Basic) + 10% (Surcharge) = 16.5%.
November, 2000	Import Duty on CPO for Manufacture of Vanaspati Raised to 25% and on Crude Vegetable Oils Raised to 35%. Import Duty on CPO for other than Vanaspati Manufacture Raised to 55%. Import Duty on Refined Vegetable Oils Raised to 45% (Basic) + 4% (SAD) = 50.8% Import Duty on Refined Palm Oil and RDB Palmolein Raised to 65% (Basic) + 4% (SAD) = 71%.
March, 2001 (As Amended on 26-4-2001)	Import Duty on Crude Oils Raised to 75% Except Soybean Oil. The Duty on Refined Oils Including RDB Palmolein Raised to 85% (Basic) Except in the Cases of Soybean Oil and Mustard Oil Where the Duty is Placed at 45% (Basic) SAD Levied on Refined Oils.
October, 2001	Import Duty on Crude Palm Oils and Its Fractions, of Edible Grade, in Loose or Bulk form Reduced form 75% to 65%.
Oilseeds	
December 1992	Exports of safflower seed allowed subject quantitative ceiling of 2500 tonnes
March 1993	Export ceiling enhanced to 7500 tonnes for safflower seed
May 1993	Ceiling raised to 50000 tonnes for safflower seed
August 1993	Export of rapeseed-mustard allowed subject to quantitative ceiling
October 1993	Export of sesame seed allowed subject to quantitative ceiling
Union budget 2000-2001	Free import of all oilseeds at 35% import duty has been allowed without any quantitative licensing requirements

Source: Annual Report 2001-02, Department of Food and Public Distribution. SAD denotes Special Additional Duty.

Table 2—India's Share in World Production of Oilseeds

Oil Seeds (Qty. in Million tonnes)	1996	1997	1998	1999	2000
Soybean					
World	124.54	132.80	158.17	159.80	171.14
India (percent share)	3.49	3.07	3.25	3.06	3.97
Cotton Seed					
World	35.30	34.48	34.68	33.55	33.19
India (percent share)	15.13	17.08	6.20	15.80	14.16
Groundnut					
World	20.43	20.85	20.28	21.47	22.87
India (percent share)	25.70	28.30	26.63	24.73	29.03
Sunflower Seed					
World	26.11	24.58	24.07	26.91	23.34
India (percent share)	5.05	5.37	4.82	2.97	2.99
Rapeseed					
World	34.59	30.98	33.12	42.64	37.61
India (percent share)	17.55	20.34	14.04	13.98	11.33
Sesame seed					
World	2.41	2.64	2.75	2.81	3.02
India (percent share)	22.82	25.38	26.91	18.15	17.55
Palm Kernel					
World	4.75	5.03	4.77	6.14	6.48
India (percent share)	0.04	0.04	0.06	0.13	0.19
Copra					
World	4.66	5.36	5.15	5.30	5.54
India (percent share)	14.38	13.43	14.37	12.45	13.36
Linseed					
World	2.54	2.30	2.43	2.97	2.34
India (percent share)	12.20	13.91	6.07	9.76	11.11
Castor seed					
World	1.22	1.12	1.19	1.24	1.39
India (percent share)	76.23	68.75	67.23	62.90	75.54
Total					
World	256.55	259.42	286.61	302.83	306.92
India (percent share)	9.66	10.00	8.41	8.09	8.40

Source: Annual Report 2000-01, Indian Vanaspati Producers Association.

Table 3—Oilseed exports: India and the world (average of 1997-99)

Groundnut shell			Sesamseed		
Country	**Metric tonnes**	**% of World Total**	**Country**	**Metric tonnes**	**% of World Total**
China	492247.00	24.07	**India**	102030.33	17.40
Argentina	368505.00	18.02	China	61395.00	10.47
United States of America	319010.33	15.60	Guatemala	31098.67	5.30
India	217262.00	10.62	Nigeria	30666.67	5.23
Netherlands	134592.67	6.58	Ethiopia	30166.67	5.14
South Africa	45291.00	2.21	Mexico	20254.33	3.45
Germany	29354.33	1.44	Netherlands	13784.33	2.35
Canada	28279.67	1.38	Tanzania, United Rep of	12977.33	2.21
Nicaragua	24947.67	1.22	Pakistan	11301.00	1.93
United Kingdom	14809.00	0.72	Thailand	11080.00	1.89

Source: FAOSTAT.

Table 4—India and the world: Top Ten Importers of Groundnut and Rapeseed/Mustard oil (Average of 1997-99)

Groundnut oil			Rapeseed/Mustard		
Country	**Metric tones**	**%of World Total**	**Country**	**Metric tones**	**%of World Total**
France	75552.67	26.02	USA	446807.67	13.35
Italy	45949.67	15.82	Netherlands	309716.67	9.26
Belgium-Luxembourg	28232.33	9.72	China	258906.67	7.74
Germany	18796.33	6.47	United Kingdom	202967.67	6.07
USA	18714.67	6.45	Belgium-Luxembourg	175899.33	5.26
Switzerland	15149.00	5.22	Russian Federation	157897.67	4.72
Netherlands	13006.67	4.48	**India**	144888.67	4.33
China	9669.67	3.33	Germany	133374.67	3.99
United Kingdom	4478.67	1.54	France	127373.67	3.81
Mali	3000.00	1.03	Mexico	83668.33	2.50
India	278.00	0.10			

Source: FAOSTAT.

Table 5—India and the world: Top Ten Importers of Palm and Soybean oil (Average of 1997-99)

Palm oil			Soybean oil		
Country	**Metric tonnes**	**% of World Total**	**Country**	**Metric tones**	**% of World Total**
India	2177302.67	17.17	China	1001748.33	13.41
China	1259782.67	9.93	Iran	528597.67	7.07
Pakistan	1026609.33	8.09	Bangladesh	502508.33	6.72
Netherlands	666079.00	5.25	**India**	475220.67	6.36
Germany	591703.67	4.67	Netherlands	283656.00	3.80
United Kingdom	490799.33	3.87	Pakistan	269026.67	3.60
Japan	413258.67	3.26	Morocco	180288.33	2.41
Egypt	390287.67	3.08	Brazil	178525.33	2.39
Iraq	285563.67	2.25	Turkey	170262.67	2.28
Italy	265266.67	2.09	Belgium-Luxembourg	165883.67	2.22

Source: FAOSTAT.

Table 6—Country wise imports of Palm oil by India

Articles	Countries	Quantity (in tones)	
		April'1999 to March'2000	April'2000 to February'2001
Crude Palm Oil and its Fractions	Indonesia	64.09	578.45
	Argentina	-	0.25
	Malaysia	31.32	231.07
	Thailand	2.044	17.29
	Chinese Taipei	-	0.5
	German F Rep	-	1
	Italy	-	1
	Singapore	-	3.74
	South Africa	-	0.5
	USA	-	2.46
Refined Palm Oil and its Fraction	Australia	0.75	0.75
	Argentina	-	6.84
	Brazil	0.5	-
	Canada	0.75	-
	China P RP	0.49	0.7
	German F Rep	0.25	-
	Indonesia	646.08	592.15
	Japan	6.481	-
	Malaysia	2090.56	1236.65
	Netherlands	1	4.829
	Singapore	11.09	1.52
	Thailand	0.5	6.46
	Ukraine	1.09	-
	USA	11.39	0.5

Source: Lok Sabha Un starred Question No. 2028, dated 3.8.2001, as provided by http://www.indiastat.com .

Table 7—Country wise imports of Soybean oil by India

Articles	Countries	Quantity (in tonnes)	
		April'1999 to March'2000	April'2000 to February'2001
Soyabean Crude Oil W/N Degummed	Argentina	12.710325	152.095758
	Indonesia	1.5	-
	Brazil	-	19.712
	Italy	-	0.25
	Malaysia	-	2.251456
	South Africa	2	7.5
	Thailand	-	4.298344
	USA	-	6.18923
Other Soyabean Oil and its Fractions	Argentina	300.201752	254.923878
	Brazil	183.374683	40.082
	Canada	0.023	-
	German F Rep	2.123	-
	Denmark	-	0.02
	Indonesia	1	-
	Malaysia	0.26639	0.001465
	Netherlands	6.5	0.5
	Saudi Arabia	2.7	-
	Korea RP	-	0.001
	South Africa	12.103322	20.39605
	Switzerland	-	0.02
	Thailand	-	0.25
	USA	75.322785	40.290462

Source: Lok Sabha Un starred Question No. 2028, dated 3.8.2001. (as provided by http://www.indiastat.com) .

Table 8—Tariffs and bound rates on major edible oils (as on April 2002)

Edible Oils (Crude)	Basic Duty (%)	Bound Duty (%)	Edible Oils (Refined)	Basic Duty (%)	Special additional duty (%)	Bound Duty (%
Soyabean Oil	45	45	Soyabean Oil	45	4%	45
Palm Oil (for Manufacture of Vanaspati)	65	300	RBD Palmolein	85	4%	300
Palm Oil (for other than Manufacture of Vanaspati)	65	300	Palm Oil	85	4%	300
Groundnut Oil	75	300	Groundnut Oil	85	4%	300
Sunflower/Safflower	75	300	Sunflower/Safflower	85	4%	300
Coconut Oil	75	300	Coconut Oil	85	4%	300
Rapeseed Oil	75	75	Rapeseed Oil	75	4%	75
Colza or Mustard Oil	75	75	Colza or Mustard Oil	75	4%	75
Other Oils	75	300	Other Oils	85	4%	300

Source: Agricultural Statistics at a Glance 2002, Ministry of Agriculture, Govt. of India.

Note: For all refined oils a special additional customs duty of 4% applies in addition to the basic duty. For crude Sunflower or Safflower Oil up to an aggregate of 150000 tonnes of total Imports in a financial year (under Tariff Rate Quota) a lower the import duty applies (50% instead of 75%).

2.3 ISSUES AND QUESTIONS

The following are some of the key issues that arise in the context of trade liberalization. High volatility in world prices could cause disruption in production and consumption patterns in an open economy. In such an eventuality it is the vulnerable sections, farm labor, small farmers and poor consumers that are likely to be affected the most. The need to minimize such disruptions by stabilizing prices then becomes obvious. However, a balance needs to be struck between the interests of oilseed growers, the processing sector that produces oil and meal and the consumers of edible oil.

The questions that arise in this context are the following:

- How are the interests of the domestic oilseed and edible oil sector linked?
- What are the alternative instruments available in an open economy environment, to cope with large fluctuations in world prices?
- What should be the target price around which prices need to be stabilized? For example, what should be the ideal base level of tariff protection to the oilseeds and edible oils sectors?
- What are the alternative instruments available for price stabilization that are compatible with the agreement under the WTO?
- Can variable levies that vary within the bound tariff level provide adequate protection against world price fluctuations?[6]
- How should the variable levies be fixed? On edible oils as well as oilseeds?
- What are the costs to the government, benefits to producers and consumers?

It is important to know how different interests are served by price stabilization. How much do the producers of oilseeds gain? How much of the gain goes to the consumers? And how much to the edible oils industry? The level of protection given to oilseed growers would to some extent determine the level of protection from imports that the edible oils industry would require and vice versa. The target price around which prices are stabilized is an important choice variable. In general, a high target-price on

[6] As per the current status variable levies are permitted under the WTO only under the special safeguard clause (article 5). Article 5 allowed for the imposition of an additional customs duty, over and above the base tariff, when a "trigger" price or a "trigger" volume was reached for the product in question. The use of the special safeguards required two preconditions which were set out in the first part of subparagraph 1, i.e. "tariffication" (or the conversion into ordinary customs duties of non-tariff border measures) of the products to which the special safeguard was to apply; and the designation of the product in question with the symbol "SSG" in the Member's schedule. This latter condition is not met in the case of edible oils. Nevertheless future negotiations could make this possible.

import-competing agricultural goods could lead to high protection and distort efficient resource allocation process. Tariff protection to producers is required mainly in the case where imports are likely to reduce their share in a limited market. However, if consumer incomes are rising, leading to rapid growth in edible oil demand, then there is no reason for discouraging imports so long as equilibrium prices are high giving reasonable profits to crushing firms and farmers. The transition to a liberalized trade regime can be smoothened by gradually varying the target price over time starting from a level based on the cost of domestic production to a level consistent with the long term trend values of border prices.

A system of variable import tariffs can be a more cost effective mechanism to stabilize prices compared to buffer stocks. Encouraging private trade and storage by removing restrictions and encouraging forward/futures trading with appropriate regulatory mechanisms/institutions can bring in price stability and reduce the cost burden on government.

3. PRICE STABILIZATION MODEL

A model of the edible oils market is necessary to simulate the impact of various policy scenarios. This would involve the specification of domestic demand and supply equations for edible oils and import demand equations. The implications of stabilizing prices of major edible oils can be worked out for alternative methods of stabilization, e.g., variable import tariffs/subsidies and buffer stocks. The implications of stabilizing oil prices on oilseeds and vice versa can be worked out using the backward and forward linkages respectively.

Since India is a net importer of edible oils and since it tries to set domestic price above the world price a base level tariff is introduced for this purpose. The fluctuations in world prices would however be reflected in domestic prices. Under a price band policy domestic prices are allowed to vary with the fluctuations in world prices but in a controlled manner. Under this policy a set of ceiling and floor prices is specified and variable tariffs are imposed on top of the base level tariff in order to prevent prices from going outside the price band. This policy could also be implemented through buffer stocks and canalized imports by government agencies. Both these alternatives are analyzed in the simulation exercises below. The model used here is similar to that used in (Srinivasan and Jha, 2001).[7]

[7] There are options where government can attempt to stabilize prices without direct intervention by encouraging hedging activities through commodity futures/options markets. Hedging involves buying or selling of commodity futures/ options whose payoffs are linked to prices of commodities sold or bought in the future. It allows the sharing of risk with speculators who are willing to take on the price risks. (Faruqee and Coleman, 1996) provide an illustration of how price stability is can be achieved through such means.

3.1 SPECIFICATION OF THE MODEL

Market equilibrium prices of oilseeds, oil and meal are determined by equating demand to supply in the respective markets.

3.1.1 Market for oilseeds

Supply of oilseeds is given as the sum of domestic production less addition to stocks plus imports. Planned production is among other things a function of expected future price of oilseeds. Realized output is subject to random fluctuations caused by weather conditions. Imports are determined as the difference between demand and supply for a given realization of world price of oilseeds. World price is taken as given if the assumption of small economy is valid. If not, world price depends on the magnitude of India's imports. Demand for oilseeds is mainly from the processing industry (crushing demand) and a small fraction is used for direct consumption. Market equilibrium for oilseeds is obtained by price mechanism equating total demand to total supply.

Production + Net depletion of stocks + net imports = crushing demand (by the processing industry).

Processing industry is assumed to produce joint products, oil and meal in fixed proportions. Oil output is assumed to be aC where C denotes Crushing demand and 'a' the oil content of seeds by weight. Similarly meal output is taken to be bC where 'b' denotes meal content of seeds by weight.

Equilibrium price is obtained by equating total demand (crushing + other demand) to the total supply of seed (domestic production + net imports + net depletion in stocks). Domestic production is a function of expected future price and realized shock to yield.

Crushing demand is a function of crushing margins. Crushing margins depend on the prices of oil, meal and seed and the extraction rates of oil and meal from the seed.i.e. crushing margin, $cm = a\, p^{oil} + b\, p^{meal} - p^{seed}$ where a and b denote the technical extraction rates (amount of oil/meal by weight per unit weight of seed) of oil and meal respectively (Table 9). Oilseed crush demand is motivated by the size of the crush margin relative to the cost of crushing. Since processing of oilseeds is not modeled it is implicitly assumed that average costs are constant. This is obviously appropriate only for a short run analysis. Due to this specification of crush demand, C=C(cm) changes in crush demand in the model indicate movement along the demand curve and not shifts in the curve.[8]

Planned production of oilseeds is a function of expected future prices. In the model the expected seed price is obtained as five-year moving average. Realized production is obtained by adding the weather induced shock to planned production. Current seed price adjusts to bring about market equilibrium (commodity balance) in the seeds market in the absence of any intervention by the government. In the case of price intervention by the government in the form of say minimum support price (MSP) the

[8] Currently most of the processing plants in India are operating at a low capacity. With a reduction or elimination of tariff barriers on oilseeds there would be increased availability of oilseeds allowing processing plants to operate at a higher level. This would reduce unit costs and may lead to an outward shift in the crush demand schedule in the medium or long run. Thus, e.g. a reduction in the price of domestic oil due to decreases in oil tariffs need not reduce the prices for oilseed farmers if there is a compensating change in the crushing efficiency. For a given oil demand curve if the supply curve for shifts outward it increases the derived demand for oilseeds and hence their prices other things remaining constant.

equilibrium conditions constitute in addition to the commodity balance equation an inequality condition which specifies that oilseed price cannot exceed the MSP. This in fact, is a complementarity condition which states that, government stocks are zero if market equilibrium price of oilseed is strictly greater than MSP and also that if government stocks are positive then market equilibrium price is equal to MSP.

Table 9—Conversion ratios between raw material and processed products

	Oil to kernels/seeds crushed (%)	Cake to kernels/seeds crushed (%)
Groundnut	40	60
Sesamum	45	55
Rapeseed-Mustard	33	67
Linseed	43	57
Castor seed	42	58
Cottonseed	11	89
Copra	65	35
Niger seed	30	70
Soybeans	18	73

Source: The Solvent Extractor's Association of India, Annual Report-2002-03.
Note: Hull from Soybeans crushed forms 8% and wastage 1%.

In the case where oilseed imports are liberalized we have another inequality that is satisfied at equilibrium namely that domestic price is less than or equal to the import parity price. This is a complementarity condition which states that imports are zero if domestic price is strictly lower than import parity price and that if imports are positive in equilibrium then domestic price is equal to the import parity price. In this case supporting farmers' price at MSP may require the use of variable import tariffs in addition to the buffer stock policy. When import parity or trigger price is greater than domestic price,

imports are zero and no tariffs are required. However, if import trigger price were lower than MSP, positive import tariff would be required to support the price at MSP.

Equilibrium in the oilseed market is therefore characterized by the following set of equations.

3.1.2 Commodity balance equation

$$\text{Oilseed output } (Q^{oilseed}) + \text{opening stocks } (gs_{-1}) + \text{imports } (m^{oilseed}) = \text{crushing demand } (C) + \text{other demand} + \text{closing stocks } (gs)$$

Output is a function of price of oilseeds and crushing demand a function of crushing margins (cm).

$$Q^{oilseed} = Q(p^{oilseed}); \; C = C(cm) \text{ and } cm = cm(p^{oil}, p^{oilseed}, p^{meal})$$

Assuming that the crushing industry is competitive, cm is obtained from the arbitrage relationship concerning the three prices given as $cm = a\, p^{oil} + b\, p^{meal} - p^{oilseed}$.

3.1.3 Complementarity conditions

1) price of oilseed ($p^{oilseed}$) $\geq$ MSP for oilseed ($msp^{oilseed}$) ; government stocks ($gs^{oilseed}$) ≥ 0; and $gs^{oilseed}$ ($p^{oilseed} - msp^{oilseed}$) $= 0$

This determines the closing government stocks of oilseeds.

2) import trigger price of oilseed ($pm^{oilseed}$) $\geq$ price of oilseed ($p^{oilseed}$) ; imports ($m^{oilseed}$) ≥ 0; and $m^{oilseed}$ ($pm^{oilseed} - p^{oilseed}$) $= 0$

This determines the quantity of oilseed imports in the liberalized trade scenario

3) import trigger price of oilseed ($pm^{oilseed}$) $\geq$ MSP for oilseed ($msp^{oilseed}$) ; import tariff ($tm^{oilseed}$) ≥ 0; and $tm^{oilseed}$ ($pm^{oilseed} - msp^{oilseed}$) $= 0$

This determines the tariff level on imports required to keep equilibrium price from going below MSP in the liberalized trade scenario.

Price of seed at wholesale level is price at farm level plus wholesaler and marketing margins. In general, marketing margins account for the price difference between the wholesale market (major markets) and the farm gate (most important producing areas) and consist of transport costs, taxes, insurance, interest charges, bagging, packing and handling charges, grading, storage and bulk handling charges. In the case of commodities that require processing, processing charges are also included (e.g. crushing margins in the case of edible oils).

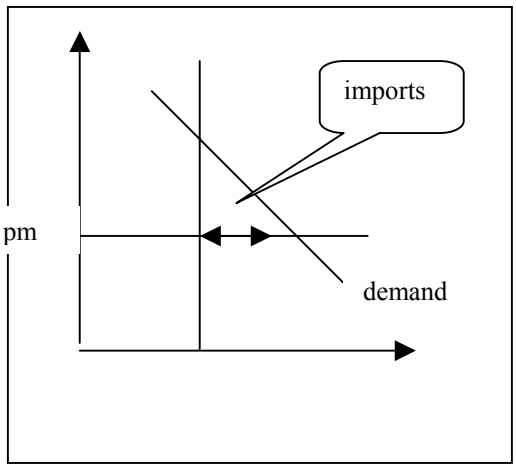
External trade margins are taken into account in deriving export/import trigger prices at domestic wholesale market level from world market prices (fob in the case of exports and cif in the case of imports). For exports we subtract trade margins from world market prices and for imports we add trade margins. External trade margins include foreign exchange brokerage, export/import registration fees, insurance costs, domestic freight, port charges, import/ export taxes, VAT and other domestic taxes.

If we make the "large country" assumption then import trigger price for oilseeds would be a function of the magnitude of imports: $pm^{oilseed} = pm^0 + \beta\, m^{oilseed}$. In the case of a "small economy" assumption $pm^{oilseed} = pm^0 = p^{world}$ (1 + import tariff – import subsidy + trade margins).

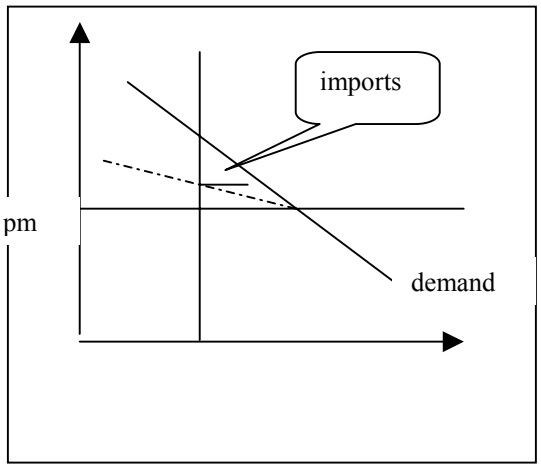
If the government wants to implement a price band stabilization policy, then in addition to a lower bound on price (MSP) it will fix an upper bound on price, pmax and attempts to maintain prices within this band. In this case we have another complementarity condition to maintain equilibrium price below pmax.

4) upper bound on oilseed price ($pmax^{oilseed}$) ≥ import trigger price of oilseed ($pm^{oilseed}$); import subsidy ($sm^{oilseed}$) ≥ 0; and $sm^{oilseed}$ ($pmax^{oilseed}$ - $pm^{oilseed}$) = 0

This condition gives the import subsidy required to keep equilibrium price below the ceiling level of the price band.



Oilseed market: small economy



Oilseed market: large economy

3.1.4 Market for oil

Equilibrium oil price is obtained by equating total demand for oil with total supply. Total supply of oil is the sum of domestically produced and imported oil. Domestic supply is a product of the technical extraction coefficient and the crushing demand for seed. Total demand consists of only the domestic demand and is a function of price and income obtained (oil is assumed to be a net importable commodity).

Equilibrium in the oil market is denoted by the equality of supply and demand as in the case of oilseeds.

$$aC + \text{net imports } (m^{oil}) + \text{net depletion of stocks } (sg_{-1} - sg^{oil}) = \text{demand for oil } (D^{oil})$$

Demand for oil is a function of own price and prices of substitute oils and income. Supply is a function of crushing margins. Unlike in the case of oilseed, production of oil is assumed to be instantaneous.

The complementarity conditions are similar to the case of oilseeds.

1) price of oil (p^{oil}) $\geq$ MSP for oil (msp^{oil}) ; government stocks (gs^{oil}) ≥ 0; and gs^{oil} ($p^{oil} - msp^{oil}$) = 0

2) import trigger price of oil (pm^{oil}) $\geq$ price of oil (p^{oil}) ; imports (m^{oil}) ≥ 0; and m^{oil} ($pm^{oil} - p^{oil}$) = 0

3) import trigger price of oil (pm^{oil}) $\geq$ MSP for oil (msp^{oil}) ; import tariff (tm^{oil}) ≥ 0; and tm^{oil} ($pm^{oil} - msp^{oil}$) = 0

4) upper bound on oil price ($pmax^{oil}$) $\geq$ import trigger price of oil (pm^{oil}); import subsidy (sm^{oil}) ≥ 0; and sm^{oi} ($pmax^{oil}$ - pm^{oil}) = 0

If we make the "large country" assumption then import trigger price would be a function of the magnitude of imports: $pm^{oil} = pm^0 + \beta\, m^{oil}$. In the case of a "small economy" assumption $pm^{oil} = pm^0 = p^{world}$ (1 + import tariff – import subsidy + trade margins).

3.1.5 Market for meal

Equilibrium meal price is obtained by equating total demand for meal with total supply. Demand for meals is the sum of domestic and export demands. Supply of meal is obtained as a product of the technical extraction coefficient and crushing demand for seed (meal is assumed to be a net exportable commodity).

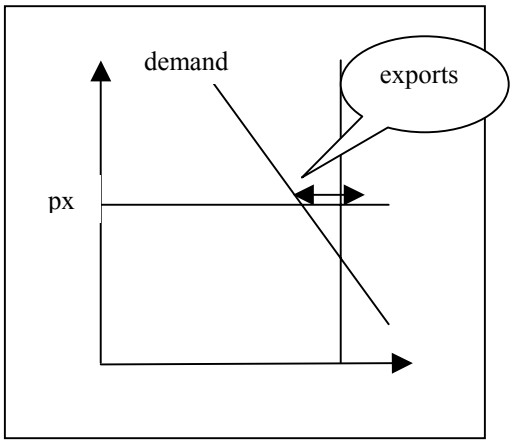
Equilibrium in the meal market is therefore given by the equality, supply of meal (bC) = domestic demand for meal + net exports.

The complementarity conditions in this case will be

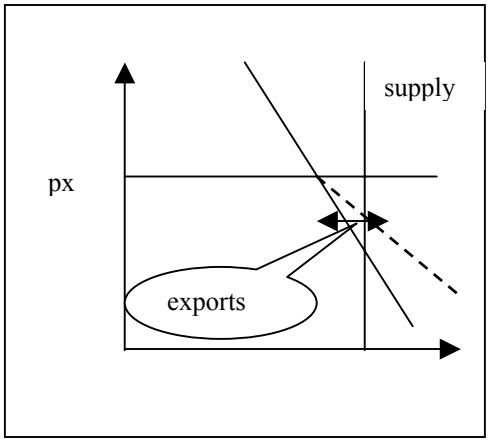
export trigger price of meal (px^{meal}) $\geq$ price of meal (p^{meal}) ; exports (x^{oil}) ≥ 0;
and x^{meal} ($px^{meal} - p^{meal}$) = 0

If we make the "large country" assumption then export trigger price would be a function of the magnitude of imports: $px^{oil} = px^{0} - \gamma\, x^{oil}$. In the case of a "small economy" assumption $px^{oil} = px^{0} = p^{world}$ (1 – tax/tariff rate - trade margins).

We assume that India is a net exporter of oil meals.



Meal market: small economy



Meal market: large economy

3.1.6 Government's objectives

The government's objective is to strike a balance between price stability achieved in oilseed/oil market and its budgetary costs while choosing the levels at which prices of oil and oilseeds are stabilized. India has been dealing with instability in food supplies and

prices by resorting to quantitative controls on trade in food grains and maintaining buffer stocks. With greater trade liberalization new instruments that affect international trade are becoming important for stabilization of food supplies and prices. For instance, the government can keep domestic prices under control by changing tariffs on imports or by altering export taxes on the affected commodities. Price bands (i.e. permitting the domestic price to fluctuate within pre-specified limits) can be a more efficient price stabilization instrument in "truncating" the extreme parts of world price distribution. Price bands have been in use in some Latin American countries. Use of large buffer stocks under public control to stabilize food supplies and prices has proven to be expensive, due to large storage losses, high administrative costs, and high opportunity cost of the tied capital (Knudsen and Nash, 1990). It is also known to displace private storage activities.

It is often argued that price bands implemented through variable levies dilute the scope for international markets to spread the risk of uncertainty in regional supply (or demand). They tend to export their instability to other markets, thereby exacerbating the volatility in unprotected markets. However, distinction needs to be made between the use of variables levies for outright protection (e.g. maintain domestic price far higher than what prevails in international markets) as opposed to that for controlling domestic price volatility caused by production instability. So long as the base tariff is fixed at a low level it need not be construed as a measure of protection. Moreover, so long as variable levies allow domestic price to vary in a reasonably wide price band rather than attempt to keep it at a constant level it is unlikely to destabilize prices of other countries. In fact, not

having a stabilization policy would amount to freely importing instability from other countries.

In the model we analyze the impact of price band policies on the welfare of consumers and producers. The price band is usually fixed relative to a reference or target price. There can be different alternative bases for the specification of a particular reference price.

- One option is to take the trend world price (adjusting for trade margins and applying zero tariffs) as the reference price. This based on the reasoning that efficiency of resource allocation can be achieved by linking domestic prices to world prices (that reflect the opportunity costs). The lower and upper bound of the price band is chosen to taking a certain percentage deviation from the target price.

- Alternatively the target price can be calibrated to achieve a certain desired level of self-sufficiency by choosing a suitable base level tariff.

- Or, the reference price can be fixed at a level such that a desired level of per capita consumption at the national level is achieved.

Policy discussions at times fail to distinguish between policies that aim to achieve price stability and those that are intended to protect farmers against cheaper imports. For example the minimum support price MSP is generally fixed at a level that tends to cover costs of production although in general discussions this is seen as an instrument for price stabilization. For an open economy environment, in particular, a clear distinction needs to be made between these two objectives.

3.1.7 Implementing the price band

Given the price band prices are maintained within this band by alternative means.

- *Buffer stocks and canalized trade*: In one of the alternatives when price (of say a particular oilseed) tends to fall below the floor level of the price band (MSP) the government or its agencies stand ready to purchase and stock any amount that is sold by farmers at MSP (subject of course to the storage capacity). Similarly, if price tends to go above the ceiling price despite the government depleting its entire stocks the government's agency imports enough quantity and sells it domestically to keep the price within the bound (this is the case when imports were not liberalized and canalized through state trading agencies).

- *Variable levies obtained as equilibrium values from the model:* Another alternative is to impose the required level of import tax to prevent domestic equilibrium price from going below the lower bound. Similarly, provide the required level of import subsidy when domestic equilibrium price tends to go above the upper bound. With the help of the model the precise levels of import tax/subsidy required to maintain prices within the specified price band is obtained as a part of the solution to the edible oils market equilibrium. Given the level of minimum support price for oilseed/oil, the model would determine the extent of import tariff required to support the price at that level. But how could one fix variable tariffs in practice? One way is to specify a simple policy rule.

- *Variable levies obtained through administrative rule:* Alternatively, an administrative rule can be specified as in (Storm, 1999) to arrive at the variable tariff/subsidy that can be imposed on imports in order to stabilize domestic prices. In this case the value of the variable tariff/subsidy depends on the deviation of the equilibrium price from the target or reference price and is given by the following functional relationship.

$$\tau_i = \left[\frac{p_i^*}{p_i}\right]^2 - 1, \left|p_i^* - p_i\right| > \alpha$$

i denotes any of the oils/oilseeds and 2α denotes the width of the price band. The quadratic function implies that variable levy is raised relatively more when market price p deviates more from the target price p*.[9]

A policy function makes it relatively simpler to administer the variable levy system. In the case where price band is specified one would have to solve the model for each of the different realizations of world oil/oilseeds price and domestic output of oilseeds. Alternatively, a policy function can be derived from the equilibrium values of tariffs, prices and quantities obtained from the price band stabilization simulations.

[9] This rule treats deviations from target price (positive and negative) symmetrically. We could have rules which treat the deviations asymmetrically, e.g.

$$\tau_i = \left[\frac{p_i^*}{p_i}\right]^2 - 1 \; if \; [(p_i^* - p_i) > 2\alpha \; or (p_i - p_i^*) > \alpha]; \quad \tau_i = 0 \; otherwise$$

Through regression a relationship between tariff rate, domestic oilseed output and world prices can be estimated, which can then be used as a tariff rule.

3.1.8 Welfare measures used

Producer surplus: Producer benefit is obtained as the difference in average post and pre intervention producer surplus. Producer surplus is defined as revenue (which is a product of realized output and realized price) less costs (which are given by the area under the supply curve). The supply curve gives planned output (q*) that corresponds to different values of expected future price (p^e).

If the inverse supply function is given as $p^e = \alpha + \beta q^*$ then the expression for producer surplus(PS) is given as $PS = pq - (\alpha q^* + \beta (q^*)^2 / 2)$, where p and q are realized price and output respectively.[10]

Consumer surplus: We compute consumer benefit as the difference between the post and pre intervention average consumer surplus. Consumer surplus for a commodity is measured as the area under the inverse demand curve less the actual expenditure incurred on its consumption.

Government Surplus: Benefit to government is taken to be the difference between the pre and post intervention costs incurred by it.

[10] Theoretically, in a situation with uncertain incomes the benefit from price stabilizing intervention can be classified into two different parts transfer benefits, and risk benefits. However we chose to ignore the risk benefits as it is usually a small fraction of the transfer benefits.

3.1.9 Description of different possible scenarios

1. *Pre liberalization scenario*: In both oilseed and edible markets there are restrictions on external trade. Imports of oils are canalized through state trading agencies and import of oilseeds prohibited. Stabilization of oilseed/oil prices involves addition to public buffer stocks to defend the floor price (MSP) and increase domestic supply through canalized imports to defend the ceiling price.

2. *Post liberalization scenarios involving stabilization of only price of oilseeds and not that of oils*: Stabilization is through variable tariffs/subsidies. Two alternatives are considered under this case. a) Variable levies computed as equilibrium outcomes and b) variable levies obtained from policy/administrative rule. In case (a) the width of the price band is varied to obtain different levels of price stability.

3. *Liberalized trade scenario where only oil prices are stabilized with two alternatives*: a) variable levies computed as equilibrium outcomes and b) variable levies obtained from policy/administrative rule. In case (a) the width of the price band is varied to obtain different levels of price stability.

4. *No price stabilization scenario*: Liberalized trade scenario where neither the price of oil nor that of oilseed is stabilized.

5. *Tariff protection on oil imports*: Liberalized trade scenario without price stabilization intervention and base-level tariff on oil imports to protect domestic processing sector.

6. *Tariff protection on oilseed imports*: Liberalized trade scenario without price stabilization intervention and base level tariff on import of oilseeds to protect domestic producers.

The last two scenarios are used to reflect the concerns of the government in protecting domestic farmers. Trade liberalization is expected to result in imports filling up domestic shortages driving down the prices of edible oils and oilseeds. Price support to farmers through import tariffs help in the short run adjustment process.

In the liberalized trade scenarios where prices are stabilized through variable levies, we should in general allow for situations where in some years oilseed prices can be very low due to bumper crop output. In such situations defending a floor price would involve either the use of buffer stocks or subsidies on exports. Since India is currently deficient in the production of oilseeds we rule out this possibility in our scenarios as this event is likely to be rare.

4. RESULTS FROM MODEL SIMULATIONS

4.1 DOES PRICE PROTECTION TO DOMESTIC PROCESSING SECTOR LEAD TO PROTECTION OF OILSEED GROWERS?

The last two set of scenarios described above help us answer this question. How does a tariff on import of oils affect the price of oilseeds and the crushing margins of the processing sector? The simulations results show the following.

- As the tariff protection on oil imports is lowered, there is not only a decrease in domestic prices but also a reduction in price variability. This means that while greater protection to the domestic processing sector implies increased domestic prices (Table 10) it also makes them more unstable. The correlation between domestic output fluctuations and international prices is such that freeing up of imports would stabilize domestic prices even though world prices are more variable than domestic prices.[11] Imposing a tariff barrier prevents this from happening. A system of variable levies can however help in the stabilization of domestic prices. Distinction needs to be made therefore between a base level tariff meant to protect domestic producers and a system of variable levies by which additional tariff is imposed to stabilize prices based on the international prices and domestic supply situation. Total tariff would then be the sum of base tariff and variable tariff which in the case of price band stabilization could be referred to as *price band* tariff.

[11] The correlation coefficient between domestic oilseed output and international price of oils is found to be positive in most of the oils. For example, the estimates of correlation coefficients are 0.88, 0.83, 0.29 respectively for soybeans, rapeseed-mustard and groundnuts.

- Tariff protection from oil imports does not affect oilseed prices much (neither the mean price nor its coefficient of variation)

- Tariff protection on oil imports affects consumers adversely since the prices rise on an average. A 45% tariff on oil for example, leads to a 13% rise in domestic market equilibrium price and consumption decreases by 4%. Variability increases in both consumption and prices (Table 11).

- Processing sector benefits however. Crushing margins rise on an average. Average revenue goes up and the variability in revenue is also decreased.

- Benefits to oilseed producers are comparatively much less. The increase in average producer revenue is only 3% as compared to the 13% rise in the revenue to processors. Other things remaining constant an increase in oil tariffs e.g. would directly increase the crush margins and hence the surplus for processors. This would increase the crush demand and thereby increase the price of oilseeds indirectly benefiting the farmers. Since it is a second round effect the latter benefits are lower.

While tariff protection on oils reduces oil imports as expected, it leads to an increase in the imports of oilseeds (assuming there is no tariff protection for oilseed imports). Least reduction is found in Palm oil imports (16%) compared to 84% reduction for Rapeseed/mustard oil and 67% for Soybean oil (Table 12).

Table 10—Impact on prices due to tariff barriers on edible oil imports

	Base level tariffs on edible oil imports			
	0%	**15%**	**30%**	**45%**
Mean oilseed price (Rupees/quintal)				
Groundnut	978.899	986.147	988.059	971.87
Soybean	864.108	881.505	893.851	903.027
Rapeseed	815.225	838.666	828.656	825.357
Other	943.18	948.076	974.062	972.286
CV of oilseed price				
Groundnut	0.287	0.286	0.291	0.294
Soybean	0.18	0.186	0.197	0.204
Rapeseed	0.234	0.236	0.239	0.237
Other	0.28	0.29	0.289	0.291
Mean oil prices (Rupees/quintal)				
Groundnut	3105.188	3141.277	3161.157	3134.155
Soybean	1917.453	2034.627	2112.74	2170.746
Rapeseed	2490.547	2618.283	2663.269	2693.599
Palm	2620.251	2987.824	3313.401	3669.43
Other	2597.42	2701.127	2831.415	2874.16
CV of oil prices				
Groundnut	0.154	0.157	0.164	0.165
Soybean	0.373	0.385	0.4	0.413
Rapeseed	0.11	0.117	0.125	0.133
Palm	0.175	0.179	0.18	0.177
Other	0.175	0.19	0.2	0.207

Source: Model simulations.
Note: Tariff on oilseed imports is fixed at zero.

Table 11—Impact on consumers, producers and processors due to tariff barriers on edible oil imports

	Base level tariffs on edible oil imports			
	0%	**15%**	**30%**	**45%**
Mean price of all oils	2568.317	2707.541	2822.498	2900.17
CV of price of all oils	0.085	0.089	0.094	0.095
Mean cons of all oils	9.958	9.778	9.632	9.524
CV of cons of all oils	0.028	0.032	0.036	0.037
Mean prod rev	18730.29	18936.15	19388.57	19335.65
CV of prod rev	0.152	0.158	0.156	0.157
Mean value of crushing margins				
Groundnut	725.941	733.635	739.953	744.963
Soybean	66.322	69.547	70.95	71.983
Rapeseed	556.592	580.797	607.587	622.199
Other	339.493	369.391	387.804	403.802
CV of crushing margins				
Groundnut	0.126	0.11	0.099	0.096
Soybean	0.513	0.442	0.431	0.404
Rapeseed	0.188	0.167	0.137	0.107
Other	0.367	0.316	0.277	0.234
Mean processor rev	9320.693	9929.694	10417.63	10755.55
Cv of processor rev	0.2	0.179	0.158	0.134
Consumer surplus	173420.9	168187.2	164017.5	161451.2
Producer surplus	9181.403	9186.453	9498.635	9460.337

Source: Model Simulations.
Note: Prices are measured in Rupees per quintal and surplus measure in Rupees Crores.

Table 12—Impact on imports due to tariff barrier on edible oil imports

	Base level tariffs on edible oil imports			
	0%	**15%**	**30%**	**45%**
Mean oil imports				
Groundnut	0.029	0.013	0.002	0
Soybean	0.188	0.123	0.088	0.062
Rapeseed	0.218	0.138	0.072	0.034
Palm	1.408	1.329	1.259	1.183
Other	0.56	0.395	0.272	0.187
CV of oil imports				
Groundnut	2.101	2.501	2.521	0
Soybean	1.222	1.609	1.962	2.292
Rapeseed	0.8	1.092	1.616	2.051
Palm	0.07	0.086	0.101	0.117
Other	0.83	1.068	1.412	1.698
Mean seed imports				
Groundnut	1.362	1.364	1.364	1.41
Soybean	2.022	2.25	2.23	2.268
Rapeseed	1.915	2.132	2.169	2.241
Other	2.143	2.494	2.687	2.895
CV of seed imports				
Groundnut	0.478	0.471	0.468	0.458
Soybean	1.055	0.887	0.915	0.846
Rapeseed	0.625	0.547	0.54	0.506
Other	0.79	0.66	0.568	0.486

Source: Model Simulations.
Note: Quantities are measured in million tones.

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4.2 HOW DOES PROTECTION OF OILSEED GROWERS FROM IMPORTS AFFECT CONSUMERS AND THE PROCESSING SECTOR?

- Prices of both oilseeds and oils rise as the protection to oilseed growers is increased. Price variability of soybean and soybean oil reduces while for others there is not much change (Table 13). Variability in the price of all oils taken together goes down. This result is in contrast to what was observed in the case of edible oils where tariff protection led to an increase in price volatility. This again can be explained by the nature of the correlation between international prices of oilseeds and domestic oilseed output.
- In terms of benefits to different agents we find that while oilseed producers tend to gain from tariff protection, consumers of edible oil and processors tend to lose out.
- Consumption of oils goes down though marginally.
- Although the prices of oils rise with the rise in oilseed prices, the net effect on crushing margins is negative. Percentage reduction in crushing margin is the maximum in the case of Soybean (Table 14).
- As expected greater protection leads to lower imports. Tariff protection for oilseeds leads to an increase in oil imports (when the latter does not face any tariff barriers) (Table 15). Vice versa also holds as seen earlier.

Table 13—Impact on prices due to tariff barrier on oilseed imports

	Base level tariff			
	0%	**15%**	**30%**	**45%**
Mean seed prices				
Groundnut	978.899	1116.967	1211.281	1261.444
Soybean	864.108	919.823	952.915	977.5
Rapeseed	815.225	932.303	987.624	1048.281
Other	943.18	1022.288	1096.498	1134.17
CV of seed prices				
Groundnut	0.287	0.282	0.288	0.303
Soybean	0.18	0.128	0.091	0.077
Rapeseed	0.234	0.221	0.221	0.237
Other	0.28	0.264	0.236	0.207
Mean oil prices				
Groundnut	3105.188	3332.72	3488.247	3568.963
Soybean	1917.453	2179.388	2327.031	2429.443
Rapeseed	2490.547	2648.257	2704.708	2774.831
Palm	2620.251	2639.825	2622.577	2629.9
Other	2597.42	2727.757	2831.591	2893.197
CV of oil prices				
Groundnut	0.154	0.16	0.166	0.177
Soybean	0.373	0.248	0.176	0.159
Rapeseed	0.11	0.108	0.111	0.112
Palm	0.175	0.176	0.175	0.17
Other	0.175	0.165	0.151	0.145

Source: Model Simulations.
Note: Prices are measured in Rupees per quintal. Tariff on oil is fixed at zero.

Table 14—Impact on consumers, producers and processors due to tariff barrier on Oilseed imports

	Base level tariff			
	0%	**15%**	**30%**	**45%**
Mean price of all oils	2568.317	2723.091	2813.287	2877.572
CV of price of all oils	0.085	0.077	0.073	0.072
Mean cons of all oils	9.958	9.766	9.657	9.577
Cv of cons of all oils	0.028	0.026	0.025	0.025
Mean value of crushing margins				
Groundnut	725.941	682.072	652.146	636.653
Soybean	66.322	56.707	49.601	43.04
Rapeseed	556.592	498.344	469.963	443.013
Other	339.493	311.262	280.701	264.167
CV of crushing margins				
Groundnut	0.126	0.157	0.188	0.212
Soybean	0.513	0.533	0.465	0.483
Rapeseed	0.188	0.234	0.241	0.277
Other	0.367	0.403	0.416	0.385
Mean prod rev	18730.29	21196.57	23200.67	24419.02
CV of prod rev	0.152	0.135	0.117	0.105
Mean processor rev	9320.693	8167.038	7334.431	6798.269
CV of processor rev	0.2	0.227	0.228	0.23
Consumer surplus	173420.9	167235.3	163683.7	161230.2
Producer surplus	9181.403	10255.97	11286.92	11831.16

Source: Model Simulations.

Table 15—Impact on imports due to tariff barrier on oilseed imports

	Base level tariff			
	0%	**15%**	**30%**	**45%**
Mean oilseed imports				
Groundnut	1.362	0.987	0.72	0.591
Soybean	2.022	1.334	0.722	0.242
Rapeseed	1.915	1.495	1.092	0.807
Other	2.143	1.594	1.062	0.773
CV of oilseed imports				
Groundnut	0.478	0.685	0.898	1.049
Soybean	1.055	1.33	1.7	2.911
Rapeseed	0.625	0.763	0.976	1.175
Other	0.79	1.025	1.34	1.526
Mean oil imports				
Groundnut	0.029	0.044	0.055	0.06
Soybean	0.188	0.224	0.262	0.307
Rapeseed	0.218	0.3	0.345	0.384
Palm	1.408	1.403	1.407	1.405
Other	0.56	0.642	0.743	0.796
CV of oil imports				
Groundnut	2.101	1.76	1.655	1.677
Soybean	1.222	1.112	0.806	0.725
Rapeseed	0.8	0.657	0.552	0.538
Palm	0.07	0.071	0.07	0.068
Other	0.83	0.735	0.603	0.505

Source: Model Simulations.
Note: Quantities are measured in million tonnes. Tariff on oil is fixed at zero.

4.3 WHAT ARE THE WELFARE IMPLICATIONS OF ALTERNATIVE PRICE STABILIZATION MECHANISMS?

We consider three different mechanisms for stabilizing edible oil/oilseed prices. In scenario I market prices are prevented from going above the ceiling level of the price band through canalized imports by the government. In scenario II we assume that private agents are allowed to freely import edible oils subject to import tariffs. Here variable levies are imposed on imports in order to keep prices within a specified band. In scenario III variable levies are fixed following an administrative rule that depends on the deviation of market price from a trend/reference level. The last scenario (scenario IV) is one where there is no price stabilization intervention.

First we consider the case where only edible oil prices are stabilized and then the case where only oilseed prices are stabilized. We note the following from our simulation results.

- Variability in oilseed prices and in crushing margins is not affected much by oil price stabilization under any of the mechanisms considered (Table 16). However, oilseed price stabilization leads to greater stability in oil prices and crushing margins (Table 17).

- Price variability appears to be the least in the canalized trade scenario (scenario I) with the exception of groundnut and soybean oil.

- With respect to welfare impact of oilseed price stabilization on different agents we find that producer surplus increases with price stabilization and it is the maximum under the canalized trade scenario. Consumer surplus decreases and is

the least in the canalized trade case. Revenue accruing to the processing sector is also the least in this case.

- In the case of oil price stabilization also producer surplus is the greatest and consumer surplus the least when canalized trade is used for stabilization purpose. However, in the variable levies case (scenarios II and III) it is the opposite result, producer surplus decreases consumer surplus increases though the magnitudes of increase/decrease are quite low (Tables 18 and 19).

The next set of simulations deal with varying the degrees of oil price stabilization by choosing a price band of varying width and using the mechanism of variable levies (import tax/subsidy) for price stabilization. In one set of simulations we assume a base level tariff of 30% to provide a certain degree of protection to domestic producers/processors. In the other set we assume no protection (base level tariff is set to zero).

- Decrease in the width of the price band for oil leads to decrease in mean prices as well as decrease in their variability (Tables 20).

- The narrower the price band the higher the magnitude of variable levies needed for price stabilization. The maximum value taken by the variable levies are much below the bound rate fixed under the WTO agreement. (Table 21).

- The magnitudes of the import tax and import subsidies are such that on an average the cost burden on government is quite small in maintaining the price band policy (Table 22).

- Gain to consumers increases with greater price stability, but the loss producers and processors also rises.

Table 16—Price variability under different mechanisms for oil price stabilization (No oilseed price stabilization)

	Scenarios			
	I	**II**	**III**	**IV**
CV of seed prices				
Groundnut	0.287	0.287	0.291	0.29
Soybean	0.133	0.109	0.104	0.122
Rapeseed	0.218	0.221	0.209	0.212
Other	0.235	0.236	0.229	0.263
CV of oil prices				
Groundnut	0.177	0.174	0.18	0.173
Soybean	0.231	0.192	0.176	0.222
Rapeseed	0.109	0.106	0.078	0.112
Palm	0.001	0.119	0.065	0.175
Other	0.133	0.13	0.113	0.188
CV of crushing margins				
Groundnut	0.129	0.138	0.132	0.148
Soybean	0.428	0.47	0.456	0.445
Rapeseed	0.2	0.239	0.247	0.204
Other	0.365	0.395	0.424	0.364

Source: Model Simulations.

Note:
The scenarios are defined as follows.

I. Price band policy where price ceiling is defended through canalized imports but no stocking policy to support the floor price.
II. Price band policy where both floor and ceiling prices are defended through tax/subsidy on imports.
III. Price band defended through administrative tariff rule.
IV. No price stabilization (reference scenario)

Price band is defined as a 15 percent deviation from target price. In the simulations target price is taken to be the border price corresponding to the base year.
Base level tariff on oils/oilseeds is fixed at 30%.

Table 17—Price variability under different mechanisms for oilseed price stabilization (No oil price stabilization)

	Scenarios			
	I	**II**	**III**	**IV**
CV of oilseed prices				
Groundnut	0.108	0.125	0.101	0.29
Soybean	0.079	0.094	0.093	0.122
Rapeseed	0.104	0.13	0.075	0.212
Other	0.104	0.128	0.109	0.263
CV of oil prices				
Groundnut	0.066	0.075	0.061	0.173
Soybean	0.154	0.173	0.172	0.222
Rapeseed	0.079	0.08	0.061	0.112
Palm	0.18	0.181	0.18	0.175
Other	0.123	0.115	0.106	0.188
CV of crushing margins				
Groundnut	0.068	0.067	0.052	0.148
Soybean	0.342	0.407	0.431	0.445
Rapeseed	0.139	0.131	0.096	0.204
Other	0.219	0.258	0.249	0.364

Source: Model Simulations.
Note:
The scenarios are defined as follows.

V. Price band policy where price ceiling is defended through canalized imports but no stocking policy to support the floor price.
VI. Price band policy where both floor and ceiling prices are defended through tax/subsidy on imports.
VII. Price band defended through administrative tariff rule.
VIII. No price stabilization (reference scenario)

Price band is defined as a 15 percent deviation from target price. In the simulations target price is taken to be the border price corresponding to the base year.
Base level tariff on oils/oilseeds is fixed at 30%.

Table 18—Welfare impacts under different mechanisms for oil price stabilization (No oilseed price stabilization)

	Scenarios			
	I	II	III	IV
Mean producer revenue	24953.03	24218.95	24333.13	24573.8
Mean processor revenue	8775.741	8300.212	8318.374	8388.282
Total consumer surplus	148848.5	153795.4	154240	151982
Total producer surplus	12190.65	11701.15	11867.05	11978.42
Government surplus	302.8	-0.094	-0.109	0

Source: Model simulations
Note: Surplus measures are in Rupees Crores.

Table 19—Welfare impacts under different mechanisms for oilseed price stabilization (No oil price stabilization)

	Scenarios			
	I	II	III	IV
Mean producer revenue	28023.05	25386.26	25694.54	24573.8
Mean processor revenue	7031.623	8123.315	8061.181	8388.282
Consumer surplus	144511.7	148984.6	148820.6	151982
Producer surplus	13709.94	12342.41	12604.5	11978.42
Government surplus	272.6	0.302	0.305	0

Source: Model simulations.
Note: Surplus measures are in Rupees Crores.

Table 20—Price variability under different degrees of oil price stabilization

	Bandwidth of the price band			
	0%	**10%**	**15%**	**30%**
	Mean seed prices			
Groundnut	1220.444	1227.393	1226.334	1206.961
Soybean	993.183	999.693	994.345	1001.249
Rapeseed	1011.319	1042.502	1020.96	1022.710
Other	1088.818	1108.123	1138.774	1160.893
	CV of seed prices			
Groundnut	0.287	0.287	0.291	0.29
Soybean	0.098	0.104	0.108	0.122
Rapeseed	0.203	0.219	0.215	0.212
Other	0.201	0.226	0.235	0.258
	Mean oil prices			
Groundnut	3583.347	3595.904	3585.810	3539.617
Soybean	2586.727	2611.948	2591.590	2630.963
Rapeseed	2897.471	2979.760	2952.188	2974.196
Palm	3101.436	3185.794	3178.967	3305.479
Other	2867.408	2973.729	3046.436	3126.182
all oils	2992.204	3062.453	3073.910	3120.877
	CV of oil prices			
Groundnut	0.177	0.177	0.177	0.173
Soybean	0.162	0.178	0.189	0.221
Rapeseed	0.052	0.088	0.104	0.112
Palm	0.000	0.083	0.119	0.169
Other	0.071	0.111	0.129	0.172
all oils	0.049	0.06	0.067	0.079

Source: Model simulations.

Note: This table relates to oil price stabilization scenarios with base level tariff fixed at 30% for both oils and oilseeds. Prices are measured in Rupees per quintal.

Table 21—Tariff variability under different degrees of oil price stabilization

	Bandwidth of the price band			
	0%	**10%**	**15%**	**30%**
Mean import tax on oils				
Groundnut	0.625	0.083	0.05	0
Soybean	0.155	0.045	0.024	0
Rapeseed	0.227	0.018	0	0
Palm	0.116	0.031	0.01	0
Other	0.187	0.026	0.016	0
Mean import subsidy on oils				
Groundnut	0.567	0.035	0.023	0
Soybean	0.133	0.057	0.037	0
Rapeseed	0.247	0.035	0.012	0
Palm	0.147	0.058	0.041	0.005
Other	0.297	0.093	0.064	0.014
CV of import tax on oils				
Groundnut	0.193	1.412	1.53	0
Soybean	0.702	1.368	1.603	0
Rapeseed	0.428	1.868	0	0
Palm	0.853	1.51	1.492	0
Other	0.657	2.904	2.983	0
CV of import subsidy on oils				
Groundnut	0.215	1.488	1.471	0
Soybean	0.819	1.35	1.474	4.082
Rapeseed	0.394	2.096	3.166	0
Palm	0.674	1.451	1.535	1.561
Other	0.423	1.211	1.382	2.802
Max import tax on oils				
Groundnut	0.791	0.25	0.179	0
Soybean	0.287	0.154	0.09	0
Rapeseed	0.341	0.081	0	0
Palm	0.252	0.101	0.032	0
Other	0.448	0.25	0.161	0
Max import subsidy on oils				
Groundnut	0.694	0.113	0	0
Soybean	0.288	0.195	0.151	0.012
Rapeseed	0.461	0.276	0.169	0
Palm	0.264	0.18	0.139	0.016
Other	0.498	0.411	0.357	0.154

Source: Model simulations.

Note: This table relates to oil price stabilization scenarios with base level tariff fixed at 30% for both oils and oilseeds. Tax/subsidy rates are expressed as a fraction of border price.

Table 22—Welfare impacts under different degrees of oil price stabilization

	Bandwidth of the price band			
	0%	**10%**	**15%**	**30%**
Mean cons of all oils	9.412	9.331	9.322	9.262
Cv of cons of all oils	0.019	0.023	0.026	0.032
Mean prod rev	23868.85	24102.84	24371.85	24526.95
Cv of prod rev	0.118	0.123	0.122	0.125
Mean processor rev	8221.6	8289.068	8301.765	8359.36
Cv of processor rev	0.239	0.229	0.217	0.206
Consumer surplus	156911.9	154340.1	153937.7	152428.8
Producer surplus	11664.73	11645.55	11885.94	11955.71
Government surplus	-0.229	-0.119	-0.091	-0.017

Source: Model simulations.
Note: This table relates to oil price stabilization scenarios with base level tariff fixed at 30% for both oils and oilseeds. Quantities are in million tonnes and surplus measures in Rupees crores.

The above results from simulation analysis allow a clear ranking of alternative price stabilization policies.

The results in table 23 reveal that price stabilization in oilseeds reduces total domestic welfare. In the case of oils government stock intervention (scenario I) reduces total domestic welfare, but scenarios II and III provide an increase in welfare. Thus, only two out of the six alternatives (three scenarios each for stabilizing oilseed and oil prices respectively) dominate the "no-price stabilization" scenario.

Table 24 shows that producers lose and consumers gain in scenarios II and III for oils, whereas the opposite holds in scenarios II and III for oilseeds. In the case of stabilizing oilseed prices there is a welfare transfer from consumers to producers in all the three scenarios. In the case of oils only in scenario I (government's stock policies) there

is welfare transfer from consumers to producers whereas the opposite is the case in scenarios II and III.

Table 23—Welfare ranking of alternative policies

Scenario	Price stabilization of Oils		Price stabilization of Oilseeds	
	Total surplus	% Change from No-stabilization case	Total surplus	% Change from No-stabilization case
I: Government stocks and canalized trade	1698	-1.5	1655	-4.0
II: Variable levies (endogenously determined)	1738	+0.8	1694	-1.7
III: Variable levies (rule based)	1744	+1.2	1695	-1.7
IV: No price stabilization	1724		1724	

Note: Total surplus is the sum of the surpluses of processors; producers, consumers and government (see Tables 18 and 19 for more details).

Table 24—Changes in consumer and producer surplus from the 'no-price stabilization' case

	% change in consumer surplus		% change in producer surplus	
	Oils	Oilseeds	Oils	Oilseeds
Government stocks and canalized trade	-2.1	-4.9	+1.8	+14.5
Variable levies (endogenously determined)	+1.2	-2.0	-2.3	+3.0
Variable levies (rule based)	+1.5	-2.1	-0.9	+5.2

Table 25—Maximum import tax on oils required for price band policy

	Maximum tax (%)	Current bound rate	Bound rate under reduction formulas post 2004			
			Sliding scale	Linear harmonization	Swiss	Harmonization low ceiling
Groundnut	25	300	50	45	37.6	25.0
Soybean	15.4	45	17.11	16.7	19.4	22.5
Rapeseed	8.1	75	28.5	25.8	25.1	25.0
Palm	10.1	300	50	45	37.6	25.0

Source: Maximum rates for stabilization (author's computations).Other rates Chand, 2003).
Note: Price band allows for a 15% deviation of domestic oil price from trend target price.

5. CONCLUDING REMARKS

India's share in world oilseed production is fairly large. The growth in oilseed output has been remarkable in the last decade. Until recently the government of India had discouraged imports of oilseeds as an incentive to domestic producers. This hurt the domestic processing industry which has excess crushing capacity. However the government had also been controlling the imports of edible oils that helped processors at the cost of consumers. With the recent liberalization of trade in edible oils and oilseeds and the rapid growth in domestic demand import of vegetable oils is likely to increase in the coming years. Highly volatile international prices and unstable domestic yields for oilseeds make it important for the government to devise ways to manage domestic price volatility.

This study examines alternative price stabilization policies for edible oils and oilseeds in India. The impact of price stabilization on different agents, the farmers growing oilseeds the consumers of edible oil and the processing sector is examined with the help of a multi market equilibrium stochastic dynamic model. Different alternative mechanisms of price stabilization are compared for their effectiveness in talking price variability and the impact on consumers, producers and processors.

The following are some of the main results obtained from the stochastic simulation exercises.

Higher import tariffs on edible oils lead to not only higher but more variable domestic prices. This however does not rule out the usefulness of variable levies in stabilizing oil prices even if the base level tariff on edible oil imports are fixed at a

minimal or zero level. We need to make a distinction between base level tariff meant to protect domestic producers and a system of variable levies by which additional tariff is imposed to stabilize prices based on the international prices and domestic supply situation.

Tariff protection on oils mainly benefits the processing sector and the benefits to oilseed growers are relatively smaller. Greater tariffs on oil imports lead to lower oil imports, oilseed imports are found to increase.

Tariff protection to growers by increasing tariffs on oilseed imports helps the producers of oilseeds, but at the cost of consumers and the processing sector. Prices of both oilseed and oils increase. However, in contrast to what was observed in the case of tariff on oils we see in the case of oilseeds that price volatility is reduced due tariff protection.

The distribution of benefits to different agents varies with the different alternative mechanisms used for price stabilization. Price stabilization appears to be most effective with the use of canalized trade. Producers of oilseeds benefit the most under this option while consumers and processors benefit the least. The opposite is the case under the alternative of variable levies. The magnitude of import tax and subsidies are such that on an average the cost burden on government due to variable levies is quite low.

The results clearly show that although freeing of imports of edible oils could increase the vulnerability of domestic consumers and producers to fluctuations in world prices erecting fixing tariff barriers may not be of help. A system of variable tariffs is what would be needed. It is also seen that tariff protection helps mainly domestic processing sector (crushing and refining units) rather than oilseed growers.

One can affect the degree of oil price stabilization by varying the width of the price band. Narrow price band implies greater price stability, higher benefits to consumers and lower benefits to producers and processors.

As the bound rates of tariffs under WTO are fixed quite high for all edible oils with the exception of soy oil, there is enough room to adjust import duties for price stabilization purposes. Based on the past trends in fluctuations in domestic production and international prices we find in our simulations that the maximum import tariff required to stabilize prices within a reasonable price band is quite low (see Table 25).

The maximum rate required for any of the oils does not exceed 25%. The current bound rates thus give sufficient room for operating variable levies for price stabilization in addition to a base rate tariff that is used to protect domestic producers. In the case of groundnut oil and palm oil the bound rates are large enough to permit a base tariff exceeding even 200%. The cheaper soy oil with a low bound rate (45%) would however put a downward pressure on domestic price of other oils due to substitution possibilities in consumption. Since the maximum tariff required for operating a policy of variable levies is 15%, the base tariff in the case of Soy oil e.g. cannot exceed 30% under current bound rate. Further reductions in bound tariffs sought in future negotiations on market access, based on certain formulas, indicate that if any of these formulas is to be agreed upon then India has not much scope for protecting its edible oil sector, though it would still have sufficient room for varying tariff for price stabilization purpose. In such a situation, if there are extreme fluctuations in world prices or sudden import surges, then India might have to fall back upon the special safeguard provisions under the WTO.

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Box 1—NDDB and Edible Oils

Encouraged by the success of the co-operative movement under the aegis of the National Dairy Development Board (NDDB) the government has brought other primary commodities like edible oil, fruit and vegetables under the ambit of NDDB.

NDDB initiated the 'Restructuring Edible Oil and Oilseeds Production and Marketing' Project in 1979 to increase farmer investment in oilseeds sector through farmer-owned co-operatives. More than 9 lakh farmers have joined nearly 5,500 oilseeds growers' co-operative societies affiliated to 18 unions in Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan and Tamil Nadu. Capacities have been created to crush 3,735 tonnes per day (TPD) oilseeds; solvent-extract 2,180 TPD oil cake; and to refine 778 TPD of edible oil. Storage has been built to handle 1.9 lakh mt. oilseeds and 2.96 lakh mt. oil.

The traditional mono-cropping of oilseeds entails risks for both the producer and the co-operative. To reduce these uncertainties, the project has promoted a multi-oilseeds cropping system supported by introduction of non-traditional oilseeds crops.

The NDDB was appointed the Market Intervention Agency for oilseeds and edible oil by the Government of India in 1989 and was charged with the responsibility of ensuring remunerative prices to farmers, reasonable prices to consumers and attaining self-sufficiency.

In order to establish a direct link between producers and consumers of oil and thereby reduce the role of oil traders and oil exchanges, NDDB decided to enter the consumer pack market for edible oil through its *Dhara* refined rapeseed oil and groundnut oil. With its tamper-proof packing and high quality it has been successful in slowly weaning away the consumer from buying oil in bulk. It is teaching them not to store because the consumer is assured of good quality oil at reasonable prices round the year.

Source: http://www.irma.ac.in/about/nddb.html.

APPENDIX—Oilseed/Edible Oil Price Stabilization Model

This appendix describes the multi commodity stochastic simulation model to analyze different price stabilization mechanisms for the oilseed sector. The model deals simultaneously with markets for oilseeds/oils/meals. Production shocks are generated using random number generator. Shocks to world price of oil/oilseed are also generated in a similar fashion. Equilibrium values of price, output, stocks etc, corresponding to any randomly realized state of the world are then computed with the help multi commodity equilibrium model formulated as a Mixed Complementarity Problem (MCP). A large number of simulations are carried out and the average of values obtained in these simulations is computed for different variables such as prices, consumption, production, producer revenue and measures of consumer, producer and government surplus. The impacts of alternative price stabilization policies, price band/ support price policies on price stability and welfare are then obtained.

It has been observed widely in the literature that scope for private inter year storage is limited, especially in the presence of public intervention for price stabilization purposes. We therefore do not model private storage in this study as we deal with inter year price stabilization.

For each type of oil considered market clearance is achieved for all the three products oilseeds, oil and meal simultaneously. Five oils are considered for the empirical implementation of the model: groundnut, soybean, rapeseed/mustard, palmolein and other. Basis for the choice of oils: groundnut, soybean and rapeseed/mustard together account for over 80% of oilseeds grown in the country and around 70% of the total edible oil consumed. Palm oil forms around 70% of edible oil imports by India. All edible oils

and all oilseeds (with the exception of groundnuts) can be considered to be importable and oil meals exportable. The model structure takes into account the possibility of world prices being influenced by the quantity of India's imports (the large country assumption).

Base year data used in the model is given are the table below. Quantities are in million tonnes and prices in Rupees per quintal

Percentage deviations from trend values of domestic production of oilseeds and the frequency of occurrence of these deviations are obtained from past data. The tables below provide the discrete probability distributions for the shocks to domestic output of oilseeds and trend world prices of oils/oilseeds.

Table A1—Base year (1997-99) data

	Groundnut	Soybean	Rapeseed	Palm	others
oil imports	0.1	0.347	0.145	1.312	0.285
Meal exports	0.319	2.960	0.313		0.416
border price of oilseed	856	840	750		856
border price of oil	3605	2158	2161	2209	2161
border price of meal	800	786	800		800
trade margins for oil	1.074	1.08	1.082	1.08	1.074
trade margins for meals	0.926	0.92	0.918		0.926
trade margins for seeds	1.12	1.08	1.08		1.12
domestic seed price	1537.8	917	1435		1537.8
domestic oil price	4239.4	2367	3918.6	3067	4239.4
domestic meal price	660	660	660		660
Domestic demand for seed	3.582	4.989	4.686		7
Domestic demand for oil	1.483	1.225	1.893	1.312	2.756
Domestic demand for meal	1.708	1.131	2.513		3
domestic supply of seed	5.208	6.668	5.712	0	7.29
domestic supply of oil	1.483	0.878	1.748	0	2.471
domestic supply of meal	2.027	4.091	2.826	0	3.416

Note:

All quantities are in million tonnes; prices are in Rupees per quintal;
All parameter values refer to average for the years 1997-1999.
The data on domestic demand and production is taken from the FAOSTAT data base (average figures for the years 1997-99). Groundnut production is in shelled equivalents.
Trade margin includes port charges + traders' margin + marketing costs and is given as a factor by which border price is multiplied to obtain the import parity price (export parity price in the case of meal).

Source of data for domestic price of oil/oilseeds is Agricultural prices in India, Directorate of Economics and Statistics (data relates to 98-99). 'Others' excludes coconuts. Groundnut production is in shelled equivalents.

Table A2—Percentage deviations from normal oilseed output
(With associated probabilities in parentheses)

	Groundnut	Soybean	Rape	Other
Normal year	0.0	0.0	0.0	0.0
	(0.23)	(0.23)	(0.20)	(0.23)
High output	14.0	22.0	25.0	14.0
	(0.41)	(0.29)	(0.44)	(0.41)
Low output	-16.0	-20.0	-25.0	-16.0
	(0.36)	(0.53)	(0.43)	(0.36)

Table A3—Percentage deviations from trend world prices of oilseeds
(With associated probabilities in parentheses)

	Groundnut	Soybean	Rape	Other
Normal year	0.0	0.0	0.0	0.0
	(0.23)	(0.23)	(0.20)	(0.23)
High prices	33.0	27.0	34.0	33.0
	(0.42)	(0.41)	(0.35)	(0.42)
Low prices	-35.0	-25.0	-21.0	-35.0
	(0.35)	(0.36)	(0.45)	(0.35)

Table A4—Percentage deviations from trend world prices of oils
(With associated probabilities in parentheses)

	Groundnut	Soybean	Rape	Palm	Other
Normal year	0.0	0.0	0.0	0.0	0.0
	(0.36)	(0.20)	(0.18)	(0.40)	(0.36)
High prices	24.0	28.0	13.0	26.0	24.0
	(0.32)	(0.33)	(0.27)	(0.30)	(0.32)
Low prices	-28.0	-22.0	-17.0	-25.0	-28.0
	(0.32)	(0.47)	(0.55)	(0.30)	(0.32)

Percentage deviations from trend values of world oil/oilseed price and the frequency of occurrence of these deviations is obtained from the data given in WB edible oils report.

Table A5—Average extraction rates used in the model for different oilseeds

Extraction rates- 1992/3 – 1994/5	Meal	Oil
Ground nut	0.566	0.414
Soybean	0.82	0.176
Rapeseed	0.603	0.373
Others	0.488	0.353

Source: Oil World, USDA as quoted in World Bank (1997).

Extraction rates provide us information on the amount (by weight) of oil/meal produced by crushing unit weight of the particular oilseed.

Table A6—Elasticity parameters used in the model

Elasticity	Value
Elasticity of crush demand w. r. t. crush margins for all seeds	+0.5 [short run elasticity estimates available for several countries fall in the range of 0.2 to 0.5]
Price elasticity of demand for all oils	-0.5
Price elasticity of demand for all meals	-0.5
Income elasticity of demand for all oils	0.5 [income elasticity estimates in the literature are in the range of 0.39 to 0.88 (Gulati and Kelly, 1999)]
Income elasticity of meals	+0.5
Price elasticity of supply of all oilseeds	+0.5 [estimates in the literature range from 0.05 to 0.59 (Gulati and Kelly, 1999)]
Import price elasticity of all oils	+0.1

Definitions:

price band for oils/oilseeds:

The lower and upper bounds of the price band are given as

p_min = border price x (1 + tariff rate) x (1 + trade margin) x (1-band width);
p_max = border price x (1 + tariff rate) x (1 + trade margin) x (1+band width)

Band width is expressed a certain percentage deviation from the reference price (border price). E.g. bandwidth =0.15 for a 15% deviation from reference price.

Crushing margin:

cm = a x (price of oil) + b x (price of meal) – (price of seed)

Price expectations of seeds/ oils:

Moving average of prices realized in the previous five years.

Import parity price for oils/oilseeds:

Small country case:

Import price = border price x (1 + base tariff rate) x (1 + trade margin) x (1+variable tariff)

Large country case:

Import price = border price x (1 + base tariff rate) x (1 + trade margin) x (1+variable tariff) + coefficient x (import quantity)
(Where, the coefficient is derived from the assumed import price elasticity)

Export parity price for meals:

Export price = border price x (1 + trade margins)

The working of the model in the closed economy case (see figure A1):

1. Planned seed output is a function of expected price which is taken as a five year moving average of past prices. Realized seed output is equal to planned output plus a random shock (due to uncertain weather, pests etc). Supply of seed is therefore a function of lagged seed prices.

2. Total demand for seed is the sum of crush demand plus other demand (food, feed etc). The latter is specified exogenously and the former is a function of crushing margins and income. Crushing margin itself is a function of seed price among other things.

3. Equilibrium price of seed is determined by the interaction of supply and demand.

4. Supply of oil/meal is determined from the crush demand for seeds, given by the technical extraction coefficients.

5. Demand functions for oil/meal are functions of their respective prices and income.

6. Equilibrium prices of oils/meals are determined by demand supply interaction.

The working of the model in the open economy case (see figure A2):

The main difference in the open economy case is in the determination of equilibrium prices for seeds/oils/meals. If at the import parity price there is excess demand then equilibrium price is equal to the import parity price and net imports are equal to the excess demand. If at the import parity price there is excess supply then equilibrium price is determined as the price that equates domestic demand with domestic supply.

Since meals are treated as exportables in the model, equilibrium prices of meals are equated to export parity price if there is excess supply at this price and net exports are equal to excess supply. If not, equilibrium price is the price that equates domestic demand and supply for meals and there are no exports.

Thus we can see that in the open economy case seed supply depends on the world price situation. Seed supply is a function of expected seed price which is taken as the moving average of the equilibrium prices realized in the past and world prices influence equilibrium prices.

Figure A1—Working of the model in the closed economy case

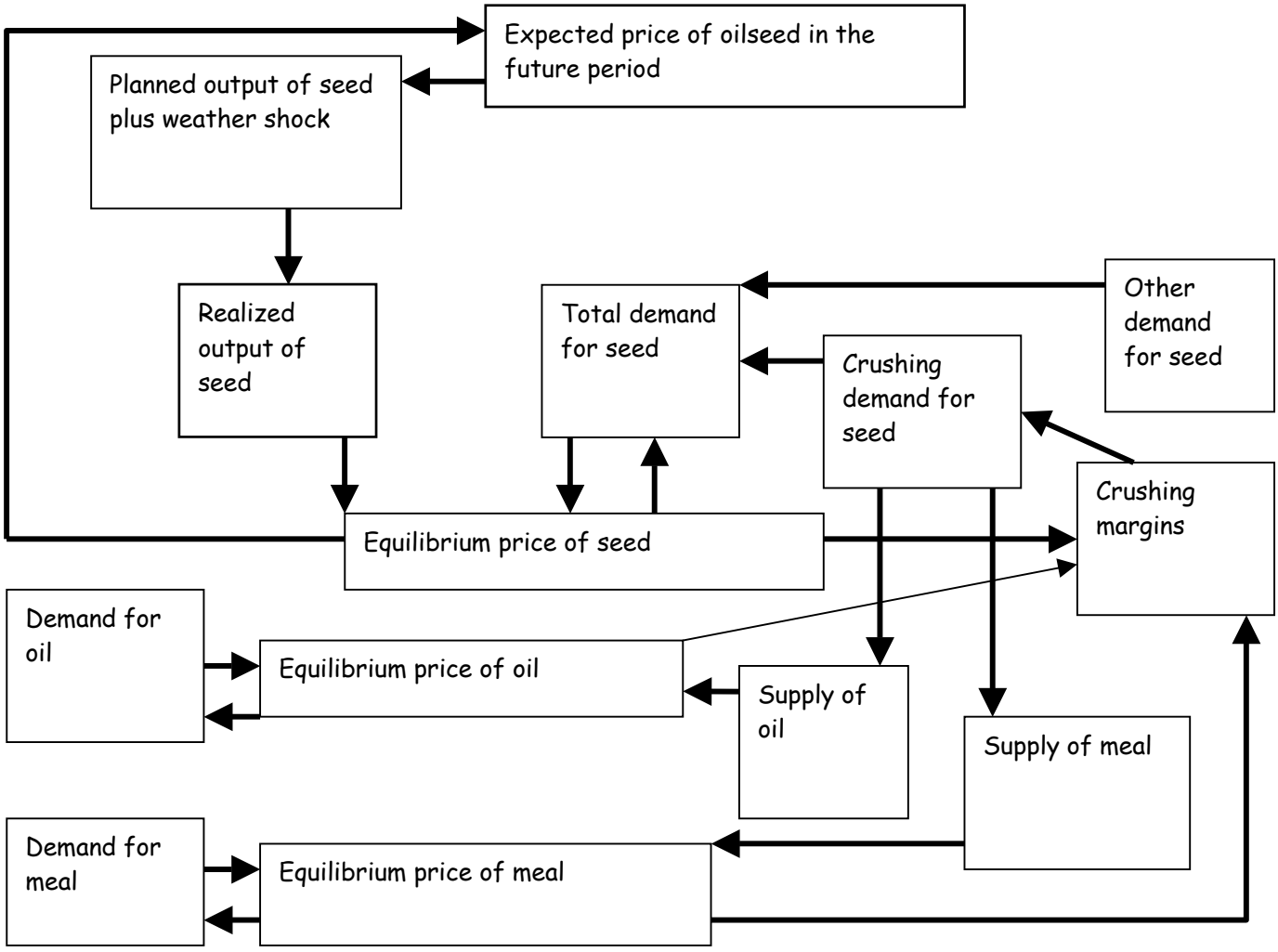
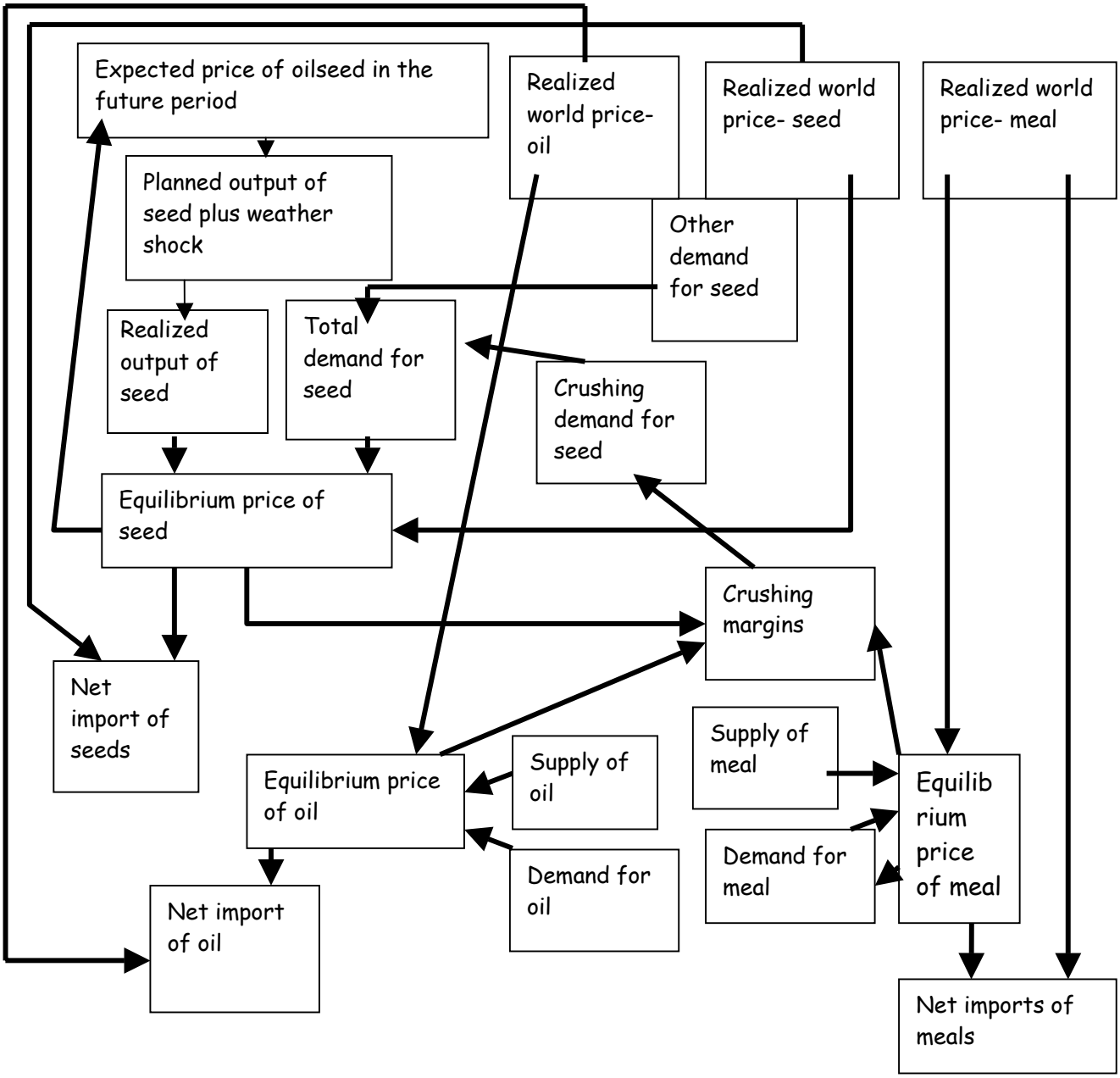


Figure A2— Working of the model in the open economy case



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