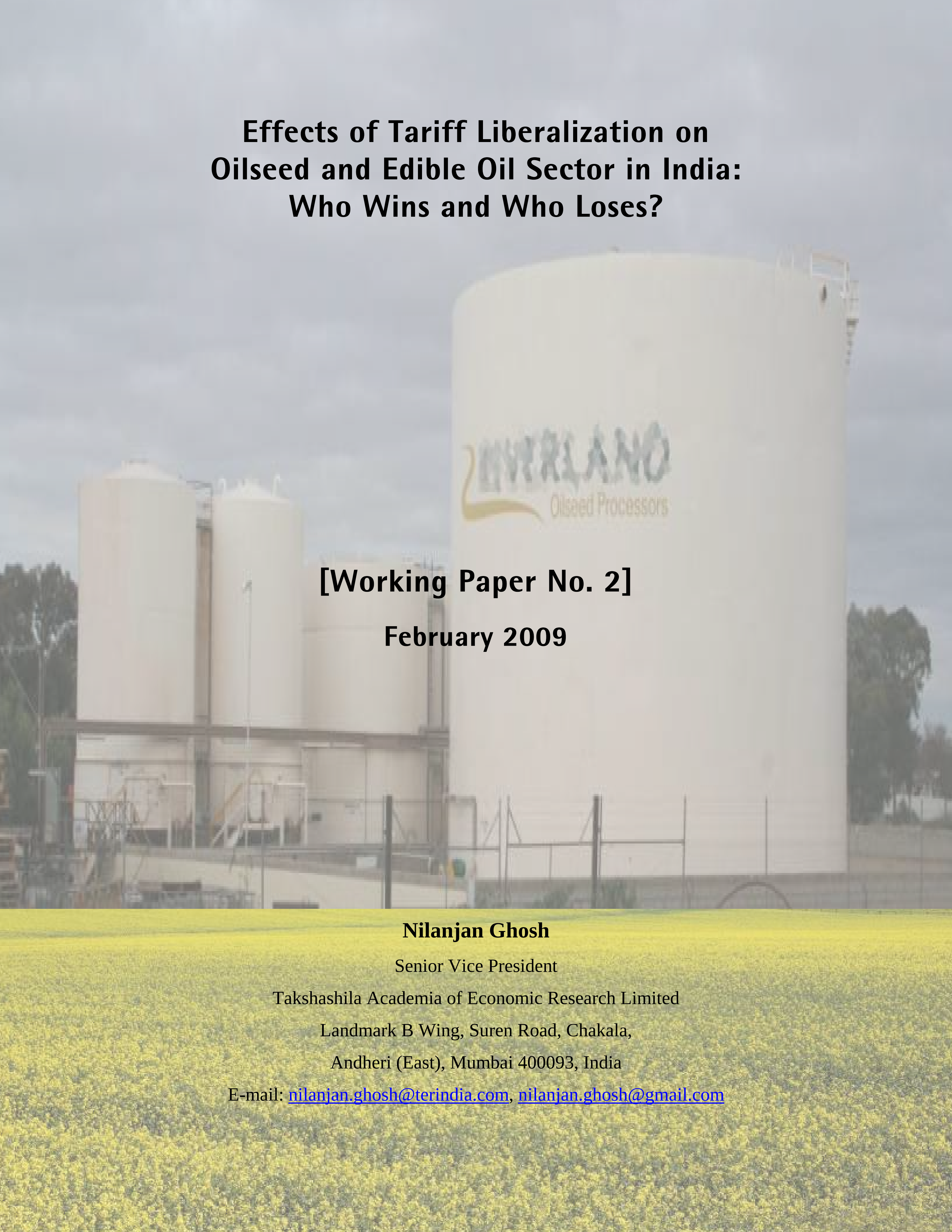

Effects of Tariff Liberalization on Oilseed and Edible Oil Sector in India: Who Wins and Who Loses?

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Abstract

The paper discusses the impacts of tariff liberalization on the edible oil and oilseed sector in India by considering the demand for oilseeds as a derived demand from the edible oil sector. A theoretical framework has been propounded, followed by a simultaneous equation system, to assess the impact of tariffs on critical variables like production, consumption, imports, etc. leading to welfare-related variables like consumer surplus, producer surplus, farmers' surplus, and governmental revenues. Counterfactual analyses have been conducted by looking at various hypothetical tariff regimes (namely, ***zero tariff****,* ***zero import****,* ***WTO binding****,* ***Lahiri Committee recommendation****, and* ***50% tariff decline****) in relation to the base case of 2005–06 tariff levels. The Lahiri Committee recommendation of 65% tariffs on Crude Palm Oil (CPO) gives the best results for welfare gains.. It is thus recommended that the tariff rates be in line with the Lahiri Committee recommendation rather than be in line with extreme situations where zero tariff or zero import (or WTO binding) will be imposed.*

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1. Introduction

India is a leading importer and consumer of edible oils in the world. Out of the 11 million–12 million tonnes of edible oil consumed in the country, around 5.5 million tonnes are imported annually, which includes about 2 million tonnes of soya bean oil from Argentina and Brazil, and 3.5 million tonnes of palm oil from Malaysia and Indonesia. Despite the importance of the edible oil sector in national income and international trade, production is unable to cope with domestic demand. Over the last two decades domestic consumption has grown at an annual rate of 6%, with imports increasing from around 5 million tonnes in the early 1990s to around 12 million tonnes in recent years. Non-packaged oils account for nearly 50% of the consumption in both urban and rural markets. The remaining is taken care of by packaged oils, with branded oils constituting a small portion of approximately 10–15%.

The major factors responsible for the high consumption and import of edible oil in India are increase in per capita income and population, change in tastes and preferences, low productivity in the domestic oilseed sector, and liberal policies for edible oil imports. With a constant rise in demand, imports are slated to rise even further in the coming years. So far, however, the tariff liberalization policies pursued in India have been the prime movers of the increase in imports since the late 1990s [Dohlman *et al* (2003)].

On the input front, oilseed yields in India are among the lowest in the world. The demand for oilseeds is a derived demand that emerges from edible oil and oil meal production. However, oilseed cultivation became increasingly unattractive due to low and unstable yields, and due to decreasing edible oil prices. The area under oilseed cultivation has stagnated at 26 million–27 million hectares over the last several years. Serious concerns are emerging over the future of oilseed production because of this stagnation and also because foodgrains are likely to get prioritized in government policies as foodgrain shortages continue. As a result, imports—which have been helped by tariff liberalization—have surged to meet the excess demand.

However, the situation was different up to the early 1990s with near self-sufficiency in edible oils [Lahiri Committee Report (2006)]. But as the domestic production of edible oils started falling short of demand, edible vegetable palmolein was placed under open general licence (OGL) in April 1994 with an import duty of 65%, much in conformity with WTO principles. This move led to domestic demand being met by imports substantially. Prior to that, edible oil was on the negative list of imports.

Beginning 1994, tariff liberalization in edible oils occurred in phases. Subsequently, other edible oil imports were also placed under OGL. From 1994 two distinct phases are discernible: the first between 1994 and 1998, when customs duty on edible oils progressively came down to reach a low of 15% in July 1998; and the second after 1999, when such duties witnessed an upward trend, touching a high of 92.2% for refined palm oil in April 2005. Between 1994 and 2005, import duties were revised 17 times (Table 1), creating apprehension and uncertainty for both edible oil producers and importers.

Table 1:
Tariff and trade policy on edible oils (1994 to 2005)

April 1994	Import of RBD palmolein placed on OGL with 65% import duty.
March 1995	Import of all edible oils (except coconut oil, palm kernel oil, RBD palm oil, RBD palm stearin) placed on OGL with 30% import duty.
1996-97 (in regular Budget)	Reduction in import duty to 20%. With 2% special customs duty, the total duty was 22%. Another special customs duty of 3% was later imposed, bringing the total duty to 25%.
July 1998	Import duty further reduced to 15%.
1999–2000 (Budget)	Import duty raised to 15% (basic) plus 10% (surcharge), bringing the total import duty to 16.5%.
December 1999	Import duty on refined oils raised to 25% (basic) plus 10% (surcharge), that is 27.5%. In addition, a levy of 4% of special additional duty (SAD) was imposed on refined oils.
June 2000	Import duty on crude oils raised to 25% (basic) plus 10% (surcharge), that is, 27.5%, and on refined oils to 35% (basic) plus 10% (surcharge) plus 4% (SAD), that is, 44.04%. Import duty on crude palm oil (CPO) for manufacture of vanaspati retained at 15% (basic) plus 10% (surcharge), that is, 16.5%.
November 2000	Import duty on CPO for manufacture of vanaspati raised to 25% and on crude vegetable oils to 35%. Import duty on CPO for manufacture, other than of vanaspati, raised to 55%. Import duty on refined vegetable oils raised to 45% (basic) plus 4% SAD, that is 50.8%. Import duty on refined palm oil and RBD palmolein raised to 65% basic plus 4% SAD, that is 71.6%.
March 2001 As amended on April 26, 2001	Import duty on crude oils for manufacture of vanaspati/refined oils by importers registered with Directorate of VVO&F raised to 75% (for others, duty at 85%) except on soya bean oil, rapeseed oil, and CPO, at 45%, 75%, and 75% respectively. Import duty on refined oils, including RBD palmolein, raised to 85% (basic) except for soya bean and

	mustard oil where it was placed at 45% (basic) and 75% (basic) respectively due to the WTO binding. A 4% SAD was also levied on refined oils.
October 2001	Import duty on CPO and its fractions of edible grade, in loose or bulk form, reduced from 75% to 65%.
November 2001	Import duty on crude sunflower oil or safflower oil reduced to 50% up to an aggregate of 1,50,000 tonnes tariff rate quota (TRQ) of total imports of such goods in a financial year subject to certain conditions. Import duty on refined rape, colza, or mustard oil reduced to 45% up to an aggregate of 1,50,000 tonnes TRQ of total imports of such goods in a financial year subject to certain conditions.
March, 2002	Status quo on import duty structure maintained. Import of vanaspati from Nepal brought under SAD of 4%.
August 2002	SAD made non-applicable on vanaspati imported from Nepal under TRQ.
March 2003	Status quo on import duty structure of vegetable oils/edible oils maintained.
April 2003	Import duty on refined palm oil and RBD palmolein reduced from 85% to 70% and SAD made non-applicable on edible oils.
July 2004	Import duty on refined palm oil and RBD palmolein raised from 70% to 75%
February 2005	Import duty on crude palm oil and RBD palmolein raised from 65% to 80%, and that on refined palm oil and RBD palmolein from 75% to 90%.

Source: Lahiri Committee Report (2006)

It was in January 2006 that the Report of the Committee on Rationalisation of Customs and Excise Duties on Edible Oils and Oilseeds headed by Ashok Lahiri came to the fore. Based on the recommendations of the Report, the government announced a cut in the import duties of palm oil and sunflower oil. The customs duty on refined palm oil was cut by 12.5 percentage points and on crude palm oil by 10 percentage points. Import duty on soya bean oil remained unchanged at 45%. The cut in import duty, however, has been accompanied by a freeze in base import prices on which the duty is being calculated.

Edible oil tariff liberalization seems to have played a significant role in determining the fate of the domestic industry, consumption patterns, and the oilseed producers [Persaud and Landes (2006)]. In 2002–03, India was the destination for over 15% of global vegetable oil imports. In the same year, imports cornered around 55% of the country's edible oil consumption and about half the value of its total agricultural imports. 2002–03 also recorded India's import–export trade in vegetable oils and oilseed products at around Rs 17,000 crore, of which Rs 12,000 crore were attributed to import of edible oils and the remaining to export of oil meals, oilseeds, and oils [Pavaskar and Kshirsagar (2008)]. In fact, the annual per capita consumption of edible oils in the country has almost doubled in the past three decades—from 6 kg in the mid-1970s to a little over 11 kg in 2002–03.

Given this background, there is grave concern about the potential impact of tariff on the domestic edible oil economy. The conservative left wing as well as the domestic extraction industry group is against tariff liberalization on the plea that such a move will destroy the domestic industry and have a negative impact on farmers. Quite a few studies have contributed to this view [e.g. Chand (2002), Chand *et al* (2004), and Hashim (2008)]. On the other hand, practitioners and exponents of free trade, as well as multilaterals, are convinced of the lack of competitive cost advantage in such production processes and state that import liberalization in edible oils will be beneficial for the economy [e.g. World Bank (1997), Gulati and Kelley (1999)].

There is no doubt that the edible oil and oilseed sector currently faces several challenges. Oilseed cultivation has become increasingly unattractive to the farmer because of low and unstable yields. The so-claimed success of the technology mission on oilseeds has been questioned from various quarters. Production of oilseeds has eventually stagnated. On the other hand, while trade liberalization has led to low demand for oilseeds, the resultant low prices have led to poor supply response. High import tariffs and non-tariff barriers, such as sanitary and phyto-sanitary restrictions, have made oilseed imports unattractive [Srinivasan (2005)]. Low domestic output of raw material, combined with restricted import of oilseeds, has also been responsible for high underutilization of the processing capacity.

On the other hand, as explained by Srinivasan (2005), the government has attempted to help oilseed growers by providing minimum support prices (MSP) through its stocking policy and by imposing customs duties on imports of edible oils and oilseeds. MSP does not appear to have worked as well for oilseeds as it has for wheat and rice. On the other hand, it is also claimed that import tariffs on edible oils tend to impose a large burden on consumers and help processors more than oilseed farmers [Srinivasan (2005)].

The question that arises is: Is tariff liberalization necessarily an ineffective mechanism that will only harm the Indian economy? Or, does it have the potential of opening up several other options by which the economy can concentrate on the production of other commodities in which it has a comparative advantage? An objective analysis is an absolute necessity at this juncture to answer these vital concerns, and the same has been attempted in this study. While answering these concerns, this paper propounds a partial equilibrium framework that links the edible oil sector with the oilseed sector, and examines the impact of tariff reduction on consumer surplus, processing margins, and farmer surplus, as well as on the production and imports of edible oils, area under cultivation, and oilseed yields. The period of analysis is from the 1986–87 oil year to 2005–06 oil year, where the oil year 1986–87 spans from October '86 to September '87. For convenience of analysis and considering the focus of the study, the 20-year period has been divided into three phases—1986–87 to 1993–94, 1994–95 to 1998–99, and 1999–2000 to 2005–06. The first phase is defined as the pre-liberalization era when edible oils were in the negative list of imports; the second phase is the liberalization era when edible oil imports were placed under OGL and tariffs were reduced in a phased manner; the third phase again witnesses a rise in tariff rates and marks an era of deviation from the second phase.

The paper has three main sections. In Section 2, the paper propounds a theoretical model in the partial equilibrium framework. In the process, Section 2 provides the theoretical explanation of welfare changes—as far as the edible oil and the oilseed sectors are concerned—when tariffs change. The framework states the linkages from consumer demand for edible oil to oilseed production as well as attempts to cover the major nodes of the edible oil value chain, including equilibrium conditions. Section 3 presents an econometric simultaneous equation system, based on which the tariff elasticity of the various variables is estimated. Based on these estimates, a counter-factual framework or a scenario analysis is presented. The scenarios have been devised from several hypothetical tariff regimes, and thus present the sensitivity of the various variables to tariff changes.

2. Impact of Tariff on Edible Oils and Oilseeds: A Theoretical Framework

The assumptions in the model are as follows:

1. Both product and factor markets are competitive. Hence, in both markets the consumers and suppliers are price-takers. The product (edible oils) and factor (oilseeds) markets are cleared.
2. Domestic source of supply of edible oils is equal to the domestic production of edible oils.
3. There are two sources of supply of edible oils: domestic production and imports.
4. As a restrictive assumption, demand is considered as a function of its own price and income only.
5. Import is a supply-side phenomenon and need not reflect the import demand. Rather, supply from imported sources is an inverse function of the level of protection given to domestic producers in the form of tariffs.
6. Domestic prices exceed import prices by the proportion of the tariff rates.
7. There is a representative processing firm that produces edible oil by using two inputs, labour and oilseeds. [Of course, there are many other inputs used, but for the sake of simplicity, they are considered to be absent.]
8. Typical of a competitive system, the processing industry maximizes its profits on its input use.
9. Labour supply in the edible oil sector is perfectly elastic, and hence wages are fixed. Labour demand is a derived demand from the quantity produced.
10. Oilseed demand is a derived demand from edible oil production, like labour demand. However, oilseed prices are determined in the oilseed market by the continuous interaction of demand and supply forces.
11. There is instantaneous information dissemination between product and factor markets, and the framework is devoid of information asymmetries.
12. The two inputs, namely, oilseeds and labour, are independent of each other. This implies that an increase in use of one input will not necessarily entail an increase in the use of the other input. However, to increase total production, both inputs have to be increased.
13. Oilseed production and supply functions are identical. Oilseed supply and production are dependent on area under production and oilseed prices.

14. The farmer takes a decision on oilseed production from the market prices of oilseeds only. [The other possible information categories that can affect the decision on acreage are not considered.]

2.1. Symbols Used

Q_d ≡ Quantity of edible oil demand

P ≡ Domestic price of edible oil

$\overline{Y}$ ≡ Consumer income

L ≡ Labour input in the edible oil processing industry

S ≡ Demand for oilseeds or usage of oilseeds in the production function

Q_E ≡ Domestic supply/ production of edible oil

P_M ≡ Import price of edible oil

M ≡ Quantity of edible oil imported

T ≡ Tariff rates

π ≡ Profit of the processor

$\overline{w_G}$ ≡ Wage rates fixed at the labour market

p_S ≡ Unit price of oilseeds

S_S ≡ Supply/ production of oilseeds

A ≡ Area under oilseeds production

A_C ≡ Area under competing crops

$\overline{A}$ ≡ Total available area

W ≡ Water use

ω ≡ Crop-water requirement for oilseeds

ω_C ≡ Crop-water requirement for competing crops

p_C ≡ Price of competing crop

r ≡ Relative price of oilseeds

In each case, adding a "*" to the symbol will indicate the equilibrium.

2.2. Equations and Identities in the Model

As stated earlier, the model entails the entire value chain from edible oil consumption to oilseed production, and eventually impact of a tariff change on the entire value chain. The relation and the linkages between the various variables in this static model have been expressed through several equations and identities.

Quantity demanded has been assumed to be a function of own price P and the given income of the individual, $\overline{Y}$. The demand function is well behaved, being drawn from a well-behaved utility function, and diminishes with P and increases with $\overline{Y}$.

$$Q_d = \phi(P, \overline{Y}), \quad \frac{\partial \phi}{\partial P} < 0, \ \frac{\partial \phi}{\partial \overline{Y}} > 0 \quad \ldots (1)$$

Quantity supplied is quantity produced, which depends on the two inputs of production, namely, labour L and oilseeds S, as well as the prices P. Of course, the supply curve is also well behaved, being derived from a well-behaved cost function.

$$Q_E = f(L, S, P), \quad \frac{\partial f}{\partial L} > 0, \ \frac{\partial f}{\partial S} > 0, \ \frac{\partial f}{\partial P} > 0. \ldots (2)$$

Domestic price P, is higher than the imported price P_M, *in the proportion of the tariff rate T.* This gives us the following identity:

$$P = P^M (1+T) \ \ldots (3)$$

Net protection coefficient (NPC) is defined as the ratio of domestic prices and the import prices. Hence, $NPC = \frac{P}{P_M}$ … (4).

NPC reflects on the level of protection or insulation of the economy from international trade. *A higher protection will always lead to lower imports*. Thus,

$$M = \theta(\frac{P}{P_M}) = \theta(1+T), \ \frac{d\theta}{dT} < 0 \ [\because \text{from } (2.7), \ \frac{P}{P_M} = (1+T)] \ \ldots (5)$$

$$\text{i.e. } M = \gamma(T) \ \frac{d\gamma}{dT} < 0 \ldots (6)$$

The equilibrium condition of the economy states that the quantity demand will be equal to the total edible oil availability, which is the sum of domestic production and imports. This is given in (7).

$$Q_d = Q_E + M \quad \ldots (7)$$

The representative processor has a profit function, π*, which is the difference between its total revenue,* $P.Q_E$*, and its total cost,* $\overline{w}.L + p_S.S$. Therefore,

$$\pi = P.Q_E - \overline{w}.L - p_S.S \quad \ldots (8)$$

Now, (7) implies the following:

$$\pi = P.f(L, S, P) - \overline{w}.L - p_S.S \quad \ldots (8A)$$

The input demand functions for labour and oilseeds will be obtained by differentiating (8A) with respect to *L* and *S* respectively, and setting each equal to zero, which is the first order maximizing condition. In other words,

$\frac{\partial \pi}{\partial L}$ = 0 and $\frac{\partial \pi}{\partial S}$ = 0, respectively, will give us the following input demand functions:

$$L = L(\overline{w}, P) \quad \ldots (9)$$

$$S = S(p_S, P) \quad \ldots (10)$$

Now, (9) signifies the labour demand function, while (10) indicates the oilseed demand function, both derived from the profit function of the processing industry.

On the input supply side, labour supply has already been taken as perfectly elastic, thereby making wages fixed and exogenous in the framework. However, prices of oilseeds are determined by the interaction between the demand and supply/production forces. Oilseed supply has been taken as a function of area *A*, and oilseeds prices p_S, as given in (11). It is also assumed that as oilseed prices increase, the farmer will tend to bring more area under oilseed cultivation. This is of course on the assumption that all other agricultural crop prices remain constant. Hence, a rise in oilseed prices will only bring about an increase in the relative prices of oilseeds as well.

$$S_S = \rho(A, p_S), \text{ where, } \frac{\partial S_S}{\partial A} > 0, \ \frac{\partial S_S}{\partial p_S} > 0, \text{ as also } \frac{\partial A}{\partial p_S} > 0. \ \ldots (11)$$

Finally, the oilseed market equilibrium in which the equilibrium price and quantity are determined is given by:

$$S = S_S \; \dots \; (12)$$

The equations and identities presented from (1) to (12) present the edible oil value chain from edible oil consumption to price determination in the oilseed sector. In Section 2.3, the impact of tariff change on the edible oil and oilseed sector has been analyzed.

2.3. Impact of Tariff Change: The Comparative Statics in the Edible Oil Market

Here, the equilibrium condition in the edible oil market, as given by (7), is considered, and equilibrium prices are obtained. The equilibrium price $P*$ can be expressed as a function of equilibrium labour input $L*$, oilseeds input in the production process $S*$, and tariff T, as shown in (13):

$$P* = g(L*, S*, T) \; \dots \; (13)$$

Here, one needs to keep in mind that $L*$ and $S*$ are also determined by their own market dynamics where edible oil prices play an important role, as shown by (9) and (10). For the oilseed market, p_S* is the equilibrium price reached through the interactive demand and supply forces. Hence:

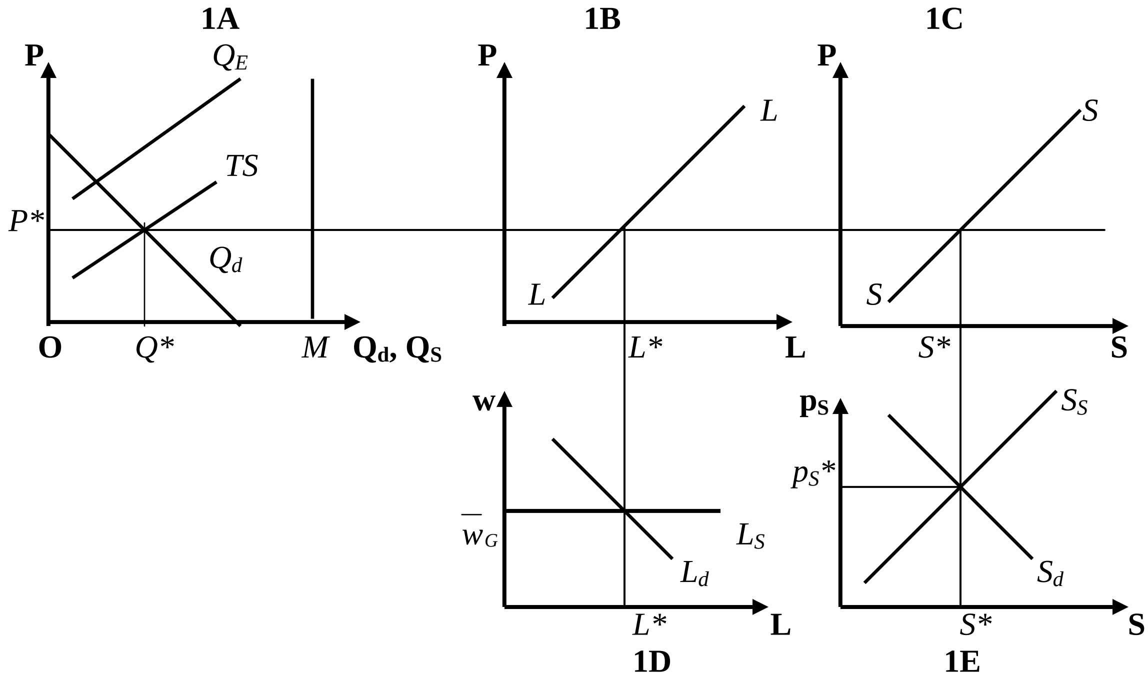
$$L* = \psi(\overline{w}, P*) \; \dots \; (14)$$

$$S* = \chi(p_S*, P*) \; \dots \; (15)$$

Again, the equilibrium quantity should be $Q* = f(L*, S*, P*) \; \dots \; (16)$

The system of equations given by (13), (14), (15), and (16) provide us with the equilibrium condition of the entire value chain of edible oils and oilseeds. This is depicted in Figure 1 in its five schedules 1A–1E.

Figure 1



One has to appreciate that the equilibrium is reached here with a continuous interaction between the various markets. In this framework, therefore, the tariff rate is assumed to be exogenous and is fixed by the government. In 1A the 90° line from M is the import schedule. The horizontal sum of Q_S and M gives the TS schedule, which reflects the total availability of edible oils as a function of P. The equilibrium price and quantity, namely $P*$ and $Q*$ respectively, are obtained by the intersection of TS and Q_d. Now, this information about the equilibrium $P*$ flows instantaneously in the factor markets. In the labour market, where the wage levels are assumed as fixed because of a perfectly elastic labour supply curve (L_S in Figure 1D), the equilibrium labour employment $L*$ is dependent on $P*$, and hence there is no change in nominal wages w. LL in 1B shows the locus of the equilibrium levels of P and L. In a similar mode, as shown in the interactive schedules of 1C and 1E, given $P*$, the oilseed demand and supply interactions provide the equilibrium price and quantity of oilseeds, given by p_S* and $S*$ respectively.

Now, we consider a scenario where tariffs T change. The change can be observed by total differentiation of $P*$ in (13) with respect to T. While doing this, it must be noted that even L^* and $S^*$are functions of P^*, as elaborated in (14) and (15). Hence, the total differentiation of P^* with respect to T yields the following:

$$\frac{dP^*}{dT} = \frac{\partial g}{\partial L^*}.\frac{\partial L^*}{\partial P^*}.\frac{dP^*}{dT} + \frac{\partial g}{\partial S^*}.\frac{\partial S^*}{\partial P^*}.\frac{\partial P^*}{\partial T} + P_M \quad \ldots (17)$$

From (17), we obtain:

$$\frac{dP^*}{dT} = \frac{P_M}{(1 - \frac{\partial g}{\partial L^*}.\frac{\partial L^*}{\partial P^*} - \frac{\partial g}{\partial S^*}.\frac{\partial S^*}{\partial P^*})} \quad \ldots (18)$$

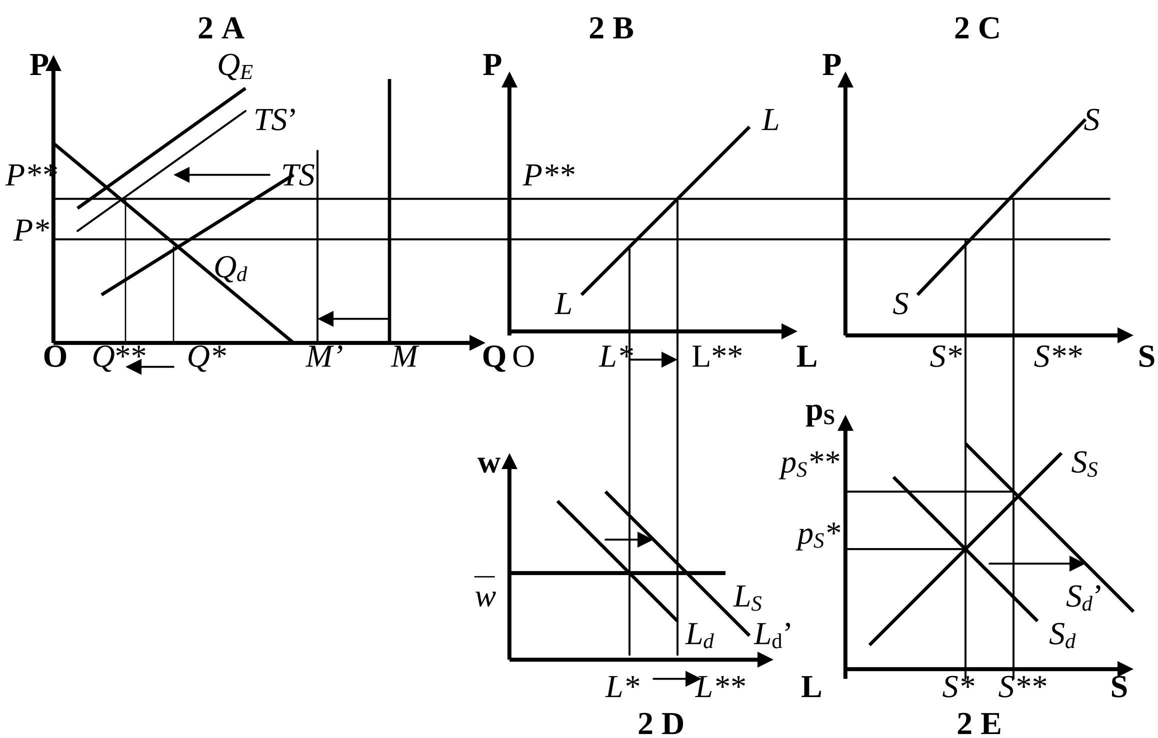
Equation (18) is an extremely significant result in this context, as it clearly states the extent of increase (decline) in equilibrium domestic prices because of an increase (decline) in tariffs, thereby linking the edible oil prices to the factor markets. Had the product and factor markets linkage not been there, the equilibrium prices would have increased by the extent of the import prices, i.e. $\frac{dP^*}{dT} = P_M$. However, that does not take place. But whether the equilibrium prices increase more or less than P_M is the critical question. This solely depends on the signs of $\frac{\partial g}{\partial L^*}, \frac{\partial L^*}{\partial P^*}, \frac{\partial g}{\partial S^*}$ and $\frac{\partial S^*}{\partial P^*}$.

We argue that $\frac{\partial g}{\partial L^*} < 0$, as a rise in nominal wages (or an upward shift in L_S schedule), will bring about a decline in equilibrium labour input L^*, thereby causing the edible oil supply/production to decline, and eventually causing edible oil prices to rise. On the other hand, $\frac{\partial L^*}{\partial P^*} > 0$, a rise in prices will induce the processing firm to produce more, thereby demanding more labour inputs. In a similar vein, we argue that $\frac{\partial g}{\partial S^*} < 0$ and $\frac{\partial S^*}{\partial P^*} > 0$. Therefore, we infer that:

$$\frac{dP^*}{dT} = \frac{P_M}{(1 - \frac{\partial g}{\partial L^*}.\frac{\partial L^*}{\partial P^*} - \frac{\partial g}{\partial S^*}.\frac{\partial S^*}{\partial P^*})} < P_M \text{ since } (1 - \frac{\partial g}{\partial L^*}.\frac{\partial L^*}{\partial P^*} - \frac{\partial g}{\partial S^*}.\frac{\partial S^*}{\partial P^*}) > 1 \quad \ldots (19)$$

The question is why the increase in tariff brings about an increase in edible oil prices, which is less than import prices. Let us have a re-look at the linkages. As tariffs increase, the imports contract and there is a decline in total availability of edible oils. This brings about a rise in edible oil prices. However, there remains a counteractive force that can again bring down the prices. This counteractive force emerges from domestic edible oil supply. As prices increase, there is greater incentive for the processor to produce more. To do that, the processor needs more labour and oilseed inputs. Hence, the demand for labour increases, though the nominal wage in our model does not increase because of perfect elasticity of labour supply. On the other hand, oilseed input increases; as with rise in edible oil prices, there is higher demand for oilseeds, which also pushes up oilseed prices. Figure 2 brings out the comparative statics of the entire system.

Figure 2



As stated earlier, an increase in tariff will result in a decline in imports, and the M schedule shifts to the left to M' in 2A. This is associated with TS-schedule shifting left to TS'. A new price-quantity equilibrium is reached (*P***, *Q***). With the new equilibrium price *P***, which induces domestic producers to produce more, the equilibrium labour input increases to L^{**}, with labour demand schedule shifting right from L_d to L_d'. On a similar note, the demand schedule for oilseeds also shifts right to S_d' because of a rise in edible oil prices. The excess demand in the oilseed market also causes oilseed prices to increase from p_S* to p_S**. Hence, while the economics of the edible oil and oilseed sector are being explained from this analysis, it will be interesting to note the extent of change in oilseed prices and production dynamics.

For doing so, we assume the following equilibrium condition in the oilseed market, obtained by equating (18) and (19), and as given in (20):

$$S(p_S, P) = S(A, p_S) \ \ldots (20)$$

This gives us the following equation under the equilibrium condition:

$$p_S* = \kappa(P*) \ \ldots (21)$$

Now, the equilibrium price p_S* (and quantity) in the oilseed market changes with the changes in the equilibrium prices in the edible oil market $P*$ (which dictates the demand side of oilseeds) and the equilibrium area $A*$. We already know that $\frac{\partial p_S *}{\partial P *}>0$(Figure 2). Ideally, we could have also taken the area under oilseeds as another determinant of oilseed prices and considered that as the supply-side phenomenon. The farmer can obtain a range of other information like subsidies, support prices, changes in relative prices of other crops vis-à-vis oilseeds, etc, and all this information can affect his acreage decision for oilseeds. If any of this information had increased the acreage, oilseed prices ideally would have fallen. However, we are assuming away the role of any such information from the supply side in our model.

2.4. Welfare Impacts in Partial Equilibrium

The theoretical framework brings about a few things to the fore. From a closer look at the sector, the increase in tariff inevitably brings about an increase in consumer prices, as has already been argued. While the total availability of edible oils has shrunk, there is a consequent decline in consumer surplus, which is proportional to the increase in prices. Hence, a decline in tariff will diminish the prices and result in an increased consumer surplus. While the consumption of edible oil will increase under free trade in India (due to substitution and income effects), the consumption of other consumables in the consumers' baskets too can increase if the positive income effect outweighs the negative substitution effect. In other words, the fall in the relative price of edible oil along with a rise in real income leads to an increase in the consumption of edible oil and in the consumption of other commodities. This is despite the increase in the relative price of the latter if the income effect outweighs the substitution effect. With a tariff rise, therefore, the price rise has been detrimental for the consumer from all angles.

However, it can prove to be more revenue generating for the processing industry, which can receive adequate protection under a rise in tariff. While domestic price increases, thereby leading to higher revenues, the impact on producer surplus will depend on the impact on input prices. A higher protection to the edible oil sector can also make the sector more amenable to employment generation; moreover, it can give a boost to farmers to produce more oilseeds at better prices. Yet, the impact on resource use like water solely depends on the water requirement of the competing crop vis-à-vis the oilseed in contention. We will estimate all these impacts in Section 3 in the counterfactual analysis.

3. Econometric Framework

The econometric framework attempts to indicate the linkage between the edible oil and the oilseed sector. The framework borrows its theoretical underpinning from what has been presented in the previous section. A simultaneous equation system, which attempts to trace the value chain from the consumption of edible oils to the area and yield of oilseeds, has been estimated. The symbols are as follows:

$Q^D{}_t$ = Edible oil consumption in time t

P_t = Price of edible oil in time t

P_t^w = Import price of the edible oil in time t

τ = Tariff per unit of price of edible oil in time t

$\overline{y_t}$ = per capita income in time t

$Q^S{}_t$ = Edible oil supply in time t

M_t = Imports of edible oil

$OS^D{}_t$ = Oilseed demand in time t

$OS^S{}_t$ = Oilseed supply in time t

P_t^{os} = Price of oilseed in time t

A_t = Area under oilseed crop in time t

Y_t = Yield of oilseed crop in time t

I_t = Percentage of irrigated area under the oilseed crop in time t

R_t = Annual rainfall in time t

$Q^{OM}{}_t$ = Quantity of oil meal produced in time t

$P^{OM}{}_t$ = Export price of oil meal in time t

P^C = price of competing crop (wheat) in time t

S_t = Ending Stock of edible oils at time t.

σ_t = Ending stock of oilseeds at time t.

Z = proxy of factors affecting domestic prices, other than imports at time t,

ε_{it} are the random disturbance terms.

The simultaneous equation system presenting the partial equilibrium model is as follows:

$Q^D{}_t = \alpha_0 + \alpha_1 P_t + \alpha_3 . \overline{y}_t + \varepsilon_{1t}$ -------------- Demand Function for edible oils (22)

$Q^S{}_t = \alpha_5 + \alpha_6 P_t + \alpha_7 . A_t + \varepsilon_{2t}$ -------- Domestic Supply Function for edible oils (23)

$M_t = \alpha_9 + \alpha_{10} . P_t + \alpha_{11} . P^W{}_t + \varepsilon_{3t}$ --------------------- Import Function (24)

$P_t = P^W{}_t + \tau + Z$ -------------------- Domestic price and tariff identity (25)

$Q^M{}_t = Q^S{}_t + M_t + S_{t-1} - S_t$ ------------------ Identity stating equilibrium in edible oils (26)

$P^{OS}{}_t = \alpha_{12} + \alpha_{13.} P_t + \alpha_{14} . A_t + \varepsilon_{4t}$ ---------- Price Function for oilseeds (27)

$OS^S{}_t = A_t * Y_t$ -------------------- Production of oilseeds (28)

$A_t = \alpha_{15} + \alpha_{16} . A_{t-1} + \alpha_{17} . P^{OS}{}_{(t-1)} + \alpha_{18} . P^C{}_{(t-1)} + \varepsilon_{5t}$ ----------Area function for oilseeds (29)

$Y_t = \alpha_{19} + \alpha_{20} . P^{OS}{}_{(t-1)} + \alpha_{21} . R_t + \varepsilon_{6t}$ ---------Yield Function for oilseeds (30)

$OS^D{}_t = OS^S{}_t + \sigma_{t-1} - \sigma_t$ ------------------- Equilibrium in oilseeds economy (31)

$Q^{OM}{}_t = \alpha_{22} + \alpha_{23}.P^{OM}{}_t + \alpha_{24}.Q_{st} + \varepsilon_{7t}$ ---------------- Production of oil meals (32)

Equation (22) presents edible oil demand (or consumption) as a function of edible oil prices (or WPI of edible oils), and per capita income. There are many other important factors that can affect demand, such as population. Population and per capita income have often been taken in demand models to explain increasing consumption [e.g. Ahluwalia (1976), IBRD (1969)]. However, in our case, we have found the existence of a spurious positive relation between the two variables over time and have thus removed population from the explanatory variables list. Equation (23) presents edible oil supply as a function of edible oil prices and area under oilseeds. Here, as in Section 2, we have taken domestic supply and domestic production of edible oils to be identical. Hence, the forces of supply and production should be the same. That is precisely why area, which is an input in oilseed production that enters into edible oil production function, has been taken as an explanatory variable and as a supply side force. This is also because there is a critical fixed relation between edible oils and oilseed production. Hence, if one takes oilseed production instead of area in the equation (which could have been another choice), the essence of the fixed relation would have been lost. Equation (24) presents imports as a function of domestic prices as well as import prices, while equation (25) reflects on the identity between domestic prices, import prices, and tariffs. Equation (25) is extremely significant for our counterfactual analysis. The identity states that apart from the import price and tariff, there might be other factors that might affect domestic prices. This is given by *Z.* In that sense, *Z* represents a "slack" variable. More importantly, what we have intended to present here is that a unit change in tariff will bring about a change in edible oil prices, all other things remaining constant, and this price rise, in the process, affects the entire economic system presented here. Equation (26) states the equilibrium condition of the edible oil economy where demand equals the sum of domestic production, imports, and change in the stocks. In our analysis, the price of oilseeds is viewed as a function of oilseed supply, and price of edible oils as given in equation (27). Oilseed prices are determined by the supply and demand side factors, as is being reflected in this equation. This owes its logic to equation (31), where the equilibrium in the oilseed economy is depicted. On the other hand, equation (28) depicts the production identity for oilseeds as the product of area and yield of oilseeds. Equations (29) and (30) present the area and the yield functions of oilseeds respectively. In the area function in equation (29), the explanatory variables are one-year lag of area under oilseeds, lag of its own price, and lag of price of competing crops. In this context, we have taken three different crops as competing with oilseeds in general. These are wheat (which competes with rapeseed/mustard in Rajasthan), cotton (which competes with groundnut in Gujarat), and *jowar* (which competes with sunflower seed in Karnataka, and soya bean in Madhya Pradesh). The list is only indicative, and in no way exhaustive. The price of competing crop has been arrived at by considering the weighted average of the wholesale price indices of the three crops under consideration, with area acting as the weight. In the yield function (30), the one-year price lag of oilseeds captures several input factors that include irrigation and use of fertilizers. We assume here that a higher price of the crop in the previous year might induce the farmer to opt for more intensive cropping and input use. On the other hand, rainfall has been taken as a natural input in the production process. In equation (32), oil meal production has been taken as a function of its own price and edible oil prices. Oil meal is a compulsory by-product of edible oil production, and a rise in edible oil prices might induce an increase in edible oil and oil meal production. All the prices considered for the analyses are the wholesale price indices (WPI) of the respective crops or commodities, as applicable. Because our primary interest is in the movements of the prices rather than the prices themselves, WPI serves the purpose best. We have run the simultaneous equation by taking the natural logarithm of all variables so that the elasticities are easily obtainable from the regression coefficients. The slope coefficient of P in the various regression equations gives the elasticities of the concerned dependent variable with price. In certain cases where edible oil price has not featured in the regression equation, elasticities have been derived from a variable that is linked to price in some other regression equation. The equation system has been estimated in STATA 10 by using a three-stage-least-squares method (Table 2).

Table 2: Results of the simultaneous equation system

Equation	Number of Observations	Parameters	R-square	P-value
$Q^{D}{}_{t}$	19	2	0.9716	0.00
$Q^{S}{}_{t}$	19	2	0.7935	0.00
M_t	19	2	0.3143	0.00
$P^{OS}{}_{t}$	19	2	0.8667	0.00
A_t	19	3	0.7067	0.00
Y_t	19	2	0.7594	0.00
$Q^{om}{}_{t}$	19	2	0.9448	0.00

	Coefficient	*Standard Error*	z	$P > \|z\|$
$Q^{D}{}_{t}$				
$\underline{P_t}$	– 0. 51178	0 .0867442	–5.90	0.000
y_t	0. 73474	0.033141	22.17	0.000
Const. (α_0)	4. 53540	0.2462925	18.41	0.000
$Q^{S}{}_{t}$				
P_t	0.7165313	0.182943	3.92	0.000
A_t	0.3973744	0.0760913	5.22	0.000
Const. (α_5)	4.326547	0.5050269	8.57	0.000
M_t				
P_t	–1.711848	0.6280238	–2.73	0.006
P_t^W	3.190112	1.015884	3.14	0.002
Const. (α_9)	–0.1063159	5.155943	–0.02	0.984
P_t^{OS}				
P_t	1.380571	0.1219706	11.32	0.000
A_t	–0.632072	0.2328679	–2.71	0.007
Const. (α_{12})	0.2504456	.7552003	0.33	0.740
A_t				
A_{t-1}	0.5598453	0.894627	6.26	0.000
$P^{OS}{}_{t-1}$	0.1682499	0.0652677	2.58	0.010
$P^{C}{}_{t-1}$	–0.1033505	0.0433758	–2.38	0.017
Const. (α_{15})	1.126924	0.2680791	4.20	0.000
Y_t				
$P^{OS}{}_{t-1}$	0.7024542	0.0980494	7.16	0.000
R_t	0.1638122	0.0391482	4.18	0.000
Const. (α_{19})	1.038829	0.675948	1.54	0.124
$Q^{OM}{}_{t}$				
$P^{OM}{}_{t}$	0.3330612	0.0180546	18.45	0.000
Q_{st}	0.2730096	0.0448024	6.09	0.000
Const. (α_{22})	5.343042	0.2021606	26.43	0.000

3.1. Estimates of Elasticities

Table 3 gives the various elasticities that have been estimated from the regression results presented in Table 2.

Table 3: Elasticities of edible oil prices (tariff)	
Consumption of edible oils	-0.5112
Production of edible oils	0.397
Import of edible oils	-1.712
Oilseed prices	1.3806
Area	0.2322
Yield	0.2261
Production of oilseeds	0.4583
Production of oil meal	0.273

The critical element, in this context, is that the sensitivity analysis is conducted on the assumption that the tariff elasticity of edible oil price is 1, which is evident from the identity (25) in the system of equations. Table 3 shows that there are two variables revealing high sensitivity to tariff changes, with their elasticities being greater than unity. These variables are tariff elasticity of import of edible oils and tariff elasticity of oilseed prices. The associated signs for each variable are as expected.

3.2. Tariff Values and Effective Tariff Duty

To check the under-invoicing of edible oil imports, the government started fixing tariff values on import of certain edible oils from August 3, 2001. The tariff values were revised from time to time according to variations in international prices. The import duty is imposed on the tariff values. In practice, the tariff value has often diverged from the actual CIF India prices. Hence, the effective duty needs to be estimated. If the tariff value is higher than the CIF India prices, the effective duty will be lower than the import duty. Therefore, in that case, there is a lower protection to the economy than that apparently shown by the actual import duty. If otherwise, there is higher protection to the system. The same can be made out from Table 4 where the effective duty has been estimated by taking into account the import duty on crude palm oil (CPO) and crude soya bean oil (CSO) as in March 2007.

Table 4: Effective import duty as in March 2007

	Import duty	Tariff	CIF ($/MT)	Effective duty
CPO	46.35	447	920	22.52
CSO	40	580	1010	23

Source: Mehta (2008)

The tariff price has not been changed since August 2006 at $447 per tonne for CPO and $580 for CSO, against the CIF price of $920 per tonne for CPO, and $1010 per tonne for CSO. This has reduced the effective duty to 22.5% for CPO and around 23% for CSO. These changes have been made under exceptional circumstances to fight food inflation in an era when international prices of edible oil have been increasing.

3.3. Scenario Analyses

For scenario analyses, we have considered 2005–06, the last year in our study period, as the base case. The following hypothetical scenarios have been conceived with changes in tariff regimes.

- *Base case (2005–06 levels):* In the base case, we have considered that tariffs and all other associated variables are at 2005–06 levels. In 2005–06, with the exception of soya bean oil (whose tariff was fixed at the WTO bound rate of 45%), all edible oils were subjected to high import duties between 75% and 90%. An important feature of this tariff regime relates to a differential duty structure for crude and refined palm oil since December 1999. With CPO constituting 80% of edible oil imports, we assume the tariff rate prevalent for palm oil to be at 80%, which is almost equal to the weighted average of the tariff rates across all oils, with import quantities being the weights.
- *WTO binding tariff rates (300% tariff):* This is the scenario where we have conceived the overall average at 300% tariff, which is the WTO bound rate.
- *Lahiri Committee recommendation (65% tariff):* The Committee on Rationalisation of Customs and Excise Duties on Edible Oils and Oilseeds headed by Ashok K. Lahiri submitted its report on January 2006 and suggested reduction of duty on most crude edible oils to 65%.
- *Zero tariff:* This is the scenario when the tariff or customs duty is zero.

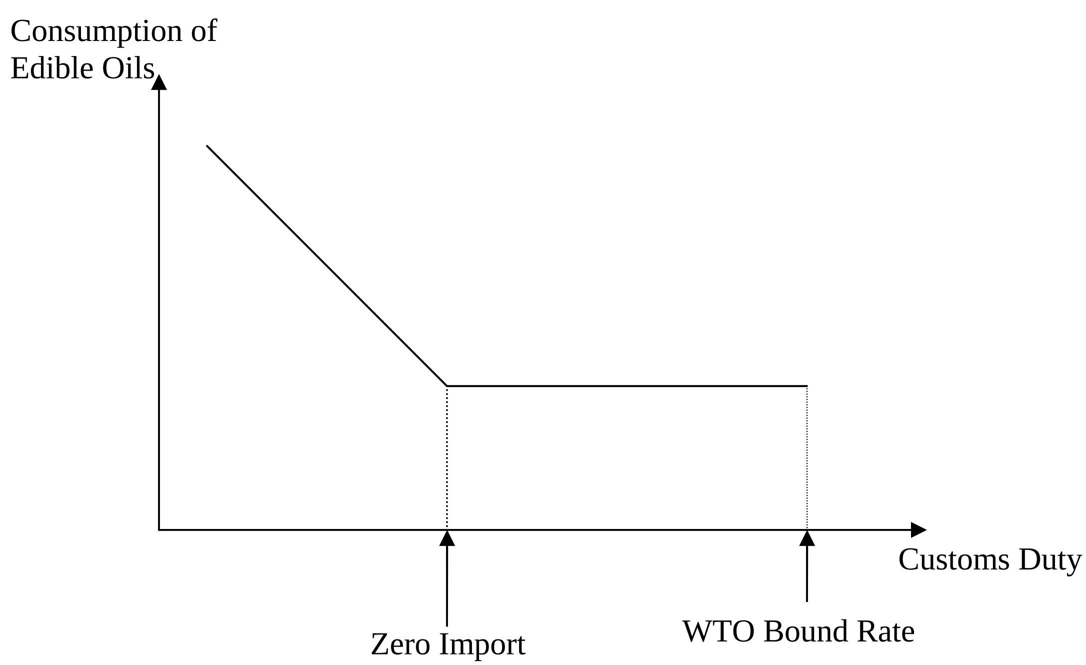
- *50% decline in tariff duty:* This is a scenario where the existing duty is reduced by 50%.
- *Zero import:* In the sensitivity analysis and from the import equation, we have estimated the tariff regime under which imports are zero and the import duty is around 143%.

It can be seen that each of these hypothetical scenarios present an interesting case by themselves. Extreme situations will be revealed by *Zero Import* and *Zero Tariff* scenarios. Two liberalisation scenarios are being taken care of by *50% decline in tariff* (which is a high liberalisation scenario) and *Lahiri Committee Recommendation* (moderate liberalisation scenario) cases. On the other hand, the scenario of *WTO binding* and *Zero Import* will reveal identical results, as argued in the next sub-section.

3.3.1. Identicality of "WTO binding tariff rates (300% tariff)" and "Zero import" scenarios

It is assumed that the relation between customs duty and domestic variables like consumption cannot be linear all through. The likely situation is shown in Figure 3.

Fig. 3: Relation between consumption of edible oils and tariff



What we assume here is that after reaching the critical zero-import point, the consumption and production variables will remain the same (all other things remaining constant) and will no more be sensitive to imports.

Hence, once the import reaches zero, tariffs cannot have any impact on the domestic price of edible oils, and the equilibria will be dictated by domestic demand and supply factors only. Therefore, all other things remaining constant, there will be no difference in the scenarios of *WTO binding tariff rates (300% tariff)* and *zero import*.

3.3.2. Effective Customs Duty in Various Scenarios

As suggested earlier, there is a difference between import duty and effective duty due to the difference in tariff value and CIF prices. Table 5 presents the effective duty that has been used in the various scenarios, considering the CIF prices and the average tariff value across the various edible oils in 2005–06.

Table 5: Effective duty in various scenarios

Scenario	Import duty (%)	Average tariff value ($/MT)	CIF ($/MT)	Effective duty (%)
Base case (2005–06 June-July)	80	450	444.00	81.15
WTO binding (300%)	300	450	444.00	304.32
Lahiri Report recommendation (65%)	65	450	444.00	65.94
Zero tariff	0	450	444.00	0.00
50% tariff reduction	40	450	444.00	40.58
Zero import	143	450	444.00	145.06

In fact, in 2005–06, as the average tariff value was higher than CIF, the rate of protection (for effective duty) was higher than the import duty. Hence, considering that the average tariff value and CIF pertaining to 2005–06 prevail across all the scenarios, we have estimated the effective duty for each scenario. The effective duty will be put to use in sensitivity analysis by using the various elasticity values that we have already obtained.

3.3.3. Various Variables

The variables that have been estimated for each scenario in the sensitivity analysis are:

- Consumption of edible oils
- Production of edible oils
- Import of edible oils
- Oilseed prices
- Area
- Yield
- Production of oilseeds
- Production of oil meal
- Production of wheat (which has been assumed as the competing crop)

In the five scenarios we have examined the changes in the four crucial variables with the base case. The variables are:

1. Change in producer surplus for the processors
2. Change in consumer surplus
3. Change in farmer surplus
4. Change in government revenue

Change in producer surplus: For each scenario we have estimated edible oil production and the associated price, oil meal production and its export price, and oilseed production and its price. Assuming that all the oil meal is exported and that the oilseed produced is going to the processor as input, we have estimated the profit for the processor. Eventually, on the base case we have estimated the change in the producer surplus in each scenario. Similar to the import price of edible oils, the export price of oil meal has been taken as an exogenous variable in our model and fixed at 2005–06 levels (when the export price of oil meal was Rs 6.70 per kg).

Change in consumer surplus: Edible oil consumption and price have been estimated for each scenario with the help of the tariff elasticity of consumption. The total consumer expenditure in each scenario has been obtained as the product of consumption and price of edible oils. The difference between the expenditure in a scenario and the expenditure in the base case signifies the change in consumer surplus in relation to the base case.

Change in farmer surplus: As tariff increases and edible oil prices rise, oilseed prices also rise—the reason for this has already been stated earlier in the theoretical framework. Here we have shown a case where the farmer, without keeping his land barren, actually shifts to competing crops. A basket of competing crops consisting of wheat, cotton, and *jowar* has been used A higher oilseed price, in relation to the competing crops, induces the farmer to bring in more land under oilseeds, thus diverting the land away from the competing crop. Hence, while there is more production of oilseeds, there is an associated opportunity cost of production loss of the competing crop(s) at the all-India level. We have estimated the log-linear regression coefficient of the production on area of the competing crop(s) and used the same estimates for obtaining wheat production across various scenarios [Table A.1]. Now, we estimate the change in production value of oilseeds and the competing crops in each scenario from the base case, and then add them up. Assuming that all costs of oilseed production and the competing crop(s) production remain constant, the sum of the changes in the value of production gives the change in farmer surplus in the concerned scenario, as compared with the base case.

Change in government revenue: The government revenue from the total tariff duties in each case has been estimated by multiplying the total value of imports by the effective tariff rates. The difference between the revenue in each scenario and the revenue in the base case gives us the estimate of the change in government revenue.

As far as farmers are concerned, what they receive is farm-gate prices and not wholesale prices, while we assume that the processors procure oilseeds at wholesale prices. We have taken wholesale prices as weighted averages of wholesale prices of individual oils and oilseeds. Farm-gate prices have been estimated in a similar manner. We have further assumed that farm-gate prices are moving in the same direction as the wholesale price index.

The important issue here is that we assume that farm-gate prices of oilseeds cannot go below the minimum support prices (MSP). Hence, in this model of perfect information across the various markets, whenever farm-gate prices fall below the MSP, the procurement will be at MSP only. Under such circumstances, by taking the proportional mark-up of wholesale prices over farm-gate prices in the base case, we have estimated the wholesale prices of edible oils for these scenarios.

The estimates of the various economic variables in the various scenarios are shown in Table 6.

Table 6. Estimates of various variables in various scenarios

Tariff regime	**Base case (2005–06 levels)**	**WTO binding (300%)**	**Lahiri Report Recommendation (65%)**	**Zero tariff**	**50% tariff reduction (from base case)**	**Zero import**
Consumption (000 tonnes)	12031	7187.68	13184.17	18181.25	15106.12	7187.68
Production (000 tonnes)	6318	8293.24	5847.70	3809.75	5063.88	8293.24
Import (000 tonnes)	4905	0.00	6479.51	13302.36	9103.68	0.00
Area (million hectares)	27.86	32.95	26.65	21.39	24.63	32.95
Yield (kgs/ hectare)	1004	1182.77	961.44	777.00	890.50	1182.77
Production of oilseeds (million tonnes)	27.98	38.08	25.58	15.16	21.57	38.08
Production of oilmeal (000 tonnes)	14111	17144.69	13388.69	10258.70	12184.85	17144.69
Price of edible oils (Rs/ kg)	50.5	68.32	46.26	27.88	39.19	68.32
Oilseed price (Rs/ kg)	16.5	34.44	14.94**	14.94**	14.94**	34.44
Farm-gate price of oilseeds	13.25	25.00	12.00*	12.00*	12.00	27.66

*MSP
** Wholesale prices when farmers get MSP.

Hence, under *WTO binding* and *zero import*, consumption of oils declines, production of oils increases, and area and yield of oilseeds also increase (thereby marking a rise in production of oilseeds). An increase in oil production is also associated with an increase in oil meal production. Wholesale prices of oils and oilseeds, as also the farm-gate prices of oilseeds, increase. The other three scenarios that reveal tariff liberalization compared with the base case reveal diametrically opposite movements of the variables. The reasons have already been explained in Section 2.

The changes in the crucial variables in monetary terms have been estimated in Table 7.

Table 7: Change in surplus generated in the economy in various scenarios with cultivation shifting to competing crop (s) (in Rs billion)

	WTO Binding (300%)	**Lahiri Report Recommendation (65%)**	**Zero Tariff**	**50% tariff reduction**	**Zero Import**
Change in producer surplus for processors	-413.60	26.09	-3.49	5.85	-413.60
Change in consumer surplus	-108.74	4.33	72.70	6.87	-108.74
Change in government's revenue	-97.21	5.70	-97.21	-5.60	-97.21
Change in farmers' surplus	509.06	20.49	28.06	23.18	509.06
System-wide surplus change (in Rs. billion)	**-110.49**	**56.61**	**0.07**	**30.30**	**-110.49**

As can be seen in Table 7 the economy tends to lose the maximum when there is no import of oil, which is prevalent in both “zero import” and “WTO binding” scenarios. In the “zero tariff” scenario, while the economy tends to gain the maximum in the context of producer surplus for processors, consumer surplus, and farmer surplus under the shifting cultivation case, there is a substantial loss in government revenue from tariff. Now, one might get intrigued by the maximum rise in producer surplus for processors even when the industry is not protected under a “zero-tariff” regime. This is because of a more than proportional decline in the input (oilseed) prices due to a decline in tariffs, as evidenced by greater unity elasticity (Table 3). As a result, though the total revenue for the processing industry might diminish, the profits increase. The Lahiri Committee recommendations are that tariffs be brought down to around 65% on an average, while the partial equilibrium system reveals the maximum increase in the total surplus of the economy for both shifting and non-shifting cultivation. When there is a 50% decline in tariffs from 80% in 2005–06 to 40%, the system can generate a surplus of Rs 30.3 billion. This is obviously lower than the Lahiri Committee recommendations; yet, it is clear that the small increase in surplus is solely due to lower governmental revenue.

There are a few things that are amply clear from this exercise. First, a lowered tariff regime will always help increase the processing margin of edible oil producing firms. Second, greater the tariff liberalization, higher is the consumer surplus. Third, a greater tariff liberalization associated with farmer movement toward more profitable crops will increase the farmer surplus and help increase the overall economic surplus. Fourth, the government revenue takes a cut due to tariff reduction, and hence it is important for the government to choose an optimum level of tariff that will be beneficial for the economy as a whole. Given the scenarios, the best case arises for the Lahiri Committee recommendation, where the total potential surplus generated in the economy is the maximum.

3.4. Context of Individual Oils

The obvious question is: What will be the scenario in each case for individual oils? To analyze that, we have considered individual edible oils for consumption, import, and production proportions, and analyzed the price behaviour and the conditions of the associated oilseeds. However, in some extreme situations, even these proportions change. For example, under zero imports, there cannot be consumption of imported oils, and consumption will be confined to domestic production only. In that case, all consumption will have to be derived from domestically produced oils and get distributed among the oils in the existing proportion. On the other hand, the identity that has been assumed here is that the total consumption is equal to domestic production and import of edible oils.

Let us first look at the consumption of various edible oils as given in Table 8. In the cases of “zero import” and “WTO binding,” we assume that import of palm oil will be zero, and hence the proportion of consumption of imported oil (palm oil and soya bean oil make up 62% and 35% of imports respectively) will be distributed among the other oils. On the other hand, peanut oil (or groundnut oil) will be negatively affected by the zero-tariff condition and confined to production only, which will witness a major decline.

Table 8: Consumption of various edible oils in various scenarios **(in '000 tonnes)**

Tariff regime	Base case (2005–06 levels)	WTO binding (300%)	Lahiri Report Recommendation (65%)	Zero tariff	50% tariff reduction (from base case)	Zero import
Palm oil (a)	3248.37	47.65	3812.80	6956.80	5022.03	47.65
Peanut oil (b)	1564.03	1609.17	1385.18	1048.95	1255.86	1609.17
Rapeseed oil (c)	2285.89	2375.76	2044.41	1548.16	1853.54	2375.76
Soya bean oil (d)	2887.44	1084.29	3074.12	4636.77	3675.14	1084.29
Total of four oils (e) = (a)+(b)+(c)+(d)	9985.73	5116.87	10316.50	14190.68	11806.57	5116.87
Others (f)	2045.27	1789.42	2934.67	4347.88	3478.21	1789.42
Consumption (g) = (e) +(f)	12031.00	6906.29	13251.17	18538.57	15284.78	6906.29

Table 8 shows that in the WTO binding and zero import scenarios, the consumption of palm oil records a major decline and gets confined to domestic production only. The decline is also noted in soya bean oil to the extent of the loss in its imports. The consumption pattern shifts substantially toward domestically produced oils, and hence the consumption of peanut and rapeseed/mustard oils increases. As has been noted earlier, these scenarios will be characterized by a decline in overall edible oil consumption.

On the other hand, consumption of both imported and domestic oils increases in the other three scenarios. However, under a zero-tariff regime, we firmly believe that the consumption of peanut oil cannot be zero, and hence there will be production due to the existing demand. Of course, production will decline and be the least in all the scenarios (Table 9).

Table 9: Production of various edible oils in various scenarios **(in '000 tonnes)**

	Base case (2005–06 levels)	**WTO binding (300%)**	**Lahiri Report recommendation (65%)**	**Zero tariff**	**50% tariff reduction (from base case)**	**Zero import**
Cottonseed oil	803.26	982.21	760.65	576.01	689.63	982.21
Peanut oil	1462.77	1788.65	1385.18	1048.95	1255.86	1788.65
Rapeseed oil	2158.92	2639.90	2044.41	1548.16	1853.54	2639.90
Soya bean oil	986.45	1206.22	934.13	707.39	846.92	1206.22
Coconut oil	382.37	467.55	362.09	274.20	328.28	467.55
Sunflower seed oil	481.01	588.18	455.50	344.93	412.97	588.18
Palm oil	43.22	52.84	40.92	30.99	37.10	52.84
Total production	6318	7725.55	5982.87	4530.64	5424.32	7725.55
Note: Production shares in 2005–06 are applied						

The import scenarios in Table 10 show that there will be no imports under WTO binding and zero imports. Palm oil and soya bean oil imports will clearly double in a zero-tariff regime, as expected.

Table 10: Import of various edible oils in various scenarios **(in '000 tonnes)**

	Base case (2005–06 levels)	**WTO binding (300%)**	**Lahiri Report recommendation (65%)**	**Zero tariff**	**50% tariff reduction (from base case)**	**Zero import**
Palm oil	3044.04	0.00	3771.87	6925.81	4984.92	0.00
Soya bean oil	1727.05	0.00	2139.99	3929.39	2828.22	0.00
Sunflower oil	112.82	0.00	139.79	256.68	184.75	0.00
Coconut oil	21.09	0.00	26.13	47.99	34.54	0.00
Total import	*4905.00*	*0.00*	*6077.79*	*11159.86*	*8032.43*	*0*

On the other hand, the area distribution of the various oilseeds is given in Table 11.

Table 11: Area under oilseeds in various scenarios (in '000 hectares)						
	Base case (2005–06 levels)	**WTO binding (300%)**	**Lahiri Report recommendation (65%)**	**Zero tariff**	**50% tariff reduction (from base case)**	**Zero import**
Soya bean	7.708	9.12	7.37	5.92	6.81	9.12
Groundnut	6.736	7.97	6.44	5.17	5.95	7.97
Sunflower	2.34	2.77	2.24	1.80	2.07	2.77
Rapeseed and Mustard	7.277	8.61	6.96	5.59	6.43	8.61
Others	3.799	4.49	3.63	2.92	3.36	4.49
Total	**27.86**	**32.95**	**26.65**	**21.39**	**24.63**	**32.95**

3.6 Limitations of the Framework and the Estimates

The estimates obtained here for various scenarios are, indeed, suggestive enough for policy implications. Yet, one needs to point to the limitations of the model and of the associated estimates. Most of these limitations have arisen because of a few assumptions that have been considered for convenience of analysis, while the rest have arisen from data constraints. Some of these limitations are:

First, we assume in the model that export price of oil meal is an exogenous variable and determined by the dynamics of international trade. In the "zero-tariff" case in our scenario analysis, we find that production of soya bean oil has diminished. However, in reality in 2008 we find that the area under soya bean has increased as import tariffs have come down drastically. Now, the increase in area under soya bean in the present circumstances can be attributed to an increase in export demand for soya meal, and not really for soya oil. In our scenario analyses, we are only concerned with changes in tariffs, keeping all other variables constant. While our econometric model can account for the reasons of the recent soya bean area increase, the sensitivity analysis has not taken into account the change in export price of oil meals, but has retained it at 2005–06 levels because the focus of the entire analysis was to solely look at the impact of tariff change, while controlling all other impacts.

Second, three competing crops have been assumed, which are merely indicative, yet representative of the competing crops complex. This is a simplistic assumption to render lucidity to the framework as also to our analysis.

Third, the tariff scenarios are also approximations of the actual tariffs recommended, but definitely a pointer to the way in which tariff regimes should move.

Fourth, in this framework we have not considered social and normative issues related to self-sufficiency of foodgrains. Rather, this analysis is more concerned with mere objective issues of the levels of tariff or the tariff regime that can bring maximum benefit to the economy. As has been the fundamental assumption in this analysis, the concerns related to wage levels and labour market have not been considered here. In that sense, the social opportunity cost of labour in the domestic industry and other associated issues have been kept out of the analysis. On a similar note, the analysis has not touched upon the micro-level distributional or re-distributional impacts, and eventually, aspects of poverty as well.

4. Policy Recommendations of the Study

The recommendations from this study are simple. We are neither in a position to recommend extreme scenarios like high tariffs where imports will be zero, nor are in a position to advise zero tariff. It is clear that none of these extreme cases will prove beneficial to the economy as a whole, though zero tariff is more advantageous than zero imports. This is because the consumer surplus and processing margins will definitely be better in a zero-tariff scenario, as compared with zero import or the WTO binding. The impact on government revenue will be severe in both cases.

In this context, any movement toward liberalization of tariffs will be more beneficial to the edible oil producers and consumers. It might even prove beneficial to farmers if they choose to cultivate the right competing crop substituting oilseeds, and the government also creates supportive mechanisms for such competing crops by allowing for a more favourable minimum support price regime that can help in making a favourable market price for the competing crop. We would rather recommend that the tariff rates be in line with the Lahiri Committee recommendation, which is emerging as the best case in our analyses. An average tariff rate of 65% marks a moderate liberalization of tariffs from the base of 2005–06 at an average rate of 80%. This shows an improvement in all the variables—even in government revenue from customs duty that is based on the nature of tariff elasticity of imports. Moreover, in all cases, an average rate of 65% customs duty reveals the maximum increase in surplus of all the scenarios. This might also be true for water use, if the farmers shift to crops having lower crop-water requirements.

In the process, the study has brought about two new dimensions to the policy debate on liberalization of tariffs on edible oils. First, the analyses show that tariff liberalization has the potential of making the edible oil industry more cost-efficient as the input costs of oilseeds diminish. Second, there is no doubt that there should be tariff liberalization for edible oils. Yet, to obtain the best results, one need not take the extreme route of zero tariffs.

References

Ahluwalia, M.S. (1976): "Income Distribution and Development", *American Economic Review,* 66 (2), 128-35.

Chand, R. (2002): '*Trade Liberalization, WTO and Indian Agriculture*', (New Delhi Mittal Publications).

Chand, R., D. Jha and S. Mittal (2004): 'WTO and Oilseeds Sector: Challenges of Trade Liberalization', *Economic and Political Weekly*, February 7, 2004, pp 533-537.

Dohlman, E., S. C. Persaud, and M. R. Landes (2003): "India' Edible Oil Sector: Imports Fill Rising Demand", OCS090301, United States Department of Agriculture, Economic Research Service.

Ghosh, N. and J. Bandyopadhyay (2009-forthcoming): "A *Scarcity Value* based Explanation of Transboundary Water Disputes in Cauvery Basin", *Water Policy.*

Gulati, A., and T. Kelley (1999): *Trade Liberalization and India Agriculture*, (New Delhi: Oxford University Press).

Hashim, D. A. (2008): "Indian Oilseed Products Industry: Impact of Tariff Reforms on Sources of Output Growth", *Commodity Vision,* 1(4), 86-96.

IBRD (1969): *Estimation of Long-run Changes in Domestic Demand for Food in LDC's.* (International Bank for Reconstruction and Development).

Kiresur, V.R., S.V.R. Rao and D.M. Hedge (2001): "Improved Technologies in Oilseeds Production – An Assessment of their Economic Potentials in India", *Agricultural Economic Research Review*, 14(2), 95-108.

Lahiri Committee Report (2006): *Report of the Committee on Rationalization of Customs and Excise Duties on Edible Oils and Oilseed*, Ministry of Finance, Govt. of India.

Mehta, B. V. (2008): "India's Vegetable Oil Market: Fundamentals and Projection", *Commodity Vision*, 1(3), 56-61.

Murthy, K. N. (2001): "Inter-Regional Variation in Consumption Patterns in Semi-arid Tropical India: A Demand System Approach", Indian Statistical Institute, Delhi, *Discussion Paper*.

Pavaskar, M and A. Kshirsagar (2008): "Paradox in India's Trade in Oilseed Products", *Commodity Vision*, 1(3), 48-54.

Persaud, S. and M. R. Landes (2006): *The Role of Policy and Industry Structure in India's Oilseed Markets*, United States Department of Agriculture, Economic Research Report, Number 17, April.

Solvent Extractors' Association of India: *Various Annual Report*, SEA, Mumbai.

Srinivasan, P. V. (2005): *Impact of Trade Liberalisation on India's Oilseed and Edible oils Sector*, Report prepared for IGIDR-ERS/USDA Project: Indian Agricultural Markets and Policy, Indira Gandhi Institute of Development Research, February 2, Mumbai.

World Bank (1997): *India-The Indian Oilseeds Complex: Capturing Market Opportunities*, Report No. 15677-IN, Rural Development Sector Unit, South Asia Region, 31 July.

Appendix

Table A.1: Regression results for area elasticity of production of competing crop (log-linear, zero-intercept function)

Dependent: *prod_comp*
Independent: *time, area_comp, no constant*

Source	***SS***	***DF***	***MS***
Model	*369.097*	*2*	*184.55*
Residual	*0.0513*	*18*	*0.0028*
Total	***369.15***	***20***	***18.46***

Prod_comp	***Coeff.***	***Std. Err.***	***t***	***P >*** $\lvert t \rvert$
time	*0.1799*	*0.0021*	*8.71*	*0.00*
area_comp	*1.1156*	*0.0067*	*165.99*	*0.00*

Number of obs. = 20
F (2, 18) = 64712.54
R-sqr. = 0.9999
Adj. R-sqr = 0.9998

Table A. 2: Monetary values of critical variables in various scenarios

Variables	**Base case (2005-06 Levels)**	**WTO binding (300%)**	**Lahiri Report recommendation (65%)**	**Zero Tariff**	**50% tariff reduction**	**Zero Import**
Consumer Expenditure (in Rs. Billion)	607.57	491.03	609.88	506.84	591.99	491.03
Production of Edible Oils (in Rs. Billion)	319.06	566.56	270.50	106.20	198.45	566.56
Value of Production of Oilseeds (Wholesale Prices of Delhi Market in Rs. Billion)	461.67	1311.38	382.19	226.49	322.30	1311.38
Production of Oil meals (Rs. Billion)	94.54	114.87	89.70	68.73	81.64	114.87
Value of Competing Crop Production (Rs. Billion)	817.28	745.12	901.60	1034.20	952.38	745.12
Value of Production of Oilseeds (Farm-gate Prices in Rs. Billion)	370.74	951.96	306.91	181.88	258.82	1053.08