Welfare Impact of Trade Liberalization in India: The Case of Edible Oil

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Abstract:- The welfare impact of the reduction in trade barriers is always an important issue for the policy makers as well as for the economists. In this paper, we have analyzed the impact of import liberalization of edible oil in India on consumers as well as on the wage earnings of the agricultural labourers. In early 1990s, during trade liberalization, India started importing palm oil which was much cheaper compared to the domestic edible oils produced in India. Therefore, palm oil became a part of the consumption basket of an Indian consumer and the change in its price started influencing the domestic economy. Suppose price of palm oil increases. Since the domestic consumers are consuming it, they are hurt by this price increase. But there is another side of the story. If we consider domestic edible price as some average of the price of locally produced edible oil and imported (palm) edible oil, an increase in palm oil price put an upward pressure on the domestic edible oil prices. The increase in the domestic edible oil price induced by the increase in the foreign (palm) oil price might have increased the domestic edible oil production and subsequently the domestic oilseeds production since oilseed is an input to edible oil production. As a result of it, wage rate of the agricultural labourers involved in oilseed production increases. On the other hand, if there is a decrease in the palm oil price, wage rate declines. The interesting question is whether this wage effect for oilseed production is large enough such that the overall agricultural wage rate gets affected. In this paper, we have answered this question using econometric techniques. The impact of the increase in palm oil price on overall agricultural wage rate turns out to be positive & significant. But the effect is significantly higher in coastal states compared to non-coastal states. Although no significant difference is noticed between the initially high & low oilseed producing areas. Later we have also shown that the increase in the domestic edible oil price due to the increase in the palm oil world price or tariff rate is significantly higher in coastal states compared to the non-coastal states . This provides the explanation for the higher wage effect in the coastal states. The findings of this paper supports the earlier literatures which claim that pass-through effect of reducing trade barrier is higher in coastal regions compared to the non-coastal regions. Finally, we investigate magnitude of the consumption effect relative to the wage effect. In coastal states, the average wage effect turns out to be larger relative to the average consumption effect . But the overall consumption effect may be larger because there are more consumers than agricultural labourers. For non-coastal states, the average consumption effect turns out to be larger than the average wage effect.

1. Introduction

Edible oil was one of the commodities that India started importing at the advent of trade liberalization in the early 1990s'. Palm oil constitutes the major share of edible oil import in India. India imports palm oil because of its cheaper world price compared to the other edible oil. Moreover the major exporting countries of palm oil are Indonesia and Malaysia which are not very distant from India. Therefore the transportation cost of import is less.

Import of edible oil in India has two counteractive effects. Suppose, price of palm oil increases. Since the domestic consumers are consuming it, they are hurt by this price increase. But there is another side of the story. If we consider domestic edible price as some average of the price of locally produced edible oil and imported(palm) edible oil, an increase in palm oil price put a upward pressure on the domestic edible oil prices. The increase in the domestic edible oil price induced by an increase in the foreign (palm) oil price might have increased the domestic edible oil production and subsequently the domestic oilseeds production since oilseed is an input to edible oil production. As a result, wage rate of the agricultural labourers involved in oilseed production increases. On the other hand, if there is a decrease in the palm oil price, wage rate declines. The interesting question is whether this wage effect for oilseed production is large enough such that the overall agricultural wage rate gets affected. This is a valid question because India almost achieved self sufficiency in oilseed production in the early 1990s due to the Technology Mission for Oilseeds or 'Yellow Revolution' which started from mid 1980s. In early 90s, the share of oilseed production in total agricultural production was 18% and the share of area for oilseed production was 14%(Gulati et al,1996) in total area for agricultural production. These shares are quite high. Therefore, it is quite interesting to investigate that whether importing palm oil affects the wage rate of the agricultural labourers.

We have done a district level panel data study where we have investigated the effect of a percentage increase in the world price or tariff rate of palm oil on the wage rate of the agricultural labourers. The impact of the increase in the world price or tariff rate of palm oil on overall agricultural wage rate turns out to be positive & significant. Although the share of oilseed production in total agricultural production was quite high in the early 90s, no significant difference in the wage effect is noticed between initially(early 90s') high oilseed producing districts and the initially low oilseed producing districts. But the wage effect turns out to be significantly larger in coastal states compared to the non-coastal states . Later we have also shown that the increase in the domestic edible oil price due to the increase in the palm oil world price or tariff rate is significantly higher in coastal states compared to the non-coastal states . There are literatures (Nicita(2009), Marchand(2012)) that empirically show that pass-through rate of the change in tariff rate for a commodity is higher in places near the sea ports or in the coastal regions. As the commodities travel to the interior regions of a country, pass-through rate falls because of transportation cost, middle men mark up etc. Our result supports their finding.

Finally, we investigate magnitude of the consumption effect relative to the wage effect. In coastal states, the average wage effect turns out to be larger relative to the average consumption effect . But the overall consumption effect may be larger because there are more consumers than agricultural labourers. For non-coastal states, the average consumption effect turns out to be larger than the average wage effect.

There is a vast literature that discusses the welfare effect of the policy induced price change(Deaton(1989), Ravallion(1990), Friedman & Levinsohn(2002), Porto(2006), Nicita(2009), Marchand(2012)) . This paper follows the same strand of literature in a new context i.e the import liberalization of edible oil in India. There are several places where our methodology and channel of thoughts differ from the earlier literatures.

2. Review of Literature

Evaluating the impact of exogenous/policy induced price change on welfare is always an important issue for the policy-makers as well as for the researchers. There is a vast literature that discusses this issue at length.

Deaton(1989) evaluated the impact of rice price increase on both consumers and producers in Thailand. Using a compensating variation measure of welfare change, he showed that increase in the rice price has a beneficial effect for all income levels. But for the middle income households, the gain is the maximum. He also showed that the welfare effect varies across regions.
Deaton did not analyze the impact of price change on wages. Ravallion(1990) considered the price induced wage responses in welfare calculation. He studied the impact of rice price increase on the agricultural wage rate in rural Bangladesh.

Friedman & Levinsohn(2002) analyzed the welfare effect of inflation on Indonesian households that occurred due to Asian currency crisis in 1997. In their welfare analysis, they took care of the substitution effect of the consumers as price increased. They estimated a demand system in order to estimate the substitution effect. In a similar study, Robles & Torero(2010) investigated the welfare impact of food price increase on the Latin American countries during the global financial crisis in 2007-08.

Porto (2006) analyzed the distributional effects of trade policy for Argentina using the household survey data. He considered the impact of tariff reduction on the domestic prices of traded goods. If the prices of traded goods get affected, wage and the prices of non-traded goods also change. Using the compensating variation measure, he assessed the welfare impact of trade policies on households across the entire range of the income distribution. He found that the consumption effect through the change in the domestic prices of traded goods favoured the rich but the combined effect from consumption and labour income was pro-poor.

Porto(2006) ignored the important issue of pass-through of tariff reduction to the interior of a country. He assumed perfect pass-through. Nicita(2009) extended Porto's approach by allowing for imperfect domestic price transmission. He did his analysis on the distributive effects of tariff liberalization in Mexico. He found that urban areas and the Mexican states which are very close to the US border gain more from tariff reduction due to imperfect pass-through of tariff reduction. It implies that locationally advantageous regions reap the fruits of trade liberalization more.

Marchand (2012) applied Porto's framework to investigate the consumption effect of trade liberalization for India using the NSS data. She also considered the impact on wages. Although she followed Porto's methodology, she considered imperfect price transmission as well(following Nicita's approach). She found a pro-poor effect of tariff reform through the change in the domestic prices of tradable goods. The pass-through elasticities for the rural areas turned out to be smaller compared to the urban areas because of greater market imperfection in rural areas & higher transportation costs.

This paper utilizes the ideas of these earlier literatures in a new context. We have analyzed the welfare effect of import liberalization of edible oil in India through both consumption and wage channel. Although this paper is based on the earlier literature, methodologies and way of thinking differs in several places.

3. Motivation

Edible oil is an important commodity in the consumption basket of a consumer. 6%-7% of the total food expenditure comes from edible oil (this figure is from the recent(2011-12) nationally representative consumer expenditure survey(NSS) of India).

Since, late sixties, domestic edible oil production/supply lagged behind domestic edible oil demand in India(Gulati et al,1996). India heavily depended on import in order to satisfy the domestic demand. But imports at that time were usually done by the Government(State Trading Corporations). Private traders/importers were not allowed to participate. In order to increase production, the Government of India set up Technology Mission for Oilseeds(TMO) in 1986. As a result of it, domestic oilseed production increased from around 11 million tones to around 25 million tonnes in the early nineties(Srinivasan,2005). This increase in oilseed production is also called as the 'Yellow Revolution'. The increase in production occurred because of the adoption of new varieties of oilseeds, expansion of areas under oilseed production and the improvement in irrigation facilities. In early nineties, share of oilseed production in total agricultural production was 18%(IFPRI database on agricultural production) and the share of area devoted to oilseed production was 14% of the total area(Gulati et al, 1996).

Even in such a situation when production of oilseed has increased, India liberalized edible oil import in early nineties(1993-94). The main reason for importing edible oil was the comparative advantage of foreign edible oil relative to domestic edible oil(Gulati et al,1996). The cheapest among all the foreign edible oil was palm oil. Furthermore; the major palm oil producing countries are Indonesia & Malaysia which are not very far from India. Therefore, the transportation cost of importing palm oil is low as well.

The table below shows the world price of palm oil compared to other edible oils in early nineties and onwards.

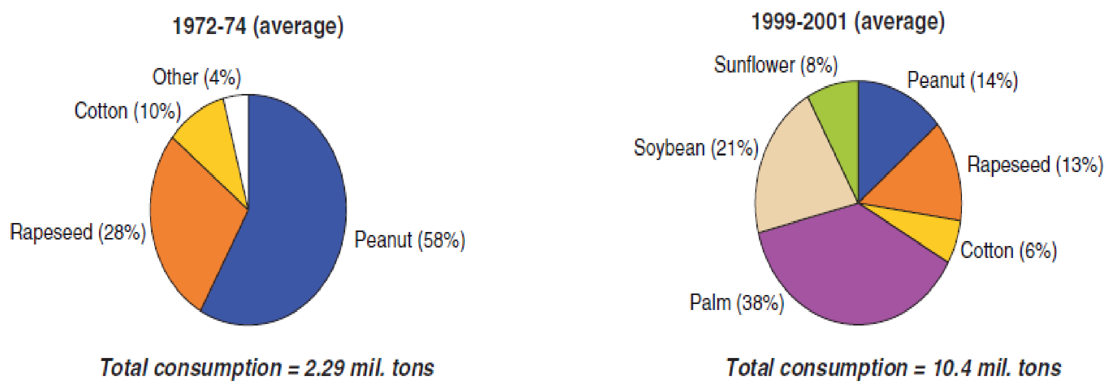
Table 1 (Price is measured in $/ton)

Year	Soybean Oil	Palm Oil	Sunflower Oil	Rapeseed Oil
1993-94	580	473	615	610
1999-2000	369	337	388	391
2001-02	413	357	560	483

Source: USDA(2003) (These figures are taken from an article by Dohlman, Persaud & Landes)

Palm oil constitutes almost two third of the total edible oil import in India(Ghosh,2009). There are evidences that the palm oil consumption has increased in India after trade liberalization (see figure1).

Figure1



Source: Production, Supply and Distribution database, USDA.

Some guess about the increased consumption of palm oil can also be made from the NSS consumer expenditure data. In 1983-84, 90% of the total domestic edible oil consumption of the Indian households came from four edible oils (groundnut, mustard ,vanaspati & coconut). The other edible oils constitute only 10% of the total edible oil expenditure. In 2009-10 , the budget share of other edible oils in the total edible oil consumption has increased to 37% (for all India). In urban areas the share has increased to 47% (our own calculation from the NSS data). The 'other edible oil' category includes palm oil. NSS consumer expenditure surveys do not provid information on palm oil consumption at the household level in the recent rounds (after 1993-94). In 1993-94 NSS survey, the consumption for palm oil was reported and the share of palm oil in the total edible oil consumption was only 0.04%. Therefore, the recent increase in the share of 'other edible oil' can be indicative of the increased consumption of palm oil.

Nicita(2009) considered the domestic price of any commodity as the weighted average of the price of locally produced variety and the price of imported variety. The weights are the value share of each of these varieties(local & imported) in the total value of consumption for that commodity. Following Nicita's approach, we can write down the domestic edible oil price as a weighted average of the price of local variety and imported variety.

$$P_{eoil} = PP_{eoil}^{\alpha} \, PM_{eoil}^{1-\alpha}$$

PP_{eoil} is the price of the locally produced edible oil and PM_{eoil} is the price of the imported edible oil (after being converted to local currency). α is the weight which lies between zero and one. P_{eoil} is the domestic price of edible oil.

When α equals one (i.e in autarky), domestic price of edible oil(price paid by the consumers) is completely determined by local producer's price i.e

$$P_{eoil} = PP_{eoil}$$

Under trade liberalization(i.e α lying between zero and one), domestic consumer's price is jointly determined by the local producer's price and the imported price. Now suppose we assume that imported edible oil price is less than the locally produced edible oil price i.e

$$PM_{eoil} < PP_{eoil} - (1)$$

Raising the power of both sides in equation (1) by the fraction (1-α) , we get

$$PM_{eoil}^{1-\alpha} < PP_{eoil}^{1-\alpha}$$

Therefore

$$P_{eoil} = PP_{eoil}^{\alpha} PM_{eoil}^{1-\alpha} < PP_{eoil}^{\alpha} PP_{eoil}^{1-\alpha} = PP_{eoil} - (2)$$

So, if imported edible oil is cheaper compared to the locally produced edible oil and free trade is allowed, then the domestic edible oil price under free trade will be less compared to a situation with no trade/autarky.

When cheaper foreign (like palm oil for India) is imported, domestic price of edible oil falls. Therefore, the consumers get benefitted. But there is another side of the story. Because of the trade induced reduction in the domestic edible oil price, there might be a decline in the domestic edible oil production. Since oilseed is an input to edible oil production, it might cause a reduction in the demand for oilseeds by the edible oil producerswhicht might have created a downward pressure on the oilseed price. Therefore, demand for agricultural labourers by the oilseed producers decrease. The labour demand curve shifts downward and the equilibrium wage rate for the agricultural labourers involved in oilseed production decreases.

So far, we have explained that what will happen when a new &cheaper imported oil becomes available to consumers. But after the imported oil enters, it becomes a part of the consumption basket. Therefore, the change in the price of that imported oil affects the domestic price of edible oil and consequently the wage rate in oilseed production in the same way as argued earlier.

Recall the expression for domestic edible oil price written in the last page i.e

$$P_{eoil} = PP_{eoil}^{\alpha} PM_{eoil}^{1-\alpha}$$

Therefore, when the price of imported oil (i.e PM) increases, the domestic edible oil price rises and the wage rate in oilseed production goes up. Similarly, if PM decreases, there is a fall in the domestic edible oil price as well as the wage rate in oilseed production.

In the paper, we have considered the impact of the change in the price of imported palm oil on domestic edible oil price and hence on wages. But the important question is whether the wage effect in oilseed production is large enough such that it affects the wage rate for the entire agricultural production. Our paper investigates this question. In the next step, we go to analyze that if the change in palm oil price affects the agricultural wage rate, does the effect uniform throughout the country or it varies across regions. Determining the magnitude of the wage effect becomes our next objective. In the final step of our analysis, we combine the consumption and wage effect together and find out the larger one in terms of magnitude.

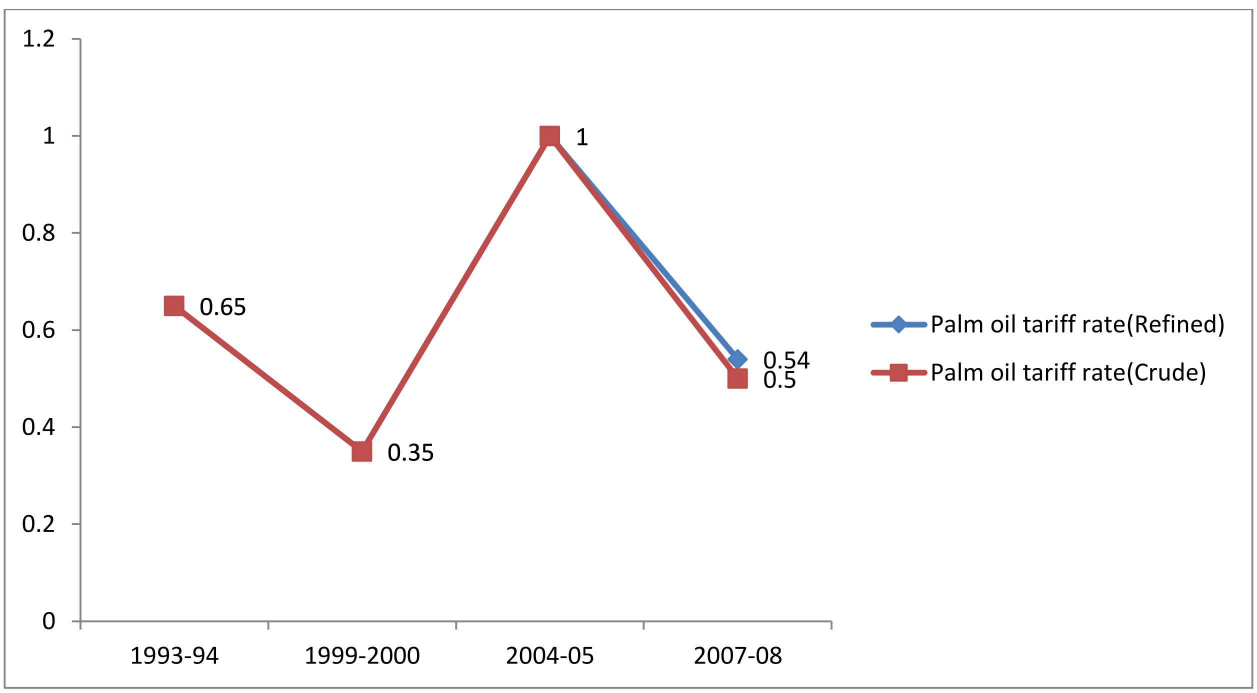
Since production of palm oil in India is negligible, the domestic price of palm oil in India is determined by the world price and the ad-valorem tariff rate for palm oil. Therefore,

$$P_{palmeoil} = P^{*}_{palmoil}\left(1 + \mu_{palmoil}\right)$$

Where $P_{palmeoil}$ is the domestic price of palm oil and the $P^{*}_{palmoil}$ & $\mu_{palmoil}$ are the world price and ad-valorem tariff rate on palm oil respectively.

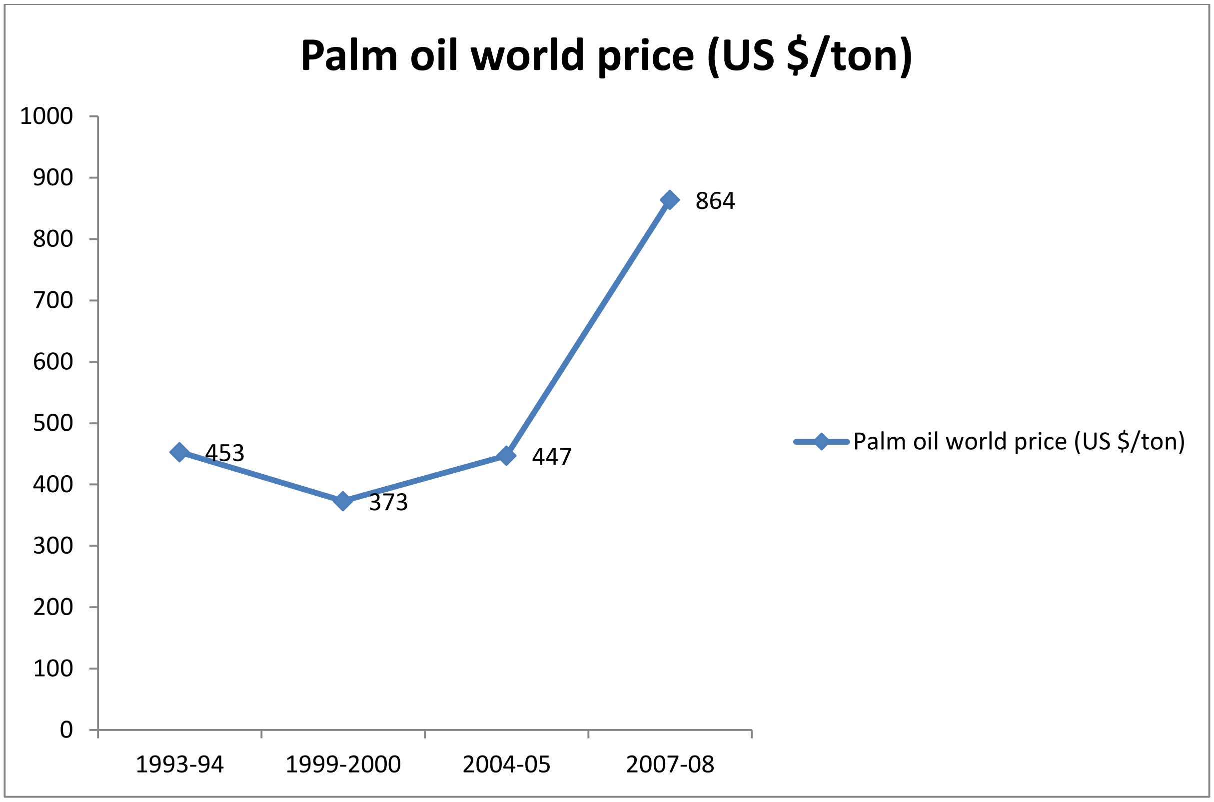
The following figures show the change in the ad-valorem tariff rate and world price of palm oil over time.

Figure 2



Source:- WITS Database, World Bank

Figure 3

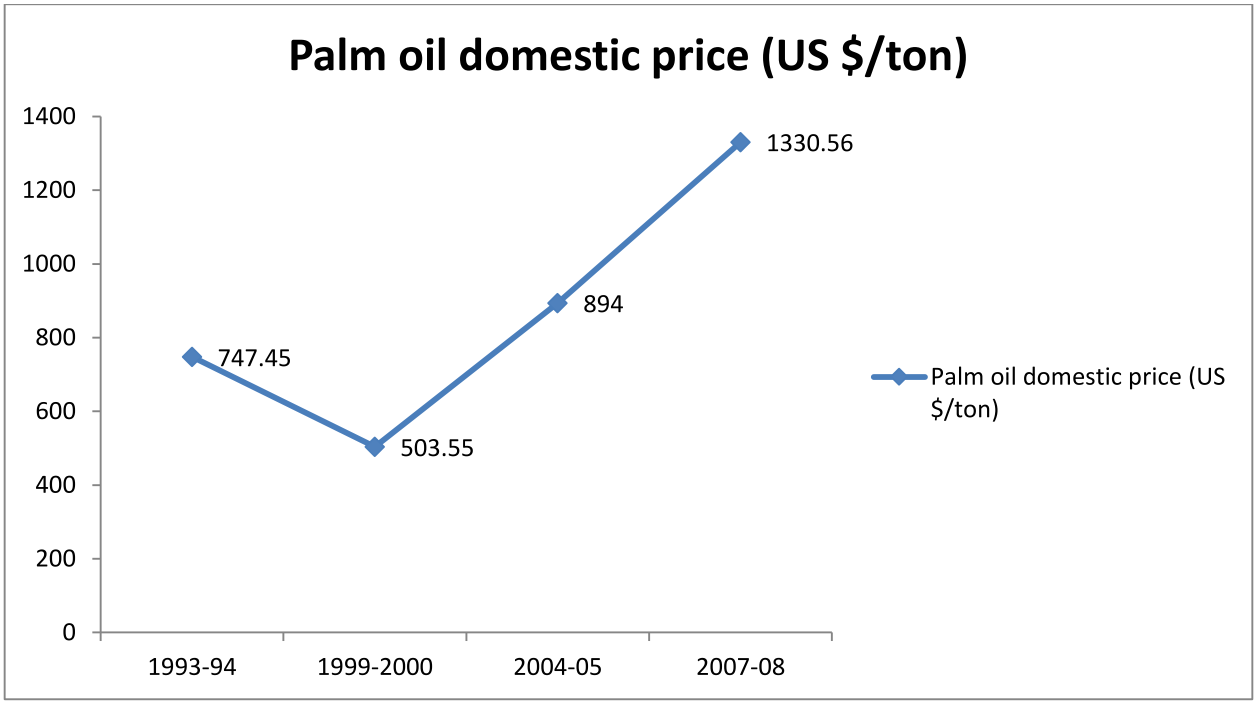


Source:- World Bank Commodity Price Data

The ad-valorem tariff-rate of palm oil has declined from 65% to 35% between 1993-94 & 1999-2000. Between 1999-2000 & 2004-05, it has increased to 100% and then again declined to 50% in 2007-08. The world price of palm oil shows a decline between 1993-94 & 1999-2000 and thereafter show an increase.

Figure 5 exhibits the change in the domestic palm oil price over time. As mentioned earlier, it is nothing but the world price multiplied by one plus ad-valorem tariff rate.

Figure 5



Therefore, just like the palm oil world price, domestic price of palm oil decreased between 1999-2000 & there after it increased.

The figures below show that the relative price of edible oil (deflated by the consumer price index) shows similar pattern over time as exhibited by palm oil price.

Figure 6

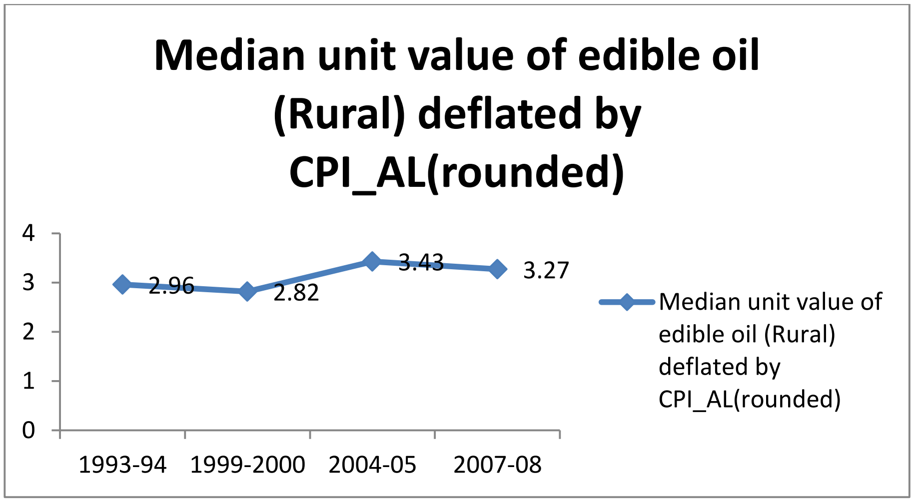
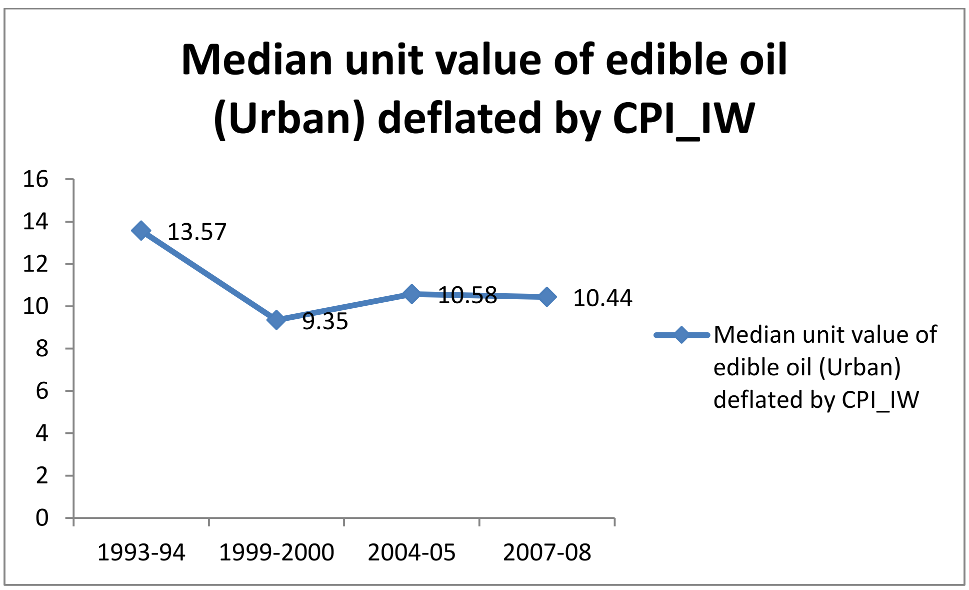


Figure 7



The relative price of edible oil in each of these years is constructed by deflating the median unit value of edible oil (obtained from the Nationally Representative Consumer Expenditure Survey) with the consumer price index. Consumer price index for agricultural labourers is used for rural area and consumer price index for industrial workers is used for urban area.

Just like the price of palm oil, the relative price of edible oil (i.e median unit value deflated by the consumer price index) falls between 1993-94 & 1999-2000 in both rural and urban areas. After that it shows an increase. Therefore, the pattern of change in the relative price of edible oil is same as the change in palm oil price.

Does the change in the relative price of edible oil induced by the change in the palm oil price(i.e either by world price of palm oil or by the tariff rate of palm oil) affect the wage rate in oilseed production and hence wage rate in agricultural production? In this paper, we will try to answer this question.

There is no way to know that how the actual wage rate in oilseed production has changed over time. But using the nationally representative employment-unemployment survey(NSS) in India, we have figured out the change in employment in oilseed production. The employment share in oilseed production in the total agricultural production was 0.017 in 1993-94. It declined to 0.016 in 1999-2000 & then again increased to 0.03 in 2004-05. The employment share in oilseed production in total agricultural production (excluding the food grain i.e cereals & pulse) was 0.24 in 1993-94. In 1999-2000, it declined 0.16 and then again increased to 0.20 in 2004-05(these figures are computed from usual principal activities provided by NSS employment-unemployment data).

The above figures indicate that there is a decline in the employment share in oilseed production between 1993-194 & 1999-2000. After 1999-2000, the employment in oilseed production again increased.

Therefore, decline in the employment share indicates decline in the wage rate in oilseed production between 1993-94 & 1999-2000 & similarly increase in the employment share indicates increase in the wage rate in oilseed production after 1999-2000. This is also consistent with the observed change in the relative price of edible oil over time.

In the rest of the paper, using econometric tools, we will investigate that whether the increase/decrease in the palm oil tariff or world price actually increases/decreases the relative price of edible oil and the real wage rare.

4. Wage Effect

The change in the world price or ad-valorem tariff rate of palm oil affects the wage rate in oilseed production and hence the wage rate of the agricultural labourer/worker changes. We don’t have the detailed data to investigate that how does the change in palm oil world price/tariff rate affects the wage rate in oilseed production. That’s why we do the next best thing i.e to directly analyze the impact on the agricultural wage rate.

4.1 **Empirical Model**

In our empirical model, we not only analyze the impact of palm oil price change(induced by the change in world price or tariff rate) on the agricultural wage rate but also the difference in the wage effect across the country. We consider two interesting comparisons.

Firstly, the difference in the wage effect between the initially(early 90s) high oilseed producing regions & initially low oilseed producing regions. This is an interesting comparison given the fact that the oilseed constituted a large enough share in total agricultural production in early 90s. Another interesting comparison is between the coastal & non-coastal states in India. This is important because the pass-through effect of the reduction in trade barriers is expected to be higher in coastal states as shown by the previous literature.

In this paper, we have done a district level panel data analysis. We have classified the districts as initially(early 90s') high & low oilseed producing districts. The districts are also classified as districts belong to coastal & non-coastal states. We have clubbed these two different types of classifications to generate four different categories: high oilseed producing & coastal districts(i.e districts belong to coastal states), high oilseed producing & non-coastal districts, low oilseed producing & coastal districts & low oilseed producing & non-coastal districts. In the regression analysis, we investigate the difference in wage effect across these four categories.

The specification for the wage regression is the following:

$$ln\_W_{dt} = \alpha_0 + \alpha_1 \ln P_t + \alpha_2 D_2 * \ln P_t + \alpha_3 D_3 * \ln P_t + \alpha_4 D_4 * \ln P_t + \boldsymbol{\beta} \mathbf{Z_{dt}} + f_d + e_{dt} \quad -(3)$$

ln_W_{dt} is the log of the real wage rate for 'd'th district at period 't'. There four time periods used in the analysis. These are 1993-94, 1999-2000, 2004-05 & 2007-08.

$\ln P_t$ is the log of the domestic price of palm oil. As mentioned earlier, the domestic price of palm oil is the world price of palm oil multiplied by one plus ad-valorem tariff rate. $\ln P_t$ varies across time only. Tariff rate is exogenous. Since the production of palm oil in India is meager, the world price of palm oil is unlikely to be affected by the domestic palm oil production. Therefore the endogeneity concern is not present. That's how we identify the parameters α_1, α_2, α_3 & α_4. In our regression model, the low oilseed producing & non-coastal districts (D_1) is the benchmark category . D_2 stands for the dummy variable for the high oilseed producing & non-coastal districts. D_3 & D_4 are the dummy variables for low & high oilseed producing coastal districts respectively. The dummy variables , D_2 , D_3 & D_4 vary across districts and don't vary across time. f_d stands for the district fixed effects. The error term is e_{dt}.

$\mathbf{Z_{dt}}$ denotes a vector of control variables for 'd' th district at period 't'. The variables included in $\mathbf{Z_{dt}}$ are total agricultural production, average annual rainfall, a composite measure of tariff, share of scheduled caste & scheduled tribe population, percentage of literate people, percentage of villages covered by bus, rail & paved roads(considering each of these as separate variables), percentage of villages which are irrigated & electrified(again considering the irrigation & electricity coverages separately). All these variables vary across districts and also across time. In running the regressions, we use logarithm of the total agricultural production & average annual rainfall . We run the regressions with & without incorporating the time trend , state-region time trend and the initial(i.e 1993-94) district specific per-capita expenditure.

In this regression, we estimate the percentage change in the rural agricultural real wage rate across different regions(defined by the dummies D_1, D_2 , D_3 & D_4) when the palm oil price increases by one percent. Therefore, α_1, α_2, α_3 & α_4 are the main coefficients of interest. We consider 'low oilseed producing & non-coastal districts' as the benchmark category. Therefore the coefficient α_1 estimates the percentage change in the agricultural real wage rate in 'low oilseed producing & non-coastal districts' due to the increase in the palm oil price by one percent. The coefficients α_2, α_3 & α_4 measure the incremental effects of the change in agricultural real wage rate in other three regions.

4.2 Variables & their Data Sources

The nominal agricultural wage rate for each district & for each period is calculated from the NSS employment-unemployment survey for the respective periods(i.e 1993-94, 1999-2000, 2004-05 & 2007-08). The nominal wage rate for each district is deflated by the state specific consumer price index of agricultural labourers for the respective years to arrive at the district specific real wage rate for the agricultural workers. The data for the state specific consumer price indices for the agricultural labourers are taken from the EPW database. EPW database provides monthly data for the consumer price index. The average of the price indices from January 1993 to December 1994 is computed to arrive at the price index for the period 1993-94. The price index for the other periods i.e 1999-2000, 2004-05 & 2007-08 is calculated in same way.

We get the production data for various agricultural crops from the IFPRI database for agricultural production. The agricultural production data are available from 1990 to2007-08. it provides district specific year wise production data(measured in tones) for various crops including rice, wheat, other cereals, pulses, various oilseeds etc. The IFPRI production data has been assembled from the year-wise documents of the ministry of agriculture for different states.

For each district , yearly production figures for all the crops (provided in the data) are added to get the total yearly agricultural production. Now, sum of the yearly agricultural production for the years 1992, 1993 & 1994 have been used to calculate the total agricultural production for the period 1993-94. The reason for taking three years sum is to eliminate any external shock(like drought)that can lower the agricultural production in a particular year. Similarly the yearly agricultural production for 1998, 1999 & 2000 are added to get the total agricultural production for the period 1999-2000. We follow the same way to calculate the total agricultural production figure for 2004-05(sum of the production figures for 2003, 2004 & 2005) & 2007-08(sum of the production figures for 2006, 2007 & 2008). The district wise total agricultural production is used as a control variable in our regression analysis.

The district wise total oilseeds production for each of the time periods i.e(1993-94, 1999-2000, 2004-05 & 2007-08) is computed in the same way as the total agricultural production is calculated(taking three years sum). The district-wise oilseed production in the initial period i.e in 1993-94 is used to construct the dummy variable for the high and low oilseed producing districts. First of all, we compute the share of oilseed production in total agricultural production for each of the district in 1993-94. Then we find out the median share which turns out to be 0.08. The districts with oilseed production share higher than the median share is considered as high oilseed producing districts and the districts for which the oilseed production share is less than the median share are considered as low oilseed producing districts.

In our paper, we have called a district 'coastal' or 'non-coastal' depending on whether it belongs to a coastal or non-coastal state. As mentioned earlier, we have combined the production dummy and the coastal dummy to construct four separate categorical/dummy variables.

The world prices of palm oil has been taken from the World Bank commodity price data. The prices are in US $/tonn. We get the ad-valorem tariff data for palm oil from the World Integrated Trade Solution (WITS) database of the World Bank.

The source of rainfall figures is the gridded dataset of the Center of Climatic Research at the University of Delaware. The rainfall figures(in millimetres) given in the data are monthly. The annual rainfall is calculated by summing up the monthly rainfall figures. For each district, rainfall figures for the period 1993-94 is constructed by considering the simple average of the annual rainfall figures for 1993 & 1994. Similarly, the rainfall figures for the other periods(i.e 1999-2000, 2004-05 & 2007-08) are computed.

District specific share of scheduled caste and scheduled tribe in the total population is calculated from the NSS data. District specific literacy rate is also obtained from the NSS data. An individual is called 'literate' if he/she has at least the secondary education.

The data source for the share of villages connected by bus, rail, paved roads in a district and share of villages electrified and irrigated in a district is the census data for 1991 & 2001. We have used the 1991 census for the periods 1993-94 & 1999-2000. The census data for 2001 is used for the periods 2004-05 & 2007-08.

In the regression analysis, a district specific composite tariff measure is used as a control variable. This composite tariff measure is an employment weighted average of the ad-valorem tariff rate of the commodities. The WITS database(World Integrated Trade Solution) of world bank provides very detailed country-wise commodity specific ad-valorem tariff rate data for various years(starting from the late 1980s). We have classified all the individual commodities into four broad classes/groups. These are agricultural products, mining products, manufacturing products & transportation products. Each of these broad classes consists of many commodities. We have considered the simple average of the tariff rates for the individual commodities within a group to arrive at the tariff rate for that group/caqtegory. Therefore, we compute ad-valorem tariff rate for agricultural goods, mining goods, manufacturing goods & transportation goods for the periods 1993-94, 1999-2000, 2004-05 & 2007-08. There is no tariff data available for India in 1993 & 1994. So, we have used the tariff data for 1992 for the period 1993-94. Since no tariff data is available for the year 2000, the tariff data for 1999 is used for the period 1999-2000. For the period 2004-05, tariff data is available for both the years i.e 2004 & 2005. In this situation, we calculate the tariff rate in the following way. Consider agricultural goods only. Firstly, we construct the agricultural tariff rate for the year 2004 & 2005 separately by taking the simple average of the individual commodities classified as agricultural goods. Then we take the simple average of the year 2004 & 2005 to arrive at the agricultural tariff rate for the period 2004-05. We follow similar approach for the other three categories of goods. Since tariff data is available for both the years 2007 & 2008, the computation of tariff rate for the period 2007-08 is similar to 2004-05. The district specific employment share for agriculture, mining, manufacturing & transportation is calculated from NSS employment-unemployment surveys of the respective years. The employment weights are multiplied by the tariff rates to get the composite tariff measure. The district wise variation in the composite tariff measure comes from the variation in the employment weights.

In our regression sample, there are 330 districts. The district boundaries are according to the 1991 census(because 1993-94 is the initial period). There are fourteen states in our sample (names & boundaries are according to the 1991 census). These are Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal. Among these states, Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Orissa, Tamil Nadu & West Bengal are coastal states.

4.3 Results

Table 2

VARIABLES	(1) ln_W	(2) ln_W	(3) ln_W	(4) ln_W
ln_P	0.159***	0.0133	0.0669	0.0662
	(0.0462)	(0.0474)	(0.0600)	(0.0600)
D2*ln_P	0.0810	0.0457	0.0215	0.0224
	(0.0554)	(0.0558)	(0.0764)	(0.0763)
D3*ln_P	0.210***	0.218***	0.161**	0.162**
	(0.0490)	(0.0470)	(0.0642)	(0.0641)
.D4*ln_P	0.205***	0.208***	0.132**	0.134**
	(0.0487)	(0.0479)	(0.0664)	(0.0664)
ln_avg_annual_rainfall	-0.0644	0.0483	-0.0403	-0.0407
	(0.0622)	(0.0579)	(0.0670)	(0.0669)
ln_sum_pdn_tot	0.0372***	0.0180**	-0.00523	-0.00561
	(0.00844)	(0.00799)	(0.00915)	(0.00922)
st_sc_share	-0.0674	-0.0242	-0.0430	-0.0400
	(0.102)	(0.0983)	(0.0991)	(0.0994)
bus_pcnt	-0.267**	-0.362***	-0.228	-0.242
	(0.133)	(0.126)	(0.148)	(0.151)
rail_pcnt	-0.459	-0.714	-0.765	-0.762
	(0.816)	(0.782)	(0.632)	(0.635)
pr_pcnt	0.228***	0.0561	0.144	0.148
	(0.0738)	(0.0731)	(0.0966)	(0.0965)
ele_pcnt	0.306***	0.107	0.265*	0.278**
	(0.113)	(0.108)	(0.136)	(0.137)
irr_pcnt	0.0624	0.0460	-0.0704	-0.0677
	(0.0616)	(0.0592)	(0.0789)	(0.0791)
tariff_measure_dist	-0.726***	0.708**	0.729*	0.697*
	(0.262)	(0.312)	(0.398)	(0.393)
literate	1.286***	0.787***	0.863***	0.852***
	(0.266)	(0.274)	(0.310)	(0.309)
Constant	1.308***	1.398***	1.886***	1.895***
	(0.404)	(0.378)	(0.437)	(0.436)
Observations	1,269	1,269	1,269	1,269
R-squared	0.416	0.463	0.526	0.527
Number of st_dt_code_50	330	330	330	330
time trend	no	yes	yes	yes
state-region time trend	no	no	yes	yes
initial mpce	no	no	no	yes

Robust standard errors are in the parentheses. ***p<0.01, ** p<0.05 & *p<0.1. Standard errors are clustered at the district level.

Table 2 illustrates the results of the regression equation(3) i.e

$$ln\_W_{dt} = \alpha_0 + \alpha_1 \ln P_t + \alpha_2 D_2 * \ln P_t + \alpha_3 D_3 * \ln P_t + \alpha_4 D_4 * \ln P_t + \boldsymbol{\beta} Z_{dt} + f_d + e_{dt} \quad -(3)$$

There are four columns in the table. The first column shows the result without incorporating the time trend, state-region time trend & the initial district specific monthly per-capita expenditure. The result in the second column incorporates the time trend but not the other two. In the third column, we include time trend & state-region time trend. But the initial district specific per-capita expenditure is excluded. In the fourth/final column all the three are included.

This is a district fixed effect regression with 330 districts & four time periods. The dependent variable is ln_W which is the log of the real agricultural wage rate in rural sector. ln P stands for the effective price of palm oil(nothing but the world price multiplied by one plus ad-valorem tariff rate). D2, D3 & D4 denote the binary variables for the high oilseed producing non-coastal districts, low oilseed producing coastal & high oilseed producing coastal districts respectively.

The coefficient of ln_P is positive but insignificant. Therefore the effect of an increase in the palm oil price on the real agricultural wage rate of the low oilseed producing & non-coastal districts is positive but insignificant. In all four cases(four columns), the wage effect is significantly larger for the high & low producing coastal districts compared to the benchmark category i.e low oilseed producing non-coastal districts. But in all four specifications, the incremental effect for the high oilseed producing & non-coastal districts are insignificant. This regression results indicates that wage effect is positive & significant for the coastal districts (i.e districts belong to coastal states).

Among the other independent variables, the coefficient of literacy is positive & significant in all four specifications. Higher literacy rate implies higher marginal productivity and hence higher wages. The coefficient of the composite tariff measure turns out to be positive & significant(except the first column). The districts that experience higher tariff increase(or less tariff decrease) face higher prices. Therefore the real wage rate is also expected to be higher. The coefficient of tariff measure in the first column is negative & significant. Probably it is because of the omitted variable bias. In the first column, we have excluded the time trend. The tariff rate of the commodities have declined over time(after trade liberalization). If the negative effect is large enough, then it can cause a negative bias for the coefficient of the tariff measure.

Table 3

VARIABLES	(1) ln_W
ln_P	0.0790*
	(0.0461)
coastal_states*ln_P	0.135***
	(0.0499)
ln_avg_annual_rainfall	-0.0433
	(0.0663)
ln_sum_pdn_tot	-0.00563
	(0.00924)
st_sc_share	-0.0422
	(0.0995)
bus_pcnt	-0.249
	(0.151)
rail_pcnt	-0.788
	(0.625)
pr_pcnt	0.143
	(0.0973)
ele_pcnt	0.278**
	(0.137)
irr_pcnt	-0.0660
	(0.0791)
tariff_measure_dist	0.705*
	(0.393)
literate	0.841***
	(0.310)
Constant	1.907***
	(0.434)
Observations	1,269
Number of st_dt_code_50	330
R-squared	0.527
time trend	yes
state-region time trend	yes
initial mpce	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Standard errors are clustered at the district level

Although rainfall is very important for wage regressions, it always turns out to be insignificant in our empirical model. The impact of total agricultural production on real agricultural wage rate is positive and significant in the first two columns. But the inclusion of the state-region time trend in the third column makes the coefficient of total agricultural production negative and insignificant. It happens to be the case that most of the state regions experience a decline in the overall agricultural production over time. Therefore, excluding the state-region time trend makes the coefficient of the total agricultural production upwardly biased. Except the share of electrified villages , other development indicators are insignificant when we include time trend, state region time trend and initial per-capita expenditure.

Table 2 has already shown that a percentage increase in the palm oil price has a larger wage effect in high & low oilseed producing coastal districts(districts belong to coastal states) relative to the low oilseed producing & non-coastal districts. But the incremental effect for the high oilseed producing & non-coastal districts is insignificant. This result suggests that the difference in the wage effect between the districts belong to coastal states & non-coastal states are statistically more important compared to the difference in the initially high & low oilseed producing districts.

Therefore, we run a separate regression to investigate the incremental wage effect for the coastal states relative to the non-coastal states. Table 4 illustrates results of the following regression equation:

$$\ln\_W_{dt} = \gamma_0 + \gamma_1 \ln P_t + \gamma_2 \text{Coastal\_States} * \ln P_t + \boldsymbol{\beta Z_{dt}} + f_d + e_{dt} \quad \text{-(4)}$$

The wage effect is positive and significant for both the coastal & non-coastal states. But relative to the non-coastal states, the effect is significantly larger for the coastal states. The coefficients γ_1 & γ_2 are the wage price elasticities for the non-coastal & coastal-states respectively(wage price elasticity here is the percentage change in the real agricultural wage rate due to an increase in the palm oil price by one percent). The wage price elasticity for the non-coastal states and the coastal states turns out to be 0.08% & 0.21% respectively.

5. Price Effect

In the last section, we have already seen that an increase the palm oil price significantly increases the agricultural real wage rate and the effect is larger for the coastal states relative to the non-coastal states. This wage effect must have come through the change in the domestic edible oil prices induced by the change in palm oil price. Therefore, in this section we investigate the effect of the palm oil price change on the domestic edible oil price and whether the price effect is larger(like the wage effect) for the coastal states relative to the non-coastal states. We estimate the following regression equation:

$$ln\_Q_{dt} = \delta_0 + \delta_1 \ln P_t + \delta_2 Coastal\_States*\ln P_t + \boldsymbol{\beta Z_{dt}} + f_d + e_{dt} \quad -(5)$$

The dependent variable ln_Q_{dt} is the log of the domestic edible oil price deflated by the state specific consumer price index of agricultural labourers for 'd'th district at time point 't'. The district specific unit value computed from the NSS consumer expenditure data deflated by the state specific consumer price index is used as district specific domestic edible oil price. NSS consumer expenditure data provides monthly expenditure and quantity consumption on edible oil at the household level. The household specific expenditure and quantity consumption are added to get the district wise monthly edible oil expenditure and quantity consumption(in kg). We deflate the total expenditure by the total quantity consumption to get the unit value of edible oil at the district level. Apart from all the control variables used in the wage regression, we used two additional controls here in $\mathbf{Z_{dt}}$.. These are district specific oilseed production and the district specific average real per-capita expenditure. We include oilseed production as an independent variable because oilseed production affects the edible oil price. The inclusion of average real per-capita expenditure is to take care of the quality issue in the unit value of edible oil i.e unit value of edible oil may be higher for a richer district.

Table 4 shows the results of regression equation(5). There are two different specifications(columns). The first one only considers those independent variables which are more relevant for a price regression. The second column includes all the other independent variables used in the wage regression in order to ensure comparability with the wage regression. A percentage increase in the palm oil price increases the real domestic edible oil price(edible oil price deflated by the consumer price index) by 0.38%-0.39% in non-coastal states and by 0.45%-0.46% in the coastal states. The magnitude is significantly larger in the coastal states relative to the non-coastal states. The elasticities of the real domestic edible oil price with respect to palm oil price don't differ much in these two different specifications.

The impact of an increase in the palm oil price on wage is much smaller than the domestic edible price(both wage & the domestic prices are in real terms). This is compatible with the competitive labour market. The higher elasticities in the coastal states confirm the more effective price transmission/pass-through in the coastal regions. The larger price change in the coastal states also explains their larger wage effect. The results support the higher pass-through of the change in tariff rate or world price in coastal regions as claimed by the earlier literatures.

Table 4

VARIABLES	(1) ln_Q	(2) ln_Q
ln_P	0.385***	0.386***
	(0.0152)	(0.0194)
.coastal_states*ln_P	0.0696***	0.0692***
	(0.0223)	(0.0234)
ln_sum_pdn_oseednew	0.0243***	-0.0157**
	(0.00530)	(0.00627)
ln_real_mpc_new	-0.0182	0.0247
	(0.0207)	(0.0187)
ln_avg_annual_rainfall		-0.0700***
		(0.0195)
literate		0.0319
		(0.0864)
st_sc_share		0.00480
		(0.0297)
bus_pcnt		-0.0272
		(0.0582)
rail_pcnt		0.0193
		(0.199)
pr_pcnt		0.0996***
		(0.0335)
ele_pcnt		0.136***
		(0.0425)
irr_pcnt		0.0443**
		(0.0224)
tariff_measure_dist		0.826***
		(0.153)
ln_sum_pdn_totnew		0.0402***
		(0.00514)
Constant	0.759***	0.451***
	(0.149)	(0.169)
Observations	1,284	1,238
R-squared	0.744	0.794
Number of st_dt_code_50	329	329
time trend	yes	yes
state-region time trend	yes	yes
initial mpce	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Stanadard errors are clustered
at the district level

The coefficient of total oilseeds production in the first column is positive & significant. This is counterintuitive because higher oilseeds production is expected to reduce the price of edible oil. But when the other control variables are included in the second column, the coefficient of the total oilseeds production becomes negative & significant. One explanation can be of the following. In the second column we have included the total agricultural production. The total agricultural production & the total oilseeds production are positively correlated. Now consider two districts with the same oilseeds production but one has higher total agricultural production compared to the other. It implies that the district with higher agricultural production has the higher other agricultural production (other than the oilseeds). Therefore, the price of the other agricultural commodities become less and the purchasing power of the people is higher for that district. So, demand for edible oil is also higher for that district(since edible oil is a luxury food product) which increases the price of edible oil more compared to the other district. Therefore, excluding the total agricultural production as a control variable might make the coefficient of the oilseed production negative in the first column.

Although rainfall is insignificant for the wage regression, it turns out to be significant at 1% level for the price regression. The negative coefficient of the rainfall variable suggests that higher rainfall increases the oilseed production and hence reduces the domestic price of edible oil. One argument against the above explanation is that very high/excessive rainfall may reduce the oilseed production and increase the edible oil price. We have run another regression (although we have not reported here) with incorporating a squared term of the log of rainfall variable. The coefficient of log of the rainfall still remains negative & significant although the squared term becomes positive & significant. Therefore excessive rainfall increases the edible oil prices.

6. Measuring Pass-through: Distance to Nearest Port

The variable 'coastal states' represents proximity to ports and that explains the higher pass-through of tariff rate or world price in coastal states. But 'coastal states' is a binary variable. In this section, we rerun the price regressions using a continuous measure of proximity to ports. For each district, we calculate the shortest distance between the district headquarter and the nearest port. We use the widely used 'Haversine Formula' in order to calculate the distance. 'Haversine Formula' is used to calculate the shortest distance(not the shortest driving distance) between any two points along the earth. The accuracy of the distance measured by 'Haversine Formula' has also been cross-checked using the distance measured by Geographical Information System software. The distance is measured in kilometers.

Table 5

VARIABLES	(1) ln_Q	(2) ln_Q
ln_P	0.443***	0.439***
	(0.0187)	(0.0213)
.ln_P*.distance	-6.45e-05*	-5.08e-05
	(3.31e-05)	(3.71e-05)
ln_sum_pdn_oseednew	0.0261***	-0.0132**
	(0.00531)	(0.00626)
ln_real_mpc_new	-0.0168	0.0276
	(0.0209)	(0.0190)
ln_avg_annual_rainfall		-0.0715***
		(0.0201)
literate		0.0106
		(0.0902)
st_sc_share		0.00318
		(0.0296)
bus_pcnt		-0.00461
		(0.0587)
rail_pcnt		0.0144
		(0.202)
pr_pcnt		0.104***
		(0.0342)
ele_pcnt		0.130***
		(0.0419)
irr_pcnt		0.0335
		(0.0230)
tariff_measure_dist		0.851***
		(0.153)
ln_sum_pdn_totnew		0.0390***
		(0.00511)
Constant	0.738***	0.424**
	(0.148)	(0.171)
Observations	1,284	1,238
R-squared	0.741	0.791
Number of st_dt_code_50	329	329
time trend	yes	yes
state-region time trend	yes	yes
initial mpce	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 shows the results of the price regression when the palm oil price is interacted with the continuous distance measure as mentioned earlier. The first column only consists of the variables relevant for the price regression. The second column includes all the control variables used in the wage regression. The coefficient of the interaction term(palm oil price interacted with the distance measure) is negative as expected. It is also significant in the first column. But when we include all the other control variables, the coefficient of the interaction term becomes insignificant. The magnitude of the coefficient of the interaction term is almost same under these two different columns. The reason of getting an insignificant coefficient might be due the use of a continuous distance measure. The percentage change in the relative price of edible oil due to an increase in the palm oil price is now a function of a continuous distance measure. Therefore, increasing the distance marginally may not affect the price response that much. Instead if we use a binary variable like coastal states, we expect a much larger gap in the price response between the coastal & non-coastal states and the possibility of getting a statistically significant gap becomes higher.

When the distance is zero (i.e port itself is located at the district head-quarter), the elasticity of the relative price of domestic edible oil with respect to palm oil price is around 0.44%. We have got a similar figure for the coastal states. The pass-through declines by 0.03% to 0.04% when the distance from the district head quarter to nearest port becomes 600 kilometres and by 0.05% to 0.06% as the distance reaches 1000 kilometres. The districts for which the head quarters are more than 600 kilometres from the nearest port, belong to the non-coastal states. In terms of magnitude, our finding is comparable with what we have found earlier(using the dummy for coastal states).

In order to check whether categorical (dummy) variables do better in terms of significance, we consider a dummy for each quartile of the continuous distance measure. We call these binary variables as low distance, medium distance, high distance & very high distance respectively. We consider low distance(bottom quartile) as the benchmark and see that how does the price response change as the distance of the district head-quarters from the nearest port increases. Each of the other three categorical variable(medium, high & very high distance) is interacted with the palm oil price. Table 6 shows the regression results. Only the coefficient of the interaction term between the palm oil price and the very high distance category turns out to be statistically significant although the coefficients of all the interaction terms are negative. The very high distance category not only does best in terms of significance but also the magnitude of the decline in pass-through is also maximum for this category. Those districts fall in the high distance category for which the distance between the head quarter and the nearest port is more than 631 kilometres.

Table 6

VARIABLES	(1) ln_Q	(2) ln_Q
ln_P	0.444***	0.452***
	(0.0196)	(0.0223)
.dist_medium*ln_P	-0.0228	-0.0381
	(0.0234)	(0.0234)
.dist_high*.ln_P	-0.0288	-0.0380
	(0.0275)	(0.0274)
.dist_vhigh*.ln_P	-0.0556**	-0.0572**
	(0.0253)	(0.0264)
ln_sum_pdn_oseednew	0.0257***	-0.0144**
	(0.00536)	(0.00639)
ln_real_mpc_new	-0.0172	0.0259
	(0.0209)	(0.0189)
ln_avg_annual_rainfall		-0.0732***
		(0.0203)
literate		0.0124
		(0.0904)
st_sc_share		0.00463
		(0.0296)
bus_pcnt		-0.00536
		(0.0583)
rail_pcnt		0.0142
		(0.196)
pr_pcnt		0.105***
		(0.0341)
ele_pcnt		0.132***
		(0.0417)
irr_pcnt		0.0327
		(0.0231)
tariff_measure_dist		0.844***
		(0.154)
ln_sum_pdn_totnew		0.0397***
		(0.00520)
Constant	0.743***	0.443**
	(0.149)	(0.172)
Observations	1,284	1,238
R-squared	0.742	0.792
Number of st_dt_code_50	329	329
time trend	yes	yes
state-region time trend	yes	yes
initial mpce	yes	yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Standard errors are clustered
at the district level

7. Welfare Analysis

In this section , we investigate the welfare impact of the palm oil price change on the consumers as well as on the wage earners. We are also interested to figure out the relative magnitude of the consumption effect as compared to the wage effect.

7.1 Theoretical Background

Compensating variation measures the income needed to compensate for change in prices. We follow Porto's (2006) measure of compensating variation as a proportion of initial income/expenditure. For any household 'j', the expression looks like (for the change in the price of 'i'th commodity)

$$\frac{CV^J}{e^j} = \left(s_i^j - \sum_m \theta_m^j \, \varepsilon_i^j \right) d\ln P_i - (6)$$

Here CV^J is the compensating variation i.e the change in the real expenditure/income needed so that 'j'th household can attain its original utlity level. e^j is initial real expenditure i.e the initial nominal expenditure deflated by consumer price index. $d\ln P_i$ is the change in the relative price(price deflated by consumer price index) of 'i' th commodity. In Porto's paper, every thing was in nominal terms(i.e change in nominal price/nominal expenditure). Although we have not shown here, it can be easily extended to real terms(deflating by consumer price index). The 'i'th commodity in our paper is the edible oil. We consider the change in relative price of edible oil induced by the change in the palm oil price. The budget share of 'i'th commodity by 'j'th household is denoted by s_i^j . θ_m^j represents the share of labour income in total expenditure for the 'm'th member belongs to 'j'th household. ε_i^j is the elasticity of rural agricultural real wage rate with respect to the relative price of edible oil. In this paper, this elasticity is estimated directly with respect to the palm oil price i.e the elasticity of rural agricultural real wage rate with respect to the price of palm oil.

Equation(6) can be written down in the following way:

$$\frac{CV^J}{e^j} = s_i^j \, d\ln P_i - \sum_m \theta_m^j \, \varepsilon_i^j d\ln P_i - (7)$$

The first term in the right hand side is the consumption effect. The second term represents the effect on wage income. A household can be a consumer, wage earner , both or none. We separate out each of these two effects and analyze them individually.

First, we look at the consumption effect. for'j'th household. Suppose, there are N_R households in region R of a country. Then the average compensating variation from consumption channel for region R is written as

$$\left(\frac{CV^R}{e^R}\right)_C = \left(\frac{1}{N_R}\right)\sum_{j\epsilon R} s_i^j \, \mathrm{dlnP}_i = s_i^R \, \mathrm{dlnP}_i - (8)$$

where s_i^R is the average budget share of edible oil in the region R. $\left(\frac{CV^R}{e^R}\right)_C$ stands for the average compensating variation as a proportion of initial real expenditure from consumption channel & for region R.

Suppose, there are two periods, period '0' & period '1'. The vector of commodity prices for period '0' & '1' are P^0 & P^1 respectively. The compensating variation due the change in prices from P^0 to P^1 is expressed as

$$CV = C(P^1, u) - C(P^0, u)$$

Where C denotes the expenditure function and u is the reference utility level.

Cost of living index for the change in prices between period '0' & '1' is defined as

$$COLI = C(P^1, u)/C(P^0, u)$$

It is the ratio of the minimum expenditure required for attaining reference utility level u at period '1' prices to the minimum expenditure required for attaining reference utility level u at period '0' prices.

Now, compensating variation as a proportion of initial expenditure is

$$\frac{CV}{C(P^0, u)} = \frac{[C(P^1, u) - C(P^0, u)]}{C(P^0, u)} = \frac{C(P^1, u)}{C(P^0, u)} - 1 = COLI - 1 = \ln COLI - (9)$$

Therefore, compensating variation as a proportion of initial expenditure is nothing but the cost of living index minus one or logarithm of the cost of living index. We will use this important relation to measure the consumption effect.

According to equation(8), consumption effect for a commodity(edible oil here) is measured by multiplying the initial(period '0') budget share with the change in price. But consumers can respond to change in price by changing the demand. Therefore, the expression in equation(8) does not capture the substitution response. One way to solve this problem is to introduce second order term(that captures the response of budget share due to price change) and estimate the second order term econometrically using a demand equation.

We have followed a second route where equation(8) has been measured by a superlative price index using the important relation between compensating variation and the cost of living index as shown earlier. A superlative price index is computed using the base(initial) as well as the current period budget share and hence takes care of the substitution response caused by the change in price. Although budget share might also change because of other factors like income, demographic characteristics, taste etc, the effect of price substitution is also present in the current period budget share and hence a superlative index provides a better approximation of equation(8). In order to approximate equation(8), we use a superlative index of the following form

$$\ln T = [(s_i^{R,1} + s_i^{R,0})/2] \, d\ln P_i$$

T is known as the Tornqvist price index. $s_i^{R,1}$ & $s_i^{R,0}$ are the budget share in period '1'(current period) & period '0'(base period) for region R and

$$dlnP_i = (\frac{lnP_i^1}{lnP_i^0})$$

The average compensating variation from the wage income channel for region R is measured as

$$\left(\frac{CV^R}{e^R}\right)_W = \left(\frac{1}{N_R}\right) \sum_{j \in R} \sum_m \theta_m^j \, \varepsilon_i^j d\ln P_i - (10)$$

Now, we assume that the wage price elasticity is same for all households in region R i.e

$$\varepsilon_i^j = \varepsilon_i^R$$

Equation (10) then boils down to

$$\left(\frac{CV^R}{e^R}\right)_W = \theta^R \, \varepsilon_i^R dlnP_i - (11)$$

where θ^R stands for the average wage/labour income in region R and $\left(\frac{CV^R}{e^R}\right)_W$ denotes the average compensating variation from wage income channel in region R.

7.2 Measuring the Consumption & Wage Effect

For measuring the welfare change due to the change in the palm oil price, we choose the time period between 1993-94 & 1999-2000. This is the time period when both the world price and ad-valorem tariff rate of palm oil saw a decline. As mentioned earlier the domestic price of palm oil (i.e the world price multiplied by the one plus ad-valorem tariff rate) decreased from 747.45$/ton in 1993-94 to 503.55$/ton in 1999-2000(almost 33% decline). Since there is price decline, consumers gain and the wage earners lose during that period.

We start with focusing on the coastal region(i.e coastal states). We consider only the rural areas because all our econometric analysis is based on rural sector. The average budget share of edible oil for the consumers(with positive consumption of edible oil) in the coastal states were 0.051 & 0.042 respectively for the period 1993-94 & 1999-2000. In order to obtain the consumption effect, we use the Tornqvist index(logarithm of it) formula. The change in the relative price of edible oil is measured by the change in the palm oil price(between 1993-94 & 1999-2000) multiplied by the elasticity of the relative price of edible oil with respect to the palm oil price (which is 0.46% as estimated earlier). The gain of the consumers turn out to be 0.84% of the initial expenditure. The share of labour income in total expenditure is 0.58 for the coastal states. The wage price elasticity (i.e the elasticity of the rural agricultural real wage rate with respect to the palm oil price) is 0.21%. Using all these informations, we compute the wage/labour income effect in equation (11) for the coastal states. The wage earners/agricultural workers lose 2.21% of their initial income/expenditure. Suppose we assume that the gain of any consumer equals the gain of an average consumer and the loss of any wage earner equals the loss of the average wage earner. Under this assumption, the gain of 2.6 consumers equal the loss of 1 agricultural worker. From the consumer expenditure survey of 1993-94 & 1999-2000, we have found that the number of consumers in the coastal states is almost 2.5 to 3 times higher than the numbers of agricultural workers. Therefore, the overall gain of the consumers & the overall loss of the agricultural labourers might have almost neutralized each other.

For the non-coastal states, the average budget share of edible oil ware 0.45 in 1993-94 & 0.38 in 1999-2000. These figures are computed considering only the consumers i.e those with non-zero consumption of edible oil. Multiplying the elasticity of the relative price of edible oil with respect to the palm oil price (0.39%) with the change in the palm oil price, we compute the average gain for the consumers. It turns out to be 0.64% of the initial income/expenditure and hence less compared to the coastal states.

The share of labour income & the wage price elasticity for the non-coastal states are 0.38 & 0.08% respectively. The average loss for a wage earner becomes 0.47% of the initial income/expenditure. Therefore, even the average consumption effect is higher compared to the average wage effect in the non-coastal states. Hence, the total gain for the consumers must be higher since there are more consumers than agricultural labourers.

8. Caveats & Future Works

This paper does not consider the impact of the palm oil price change on the oilseed producers/farmers, producers/processors of edible oil . In the next step of our analysis, we need to investigate and incorporate those effects in our welfare analysis.

So far, we have done our analysis for four time periods; 1993-94, 1999-2000, 2004-05 & 2007-08. We need to update our econometric analysis by extending it to 2011-12.

We have to improve our regression analysis(especially the wage regression) by adding more control variables like number of delicensed industries in a district, district specific share of FDI, bank branches per-capita in a district etc. We can also bring more variation in the composite tariff measure by using a more disaggregated/finer classification of industries.

9. Conclusion

In this paper, we discuss the impact of import liberalization of edible oil on the consumers and agricultural labourers. During trade liberalization in the early nineties, India started importing palm oil. As a result, the share of palm oil in total domestic edible oil consumption has increased to a large extent in the post liberalization period. Since production of oil palm in India is meager, the effective price of palm oil in the domestic market gets determined by the world price and ad-valorem tariff rate. This paper investigates the effect of change in palm oil price(through the change in tariff rate or world price) on the consumers as well as on the agricultural labourers.

We have shown that consumers gain and the agricultural workers lose from a decline in the palm oil price. The reverse is true when palm oil price increases. We have also found that both the consumption & wage/labour income effect is higher in the coastal states compared to the non-coastal states because of higher pass-through of tariff rate and world price. In coastal states, the average gain for the consumers turn out to be much lower compared to the average loss of the agricultural labourers when the price of palm oil declines. Since there are more consumers compared to the agricultural labourers, total gain may exceed or become equal to the total loss. . In non-coastal states, even the average gain for the consumers is larger relative to the average loss of the agricultural workers. Therefore, the total gain must be higher.

This paper analyzes the welfare impact of the change in price of an imported product. A very important aim of the trade theorists is to establish the link between free trade and domestic welfare through different channels and in different ways. Here, we have focused on the same issue in a new context. Although, we have considered a specific issue, this research opens up many other important research questions relating trade and welfare that can be investigated later.

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