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General part

Objective within the project

This deliverable discusses the scenarios run with the models developed in deliverables 6.1 and 6.2, and using the baselines as developed in developed in deliverable 7.1 as a point of reference.

Executive summary

In this deliverable some scenarios on the development of India in relationship with the rest of the world are being analysed. One of the focuses of TAPSIM is on the relationship between India and the EU. For this reasons two scenarios on trade agreements that may be relevant for trade between India and the EU are analysed with MAGNET and the national CGE (chapter 2). After discussing the background of tariff analysis and providing an overview of current tariffs (section 2.2 and 2.3) the design of a Free Trade Agreement between the EU and India and a multilateral WTO trade agreement are discussed (section 2.4 and 2.5). The analysis of simulation focusses on the same factors as analysed in the baseline scenarios of deliverable 7.1, i.e. GDP, trade, production and consumption, as well as on welfare (section 2.6). This deliverable discusses the scenarios run with the models developed in deliverables 6.1 and 6.2, and using the baselines as developed in developed in deliverable 7.1 as a point of reference. Based on the analysis with the national CGE model, some consequences on income distribution are being discussed.

With respect to import tariffs, the import tariffs of the EU are much lower than the import tariffs of India, both for the bound tariffs and the applied rates. The EU to a small extent and India to a larger extent have a lot of water in the tariffs, applying that the applied tariffs normally are lower than the bound tariffs. This creates the opportunity to adjust tariffs upwards in case of temporary problems. The applied tariffs on agriculture by India are around 30%, but for example on wheat there is an applied tariff of 100%. The applied tariffs on agriculture by the EU are around 5%, but for example the tariff on sugar is 50% and the tariffs on meat, paddy rise and coarse grains is above 10%. Import tariffs on industry are much lower, for India around 12%, for the EU 2.6%.

The approach in handling tariff reductions in the context of an India-EU free trade agreement is relatively simple. The basic idea is that all tariffs are abolished, except for tariffs on sensitive products, i.e. products that are particularly susceptible to competition from imports from other country suppliers. Sensitive products for India are dairy products, animal products, sugar, spirits and wines, and honey, while sensitive products for the EU are sugar, rice, cattle, beef, and non-ruminant animal products. The average import tariff rate by the EU for commodities from India is reduced from 2% to 0.1%, and the average import tariff rate by India for commodities from the EU is reduced from 8.4% to 0.6%. The Indian import tariff reductions for crops and processed agricultural commodities are very substantial (40 and 70 percentage points), while Indian import tariffs for industry are reduced from 14% to 0.3%.

The basic idea of a multilateral trade agreement is that current bound tariffs are divided in bands of tariffs depending on the size of the tariff. Because rich countries have, on average, lower tariffs and more possibilities to reduce tariffs, the tariff cuts are higher and the tariff bands are smaller. Some commodities are exempted from tariff cuts because they are sensitive. In general the tariff cuts are smaller for the WTO agreement than for the FTA, because for most commodities the tariff cut under the FTA is 100% while for the WTO agreement it is a smaller percentage and applied to the bound rates, with in many cases the effect that the applied rates are not influenced because the new bound rate is above the applied rate. For Indian tariffs on imports from the EU the tariff rate declines with 5 percentage points for primary agriculture, with 32 for processed agriculture, and with only 0.6% for industry. For the EU all the tariff reductions on imports from India are below 1 percentage point. So, the main effect of a WTO agreement as proposed by for example Falconer is mainly on preventing large tariff increases in special circumstances, and has relatively little effect on effective applied tariffs. But it has little effect on tariffs for imports from the whole world, and this increase the effect of such an agreement compared with a FTA.

The effect of a FTA on GDP of India is in the order of magnitude of 5 billion dollar in 2015, but grows till about 50 billion dollar in 2030. This growth is both because the economy grows during this period and because the extra income generated by the FTA is partly invested in capital goods that stimulate further growth. The 50 billion dollar in 2030 is still only about 0.7% of Indian GDP. For the EU the effect on GDP of such a FTA is around 0. The effect of a WTO agreement on GDP for India is only half of the effect of an EU-India FTA, while for the EU the effect of a WTO agreement is positive, although still less than 0.1% of GDP.

The effect of a FTA on Indian imports from the EU is larger: an average increase of imports by 52%, with an 8-fold increase in imports of processed agricultural products and a 3-fold increase in crop imports. The effect on total Indian imports is from the world is relatively small: an 4.3% increase on average and an 18% increase for processed agriculture. This is caused by a reduction in imports from other regions than the EU; for processed agriculture products mainly the neighbouring countries. So, half of the increased imports as a consequence of the FTA is trade diversion.

With respect to Indian exports the FTA increases an increase of 15% of Indian exports to the EU, mainly in manufacturing industry. Industrial exports to other regions of the world increase also because India is becoming cheaper as a consequence of cheaper imports of intermediate inputs. For the EU the increased industrial Indian exports to other regions and the reduction in agricultural imports from other regions implies that the other regions try to sell their excess supply of commodities to the EU, implying an increase of imports by the EU from the rest of the world.

A special investigation on the textile industry shows that a FTA increases trade in both directions, but that the net exports of India to the EU increase with 6 billion dollars. This generates extra demand for cotton and with that an increased pressure on land price.

The effects of a FTA on Indian production, the most sensitive topic in the context of trade agreements, shows that the effects are relatively modest. An increase in textile production of almost 6% and a reduction in vegetable oil production of 6% at the cost of the EU are the main effects on India.

The effects of a WTO agreement on both EU and Indian production. The EU cattle meat sector loses 20%, while in India the chicken production increases with 4% For India the wheat sector loses 5% of production while the cotton production increases with 3%.

With respect to the analysis with the national CGE model on income distribution, the analysis shows that a FTA gives benefits to the rural poor, while a WTO agreement tends to reduce rural wages, while capital income and land rents increase.

In summary, an EU-India FTA gives advantages to both India and the EU, although for different reasons. The net effect for the rest of the world is slightly negative. A WTO agreement as implemented here implies relatively small reductions in tariffs and generates relatively small benefits for India and only short term benefits for the EU. The rest of the world has the most advantages of such an agreement. The analysis shows how important it is to include dynamic effects of trade agreements.

Chapter 3 focuses on three biofuel scenarios. One scenario assumes that India realizes its blending target of 20% for biofuels in transport, but is doing this mainly through the use of molasses and sugar cane, because it seems that jatropha as an input for biofuels is not working out in the short term. A second scenario analyses the consequences of a worldwide biofuels policy on India. The last scenario analyses the combination of the two scenarios that behaves more or less like this: as the addition of the two scenarios.

In order to do the analysis biofuel sectors, molasses and for the international scenarios also oilcakes have been added to the model. Animal feed has been split from a broader processed food and feed sector, and fertilizer is explicitly included as a sector in the model. A production structure that differs between sectors has been designed that allows for relevant substitutions between biofuels and fossil fuels, different feedstock of biofuels, land-fertilizer substitution in crop production, roughage-concentrate substitution in livestock sectors, while substitution between capital and energy is allowed in all other sectors. Simulation results (section 3.4) show the consequences of Indian and international biofuel policies on production, consumption and trade as well as on land use and poverty.

Current biofuel policies in India and other countries are based on the use of first-generation biofuels, such as ethanol made from conventional sugar and starch crops, and biodiesel produced from vegetable oils. The use of these crops for biofuel production was found to have various effects on poverty, welfare, land use, trade, food security, etc. in India.

Biofuel policies outside India generate a global increase in biofuel crop prices and production, with roughly a 20% increase in production of crops used for biofuels and roughly a 15% increase in the price of these crops. When also India activates its biofuels policy then the production of sugar cane has to increase with another 20% on a global scale, while the sugar cane price rises with 25%. The increase in crop prices generates an increase in intensification of land use. As a consequence the increase in land use is less than the increase in production. For biofuel crops the increase in land use is 14%, while total arable land increases with 2.45% in the global biofuel scenario.

The biofuel policies outside India were found to have a negative net effect on poverty in India. The effect is less for the rural poor in India, because they benefit from increased wages in agriculture, while the urban poor only experience higher food prices. As a result the consumption of crops and livestock in India decreases, although the welfare effects are positive. These positive welfare effects are caused by a positive ‘terms of trade effect’. This effect is the result of that the prices of imports decrease less than of export. As a consequence, the price of intermediate inputs is reduced, which increases the value added of the commodities produced and thus welfare.

The National Biofuel Policy in India also has substantial effects. Global sugar cane production increases by 18% and sugar cane prices by 27%. The welfare effects in India are negative, because biofuel production (implicitly or explicitly) is subsidized. The increased use of resources for biofuel crop production cannot be used in other sectors, implying a reduction in production in these other sectors.

The results presented in this chapter are based on the MAGNET economic model. It is obvious that the calculations are extremely rough. Especially relevant is the question to what extent the urban and rural poor benefit from the increased demand for labour as a consequence of biofuel policies. Our observations are consistent with observations found in the literature (Chakravorty *et al.* 2012). However, further empirical validation and more refined analyses are still very much needed as regional and longer term effects from biofuel policies on agricultural productivity, rural development and technological change are only partially considered.

Chapter 4 makes an analysis of the Indian National Rural Employment Guarantee Scheme (NREGS). It is a government flagship program to eradicate rural poverty by generating employment for rural poor households. The focus of the analysis is on the consequences for rural poverty, income and income distribution.

According to the simulation with the national CGE the impact of NREGA on the economy in the long run is negative for income in agriculture. It only helps industry, although in the early period, between 2007-10, agriculture and services improve marginally; between 2010-20, it brings down agricultural share in total GDP from 13% to 11.8%. This may be due to government resources being diverted to NREGA from erstwhile productive sectors. In this analyses the potentially positive effects of the NREGA on agricultural productivity are not included.

Real income in rural areas in India has gone down partly due to lower agriculture growth and partly due to a lower market wage as compared to BAU scenario during 2010-20 period . The overall picture is, NREGA has contributed to industry growth;

NREGA provided a big fillip to the industries such as manufacturing, both labour and capital intensive, and the construction sector. Wages of the unskilled market labour in the rural is not increasing due to NREGA against the expectation that it would push up agriculture wages. This is based on the model assumption that NREGA supplements only the off-season employment and does not draw the agriculture labour away from farming. Real income per capita also supports the result that NREGA pushes up the income of urban poor, and not rural poor, in the long run, because of the higher growth of the manufacturing and construction sector under NREGA.

Policy Implication is, not only NREGA may not be sustained in the long run given limited resources of the government, but according to this analysis NREGA does not continue to provide benefits to rural poor as it was intended for. This conclusion depends on the assumption that NREGA does not increase rural wages and that the investments of NREGA do not results in higher agricultural productivity.

In summary, the scenarios analysed in this deliverable give valuable insights in the dynamics of different policies, both with respect to India and for the trade and biofuel scenarios also for the world as a whole and the EU.

Scientific and societal relevance

The analysis of the effect of trade policies, biofuel policies and NREGS is relevant for designing those policies and for negotiations about these policies. It is also relevant for projections of sectors for which the effect of different policies is relevant for perspectives on the future.

In order to be able to analyse the trade scenarios a method to calculate tariff changes based on six digit information and the current state of negations has been designed. By including international investment dynamics and labour market dynamics a difference can be made between short term and long term effects of the different policies.

A method to transfer price information to the national model has been accomplished and in this way the effect of the policies on different income groups can be calculated.

With the national model the NREGS policies have been calculated. For this purpose the specific characteristics of such a policy had to be included in the model.

Specific part

1 Introduction

In this deliverable some scenarios on the development of India in relationship with the rest of the world are being analysed. One of the focuses of TAPSIM is on the relationship between India and the EU. For this reasons two scenarios on trade agreements are analysed with MAGNET and the national CGE (chapter 2). After discussing the background of tariff analysis and providing an overview of current tariffs (section 2.2 and 2.3) the design of a Free Trade Agreement between the EU and India and a multilateral WTO trade agreement are discussed (section 2.4 and 2.5). The analysis of simulation focusses on the same factors as analysed in the baseline scenarios of deliverable 7.1, i.e. GDP, trade, production and consumption, as well as on welfare (section 2.6). This deliverable discusses the scenarios run with the models developed in deliverables 6.1 and 6.2, and using the baselines as developed in developed in deliverable 7.1 as a point of reference. Based on the analysis with the national CGE model, some consequences on income distribution are being discussed.

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2 Trade policy

2.1 Introduction

The purpose of this chapter is to give an analysis of the impacts of trade agreements on India in relationship with the EU and the rest of the world. The focus of this analysis is on the mechanisms involved. After a short discussion of the principles of tariffs (section 2.2), the current applied tariffs are discussed (2.3). This is followed by an analysis of how to implement a free trade agreement between India and the EU (section 2.4) and a WTO agreement (section 2.5) in the model. The main ingredient of this chapter is the discussion of the simulation results, where we compare the results of an FTA with a WTO agreement (section 2.6). Consequences for welfare are also discussed (in section 2.7). One of the important improvements of this analysis is the inclusion of dynamic effects through capital accumulation, which is also elaborated on (section 2.7). Throughout the chapter we draw comparisons, where possible, with the outcomes of the Trade Sustainability Impact Assessment of the EU-India FTA that was carried out by Ecorys (2009). The latter, next to including dynamic investment effects in the long run, also include a services trade liberalisation and reductions in NTMs as a reduction in trade costs (trade facilitation). The Ecorys study's baseline includes a notional Doha round agreement.

2.2 General background on tariffs

Tariffs can be classified into two groups. Bound tariffs and applied tariffs. Bound tariffs represent the maximum allowable Most Favourite Nation tariff that WTO members have agreed upon as part of the Uruguay Round commitments. Hence, these rates are used as basis for WTO tariff reduction negotiations. Applied tariffs are the import duties that traders face and that determine trade flows. In contrasts with bound tariffs, applied rates may be altered (on a non-discriminatory basis) without formal notice to the WTO or compensation of trading partners as long as they do not go above the bindings. As applied rates can be lower than bound tariffs, a negotiated cut in bound rates does not automatically translate into an equivalent cut in applied rates. Therefore, it's important to take into account these different tariffs when doing simulations. The modelling tool has to be fed with the impacts/changes on applied tariffs, which implies that when policy agreements are defined in terms of changes in bound tariffs, that still the implied impact on corresponding changes in applied tariffs will have to be derived.

Both the applied and bound tariffs used for this analysis come from the MacMap database developed by the International Trade Centre (ITC). The database is updated continuously using national sources and the UN Tariff and Market Access Database (UN TARMAC) of ITC and UNCTAD. The database is very detailed and it uses the Harmonized system (HS) to distinguish different products. The Harmonized System is an international nomenclature for the classification of products. It allows participating countries to categorize traded goods on a common basis for customs purposes. At the international level, the Harmonized System for classifying goods is a six-digit code system. The HS comprises approximately 5300 article/product descriptions.

India's bound tariffs are relatively high. Its applied tariffs are usually much lower. India's average applied tariff on non-agricultural products is about 12 per cent and about 40 per cent on agricultural products (Polaski et al, 2008, 7). For specific products, tariffs may strongly deviate from the supplied averages. There are often significant differences between applied and bound tariffs India shares with the EU. The existence of such a gap (known as the "binding overhang") provides the Indian government with significant policy space with respect to trade and agricultural prices. It allows India to raise and lower tariffs in response to world price changes and changing conditions in the domestic economy.

Being an emerging or developing economy, India qualifies for the EU's generalised system of preferences (GSP), which offers duty free access for imports from developing countries (non-sensitive products), or reductions in the otherwise applicable standard tariffs (sensitive agricultural products). When certain products grow in market share, GSP preferences are abolished when a certain threshold is reached (12.5% or 15%, depending on the product category). This is the case for Indian textiles (Chapter 50-60 of the HS). According to the latest statistics of the EU[1] 47.72% of Indian exports are imported under the GSP. In practice, preferential market access into the EU for India, however, is limited due to the exclusion of many, often 'sensitive', agricultural products and the often limited tariff reductions offered.

[1] Statistics over 2008 http://trade.ec.europa.eu/doclib/docs/2010/march/tradoc_145945.pdf

Not only tariff measures hamper Indian exports to the EU or the other way around, but also non-tariff measures (standards) that affect the possibilities to trade. Examples of non-tariff barriers are quantitative restrictions, import licensing, mandatory testing and certification for a large number of products, as well as complicated and lengthy customs procedures. Also (prohibitive) export restrictions could be added to this list. India uses this instrument, applying export restrictions (quantitative/ceiling/canalisation) to cattle, camels, cereals, fertilizers, groundnut oil, pulses, petroleum products etc. The focus of the TAPSIM project is not primarily on NTMs, although for some products (dairy and fruit and vegetables) NTMs are analysed in a qualitative way. The results of this analysis will be used to qualify the outcomes of the quantitative analysis, where possible and relevant.

2.3 Current tariffs

In order to analyse the impacts of trade agreements, it is important to have an indication of the tariff rates that are currently applied. Because we use the 2007 GTAP database as a starting point, we show the applied tariffs in this database. Figure 3.1 shows that the average tariffs levied by India are much higher than those levied by the EU and that for both India and the EU the tariffs on primary agriculture are higher than on industry. No tariffs on services are available in the database. Especially for processed agricultural commodities the Indian tariffs on products imported from the EU are much higher than the tariffs on commodities imported from the rest of the world. The EU levies higher taxes on imports from India than on those from the rest of the world for primary agricultural commodities, although these tariffs remain far below 10% while Indian tariffs are around 35%.

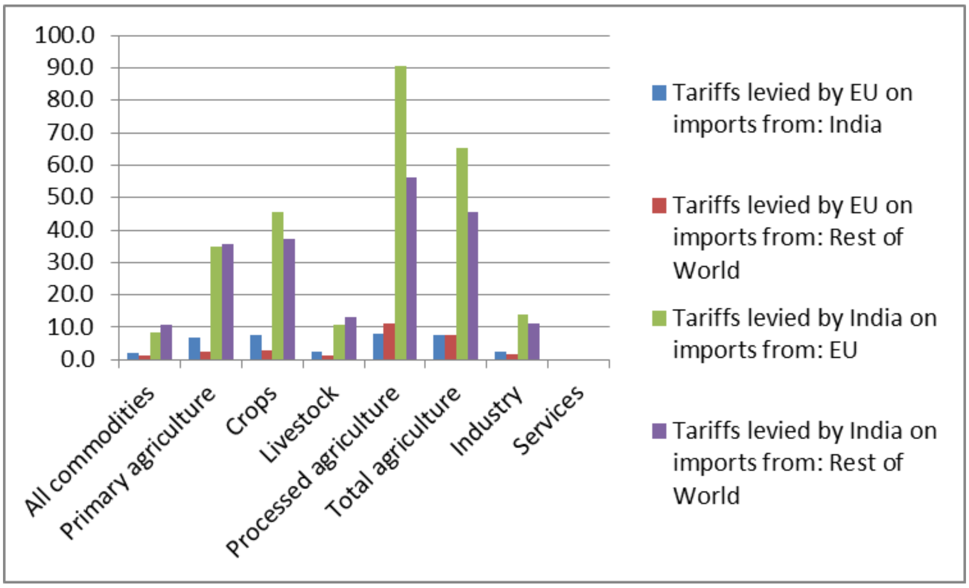

Figure 2-1 Applied import tariffs by EU and India in 2007

Table 3.1 shows the applied tariffs at a more detailed level, i.e. the commodity aggregation as used in the simulations, excluding the commodities with zero tariffs. Tariff rates between commodities differ a lot. For example, tariffs on sugar are around 70% for both the EU and India, while tariffs on meat imports are around 20%, with the EU having a lower import tariff on meat or sugar coming from India than from the other regions of the world, and India having a higher tariff on EU meat imports but a lower tariff on EU sugar imports than on imports from other regions in the world. It also becomes clear that the high tariff levied by India on processed agricultural goods from the EU (figure 2.1) especially stems from high tariffs on beverages and tobacco products (applied tariff rate of 146% for the EU relative to 64% for the rest of the world).

Table 2-1 Detailed applied import tariffs by India and the EU, 2007

	Tariffs levied by EU on imports from:		Tariffs levied by India on imports from:	
	India	Rest of World	EU	Rest of World
Paddy rice	13.8	18.6	58.2	41.9
Wheat	5.4	5.0	99.5	99.3
Cereal grains nec b)	10.2	3.1	0.0	21.0
Oilseeds	0.0	0.0	29.0	46.8
Vegetables, fruit, nuts	3.0	4.6	47.7	33.8
Plant-based fibbers	0.0	0.0	13.3	9.8
Crops nec	1.5	0.9	25.2	53.5
Cattle, sheep, goats, horses	0.1	1.2	18.1	14.8
Animal products nec	3.4	1.7	5.3	6.6
Dairy products	3.1	23.9	32.2	30.1
Sugar	49.8	71.6	69.7	89.5
Vegetable oils and fats	1.1	4.6	38.6	57.7
Meat	10.3	29.5	29.9	14.9
Food products nec	6.2	5.8	38.5	35.1
Beverages and tobacco products	14.9	5.6	146.0	63.9
Fish	3.5	2.8	29.3	12.3
Forestry	1.5	0.1	9.2	6.6
Crude oil	0.0	0.0	0.2	9.9
Petroleum producs	0.0	0.3	14.8	13.9
Gas production	0.0	0.0	0.0	10.0
Coal	0.0	0.0	8.3	32.0
Chemicals	0.5	1.7	15.7	14.4
Labour intensive manufactures	2.0	2.8	14.2	12.6
Capital intensive manufactures	2.6	2.0	13.0	11.6
Services	0.0	0.0	0.0	0.0
Textiles and leather	7.4	3.7	15.8	15.5
Minerals	0.0	0.0	14.9	6.7

2.4 An FTA agreement between India and the EU

The approach in handling tariff reductions in the context of an India-EU free trade agreement is relatively simple. The basic idea is that all tariffs are abolished, except for tariffs on sensitive products, i.e. products that are particularly susceptible to competition from imports from other country suppliers. Sensitive products for India are dairy products, animal products, sugar, spirits and wines, and honey, while sensitive products for the EU are sugar, rice, cattle, beef, and non-ruminant animal products.

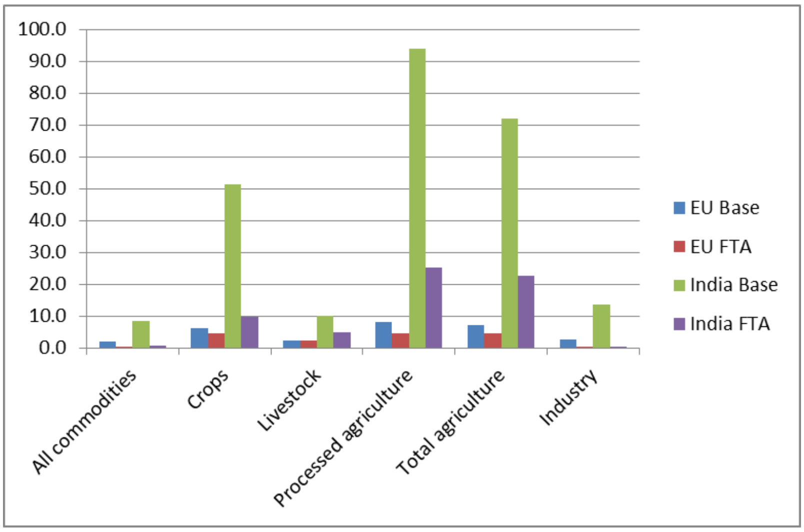

Figure 2-2 Bilateral import tariff reduction for EU and India in a free trade agreement

The consequence of such a tariff reduction is summarized in figure 2.2. The average import tariff rate by the EU for commodities from India is reduced from 2% to 0.1%, and the average import tariff rate by India for commodities from the EU is reduced from 8.4% to 0.6% (first category of columns in figure 2.2). The Indian import tariff reduction for crops and processed agricultural commodities are very substantial (second and fourth category of columns in figure 2.2). Indian import tariffs for industry are reduced from 14% to 0.3%. The EU tariff reductions are minor compared to these shocks, so one may conclude that the reduction in import tariffs is happening mainly on the Indian side. This can be explained by much higher initial rates of protection by India compared to the EU.

If we look into more detail for primary agricultural commodities (figure 2.3) we see that reductions in Indian import tariffs are especially large for vegetables, fruits, nuts (45%), and to a lesser extent for oilseeds, plant-based fibers and ruminant animal products. For industry, the differences in tariff changes are much less significant; for India tariffs on industrial products are all reduced by about 15%, and for the EU the largest reductions are in tariffs on textile (7%) and on manufacturing (2%).

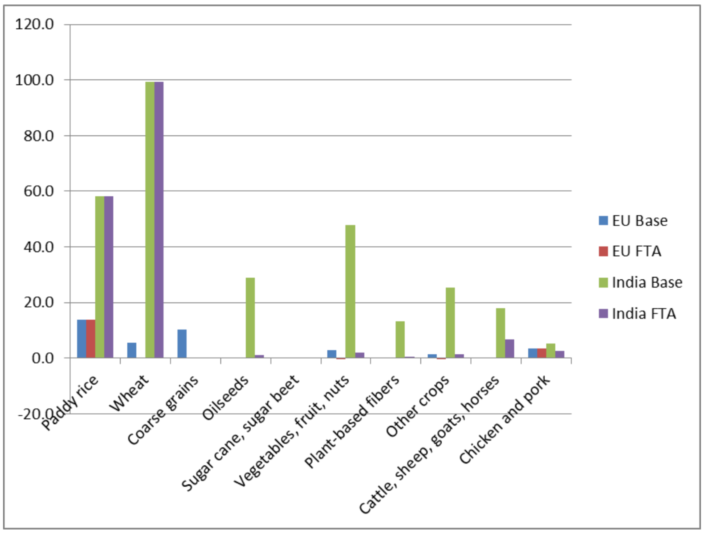

Figure 2-3 Bilateral import tariff reductions for EU and India in a free trade agreement for primary agricultural commodities

2.5 A WTO agreement

Negotiating a number of free trade agreements is a good strategy. However, from a global perspective it is better to have a consistent set of global tariff reductions. Although there are no formal negotiations under WTO, we will analyze the effects of a multilateral WTO agreement. We will follow the Falconer proposals, i.e. the proposals that still approach more or less what could happen in such a WTO agreement.

Table 2-2 Multilateral reduction in tariffs

Developed countries (including EU)		Developing countries (including India)	
Band	Tariff cut	Band	Tariff cut
<20	50	<30	33
20-50	57	30-80	38
50-75	64	80-130	43
>75	70	>130	47
average	54	average	36

The basic idea of a multilateral trade agreement is summarized in table 2.2. Current bound tariffs are divided in bands of tariffs depending on the size of the tariff. Because rich countries have, on average, lower tariffs and more possibilities to reduce tariffs, the tariff cuts are higher and the tariff bands are smaller. Some commodities are exempted from tariff cuts because they are sensitive, as summarized in table 2.3. Sensitive product exemptions are implemented for the EU, the NAFTA region (Canada, the US and Mexico), and India. If a product is identified to be sensitive, only one third of the tariff cuts as defined in the Falconer proposal are applied.

Table 2-3 Sensitive products in a WTO agreement

Country/region	Sensitive products
EU	Sugar, Cattle, Other agricultural products
NAFTA (Canada, US, Mexico)	Sugar, Dairy
India	Rice and Sugar

As indicated before, the reduction in bound tariffs may be much larger than the effective reduction in applied tariffs. For each 6 digit tariff line the new bound tariffs are calculated, and the minimum of the current applied tariff and the new bound tariff is considered to be the new applied tariff rate. What is relevant for the simulations is the change in applied tariff rates of which figures 2.4 and 2.5 give a short summary, comparing the tariff reductions with those of a free trade agreement.

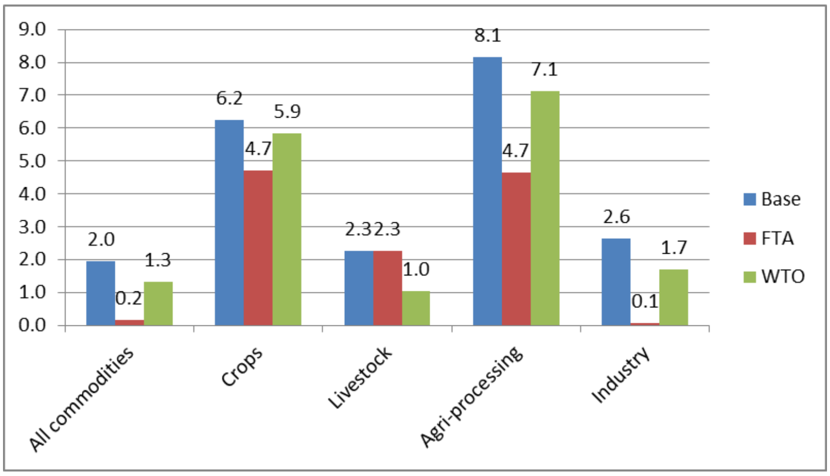

Figure 2-4 EU applied import tariffs for commodities from India (2015)

If we compare the impacts of a WTO agreement with a free trade agreement, we must be aware that a WTO agreement is a multilateral agreement, so trade tariffs with all countries are reduced, and roughly in the same manner. Considering the tariff changes by the EU for imports from India, we see that in general the WTO tariff reduction is smaller than the FTA tariff reduction, except for livestock products (figure 2.4). This is because in the FTA, the tariffs for the non-sensitive commodities are reduced by 100%, while for the non-sensitive products in the WTO agreement the bound tariffs are reduced by much less than 100% (table 2.2), where the effective applied rate reduction may even be smaller if the applied tariffs are below the bound tariffs (i.e. in the presence of a binding overhang).

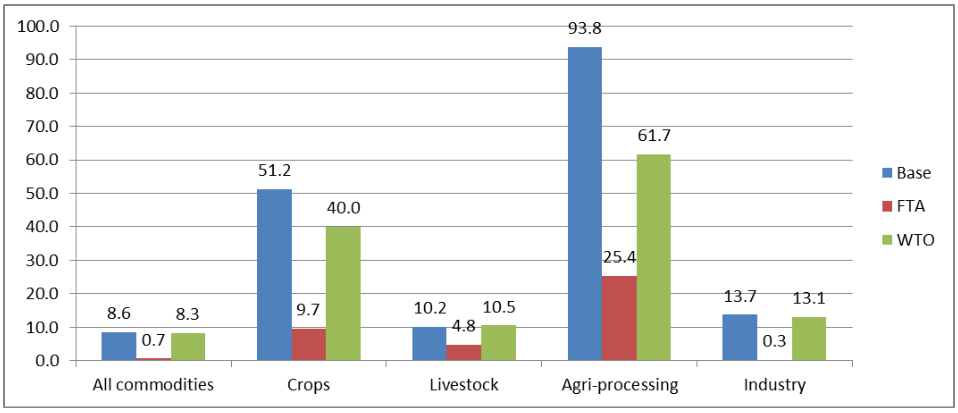

Figure 2-5 Indian applied import tariffs for commodities from EU (2015)

Note: agri-processing includes dairy products, sugar, vegetable oils and fats, meat, food products nec, beverages and tobacco products, oilcake and molasses.

With respect to Indian import tariffs for EU products, the reduction is larger for all commodities under an FTA agreement compared to the EU import tariffs for Indian commodities. However, the WTO agreement implies much smaller applied tariff reductions compared to those of the EU as India has a much higher binding overhang; a large reduction of bound tariffs only has a small impact on the applied tariffs of India. Furthermore for developing countries such as India, all bound tariff reductions are below 50%, while they are all above 50% for developed countries (table 2.2). At a more detailed level it can be seen that, as a consequence of changes in weights, the average tariff rate for livestock actually becomes higher with a WTO agreement than in the baseline; this is the consequence of a faster increase in imports of commodities with a higher tariff rate compared to those with a lower tariff rate.

Table 2-4 Indian applied import tariffs for agricultural imports (incl. processing) from the EU

	Base	FTA	WTO
Rice	58	58	50
Wheat	99	99	58
Oil seeds	29	1	29
Vegetable/fruit/nuts	48	2	31
Plant-based fibres	13	1	13
Other crops	25	1	23
Sheep, goat, cattle	18	7	18
Chicken and pork	5	3	5
Dairy	32	32	28
Sugar	70	70	70
Vegetable oil	51	19	46
Meat	30	10	29
Other food and feed	39	4	32
Beveridges and tobacco	146	146	81
Fish	29	28	29

The general pattern is the same for detailed agricultural commodities (table 2.4): in general the WTO agreement gives a much smaller reduction in tariffs for Indian imports from the EU than the FTA. Only for commodities that can be treated as sensitive under an FTA but not under a WTO agreement like wheat and dairy keep higher tariffs under an FTA agreement. This suggests that a large number of FTAs may perhaps have larger effects on total Indian import tariffs and import tariffs from partner countries than a WTO agreement.

In summary, with an EU-India FTA, average Indian import tariffs on products from the EU are reduced by about 8 percentage points, while in the WTO agreement the average applied tariffs reduced by less than half a percentage point. The average EU tariffs for imports from India reduced by about 2 percentage points in an FTA with the EU, and with 0.7 percentage points in a WTO agreement. For India the largest reductions in import tariffs under a WTO agreement are in agri-processing, and to a lesser extent crops, while an FTA generates tariff reductions across the board, but with relatively large reductions for crops, agri-processing and industry. For the EU, livestock tariffs go down more under a WTO agreement, while under a free trade agreement agri-processing, industry and to a lesser extent crop import tariffs are reduced by relatively more.

2.6 Simulation results

This section presents the results of the FTA and WTO scenarios. Since the implementation of the FTA and WTO agreement is in the period 2010-2015, we will present results for 2015, showing the impact of these agreements in difference from the baseline outcome in 2015. Note that, as the underlying data of the model are in value terms, in dollars of the year 2007, and prices are normalised to 1 (Harberger Convention), volume changes are also measured in 2007 dollar values (so assuming this dollar value hasn't changed since 2007).

2.6.1 GDP

We present the results of tariff liberalisation in agriculture and industry, excluding services and FDI, and also do not consider the impacts of non-tariff measure reductions. Furthermore, the results in later years may be different due to dynamic factor mobility and changes in incomes, and therefore savings and capital accumulation in the long term. In general, the consequences of trade agreements are larger in the long term than in the short term (conform the analysis by Ecorys, 2009).

Table 2-5 Change in real GDP in 2015 (2007 US$ million and %, in difference from the baseline)

	Change in mln 2007 $		Percentage of baseline	
	FTA	WTO	FTA	WTO
India	5303	3769	0.23	0.17
EU27	587	9410	0.00	0.05
Non_EUIndia	24	28965	0.00	0.06

Table 2.5 shows that GDP in India changes by about 5 billion 2007 dollars with an FTA and 4 billion with a WTO agreement compared to the baseline GDP in 2015. For the EU, the GDP impact of an FTA with India is much smaller as India is only a small trading partner for the EU (accounting for 1.8% of EU's trade) and the tariff reduction for imports from India by the EU are relatively small. However, the benefits of an FTA for India in relative terms are also very small, around 0.24% of GDP.

Ecorys (2009) finds in the limited FTA agreement in the short-run (in which tariff reductions dominate and so is most in line with our FTA scenario) that national income of India increases by 1.46 billion euro relative to a baseline with a WTO agreement and that of the EU by much more (2.9 billion euro). Neighbouring countries are slightly worse off and the rest of the world more so (by 2.14 billion euro). The EU's income gain in the short-run mostly stems from gains from tariff liberalisation, which however leads to very different results in our study. For India most of the gains stem from reductions in non-tariff barriers, which we did not model.

2.6.2 Trade

Table 2-6 Change in volume of Indian imports from the EU in 2015 (in difference from the baseline)

	FTA		**WTO**	
	2007 US$ million	% difference	2007 US$ million	% difference
All commodities	41149	52	2128	2.7
Crops	243	201	65	53.7
Livestock	21	36	4	6.8
Agri-processing	1842	687	102	38.1
Industry	38929	82	1657	3.5
Services	114	0	300	0.9

Let us investigate how the trade pattern of India changes. First, total imports by India of products from the EU change only slightly in the presence of a WTO agreement (2.7%), and increase considerably (by 52%) with an FTA. Especially the imports of processed agricultural products increases a lot (by 1.8 billion dollars, a close to 8-fold increase), while the import of industrial commodities almost doubles. In relative terms crop imports also shows a large (3-fold) increase in the presence of an FTA. Service imports remain more or less stable but are also not liberalised, so we refrain from making further statements on the services sector. In general, the observed patterns are in line with what we would expect from the tariff shocks discussed in sections 2.4 and 2.5, with WTO tariff reductions by India being relatively minor, and FTA tariff reductions being considerable and especially for crops, agri-processing and industry.

Table 2-7 Change in volume of Indian imports from the world in 2015 (in difference from the baseline)

	FTA		WTO	
	2007 US$ million	% difference	2007 US$ million	% difference
All commodities	18696	4.3	4401	1.0
Crops	207	4.1	875	17.2
Livestock	10	2.3	-18	-4.1
Agri-processing	1076	18.2	136	2.3
Industry	16885	4.9	3178	0.9
Services	517	0.7	231	0.3

Table 2.7 shows that a large part of the increase in Indian imports from the EU is not influencing total Indian imports that much. About half of the changes in imports from the EU is trade diversion, where India imports more from the EU at the cost of other countries (see also table 2.10 further on). For most commodities the diversion is more or less equally distributed over regions, but for agri-processing the increase in imports from the EU is mainly compensated by a decrease in imports from South and South East Asia.

Table 2-8 Change in volume of Indian exports to the world in 2015 (in difference from the baseline)

Destination:	EU27				Non_EUIndia			
Agreement	FTA		WTO		FTA		WTO	
Reported in:	2007 US$ million	% difference	2007 US$ million	% difference	2007 US$ million	% difference	2007 US$ million	% difference
All commodities	21290	15.7	3193	2.4	3761	1.0	2439	0.6
Crops	72	6.1	21	1.8	-131	-1.8	-11	-0.2
Livestock	0	-0.3	4	2.8	-2	-0.4	12	3.3
Agri-processing	287	12.7	171	7.6	-55	-0.5	368	3.2
Industry	21350	23.5	3385	3.7	4782	1.6	2261	0.8
Services	-418	-1.0	-389	-0.9	-833	-1.3	-191	-0.3

If we look at the change in the volume of Indian exports (table 2.8) the picture is roughly the same, except that exports to non-EU regions also increase in the FTA for industrial products. The background of this is quite simple: as a consequence of cheaper imports, the average market price of Indian commodities decreases and this gives the opportunity to export more, also to non-Indian regions. This pro-competitive effect is strongest for industry, where India already has a strong comparative advantage (see Deliverable 7.1).

Ecorys (2009) finds that in the short run following tariff liberalisation in an FTA with the EU, Indian exports increase by 4.9%. They also find that the surge in imports serves as an input to fuel the expansion of the domestic industry.

Table 2-9 Change in volume of EU imports in 2015 (in difference from the baseline)

Destination:	India				Non_EUIndia			
Agreement	FTA		WTO		FTA		WTO	
Reported in:	2007 US$ million	% difference	2007 US$ million	% difference	2007 US$ million	% difference	2007 US$ million	% difference
All commodities	22485	15.9	3388	2.4	6926	0.3	66355	2.4
Crops	77	6.0	22	1.7	119	0.2	-2077	-3.9
Livestock	0	-0.3	4	2.8	9	0.2	-290	-6.2
Agri-processing	322	13.2	179	7.4	267	0.4	16287	22.3
Industry	22505	23.5	3571	3.7	4353	0.2	56271	2.7
Services	-418	-1.0	-389	-0.9	2178	0.4	-3836	-0.7

The impacts of the FTA on EU imports seems to be different from that of India (table 2.9). While an FTA increases EU imports from India (parallel to the rise in Indian exports to the EU), especially for industrial products, also the imports from other regions of the world increase. The background of this effect is that, as shown before, India is importing less from other regions (due to abolishment of the tariffs shown in Table 2.1 the EU becomes a more interesting source region for India) and exporting more, so that as a consequence these regions try to sell their (industrial) commodities to the EU.

Summarising the changes in trade patterns from the perspective of the change in total international trade flows in 2015 in difference from the baseline (table 2.10), we see that India increases its exports to both the EU and the rest of the world, while the EU increases its exports to India partly at the cost of other regions in the world. The total exports of the rest of the world are reduced, mainly due to a fall in the exports to India as a consequence of the better competitive position of the EU following the FTA.

Ecorys (2009) finds very limited third-country effects on neighbouring countries (see also the reported national income changes before), mainly due to limited export volumes and the fact that some of India's neighbouring countries already enjoy preferential treatment through GSP+ and EBA. The remaining negative impact is mostly due to losses in market shares in textiles, important for those countries and largely overlapping with India's export interests.

Table 2-10 Change in volume of bilateral trade as a consequence of an India-EU FTA (2007 US$ million, difference from baseline)

From \ To	India	EU27	Non_EUIndia	World
India	0	22485	3926	26411
EU27	41149	-14036	-13266	13847
Non_EUIndia	-22453	6926	4138	-11389
World	18696	15375	-5202	-

With respect to imports (columns of table 2.10), we see that the EU imports more from India, and a little bit more from the rest of the world, at the cost of intra-EU trade. The rest of the world imports less from the EU, which is not fully compensated by increased imports from India and other regions of the world.

Table 2-11 Change in volume of bilateral trade in crops as a consequence of an India-EU FTA (2007 US$ million, difference from baseline)

From \ To	India	EU27	Non_EUIndia	World
India	0	77	-142	-64
EU27	244	-98	-51	95
Non_EUIndia	-37	119	34	117
World	207	99	-158	-

While table 2.10 describes the developments in total trade, table 2.11 focusses on trade in crops. The small increase in exports of crops of India to the EU is more than counteracted by a decrease in exports of crops to the rest of the world. For the EU, the increase in exports of crops to India is higher than the reduction of exports to other regions.. For the rest of the world, the increased exports of the EU to India provide opportunities to export more to the EU.

2.6.3 Focus: textile trade

In this section we analyse in more depth trade in textiles, the second largest employment generating sector in India. Table 2.12 shows that under an FTA the value of exports from India to the EU increases by 6 billion 2007 dollars, only partly counteracted by a reduction in exports to other regions of the world. The increased imports by the EU of textile products from India is more than counteracted by less imports from other regions in the world. These patterns reveal India's strong competitive position in textiles, which is further strengthened by an FTA with the EU. Also the EU exports somewhat more textile products to India, also found by Ecorys (2009). The reduction in import tariffs of India on EU textiles is about 15 percentage points, while the reduction of the EU import tariffs on Indian textiles is about 7 percentage points (see also table 2.1 for original tariff levels).

Table 2-12 Change in textile trade as a consequence of an India-EU FTA

(2007 US$ million, difference from baseline)

From \ To	India	EU27	Non_EUIndia
India	0	6708	-551
EU27	430	-2088	-71
Non_EUIndia	-118	-2528	192

The increased textile exports by India require additional production in India (table 2.13). In turn, the extra production in India implies more demand for plant-based fibres (i.e. cotton). 90% of this demand is supplied by domestic cotton producers, implying an increase in Indian cotton production of almost 4%. Because extra land is needed to produce this extra cotton, the land price increases by about 4%, so that only about 3% more land is required for this production. For the EU, the reduction in textile import tariffs implies a reduction in EU production of about 4 billion dollars, i.e. 1.7% of the total textile production value in the EU. Ecorys (2009) also finds that clothing and leather in the EU contract by about 2 to 3 percent.

Table 2-13 Indian production (2007 US$ million) and land use changes as a consequence of the EU-India FTA in 2015 (difference from the baseline)

Production volume	Textile	6344
Production volume	Plant-based fibres	659
Land use (km2)	Plant-based fibres	3329
Indian imports	Plant-based fibres	66

Considering the impacts of a WTO agreement, we see that the impact on trade with India is less, but that also other countries than India increase their exports to EU. The smaller impacts on trade are caused by the relatively small reductions in applied EU tariffs for textile imports: only a 3 percentage point reduction under a WTO agreement compared to a 7 percentage point under an FTA; for imports from other regions the reduction in tariffs is even half of this. The impacts of the WTO agreement on production and land use are roughly in line with the observed changes in trade.

Table 2-14 Change in textile trade as a consequence of a WTO agreement in 2015 (2007 US$ million, difference from the baseline)

From \ To	India	EU27	Non_EUIndia
India	0	1561	316
EU27	14	0	222
Non_EUIndia	57	3736	0

2.6.4 Consequences of trade agreements for production

Table 2-15 Percentage change in production as a consequence of an EU-India FTA (2015, in difference from the baseline)

		India	EU27	Non_EUIndia
Primary agriculture	Rice	0.00	-0.19	0.01
	Wheat	0.17	-0.09	0.05
	Coarse grains	0.04	-0.05	0.01
	Oilseeds	-1.62	0.60	-0.09
	Sugar cane/beet	-0.03	-0.08	0.02
	Vegetables and fruits	-0.04	0.05	0.00
	Plant-based fibres	3.62	0.07	0.09
	Other crops	-0.01	-0.13	0.01
	Cattle, sheep, goat	0.18	-0.07	0.00
	Chicken, pork	0.03	-0.06	0.01
	Milk	0.00	-0.05	0.01
Agri-processing	Dairy	-0.03	-0.05	0.03
	Sugar	-0.06	-0.13	0.03
	Vegetable oils	-5.96	5.71	-0.32
	Cattle, sheep, goat meat	-0.54	-0.08	0.02
	Chicken and pork meat	-0.32	-0.06	0.03
	Other feed and food	0.23	-0.07	0.02
	Beverages and tobacco	0.04	-0.03	0.01
Industry	Fish	-0.04	-0.01	0.01
	Forestry	-0.25	-0.04	0.01
	Crude oil	-0.06	-0.03	0.02
	Petroleum products	0.13	0.08	-0.01
	Biodiesel	2.64	0.02	0.14
	Biogasoline	0.24	-0.01	-0.01
	Gas	-0.08	-0.05	0.01
	Gas distribution	0.01	-0.10	0.01
	Coal	0.00	-0.02	0.01
	Chemicals	-0.62	0.21	-0.05
	Labour intensive manufacturing	0.67	-0.07	0.02
	Capital intensive manufacturin	0.38	0.11	-0.06
	Textile	5.36	-1.72	-0.25
	Minerals	-0.51	1.38	-0.10
	Construction	0.51	-0.07	0.02
	Fertilizer	0.93	-0.32	0.02
	Animal feed	0.07	-0.09	0.02
	Crude vegetable oil	-1.09	-0.14	-0.20
Services	Electricity	0.24	0.02	-0.01
	Water supply	-0.03	-0.01	0.01
	Trade	0.14	-0.01	0.00
	Transport	0.22	-0.01	0.04
	Other services	-0.20	-0.02	0.02

The most sensitive part of a trade agreement is what it implies for production of important sectors in the economy. The major changes in production for India as a consequence of an EU-India FTA are summarized in table 2.15. The table shows that vegetable oil and oilseeds is the main sector that loses, while textile and plant-based fibres is the main sector that gains, at a cost of EU textile production. Manufacturing is gaining slightly, while meats lose out slightly.

These outcomes are in line with the Ecorys (2009) study which also finds that the greatest gains are in clothing and leather products with around 20% increases in output in the short run as these sectors benefit from improved market access into the EU. (Note these outcomes are relative to a baseline including a WTO agreement, our baseline does not).They also find other industry expanding (light and heavy), but by less, and primary agricultural sectors contracting (by up to 0.5% in the short run). The surge in machinery and equipment production and export is found to support the rise in investment in India and subsequent dynamic gains. Cheaper imports are also found to fuel the expansion of the domestic industry.

The contraction of several primary agricultural sectors in India may imply farmers losing production and income, which has implications for food security especially for marginalised farmers. In this context, government support may be required. In general, however, the impacts are relatively small, although they may be higher for some specialised commodities. Part of the smallness of impacts can be explained by the assumption that the competition process as described by the Armington function in the model will not fundamentally change when the economy is opened up. Moreover NTB reductions, which may be quite considerable, haven't been considered, nor have longer term dynamic effects been included at this stage.

Table 2-16 Percentage change in production as a consequence of a WTO agreement (2015, in difference from the baseline)

		India	EU27	Non_EUIndia
Primary agriculture	Rice	-1.08	1.92	-0.83
	Wheat	-5.43	0.72	0.14
	Coarse grains	0.11	-0.12	0.52
	Oilseeds	0.69	1.30	-0.89
	Sugar cane/beet	1.03	-0.21	-0.13
	Vegetables and fruits	0.09	0.37	-0.07
	Plant-based fibres	2.74	2.44	-0.06
	Other crops	0.05	0.44	-1.10
	Cattle, sheep, goat	0.22	-9.16	1.66
	Chicken, pork	0.48	-0.55	0.05
	Milk	0.41	-0.62	0.21
Agri-processing	Dairy	0.18	-0.72	0.22
	Sugar	1.39	-0.27	-0.65
	Vegetable oils	0.76	-3.71	0.13
	Cattle, sheep, goat meat	-2.65	-19.88	2.78
	Chicken and pork meat	4.25	-1.18	0.17
	Other feed and food	0.39	0.29	-0.11
	Beverages and tobacco	-0.39	0.17	-0.01
Industry	Fish	-0.01	-0.13	0.00
	Forestry	0.02	-0.15	-0.25
	Crude oil	0.02	0.15	0.08
	Petroleum products	0.11	-0.02	0.23
	Biodiesel	-4.63	-1.38	1.82
	Biogasoline	-0.15	1.37	0.04
	Gas	-0.04	0.08	0.02
	Gas distribution	-0.49	0.22	-0.05
	Coal	-0.62	0.15	0.09
	Chemicals	-0.17	0.08	-0.19
	Labour intensive manufacturing	0.08	-0.35	0.20
	Capital intenstive manufacturing	0.12	-0.08	0.06
	Textile	1.75	-2.86	0.49
	Minerals	0.02	0.14	0.03
	Construction	0.07	0.20	0.07
	Fertilizer	-2.04	-0.08	-0.23
	Animal feed	1.90	-3.39	0.55
	Crude vegetable oil	-0.19	-0.58	0.07
Services	Electricity	0.02	0.01	0.00
	Water supply	0.04	-0.06	0.02
	Trade	0.12	0.05	-0.03
	Transport	0.17	0.36	0.11
	Other services	-0.05	0.05	0.00

The impacts of a WTO agreement on Indian and European production are much higher. For India (table 2.16) it generates an increase in chicken and pork meat production and, related to this, animal feed production. It increases also refined vegetable oil production. The sector that loses most is the wheat sector, followed by the biodiesel sector.

For the EU the plant-based fibres sector also wins, as does wheat and horticulture production (table 2.16). The EU cattle meat sector loses really significantly with 20%, and related with this the animal feed sector and the vegetable oil and biodiesel sector loose. Also EU textile loses about 3%.

In summary, for India the impact of an EU-India FTA on production is more or less of the same order of magnitude as a WTO agreement. For the EU a WTO agreement is much more significant. The reason for this is obvious: while for India trade with the EU is about 25% of its total trade, for the EU trade with India is less than 4% of its total trade.

2.6.5 Consumption

Both an FTA and a WTO agreement make consumption of agricultural commodities cheaper. Table 2.17 shows that this effect in India is very small for both an FTA and a WTO agreement, but relatively larger for the latter. The reason is that an EU-India FTA reduces only the tariffs between India and EU, and Indian imports of agricultural commodities from the EU are only 0.07% of production, so that the effect is very small. Total agricultural imports are about 2% of production in India, still not much, but at least more than the importance of trade with the EU.

Table 2-17 Percentage change in Indian consumer prices, 2015, relative to baseline

	FTA	WTO
Crops	-0.03	-1.69
Livestock	0.07	-1.55
Agri-processing	-0.29	-0.73
Industry	-0.13	0.11
Services	0.31	0.16

As a consequence, the impacts on consumption are also not very large. Nonetheless, a small increase in income increases private consumption slightly, i.e. by 0.25% in the case of a WTO agreement, and by close to nothing in the case of an FTA. Hence for the average Indian household, an FTA agreement with the EU does not seem to matter much from a food security perspective. A multilateral agreement appears to be slightly more beneficial. This does conceal impacts at the sectoral level, as observed before.

2.6.6 Welfare

In order to analyse the impact of trade agreements on welfare, the so-called equivalent variation is calculated. This tells us how much money would have to be taken away from the consumer *before the price change* to make her as well off as she would be after the price change. We calculate the equivalent variation per period and scenario and then calculate the difference with the baseline. The change in welfare can be decomposed into an allocation effect, i.e. the effect that resources are better allocated according to the preferences within the country, an endowment effect, i.e. the welfare effect because more endowments are available, a technology effect, i.e. the result of technological change, a population effect, i.e. the welfare increase of a rising population, a terms of trade effect, from improvements in the terms-of-trade, and finally the effect of investment that may differ from savings. Table 2.19 summarizes the welfare effects of an FTA at the end of each four five-year periods,.

Table 2-18 Welfare decomposition of an FTA for India over time (2007 US$ million, % of GDP, difference from baseline)

	2007 US$ million				% of GDP			
	2015	2020	2025	2030	2015	2020	2025	2030
Allocation	1945	-875	-1386	-1801	0.09	-0.03	-0.03	-0.03
Endowment	1553	3489	4480	6035	0.07	0.10	0.09	0.08
Technology	641	2315	3881	6108	0.03	0.07	0.08	0.09
Population	65	125	336	519	0.00	0.00	0.01	0.01
Terms of Trade	-1441	-2101	-3345	-6379	-0.06	-0.06	-0.07	-0.09
Investment/Saving	-334	0	-12	-35	-0.01	0.00	0.00	0.00
Total	2429	2953	3954	4447	0.11	0.09	0.08	0.06

The table shows that the FTA is beneficial for India, where the total effect is in the order of magnitude of billions of dollars, but this is only a very small percentage of Indian GDP. Let us first consider the impacts in 2015. Lowering the import tariffs increases welfare in 2015 because it firstly greatly improves the allocation of resources within the country. The second considerably positive effect is an endowment effect, especially because the capital stock increases as a consequence of higher GDP and therefore higher savings. Also the use of land increases a little bit, but this effect is relatively small. These beneficial impacts are counteracted by a large loss in terms of trade: as India reduces its import tariffs for imports from the EU, but keeps the tariffs for imports from other regions in many cases at the same level, India's terms-of-trade with its trading partners on net deteriorates; India imports from the more expensive EU at the cost of cheaper suppliers. This trade diversion effect results in a negative terms of trade effect. However, the overall welfare impact is still positive in 2015, and in all other periods.

As times go by, the benefits of the FTA tend to increase. The fundamental reasons for this are the endowment and technology effect. Because India generates a higher GDP, India is able to save more, and as a consequence invests more. The extra growth in capital stock is small, but in 2030 the capital stock is 0.6% higher than without the FTA, in total generating about 6 billion 2007 dollars more welfare.

The larger capital stock creates also more benefits of technological change, because this is applied to a larger value. Due to the larger exports India loses a lot on the terms of trade.

Table 2-19 Welfare decomposition of a WTO agreement for India over time (2007 US$ million, % of GDP, difference from baseline)

	2007 US$ million				% of GDP			
	2015	2020	2025	2030	2015	2020	2025	2030
Allocation	1931	137	175	211	0.09	0.00	0.00	0.00
Endowment	837	1092	1348	1493	0.04	0.03	0.03	0.02
Technology	-34	419	742	1127	0.00	0.01	0.02	0.02
Population	64	39	94	118	0.00	0.00	0.00	0.00
Terms of Trade	-501	-530	-832	-1370	-0.02	-0.02	-0.02	-0.02
Investment/Saving	127	1	-10	-8	0.01	0.00	0.00	0.00
Total	2424	1158	1517	1571	0.11	0.03	0.03	0.02

The welfare effects of a WTO agreement are much smaller than for an FTA (table 2.20). The allocation effect for 2015 is almost identical to that occurring in the FTA agreement, where the smaller reduction of tariffs is compensated by the fact that the reductions are for all regions of the world, leading to a much smaller terms of trade loss. However, the endowment and technology effects are much smaller, because GDP rises less, and therefore the growth of capital stock is smaller.

Table 2-20 Welfare decomposition of an FTA for the EU over time (2007 US$ million, % of GDP, difference from baseline)

	2007 US$ million				% of GDP			
	2015	2020	2025	2030	2015	2020	2025	2030
Allocation	1173	-1079	-1281	-1665	0.01	-0.01	-0.01	-0.01
Endowment	-249	-146	213	423	0.00	0.00	0.00	0.00
Technology	105	1165	1133	1256	0.00	0.01	0.01	0.01
Population	14	137	70	-17	0.00	0.00	0.00	0.00
Terms of Trade	3639	1710	3082	6179	0.02	0.01	0.01	0.03
Investment/Saving	188	88	101	136	0.00	0.00	0.00	0.00
Total	4870	1875	3318	6312	0.03	0.01	0.02	0.03

For the EU the picture is quite different (table 2.21). Because the FTA generates almost no extra growth, the endowment effect is small. The allocation effect is positive in the first period, but becomes negative afterwards as a consequence of the increased trade that makes the distortions more disturbing. But the real benefit for the EU is an improvement in its terms of trade because of the reduction in Indian tariffs.

Table 2-21 Welfare decomposition of a WTO agreement for the EU over time (2007 US$ million, % of GDP, difference from baseline)

	2007 US$ million				% of GDP			
	2015	2020	2025	2030	2015	2020	2025	2030
Allocation	6529	-2150	-3122	-4214	0.04	-0.01	-0.01	-0.02
Endowment	1093	1634	1314	980	0.01	0.01	0.01	0.00
Technology	-80	-1150	-911	-697	0.00	-0.01	0.00	0.00
Population	21	-210	-96	19	0.00	0.00	0.00	0.00
Terms of Trade	-6969	1249	1718	2514	-0.04	0.01	0.01	0.01
Investment/Saving	-354	-162	-111	-39	0.00	0.00	0.00	0.00
Total	240	-789	-1208	-1437	0.00	0.00	-0.01	-0.01

The WTO agreement seems to work out negatively for the EU's welfare (table 2.22), except for the first period when the agreement is introduced. During the first period the allocation effect is very positive, compensating for the losses as a consequence of changes in the terms of trade. Although the WTO generates slightly higher growth, the effect is small. The terms of trade improvement that is generated by the agreement does not compensate for the negative effect of the remaining import taxes.

Table 2-22 Welfare decomposition of a FTA for the rest of the world over time (2007 US$ million, % of GDP, difference from baseline)

	2007 US$ million				% of GDP			
	2015	2020	2025	2030	2015	2020	2025	2030
Allocation	-339	-274	-522	-920	0.00	0.00	0.00	0.00
Endowment	166	-432	-1089	-2352	0.00	0.00	0.00	0.00
Technology	-243	-1870	-2480	-3630	0.00	0.00	-0.01	0.00
Population	7	-421	-478	-492	0.00	0.00	0.00	0.00
Terms of Trade	-2286	374	245	81	0.00	0.00	0.00	0.00
Investment/Saving	145	-87	-89	-103	0.00	0.00	0.00	0.00
Total	-2550	-2710	-4413	-7416	-0.01	-0.01	-0.01	0.00

For the rest of the world the effect of a FTA between India and the EU is certainly negative (table 2.23). The agreement hampers the development of sectors with faster technological change, and therefore makes the rest of the world worse off. The agreement gives a negative terms of trade effect in the first period because the non-involved regions have more problems to export.

Table 2-23 Welfare decomposition of a WTO agreement for the rest of the world over time (2007 US$ million, % of GDP, difference from baseline)

	2007 US$ million				% of GDP			
	2015	2020	2025	2030	2015	2020	2025	2030
Allocation	17558	-6961	-8745	-11461	-0.01	-0.02	-0.02	0.00
Endowment	6592	18665	21543	23136	0.04	0.04	0.03	0.00
Technology	2854	11342	14441	20461	0.02	0.03	0.03	0.00
Population	381	466	105	-397	0.00	0.00	0.00	0.00
Terms of Trade	7771	-834	-1086	-1700	0.00	0.00	0.00	0.00
Investment/Saving	230	178	140	68	0.00	0.00	0.00	0.00
Total	35386	22856	26398	30107	0.05	0.05	0.04	0.00

Finally, the welfare effect of a multilateral WTO agreement is very positive for the world as a whole (table 2.24). The reduction in import tariffs in a lot of regions give an initial improvement of the terms of trade, but when the economy grows further this effect is reduced over time. The WTO agreement gives opportunities to specialize better, and this implies that technological development can be better used. The higher GDP that is generated creates extra savings and therefore more investment generating further growth. In 2030 the world capital stock is 0.15% higher; not much but certainly valuable.

The Ecorys (2009) study does not incorporate welfare impacts in terms of the EV but only in terms of national income. They find that the short term for a limited FTA dominated by tariff reductions (as we modelled the FTA agreement) gains for India of 1.46 billion euro increase to 9.57 billion euro in the long run. The EU is expected to gain 2.9 billion euro in the short run and only 350 million euro in the long run. For the rest of the world (excluding neighbouring countries), the losses increase from 2.14 billion euro in the short run to 10.88 billion euro in the long run.

2.7 The effect of trade agreements on Indian income distribution

This section provides the results of the scenario of FTA and WTO impacts on income distribution. The similar set of import tariff and export tax reductions that were adopted in the global model were introduced in the national model. The scenarios basically indicate tariff reduction on imports by India from rest of the world and imports by the rest of the world from India as agreed upon in FTA and WTO negotiations. The border prices extracted from the global model were fed into the national model to get the revised baseline scenario results and then with similar assumptions on other parameters being held, the FTA and WTO import and export tax regimes were implemented to arrive at FTA and WTO scenario results. These results were compared with that of the revised baseline. The results were obtained only for the block year 2015 in line with the global model results.

2.7.1 Composition of income across rural and urban

Rural income share has increased in FTA scenario by 2 percentage points. No significant changes were recorded in rural urban income distribution as compared to the baseline in the WTO regime. However there is an income transfer from rural rich to rural middle and poor in the WTO scenario. Under FTA regime, there is an overall increase in all the groups in the rural even though the increase is more in percentage terms for rural poor. Rural poor real income share has increased from 4.90 to 5.35.

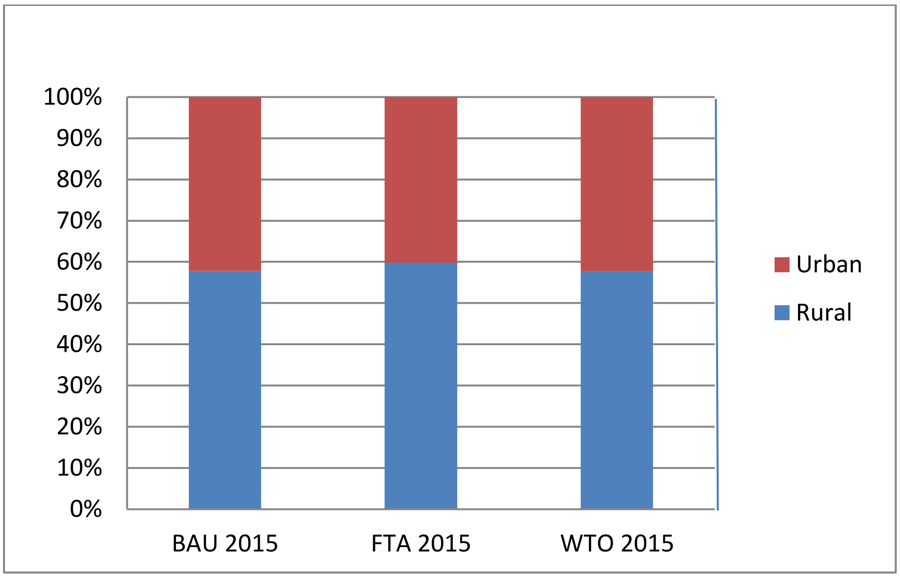

Figure 2-6 Real Income Composition – Rural vs Urban

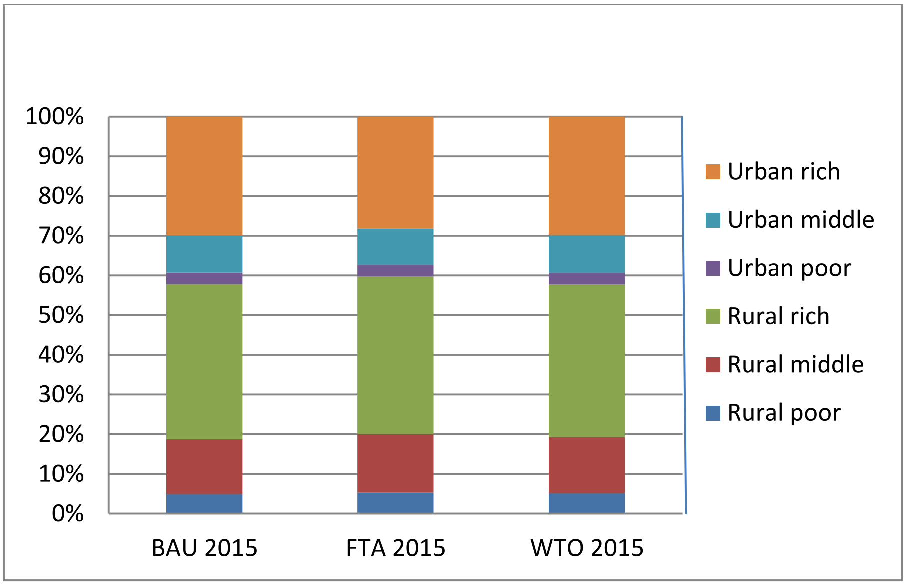

Figure 2-7 Real Income Composition by Income groups

The table below clearly indicate that the introduction of FTA or WTO redistribute income from rich to poor and middle groups as compared to BAU scenario in the year 2015. In the absence of changes in trade policies , from 2007 to 2015 , the share of poor in the total income, both rural and urban, has seen a significant reduction.

Table 2-24Real Income composition in comparison with base year

HH	2007		2015		
			BAU	FTA	WTO
Rural poor	5.65		4.90	5.35	5.15
Rural middle	14.79		13.80	14.65	14.13
Rural rich	37.70		39.12	39.78	38.43
Urban poor	3.18		2.86	2.85	2.93
Urban middle	9.80		9.42	9.13	9.47
Urban rich	28.88		29.89	28.24	29.89
Rural	58.14		57.82	59.78	57.71
Urban	41.86		42.17	40.22	42.29

If we peruse total annual percentage growth rates in real income, then FTA scenario has the maximum gain for poor people in both rural and urban.

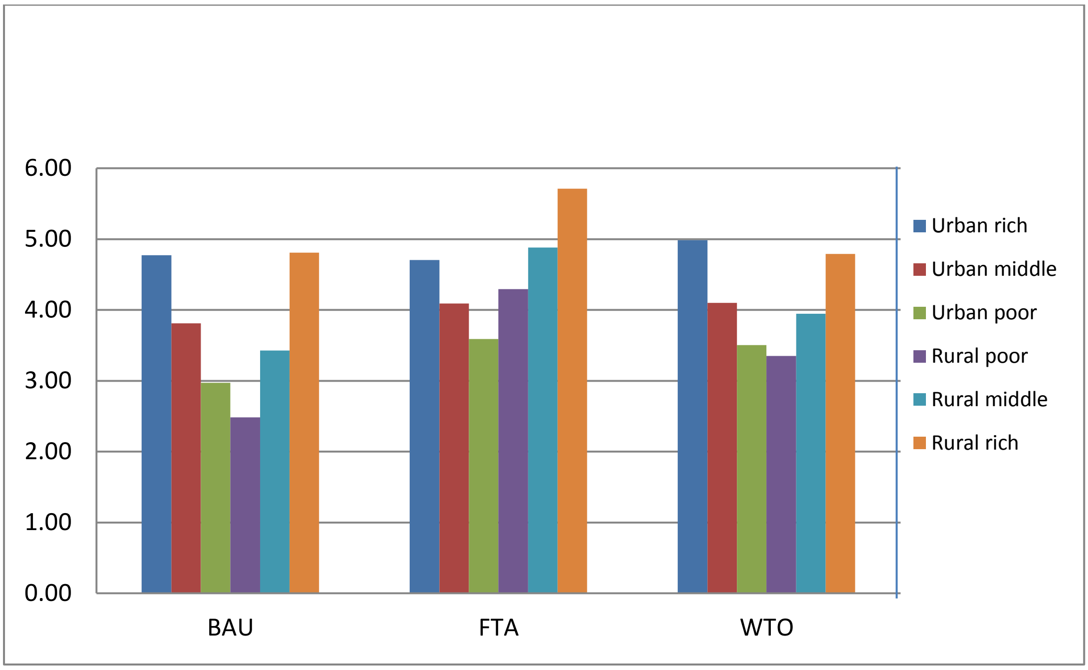

Figure 2-8 Total Real Income annual Growth rates in % by Household Groups

Table 2-25 Real Income per Capita – Annual income in rupees (₹)

HH	2007		2015		
			BAU	FTA	WTO
Rural poor	8412		9589	11031	10256
Rural middle	16531		20277	22674	21104
Rural rich	56172		76620	82066	76507
Urban poor	12170		12743	13370	13278
Urban middle	28149		31458	32137	32163
Urban rich	110696		133146	132483	135325

Income per capita increases by about ₹ 1442 for rural poor and ₹ 627 for urban poor in the FTA scenario. The WTO regime is more favourable to urban middle and rich as compared to FTA.

Rural skilled and unskilled wages have been pushed up in the FTA and WTO scenario

Table 2-26 Wages (base year 2007 wage = 1.00)

Labour	2015 BAU		2015	
			FTA	WTO
Rural unskilled	1.28		1.33	1.26
Rural skilled	1.30		1.31	1.25
Urban unskilled	1.17		1.17	1.12
Urban unskilled	1.22		1.21	1.20

Rural unskilled labour gained the most in the FTA regime. In terms of wage WTO is not benefitting the rural nor the urban workers. However rural income is boosted because of increase in land prices and capital prices. Scarcity in agriculture capital also is one reason for increasing agriculture capital rental income. Urban rich obtain a significant increase in income in the WTO scenario.

2.7.2 Concluding Remarks

The income distributional impacts of FTA is favourable to rural, particularly rural poor. However, the WTO regime is not giving significant gain to the rural poor, although rural poor and middle income groups gain compared with the BAU scenario. In general, WTO renders more benefits to urban than rural if we compare WTO with FTA regimes.

2.8 Conclusion

In summary, an EU-India FTA gives advantages to both India and the EU, although for different reasons. The net effect for the rest of the world is slightly negative. A WTO agreement as implemented here implies relatively small reductions in tariffs and generates relatively small benefits for India and only short term benefits for the EU. The rest of the world has the most advantages of such an agreement. The analysis shows how important it is to include dynamic effects of trade agreements.

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3 Biofuel scenarios

The production and use of biofuels can have positive impact on food security (e.g. through higher producer prices and higher household incomes and increased rural development) and negative food security impacts (e.g. reduced availability of land for food production and higher consumer prices). The biofuel policies in India and elsewhere may therefore have large consequences for international trade of agricultural commodities and food security.

3.1 Introduction

The production and use of biofuels increased rapidly during the previous years. Global ethanol production increased from 48 billion litres in 2005 to 113 billion litres in 2012, and biodiesel production increased from 5.3 to 28 billion litres (FAO and OECD 2012). At this moment more than 50 countries across the world have implemented biofuel policies, including India (Sorda *et al.* 2010). These policies typically consist of subsidies on biofuel use or production or biofuel blend mandates.

The recent rise in use of biofuels is driven by concerns over energy security, climate change and rising fossil fuel prices. But also the additional demand for agricultural commodities and consequently additional farm income are important benefits of these biofuel policies. Furthermore, biofuels are often seen as a stimulant for rural development and employment.

In recent years it has become clear that the use of current first-generation biofuels, which are made from conventional starch-, oil- and sugar-containing crops, such as wheat, maize, rapeseed, palm fruit, soybeans and sugarcane, has important disadvantages. Food security may be negatively affected by higher prices of agricultural commodities and also the greenhouse gas balance is not as beneficial as initially assumed, partly as a result of the loss of natural vegetation due to indirect land use change (ILUC). These ILUC effects also reduce biodiversity. Finally, various studies suggest that biofuel production can negatively affect the socio-economic conditions in rural areas in developing countries, for example the insidious dissipation of indigenous land use rights.

In 2001 India implemented a pilot program aimed at realising 5% ethanol blending (E5) and launched a National Mission on Biodiesel in 2003 to achieve a 20%

biodiesel blends (B20) by 2011–2012 (Pohit *et al.* 2011). In 2009 the Government of India approved the National Policy on Biofuels that includes an indicative 20% blending target by 2017, both for bio-diesel and bio-ethanol (India 2009). The objective of this policy is to reduce the dependency on imports of fossil oil, to reduce greenhouse gas emissions, and to promote rural development and generate employment opportunities. A prerequisite thereby is that biofuels may not be produced at the cost of food crops. For this reason, only the production of biodiesel from non-edible oilseeds on waste, degraded and marginal lands is promoted. At the moment the production of jatropha is not commercially viable, except for some heavily subsidised projects, and it is expected that the blending target for biodiesel for 2017 will not be realized (Pohit *et al.* 2011; USDA 2012). In the case of ethanol the main feedstock is molasses, which is a by-product of sugar cane processing. However, it is expected that the 20% blending target for ethanol by 2017 cannot be realised using only molasses (Pohit *et al.* 2011; Raju *et al.* 2012; USDA 2012).

Several studies have been carried out on status of biofuel use in India and on the impact of on the implications for land use, food production and environment in India (Pohit *et al.* 2011; Ravindranath *et al.* 2011; Schaldach *et al.* 2011). Also several case studies have been carried out (Mahapatra and Mitchell 1999; Agoramoorthy *et al.* 2009; Findlater and Kandlikar 2011; Sasmal *et al.* 2012). This chapter adds to these studies by investigating the consequences of the National Biofuel Policy of India and of biofuel policies in other countries on poverty, welfare, land use, trade, food security, etc. in India to the year 2020 using a global economic model.

3.2 Modelling biofuels

The impact of biofuel policies in India and elsewhere are investigated using the MAGNET general equilibrium model framework (i.e. Modular Applied GeNeral Equilibrium Tool). For the simulations in TAPSIM the MAGNET model is expanded and improved so that it takes into account the production of ethanol from molasses, the intensification of crops and livestock production, the use of by-products of biofuel production as animal feed, and also the substitution possibilities for different feedstock of biofuel production.

3.2.1 New sectors

First, several new sectors were added to the MAGNET model to generate a model that is suitable to analyse the impact of biofuel policies, namely:

- The production of ethanol from molasses, which is a by-product of sugar production, is split off from the sugar sector. In other countries biofuels are produced from conventional agricultural crops, which are already considered in the MAGNET model. Growing sweet sorghum is also a potentially feasible option for marginal lands in India, though the yields are likely to be low (Ravindranath *et al.* 2011) and therefore only the production of ethanol from molasses and sugar cane are considered.
- The production of animal feed is separated from the sector “other feed and food”, which includes for example also canned fish. This is needed to account for the impact of high value by-products of biofuel production. For maize and wheat ethanol this is Distiller's Dried Grains (DDG) and the main by-product of biodiesel production is oilcake from crushing of oilseeds in the vegetable oil sector.
- The vegetable oil sector is split in a sector that produces relatively cheap crude vegetable oils, which are used for biodiesel production, and relatively expensive refined and processed vegetable oils, which are used in cosmetics and in the food processing industry.
- Finally, a key issue is the impact of biofuels on the intensification of agriculture, i.e. on crop yields. One of the main ingredients of intensification is the increase in the use of fertilizer. In the GTAP database fertilizer is included in the chemical sector. For this reason the fertilizer sector had to be split from the chemical sector.

3.2.2 Substitution in production

The next step thus involves the modelling of substitution between fossil fuels and different biofuels, substitution between biofuel by-products and other feed for livestock, and for substitution between different inputs for biofuel production. The MAGNET model has a flexible constant elasticity of substitution (CES) nesting structure for production. This flexibility creates the opportunity to change the substitution possibilities between inputs in case this is relevant for a specific policy scenario.

For all sectors that are not discussed below a production structure derived from GTAP-E, i.e. the energy variant from GTAP, is used (Figure 3-3-1). At the top value added and all intermediate inputs have fixed technical coefficients. Within value added there is a non-capital value added nest and a capital-energy nest. Within the capital-energy nest capital and energy can be substituted. Within the energy nest different types of energy can be substituted. The elasticity of substitution between capital and energy is set at 0.5, and between the different types of energy at 1.0, following GTAP-E. For the non-capital value added nest the standard GTAP substitution elasticities are used.

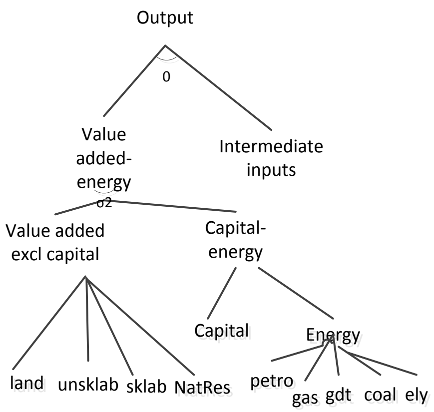

Figure 3-3-1 The standard CES production structure of MAGNET

In the petroleum sector crude oil is converted into conventional fossil fuels and also ethanol and biodiesel are blended with these petroleum products. For this reason, the first CES level concerns the blending and substitution of biofuels and fossil fuels (Figure 3-3-2). The share of biofuels in fossil fuels is exogenously determined, based on the biofuel policies in various countries {Sorda, 2010 #90}. The elasticity of substitution fossil and biofuel is thereby set very high (50) while substitution possibilities between biodiesel and ethanol is relatively small (3). The production structure of the fossil fuel sector is the standard GTAP configuration: a CES nest for value added and fixed coefficients for the intermediate inputs.

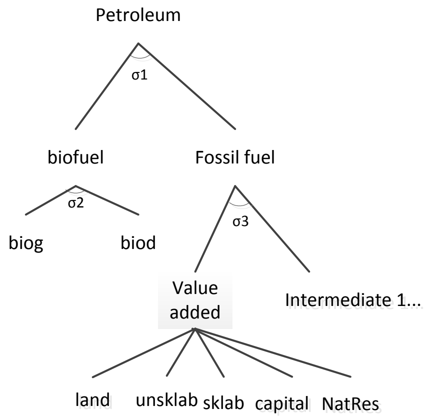

Figure 3-3-2 The CES production structure of the petroleum sector

The ethanol and biodiesel sector convert biofuel feedstock into biofuel. These sectors follow the standard production structure with one extra nest, the feedstock nest. Biodiesel is made from vegetable oil only, so no substitution is possible (Figure 3-3-4). For ethanol the substitution possibilities are much larger, as Figure 3-3-3 shows (the part below the value-added energy nest is not shown). Substitution is possible between sugar based and other feedstock with an elasticity of substitution of 5. Much easier is the substation between sugar based feedstock (sugar cane, sugar beet and molasses; elasticity of substitution of 50) and between starch based feedstock (wheat and grain; elasticity of substitution of 20). These numbers are chosen based on the plausibility of the results.

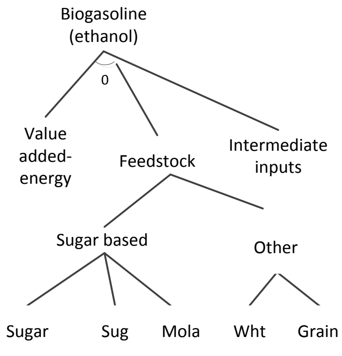

Figure 3-3-3 The CES production structure of the ethanol sector

The intensification of crop production requires that the use of cropland can be replaced by an increased use of fertilizers, i.e. when you apply more fertilizer less land per kg of crop is required. Figure 3-3-4 shows the resulting production structure of crop producing sectors. The basis is standard GTAP/MAGNET, but the value added nest is split into a land-fertilizer nest and a standard value added nest that excludes land. Substitution between land and fertilizer is possible within the fertilizer-land nest. For the substitution between fertilizer-land and value added a substitution elasticity of 0.1 is used, which is the default value in MAGNET, and the substitution elasticity between land and fertilizer is 0.8.

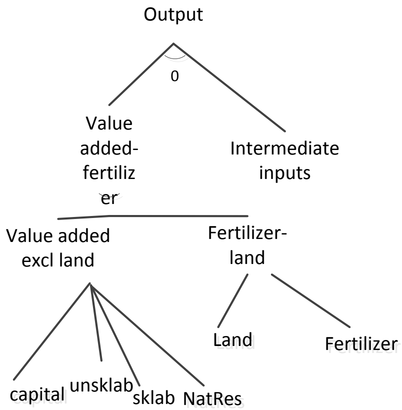

Figure 3-3-4 The CES production structure of crop sectors

The animal sectors have a similar CES structure as the crop sectors, except that there is no land-fertilizer substitution, but only a land - animal feed nest (with an elasticity of substitution of 0.6; Figure 3-3-5). This nest mimics the substitution possibility between crops used as animal feed (e.g. maize, soybean, wheat, beet) and pastures used for grazing. Within the animal feed nest there is a possibility to substitute between high energy feed and high protein feed with an elasticity of substitution of 2. Within these feed categories the elasticity of substitution is 20, i.e. the various feed sources can easily be substituted. This ensures that the effects of an increase in the supply of by-products of biofuel production, for example DDGs and oilcake, or a decrease in the availability of molasses for animal feed production are properly considered.

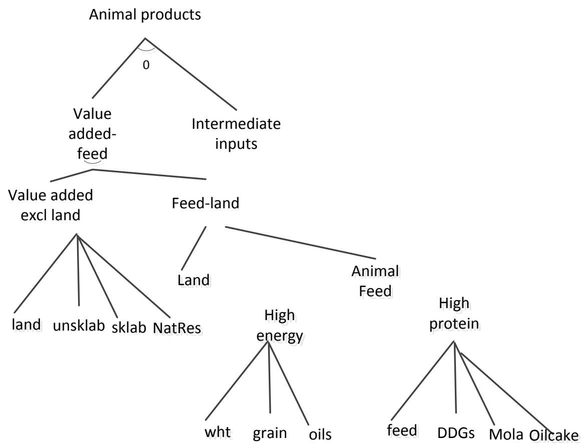

Figure 3-3-5 The CES production structure of animal sectors

As discussed before, GTAP has a large sector called "other feed and food" that includes the production of animal feed. Concentrated animal feed is produced from various ingredients, depending on relative prices. For this reason, the animal feed is split off from the "other feed and food" sector and has been given a separate nesting structure.

In summary, for the simulation in TAPSIM an detailed production structure has been developed that takes into account the technologies for biofuel production, intensification in crops and livestock, use of molasses for ethanol production, use of by-products of biofuel production as animal feed, and also substitution possibilities for different feedstock of biofuel production. In almost all sectors capital and energy can be substituted and different types of energy are substitutable. The result is an updated version of the MAGNET general equilibrium model framework in which the key economic mechanisms are considered that are needed when evaluating the macro-economic and food security impacts of biofuel policies in India and worldwide.

3.2.3 Modelling biofuel targets

In most countries biofuel policies are formulated as a target share of biofuels in fuel used for road transport. Data on biofuel production, consumption and share of biofuel in road transport in the base year of the MAGNET model (2007) are taken from data from the International Energy Agency {IEA, 2011 #10}. The value of biofuel production in each country in the GTAP database is calculated by multiplying these numbers with the price of the biofuels. The price of biofuels is based on cost structures of the ethanol and biodiesel production per feedstock and the price of feedstock calculated from the required quantities and the average price of these quantities in the model.

The biofuel is blended with fossil fuels in the petroleum sector, and this is sold to the users of transport fuels. Substitution between fossil fuels and biofuels in the MAGNET model is guided by subsidies on biofuel use in the petroleum sector. In order to prevent that these subsidies are at the cost of the government budget we assume that the users of transport fuel pay a fictive fuel tax that finances the required subsidy. In this manner the blending of biofuel is financed in a budget neutral way for the government and works as a blending requirement for the petroleum sector.

The biofuel policies implemented in many countries across the world requires in many cases a rapid increase in biofuel use to 2020. To accommodate these large changes the substitution elasticities between conventional fuels and biofuels are set very high, i.e. at 50. This is also feasible if the biofuel shares are set exogenously, as is done during all simulations discussed in this chapter. To allow for substitution of different types of biofuels feedstocks without drastic changes in relative costs, the elasticities of substitution are set very high, namely 5 in general, 50 between different sugar inputs, and 20 between the other inputs. This guarantees that substitution is possible, which is especially important to allow for substitution between sugar cane and molasses in India.

3.3 Scenarios

Three scenarios have been developed that can be compared with a baseline in which the share of biofuels used in transport fuels remains constant at the level in 2007 in all countries. In the first scenario only biofuel policies outside India are considered (called Non-India biofuels). This implies a biofuel share in transport in 2020 of 5% for the EU and South East Asia, 10% for the USA, Indonesia, Rest of Southern Asia, 15% for China and 25% for Brazil. In the second scenario a biofuel share of 20% for India in 2020 is assumed (called India biofuels). The third scenario combines the other two scenarios, i.e. both India and the rest of the world fulfil their biofuel commitments (called Global biofuels).

3.4 Simulation results

3.4.1 Biofuel production and feedstock demand

The average worldwide biofuel share in transport fuels is 6.0%, 1.4%, and 6.7% for the Non-India biofuels, the India biofuels and the Global biofuels scenario, respectively. The biofuel share in the baseline scenario is 0.7%. Most of the production of the biofuels will take place in the regions where the demand is generated and trade of biofuels is limited.

Table 3-1 The volume of use of agricultural commodities for biofuel production in 2020 in the three scenarios relative to the baseline scenario, in million constant 2007 dollars.

	Non-India biofuels	India biofuels	Global biofuels
Wheat	2475	2	2542
Coarse grains	90656	54	90273
Sugar cane/beet	13627	11143	24941
Molasses	1255	2072	3508
Vegetable oils	58436	38	59732

The production of biofuels requires extra feedstock, as shown in Table 3-1. The India biofuel scenario results in an increase of especially the use of sugar cane and partially molasses. The increase in use of molasses outside India is the result of small shares in 2007 of ethanol from molasses in the Southern America and South-East Asia in combination of the high substitution elasticity with sugar cane.

The increase in demand of feedstock used for biofuel production generates a substantial price effect (Table 3-2). The biofuel policy in India results in a 27% higher sugar cane/beet price and 11% higher molasses price in 2020. Biofuel policies in the rest of the world especially affect the price of coarse grains (+18%) and vegetable oils (+19%). The price of wheat is much less influenced by biofuel policies in India and elsewhere.

Table 3-2 The change in global price of feedstock input for biofuels in 2020 relative to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels	Global biofuels
Wheat	5	1	6
Coarse grains	18	0	21
Sugar cane/beet	13	27	38
Molasses	-1	11	12
Vegetable oils	19	0	21

The increase in prices of agricultural commodities also reduces demand for these commodities other than for biofuels. Therefore, the net effect of the extra biofuel production is less, as can be seen by comparing Table 3-1 and Table 3-3. You see even that for the commodities that are used in small amounts the production volume, i.e. wheat and molasses, the production volume is less in the biofuels scenarios than in the baseline. For molasses this is a little bit confusing, because in the production of ethanol from sugar cane implicitly also some molasses is produced, which is not mentioned separately in the statistics.

Table 3-3 The volume of global use of agricultural commodities in 2020 relative to the baseline scenario, in million constant 2007 dollars.

	Non-India biofuels	India biofuels	Global biofuels
Wheat	-988	28	-919
Coarse grains	86047	264	84558
Sugar cane/beet	13480	11727	25141
Molasses	-325	-82	-401
Vegetable oils	54028	90	55014

Further, Table 3-4 shows that the total effect of biofuel policies on production of agricultural commodities is significant. In the Global biofuels scenario the global production of sugar cane increases with 40%, the production of coarse grains with 30%, and the production of vegetable oils even with almost 50%. The production of molasses is relatively constant in all three scenarios.

Table 3-4 The change in volume of global production of agricultural commodities in 2020 relative to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels	Global biofuels
Wheat	-0.5	0.0	-0.5
Coarse grains	31.2	0.1	30.7
Sugar cane/beet	20.7	18.0	38.7
Molasses	-1.5	-0.4	-1.9
Vegetable oils	47.5	0.1	48.3

3.4.2 Land use and intensification

As a consequence of the biofuels policies the use of agricultural land changes. Table 3-5 shows that total global area of agricultural land increases 1.9% in case of the Global biofuels scenario. Especially the area cropland used for biofuel feedstock crops increases, which results in a 4.5% increase of global area cropland. The (limited) increase in use of land for livestock is the result of that crops used as animal feed are more expensive. The biofuel policy in India increases the use of land of the main biofuel feedstock with somewhat more than 10% compared to the Non-India biofuels scenario.

Table 3-5 The change in global land use in 2020 relative to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels	Global biofuels
Wheat	-2.3	-0.2	-2.8
Coarse grains	11.2	-0.1	9.7
Sugar cane/beet	13.0	9.7	21.1
Oilseeds	13.1	-0.4	11.6
All crops	4.5	0.0	3.8
Livestock	0.2	0.2	0.8
Primary agriculture	1.8	0.1	1.9

The increase in biofuel use also results in increased crop yields (Table 3-6). The increase in crop yields is the highest in the regions with ambitious biofuel policies and where the demand for crops increases most, i.e. for vegetable oils in the EU, for coarse grains in the US (Non-India), for sugar cane and beet almost everywhere in the case of the global biofuels directive, and for wheat a little bit in the EU.

Table 3-6 The change in crop yields per hectare in 2020 relative to the baseline scenario, in per cent.

		Non-India biofuels	India biofuels	Global biofuels
Wheat	India	1.6	1.2	2.9
	EU27	4.4	0.2	4.7
	Non_EUIndia	0.7	0.2	1.3
Coarse grains	India	1.0	0.4	1.3
	EU27	2.8	0.1	2.8
	Non_EUIndia	21.0	0.1	22.3
Oilseeds	India	1.8	0.2	1.9
	EU27	19.0	0.5	22.1
	Non_EUIndia	5.7	0.5	7.3
Sugar cane/beet	India	1.0	13.0	14.1
	EU27	11.1	0.4	12.7
	Non_EUIndia	9.0	0.7	10.9

The increase in crop yields is driven by the increase in demand for crops for biofuel production and increase in land prices. Table 3-7 shows the prices changes in prices of agricultural land in the different scenarios. We see that as a consequence of the relatively low elasticities of substitution between different types of land, relatively large price differences occur. Especially in India the price of land used for sugar cane production increases rapidly, by 150% or more. To what extent these effects are correct is an empirical question, whereby we must be aware that the price is for effective land units, so if expansion of land requires the use of less suitable land, this also implies an increase in the need for land.

Table 3-7 The change in real land prices of biofuel feedstock crops in 2020 relative to the baseline scenario, in per cent.

		Non-India biofuels	India biofuels	Global biofuels
Wheat	India	4	5	10
	EU27	12	0	11
	Non_EUIndia	5	1	6
Coarse grains	India	5	7	12
	EU27	8	0	7
	Non_EUIndia	77	0	89
Oilseeds	India	13	9	24
	EU27	46	1	56
	Non_EUIndia	37	1	45
Sugar cane/beet	India	6	156	174
	EU27	24	0	27
	Non_EUIndia	36	2	47

Table 3-8 The change in land use of biofuel feedstock crops in 2020 relative to the baseline scenario, in per cent.

		Non-India biofuels	India biofuels	Global biofuels
Wheat	India	-2.3	-3.2	-4.8
	EU27	-0.1	0.1	-0.2
	Non_EUIndia	-2.6	0.2	-2.9
Coarse grains	India	-1.4	-1.2	-2.5
	EU27	-3.1	0.0	-3.0
	Non_EUIndia	13.5	0.0	11.8
Oilseeds	India	4.3	-1.7	1.7
	EU27	23.7	0.1	21.6
	Non_EUIndia	13.3	-0.3	12.1
Sugar cane/beet	India	-0.9	68.0	68.3
	EU27	8.6	0.3	8.0
	Non_EUIndia	15.8	0.3	14.0

Table 3-9 shows the changes in the use of land for different crops. In the India biofuels scenario the area under sugar cane cultivation in India expands by 68%. The impact of the Global biofuels scenario on land use for production of other biofuel feedstock in India is less, but still substantial (3.13%). This means that part of the additional production of biofuel feedstock needed to meet the biofuel blend mandates outside India directly or indirectly comes from India. The effects of the Global biofuels scenario are strongest for the feedstock types used in the regions with aggressive biofuel policies (e.g. oilseed in the EU, coarse grains in the US).

Table 3-9 The change in crop production in 2020 relative to the baseline scenario, in per cent.

		Non-India biofuels	India biofuels	Global biofuels
Wheat	India	-2.3	-3.2	-4.8
	EU27	-0.1	0.1	-0.2
	Non_EUIndia	-2.6	0.2	-2.9
Coarse grains	India	-1.4	-1.2	-2.5
	EU27	-3.1	0.0	-3.0
	Non_EUIndia	13.5	0.0	11.8
Oilseeds	India	4.3	-1.7	1.7
	EU27	23.7	0.1	21.6
	Non_EUIndia	13.3	-0.3	12.1
Sugar cane/beet	India	-0.9	68.0	68.3
	EU27	8.6	0.3	8.0
	Non_EUIndia	15.8	0.3	14.0

The increase in crop yields and land prices also results in an increase of the use of fertilizers per hectare and, to a certain extent, also a higher use of capital and labour per hectare. In Table 3-10 we see this clearly for the sugar cane production. The biofuel policy in India results in a 112% increase in the use of fertilizers per hectare. But also more capital and labour is required, among others to improve the irrigation of sugar cane, part of which is by the way also included in the rise in land price.

Table 3-10 The change in input use per hectare in India in 2020 relative to the baseline scenario, in per cent.

		Non-India biofuels	India biofuels	Global biofuels
Wheat	Labour	1	0	2
	Capital	1	0	2
	Fertilizer	5	4	9
Coarse grains	Labour	1	-1	0
	Capital	1	-1	0
	Fertilizer	5	6	11
Oilseeds	Labour	3	-1	1
	Capital	3	-1	1
	Fertilizer	11	7	20
Sugar cane/beet	Labour	1	19	20
	Capital	1	18	19
	Fertilizer	6	112	127

Table 3-11 shows results for intensification and input use of crop production outside India. It is obvious that the biofuel policy in India has only a small effect on intensification in the rest of the world. Biofuel policies outside India have a much larger impact on intensification of crop production. This is especially relevant in the case of coarse grains, and to a lesser extent oilseeds and sugar cane/beet. Table 3-11 shows that the non-India biofuel scenario generates also a limited intensification in India, especially in the case oilseed production due to the extra demand for crude vegetable oil.

Table 3-11 The change in input use per hectare outside India in 2020 relative to the baseline scenario, in per cent.

		Non-India biofuels	India biofuels	Global biofuels
Wheat	Labour	2	0	3
	Capital	0	0	1
	Fertilizer	5	0	6
Coarse grains	Labour	11	0	12
	Capital	17	0	18
	Fertilizer	65	0	72
Oilseeds	Labour	9	1	11
	Capital	8	1	10
	Fertilizer	25	1	30
Sugar cane/beet	Labour	7	1	9
	Capital	11	1	14
	Fertilizer	28	1	34

3.4.3 Animal feed

Biofuel production also has consequences for the animal feed sector. While molasses is a by-product of sugar production that either is used for animal feeding or for ethanol production, the production of biodiesel and ethanol results in oilcakes and DDGs as by-products, respectively, both are used as animal feed. Table 3-12 shows that the net effect of biofuel policies on the price of animal feed is that the price increases, as the rise in crop prices more than compensates the increase in supply of by-products of biofuel production. Especially important is the increase in land prices, which results in intensification, i.e. higher crop yields per hectare. The use of molasses for biofuel use in India results in an increase of the price of molasses and as a result the price of animal feed rises more than the price of land for livestock. The result is that farmers reduce the use of crops for animal feed production and increase the use of pastures for grazing.

Table 3-12 Change in use of production factors and livestock output per hectare in India and the EU in 2020 compared to the baseline scenario, in per cent.

	India	India	India	EU27	EU27	EU27
	Non-India biofuels	India biofuels	Global biofuels	Non-India biofuels	India biofuels	Global biofuels
Land	5.7	2.8	7.5	6.1	0.4	3.8
UnSkLab	4.3	3.1	6.3	11.0	0.7	12.1
SkLab	5.9	-1.3	2.9	10.9	0.8	12.0
Capital	4.8	2.2	5.9	10.4	0.7	11.6
Price feed	2.9	6.7	9.8	0.0	0.5	0.6
Production per ha	0.6	-1.1	-0.6	2.2	0.0	1.6

3.4.4 Production and welfare

In this section we evaluate the consequences of biofuel policies on welfare and production in India. Table 3-13 shows that the effect of the biofuels directives in other countries is positive for all sectors of the economy in India, except for livestock. Crop production expands as a result of higher crop demand. The decrease in import prices is smaller than the decrease in export prices in the Non-India biofuels scenario. As a result the price of imported intermediate inputs is reduced, which increases the value added of the commodities produced. This positive 'terms of trade effect' is also responsible for the increases in welfare as discussed below. In the India biofuels scenario the production of crops is much higher, but because these crops are used for subsidised (implicitly or explicitly) production of biofuels in India this does not contribute to economic growth or welfare. The increased use of resources for biofuel crop production cannot be used in other sectors, implying a reduction in production in these other sectors.

Table 3-13 Change in production volume in India in 2020 compared to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels	Global biofuels
Crops	0.81	1.71	2.49
Livestock	-0.15	-0.76	-0.82
Agri-procesed	0.96	-2.68	-1.91
Industry	0.61	-0.37	-0.01
Services	0.39	-0.20	0.11

Table 3-14 shows the decomposition of welfare effects in India, the EU and the rest of the world for the Non-India and India biofuels scenarios. The Non-India biofuels scenario increases welfare in India, whereby the change in terms of trade is responsible for the largest benefit; import prices are reduced 1.5% compared to export prices. For the EU the Non-India biofuels scenario generates a welfare benefit too, also mainly as a consequence of terms of trade benefits, but also because distortions from production and consumption taxes in the economy are reduced. For the rest of the world, the welfare effects in both the Non-India and India biofuel scenarios are clearly negative, because of the negative terms of trade effects and due to the negative allocation effects that are a consequence of the implicit and explicit subsidies on biofuel use in these regions.

Table 3-14 Decomposition of welfare effects in India, the EU and the rest of the world, changes compared with baseline scenario, in million constant 2007 dollars.

	India		EU27		Non_EUIndia	
	Non-India Biofuels	India biofuels	Non-India Biofuels	India biofuels	Non-India Biofuels	India biofuels
Allocation	4642	-11349	11107	3727	-89357	2449
Endowment	1306	2662	103	14	5614	1896
Technology	1297	642	1625	138	15221	735
Population	347	-7	84	13	-2038	-197
Terms of trade	9221	6258	13399	1518	-21921	-7464
Investment-Savings	116	150	2407	407	-2557	-565
Total	**16929**	**-1644**	**28725**	**5817**	**-95038**	**-3146**

The biofuel policies in India clearly have a negative allocation effect in India, mainly as a consequence of the distorting effect of biofuel subsidies. This negative effect is partly compensated by a positive terms of trade effect, because the costs of import of fossil fuel decreases, whereby this benefit obviously occurs at the cost of the oil producing regions. The welfare effects of biofuel policies of other countries in these countries are always typically negative.

3.4.5 Consumption

The introduction of biofuels also has consequences for the consumption in India. Table 3-15 shows that consumption of food in India is reduced as a consequence of the higher agricultural prices in both the Non-India and India biofuels scenarios. This also suggests that food security effects are negative, although the effects are smaller than 1%. In the Non-India biofuel scenario the reduction in food consumption is accompanied by higher expenditures on industry and services, because total gross domestic product is increased. The effect of the biofuel policies in India is that also the private demand for industrial commodities is reduced.

Table 3-15 Change in consumption in India in 2020 relative to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels
Crops	-0.446	-0.7
Livestock	-0.712	-0.562
Agri-processed	-0.19	-0.613
Industry	0.933	-0.358
Services	0.912	0.033

3.4.6 Trade balance

If we look at the effect of biofuel policies on trade we see that these effects are relatively small (Table 3-16 and Table 3-17). The implementation of biofuel policies outside India leads to an increase of exports of crops and processed food. Net exports of industrial goods increase, because India pays about 6% less for its crude oil, which reduces the oil import bill. The price of crude oil is less important in the case of services, which sector loses a little bit of its comparative advantage, and therefore net exports of services are reduced.

Table 3-16 Net export of India as fraction of Indian production in 2020.

	Baseline	Non-India biofuels	India biofuels	Global biofuels
Crops	0.25	0.65	-0.29	0.04
Livestock	-0.17	-0.14	-0.23	-0.19
Agri-processed	4.62	5.26	1.88	2.55
Industry	0.84	0.93	1.09	1.15
Services	0.54	0.42	0.51	0.39

An Indian biofuels policy implies again a reduction in crude oil price, but the main effect is a reduction in the need to import crude oil, because oil imports are replaced by domestically produced biofuels. However, because the increased use of crops for the production of biofuels in India less crops are available for use as food. This implies that imports of primary and processed food must increase, which is indeed the case as shown in Table 3-16 and Table 3-17.

Table 3-17 The change in net export of India in 2020 compared to the baseline scenario, in million 2007 dollars.

	Non-India biofuels	India biofuels	Global biofuels
Crops	1369	-1826	-640
Livestock	22	-68	-39
Agri-processed	1315	-4328	-3048
Industry	2239	6416	8156
Services	-2856	-779	-3381
All commodities	2087	-585	1047

3.4.7 Poverty

The production of biofuels also influences poverty in India. As an indication of poverty we compare the development of the price of crops as an indicator of the cost of living of poor people, with the change in wages. Table 3-18 shows that in case of the Non-India biofuels scenario the wage rate in agriculture rises with about the same rate as the price of crops in India. This suggests that the effect of the biofuel policies in poor rural areas is probably not very big. However, in the industry, i.e. in urban areas, wages do not change much (+0.1%), while the price of crops increases 4.3%. This shows that the urban poor experience a decrease in purchase power of food. When looking at an Indian biofuels policy, the result for poverty seems to be much more negative. The price of crops rises 11.5% and the wage rate for unskilled labour in agriculture increases by just 3.0%. These effects are reinforced when biofuel policies in India and elsewhere are combined.

Table 3-18 Percentage change in prices and wages in India in 2020, relative to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels	Global biofuels
Price crops	4.3	11.5	16.5
Unskilled wage agriculture	4.3	3.0	6.3
Unskilled wage Industry	0.1	-0.1	0.0

Table 3-19 shows more detailed results per crop type. In the India biofuels scenario the price of sugar cane increases 77%, while the price effects for other crops is 15% or below in all scenarios. The increase in the price of rice and wheat, which are the two staple food crops in India, is much less than the rise in average crop price. Nevertheless the price increase of other crops is higher than the wage increase in India and the consumption of crops is reduced.

Table 3-19 Percentage change in crop prices in India in 2020, relative to the baseline scenario, in per cent.

	Non-India biofuels	India biofuels	Global biofuels
Rice	1.9	3.3	5.3
Wheat	1.4	3.2	4.7
Coarse grains	3.0	5.1	8.1
Oilseeds	7.6	6.8	15.2
Sugar cane	4.2	77.3	86.9
Horticulture	5.3	7.5	13.0
Plant-based fibres	4.7	6.1	10.9
Other crops	4.3	7.3	11.8

3.5 Conclusions

Current biofuel policies in India and other countries are based on the use of first-generation biofuels, such as ethanol made from conventional sugar and starch crops, and biodiesel produced from vegetable oils. The use of these crops for biofuel production was found to have various effects on poverty, welfare, land use, trade, food security, etc. in India.

The biofuel policies outside India were found to have a negative net effect on poverty in India. The effect is less for the rural poor in India, because they benefit from increased wages in agriculture, while the urban poor only experience higher food prices. As a result the consumption of crops and livestock in India decreases, although the welfare effects are positive. These positive welfare effects are caused by a positive ‘terms of trade effect’. This effect is the result of that the prices of imports decrease less than of export. The effect is that the price of intermediate inputs is reduced, which increases the value added of the commodities produced and thus welfare.

The National Biofuel Policy in India also has substantial effects. Global sugar cane production increases by 18% and sugar cane prices by 27%. The welfare effects in India are negative, because biofuel production (implicitly or explicitly) is subsidized. The increased use of resources for biofuel crop production cannot be used in other sectors, implying a reduction in production in these other sectors.

The results presented in this chapter are based on the MAGNET economic model. It is obvious that the calculations are extremely rough. Especially relevant is the question to what extent the urban and rural poor benefit from the increased demand for labour as a consequence of biofuel policies. Our observations are consistent with observations found in the literature (Chakravorty *et al.* 2012). However, further empirical validation and more refined analyses are still very much needed as regional and longer term effects from biofuel policies on agricultural productivity, rural development and technological change are only partially considered.

3.6 References

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4 NREGS scenario

This chapter deals with a government flagship program to eradicate rural poverty and its impact on income distribution and wages. National Rural Employment Guarantee Scheme (NREGS) is basically an employment generation program of the government for the rural poor households. It is the policy of direct transfer to the poor through the provision of public works satisfying the property of self-selection. Unlike, the earlier wage employment programs that were allocation based, NREGS is demand driven.

The National Rural Employment Guarantee Act (NREGA) notified in September 2005 intends to enhance livelihood security in rural areas by providing at least 100 days of guaranteed wage employment in a financial year to every household whose adult member volunteers to do unskilled manual work. It was launched in 2006 intially in 200 districts and the extended to cover 130 more districts in 2007. The amount allocated was 115000 million Rupees, which was financed by the federal budget in 2006-07. In this year NREGA provided jobs to 21 million households. The total person days generated is 900 million at an average 42.85 person days per family.

Permissible work under the scheme includes Water conservation and Water harvesting, Drought proofing (Afforestation and tree plantation),irrigation canals, renovation of traditional water bodies, tank desilting, land development, flood control and protection works including drainage in water logged areas, rural connectivity to provide all weather access and any other work notified by the Central/State Government .

4.1 Literature survey

There are a large number of studies on NREGA impact based on a partial equilibrium framework. Some important studies are mentioned below:

Kamath (2010) looked at macroeconomic impacts of NREGA in terms of output enhancement through ‘multiplier and accelerator’ if properly implemented. Since rural population will have a higher propensity to consume, it will have a multiplier effect on output. Increasing output would stimulate private investment through the ‘accelerator effect’. The author felt that there needs to be an increased mobilisation and awareness of the NREGA to depart from the line of the most of the existing poorly implemented public work schemes.

Jha et al. (2012) has looked at the relatively important but neglected element of real income transfers net of opportunity cost of time of the NREGS. Using the primary household data for three states, the study has found that net transfers of NREGS are quite modest and its poverty reduction potential is also very limited.

Basu et al. (2005) have raised the issue of contestability effect of NREGA, i.e. if the alternative source of employment in public works raise the private wages to retain them in agriculture.

Khan and Saluja (2007) have discussed the impact of NREGA based on a general equilibrium approach. Using a village survey, the study concluded that even though it has many beneficial effects the major concern is leakage and corruption. The authors recommended a more decentralised administrative mechanism for the scheme to be effective.

We have come across a recent study where the scenario of the impact of NREGS was analysed using a general equilibrium modelling approach with the use of SAM for the year 2003-04. Kumar and Panda (2009) have found that NREGA increases private consumption by 0.3% and the GDP by 0.5 % points. The study also found that if the scheme covers fully bottom 70% of the rural population then unemployment will reduce by 0.5%.

4.2 Modelling aspects

The existing model follows the neo-classical approach and assumes the labour market to be functioning efficiently with the flexible wage rate determined as a market clearing price between labour endowment and factor employment in the commodity sectors. Unemployment is assumed to be voluntary (exogenous). The government provides employment guarantee under the NREGS and therefore incurs expenditure for both the wage bill and the non-wage components. The non-wage component can be a maximum of 40% of the total expenditure. This results in additional government expenditure and thereby affecting its savings. The employment to rural unemployed labour results in additional income generation for households thereby increasing the household expenditure on consumption goods and creating additional demand for commodities.

In the base year, the SAM reflects the full employment scenario in the economy. However, to map the employment generated under the NREGS during the later periods, the total labor supply in the economy is to be modified to account for the unemployment. Under the scheme, the unemployed unskilled labor in the rural households is provided employment on demand. The unskilled labor endowments of rural households are therefore updated for the subsequent period to reflect increased labor supply in the economy. It is proposed to introduce a supply function for NREGS labor. Wage bill under the program should constitute minimum 60 percent of the total expenditure under the programme (Average is 70 % for 2009-10).

The wage rate for the NREGS is set at a lower level than the market wage rate of unskilled labour in rural areas (say @ 70 % of the market wage rate) so that it does not lead to substitution of labour from the normal economic activity.

The non-wage component in the government expenditure due to NREGS will be introduced consistent with the existing norms.

NREGS also causes impacts on capital. It creates extra capital in certain sectors which will be accounted for. The mobility of capital will be restricted only within the agricultural sector.

This has implications for the model both in terms of government expenditure and employment of rural households having unskilled labor endowment. In the model, it will be assumed that the unemployed unskilled labor in rural areas belonging to the bottom 2 classes of rural households would seek employment under the NREGS (the bottom 2 classes constitute 70 percent of the rural population). The material used for the programme is expected to generate demand for various commodities like tools and machinery, cement, transportation, petroleum, electricity, etc.

We modify the base equation of the model to initially to introduce unemployment and then moved to employment under the employment guarantee program. We modify the base equation of the model as follows:

EQUATION 'NREGS labour supply' ELSEGS* ((WGEGS/PF)**ε)) =LSEGSQ

Where:

- ‘ELSEGS’ is labour entitled for employment under NREGS scheme .
- ‘LSEGSQ’ is rural labour supply to NREGS scheme

- 'WGEGS' is NREGS wage rate which is always less than the Market wage
- 'PF' is market wage
- 'ε' is labour elasticity for NREGS Scheme. In other words, it refers to percentage change in the NREGS labour due to 1 percentage change in the relative wage of NREGS to market wage.

EQUATION 'NREGS labour demand' LDEGSQ(fl) =CVR(fl)*LSEGSQ(fl)

Where:

- LDEGSQ is labour demand for NREGS scheme
- CVR is coverage factor indicating eligible household category for NREGS.
- It is '1' for rural unskilled and '0' for others.

It is assumed that NREGS will not compete with the open market labour and hence it does not enter directly in the production activities. Hence those eligible labour who offer themselves for NREGS will have to be absorbed in the scheme. This means demand has to be created by the public work.

The additional demand for capital goods created due to the introduction of NREGA scheme of public work has also been allocated to a host of manufacturing sector in the model.

4.3 Results

BAU 8% GDP growth has been compared with NREGS scenario basically because all the parametric assumptions are similar to the one in 8% GDP growth. Also found is that NREGA has only marginally increased the GDP growth from 8% to 8.04%. It should be noted that total resources of the government are kept constant and NREGS has diverted government resources to the scheme. On the other side, rural poor income is enhanced by NREGS and as a result has created more demand for various commodities which has an impact on many sectors of the economy.

As for composition of Real GDP, NREGS has brought down agriculture share in the long run between 2010-20, from 13% to 11.8%. This could be in view of shortage of labour for agriculture due to the presence of NREGA even though the rule on paper says, NREGS absorb labour mainly during the off season when the labour has no other opportunity.

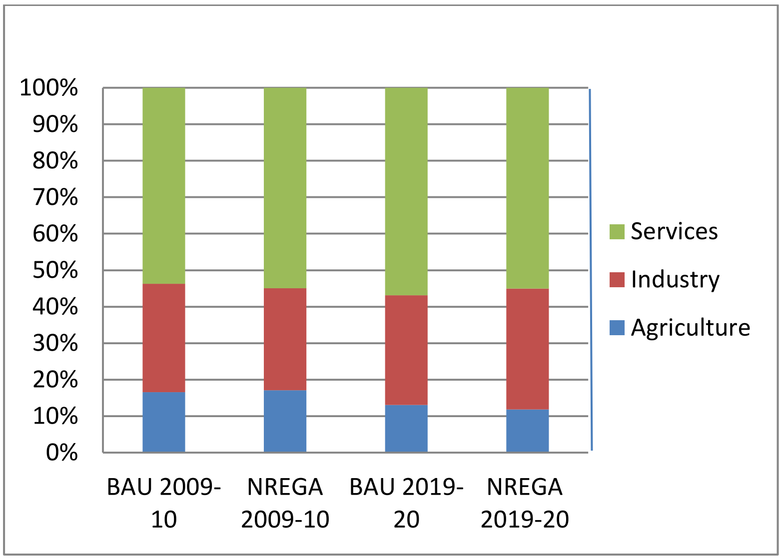

Figure 4-1 Composition of Real GDP

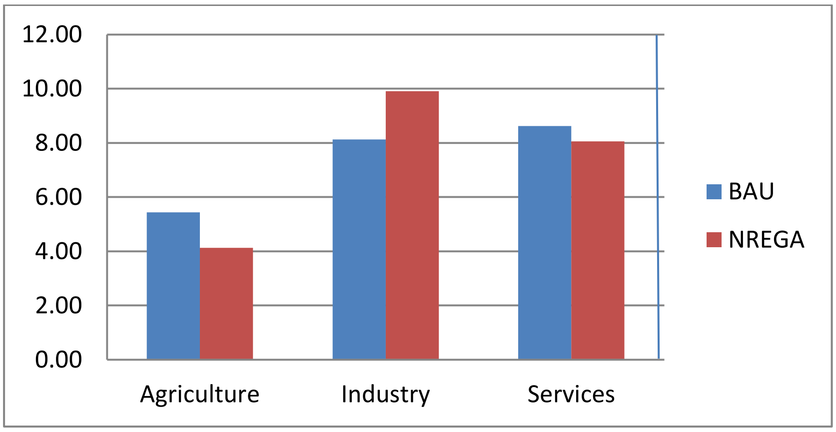

Figure 4-2 Real GDP Sectoral Annual Growth rates between 2010-20

From the figure it is evident NREGA gives a boost to industries, The sectors such as construction has seen increase in output under NREGA.

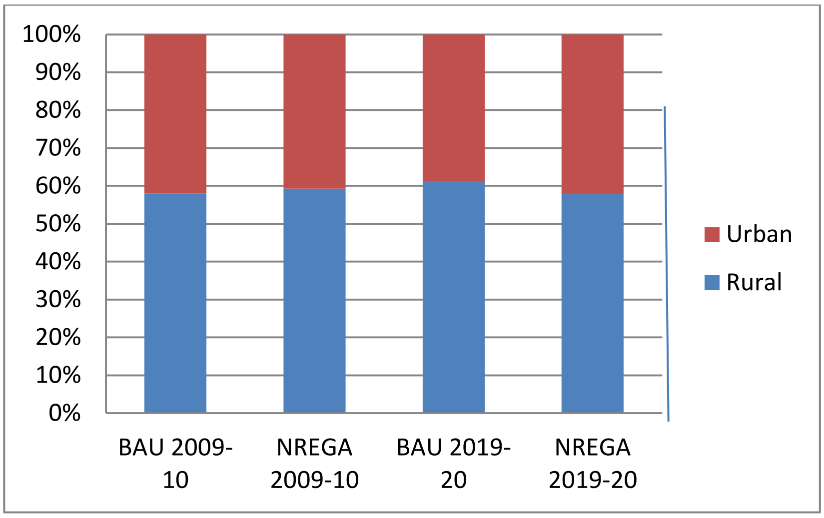

Figure 4-3 Real Income Composition

Income distribution by household groups shows that, though initially NREGA impact was positive for the rural poor, in the long run it does not benefit the rural poor because the reallocation of resources to NREGA effectively has withdrawn resources from the productive sectors and hence impacted the wage income.

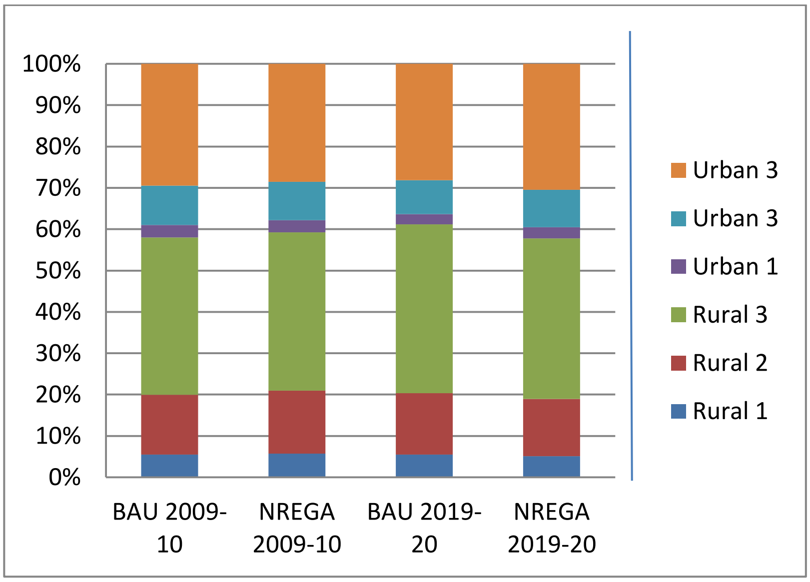

Figure 4-4 Real Income Composition by Household Groups

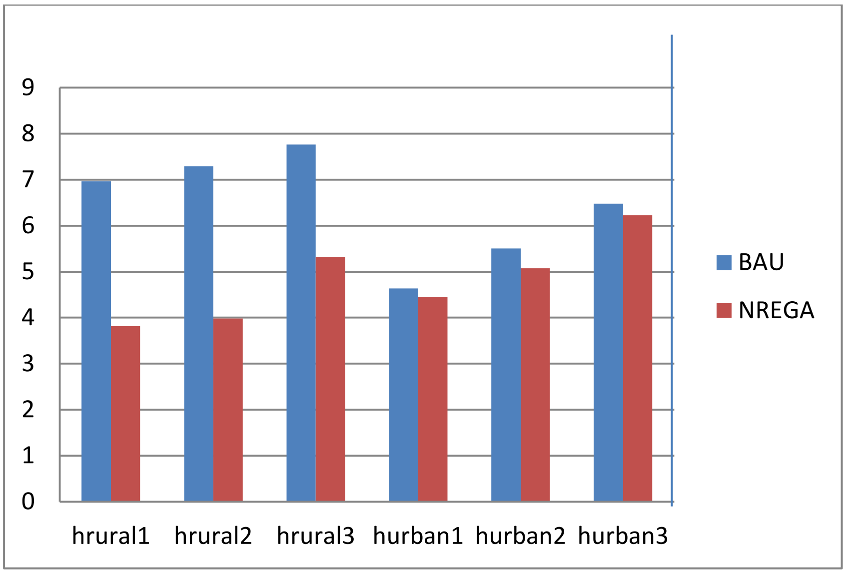

Figure 4-5 Real Income Annual Growth rate (%) by HH Groups between 2010-20

As expected, between BAU and NREGA, the income accounts do not vary much in the urban as NREGA is basically a rural program. However NREGA can suppress the migration from rural to urban which would affect the rural urban aggregate income distribution.

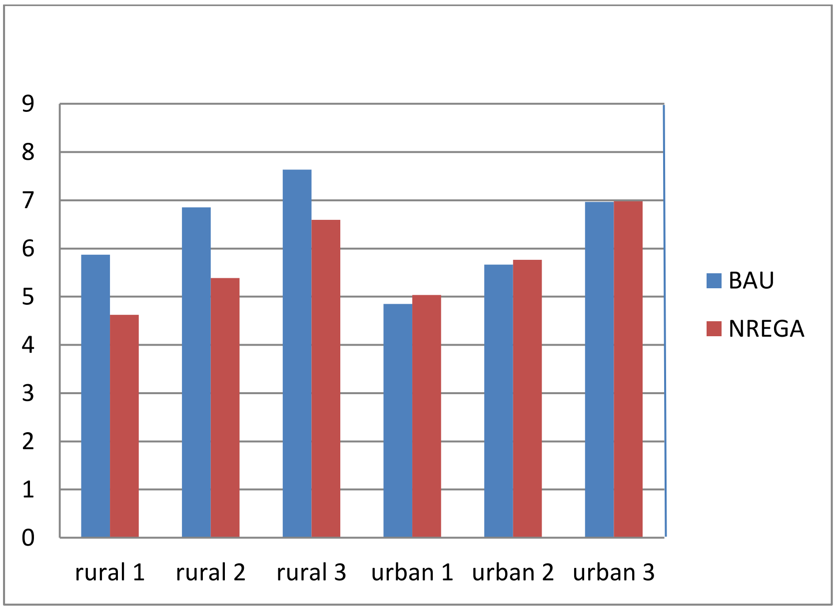

Figure 4-6 Current Consumption Annual Growth Rates (%) between 2010-20

Table 4-1 Wages

Labour	2006-07	2009-10		2019-20	
		BAU	NREGA	BAU	NREGA
Rural unskilled	1.00	1.12	1.16	1.97	1.68
Rural skilled	1.00	1.10	1.11	1.79	1.65
Urban unskilled	1.00	1.03	1.03	144	1.42
Urban skilled	1.00	1.02	1.07	1.42	1.49

There is a debate on whether NREGA pushes up wage for agriculture labour due to the fact the labour could be withdrawn from the agriculture to NREGA and hence cause scarcity of labour for agriculture. The results do not support this argument in the long run as shown by 2019-20 results.

Table 4-2 Annual Real Income per capita

Household	2009-10		2019-20	
	BAU	NREGA	BAU	NREGA
Rural1	9035	10252	16274	14279
Rural2	17883	20462	33215	28973
Rural3	62585	68681	121447	108749
Urban1	11688	12409	15191	15937
Urban2	27481	29379	38820	39858
Urban3	113694	119657	176013	179371

4.4 Conclusion

NREGA impact on the economy in the long run is negative for agriculture. It only helps industry, though in the early period, between 2007-10, agriculture and services improve marginally; between 2010-20, it brings down agriculture share in total GDP from 13% to 11.8%. This may be due to government resources being diverted to NREGA from erstwhile productive sectors.

Real income in rural has gone down partly due to lower agriculture growth and partly due to lower market wage as compared to BAU scenario during 2010-20 period . The overall picture is, NREGA has contributed to industry growth; NREGA provided a big fillip to the industries such as manufacturing, both labour and capital intensive, and the construction sector. Wages of the unskilled market labour in the rural is not increasing due to NREGA against the expectation that it would push up agriculture wages. It is confirmed that NREGA supplement only the off-season employment and it does not draw the agriculture labour away from the farming. Real income per capita also support the result that NREGA pushes up the income of urban poor, and not rural poor, in the long run, because of the higher growth of the manufacturing and construction sector under NREGA.

Policy Implication is, not only NREGA may not be sustained in the long run given limited resources of the government, but NREGA does not continue to provide benefits to rural poor as it was intended for.

4.5 References

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