Economic impacts of the Biosafety Law and implementing regulations in Turkey on the Turkish importing and user sectors

Briefing document

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Executive summary and conclusions

This paper examined the economic impacts of the Biosafety Law and implementing regulations of Turkey on the sourcing and use of raw materials by the Turkish importing, crushing, feed manufacturing, food manufacturing/processing and livestock production sectors.

The analysis draws significantly on information provided from interviews with representatives of companies and organisations in the Turkish importing and agricultural raw material processing and user sector.

The GMO regulations

Turkey first introduced a GMO regulation in October 2009 to control the importation and use of GMOs ('*Regulation on the Import, Processing, Export, Control and Inspection of Food and Feed Products Bearing GMOs and GMO Components'*). This regulation was subsequently repealed and subject to several amendments throughout 2010 before the Biosafety Law came into force in September 2010:

- The legislation bans the cultivation of GM crops in Turkey;
- It requires all GMOs, including imports, to be approved for use in Turkey and establishes a strict policy of testing for products potentially containing GMOs;
- At the time of writing (February 2012), Turkey has approved 3 soybean and 13 corn GMO events for feed use only. This compares with a total of 56 GMO events which were present in commercially grown (global) crops in 2010/11[1]. No GMO events have been granted approval for food use in Turkey;
- There is a zero tolerance threshold for the presence of unapproved GMOs in Turkey. This effectively applies to all GMO events without any form of approval in Turkey and to all GMOs including those with approval in Turkey if the products containing or derived from them are destined for non feed use;
- Labelling of products containing GMOs is mandatory. The threshold for triggering GMO content labelling is 0.9%. It is, however, interesting to note that given no GMOs have yet been given approval for food use, no food products sold in Turkey will carry positive GMO labelling unless they are 'illegal';
- GMO ingredients are banned in baby food, baby formula, continuation food and infant formula and in food supplements for babies and young children.

The Turkish GMO regulatory approval system is currently significantly slower than approval systems in most other countries, and holds the unique distinction of being the only system in the world that does not approve GMOs for both food and feed use. Even the EU operates a GMO regulatory regime that is quicker than Turkey's and approves GMOs for both food and feed uses. Overall, the Turkish GMO approval system differs from all other countries with a regulatory approval mechanism (including the EU, Switzerland, Norway, Japan, South Korea, Australia, New Zealand, the USA, Canada, Brazil and Argentina); it lacks transparency and is not based on sound science.

[1] Note: this refers only to events (including stacks) in commercial crops in 2010/11. It does include several GMO events that will have been used commercially in 2011/12 including 4 soybean events that are not approved for any use in Turkey

Trade diversion (section 3.2.1)

As a result of the introduction of the Turkish GMO regulations in 2009, there have been significant changes in the sources of supply of imported commodities and derivatives away from GMO producing countries to non-GM growing countries. More specifically:

- Soybean and soymeal imports have continued to be dominated by GMO producing countries, mainly because there are few alternative sources of supply (unless identity preservation/segregation of non-GM sources of supply are established). Also the primary uses for these products are in the feed sector where approvals for feed use have been given in Turkey. In contrast, soy oil imports have been diverted away from GMO sources of supply, although the volumes involved have been relatively small;
- Prior to the introduction of the GMO regulations Turkey used to import modest amounts of rapeseed and rapeseed meal from the GMO producing countries, Canada and the USA. All trade in these products now comes from non-GM producers;
- Cottonseed and cotton seed derivative trade has not been affected, mainly because Turkey is largely self sufficient in cotton and derivatives. Also the limited volume of imports of these products comes from non-GM producers such as Greece;
- There has been significant trade diversion away from GMO corn and corn derivative/by-product producing countries (notably the USA) following the introduction of the GMO regulations. This has affected trade in corn, corn oil, corn gluten feed and dried distillers grain with solubles (DDGS);
- There has been noticeable trade diversion away from the US to other sources of supply in respect of formulated pet food. This is because much of the pet food originally sourced from the USA used corn and corn derivatives as key ingredients.

This trade diversion raises the potential of a World Trade Organisation (WTO) complaint/challenge being launched against Turkey by the leading GMO producing countries such as the USA, Canada, Argentina and Brazil. All of these countries have seen their exports of soybean, rapeseed and corn commodities and their derivatives to Turkey decline after the GMO regulations were introduced. If such a complaint was launched the magnitude of compensatory or retaliatory claims would probably be based on the value of imports 'lost' since the introduction of the GMO regulations compared to a baseline before the introduction of the GMO regulations. Analysis suggests that for the three year period since the introduction of the first Turkish GMO regulations, this could be over $1.1 billion[2].

General impacts (section 3.2.2)

a) Short term costs late 2009

When the original GMO regulation was introduced in late September 2009, it became operational almost immediately and resulted in considerable short term (2-3 months) disruption to the import trade of cereals, oilseeds and derivatives. During this period:

- Users of imported raw materials were denied access to imported products and had to draw on existing stocks to keep their businesses operational;

[2] This is illustrative of the methodology that might be applied. If such a WTO case was initiated, the baselines and values used might differ from those used in this analysis

- Some import shipments were rejected and sent back to the country of origin (or diverted to other markets) because of the presence of (then unapproved) GMOs, whilst other shipments were delayed in port waiting for testing and either rejection or customs clearance (see below);
- The import price of a number of commodities increased substantially (eg, the soymeal price increased from about $525/tonne in October 2009 to $700/tonne in November and December 2009, before falling back to $540/tonne in January 2010). The additional cost burden of this was about $48 million.

b) Stock holding costs

The GMO regulations have increased the risk of not being able to obtain and access raw materials and resulted in a general increase in the level of raw material stocks being held. This has been a feature of soybeans and derivative markets where, since late 2009, about $280 million worth of capital has been tied up in additional soybean and derivative stock holding, with a further $197 million potentially tied up during 2011/12. At a typical rate of interest of 10%[3] this suggests that the cost of this stock holding has been about $28 million, with a further cost in 2011/12 of $19.7 million.

c) Costs for testing and shipment delays

In a) above the issue of testing of supplies entering the country for the presence of unapproved GMOs and the associated delays before shipments can be unloaded, cleared customs and transhipped to their end user was highlighted. Two main costs are associated with this:

- *Testing costs.* Our estimates suggest that since late 2009, the total testing costs incurred are within a range of $0.7 million to $5.8 million[4];
- *Delay (demurrage) costs*. All ships that cannot unload because of delays due to testing and/or delays in customs clearance of imports incur demurrage charges. The length of delays applicable to imports of products that require GMO testing have increased from an average of 2 days before the introduction of the first GMO regulation (when few shipments were subject to testing and usually only to satisfy contractual requirements) to an average of 10 days. This highlights the inadequacy of the infrastructure in place for undertaking GMO testing in Turkey. The demurrage charges have added nearly $47 million to the cost of raw materials used by the Turkish importing and user sectors since late 2009.

d) Impact of GMO regulations on costs of using domestic corn

Although imports of corn have accounted for less than 10% of total annual supplies, the availability of imports has significantly influenced domestic corn prices in Turkey. Prior to the introduction of the first GMO regulations in late 2009, domestic corn prices tended to track (cif[5]) import prices closely, trading at about a $7/tonne-$10/tonne premia. Following the introduction of the GMO regulations, imports of corn have been significantly disrupted because of difficulties in obtaining certified non GM corn supplies that do not contain even trace levels of unapproved GMOs. The net effect of this supply disruption has been to place increasing demand pressure on domestic supplies of corn. As a result the domestic price of corn has increased relative to import

[3] Based on industry sources – see section 3.2.2

[4] Range varies due to assumptions made on size of vessels or loads subject to testing: see appendix 1

[5] Cost, insurance and freight

values significantly in 2009/10 and 2011/12. Thus the average price premia of domestic corn over imported corn was $72/tonne in 2010 and $48/tonne in 2011. On the basis of these premia, the additional cost incurred by the Turkish agri food, feed and livestock production sectors, since late 2009, has been about $417 million.

Food sector-specific impacts (Section 3.2.3)

The banning of the use of any commodity or derivative derived from a GMO crop in food usage has had a significant impact on the use of soybean and corn derivatives in the Turkish food sector. More specifically:

a) Soybean oil

Use of soy oil has been largely eliminated and replaced with alternative oils (mostly sunflower oil)[6]. Comparing the cost of sunflower oil with the cost of soybean oil, this change in use has resulted in a net increase in costs to the Turkish food using sector of $73.7 million since late 2009.

b) Corn oil

Like soybean oil, corn oil use has decreased since 2009 as some food manufacturers have switched to alternative oils (mainly sunflower and/or rapeseed and cotton seed oils) rather than source certified conventional corn oil. Nevertheless, a corn oil food use market still exists because the availability of (certified) non-GM corn is greater than the availability of certified non-GM soybean oil (mostly from domestic supplies and/or from nearby non-GM corn growing countries such as Russia, Ukraine, Hungary and Serbia). The requirement for supplies to have zero presence of unapproved GMOs (unapproved in Turkey) has, however, caused additional problems for a number of importers and users sourcing products from some markets (eg, EU countries) where non-GM guarantees are typically only offered to the EU labelling threshold of 0.9% for approved GMOs in the EU (where a greater number of GMO corn events are approved than in Turkey and all approvals are for both food and feed use). The economic costs associated with these changes since late 2009 have been nearly $40 million for the replacement of corn oil with alternatives plus $3.5 million paid in the form of higher prices to obtain certified non-GM corn oil.

c) Soy derivatives

Changes in these markets have followed a similar path to that referred to above for soybean and corn oils. The main suppliers and users of these products and/or food products containing such ingredients have largely adopted a GM ingredient avoidance policy which has focused on a requirement to use certified non-GM sources of supply and/or switching to alternatives like sunflower (eg, for lecithin). This has probably added between $13.2 million and $14.6 million to the costs of production for the food products using these ingredients.

d) Corn use: food sector (starch and sweeteners)

In this sector, the GMO regulations have mainly affected the cost of raw materials used. There has been a shift in the origin of raw materials used away from imports from largely GMO growing countries such as the USA and Argentina to domestic supplies and non-GM growing countries. Sourcing from countries where GMO corn is not grown has, however, not been

[6] The use of alternative oils rather than replacement of GM derived soy oil with certified conventional soy oil has been the preferred and chosen approach taken by the food sector largely because of increasing difficulties in obtaining supplies of certified conventional soy oil

without problems (eg, Hungary) because suppliers are often only prepared to guarantee supplies are free of GMOs that are unapproved in the EU and therefore could contain up to 0.9% content of GMO corn events approved in the EU, some of which remain unapproved in Turkey and all of which do not have approval for food use in Turkey.

Requiring all supplies of corn destined for food use to be certified as non-GM has also resulted in a price premia relative to supplies without such certification being paid. The annual cost of this has been about $16.5 million (a total cost since late 2009 of $33 million).

e) Pet food

The GMO regulations have affected the cost of raw materials used in this sector as a result of a shift in the origin of raw materials used away from the USA (where corn gluten was a primary ingredient in supplies). These supplies have largely been replaced by more expensive supplies from the EU. This has resulted in an increase in the average cost of pet foods imported of about 15% (+$200/tonne), adding about $8.5 million to the cost of imported pet food during 2010 and 2011.

Feed and livestock production sector-specific impacts (Section 3.2.4)

These sectors have been significantly impacted by the introduction of GMO regulations in Turkey. Access to important feed ingredients has been subject to significant disruption and levels of uncertainty and risk associated with ensuring regular supplies of competitively priced raw materials have increased. Some of the primary impacts have been as follows:

- *Replacement of soy derivatives in feed*. As a result of the difficulties in accessing soybean and derivative feed raw materials in the period immediately following the introduction of the GMO regulations in October 2009, the poultry and egg sectors had to firstly draw on existing stocks of raw materials and then switch to alternative ingredients (sunflower meal, wheat bran and enzymes). The volume of production affected was approximately equal to about 3 months production of poultry meat and eggs. Due to the crucial importance of soy derivatives to productivity and performance in the poultry and egg sectors, this switch to alternative ingredients resulted in poorer feed conversion rates (slower rates of growth which results in lower efficiency and higher costs) and a need to increase the amount of feed used in order to deliver the same performance as a soy ingredient based feed. In addition, poultry flocks experienced higher incidence of diarrhoea and bird mortality, which resulted in production losses and poorer meat quality equal to a loss of production of about 2%. Therefore the switch in feed ingredients during late 2009/early 2010 cost the Turkish poultry and egg sectors approximately $103 million in terms of additional feed required and loss of production;

- *Replacement of corn in feed.* Disruption to supplies of imported corn from leading corn exporting countries (notably the US and Argentina) has necessitated obtaining alternative sources of supply where GMO corn events are not used such as Hungary, Russia, Serbia, Ukraine and the domestic sector. Where additional supplies have been taken from the domestic sector this has resulted in having to pay higher prices (see above) or switching to alternative raw materials. This course of action has mainly affected the poultry and egg sectors where corn has traditionally been incorporated into feeds at rates of between 50% and 60% in feeds (the primary energy source);

- *Replacement of corn derivatives in feed*. Access to imported corn gluten feed and dried distillers grain that may contain or be derived from GMO sources of supply (notably the USA) has been disrupted. The main sectors affected have been dairy, cattle production and the egg laying sector. These sectors have had to switch to alternative feed ingredients, mostly barley, sunflower meal and soybean meal. This resulted in net increases in the average cost of feed in 2010 (eg, dairy feed costs increased in the early part of 2010 by between 10% and 20%), although in 2011, these ingredients were cheaper than the alternative of non-GM sources of dried distillers grain and corn gluten feed.

Summing the estimates of the cost burden incurred by the Turkish agri-food as a result of the GMO regulations discussed above comes to over $0.8 billion (over $1.3 billion including capital tied up in additional stock holding: Table 1).

Table 1: Summary of costs incurred by the Turkish agri-food chain October 2009-end of 2011

Cost type	$ million
Short term costs (October-November 2009) – higher cost of soybeans and derivatives	48.0
Additional stock holding costs (soybeans and derivatives)	47.7 (477)
GMO testing of import consignments	0.7 to 5.8
Demurrage (delay) charges	47.0
Higher price of domestic corn	417.0
Replacement of soy oil in food uses	73.7
Replacement of corn oil	43.5
Premia for certified non-GM corn for food uses	33.0
Replacement of soy protein derivatives and lecithin	13.2 to 14.6
Higher price for pet food ingredients	8.5
Inability to access soybeans and derivatives in the poultry and egg sectors: additional feed costs and production losses (late 2009/early 2010)	103.0
Total	**835.3 to 841.8 (1,312.3 to 1,318.8)**

Note: additional stock holding costs – bracketed figure refers to capital tied up

Looking forward: the next 3-4 years (Section 3.3)

Looking forward, assuming no change to the number of GMO events being used in global agriculture, no change to the number of GMO events receiving approval for feed use in Turkey, continuation of no approvals for food use of any GMO in Turkey and based on 2011 prices of cereals and oilseeds, the on-going annual cost is between $0.4 billion and $0.46 billion.

However, the nature and availability of oilseeds and cereals, their prices and the adoption of new GMO events in global agriculture are subject to change. This means that the above estimate of annual costs is likely to change. The key factor affecting this will be the availability of new GMO events, their adoption in global agriculture, and the extent to which Turkey grants approval for their use or not. In 2011, Turkey had only approved feed use for 3 soybean events and 13 corn events (less than 30% of the total number of GMO events (including stacks) in global agriculture).

In the next 5 years, it is likely that about 30 new GMO events will be commercialised in some of the leading cereal and oilseed producing and exporting countries of the world. Some of these (eg, 4 new soybean GMO events) may already be in 2011/12 commercial crops and therefore can be expected to be found in some globally traded commodities and derivatives. When the

likelihood of some of these GMO events being stacked with each other and/or with existing GMO events is taken into consideration, the additional number of GMOs that would need to be assessed for importation and use in Turkey could be as high as 80. This highlights the likely widening shortfall between approvals in Turkey relative to the number of GMO events being used worldwide.

Faced with this widening gap between the numbers of GMO events being used in global agriculture relative to approvals in Turkey, additional periods of disruption and breaks in the supply of cereal and oilseed raw materials can be expected. These have the potential to be more frequent and longer lasting than the ones so far experienced. The associated short term costs referred to in section 3.2 can reasonably be expected to be repeated and of greater magnitude than so far experienced. Examples include:

- The additional feed costs and loss of production in the poultry and egg producing sector experienced in late 2009/early 2010 affected about 3 months output at a cost of $103 million. With a significant number of new soybean GMO events scheduled for adoption in the leading soybean producing countries in the next 5 years, additional disruption to supplies can be expected. On the basis of the costs incurred during the short term disruption to supplies in late 2009/early 2010, an extension of such costs to a year would increase the cost to over $400 million;
- The short term costs incurred in late 2009 (significant price increases for soybeans and soymeal which equated to $48 million) may become a more regular occurrence;
- The more GMO events being used globally increases the number of potential tests to be undertaken and to the length of associated delays. It is therefore reasonable to assume that testing costs and demurrage charges will increase;
- Increased, rather than decreased, levels of stock holding to minimise risks of disruption to supplies of raw materials (tying up greater amounts of capital, with a higher associated cost).

In addition, with an increasing array of GMO events being available in global supplies of cereals and oilseeds, most of which are likely to be classified as unapproved in Turkey[7], an increasing risk may occur of unapproved GMOs being found further down the agri-food chain (especially in manufactured products). Should this category of problem arise, the level of market disruption and cost involved would increase substantially because manufactured products may have to be withdrawn from markets. Drawing on analysis in the EU[8], this suggests that the total costs involved of dealing with several incidents of low level presence of not approved GMOs in a large sector such as soybean and derivatives could be as high as between $1.47 billion and $4.1 billion. Whilst this analysis was not made in respect of the Turkish agri-food sector, the similarities between the EU and Turkey in terms of how cereal and oilseed supply chains operate suggests that these costs reflect what could occur in Turkey in the coming years.

Overall, the analysis suggests that in the future, the on-going costs associated with the operation of the Turkish GMO regulations and incurred by the Turkish agri-food sector can be expected to increase. Section 3.3 estimates these on-going costs under a number of possible scenarios and

[7] Based on the current nature and speed of approvals made

[8] See Brookes G (2008) Economic impacts of low level presence of not yet approved GMOs in the EU food sector, report for the Federation of European Rice Millers and CIAA

shows a range of between $0.4 billion and nearly $1.6 billion, with an annual cost of between $0.7 billion and $1 billion having a reasonable probability of arising.

Competitiveness issues for the Turkish agri-food sector

Relative to the level of net profitability across the entire food and drink industry in Turkey, the $0.8 billion plus cost burden associated with the GMO regulations to date is equal to between 33% and 50% of the total sector net profitability. Given that the impact of the GMO regulations has affected a limited number of sub-sectors within the food and drink industry (eg, animal feed, meat production, oilseeds and fats, confectionery); the additional costs will be equal to a significantly higher share of total net profitability[9] for these sectors. At the company level, the precise impact will vary according to a number of factors (eg, size of business, importance of 'affected commodities' in total business), however, this analysis does illustrate how the additional costs associated with the GMO regulations have significantly reduced profitability of many businesses during a difficult global recessionary period. It is also likely to have pushed a number of businesses into a loss making position.

Businesses making little or no profit (or those making losses) are unlikely to continue in this position indefinitely. It is therefore likely that the negative impact on profitability arising from the GMO legislation will have an adverse impact on income and employment generation in the Turkish agri-food sector, as some operators move out of affected sub sectors and/or cease trading rather than make losses. Those at greatest risk are probably small and medium sized businesses (that dominate the sector).

The net effect is a loss of competitiveness, both in the domestic market and export markets relative to suppliers who have greater flexibility and access to competitively priced raw materials.

In the longer term, higher costs of production, lower levels of profitability and relatively high levels of risk and uncertainty relating to access to raw materials results in a loss of competitiveness, lower levels of investment, less value adding and lower levels of employment in the Turkish agri-food processing and manufacturing sector than would otherwise have occurred if the GMO regulations were based on the timely application of a science-based approval system.

Impact on consumers

There are two ways in which consumers may be affected by the introduction and operation of the GMO regulations.

a) Impact on prices paid

Attempting to quantify the extent to which the significant additional cost burden of the GMO regulations has been passed on down the supply chain is difficult because of the numerous variables that affect prices and their transmission along the supply chain. Nevertheless, some conclusions drawn:

- Increases in costs faced by importers, crushers and animal feed manufacturers have been passed on to customers in the livestock production and food manufacturing sectors in the form of higher prices. For example, the average price of imported soybeans and corn

[9] It is not possible to disaggregate this analysis to sub-sectors due to a lack of data

increased by +15% to +20% respectively between 2009 and 2011, whilst the average price of compound feed increased by between 14% and 36% over the same period;
- The livestock production sector and food manufacturing sector absorbed much of the short-term cost increases but had inevitably passed on some of the recurring/longer term cost increases in the form of higher prices;
- Prices of livestock products and foods containing or derived from soybean and corn derivatives are likely to be higher for consumers than they probably would have otherwise been in the absence of the GMO regulations.

b) Impact on availability and quality

The introduction of the GMO regulations has so far not had any direct 'knock on' effects to the end consumer level relating to product availability or quality. There has, however, been a reduced availability of some oils, notably corn oil, with sunflower oil being the main replacement available to consumers. The extent to which this has affected consumers is largely down to different taste and preference of consumers.

Concluding comments

To date, the operation of the GMO regulations in Turkey has had a significant negative impact on the Turkish agri-food chain. There has been considerable trade and market disruption, a significant cost burden (of over $0.8 billion) and commercial difficulties for many operators. The on going annual cost can reasonably be expected to be between $0.7 billion and $1 billion and could be higher.

With an expected widening discrepancy between the timing and nature of new GM event approvals in Turkey compared to major cereal and oilseed raw material supplying countries, and the rapid 'pipeline' of new traits and combinations of existing/new 'stacked' traits being approved for use in global agriculture, the negative impact is likely to get progressively worse. The longer term implications of the GMO regulations for the agri-food sector in Turkey are, therefore, likely to become increasingly negative with:

- Reduced profitability;
- Possible re-location of processing facilities outside Turkey (ie, lower levels of income and employment generation as jobs and investment are exported);
- Those at greatest risk being small/medium sized businesses that dominate the Turkish food sector;
- Greater levels of legal and business uncertainty, which reduces business confidence, adding to negative economic impact;
- Possible reduction in consumer product choice and higher prices.

If these significant negative economic impacts are to be avoided, the Turkish GMO regulations should be applied through a timely application of a science based approval system. At present, it is neither timely nor science based. Given Turkey is in a customs union with, and has applied for membership of, the EU, a GMO approval system that 'shadows' the EU system would at least

represent a positive step forward relative to the current Turkish regulations[10]. The EU's GMO approval system is, however, far from a 'model' in terms of timely delivery of science-based decisions, with constant political interference in its decision taking process. Nevertheless, it represents an improvement compared to the Turkish regulations and could form a first step towards the development of an effective, efficient and science based system.

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[10] The EU system current approves GMOs at a faster rate than the Turkish one, and has to date, eventually based most of its decisions on the scientific judgements of the European Food Safety Agency (EFSA)

1 Introduction

1.1 Background

Regulatory approval procedures for genetically modified organisms (GMOs) were first introduced in Turkey in October 2009 and were subsequently consolidated into a Biosafety Law which came into force in September 2010. These pieces of legislation affect the approval for the importation and use of commodities, derivatives and products as raw materials and ingredients used in the food, feed and industrial sectors of Turkey.

The procedures have important differences to, and take significantly longer than, the approval procedures in some of the major agricultural commodity trading partners of Turkey. GMOs tend to be approved for commercial use in food and feed products in countries such as the European Union (EU), the US, Argentina and Brazil before approval is granted in Turkey. In addition, to date, Turkey has not given approval for the use of any GMOs in food products.

This 'asynchronous authorisation' process has resulted in trade disruption, where agricultural commodities and derivatives that may contain or be derived from GMOs approved in an exporting country are exported to Turkey, before Turkey considers or grants authorisation for importation and use. The extent to which trade disruption has occurred depends on a number of factors including the rate of adoption of a newly approved GMO in the exporting country and the scope (and financial incentives in form of differentiated prices) for initiating segregated or identity preserved supply chains in the exporting countries and subsequent international transportation systems (separately into products with approval for importation into Turkey and products without Turkish import approval). Of equal importance, however, is the nature of rules relating to adventitious (or accidental) presence of not yet 'Turkey approved' GMOs in consignments or shipments of agricultural commodities and derivatives exported to Turkey.

As it is practically impossible to supply (outside a laboratory) a crop commodity with 100% purity, agricultural commodity trade has historically utilized the principle of thresholds or tolerances for the technically unavoidable or adventitious presence of unwanted materials in traded commodities. These thresholds/tolerances exist for a wide variety of unwanted materials, for example, off types, weed material, dirt, different seeds or grains to the mainstream product supplied, and include the tiny presence of materials that may be damaging to human (or animal) health (eg, mycotoxins, heavy metals). The tolerances are more restrictive (ie, lower) for unwanted materials of a dangerous (to human and animal health) nature[11] than those that are 'undesirable but less damaging to health'. In the case of the adventitious presence of GMOs not yet approved for importation and use in Turkey, this historic practice of setting and relating threshold/tolerances to reflect levels of risk was not applied, and the threshold/tolerance applied is zero (ie, there is no tolerance).

This paper explores the economic impact of the asynchronous nature of approvals procedures, coupled with the operation of a zero tolerance threshold for the adventitious presence of not approved or use-specific only approvals of GMOs in Turkey, on the Turkish sectors that rely on imports of agricultural products and derivatives. This includes agricultural commodity

[11] Usually set as maximum residue levels in terms of micrograms per kg

importers, oilseed crushers, food importers and manufacturers, feed manufacturers and livestock producers.

1.2 Objectives

The primary objective of this research was to produce a paper documenting and quantifying the economic impacts of the Biosafety Law and implementing regulations of Turkey on the Turkish importing, crushing, feed manufacturing, food manufacturing/processing and livestock production sectors.

The research focused on the implications of the Biosafety Law and implementing regulations on the sourcing and use of GM derived raw materials relative to sourcing and using alternatives (non-GM origin raw materials) in respect of existing crops/traits widely used in global agriculture (ie, soybeans, corn, canola/rapeseed and cotton plus their main derivatives).

The specific aspects of the study[12] were to cover the following:

- A brief quantification of Turkey's typical use of soybeans/derivatives, corn/derivatives, other oilseeds/derivatives (eg, canola, cotton seed) and cotton, together with primary sources of supply and costs (at import level);
- A brief analysis of available supplies of these commodities/derivatives in terms of GM and non-GM origin and world prices of these differentiated products;
- Economic consequences for Turkey of using GM derived commodities/derivatives relative to requiring certified non-GM commodities/derivatives – examining both cost differences and availability issues/alternatives. This focused on impacts for the main user sectors and their competitiveness relative to supplies that may use GM derived raw materials. It also considered which markets specifically required non-GM products and the opportunities/constraints to supplying these markets;
- A brief consideration of competitiveness issues for Turkish user sectors of these raw materials both domestically and in export (world) markets;
- Qualitative discussion of impacts on consumers in terms of price and availability of foods.

1.3 Approach

The study was conducted through a combination of desk research/analysis and interviews with operators in the importing and user sectors (crushers, importers, traders, feed manufacturers, food companies, livestock products (notably poultry operators) in Turkey). A semi structured interview guide was drafted as a baseline for the interviews which were conducted between

[12] The authors acknowledge that funding towards the researching of this paper was provided by the United Soybean Board and the American Soybean Association-International Marketing. The material presented in this paper is, however, the independent views of the authors – it is a standard condition for all work undertaken by PG Economics that all reports are independently and objectively compiled without influence from funding sponsors

October 2011 and January 2012. A total of 68 confidential interviews were conducted across a reasonably representative sample of sectors and bodies (eg, the survey respondents accounted for more than two-thirds of total soybean and derivative use, one-third of total corn use and 20% of rapeseed/derivative use). A breakdown of the interviews by main category of organisation is presented in Table 2.

Table 2: Supply chain interviews

Type of organisation	Number interviewed
Importer/broker	14
Crusher	4
Food manufacturer	10
Feed manufacturer	15
Livestock product producer	14
GMO testing companies	5
Trade associations	6
Total	**68**

The interviews in Turkey, together with the collection of local statistics, were undertaken by, Professor Selim Cetiner of Sabanci University and Professor Alper Guzel of Ondokuz Mayis University. Their input into this part of the study and for important input into the drafting of the report is gratefully acknowledged by the lead author.

2. Importation and use of 'affected' commodities and derivatives

This section presents an overview of the use and sources of supply for agricultural commodities and derivatives in Turkey that may be/are directly affected by the operation of the Biosafety Law and implementing regulations for authorising (or not) the importation and use of GMO crops, derivatives and products.

2.1 The GMO regulations

Turkey first introduced a GMO regulation in October 2009 to control the importation and use of GMOs ('*Regulation on the Import, Processing, Export, Control and Inspection of Food and Feed Products Bearing GMOs and GMO Components'*). This regulation banned the importation and use of all crops, commodities, derivatives and products containing or derived from GMOs until approval had been given by a Scientific Committee established in the Ministry of Agriculture and Rural Affairs (MARA). At the time of introduction in October 2009, this effectively banned all imports of commodities and their key derivatives of soybeans, rapeseed/canola and corn. The regulation was subsequently repealed and subject to several amendments throughout 2010 before the Biosafety Law came into force in September 2010. This 'framework law' was 'supported' by four implementing regulations which became operational in the autumn of 2010.

Key points of relevance to this study include:

- The legislation bans the cultivation of GM crops in Turkey;
- Immediately following the introduction of the 2009 GMO regulation, imports of GMO containing products could not take place and trade was severely disrupted for approximately 2-3 months;
- The GMO regulation was subject to amendment, repeal (early December 2009) and further amendment throughout 2010. During 2010, there were periods when GMO containing imports were allowed and the basis for authorisation was essentially related to the list of GMO events approved for importation and use in the EU;
- The Biosafety Law and its implementing regulations have been operational since October 2010. This legislation requires all GMOs to be approved for use in Turkey and establishes a strict policy of testing for products potentially containing GMOs;
- At the time of writing (February 2012), Turkey has approved 3 soybean and 13 corn GMO events for feed use only. This compares with a total of 56 GMO events which were present in commercially grown (global) crops in 2010/11[13]. No GMO events have been granted approval for food use, or even non food use (ie, industrial use) in Turkey, although the 3 soybean events have since the autumn of 2011, been given approval for industrial use. Thus whilst Turkey has given partial (feed only) approval for use of the 3 main soybean GMO events currently widely used globally, it has approved only 13 corn events for feed use out of about 30 currently widely used worldwide and has not given any approval to the 3 canola events widely used or to over 20 cotton events and events in alfalfa and sugar beet. The Turkish GMO regulatory approval system is currently

[13] Note: this refers only to events (including stacks) in commercial crops in 2010/11

significantly slower than approval systems in most other countries, and holds the unique distinction of being the only country in the world (countries with functioning GMO approval regulatory systems) that does not approve GMOs for both food and feed use. Even the EU, with which Turkey is in a customs union, operates a GMO regulatory regime that is quicker than Turkey's and approves GMOs for both food and feed uses. It is clear that, to date, the decision taking process used for approving GMOs in Turkey does not use sound science;

- There is a zero tolerance threshold for the presence of unapproved GMOs. This effectively applies to all GMO events without any form of approval in Turkey and to all GMOs, including those with approval in Turkey if the products containing or derived from them are destined for non feed use;
- Labelling of products containing GMOs is mandatory. The threshold for triggering GMO content labelling is 0.9%. It is, however, interesting to note that, given no GMOs have yet been given approval for food use, no food products sold in Turkey will carry positive GMO labelling unless they are 'illegal';
- GMO ingredients are banned in baby food, baby formula, continuation food and infant formula and in food supplements for babies and young children.

2.2 Use of 'affected' commodities and key derivatives

In order to present a baseline for examining the impact of the GMO regulations on the importation and use of various commodities and their derivatives, this section briefly summarises the Turkish supply balances for the main relevant commodities and their derivatives. Supply balances for the 2008/09 marketing year have been used as the baseline because this is the last full year before the introduction of the GMO regulations.

2.2.1 Soybeans and derivatives (Table 3)

Domestic production of soybeans in Turkey is limited (typically 15,000-20,000 hectares annually), with the majority of usage derived from imports. In 2008, Argentina and the US were the primary sources of supply, followed by Brazil and Paraguay (Figure 1). These two countries also accounted for the majority of soymeal imports into Turkey (Figure 2). In terms of usage:

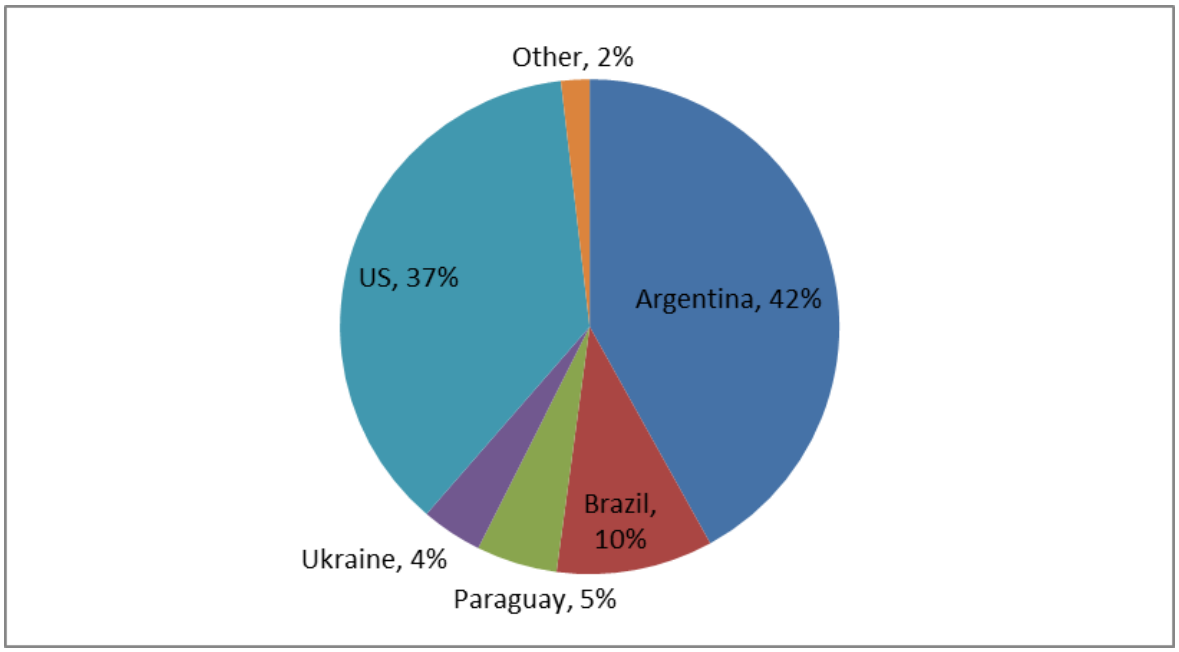
- Two thirds of soybeans were used in the feed sector (not crushed and used as de-hulled full fat soybeans), with almost all of the balance crushed (1% of usage also accounted for by the food sector);
- Soy oil use was divided between food (52%), feed (24%) and industrial (24%) uses.

Table 3: Soybean and derivative supply balance 2008/09 ('000 tonnes)

	Soybeans	Soy oil	Soy meal
Opening stocks	205	12	10
Domestic production	30	69	304
Imports	1,076	11	392
Total supply	**1,311**	**92**	**706**
Uses			
Exports	0	4	3
Crushing	380	Not relevant	Not relevant
Food use (not crushed for soybeans)	10	44	0
Feed/waste use (not crushed)	770	20	680
Industrial use	0	20	0
Total consumption	**1,160**	**84**	**680**
End stocks	151	4	23

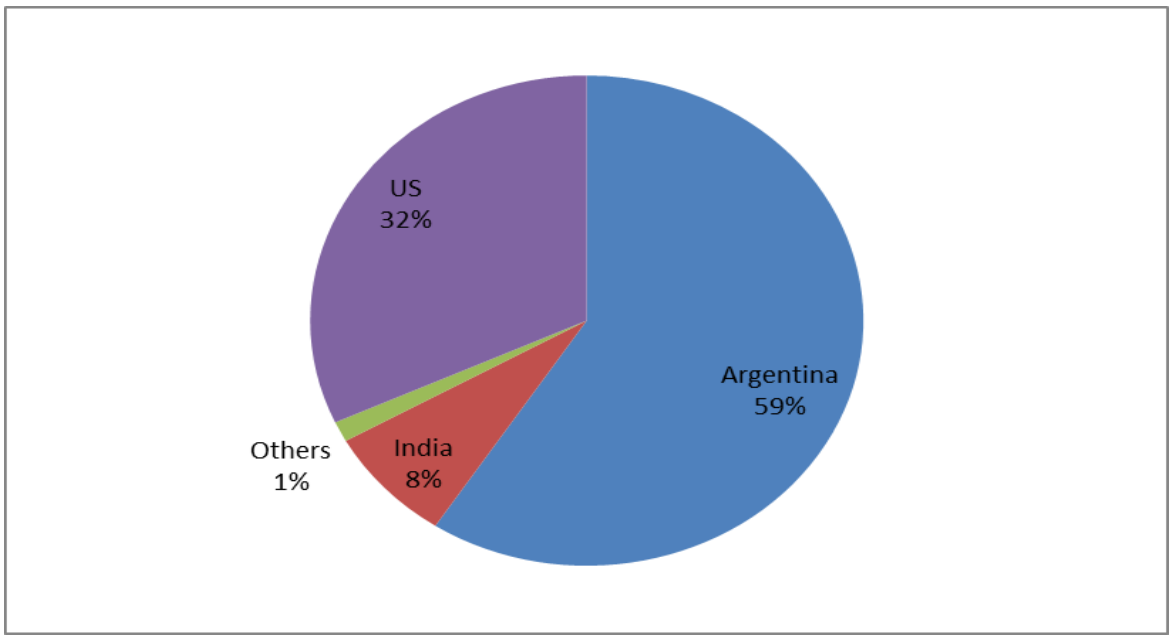
Sources: USDA, Oil World

Figure 1: Soybean imports Turkey 2008 ('000 tonnes)



Source: GDPC, Foreign Trade Office, Turkish Statistical Office

Figure 2: Soymeal imports Turkey 2008 ('000 tonnes)



Source: GDPC, Foreign Trade Office, Turkish Statistical Office

2.2.2 Cottonseed and derivatives (Table 4)

The vast majority of cottonseed used in Turkey derives from domestic production, with imports accounting for only 3% of total supplies. Almost all (99%) of the imports came from Greece. Virtually all of the cottonseed is crushed (1% used whole in the feed sector), with most cottonseed oil (84%) used in the food sector and all of the cottonmeal used in the feed sector.

Table 4: Cottonseed and derivative supply balance 2008/09 ('000 tonnes)

	Cottonseed	Cottonseed oil	Cottonseed meal
Opening stocks	5	24	0
Domestic production	630	108	360
Imports	18	7	0
Total supply	**653**	**139**	**360**
Uses			
Exports	0	2	5
Crushing	640	Not relevant	Not relevant
Food use (not crushed for cottonseed)	0	108	0
Feed/waste use (not crushed)	10	0	355
Industrial use	0	20	0
Total consumption	**650**	**128**	**355**
End stocks	3	9	0

Sources: USDA, Oil World

2.2.3 Rapeseed/canola and derivatives (Table 5)

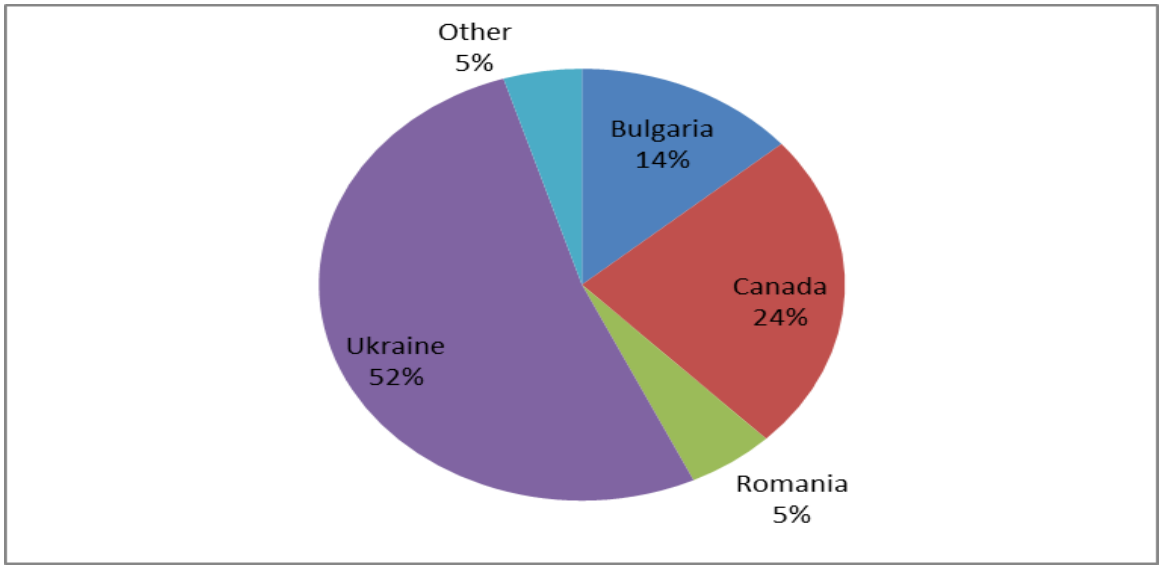
Rapeseed supplies were divided between domestic production (45%) and imports (55%). The imports (2008) came mostly from the Ukraine and Canada (Figure 3). In terms of usage, all of the rapeseed supplies were crushed and the derivatives used domestically. Rapeseed oil is reported to be used in a variety of uses (food, feed and industrial), with rapeseed meal used mainly in the feed sector.

Table 5: Rapeseed and derivative supply balance 2008/09 ('000 tonnes)

	Rapeseed	Rapeseed oil	Rapeseed meal
Opening stocks	35	0	0
Domestic production	84	89	124
Imports	102	0	42
Total supply	**221**	**89**	**166**
Uses			
Exports	0	1	19
Crushing	221	Not relevant	Not relevant
Food use (not crushed for rapeseed)	Not available	Not available	Not available
Feed/waste use (not crushed)	Not available	Not available	Not available
Industrial use	Not available	Not available	Not available
Total consumption	**221**	**88**	**147**
End stocks	0	0	0

Source: Oil World

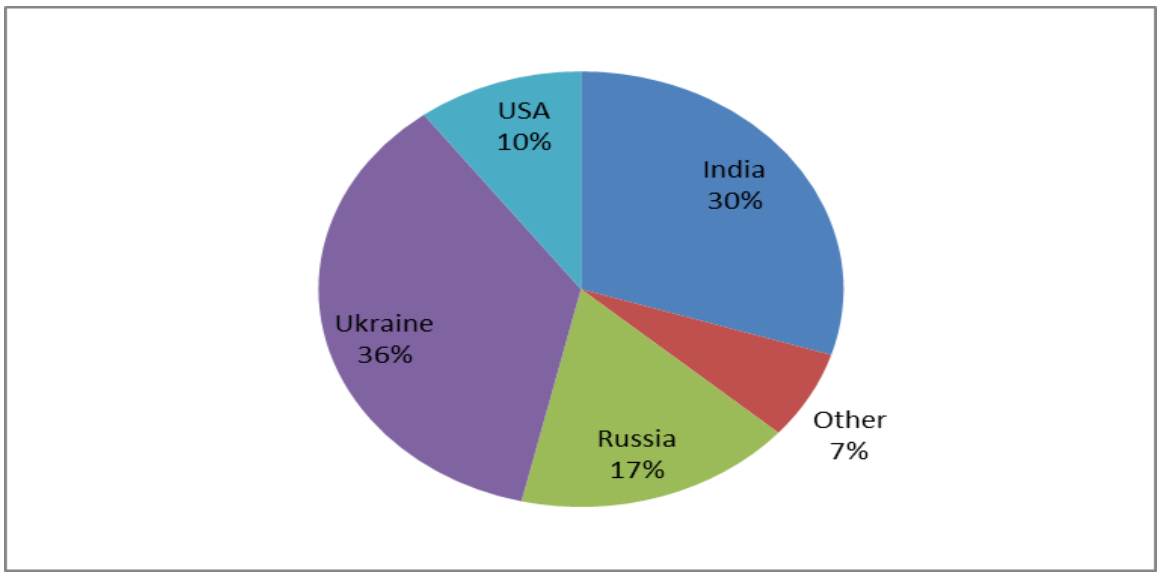
Figure 3: Rapeseed imports Turkey 2008 ('000 tonnes)



Source: GDPC, Foreign Trade Office, Turkish Statistical Office

All of the rapeseed oil used in Turkey derives from domestically crushed rapeseed and in respect of rapemeal, about a quarter of supplies come from imports. These imports come from a number of sources, of which the Ukraine and India had the largest shares in 2008 (Figure 4).

Figure 4: Rapemeal imports Turkey 2008 ('000 tonnes)



Source: GDPC, Foreign Trade Office, Turkish Statistical Office

2.2.4 Corn, corn oil, corn gluten and dried distillers grain (Table 6)

In 2008/09, Turkey used about 4.3 million tonnes of corn, with 80% of supplies coming from domestic production. Of the 0.4 million tonnes of imports, the main suppliers were the USA, Argentina and the Ukraine which respectively accounted for 42%, 27% and 20% of total imports. The feed sector accounted for the largest usage (79%), with a mix of food and industrial uses accounting for the rest of use. In relation to corn gluten usage, this was an important feed ingredient used by the Turkish livestock production sector. It has largely been supplied by imports, of which the USA has been the primary source (93% of total supplies in 2008). Corn oil consumption in 2008/09 was just under 0.12 million tonnes, of which imports accounted for the majority of supplies (two thirds). The USA was the principal source of imported corn oil in 2008, accounting for 71% of total imports. The USA was also the main source of dried distillers grain with solubles (DDGS: 93% of the total).

Table 6: Corn, corn gluten and DDGS supply balances 2008/09 ('000 tonnes)

	Corn	Corn oil	Corn gluten feed	DDGS
Opening stocks	599	0	68	Not available
Domestic production	4,150	38	Not available	Not available
Imports	403	83	387	522
Total supply	**5,152**	**121**	**455**	**522**
Uses				
Exports	67	4	0	0
Feed use	3,400	0	455	522
Other uses	900	117	0	0
Total consumption	**4,300**	**117**	**455**	**522**
End stocks	785	0	0	0

Sources: USDA, Oil World and Turkish Statistical Institute
Note: DDGS based on 2008 import statistics

2.3 GM versus conventional (non-GM) sources of supply

2.3.1 Global context

In 2010/11, the global area planted to GM traited crops reached over 139 million hectares. In terms of the share of the main crops in which GM traits have been commercialised (soybeans, corn, cotton and canola), GM traits accounted for 42% of the global plantings to these four crops in 2010/11. At the crop level, in terms of the share of total global plantings to these four crops, GM traits accounted for the majority of soybean plantings (70%) in 2010/11. For the other three main crops, the GM shares in 2010/11 were 26% for corn, 52% for cotton and 20% for canola[14].

Looking at the extent to which the leading GM producing countries are traders (exporters) of these crops and key derivatives (Table 7 and Table 8) shows the following:

- *Soybeans*: in 2010/11, 35% of global production was exported and 98% of this trade came from countries which grow GM soybeans. As there has been some development of a market for certified non-GM soybeans and derivatives (mostly in the EU, Japan and South Korea), this has necessitated some segregation of exports into GM versus non-GM supplies or sourcing from countries that do not use GM soybeans. Based on estimates of the size of the certified non-GM soy markets in the EU and SE Asia (the main markets), about 3.3% of global trade in soybeans is probably currently required to be certified as non-GM, and if it is assumed that this volume of soybeans traded is segregated from GM soybeans, then the GM share of global trade is 95%. A similar pattern occurs in soymeal, where 85% of globally traded meal probably contains GM material;
- *Corn*: 11% of global production was internationally traded in 2010/11[15]. Within the leading exporting nations, the GM corn growers of the US, Argentina, Brazil, South Africa and Canada are important players (83% of global trade). As there has been some, limited development of a GM versus certified non-GM corn market (mostly in the EU, and to a lesser extent in Japan and South Korea), which has necessitated some segregation of exports into GM versus certified non-GM supplies, the likely share of global trade accounted for by GM corn exports is about 79%;
- *Cotton*: in 2010/11, 31% of global production was traded internationally. Of the leading exporting nations, the GM cotton growing countries of the US, Australia, India, Brazil and Burkina Faso are prominent exporters accounting for 72% of global trade. Given that the market for certified non-GM cotton is very small, virtually all of this share of global cotton trade from GM cotton growing countries is probably not subject to any form of segregation and hence may contain GM derived material[16]. In terms of cottonseed meal the GM share of global trade is 47%;
- *Rapeseed/canola*: 17% of global canola production in 2010/11 was exported, with Canada being the main global trading country. The share of global canola exports accounted for by the three GM canola producing countries (Canada, the US and Australia) was 82% in

[14] Source: Brookes G and Barfoot P (2011) GM crops: global socio-economic and environmental impacts 1996-2009. www.pgeconomics.co.uk

[15] Corn is an important subsistence crop in many parts of the world and hence the majority of production is consumed within the country of production

[16] We consider this to be a reasonable assumption; we are not aware of any significant development of a certified conventional versus GM cotton market and hence there is little evidence of any active segregation of exports into these two possible streams of product

2010/11. As there has been only a very small development of a market for certified non-GM canola globally (the EU, the main market where certified non-GM products are required, has been largely self sufficient in canola and does not currently grow GM canola), non segregated GM exports probably account for 82% of global trade. For canola/rapemeal, the GM share of global trade is about 58%.

Table 7: Share of global crop trade accounted for GM production 2010/11 (million tonnes)

	Soybeans	Maize	Cotton	Canola
Global production	264.2	828.0	25.1	60.2
Global trade (exports)	93.45	91.3	7.75	10.34
Share of global trade from GM producers	91.66 (98.1%)	76.5 (83.7%)	5.56 (71.7%)	8.46 (81.8%)
Estimated size of market requiring certified non-GM (in countries that have import requirements)	3.1	4.5	Negligible	Negligible
Estimated share of global trade that may contain GMOs (ie, not required to be segregated)	88.56	72.0	5.56	8.46
Share of global trade that may be GM	94.8%	78.9%	71.7%	81.8%

Sources: derived from and updated - USDA & Oil World statistics

Notes: Estimated size of market requiring certified non-GM in countries with import requirements excludes countries with markets for certified non-GM for which all requirements are satisfied by domestic production (eg, maize in the EU). Estimated size of certified non-GM market for soybeans (based primarily on demand for derivatives used mostly in the food industry): EU 2.1 million tonnes bean equivalents, Japan and South Korea 1 million tonnes.

Table 8: Share of global crop derivative (meal) trade accounted for GM production 2010/11 (million tonnes)

	Soymeal	Cottonseed meal	Canola/rape meal
Global production	177.8	19.7	33.6
Global trade (exports)	60.0	0.5	4.8
Share of global trade from GM producers	53.6 (89.3%)	0.236 (47.2%)	2.8 (58.3%)
Estimated size of market requiring certified non-GM (in countries that have import requirements)	2.5	Negligible	Negligible
Estimated share of global trade that may contain GMOs (ie, not required to be segregated)	51.1	0.236	2.8
Share of global trade that may be GM	85.2%	47.2%	58.3%

Sources: derived from and updated - USDA & Oil World statistics

Notes: Estimated size of certified non-GM market for soymeal: EU 2.25 million tonnes, Japan and South Korea 0.25 million tonnes (derived largely from certified non-GM beans referred to in above table)

2.3.2 Turkey context

a) Market-driven demand for certified non-GM material[17]

Focusing on Turkey, the market-driven demand for certified non-GM supplies of any of these commodities and derivatives (ie, market demand as distinct to any regulation-induced demand) is small. Evidence from the industry survey found limited reference to this market segment existing in Turkey, other than as a) a small niche (in the food sector, such as demand for organic produce) or b) where supplies of food products have been manufactured by large food companies to meet the requirements of certified non-GM segments of the EU market are additionally exported to Turkey[18]. As such, this mostly applies to some soy-based derivatives used in a range of food products at very low (less than 1%) incorporation rates (eg, lecithin). It also applies to some products with corn-based derivatives. Overall, this segment of the market probably accounts for no more than 1%-2% of total demand for soybeans, corn and their derivatives in Turkey. The survey also identified negligible market-driven requirements in the livestock production sectors in Turkey to use certified non-GM feed ingredients in livestock rations[19].

Overall, the current proportion of total raw material use in Turkey, from the main crops and derivatives for which GM material are traded on global markets, that has a market-driven demand for certified non-GM material is very small.

b) Baseline (2008/09) usage and imports

Drawing on the supply balance and import data (section 2.2) and the assessment of GM material in global trade (section 2.3.1), Figure 5 summarises the likely share of GM material in the importation and use of key commodities and their derivatives in Turkey prior to the introduction of the GMO regulations in 2009. This shows that before the GMO regulations were introduced:

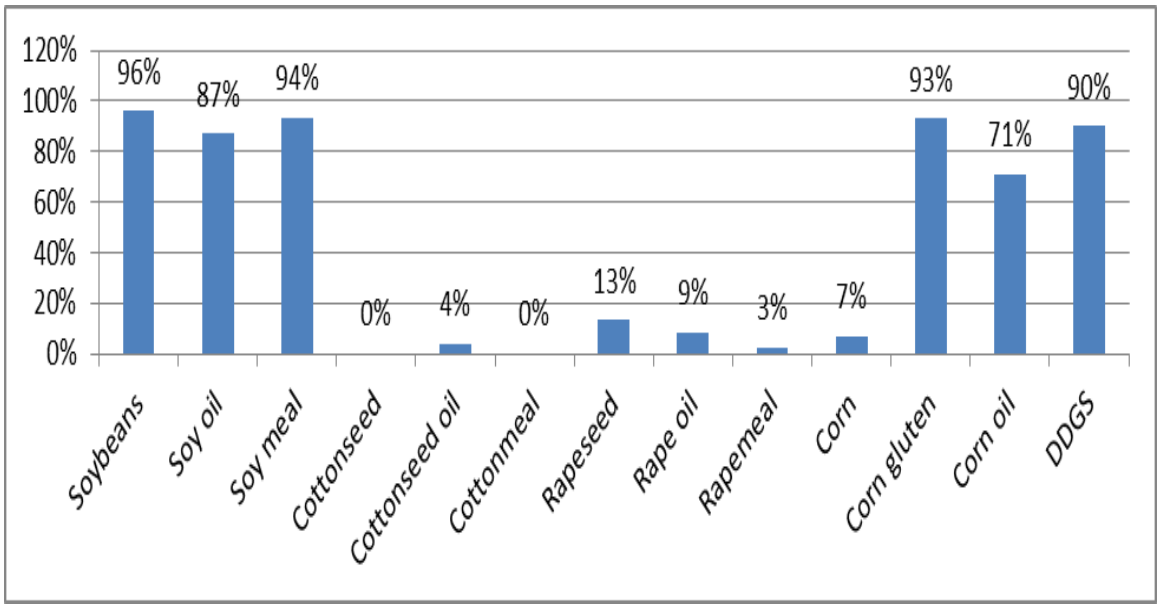
- Almost all (90% plus) soybeans and derivatives used in Turkey were derived from GM material;
- Almost all cottonseed and derivatives used were non GM (ie, largely derived from domestic production);
- Rapeseed and derivative use was largely supplied from non-GM sources (domestic sector and imports from nearby, non-GM producing countries);
- Just under 10% of corn used in Turkey derived from GM origin material (imports);
- Importation and use of corn derivatives (maize oil, corn gluten feed and DDGS) were mostly of GM origin (imports).

[17] It is equally possible to argue that even this market segment is regulatory driven in that a primary influence on food companies requiring raw materials to be certified as non-GM is mandatory labelling requirements for GMO content (that do not apply to any other production process)

[18] In other words, the requirement to use certified non GM raw materials in food products for the EU market has dictated that non GM raw materials are used in all products sold within the region, including Turkey

[19] This does not totally exclude the existence of such demand, though any such market, if it exists in Turkey, is likely to be extremely small

Figure 5: Share of GM material in use of key commodities and derivatives in Turkey: 2008



Note: Assumes all domestic production is non-GM and all imports from GM producing countries are GM (ie, there is no active segregation of non-GM material in imports)

3. Impact of the GMO regulations

This section examines the trade, usage, market and economic impact of the GMO regulations on the importing and user sectors of agricultural commodities and their derivatives.

3.1 Usage and source of supply changes

Drawing on a combination of the survey findings and examination of supply balances and trade data, the following presents an overview of recent changes.

Soybeans (Table 9)

- Usage has increased mainly driven by expanding demand as a feed ingredient for the livestock production sector. Soybeans (as full fat soybeans, soy oil and soymeal) are considered as key feed ingredients, especially in the poultry and eggs sectors;
- Total use is expected to fall in 2011/12 relative to 2010/11 due to difficulties in finding markets for soy oil (see below), with the volume crushed expected to decline to about 400,000 tonnes;
- Food use of whole soybeans has effectively ceased because there is no approval for the use of GMO derived soybeans in food. The lack of GMO approval for uses other than feed also adversely affected industrial uses, although volumes used in industrial applications are expected to recover in 2012 following the approval for GMO soybean industrial use in late 2011;
- There has been a small increase in domestic production of soybeans, but this remains very small relative to total usage[20];
- The volume of imports has increased significantly since 2008/09 to meet the increasing demand;
- There has been a major increase in stock holding since the introduction of the GMO regulations in late 2009. This continued through 2010-11 and into 2011-12;
- Imports are dominated by supplies from GMO producing countries. Over 99% of imports in 2010 and 98% in 2011 came from GMO producing countries[21].

Soy oil (Table 10)

- In 2010/11 soy oil usage was marginally higher than in 2008/09. There has been a significant increase in usage from the livestock sector, with food use falling dramatically. The decline in food use reflects the imposition of the GMO regulations that authorised the use of GMO soybeans for feed use only. The limited food use of soy oil is now strictly as certified non-GM soy oil;
- Closing stock levels at the end of 2010/11 increased reflecting the inability of crushers to sell soy oil, not required in the feed/livestock production sector because of the GMO restrictions (not even permitted for non feed uses, including industrial). This was highlighted as a major problem throughout 2010 and 2011 by crushers, with soybean

[20] Despite projections by the Turkish Ministry of Agriculture that the domestic soybean area would expand to 80,000 ha by 2011, this has not occurred mainly because maize and cotton continue to be more profitable crops

[21] 3% of imports in 2010 and 12% in 2011 also came from the Ukraine, nominally a non GMO producer. However, as about half of the Ukraine soybean crop is estimated to be illegally planted to varieties containing GMOs, supplies from the Ukraine have been classified as GMO

crushing in the latter half of 2010 limited by a build up in stocks. In the latter half of 2011 soy oil stocks reached between 25,000 and 30,000 tonnes. The authorisation for industrial use of GMO soy oil in late 2011 may alleviate this problem of stock build up, although the lack of authorisation for food use is expected to continue to constrain the volume of soybeans crushed;

- In terms of sources of supply, these have continued to be dominated by GMO producing countries (ie, via soy oil derived from domestically crushed soybeans: see above). Of the imported soy oil, this mostly comes from GMO producing countries although about a third of imports in 2011 came from non-GM producers (the EU and Israel). The EU origin imports which accounted for 5% of total imports in 2011 are likely to have been certified as non-GM origin soy oil.

Table 9: Turkey soybean usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	**2010/11**
Opening stocks	205	409
Domestic production	30	60
Imports	1,076	1,350
Total supply	**1,311**	**1,819**
Uses		
Exports	0	0
Crushing	380	520
Food use (not crushed)	10	0
Feed/waste use (not crushed)	770	970
Total consumption	**1,160**	**1,490**
End stocks	151	329

Sources: USDA, Oil World

Table 10: Turkey soy oil usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	**2010/11**
Opening stocks	12	18
Domestic crush: beans	380	500
Domestic crush oil output	69	90
Imports	11	2
Total supply	**92**	**110**
Uses		
Exports	4	10
Industrial use	20	34
Food use	44	1
Feed/waste use	20	55
Total consumption	**84**	**90**
End stocks	4	10

Sources: USDA, Oil World

Soy meal (Table 11)

- There has been increased usage since 2008/09 mainly driven by expanding demand as a feed ingredient in the livestock production sector;

- To meet the higher demand, import volumes have increased significantly;
- There has been a significant increase in stock holding in 2010/11 and into 2011/12;
- 90% of imports in 2010 came from GMO producing countries, with the USA and Argentina continuing to dominate supplies. In 2011, GMO producing country soymeal continued to dominate supplies although 35% of total imports came from EU countries. Most of this EU origin meal is, however, likely to have been derived from GMO soybeans crushed in the EU.

Table 11: Turkey soymeal usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	**2010/11**
Opening stocks	10	115
Domestic production from crush	304	416
Imports	392	534
Total supply	**706**	**1,065**
Uses		
Exports	3	8
Industrial use	0	0
Food use	0	0
Feed/waste use	680	840
Total consumption	**680**	**840**
End stocks	23	217

Sources: USDA, Oil World

Cottonseed and derivatives (Table 12, Table 13, Table 14)

- Both domestic usage and production has increased since 2008/09. Production has increased largely in response to increases in the world price of cotton;
- Cottonseed meal use has increased in line with increased demand in the feed/livestock sectors;
- Cottonseed oil use has fallen marginally since 2008/09. Within usage, there has been an increase in feed and industrial sector uses offsetting a decline in food sector usage;
- Usage of cottonseed and its main derivatives have not been noticeably impacted by the GMO regulations largely because supplies are dominated by (and continue to be) domestic (non-GM) sources. None of the respondents to the industry survey identified any GMO regulation issues in respect of the use of cottonseed and/or its derivatives, although there has been some limited trade diversion since 2008 away from importation of small volumes of cotton seed oil from the GMO producing country, Argentina (no GMO cotton events have received approval for use in Turkey).

Table 12: Turkey cottonseed usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	5	2
Domestic production	630	720
Imports	18	8
Total supply	**653**	**730**
Uses		
Exports	0	0
Crushing	640	720
Food use (not crushed)	0	0
Feed/waste use (not crushed)	10	10
Total consumption	**650**	**730**
End stocks	3	0

Sources: USDA, Oil World

Table 13: Turkey cottonseed oil usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	24	0
Domestic production	108	115
Imports	7	5
Total supply	**139**	**120**
Uses		
Exports	2	2
Industrial use	20	33
Food use	108	55
Feed/waste use	0	30
Total consumption	**128**	**118**
End stocks	9	0

Sources: USDA, Oil World

Table 14: Turkey cottonseed meal usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	0	0
Domestic production	360	410
Imports	0	0
Total supply	**360**	**410**
Uses		
Exports	5	4
Industrial use	0	0
Food use	0	0
Feed/waste use	355	406
Total consumption	**355**	**406**
End stocks	0	0

Sources: USDA, Oil World

Rapeseed and derivatives (Table 15, Table 16, Table 17)

- Domestic usage of rapeseed has increased between 2008/09 and 2010/11, largely based on an increase in imports (there has been some increase in domestic production but from a relatively small base);
- Rapeseed meal use has increased substantially since 2008/09 (a doubling in use by 2010/11). This reflects an increase in demand from the expanding livestock production sector, although the GMO regulations have also impacted on usage. Since 2009, with increasing uncertainty surrounding authorisations of GMO soybeans and derivatives, some crushers (and importers of meal) have increasingly looked to import rapeseed from non-GMO producing countries for crushing, or rapeseed meal for direct use in the feed sector as a 'less risky alternative';
- Rapeseed oil usage has also increased since 2008/09, both in non food and food uses. An important reason for the increase in usage, especially in the food sector, has been as a replacement for soy oil because of restrictions on the use of GMO soy oil in these sectors;
- In 2010 and 2011 imports of rapeseed and meal were exclusively from non-GM growing countries (notably the EU, Ukraine, Croatia and Russia[22]). Whilst this means that all of the rapeseed and derivatives used in Turkey in 2010 and 2011 derived from non-GM sources of supply, this is not a significant change from the nature of supplies before the introduction of the GMO regulations. There has, however, since 2008, been some trade diversion away from the importation of GMO derived rapeseed from Canada and rapeseed meal from the USA.

Table 15: Turkey rapeseed usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	**2010/11**
Opening stocks	35	N/a
Domestic production	84	90
Imports	102	215
Total supply	**221**	**305**
Uses		
Exports	0	0
Crushing	221	310
Food use (not crushed)	N/a	N/a
Feed/waste use (not crushed)	N/a	N/a
Total consumption	**221**	**310**
End stocks	N/a	N/a

Sources: Oil World

[22] Also India for rapemeal

Table 16: Turkey rapeseed oil usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	N/a	N/a
Domestic production	89	125
Imports	0	0
Total supply	**89**	**125**
Uses		
Exports	1	2
Industrial use	N/a	N/a
Food use	N/a	N/a
Feed/waste use	N/a	N/a
Total consumption	**88**	**123**
End stocks	N/a	N/a

Sources: Oil World

Table 17: Turkey rapemeal usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	N/a	N/a
Domestic production	124	174
Imports	42	52
Total supply	**166**	**226**
Uses		
Exports	19	0
Industrial use	N/a	N/a
Food use	N/a	N/a
Feed/waste use	N/a	N/a
Total consumption	**147**	**224**
End stocks	N/a	2

Sources: USDA, Oil World

Corn (Table 18, Table 19, Table 20)

- Corn usage in 2010/11 was broadly similar to usage three years earlier. The majority of supplies were derived from domestic production with imports accounting for less than 10% of total supplies;
- The main use for corn is, and has been, the feed/livestock production sectors. Since 2008 there has been significant expansion in the production levels of livestock (notably poultry) and this has fuelled a rapid increase in demand for feed ingredients. Thus, whilst feed sector usage of corn increased by about 3% in 2010/11 compared to 2008/09, it is likely that the volumes of corn used would have increased by substantially greater amounts if, firstly, domestic production had not fallen in 2009 and secondly, the introduction of the GMO regulations effectively banned the importation of GMO derived corn from late 2009;
- Since 2008 there have been important changes to the origin of corn imports. There has been significant trade diversion away from GMO corn producing countries (notably the USA, Argentina and Canada) to countries that currently do not permit the growing of GMO corn (Hungary, Ukraine and Russia). Thus whilst in 2008, 73% of corn imports

came from GMO producing countries, by 2010, corn imports from GMO corn producing countries accounted for only 5% of imports (4% in 2011);

- Corn gluten feed use has fallen significantly since 2008/09 (by 20% by 2010/11). This reduction in usage has been largely caused by the lack of regulatory approval of GMO corn events in Turkey, which has disrupted imports from the USA which was, in 2008, the primary source of supply. There has also been some trade diversion away from supplies from the GMO corn producing USA, to Ukraine;
- In 2010/11, corn oil use had fallen by a third compared to 2008 consumption levels. An important contributory factor for this decrease in use[23] has been anti GMO campaigning by activist groups, which is perceived to have put consumers and food companies off using corn oil in, or for cooking, food. The share of total supplies accounted for imports also fell from two-thirds in 2008/09 to about 50% in 2010/11 and is reported to have fallen further by the end of 2011. In terms of the origin of imports in 2010/11, the USA continued to be the largest supplier but with a reduced volume and share (about 32,000 tonnes, 58% of imports in 2010 and 19,000 tonnes, 55% of imports in 2011) Coupled with the increasing share of total consumption accounted for by domestic supplies, this points to significant trade diversion away from countries where most corn oil derives from GMO corn to sources that derive from conventional corn. Industry sources report the decline in the corn oil market has continued into 2011/12 with estimates of total usage expected to fall to no more than 50,000 tonnes;
- Dried distillers grain (DDGs) has become an important feed ingredient in the last few years, with imports reaching over half a million tonnes in 2008. By 2011, the volume of imports had fallen significantly to 157,000 tonnes, mainly because of the non approval of many corn GMOs widely used in the US (and present in DDGs), the primary source of supply. Most of the (reduced volume of) DDGs imported in 2011 now comes from non-GMO corn producing countries (EU, Ukraine and Russia), with the USA share having fallen to 9%.

Table 18: Turkey corn usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	**2010/11**
Opening stocks	599	725
Domestic production	4,150	3,600
Imports	403	330
Total supply	**5,152**	**4,655**
Uses		
Exports	67	11
Feed use	3,400	3,500
Other uses	900	900
Total consumption	**4,300**	**4,400**
End stocks	785	244

Sources: USDA

[23] As indicated in the industry survey

Table 19: Turkey corn gluten feed usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	68	74
Imports	387	290
Total supply	**455**	**364**
Total consumption	**455**	**364**

Source: Oil World

Table 20: Turkey Corn oil usage balances 2008/09 and 2010/11 ('000 tonnes)

	2008/09	2010/11
Opening stocks	0	0
Domestic production	38	50
Imports	83	55
Total supply	**121**	**105**
Uses		
Exports	4	18
Feed use	0	0
Other uses	117	80
Total consumption	**117**	**80**
End stocks	0	7

Sources: USDA, Oil World

3.2 Economic impacts of usage and source of supply changes

Drawing on a combination of analysis of market data and the findings of the industry survey, this sub-section provides discussion and quantification of the economic impacts incurred to date by the Turkish agri-food sector.

3.2.1 Trade diversion

As indicated in section 3.1 there have been significant changes in the sources of supply of imported commodities and derivatives away from GMO producing countries to non-GM growing countries. This can be largely attributed to the Turkish GMO regulations. These are quantified in Table 21. More specifically:

- Soybean and soymeal imports have continued to be dominated by GMO producing countries, mainly because there are few alternative sources of supply (unless identity preservation/segregation of non-GM sources of supply are established). Also the primary uses for these products are in the feed sector where approvals for feed use have been given in Turkey. In contrast, soy oil imports have been diverted away from GMO sources of supply, although the volumes involved have been relatively small;
- Prior to the introduction of the GMO regulations Turkey used to import modest amounts of rapeseed and rapeseed meal from the GMO producing countries, Canada and the USA. All trade in these products now comes from non-GMO producers;
- Cottonseed and cottonseed derivative trade has not been affected mainly because Turkey is largely self sufficient in cotton and derivatives. Also the limited

volume of imports of these products comes from non-GMO producers such as Greece;

- There has been significant trade diversion away from GMO corn and corn derivative/by-product producing countries (notably the USA) following the introduction of the GMO regulations. This has affected trade in corn, corn oil, corn gluten feed and DDGS;
- There has been noticeable trade diversion away from the US to other sources of supply in respect of formulated pet food. This is because much of the pet food originally sourced from the USA used corn and corn derivatives as key ingredients.

Table 21: Share of imports of commodities and key derivatives derived from GMO producing countries 2008-2011

Product	Baseline volume of total imports (annual average 2006-08: '000 tonnes)	Share of baseline imports from GMO producing countries %	Share of imports from GMO producing countries 2009%	Share of imports from GMO producing countries 2010 %	Share of imports from GMO producing countries 2011 %
Soybeans	1,162.3	99.9	98.7	98.0	98.1
Rapeseed	215.5	20.8	0	0	0
Cottonseed	32.5	0	0	0	0
Corn	450	77	7.9	5.7	3.7
Soybean meal	323.3	98.6	94.3	82.4	91.4
Rapeseed meal	38.8	7.2	0	0	0
Cottonseed meal	Negligible	0	0	0	0
Soy oil	36	74.7	67.6	64.9	10.0
Rapeseed oil	4.8	0	0	0	0
Cottonseed oil	4.9	36.3	13.0	0	0
Corn oil	108	75.4	95.7	75.0	77.4
Corn gluten feed	566.7	93.3	89.7	66.1	5.3
DDGS	464.7	90.0	99.5	90.0	8.8
Pet food	20.6	32.0	24.0	9.0	3.0

Note: 2011 11 months, corn gluten feed and DDG annual average of 2007 and 2008

This clear trade diversion related to the GMO regulations raises the potential of a World Trade Organisation (WTO) complaint/challenge being launched against Turkey by the leading GMO producing countries such as the USA, Canada, Argentina and Brazil. All of these countries have seen their exports of soybean, rapeseed and corn commodities and their derivatives to Turkey decline after the GMO regulations were introduced. If such a complaint was launched the magnitude of compensatory or retaliatory claims would probably be based on the value of imports 'lost' since the introduction of the Turkish GMO regulations, compared to a baseline before the introduction of the GMO regulations. Illustrative analysis (Table 22) suggests that for

the three year period since the introduction of the first GMO regulations, this could be over $1.1 billion[24].

Table 22: Trade diversion: import value loss on imports of commodities and key derivatives derived from GMO producing countries 2009-2011 (million $)

Product	2009	2010	2011
Soybeans	88.9	Nil	Nil
Rapeseed	18.8	22.0	30.1
Cottonseed	0	0	0
Corn	86.0	78.6	107.2
Soybean meal	0	0	0
Rapeseed meal	0.6	0.7	0.7
Cottonseed meal	0	0	0
Soy oil	20.6	27.3	36.1
Rapeseed oil	0	0	0
Cottonseed oil	0	0	0
Corn oil	1.4	37.2	76.5
Corn gluten feed	38.0	88.3	154.1
DDGS	0	2.5	132.6
Pet food	2.2	26.2	42.5
Total	**256.5**	**282.8**	**579.8**

Notes

1. 2011 11 months
2. Values based on changes in volume of imports from the main GMO producing countries in each year compared to a 2006-2008 baseline multiplied by the average import value for each commodity in the respective years

3.2.2 General impacts

a) Short term costs late 2009

When the original GMO regulation was introduced in late September 2009, it became operational almost immediately and resulted in considerable short term disruption to the import trade of cereals, oilseeds and derivatives. In effect, all imports of cereals, oilseeds and their derivatives which contained GMOs were banned. This lasted about two months before legal changes were made permitting some imports (containing GMOs that had been approved in the EU). During this period, users of imported raw materials such as soybeans, soymeal, soy oil, corn and derivatives (notably corn gluten feed and dried distillers grain) were denied access to imported products and had to draw on existing stocks to keep their businesses operational (eg, crushing of oilseeds, manufacturer of compound feed). In addition, some import shipments were rejected and sent back to the country of origin (or diverted to other markets) because of the presence of (then unapproved) GMOs, whilst other shipments were delayed in port waiting for testing and

[24] This is illustrative of the methodology that might be applied. If such a WTO case was initiated, the baselines and values used might differ from those used in this analysis

either rejection or customs clearance. The costs of testing and for delays to ships added to the cost of the products when/if they eventually completed customs clearance (see c) below).

During the period following the introduction of the GMO regulation in late September 2009 the import price of a number of commodities used by the Turkish food and feed sectors increased substantially (eg, the soymeal price increased from about $525/tonne in October 2009 to $700/tonne in November and December 2009, before falling back to $540/tonne in January 2010). Some importers and users who had exhausted stocks and contracted for new orders once the ban was lifted had to pay the substantially higher market prices prevailing in the November-December 2009 period. Whilst it is not possible to fully identify the extent to which Turkish importers, traders and users were faced with this significant increase in the costs of raw materials, the industry survey identified a significant number who were adversely affected. If it is assumed that the equivalent of two months of import volumes of soybeans, soymeal, corn gluten feed and distillers grain were affected (about 180,000 tonnes of raw materials), the additional cost burden was about $48 million (Table 23).

Table 23: Short term cost price increase effects late 2009

Commodity affected	Volume affected ('000 tonnes)	Effective price increase average Nov-Dec 2009: $/tonne	Additional cost burden ($ million)
Soybeans	162.2	190 (both months)	30.83
Soymeal	58.6	175 (both months)	10.26
Corn gluten feed	63.0	32 (Nov), 70 (Dec)	3.21
DDGS	74.8	30 (Nov), 70 (Dec)	3.74
Total	**358.6**		**48.04**

Notes:

1. Only commodities with significant increases in prices during this period have been included
2. Volume affected based on one sixth of the total 2009 import volumes for each commodity

b) Stock holding costs

The introduction of the first GMO regulations in October 2009, their subsequent legal challenges and amendments through 2010 and the introduction of the Biosafety Law in late September 2010 have all contributed to both legal and market uncertainty for the Turkish agri-food, feed and livestock production sectors. This was a particular problem in late 2009 and throughout 2010 before the Biosafety Law was implemented towards the end of the year. One important impact of this uncertainty has been increased risk of not being able to obtain and access raw materials for a period and, as a result, has led to a general increase in the level of raw material stocks being held. This has been a feature of the soybeans and derivative markets, where since late 2009, about $280 million worth of capital has been tied up in soybean and soymeal stock holding, with a further $197 million tied up during 2011/12. At an assumed rate of interest of 10%[25] this suggests that the cost of this stock holding has been about $28 million, with a further cost in 2011/12 of $19.7 million (Table 24).

[25] The rate of interest payable varies by bank, company and length of loan/borrowing. Industry sources suggest that the interest rate for borrowed capital in US dollars is typically between 5.75% and 7.25%, whilst borrowing in Turkish lira is typically in a range of 12.5% to 14.3%. For the purposes of this analysis we have used 10% which is the average of the two ranges

Table 24: Stock holding changes 2008/09-2011/12 and associated costs

	2009/10	2010/11	2011/12
Soybeans			
Opening stocks ('000 tonnes)	136	409	329
Opening stocks as % of usage	10%	27%	21% on forecast usage
Estimated increase in stock holding due to GMO regulations ('000 tonnes)	223	220	177
Soymeal			
Opening stocks ('000 tonnes)	26	115	217
Opening stocks as % of usage	4%	14%	24%
Estimated increase in stock holding due to GMO regulations ('000 tonnes)	66.66	124	172
Soy oil			
Opening stocks ('000 tonnes)	12	18	30 (end 2011)
Opening stocks as % of usage	14%	20%	33%
Estimated increase in stock holding due to GMO regulations ('000 tonnes)	0	6	18
Short term capital requirement for additional stock holding (million $)	**98.34 (soybeans) 28.86 (soymeal) 0 (soy oil)**	**93.06 (soybeans) 51.34 (soymeal) 8.0 (soy oil)**	**93.99 (soybeans) 77.74 (soymeal) 25.1 (soy oil)**
Interest on capital requirement (million $)	**9.83 (soybeans) 2.89 (soymeal) 0 (soy oil)**	**9.31 (soybeans) 5.13 (soymeal) 0.8 (soy oil)**	**9.40 (soybeans) 7.77 (soymeal) 2.51 (soy oil)**

Notes:

1. Assumed level of stock holding under normal market conditions (ie, no significant impact of GMO regulations) is 10% for soybeans, 5% for soymeal and 14% for soy oil
2. Increase in stock holding volumes calculation example: soybeans 2010/11 average stock holding through year 369,000 tonnes less 10% normal stock holding cost of 149,000 tonnes = 220,000 tonnes
3. Cost of soybeans based on average import values: soybeans 2009/10 $441/tonne, 2010/11 $423/tonne, 2011/12 $531/tonne; soymeal 2009/10 $433/tonne, 2010/11 $414/tonne, 2011/12 $452/tonne, soy oil 2010/11 $1,327/tonne, 2011/12 $1,397/tonne
4. Interest on capital charges vary by business depending on factors such as cash flow, reserves, retained profits and terms and conditions of loans obtained from financial institutions. An assumed rate of 10% has been used

c) Costs for testing and shipment delays

In a) above, the issue of testing of supplies entering the country for the presence of unapproved GMOs and the associated delays before shipments can be unloaded, cleared customs and transhipped to their end user was highlighted. Two main costs are associated with this:

- *Testing costs*. Unless a test is conducted as part of an official control after customs clearance, the cost of conducting tests to provide 'proof' that unapproved GMOs are not being imported into Turkey falls on the importer. A cost for an initial, simple 'GMO presence' test is about $300/test and the cost of a more detailed, specific event level test is typically about $1,480/test. The initial test tends to apply to all import loads from container levels through various size of vessels (eg, 1,000 tonnes, 10,000 tonnes), with the more detailed test applied if the first level test shows a positive result. Such tests have been applicable to all import loads of soybeans and derivatives, corn and derivatives and to rapeseed and derivatives. Estimating the total cost burden associated with this testing is difficult because of the numerous variables of influence (eg, size of load or vessel, number of positive simple tests requiring a more detailed test[26]). However, our estimates suggest that in 2010 and 2011 (based on import volumes during 2010 and 11 months of 2011), the total testing costs incurred are within a range of $0.7 million to $5.8 million (see Appendix 1 for additional information);
- *Delay costs*. All ships that cannot unload because of delays due to testing and/or delays in customs clearance of imports incur demurrage charges. The industry survey identified that the length of delays applicable to imports of products that require GMO testing have increased from an average of 2 days before the introduction of the first GMO regulation (when few shipments were subject to testing and usually only to satisfy contractual requirements) to an average of 10 days[27]. This increase in delays highlights an inadequacy in the infrastructure for conducting GMO testing in Turkey. The typical demurrage charge applied to ships waiting to unload at Turkish ports has been about $0.75/tonne-[28]. Applying this charge to an average delay of 10 days and to the tonnages of relevant commodities imported in 2010 and 2011 (11 months) suggests that delay costs of nearly $47 million have been incurred by the Turkish importing and user sectors over this period.

d) Impact of GMO regulations on costs of using domestic corn

Although imports of corn have accounted for less than 10% of total annual supplies, the availability of imports has significantly influenced domestic corn prices in Turkey. Prior to the introduction of the first GMO regulations in late 2009, domestic corn prices tended to track import prices[29] closely trading at about a $7/tonne-$10/tonne premia. Following the introduction of the GMO regulations, imports of corn have been significantly disrupted because of difficulties in obtaining certified non-GM corn supplies that do not contain even trace levels of unapproved

[26] The industry survey suggests about 40% of consignments subject to the initial test require a more detailed and expensive second event test. Some of these 'second round' are, however, reported to be based on 'false positive' tests from the first level tests, reflecting inadequate levels of testing expertise and equipment

[27] Increasing to 15 days plus on some occasions (eg, following the introduction of the Biosafety Law in late of 2010)

[28] This varies by ship size

[29] Cif import prices (ie, before imposition of a 30% duty)

GMOs. The net effect of this supply disruption has been to place increasing demand pressure on domestic supplies of corn. As a result the domestic price of corn has increased significantly relative to import values in 2009/10 and 2011/12. Thus the average price premia of domestic corn over imported corn was $72/tonne in 2010 and $48/tonne in 2011. On the basis that these additional premia have been directly driven by the supply difficulties caused by the GMO regulations, the additional cost incurred by the Turkish agri food, feed and livestock production sectors from using domestic corn in the period since October 2009 (10 months of the 2009/10 marketing year, all of 2010/11 and five months of 2011/12) is about $417 million (see appendix 1 for details). This additional cost has resulted in higher costs of production for all corn products used in both the food and feed sector, although the domestic corn producing sector has benefited from these higher prices (ie, there has been a transfer from the downstream(post farm gate) part of the supply chain to the production sector).

3.2.3 Food sector impacts

Since their introduction in late 2009, the GMO regulations have banned the use of any commodity or derivative derived from a GMO crop in food usage. This has had a significant impact on the use of soybean and corn derivative use in the Turkish food sector. More specifically:

a) *Soybean oil* use in the food sector has been largely eliminated and replaced with alternative oils, of which the main alternative used has been sunflower oil[30]. Based on soy oil consumption levels in 2008, prior to the introduction of the GMO regulations, the annual volume affected has been about 80,000 tonnes per year. Comparing the cost of sunflower oil with the cost of soybean oil, this change in use has resulted in a net increase in costs to the Turkish food using sector of $33.4 million in 2009/10 and $40.3 million in 2010/11[31].

b) *Corn oil.* Like soybean oil, corn oil use has decreased since 2009 as food manufacturers have sought to avoid the use of GMO-derived corn oil and chosen a policy of switching to alternative oils (mainly sunflower and/or rapeseed and cotton seed oils) rather than source certified conventional corn oil. In addition, some consumers have moved away from the use of corn oil *per se* (the industry survey suggests that this decline is due to adverse and negative reporting in the media coupled with anti GMO campaigning by activist groups). Nevertheless, a corn oil food use market still exists because much of the corn oil used has been certified as from conventional (non-GM) sources of supply. This latter course of action has been possible because the availability of (certified) non-GM corn is greater than the availability of certified non-GM soybean oil (mostly from domestic supplies and/or from nearby non-GM corn growing countries such as Russia, Ukraine, Hungary and Serbia). The requirement for supplies to have zero presence of

[30] The use of alternative oils rather than replacement of GM derived soy oil with certified conventional soy oil has been the preferred and chosen approach taken by the food sector largely because of increasing difficulties in obtaining supplies of certified non-GM soy oil

[31] On the basis of price differences in the first 5 months of the 2011/12 year (when average prices for sunflower oil were cheaper than soy oil) suggests that if this price differential continues throughout 2011/12, there would be a net saving of $4 million to the food sector, offsetting by a small amount the additional costs incurred in 2009/10 and 2010/11 (across the 3 years the net loss/increase in costs would be $69.7 million)

unapproved GMOs (unapproved in Turkey) has, however, caused additional problems for a number of importers and users sourcing products from some markets (eg, EU countries) where non-GM guarantees are typically only offered to the EU labelling threshold of 0.9% for approved GMOs in the EU (where a greater number of GMO corn events are approved than in Turkey and all approvals are for both food and feed use). The economic costs associated with these changes since late 2009 have been nearly $40 million for the replacement of corn oil with alternatives plus $3.5 million paid in the form of higher prices to obtain certified non-GM corn oil (Table 25 and Table 26).

Table 25: Economic impact of replacing corn oil with sunflower oil 2009-2011

	Corn oil consumption ('000 tonnes)	Market loss (relative to baseline)	Change in cost: $ million: (+ = additional cost, - = lower cost)
Baseline (2008: before GMO regulations)	117	Not applicable	Not applicable
2009	102	15	+8.86
2010	80	37	+33.86
2011	50	67	-3.15
Total impact 2009-2011		**119**	**+39.57**

Sources: Turkish Statistical Institute, Oil World, USDA

Notes:

1. 2011 corn oil consumption: estimated based on 2010
2. Corn oil prices based on cif import values: 2009 $856/tonne, 2010 $917/tonne, 2011 $1,394/tonne
3. Sunflower oil prices based on cif import values: 2009 $1,447/tonne, 2010 $1,832/tonne, $1,347/tonne

Table 26: Cost premia for certified non-GM corn oil 2009-2011

	Market ('000 tonnes)	Cost premia for certification of non-GM status ($ million)
2009	102	1.53
2010	80	1.20
2011	50	0.75
Total		**3.48**

Sources: derived from Turkish Statistical Institute, USDA, Oil World and industry survey

Notes:

1. Market for food uses has common requirement of certification of non-GM status to 0.1% maximum threshold for the adventitious presence of GMOs (ie, the reliable limit of detection)
2. Non-GM cost premia: $15/tonne (source: industry survey)

c) Soy derivatives

The use of soybean protein and oil derivatives (notably lecithin, but also protein isolates and soy flour) in the Turkish food sector is, and has been, a small, specialist ingredient market (eg, total lecithin use is between 4,500 tonnes and 5,000 tonnes). Changes that have occurred in this market in recent years have followed a similar path to that referred to above for soybean oil and corn oil. The main suppliers and users of these products and/or food products containing such ingredients have largely adopted a GM ingredient avoidance policy which has focused on:

- The sourcing of certified non-GM soy sources of supply. Adopting a policy of using only certified non-GM supplies has, however, been complicated by the non approval of the

three main soybean GMO events used in most global supplies for food use. A primary source of certified non-GM soy derivatives has been countries in the EU which, for example, in 2008 and 2009 accounted for about 40% of total Turkish lecithin imports. However, suppliers of such products have only been prepared to certify supplies as having less than 0.9% GMO content and therefore some import consignments of these products have not been allowed entry into Turkey because of trace levels of GMOs. Attempts to overcome this risk have resulted in increased imports from non-GM soybean producing countries such as India and China (eg, imports of lecithin from the EU fell from about 40% of total imports in 2008 to 18% in 2011, whilst imports from India increased from 8% to 63% of total imports over the same period). Supplies from India and China are still subject to testing on arrival (incurring the testing and delay charges referred to above) and are widely considered to have lower average quality levels than other sources of supply. Some consignments have also had problems with, and been rejected for, too high presence levels of contaminants such as pesticide residues and heavy metals. Overall, certified non-GM soy probably accounts for 90%-95% of total supplies of lecithin used. This has resulted in significant increases to the prices paid for these products. For example, the price premia for certified non-GM soy protein derivative and soy flour tends to be 20%-30% higher than derivatives that may contain GMOs and certified non-GM soy lecithin prices typically trade at approximately double the price of lecithin that may contain GMOs;

- A switch to a different raw material in which GM technology is not used; in the case of lecithin this has involved switching from soy lecithin to sunflower lecithin as an ingredient in confectionery products. This approach has accounted for a small part of the market and probably accounts for only 5%-10% of total lecithin use, with the main sources of supply being the EU and Ukraine. Sunflower lecithin has, however, been a more expensive option than using certified non-GM soy lecithin.

Overall, the requirement to use certified non GM sources of supply and/or switching to alternatives like sunflower lecithin has added cost to the Turkish food manufacturing sector. For example the average import price for lecithin rose by over 50% between 2008 and 2010, compared to a 10% increase in the average soy oil import price over the same period. In total, over the last three years, the switch to using alternative sources of ingredients that are certified non-GM has probably added between $13.2 million and $14.6 million to the costs of production for the food products using these ingredients.

d) Corn use: food sector (starch and sweeteners)

Turkey annually uses about 1.1 million tonnes of corn for food uses (via starch and sweetener/derivative manufacture). This level of use is broadly similar to 2008/09. Whilst the GMO regulations have not materially affected the volume of corn used in this sector, the regulations have affected the cost of the raw material used. As in the corn oil market, the sector has sought to avoid disruption to raw material supplies by requiring all supplies to be certified as non-GM. This has resulted in a shift in the origin of raw materials used away from imports from largely GMO growing countries such as the USA and Argentina to domestic supplies and non-GM growing countries. Sourcing from countries where GMO corn is not grown has, however, not been without problems (eg, Hungary) because suppliers are often only prepared to guarantee supplies are free of GMOs that are unapproved in the EU. Therefore these supplies could contain up to 0.9% content of GMO corn events approved in the EU, some of which remain unapproved

in Turkey and all of which do not have approval for food use in Turkey. The effect of this on corn shipments entering Turkey has been:

- Some rejected if they contain any GMOs and were destined for use in the food sector;
- Some rejected for feed use if they contain traces of (up to 0.9% presence) GMO corn events not approved in Turkey;
- Some diverted to feed use if they contain traces of GMO corn events approved for feed use in Turkey.

Requiring all supplies of corn destined for food use to be certified as non-GM has also resulted in a price premia relative to supplies without such certification being paid. The industry survey suggests this has consistently been about $15/tonne since late 2009 and therefore the annual cost of this has been about $16.5 million. Applicable to two last two marketing years (2009/10 and 2010/11), the total cost to date has therefore been about $33 million.

Lastly, the difficulties in accessing corn imports referred to above have contributed to increases in the prices paid for the domestic (main alternative) source of corn *per se* (not just because of any non-GM price premia: see section 3.2.2).

e) Pet food

The pet food[32] (cat and dog) market in Turkey is an expanding market that is mainly serviced by imports (especially retail packs). In 2011, about 22,000 tonnes of imports, worth $35 million (at the import level) entered Turkey. Before the introduction of the GMO regulations, GMO producing countries, of which the USA was a primary source of supply, were an import source of supply accounting for about a third of total imports. However, by 2011, this share of Turkish imports had fallen to 3% mainly because of the widespread use of corn derivative ingredients (notably corn gluten feed) which contain GMOs unapproved for food or feed use in Turkey. Supplies from GMO producing countries have largely been replaced by supplies from the EU. This has resulted in an increase of about 15% in the average cost of imported pet foods (+$200/tonne), adding about $8.5 million to the cost of imported pet food during 2010 and 2011.

3.2.4 Feed and livestock production sector impacts

These sectors have been significantly impacted by the introduction of GMO regulations in Turkey. Access to important feed ingredients has been subject to significant disruption and levels of uncertainty and risk associated with ensuring regular supplies of competitively priced raw materials have increased. Some of the primary impacts have been as follows:

- *Replacement of soy derivatives in feed*. Whilst GMO feed use approvals for the main soybean GMO events widely used in global supplies of soybeans and their derivatives were given by the Turkish authorities in 2010[33], facilitating the importation and use of these feed raw materials, there was disruption to these supplies in the autumn of 2009 (an effective ban on imports for October and November 2009). As soy derivatives, which are mostly used in the poultry and egg producing sectors, are considered to be key ingredients, any breakdown in supplies causes significant disruption to poultry and egg

[32] Formulated

[33] On an interim basis in 2010 and formally after the Biosafety Law in January 2011

production. Our industry survey identified that as a result of the difficulties in accessing soybean and derivative feed raw materials in the period immediately following the introduction of the GMO regulations in October 2009, the poultry and egg sectors had to firstly draw on existing stocks of raw materials and then, as a last resort, switch to alternative ingredients. The volume of production affected at that time was approximately equal to about 3 months production of poultry meat and eggs. The main alternative feed ingredients used were sunflower meal and wheat bran (plus enzymes). Due to the crucial importance of soy derivatives to productivity and performance in the poultry and egg sectors, this switch to alternative ingredients resulted in poorer feed conversion rates (ie, lower efficiency and higher costs from slower rates of growth) and a need to increase the amount of feed used in order to deliver the same performance as a soy ingredient based feed. In addition, poultry flocks experienced higher incidence of diarrhoea and bird mortality, which resulted in production losses and poorer meat quality equal to a loss of production of about 2%. Therefore the switch in feed ingredients during late 2009/early 2010 cost the Turkish poultry and egg sectors approximately $103 million in terms of additional feed required and loss of production (Table 27).

Table 27: Poultry and egg sector losses late 2009/early 2010 caused by GMO regulations

	Broilers	**Egg laying**
Affected volume of feed (tonnes)	898,400	205,225
Additional feed required (tonnes)	89,840	24,627
Total additional cost of feed ('000 $)	53,544	10,910
Production losses: volume	625,000 tonnes broiler meat	2.96 million eggs
Production losses ('000 $)	33,333	5,328
Total losses/additional costs	**86,877**	**16,238**

Notes:

1. Affected production based on 3 months of total production for 2010
2. Additional feed requirement 10% broilers, 12% layers
3. Feed prices: $596/tonne broiler, $443/tonne egg layer. Broiler price $2,665/tonne, egg price $90/1,000 eggs
4. Production losses due to higher rates of diarrhoea and mortality 2%

- *Replacement of corn in feed.* As indicated earlier, access to imported corn that may contain or be derived from GMO sources of supply has been subject to disruption since October 2009. This disruption has limited the availability of imported corn from leading corn exporting countries (notably the US and Argentina). This has necessitated obtaining alternative sources of supply where GMO corn events are not used such as Hungary, Russia, Serbia, Ukraine and the domestic sector. Where additional supplies have been taken from the domestic sector this has resulted in having to pay higher prices (see section 3.2.2) or switching to alternative raw materials. This course of action has mainly affected the poultry and egg sectors where corn has traditionally been incorporated at rates of between 50% and 60% in feeds (the primary energy source). When faced with limited supplies and relatively high prices for corn, some producers have reduced corn incorporation rates to between 30% and 45% and replaced this corn with feed wheat;

- *Replacement of corn derivatives in feed*. As with corn (above), access to imported corn gluten feed and DDGS that may contain or be derived from GMO sources of supply (notably the USA) has been subject to disruption since October 2009. The main sectors affected have been dairy and cattle production where typical incorporation rates for DDGS have been about 40% and 20% respectively. Also in the egg laying sector corn gluten feed is typically used at a 5% incorporation rate. The main course of action taken by these sectors has been to switch to alternative feed ingredients, mostly barley, sunflower meal and soybean meal in the early part of 2010. This resulted in net increases in the average cost of dairy feed, of between 10% and 20%, and by about 5% for cattle feed. The main alternative to this strategy of switching raw material types is to find non-GM sources of supply of DDGS and corn gluten feed. Such sources of supply have, however, been more expensive than the supplies that contain GMOs, making the 'switch of ingredients' option (to mainly barley and sunflower meal), the more cost effective choice in 2011.

3.3 Looking forward: the next 3-4 years

In section 3.2, the estimate of the cost burden associated with the GMO regulations incurred by the Turkish agri-food since late 2009 was over $0.8 billion, with an additional $477 million of capital tied up in 'contingency stock holding'[34].

Looking forward, many of these costs are likely to continue. Assuming no change to the number of GMO events being used in global agriculture, no change to the number of GMO events receiving approval for feed use in Turkey, continuation of no approvals for food use of any GMO in Turkey and based on 2011 prices of cereals and oilseeds, the on-going annual cost is between $0.4 billion and $0.46 billion (Table 28[35]).

However, the nature and availability of oilseeds and cereals, their prices and the adoption of new GMO events in global agriculture are subject to change. This means that the above estimate of annual costs is likely to change. The key factor affecting this will be the availability of new GMO events, their adoption in global agriculture, and the extent to which Turkey grants approval for their use or not. In 2011, Turkey had only approved feed use for 3 soybean events and 13 corn events (less than 30% of the total number of GMOs events (including stacks) in global agriculture).

[34] Additional stock holding above what would reasonably be expected under a science-based, efficiently functioning GMO regulatory system

[35] With an additional $197 million tied up in 'contingency stock holding'

Table 28: On going annual costs of GMO regulations ($ million)

Cost type	$ million
Replacement of soy oil in food uses	0-40
Replacement of corn oil	0.4 to 14.6
Certified non-GM premia for corn in food use	16.5
Capital tied up in additional stock holding	196.8
Interest charged/foregone on stock holding	19.7
GMO testing	0.7 to 5.8
Demurrage charges	18.3
Replacement of soy protein derivatives and lecithin	4.7 to 6.6
Higher cost of using domestic corn	144
Higher cost of pet food ingredients	4.4
Total	**405.5 to 466.7**

Notes:

1. Soy oil replacement costs relative to sunflower oil costs which have varied considerably in the last 3 years. Lower end of range based on 2011 differentials (ie, zero) with the higher end of the range based on the 2010 prices
2. Corn oil replacement based on sunflower oil. Lower end of range based on 2011 prices when sunflower was cheaper than corn oil. Higher end of range based on average differential over the last 3 years
3. Additional stock holding for soybeans and derivatives based on 2011/12 opening stocks relative to 2008/09 levels
4. Interest rate charged – assumed to be 10%
5. Other costs based on estimates of costs incurred in 2011

In the next 5 years, it is likely that about 30 new GMO events will be commercialised in some of the leading cereal and oilseed producing and exporting countries of the world (Table 29). When the likelihood of some of these GMO events being stacked with each other and/or with existing GMO events is taken into consideration, the additional number of GMOs that would need to be assessed for importation and use in Turkey (where stacked events are treated as different to single GMOs for approval purposes) could be as high as 80. Whilst an estimate of 80 new GMO events requiring assessment for approval represents the high end of a possible range, it highlights the likely widening shortfall between approvals in Turkey relative to the number of GMO events being used worldwide.

Table 29: GMO events likely to be commercialised in the next 5 years

Crop	Current	To be expected in the next 5 years (including some with approval and some seeking approval for planting)
Soybeans	3 (0)	11 (30)
Corn	11 (30)	7 (20)
Others (cotton, sugar beet, canola, alfalfa)	14 (26)	14 (30)
Total	**28 (56)**	**32 (80)**

Source: estimated by PG Economics

Notes: Bracketed figures denote stacked events (current) or possible stacked events (next 5 years). The number of possible future stacked combinations is illustrative and based on past trends. It does not reflect the level of current applications for approval of stacked events around the world

Faced with a high probability of a widening gap between the numbers of GMO events being used in global agriculture relative to approvals in Turkey, it is likely that the levels of disruption to trade in cereals, oilseeds and their derivatives entering Turkey will increase. Additional periods of disruption and breaks in the supply of raw materials are to be expected. These have the potential to be more frequent and longer lasting than the ones so far experienced. The associated short term costs referred to in section 3.2 can reasonably be expected to be repeated and could well be greater than so far experienced. Examples include:

- The additional feed costs and loss of production in the poultry and egg producing sector experienced in late 2009/early 2010 affected about 3 months output at a cost of $103 million. With a significant number of new soybean GMO events scheduled for adoption in the leading soybean producing countries in the next 5 years, additional disruption to supplies can be expected. On the basis of the costs incurred during the short term disruption to supplies in late 2009/early 2010, when 3 months output was affected, an extension of such costs to a year would increase the cost to over $400 million;
- The short term costs incurred in late 2009 (significant price increases for soybeans and soymeal which equated to $48 million), as a result of GMO regulation related supply disruption may become a more regular occurrence;
- More GMO events being used globally increases the number of potential tests to be undertaken and the length of associated delays. It is therefore reasonable to assume that testing costs and demurrage charges can be expected to increase;
- Increased rather than decreased levels of stock holding to minimise risks of disruption to supplies of raw materials (tying up greater amounts of capital, with a higher associated cost).

The prospect of an ever increasing proportion of world production of key cereal and oilseed commodities using GMOs also means that the price differential between GM derived and conventional (non-GM) supplies is likely to widen further. The differential reflects two main components:

- Firstly, GMO crops tend to be cheaper to produce (because of higher productivity and often lower costs of production) than conventional production methods. Due to the income benefits derived by farmers using GMO technology compared to conventional technology, farmers in countries that allow the planting of GMO crops are increasingly switching away from conventional crops in favour of GM technology. Therefore if customers wish to continue to buy non-GM products, these farmers have to be offered a price incentive (premia) that at least offsets the benefits that GM technology delivers and would otherwise have to be foregone by growing conventional crops;
- Secondly, the cost involved in initiating identity preservation or segregation systems. These systems tend to become more costly as the proportion of non-GM production relative to GM production falls. The cost of supplying certified non-GM is also affected by the maximum permitted adventitious presence level of GMO material. If this is set at a very low level (eg, 0.1%), the cost tends to be much higher than if the level is set at 0.9%.

Lastly, with an increasing array of GMO events being available in global supplies of cereals and oilseeds, most of which are likely to be classified as unapproved in Turkey[36], an increasing risk may occur of unapproved GMOs being found further down the agri-food chain, especially in manufactured products. Should this category of problem arise, the level of market disruption and cost involved would increase substantially because manufactured products may have to be withdrawn from markets. All users of cereals and oilseeds (and their derivatives) in the food (and feed) sector(s) will be faced with increased risk of low level presence of unapproved GMOs being found in supplies of raw materials. Whilst the cost of dealing with a single incident of not approved GMO low level presence will vary by sector and company, estimates that draw on analysis in the EU offer some indication of potential costs[37]. This work drew on the experience of the EU rice sector which has been faced with actual incidence of low level presence of unapproved GMOs being found in supplies from 2006. It ascertained that a first positive test for low level presence of a not yet EU approved GMO in supplies triggers systematic testing of all import shipments and additional positive tests can be expected. As such, a wider range of businesses are affected resulting in additional costs. Replicating such impacts to a large commodity and derivative using sector, such as soybeans, identified a total cost estimate of dealing with several likely incidents of not yet approved GMO low level presence being found in the soybean and derivative user sector of between $1.47 billion and $4.1 billion[38]. Whilst this analysis was not made in respect of the Turkish agri-food sector, the similarities between the EU and Turkey in terms of how cereal and oilseed supply chains operate suggests that these costs reflect what could occur in Turkey in the coming years.

Overall, the analysis suggests that in the future, the on-going costs associated with the operation of the Turkish GMO regulations and incurred by the Turkish agri-food sector, can be expected to increase. Table 30 provides estimates of the possible annual on-going costs based on a number of scenarios. This shows a range of between $0.4 billion and nearly $1.6 billion, with an annual cost of between $0.7 billion and $1 billion having a reasonable probability of arising.

[36] Based on the current nature and speed of approvals made

[37] See Brookes G (2008) Economic impacts of low level presence of not yet approved GMOs in the EU food sector, report for the Federation of European Rice Millers and CIAA

[38] Based on two to three 40,000 tonne shipments being affected from which derivatives were supplied and used by all of the six soy using sub-sectors in the food industry

Table 30: On-going annual cost of GMO regulations for the Turkish agri-food sector: possible scenarios

$ million	Scenario 1 (unlikely): annual costs based on current basis: assuming no change	Scenario 2 (probable)	Scenario 3 (possible)	Scenario 4 (worst case)
Cost type				
Replacement of soy oil in food uses	0-40	0	33	40
Replacement of corn oil	0.4 to 14.6	0	9	34
Premia for certified non-GM corn for food uses	16.5	22.0	27.5	33.0
Capital tied up in additional stock holding	196.8	288.3	379.4	525.8
Interest charged/foregone on stock holding	19.7	28.8	37.9	52.6
GMO testing	0.7 to 5.8	0.75 to 6.9	0.81 to 8.1	0.87 to 9.2
Demurrage charges	18.3	28.0	37.3	46.6
Replacement of soy protein derivatives and lecithin	4.7-6.6	4.7	5.65	6.6
Higher cost of using domestic corn	144	180	230.4	270
Higher price for pet food ingredients	4.4	6.1	7.6	9.2
Price increases for soybeans/soymeal if supply disrupted (as per late 2009)	0	48	96	144
Inability to access soybeans and derivatives in the poultry and egg sectors: additional feed costs and production losses	0	103	206	412
Total	**405.5 to 466.7**	**709.65 to 715.80**	**1,070.56 to 1,077.85**	**1,574.67 to 1,583.0**

Notes:

1. Soy oil replacement costs based on average price differential of sunflower and soy oil 2011, 2010 and 2009 respectively (ie, 2009 is worst case scenario)
2. Corn oil replacement costs based on average price differential of sunflower and corn oil 2011, 2010 and 2009 respectively (ie, 2009 is worst case scenario)
3. Stock holding costs for soybeans and derivatives: assumes stock holding as % of total domestic use ranges from 2011 levels rising to one third, 40% and 50%
4. GMO testing scenarios: 50%, 60% and 70% of first round tests show positive necessitating a second round test (baseline is 40%)
5. Demurrage charge assumption scenarios: delays increase to 15 days, 20 days and 25 days (baseline is 10)
6. Replacement of soy derivatives based on range for current costs incurred over the last 3 years together with the average within this range
7. Higher cost of domestic corn scenarios: based on 2011-12 usage with scenarios assuming GMO regulation influence on price differential between domestic corn and import corn values rising from baseline of $40/tonne to $50/tonne, $64/tonne (reflecting actual 2010 levels) and $75/tonne
8. Higher cost of pet food scenarios: baseline based on 2011 import volumes and higher cost of $200/tonne (a 14% increase relative to costs from GMO producing countries). Scenario assumptions increase the price differential between GMO and non-GM sources to 20%, 25% and 30%
9. Price increases for soybeans and soymeal scenarios based on 2, 4 and 6 months supply respectively affected (2009 price increases assumed)
10. Inability to access soybeans and derivatives in the poultry and egg sectors scenarios respectively based on 3, 6 and 12 months production affected
11. Knock on effects in manufactured products using soy and corn derivatives, requiring withdrawal of products from markets based on range and mid point of this range identified in EU study from 2008 (Brookes (2008))

3.4 Competitiveness issues for the Turkish agri-food sector

A key element of remaining competitive is having access to raw materials that meet product specifications and quality requirements, at the lowest possible cost. This is especially important in user sectors for which different crop and derivative raw materials have a degree of inter changeability or can be substituted for one another:

- *The animal feed sector*: provided raw materials deliver specific quality requirements (eg, protein levels), the mix of feed ingredients used is determined by least cost formulation techniques. This means that many feed ingredients are considered as substitutes for one another and the key to which crops/derivatives are used is determined by their price;
- *The livestock production sector*: most producers in this sector operate on fairly low margins per tonne of output and feed accounts for a significant proportion of total costs of production (especially in the poultry and egg sectors where feed can account for over 70% of variable production costs). Cost of production is therefore key to survival in this sector;
- *Non food uses*: cost of raw materials is the single, most important factor influencing competitiveness with fossil fuels;
- *Food uses:* although this sector offers greater scope for the production of value added (often branded) products, with relatively high margins, and in which raw material costs are relatively less important in terms of total costs than the sectors referred to above, access to competitively priced raw materials remains important.

The importance of access to competitively priced raw materials influences which sources of supply are used and may impact on the location of processing facilities. Hence, countries with the lowest cost bases for the production of key crops and with reputations for providing a stable environment for accessing raw materials tend to be most competitive and tend to attract, in the long run, processing facilities that utilise agricultural raw materials. Conversely, countries that have relatively higher cost of production bases, and with reputations for erratic and inconsistent access to raw materials, are less competitive in world markets. These countries lose out relatively in terms of the income and employment generation associated with the development of agricultural product processing facilities.

The total value of food and drink production in Turkey (2009) was about $125 billion. The value of this at the ex-factory level, inclusive of gross margin was approximately $89 billion (gross margin of about $20.5 billion[39]). On the basis of the estimated costs incurred to date (over $1 billion including stock holding costs), this is equal to nearly 5% of the total market gross margin for the entire Turkish food and drink sector. Given that the net profit element within the gross margin is, in reality, only a proportion of the total gross margin, it is evident that the additional costs incurred by the Turkish food and drink sector has been substantial. More specifically, if an average food manufacturing business was operating on a net profit level of 10%-15% of the gross margin[40], then the total cost burden so far imposed on the Turkish food and drink sector from the operation of the GMO regulations, has been equal to between 33% and 50% of the total net profitability. Given that the impact of the GMO regulations has affected a limited number of sectors within the food and drink sector (eg, animal feed, meat production, oilseeds and fats, confectionery), the additional costs will be equal to a significantly higher share of total net profitability[41] for these sectors. In addition, at the company level, the precise impact will vary according to a number of factors (eg, size of business, importance of 'affected commodities' in total business). However, this analysis does illustrate how the additional costs associated with the GMO regulations have significantly reduced profitability of many businesses during a difficult global recessionary period. It is also likely to have pushed a number of businesses into a loss making position.

Businesses making little or no profit (or those making losses) are unlikely to continue in this position indefinitely. Whilst the authors are unaware of any business casualties having yet occurred in the Turkish agri-food sector, as a direct result of the impact of the GMO regulations, no business in a loss making position will continue to trade in the long term. It is therefore possible that the negative impact on profitability arising from this legislation will have an adverse impact on income and employment generation in the Turkish agri-food sector, as some operators move out of affected sub sectors and/or cease trading rather than make losses. Those at greatest risk are probably small and medium sized businesses (that dominate the sector).

[39] This is based on a broad assumption that the retail mark up/margin is 40% and the gross margin to the manufacturing sector is 30% (gross margin is equal to gross profit after variable costs but before overheads). These margins vary by sub-sector and company but are broadly representative

[40] For products like corn, oils etc, a net profit margin of 10% is probably reasonably representative. For products that are subject to secondary processing/value adding (eg, confectionery), higher average net profit margins of up to one third of the gross margin might be achieved. Conversely net margins in the livestock product sector are typically lower than 10%

[41] It is not possible to disaggregate this analysis to sub-sectors due to a lack of data

The introduction of the GMO regulations in Turkey from late 2009 has already added in excess of $0.8 billion to the costs of production of the Turkish agri-food chain and raised the levels of risk and uncertainty amongst companies in the sector relating to access of raw materials (eg, the increase in stock holding has tied up over $280 million that could otherwise have been used for other business activities). The higher costs either have to be absorbed by businesses which results in lower levels of profitability, or it necessitates increasing the price of products to customers. The net effect is a loss of competitiveness, both in the domestic market and export markets, relative to suppliers who have greater flexibility and access to competitively priced raw materials.

In the longer term, higher costs of production, lower levels of profitability and relatively high levels of risk and uncertainty relating to access to raw materials results in lower levels of investment, value adding and employment in the Turkish agri-food processing and manufacturing sector than would otherwise have occurred if GMO regulations were based on the timely application of a science-based approval system. In addition, some agri-food processing and manufacturing businesses may decide to re-locate away from Turkey to countries/regions with a more competitive, flexible and less risky business environment.

3.5 Impact on consumers

There are two ways in which consumers may be affected by the introduction and operation of the GMO regulations; impacts on the prices paid for food products affected and impacts on the availability and quality of products. These are discussed further below.

a) Impact on prices paid

The analysis presented in section 3.2 shows that the Turkish agri-food sector has incurred significant additional costs because of the introduction and implementation of the GMO regulations. Some of these costs have been of a short term 'one off' nature (eg, the price increases in soybeans for 2 months, following the introduction of the GMO regulations in October 2009 which added $48 million to raw material costs in the soybean processing and user sectors), whilst others have been of a longer term and recurring nature (eg, testing costs, sourcing certified non-GM corn and derivatives, sourcing certified non-GM soybean derivatives for food uses and additional stock holding costs). Overall, these additional costs have amounted to over $0.8 billion since late 2009 and are likely to continue on an annual basis at between $0.7 billion and $1 billion.

When faced with these additional costs, the supply chain may absorb some or all of these cost increases, or pass on some or all of the cost increases as higher prices to customers.

Attempting to quantify the extent to which the additional costs have been passed on down the supply chain is, however, difficult because of the numerous variables that affect prices and their transmission along the supply chain. It is also beyond the terms of reference for this study to examine this in detail. Nevertheless, some assessments can be made and conclusions drawn:

- Increases in costs faced by importers, crushers and animal feed manufacturers have been passed on to customers in the livestock production and food manufacturing sectors in the

form of higher prices. For example, the average price of imported soybeans and corn increased by +15% to +20% respectively between 2009 and 2011, whilst the average price of compound feed increased by between 14% and 36% over the same period;

- The livestock production sector and food manufacturing sector indicated that they had absorbed much of the cost increases, especially short-term cost increases but have inevitably passed on some of the recurring/longer term cost increases in the form of higher prices;
- Prices of livestock products and foods containing or derived from soybean and corn derivatives are likely to be higher to consumers in 2011 than they probably would otherwise have been in the absence of the GMO regulations. It is, however, not possible to assess the extent to which this occurred.

b) Impact on availability and quality

The introduction of the GMO regulations in late 2009 has so far not had any direct 'knock on' effects to the end consumer level relating to product availability or quality. There has, however, been a reduced availability of some oils, notably corn oil, with sunflower oil being the main replacement available to consumers. The extent to which this has affected consumers is largely down to different taste and preference of consumers.

Appendix 1: Additional information

Demurrage charge estimates

Affected commodities ('000 tonnes)	2010	2011 (11 months)
Soybeans	1,756.1	1,190.7
Soy meal	408.4	504.2
Corn	452.4	332.6
Rapeseed	307.1	83.6
Rapeseed meal	35.9	99.2
Corn gluten feed	306.5	119.4
DDGS	506.0	156.8
Total tonnage	*3,772.2*	*2,486.5*
Demurrage cost/day for all affected commodities ($ million)	2.83	1.86
Total demurrage charges (4 million)	28.29	18.65

Notes:

1. Demurrage cost based on $0.75/tonne/day and average delay of 10 days

Testing charge estimates

	If all testing per 10,000 tonne boat loads	If all testing based on 1,000 tonne consignments
Total number of consignments (2010 and 2011)	564	6,259
1st round test costs ($ ' 000s)	169.1	1,877.7
2nd round test costs ($'000s)	333.7	3,705.2
Total costs ($ '000s)	**502.8**	**5,582.9**

Notes:

1. Initial test cost $300, follow up test cost $1,480
2. Number of consignments based on affected tonnages – see table above

Additional cost of using domestic corn estimates

	2009/10 (10 months)	2010/11	2011/12 (5 months)
Corn usage from domestic crop ('000 tonnes)	3,333	3,600	1,500
Assumed differential due to GMO regulations ($/tonne)	64	40	40
Additional cost incurred due to GMO regulations ($ million)	213.3	144.0	60.0

Notes:

1. For part years (2009/10 and 2011/12), domestic corn use = pro rata amount from total usage (4 million tonnes 2009/10 and estimated for 2011/12 at 3.6 million tonnes)
2. Difference between domestic corn price and average cif import price: 2008-09 average $8/tonne. 2010 $72/tonne, 2011 $48/tonne.
3. Assumed 'normal' differential (not due to GMO regulatory influence) $8/tonne

Appendix 2: Summary of chronological developments in GMO Regulations

October 26, 2009- Regulation on the Import, Processing, Export, Control and Inspection of Food and Feed Products Bearing GMOs and GMO Components introduced.

November 2, 2009 – The Ministry of Agriculture (MARA) announced that 27 commodities will be tested for GMO presence. The MOA also sent a Directive to local branches to establish GMO testing laboratories.

November 9, 2009 – Due to inadequacies in the GMO testing laboratory infrastructure the number of commodities to be tested for GMO presence was reduced to 9 by another Directive.

November 20, 2009- Five Articles of the Regulation were amended, and with a temporary Article added, those importers who had import permits before the 26th of October were allowed to import commodities that were in compliance with the EU approved GMOs (with both food and feed use approval) until March 1, 2010.

November 20, 2009- The Council of State cancelled two of the Articles related to the import of GM commodities of the Regulations, stating that it would be unlawful to issue regulations without the Biosafety Laws having been passed.

December 24, 2009- The Appeal of the Ministry of Agriculture was accepted by the Administrative State Council.

January 20, 2010- Postponement of the enforcement of some of the Articles of the Regulation until March 1, 2010 was published in the Official Gazette.

March 18, 2010- The Biosafety Law was passed in the Turkish Parliament.

March 26, 2010- The Biosafety Law was published in the Official Gazette.

April 28, 2010- The Original GMO Regulation of October 26 was changed for a 3rd time.

May 11, 2010- The Scientific Committee was established based on the Regulation of October 26 and announced its decision that a threshold level of 0.9% for the presence of GMOs should be used as the basis for labelling of GMOs (as in the EU).

August 13, 2010- The Regulation on GMOs and Products Thereof was published in the Official Gazette.

August 13, 2010- The Regulation on the Working Procedures and Principles of the Biosafety Board and Committees was published in the Official Gazette.

September 26, 2010- The Biosafety Law and its implementing regulations entered into force.

September 27, 2010- The Implementation Directive for the GMOs and products thereof was sent to the local authorities by the MARA.

January 21, 2011- The Biosafety Board's decision on the approval of 3 GM soybean events for importation for feed purposes only was published in the Official Gazette.

December 24, 2011 – The Biosafety Board's decision on the approval of 13 GM maize events for importation for feed purposes only was published in the Official Gazette.