

Treasury Report: Briefing on Genetic Modification Economic Analysis Cabinet Paper

Date:	28 March 2003	Treasury Priority:	High
Security Level:	IN-CONFIDENCE	Report No:	T2003/461

Action Sought

	Action Sought	Deadline
Minister of Finance	<p>Note the results of the economic analysis and the key themes identified from these results</p> <p>Refer copies of this report and the attached Cabinet paper to the Prime Minister, and the Ministers of Economic Development, Agriculture, Research, Science and Technology, and Maori Affairs, and the Minister for the Environment</p> <p>Sign the attached Cabinet paper, and refer the paper to the Minister for the Environment for her co-signature and submission to the Cabinet Office</p> <p>Refer this report and the attached Cabinet paper to your media staff</p>	In time for the Minister for the Environment to co-sign the Cabinet Paper and submit it to Cabinet Office by 10am, Thursday 3 April
Associate Minister of Finance (Hon Trevor Mallard)	Note	None
Associate Minister of Finance (Hon Paul Swain)	Note	None

Contact for Telephone Discussion (if required)

Name	Position	Telephone	1st Contact
			✓

Enclosure: Yes

28 March 2003

SH-10-5-3

Treasury Report: Briefing on Genetic Modification Economic Analysis Cabinet Paper

Executive Summary

This report recommends you and the Minister for the Environment submit the attached joint Cabinet paper on the results of the economic analysis of the opportunities and risks of the use of genetic modification (GM) and non-GM organisms in New Zealand. The Cabinet paper also recommends that the results of this analysis be publicly released. A copy of the executive summary of the results is attached to the Cabinet paper; the full research study is still being readied for publication, and will be presented to Ministers prior to POL.

Results of Economic Analysis

The results of the economic analysis predict a range of possible outcomes for both GM and non-GM scenarios. The results from individual uses of GM organisms range from a potential increase of 2.5% in GDP (over 10 years) in the best-case scenario, to a potential decrease of 1.3% for the worst-case scenario. In terms of the GM-free scenarios, the predicted outcomes range from a decrease in GDP of 0.1% for the likely best-case scenario to a decrease of 6.4% for the worst-case scenario. The reasons the ranges are so large is because of the uncertainties around the assumptions that are fed into the modelling. These uncertainties are unlikely to be clarified for several years, until the technology matures.

Interpretation of Results

Given the large range of potential results, we recommend that you focus on the more likely outcomes, rather than the relatively less likely outcomes that have been included to ensure all possible outcomes have been modelled. Based on the assumptions underlying each scenario, we consider that the most likely outcome of the GM-use scenarios will be a small positive movement in GDP (between 1.2% and 2.5% over 10 years), while the most likely outcome of the non-GM scenarios will be a small negative movement in GDP (between 0.1% and 3.2% over the 10 year period).

The predictions at very high or very low ends of the possible range of results are considered unlikely, as they represent "ideal" or "worst-case" sets of assumptions. For example, it is unlikely that there will be no productivity improvement from the use of GM organisms, as otherwise rational users of the technology would not adopt it. It is also considered unlikely that negative price impacts will be as high as suggested by the survey results, although, some negative price impact is possible.

Key Themes of the Analysis

The key issues that the analysis raises are:

- New Zealand does have a "clean-green" environmental image in our key export markets, and a majority of consumers surveyed in these countries indicate that this has an impact on the prices they are prepared to pay for New Zealand goods. Maintenance of this "clean-green" image is important so as to minimise the impact the release of a GM organism may have on the prices received for New Zealand exports in these markets;

- The impact of releasing a GM organism in New Zealand or not using GM organisms in production can result in both negative or positive overall economic outcomes, depending on the assumptions made;
- price impacts are one of the key determinants of the size of the movement in Gross Domestic Product (GDP). Price impacts are the size of any decrease in price of New Zealand non-GM exports as a result of a GM organism release. Officials advise that the likely price impacts are likely to be lower than those used in the modelling and therefore the results for GM organism release scenarios are more likely to be a positive rather than a negative movement in GDP;
- the size of productivity gains from GM releases are the other key determinant of the size of the movement in GDP. Government policy interventions can have a significant impact on maximising the gains from the use of GM organisms in terms of promoting biotechnology research;
- the Government's current GM regulatory framework should minimise the negative price impacts through a robust regulatory regime (including the proposed conditional release category), a case-by-case approach to applications, and encouraging successful co-existence. The Environmental Risk Management Authority (ERMA) is currently required to consider the economic impacts of an application, including likely spillover effects and price impacts;
- the productivity gains to be derived from the use of GM organisms are also a key determinant of the overall economic impact. Promoting biotechnology through the Growth and Innovation Framework will help develop domestic research into possible innovations. The results indicate that the bigger gains from GM organisms come from domestic development of technology rather than imported technology;
- the potential negative price impacts were lowest where the proposed GM organism release was for medical purposes. The potential negative price impact increased as the proposed release got closer to the human food chain;
- the best producer returns are generated where there is successful co-existence between GM and non-GM production methods;
- a conservative estimate of the cumulative impact on GDP of several GM releases is a gain of at least 1% in GDP, but this may well be higher; and
- given that officials consider that international price premiums for non-GM goods are likely to reduce over time, the GM-free scenarios are more likely to be negative for GDP.

Recommended Action

We recommend that you:

- a **note** the results of the economic analysis and the key themes identified from these results;
- b **refer** copies of this report and the attached Cabinet paper to the Prime Minister, and the Ministers of Economic Development, Agriculture, Research, Science and Technology, and Māori Affairs, and the Minister for the Environment for their information;

- c **sign** the attached Cabinet paper, and refer the paper to the Minister for the Environment for her co-signature and submission to the Cabinet Office; and
- d **refer** this report and the attached Cabinet paper to your media staff.

Prime Minister
Minister of Economic Development
Minister of Agriculture
Minister of Research, Science and Technology
Minister of Maori Affairs
Minister for the Environment
Media Staff

Referred: Yes/No

Hon Dr Michael Cullen
Minister of Finance

Treasury Report: Briefing on Genetic Modification Economic Analysis Cabinet Paper

Purpose of Report

1. This report seeks your approval to submit the attached joint Cabinet paper, with the Minister for the Environment, on the results of the economic analysis of the opportunities and risks of the use of genetic modification (GM) and non-GM technologies in New Zealand. The Cabinet paper also recommends that the results of this analysis be publicly released. A copy of the executive summary of the results is attached to the Cabinet paper; the full research study is still being readied for publication and will be presented to Ministers prior to POL.
2. Treasury has previously reported to you with an outline of the results of the economic analysis [T2003/395 refers]. The results have changed slightly since that report, due to refinements of the assumptions used, and some further sensitivity analysis of the results.

Analysis

3. As part of its November 2001 response to the report of the Royal Commission on Genetic Modification, the Cabinet directed officials to report back on an economic analysis of the risks and opportunities that may arise from GM and non-GM technologies [CAB Min (01) 33/22 refers]. The analysis methodology is outlined in Annex One to this report.

Results of Economic Analysis

4. The results of the economic analysis are presented in the attached draft Cabinet paper. Given the wide range of possible results, it is more useful to focus on those outcomes that officials consider relatively more likely. A summary of the results is presented below, along with an indication of what officials consider the likely outcomes to be, based on the most realistic underlying assumptions. More detailed analysis of the individual scenario results is presented in Annex Two of this report.

GM release scenarios

5. For GM organism release scenarios, the predicted implications for “realistic scenarios” range from a possible increase in GDP of 2.5% to a possible decrease in GDP of 1.2%, depending on the type of release being modelled, the assumptions about productivity increase, and negative price impact on non-GM exports. The most positive results for GDP occur where both the productivity increases are largest and the negative price impacts are smallest. Conversely, the most negative results occur where productivity enhancements are zero and negative price impacts are largest.
6. The data underlying the modelling results show that the largest increase in producer returns occurs when there is cautious and regulated adoption of GM technology, with a maintenance of successful co-existence. That means producers can gain from selling low-priced GM-based products, and also gain from selling identified non-GM produce at a small price premium.

7. Treasury considers the most realistic GMO release scenario to be where, over time, more than one GM-based innovation would be used in New Zealand. However, the survey suggests that any widespread negative price impact would likely only be a one-off when the first release of GM occurred. Therefore, the more GM-based innovations that generate benefits, the greater the likely economic gains to New Zealand overall are likely to be, as those benefits will compound over time. A very conservative estimate of the impact if the three GM-use scenarios considered in this study are combined suggests a possible increase in GDP of at least 1%. It is likely that the overall impact will be higher than this, as this is a conservative estimate only.

Non-GM scenarios

8. For non-GM scenarios, that is those involving New Zealand forgoing the release of GM organisms, the predicted implications for “realistic scenarios” range from a possible decrease in GDP of between 0.1% and 6.4%. These ranges vary depending on the assumptions about both productivity decreases relative to the rest of the world, and price premiums generated for New Zealand non-GM exports. The most positive results for GDP occur when the productivity loss relative to the rest of the world is smallest, and the price premium for New Zealand non-GM exports are the highest.
9. Treasury considers that the price premium of approximately 34%, as suggested in the survey and used in the modelling, is very high, with overseas evidence suggesting a more realistic premium of between 10% and 20%. With these lower price premiums, the impact on GDP is likely to be a small negative movement (between 0.1% and 3.2% over 10 years). Furthermore, the price premium generated by New Zealand non-GM goods overseas is likely to reduce closer to zero over time. As the price premium declines to zero, the impact on GDP becomes more negative.

Price impact survey results

10. The price impact survey which fed into the economic modelling also revealed a number of relevant results:
- New Zealand consistently ranked “above average” or “among the best” in terms of environmental image;
 - The release of a GM organism had a varied impact on that image. Approximately 55% of international survey respondents stated that their image would either not change or would improve as a result of a release of GM technology. However, approximately one third indicated that their image of New Zealand would get worse if there was a release of GM technology.
 - Approximately 40% - 70% (depending on the country) of surveyed consumers indicated their purchasing of New Zealand commodities would remain unchanged if there was a release of a GM organism. However, a significant group of international consumers (20% - 30%) responded that they would cease purchasing New Zealand commodities in this situation.
 - The majority of international consumers surveyed indicated that their purchasing behaviour would be based on price. If the use of GM technology reduced the prices of New Zealand products, they would buy more. If adopting a “non-GM” brand meant that prices of New Zealand products increased, they would buy less.

- Approximately 85% of in-bound tourists indicated that a release of a GM organism in New Zealand would have no impact on their willingness to purchase a New Zealand holiday. However, 5% - 9% (depending on their country of origin) indicated that a GM organism release would reduce the likelihood of them returning to New Zealand for a holiday.
11. The above results suggest that there may be a negative impact from the release of a GM organism in New Zealand, affecting New Zealand's environmental image and flowing through into the prices some overseas consumer may be willing to pay for New Zealand exports. The potential sizes of these negative impacts varied according to the type of GM organism released, with medical releases generating the lowest potential negative impact, and GM rye-grass generating the highest potential negative impact.
 12. However, Treasury considers that these price impacts are likely to be overstated, for the following reasons:
 - the type of survey used tends to overstate the weighting that consumers place on factors such as GM content, and to understate the weighting that they place on price;
 - New Zealand products are often not identified on supermarket shelves as coming from New Zealand;
 - it is unlikely that all international consumers will be aware of a release of a non-food GMO in New Zealand; and
 - generalisation of the survey results assumes that all New Zealand's export markets are similarly affected, which is unlikely given the wide range of our export markets.
 13. Therefore, in practice, the number of consumers changing their purchase behaviour on the basis of GM content alone is likely to be less than indicated by this survey.

Implications of Results for Government Policy

14. The modelling results indicate that there are two key determinants of the likely impact of GM technology on the New Zealand economy:
 - the size of any increases in producer returns, through increased productivity and/or reduced cost, that are generated from the use of GM technology; and
 - the size of any impact on the sales price or volume of New Zealand's non-GM exports that may arise from the adoption of GM technology or from forgoing GM technology.
15. The productivity impact of GM technology is based on technological advances derived from research. This emphasises the importance of the biotechnology sector as a focus for the Government's Growth and Innovation Framework, since the modelling suggests that New Zealand-derived GM innovations lead to a much larger positive impact on GDP than those from overseas. Furthermore, the longer we can restrict overseas producers' unlimited access to these innovations, the greater the gains for New Zealand.

16. The Government's regulatory and legislative measures can also have a significant impact on the level of negative price impact that would result from the use of GM technology. It is assumed that economically rational producers will not use GM technology if the likely gain does not significantly exceed any negative price impact that will affect them directly. Prior to any decision on a GM release application, ERMA would consider any negative economic spillover impact that might result from that release.
17. Consistent with international evidence, the modelling results indicate that there are different potential benefits, risks, and net impacts for different uses of GM technology. For example, uses such as GM rye-grass that are relatively closer to the human food-chain carry greater risks in terms of negative price impacts than do the release of GM possum control, or the development of a GM therapeutic. This is consistent with the current case-by-case approach to considering GM releases, where the risks and benefits of each individual application are assessed, rather than a more general prohibition or approval. The appropriateness of the case-by-case approach is reinforced by the modelling results, which indicate that the selective use of GM technology is likely to have a significant compounding increase in GDP, while forgoing releases of GM organisms is more likely to lead to a small negative impact on GDP.
18. To minimise any negative price impact from the use of GM technology, and to maximise any gains New Zealand non-GM producers can make from their markets, it is important that New Zealand has a robust regulatory regime (including conditional release), and mechanisms to encourage successful co-existence. This will help preserve a "clean-green" environmental image, and preserve options for producers to benefit from both GM-based market opportunities and explicitly non-GM market opportunities on a case-by-case basis. The Royal Commission on Genetic Modification provided an independent confirmation of the robustness of the HSNO regime, and recommended the co-existence mechanisms currently being considered by Ministers. The results of this economic modelling also emphasise the importance of ERMA considering possible indirect economic costs, in terms of negative price impacts, as part of assessing an application for the use of GM technology.
19. It is also important to maintain international confidence in New Zealand's environmental image, and particularly in the robustness of that the regime for managing GM technology. The proposed HSNO amendments, particularly the proposed conditional release category, and the proposed co-existence mechanisms (being considered by Cabinet at the same time as this paper), will contribute to this confidence. The management of New Zealand's "clean-green" image in overseas markets goes beyond the careful management of new organisms, and also covers wider environmental management and sustainable development issues.

Annex One: Economic Analysis Methodology Used

20. The economic modelling considers the overall impact on New Zealand's gross domestic product (GDP) of four scenarios. These scenarios reflect a range of potential uses of GM technology, as well as a scenario of New Zealand rejecting the commercialisation of GM technology. The scenarios modelled were:
 - New Zealand allows the release of genetically modified rye-grass, leading to an increase in productivity in agricultural production;
 - New Zealand allows the release of GM-based possum control methods to reduce the incidence of bovine Tb;
 - New Zealand allows the release of a GM-based medicine; and
 - New Zealand forgoes the release of any GM organisms.
21. Each of these scenarios was subjected to a range of "sensitivity tests" reflecting the impact of changes in the assumptions that underlie the model. The main assumptions tested were around the productivity increases from the use of GM technology, and any price impacts on New Zealand's exports.
22. The modelling was carried out using a partial-equilibrium trade model to estimate the specific effects for producers, and a general-equilibrium model to estimate the effect these producer returns would be likely to have on the wider economy, as measured by GDP, employment, and other variables. The use of both modelling techniques ensures that there is both depth and breadth to the modelling results.
23. A survey of consumers and buyers in New Zealand's main export markets (Australia, UK and the US) was used to determine the extent of any price impacts from the use or avoidance of GM technology. These price impacts were then fed into the economic modelling to determine how they affected overall economic impacts.
24. It should be noted that modelling results are always simplifications of reality, and, in the case of GM technology, the modelling required predictions of likely uses of GM technology in New Zealand, and the price and productivity impacts. These weaknesses are overcome by modelling a number of different scenarios and by conducting sensitivity analysis testing the impact of changes in the key assumptions.
25. Nevertheless, the outcome of the modelling is a range of possible impacts, rather than one specific number. Where possible, officials have indicated where they consider the most likely outcome to be within the range of predicted outcomes, based on the likelihood of the underlying assumptions actually occurring.
26. The modelling does not consider the distribution of any economic impacts, that is who is likely to bear the benefits and costs, as the type of modelling used does not allow such analysis.

Annex Two: Interpretation of Individual Scenario Results

27. A more detailed analysis of the individual scenario results confirms that those results at either end of the predicted ranges are considered relatively less likely to occur, and, in some cases, are unrealistic. This annex examines the individual scenario results in more depth.

Scenario 1: Release of GM rye-grass

28. The modelling predicts a range of results for this scenario of between a 3% increase in GDP and a decrease of 2.4% over the 10 year period.
29. Within this wider range, Treasury considers the likely outcomes to be between +2.5% and -0.1%. These are based on productivity estimates that overseas evidence has suggested are realistic, and on negative price impacts between zero and those indicated by the survey. As noted above, Treasury considers that the survey overstates the likely negative price impacts, and overseas evidence shows no indication of economy-wide negative price impacts in countries that have released GMOs.
30. Treasury considers that both the positive and negative numbers at each end of the range to be unrealistic and therefore highly unlikely to occur for the individual GM release scenario. The 3% increase prediction is based on higher productivity increases than have been experienced overseas from the uses of individual GMOs. Similarly, the 2.4% decrease prediction is based on zero productivity increase and a high negative price impact on New Zealand exports. Zero productivity increase across the whole sector is considered unlikely based on overseas evidence, and it is unlikely that there would be ongoing uptake of the technology over the 10 year period under study if early results did not show a productivity increase. The arguments against assuming a high negative price impact are outlined in the preceding section.

Scenario 2: Release of GM pest control

31. The modelling predicts a range of results for this scenario of between a 1.2% increase in GDP and a decrease of 2.5% over the 10 year period.
32. Within this wider range, Treasury considers the likely outcome to be closer to +1.2% as this is based on productivity estimates that overseas evidence has suggested are realistic, and on negative price impacts between zero and those indicated by the survey. As noted above, Treasury considers that the survey overstates the likely negative price impacts, and overseas evidence shows no indication of economy-wide negative price impacts in countries that have released GMOs.
33. Treasury considers that the negative numbers at the bottom end of the range to be unrealistic and therefore highly unlikely to occur for the individual GM release scenario. The 2.5% decrease, and other decrease predictions, are based on unrealistically high negative price impacts on New Zealand exports.

Scenario 3: Release of GM human medicine

34. The modelling predicts a range of results for this scenario of between a 1.4% increase in GDP and a decrease of 1.4% over the 10 year period.

35. Within this wider range, Treasury considers the likely outcome to be between +0.4% and +1.4%, as this is based on negative price impacts between zero and those indicated by the survey, and modest revenue from the overseas sale of the medicine. As noted above, Treasury considers that the survey overstates the likely negative price impacts, and overseas evidence shows no indication of economy-wide negative price impacts in countries that have released GMOs.
36. Treasury considers that the negative numbers at the bottom end of the range to be unrealistic and therefore highly unlikely to occur for the individual GM release scenario. The 2.1% decrease, and other decrease predictions, are based on unrealistically high negative price impacts on New Zealand exports.

Scenario 4: No release of GMOs

37. The modelling predicts a range of results for this scenario of between an 11.3% increase in GDP and a decrease of 11.2% over the 10 year period. Treasury considers that these positive and negative numbers at each end of the range to be unrealistic and therefore highly unlikely to occur for the “no GM releases” scenario.
38. Within this wider range, Treasury considers the likely outcomes to be between –6.4% and zero impact, as these are based on estimates of productivity increases forgone by New Zealand that overseas evidence has suggested are realistic, and on non-GM price premia between zero and those indicated by the survey. As noted above, Treasury considers that the survey overstates the likely price premia that can be derived from non-GM products. In making assessments of which scenarios are realistic, Treasury has used price premia closer to those currently being received in international markets.
39. The price premia generated by New Zealand non-GM goods overseas is likely to reduce closer to zero over time. The more of New Zealand’s competitors and trading partners that try to pursue a non-GM marketing strategy, the harder it will be for New Zealand producers to generate high profits from non-GM sales. Markets may become saturated, reducing prices, and New Zealand producers will have to differentiate their product from other non-GM producers. As the price premium reduces closer to zero, the GDP impact becomes negative. At 10% price premium, the long-term impact on GDP of forgoing GM releases is estimated at –3.2%; at zero price premium, the estimated impact is -6.4%.
40. The 11.3% increase prediction, and other high positive predictions, are based on a higher non-GM price premium than has been consistently experienced overseas from the uses of individual GMOs. These high positive predictions also assume that the rest of the world does not get any productivity increase from the adoption of GMOs, which Treasury advises is unrealistic given that GMOs would not continue their current gradual adoption if no sustainable productivity gain can be demonstrated.
41. Similarly, the 11.2% decrease prediction is based on high productivity increases from the use of GMOs in the rest of the world that are not supported by international evidence to date.

Cumulative release of GMOs

42. The above GM release scenarios all consider only one GM release in isolation. This is likely to understate the economic impacts of the case-by-case approach to managing GM organisms, as, over time, more than one GM-based innovation will be used in New Zealand. However, the survey suggests that any widespread negative price impact would likely only be a one-off when the first release of GM occurs. Therefore, the more GM-based innovations that generate benefits, the greater the likely economic gains to New Zealand overall are likely to be, as those benefits will compound over time. Treasury considers that these positive and negative numbers at each end of the range to be unrealistic and therefore highly unlikely to occur for the “no GM releases” scenario.
43. Treasury therefore advises that an appropriate comparison of the economic impacts of releasing a GMO and forgoing GMO releases would be to compare this cumulative release outcome with the non-GM scenario. That is, a conservative likely increase of at least 1% for cumulative GMO release, and a likely outcome of between –6.4% and zero impact for forgoing GMO releases.