Review of the Animal Welfare (Layer Hens) Code of Welfare

Draft Economic Analysis for Consultation

December 2010

Ministry of Agriculture and Forestry
Te Manatū Ahuwhenua, Ngāherehere

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1. Executive summary

The current Animal Welfare (Layer Hens) Code of Welfare (the Code) was issued in 2005 under the Animal Welfare Act 1999. The Code sets out minimum standards that require cages built after 1 January 2005 to have at least 550 square centimetres per bird in floor area, and for all cages to have at least 550 square centimetres per bird by 2014. Approximately 2.88 million birds in New Zealand are housed in cage systems.

This economic analysis estimates the long-term impacts on the New Zealand cage egg market, including on producers and consumers, from a number of welfare Code options including minimum standards requiring the use of colony cages. Impacts modelled include those on:
- capital costs (including resource consent costs) of converting farms;
- variable costs;
- productivity;
- farm profitability and industry exits;
- the price paid by consumers;
- consumers' access to eggs; and
- the number of birds housed in current cages overseas (how much bird welfare is "exported overseas").

The analysis uses conservative assumptions that may overstate the true impacts. The analysis does not calculate a net benefit or recommend an option.

Information about farms and estimates of the costs of complying with codes was provided by the Egg Producers Federation of New Zealand. Other information has been derived from a number of public sources.

1.1. MAIN ASSUMPTIONS

The following main assumptions were used for the analysis of possible codes that set colony cages with 750 square centimetres of floor space per bird as the minimum standard for cages:
- Farms that use cages will install colony cages rather than switch to free-range or barn production.
- There are negligible changes to feed and labour costs with colony cages.
- Farms incur capital costs of installing new cages and additional sheds.
- Cages have a useful lifetime of about eight years, and farms finance the cost of converting to colony cages at a cost of 9% compounding monthly.

The estimated impacts of changes to key assumptions are reported in the sensitivity analysis.

1.2. RESULTS OF THE MODEL

The model estimates impacts of a number of potential changes to the Code. These can be grouped into two types:
- requiring colony cages at some date after the move to 550 square centimetres in 2014; and
- replacing the 550 square centimetre minimum standard with a requirement for colony cages from some date.

Requiring colony cages after the move to 550 square centimetres

The model estimates that minimum standards requiring at least 550 square centimetres in floor area followed by <u>colony cages before 1 January 2022</u> will cause:
- a 14.03% higher cage egg price until 1 January 2022, falling to 10.41% higher after;

- the quantity of cage eggs produced and consumed to be 13.32% lower until 1 January 2022, falling to 10.22% lower after; and
- industry exits of 20.93% (remaining farms 9.63% larger) until 1 January 2022, falling to 16.23% (remaining farms 7.18% larger) after.

Requiring at least 550 square centimetres in floor area followed by <u>colony cages after 1 January 2022</u> is estimated to cause:
- a 10.41% higher cage egg price;
- the quantity of cage eggs produced and consumed to be 10.22% lower; and
- industry exits of 16.23% (remaining farms 7.18% larger).

The total cost to New Zealand cage egg producers and consumers of requiring at least 550 square centimetres in floor area followed by colony cages is estimated to be:
- $8.24 per bird per annum until1 January 2022, falling to $6.01 per bird per annum after, if colony cages are required before 1 January 2022; and
- $6.01 per bird per annum if colony cages are required after 1 January 2022.

Replacing the 550 square centimetre requirement with a colony cage requirement

The model estimates that replacing the minimum standard of 550 square centimetres with a minimum standard requiring <u>colony cages before 1 January 2019</u> will cause:
- a 13.23% higher cage egg price until 1 January 2019, falling to 10.34% higher after;
- the quantity of cage eggs produced and consumed to be 12.65% lower until 1 January 2019, falling to 10.16% lower after; and
- industry exits of 19.93% (remaining farms 9.09% larger) until 1 January 2019, falling to 16.14% (remaining farms 7.13% larger) after.

Requiring at least 550 square centimetres in floor area followed by <u>colony cages after 1 January 2019</u> is estimated to cause:
- 10.34% higher cage egg price;
- quantity of cage eggs produced and consumed to be 10.16% lower; and
- industry exits of 16.14% (remaining farms 7.13% larger).

The total cost to New Zealand cage egg producers and consumers of replacing the minimum standard of 550 square centimetres with a minimum standard requiring colony cages is estimated to be:
- $7.74 per bird per annum until 1 January 2019, falling to $5.97 per bird per annum after, if colony cages are required before 1 January 2019; and
- $5.97 per bird per annum if colony cages are required after 1 January 2019.

2. Background on the Code

2.1. THE ANIMAL WELFARE ACT 1999

Part 5 of the Animal Welfare Act 1999 (the Act) establishes procedures for the development, issue, amendment, review, and revocation of codes of welfare. These codes set out minimum standards and best practice recommendations for how people should manage and care for animals, including:

- stockmanship;
- food and water;
- shelter and housing facilities;
- providing for behavioural needs;
- handling and husbandry procedures;
- disease and injury control;
- emergency humane destruction; and
- quality management.

2.2. LEGAL EFFECT OF CODES

Non-compliance with a code of welfare is not itself an offence under the Act. Instead, prosecutions are made against alleged failure to meet the obligations of the Act relating to the care of an animal or for ill-treatment of an animal.

Non-compliance or otherwise with minimum standards can be used as evidence in support or defence of a prosecution.

2.3. REGULATORY PROCESS AND ROLES

Anyone can draft a code of welfare. Once drafted, the code is guided through the regulatory process by the National Animal Welfare Advisory Committee (NAWAC) and the Ministry of Agriculture and Forestry (MAF). In this case, NAWAC is reviewing the current Animal Welfare (Layer Hens) Code of Welfare (the Code) and developing a new one.

NAWAC has asked MAF to complete an economic analysis of NAWAC's draft proposals. This analysis is released with the draft Code for public consultation.

In developing the new code, NAWAC must consider all submissions, good practice and scientific knowledge, available technology, and any other relevant matters including economic and other impacts. NAWAC must be satisfied that any minimum standards are the *minimum necessary* to ensure that the objectives of the Act will be achieved, and that any best practice recommendations are appropriate. NAWAC then makes a recommendation to the Minister.

MAF advises the Minister on NAWAC's recommendation, and the Minister decides whether to approve, amend or decline the code.

2.4. EXCEPTIONAL CIRCUMSTANCES

Under section 73 of the Act, NAWAC can recommend minimum standards that do not comply with the obligations of the Act having regard to:

(a) the feasibility and practicality of effecting a transition from current practices to new practices and any adverse effects that may result from such a transition;

(b) the requirements of religious practices or cultural practices or both;

(c)the economic effects of any transition from current practices or both.

The exceptional circumstances section was intended by Parliament to be used rarely and for situations out of the ordinary.

When the exceptional circumstances section might be used

NAWAC can recommend a code allowing practices that do not meet the obligations of the Act to continue indefinitely in two situations. Where these situations do not exist, a date should be set for the transition to new practices.

The first is where it is not feasible to transition to new practices. This may be because it isn't practical for people to implement new practices in a certain time period, or because there aren't other practices that would meet the obligations of the Act. In the former case, the exceptional circumstances section could be used for a period long enough to make the transition to a new practice (eg, for farms to plan changes, secure regulatory approval like resource consent, train staff, and source and install new equipment). In the latter case, the exceptional circumstances section could be used for a period until other practices are developed or refined until the point where they comply with the Act.

The second is where moving to a new practice would result in the industry shutting down with very significant economic impacts. This may be because moving too quickly causes high costs and farms to lose profits and exit the industry such that the industry collapses, or because, no matter how slowly the move is made, the costs are too high. In the former case, the exceptional circumstances section could be used for a certain period so that people can spread the cost over a number of years. In the latter case, the exceptional circumstances section might be used indefinitely, and reviewed when the new practices have less cost.

Overall

Practices may be allowed which don't meet the obligations of the Act until it is both feasible for people to implement new practices and the new practices wouldn't result in the industry shutting down and with very significant economic impacts.

2.5. THE ANIMAL WELFARE (LAYER HENS) CODE OF WELFARE

Cages

The current Animal Welfare (Layer Hens) Code of Welfare was issued in 2005, and revised in 2007. The Code provides guidance to owners of layer hens, and to other people in charge of layer hens, about the standards they must achieve to meet their obligations under the Act.

A key part of the Code, and the subject of this economic analysis, is the size and type of cage layer hens are housed in. The current Code states that:

1. cages existing before the commencement of the Code on 1 January 2005 should have had an area of at least 450 square centimetres of floor space per bird until 1 January 2008 from when these cages should have an area of at least 500 square centimetres per bird;

2. cages built after 1 January 2005 should have an area of at least 550 square centimetres per bird; and

3. by 1 January 2014, all cages (whether built before or after 1 January 2005) should have an area of at least 550 square centimetres per bird.
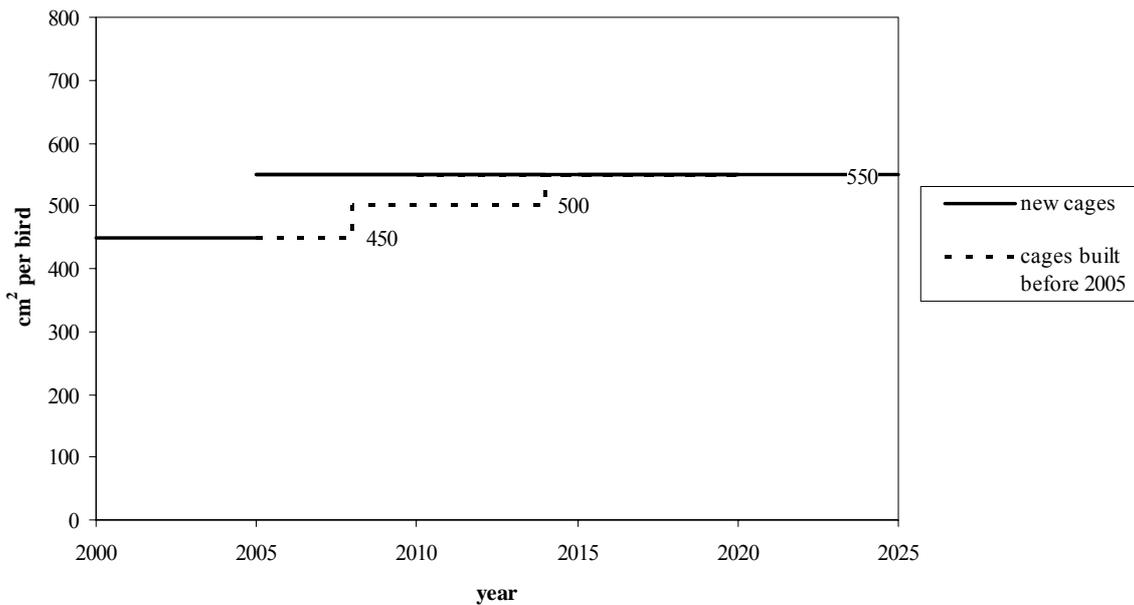
At present, cages should be at least 500 square centimetres if built before 1 January 2005 and at least 550 square centimetres if built after 1 January 2005. By 2014, all cages should be at least 550 square centimetres.

Exceptional circumstances

For the current Code, NAWAC judged that floor space of less than 550 square centimetres did not meet the obligations of the Act, but that 550 square centimetres did. NAWAC used the exceptional circumstances section of the Act to allow the continued use of cages with 500 square centimetres for a period of nine years (until 1 January 2014) provided they were built before 1 January 2005. By 2014, farms should have transitioned to a minimum of 550 square centimetres.

2.6. CAGES

According to NAWAC, cage systems[1]:

> *have the advantage of protecting bird health and welfare, through the separation of the animal from its faeces, and through precise environmental control. In terms of problems such as feather pecking and cannibalism, the small group size found in a cage allows management interventions to be targeted, and reduces the total number of birds directly affected by such events.*

> *The major disadvantage of cages is that they prevent the birds from displaying many of their normal behaviours such as they are not able to fly, run, or walk continuously. Cages also provide a barren environment where birds are denied the ability to forage or dust bathe and nest. Birds may have weaker bones due to lack of exercise.*

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[1] NAWAC, 7 September 2007, *Animal Welfare (Layer Hens) Code of Welfare 2005 as amended by Animal Welfare (Layer Hens) Code of Welfare Ammendment Notice* 2007, p.20, http://www.biosecurity.govt.nz/files/regs/animal-welfare/req/codes/layer-hens/layer-hens-amendment-notice-2007.pdf.

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2.7. REASON FOR THE REVIEW

In the current Code, NAWAC says that[4]:

> *In contrast to cages, enriched-cages [colony cages] are showing increased potential for allowing birds to display more of their normal behaviours.*

> *Alternative systems generally provide more enriched environments and an ability to display normal behaviours; nevertheless there are potential welfare issues such as feather pecking, cannibalism, greater incidence of disease, and higher mortalities.*

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[2] Picture taken from http://www.eggfarmers.co.nz/video3.asp.

[3] Picture taken from Mench, J.A.., Sumner, D.A.., and Rosen-Molina, J.T. (2011), *Sustainability of egg production in the United States – The policy and market context*, Poultry Science, 90(1), p. 230, http://ps.fass.org/cgi/reprint/90/1/229.pdf.

[4] NAWAC, 7 September 2007, *Animal Welfare (Layer Hens) Code of Welfare 2005 as amended by Animal Welfare (Layer Hens) Code of Welfare Ammendment Notice* 2007, p.21, http://www.biosecurity.govt.nz/files/regs/animal-welfare/req/codes/layer-hens/layer-hens-amendment-notice-2007.pdf.

All production systems are subject to continual review and development. Future research may therefore lead to major changes in the way layer hens are managed. It is recognised that international research and development, and commercial trials, are currently being conducted with cages containing perches, nest boxes, litter, and abrasive strips, and that these cage features may offer potential for the New Zealand layer industry. NAWAC therefore wishes to see further research comparing cage and alternative systems, including enriched-cages. NAWAC will not make any final decision on whether cages should continue, be modified or be phased out, until 2009, when it will review that scientific research (both national and international).

NAWAC has reviewed the scientific research and may revise its judgement in the current Code that cages with floor space of 550 square centimetres per bird meets the obligations of the Act. NAWAC may instead recommend that colony cages are the minimum necessary to meet the obligations of the Act.

3. Purpose of the analysis

3.1. PURPOSE OF THE ECONOMIC ANALYSIS

This economic analysis aims to serve a number of purposes:

1. To help inform NAWAC's deliberations on what options should be included in the draft Code for consultation.

2. To help inform public discussion on the draft Code.

3. To seek information from the public to further refine the analysis.

4. To form the basis of MAF's regulatory impact analysis.

5. To help inform NAWAC's decisions on a final Code.

6. To help advise the Minister on NAWAC's final recommendation.

3.2. SCOPE OF THE ECONOMIC ANALYSIS

NAWAC may determine that current cages do not meet the obligations of the Act and is, therefore, interested in the practicalities and economic impacts of moving from current cages to colony cages with greater floor space.

Compared to traditional cages, colony cages provide more space, and can include a perch, nest box, and a dust-bathing area. Colony cages allow birds to display more normal behaviours including limited walking, running and flight, and foraging, nesting and dust-bathing. The disadvantages of colony cages compared to traditional cages include problems of feather pecking, cannibalism, and difficulties for farm managers in regulating bird welfare.

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[5] An example of an enriched cage; picture taken from http://www.upc-online.org/battery_hens/100710enriched_cages.html.

[6]

Minimum Standards 4 (Housing and Equipment Design and Maintenance), 5 (Stocking Densities) and 11 (Behaviour) are key minimum standards in NAWAC's draft Code for the purposes of this analysis.

Minimum Standard 4 requires the housing used in colony systems to include nesting areas with substrate to encourage the hens to perform nesting behaviour, and the addition of perches, with 15cm of perch provided per hen.

Minimum Standard 5 says that colony cages must provide at least 750 square centimetres of floor space per bird.

Minimum Standard 11 says that existing housing systems that do not allow layer hens to express their priority patterns of behaviours must be replaced by some date to be determined. In addition, any new facilities that are constructed after the date of issue of the new Code must enable the hens to have the opportunity to express their priority patterns of behaviours.

This analysis estimates the long-term impacts of options for the transition from current cages to colony cages by various dates.

Impacts modelled include those on:
- capital costs (including resource consent costs) of converting farms;
- variable costs (feed, labour, etc);
- productivity;
- farm profitability and industry exits;
- the price paid by consumers;
- consumers' access to eggs; and
- the number of birds housed in current cages overseas (how much bird welfare is "exported overseas").

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[6] Another example of an enriched cage; picture taken from Mench, J.A.., Sumner, D.A.., and Rosen-Molina, J.T. (2011), *Sustainability of egg production in the United States – The policy and market context*, Poultry Science, 90(1), p. 233, http://ps.fass.org/cgi/reprint/90/1/229.pdf.

The analysis uses a partial-equilibrium model. That is, the analysis estimates impacts on the cage egg market and does not estimate impacts on the entire economy.[7] For simplicity, the analysis will be referred to as an "economic analysis" rather than a "partial-equilibrium model".

The analysis is a draft analysis. There are limitations and uncertainties that will be raised throughout the paper. The analysis is intended to stimulate discussion and encourage improvements to the model and data.

Estimated impacts are rounded to the nearest $100. Totals of estimated impacts are accurate, but may not match the individual estimates as they appear in this document due to rounding of the individual estimates.

The analysis does not attempt to monetise any welfare gain to birds, that is, convert changes in bird welfare into a dollar value.

3.3. WHAT QUESTIONS DOES THE ECONOMIC ANALYSIS NEED TO HELP ANSWER?

If NAWAC determines that current cages do not meet the obligations of the Act, NAWAC needs to consider whether exceptional circumstances exist that mean that current cages could be permitted and for how long they might be permitted. This analysis endeavours to help answer the question of whether exceptional circumstances exist.

This analysis estimates the economic impacts of changes to the Code. This will help answer the question of whether moving from current cages to colony cages by certain dates would result in the industry shutting down.

This analysis does not consider how long an industry might need to physically make a change to colony cages.

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[7] To do so would require a model of the entire New Zealand economy. In any case, the impacts on caged egg producers is unlikely to be significant enough to register in such a model.

4. Method

This chapter broadly outlines the approach taken in estimating the economic impact of changes to the Code. More information on the underlying theory and how this type of analysis differs from some past analyses can be found in Appendix 1.

4.1. OVERALL APPROACH OF THIS ANALYSIS

A model of the domestic egg market has been constructed using data on the New Zealand market, and supplemented by information from overseas where little New Zealand data exists. The model incorporates demand and supply curves, and estimates how much price and quantity might change by adjusting those curves in response to changes to the Code.

Nimmo-Bell surveyed farms[8] on behalf of the Egg Producers Federation. Nimmo-Bell used the results of its survey to make assumptions about how three representative farms (small, medium, and large) would respond to changes in the Code.

MAF's economic model uses the expected responses from Nimmo-Bell's report. Three sets of impacts were estimated using each of the three groups of farms as the representative farm. That is, the model was run assuming the market is made up of only small farms, only medium farms, or only large farms.

The model then follows the approach below:

1. Current short-term demand and supply curves are estimated using current prices and quantities and estimates of elasticities found in economic studies.

2. Increases in variable costs (the kinds of costs that vary in the short-term depending on how much the farm produces) are added to find a new short-term supply curve.

3. A new short-term equilibrium is identified.

4. Fixed costs (the kinds of costs that do not vary in the short-term depending on how much the farm produces, eg capital costs and Resource Management Act costs) are added.

5. Farm profitability is assessed.

6. If farms are making lower than normal profits, some farms will, over time, decide to exit the industry. These exits decrease supply and increase the price received by farms that remain in the market.

7. Using the demand curve, estimates are found of the quantity reduction (ie, how many farms would need to exit) needed to generate a price that would leave the remaining farms with normal profits in the long-term. This process may take several years or longer.

8. The resulting long-term equilibrium is found and the results presented.

So as not to overload readers of this report with results, only the estimated impacts for when large farms are the representative farm are presented. The estimated impacts for medium farms are not presented because they are very similar (very marginally smaller) than the estimated impacts for when large farms are the representative farm. The estimated impacts for when small farms are the representative farm are not presented because there is significant uncertainty about the likely reaction of small farms to the change[9] and, because small farms make up only a small amount of total production, it is unlikely that the true market impact would reflect the estimated impact using small farms as the representative farm.

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[8] Nimmo-Bell, March 2010, *Economic Impact of a proposed revision to the Code of Welfare for Layer Hens*.

[9] In particular, about how many small farms will wait to see whether the price of cage eggs increases, or whether small farms will exit the industry earlier.

4.2. PRICES CAN CHANGE

The major difference between this analysis and some past analyses is that prices are allowed to change in response to changes to the Code. If some of the cost increase is reflected in price increases, the impact on farm profitability will be limited compared to if prices do not change.

This does not mean that egg producers have market power and can actively restrict supply to set prices where they like. Instead, step 6 in Chapter 4.1 says that cost increases will cause lower profits and eventually some farms will exit the industry. When farms exit, supply decreases. A reduction in supply pushes up the price, increasing the revenue of farms that remain. Farms continue to exit, supply continues to decrease, and the price continues to rise until remaining farms are making normal profits again (the kind of profits they were making before a change to the Code).

An example of prices changing in response to cost increases can be seen from past changes to feed costs. About 60% of the variable cost of producing eggs is feed for birds. As shown in Figure 4.1, changes in the price of eggs correlate quite closely[10] with changes in the price of feed.

Figure 4.1: Feed and egg prices
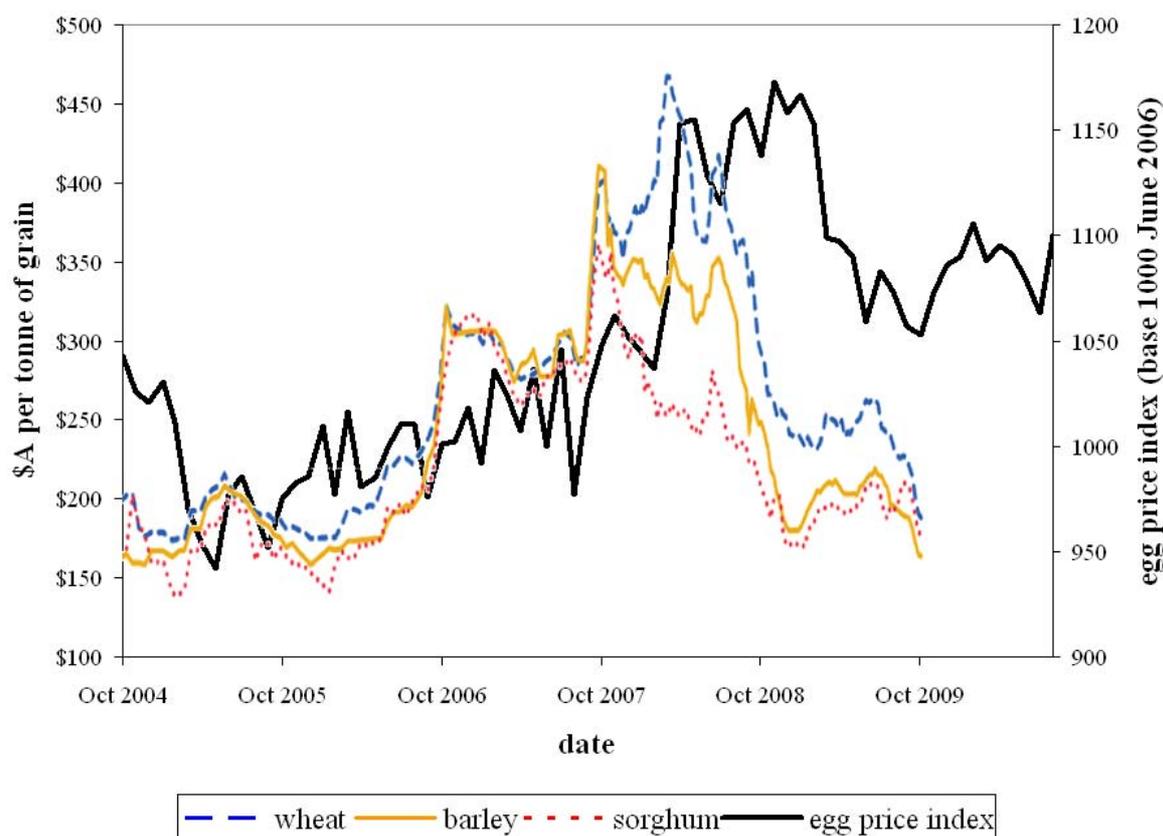
4.3. DEMAND AND SUPPLY – CAGE EGGS MARKET

Fresh eggs and processed egg

Egg farms produce eggs for two destinations. Most eggs end up being sold as fresh eggs (also called table eggs). Some eggs are processed and sold as powdered egg.

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[10] Changes in the price of eggs appear to lag changes in the price of feed by a few months. The graph of feed prices comes from http://www.nzpork.co.nz/LinkClick.aspx?fileticket=hHdm7HdgKG8%3d&tabid=133&mid=658, and the egg price index from http://www.stats.govt.nz/infoshare/.

Biosecurity regulations prohibit fresh eggs from being imported, and have only recently allowed the importation of powdered egg.

Sources of demand

There are three main customer types for eggs: supermarkets, industrial users for making their own food products, and other retailers including food services such as restaurants.

Table 4.1: Customer types for all eggs

Customer type	Share of eggs purchased
Supermarkets	47.6%
Industrial users	15.0%
Other retail including food services	37.4%

Supermarkets and other retailers purchase fresh eggs. Industrial users purchase fresh eggs and processed egg. Industrial users may be more price sensitive than supermarkets and other retailers because they have an additional substitute for fresh eggs available in the form of imported processed egg. How sensitive consumers or producers are to changes in price is called "elasticity". The more price sensitive, the higher the elasticity of demand or supply.[11]

Key Assumption: Demand for eggs by industrial users is more elastic than demand from supermarkets and other retailers.

If consumers are very price sensitive, an increase in price causes a relatively big decrease in the quantity demanded (demand is elastic). Therefore, the necessary increase in price in step 7 from Chapter 4.1 will require a relatively big reduction in quantity.

If consumers are not very price sensitive, an increase in price causes a relatively small decrease in the quantity demanded (demand is inelastic). Therefore, the necessary increase in price in step 7 will require a relatively small reduction in quantity.

Key Point: The impact of cost increases on producers will be lower the less price sensitive consumers are to price increases.

Free-range eggs

About 82.4% of eggs are produced in cage systems and 17.6% of eggs are free-range, barn, or organic. Free-range eggs receive a premium price and, for the purposes of this analysis, are treated as a separate market. That is, the analysis incorporates the demand and supply for eggs produced in cage systems only.

A shift to colony cages is expected to increase the price of cage eggs relative to free-range eggs. This will decrease the margin between the price of free-range eggs and cage eggs and may cause an increase in demand for free-range eggs. However, the margin between the welfare of free-range birds and caged birds has also changed, meaning that some customers may shift from free-range to cage eggs. The analysis does not estimate these effects, though the sensitivity analysis (Appendix 3) does consider the impact on the cage egg market of changes to the Code where there has been a shift in demand from cage eggs to free-range.

Supermarkets and other retailers buy free-range eggs as well as cage eggs. Table 4.1 needs to be adjusted to account for this:

Table 4.2: Customer types for cage eggs

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[11] See Appendix 1 for more on elasticity.

Customer type	Share of cage eggs purchased
Supermarkets and other retailers	81.8%
Industrial users	18.2%

Demand and supply

Because the free-range market is separated from the caged market, supply of eggs comes from one source: caged systems. Demand for eggs is from two sources: the relatively inelastic supermarkets and other retailers, and the relatively elastic industrial users.

Farmers receive one price for eggs irrespective of its final destination. This implies that if prices increase in response to a reduction in egg supply, egg producers would face a proportionally greater reduction in the quantity demanded by industrial users than from supermarkets and other retailers.

The model takes the demand from industrial users and the demand from supermarkets and other retailers to find a total demand for eggs. Demand and supply curves are constructed for the status quo in Chapter 5. Chapter 6 estimates and models the effects of changes to the Code.

5. Status quo

This chapter sets out what would happen if the current Code remained (the status quo). This chapter constructs a model of the New Zealand cage egg market, presenting key points, assumptions and results along the way.

Nimmo-Bell reports[12] that there are three broad farm groupings by size:
- farms with up to 30,000 birds;
- farms with between 30,001 and 100,000 birds; and
- farms with more than 100,000 birds.

5.1. FARM SIZE

In 2010, Nimmo-Bell reported the following:

Table 5.1: Farm size 2010

Variable	Small farm	Medium farm	Large farm	Total
No. of birds	Up to 30,000	30,001 to 100,000	More than 100,000	
No. of farms	20	13	8	41
Total no. of birds	358,600	796,200	1,727,600	2,882,400
Average no. of birds per farm	17,930	61,246	215,950	70,302

In 2005, Nimmo-Bell reported the following[13]:

Table 5.2: Farm size 2005

Variable	Small farm	Medium farm	Large farm	Total
No. of birds	Up to 19,999	20,000 to 80,000	More than 80,000	
No. of farms	26	29	9	64
Total no. of birds	244,340	1,100,676	1,637,700	2,982,716
Average no. of birds per farm	9,398	37,954	181,967	46,605

Although the number of farms has decreased over the last five years, the number of birds housed in caged systems has remained fairly constant with the average size of farms increasing from less than 50,000 birds to more than 70,000 birds.

5.2. CAGE USE

Nimmo-Bell reported that large and medium farms still use cages of 500 square centimetres, but that smaller farms already meet the 2014 requirement for 550 square centimetres. 50% of birds in large farms and 35% of birds in medium farms are housed in cages of 500 square centimetres per bird.

5.3. DOMESTIC PRODUCTION

Domestic egg production and consumption has been increasing over time[14] although 2002 was an unusually low level of production.

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[12] Nimmo-Bell, March 2010, *Economic Impact of a proposed revision to the Code of Welfare for Layer Hens.*

[13] Nimmo-Bell, February 2005, *Economic Analysis: Economic Effect, Feasibility and Practicality of Minimum Standard 7d Animal Welfare (Layer Hens) Code of Welfare.*

Figure 5.1: Domestic production of eggs (caged and free-range)
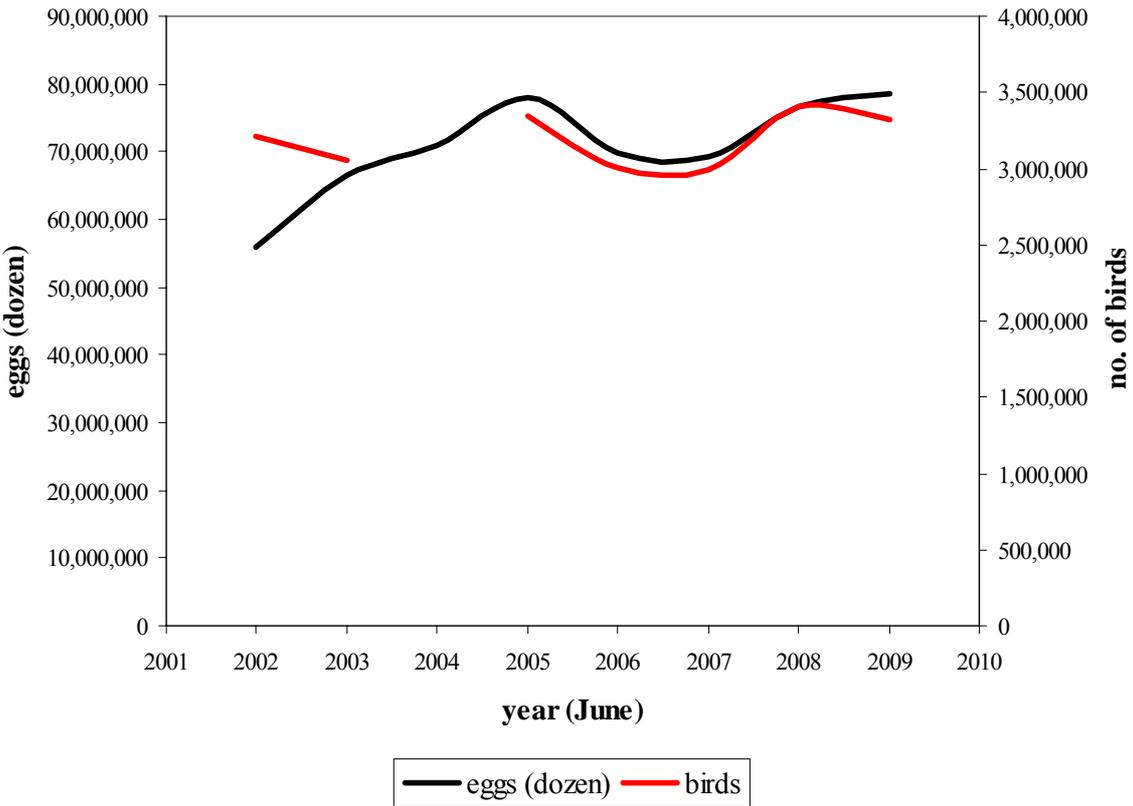
Table 5.3: Domestic production

Year	Dozen eggs	No. of birds	Dozen eggs per bird
2002	55,964,430	3,217,360	17.39
2003	66,431,948	3,057,973	21.72
2004	70,905,849	Not available	Not available
2005	77,933,181	3,348,916	23.27
2006	69,780,113	3,011,425	23.17
2007	69,341,843	2,994,202	23.16
2008	76,635,716	3,405,415	22.50
2009	78,575,736	3,321,059	23.66

Growing demand for eggs will offset some of the costs of a new Code for existing farms and reduce the likelihood of existing farms exiting the industry. The primary concern of this analysis is to consider whether the industry will collapse as a result of changes to the Code. To ensure that we do not underestimate the risks of the industry collapsing, this analysis uses a conservative assumption that demand does not grow over time.

Key Model Assumption: Demand for eggs does not change over time.

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[14] http://www.stats.govt.nz/infoshare/. See also http://www.eggfarmers.org.nz/industry-statistical-facts.asp.

5.4. IMPORTS

> **Key Point:** Countries from which New Zealand might import processed egg may have lower welfare standards.

Since September 2009, New Zealand has allowed the importation of dried (processed) egg. If the cost of domestically-produced eggs increases, industrial users may increase their demand for imported processed egg. Imported egg may come from countries with lower welfare standards than New Zealand.

Major exporters of processed egg are graphed below[15]:

Figure 5.2: Exports of processed egg by countries
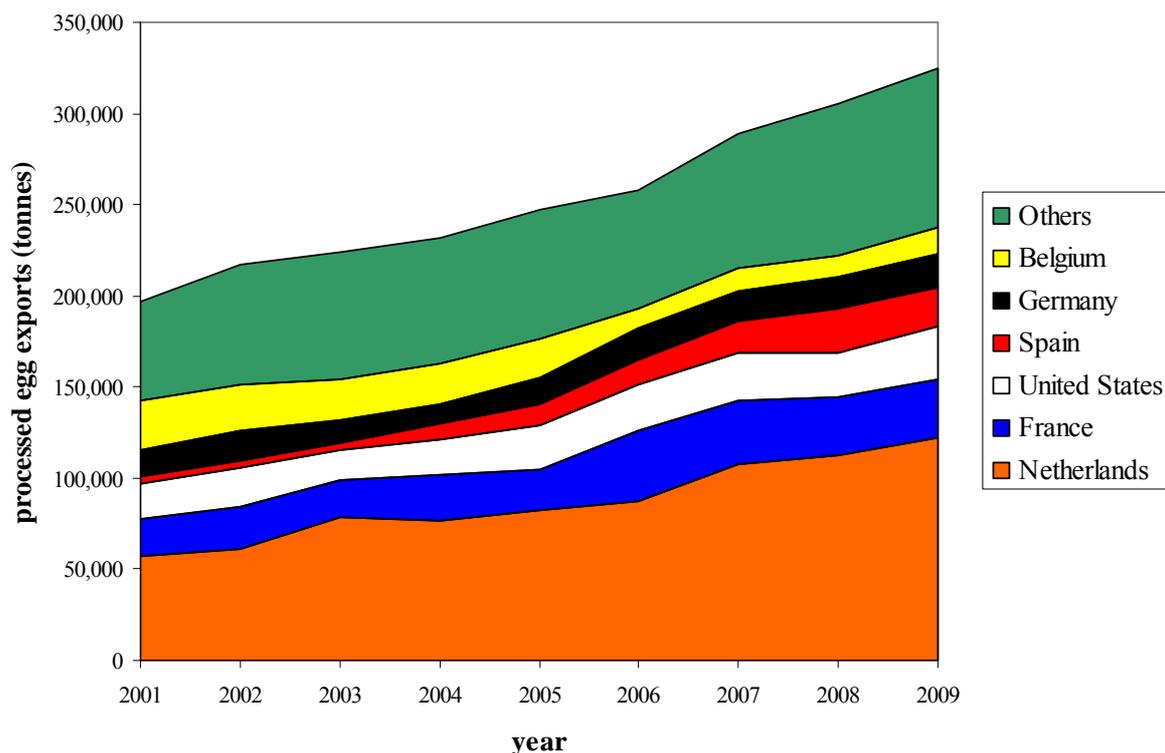
5.5. DEMAND AND SUPPLY – CURRENT

This chapter establishes demand and supply curves for the current domestic cage egg market. It uses New Zealand data and estimates of price elasticities of demand and of supply from economic studies.

The model uses constant elasticity of demand and supply curves[16] with the relationship $Q=AP^\varepsilon$, where Q is quantity, P is price, ε is elasticity, and A is a constant.

For demand, ε is generally negative. A value of zero means that as prices increase, the quantity demanded remains the same. A value of -1 means a 1% increase in price results in a 1% decrease in the quantity demanded. A value of -3 means a 1% increase in price results in a 3% decrease in the quantity demanded.

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[15] International Trade Centre, http://www.intracen.org/tradstat/. Exports are presented rather than imports due to the limited data available (only one year since September 2009) on imports of processed egg.

[16] A constant elasticity function means that, whatever the quantity, a 1% change in price causes a 1%e change in quantity. There is no particular theoretical reason for this choice of function. The function is convenient for the amount of information available and the sensitivity analysis around elasticities should capture the range of likely results.

For supply, ε is generally positive. A value of zero means that as prices increase, the quantity supplied remains the same. A value of 1 means a 1% increase in price results in a 1% increase in the quantity supplied. A value of 3 means a 1% increase in price results in a 3% increase in the quantity supplied.

A couple of New Zealand studies have reported estimates of the elasticity of demand and supply. A 1988 study estimated the elasticity of demand at the farm level to be -0.18[17]. The same study used an elasticity of supply of 0.7 based on Australian estimates. More recently, a 2004 study[18] estimated the elasticity of demand for farm products – a subgroup of food that included eggs, dairy products, vegetable oils and fats – at -1.01.

One Australian study[19] reported a number of Australian estimates of the elasticity of demand ranging from -0.01 to -0.40 and overseas estimates ranging from -0.15 to -0.96[20].

Another Australian study reported[21] an elasticity of demand of -0.2 and an elasticity of supply of 0.7.

A report commissioned by the Egg Producers Federation included an elasticity of demand of -0.3 based on two overseas studies: one from the UK putting elasticity at -0.28, and one from Canada putting elasticity at -0.35[22].

The studies suggest both the demand and supply of eggs is fairly inelastic.

The model uses a value of 0.7 for the elasticity of supply of eggs, consistent with the value used in other studies.

Conservative assumptions are made about the elasticity of demand – that demand is at the elastic end of estimates – so as not to underestimate the risks of the industry collapsing. The elasticity of demand for supermarkets and other retailers is set at -1.0 and, taking account of the greater number of substitutes available in the form of imported processed egg, -1.5 for industrial users. This is at about three times the elasticity suggested by studies.

Key Point: Studies suggest that egg demand and supply is inelastic.

Key Model Assumption: The elasticity of supply is 0.7.

Key Model Assumption: The elasticity of demand is -1.0 for supermarkets and -1.5 for industrial users.

Demand curves

According to the Nimmo-Bell survey, there are 2,882,400 birds in caged systems (see table 5.1) producing about 25 dozen eggs per year each for a total of 72.06 million dozen of eggs per year. Assuming that the market clears – that consumers purchase all of those eggs – 58.94 million dozen (81.8% of the 72.06 million dozen) are purchased by supermarkets and other retailers. 13.12 million dozen (18.2% of the 72.06 million dozen) are purchased by industrial users. Using these quantities (Q), the elasticites (ε) of -1.0 and -1.5, and the farm gate price[23]

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[17] J.K. Gibson, April 1988, *An Economic Analysis of the 1986 Deregulation of the New Zealand Egg Industry*, p. 39.

[18] Khaled, M., McWha, V., and Lattimore, R., March 2004, *Fragmenting Food Markets: Some New Zealand evidence from a Two-Stage Budget Model*, p. 15, http://www.nzier.co.nz/includes/download.aspx?ID=5118.

[19] E. Oczkowski and T. Murphy, 1998, *Modelling the Determinants of Domestic Egg Demand*, p. 4.

[20] Excluding an outlier study from California putting elasticity at -1.7.

[21] Bureau of Agricultural Economics, July 1983, *A Review of Egg Marketing Arrangements in Australia*, p.69.

[22] K. Murray and P. Harnett, June 2010, *Egg market Dynamics – An Investigation into the Impact of Changed Production Requirements*, LECG, p. 11.

[23] The price farmers receive as opposed to the price supermarket customers pay.

of $2.10 per dozen (P), and the demand curve relationship, $Q=AP^{\varepsilon}$, the demand curves are estimated and plotted in the graph below.[24]

Figure 5.3: Cage egg market – current demand
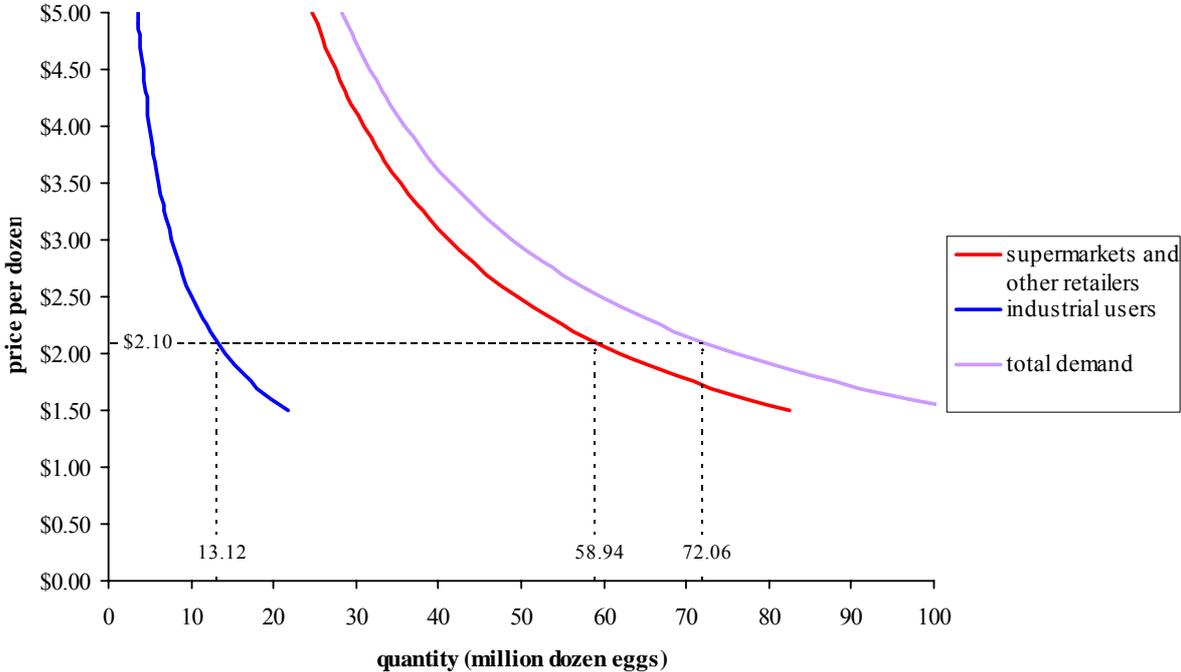
Supply curves

Using these 72.06 million dozen (Q) produced by cage systems, the elasticity (ε) of 0.7, and the price of $2.10 per kg (P), and the supply curve relationship, $Q=AP^{\varepsilon}$, the supply curve is estimated and plotted in the graph below.

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[24] The functions of the demand and supply curves are in Appendix 2.

Figure 5.4: Cage egg market – current supply
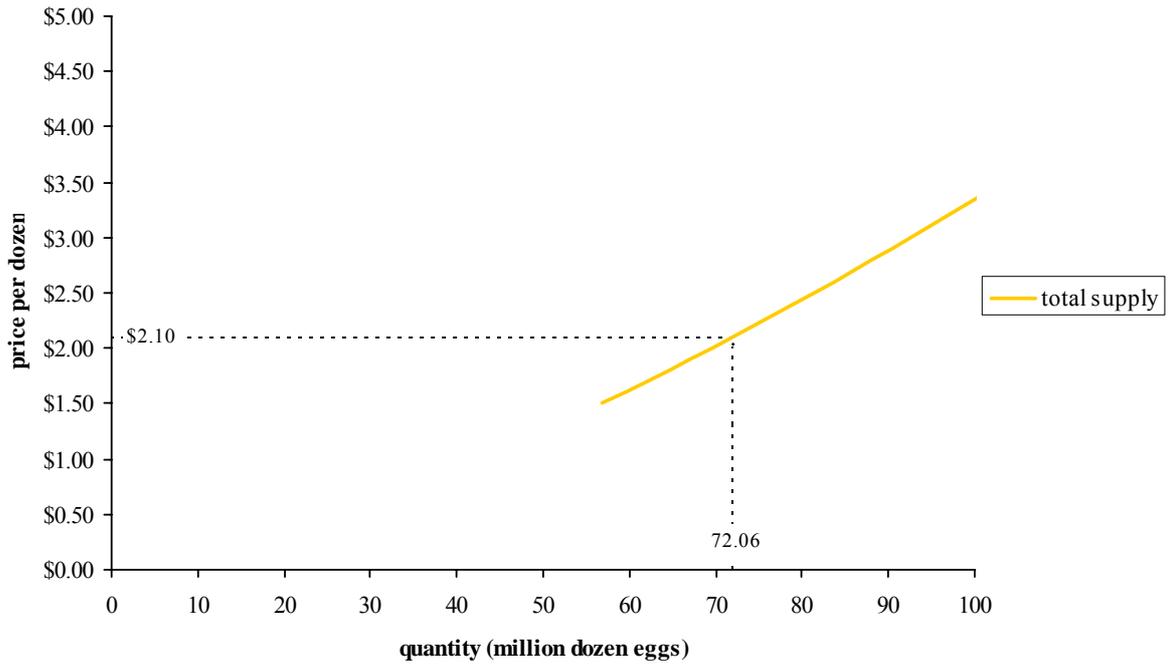
Total demand and total supply together give a market that looks like this:

Figure 5.5: Cage egg market – current
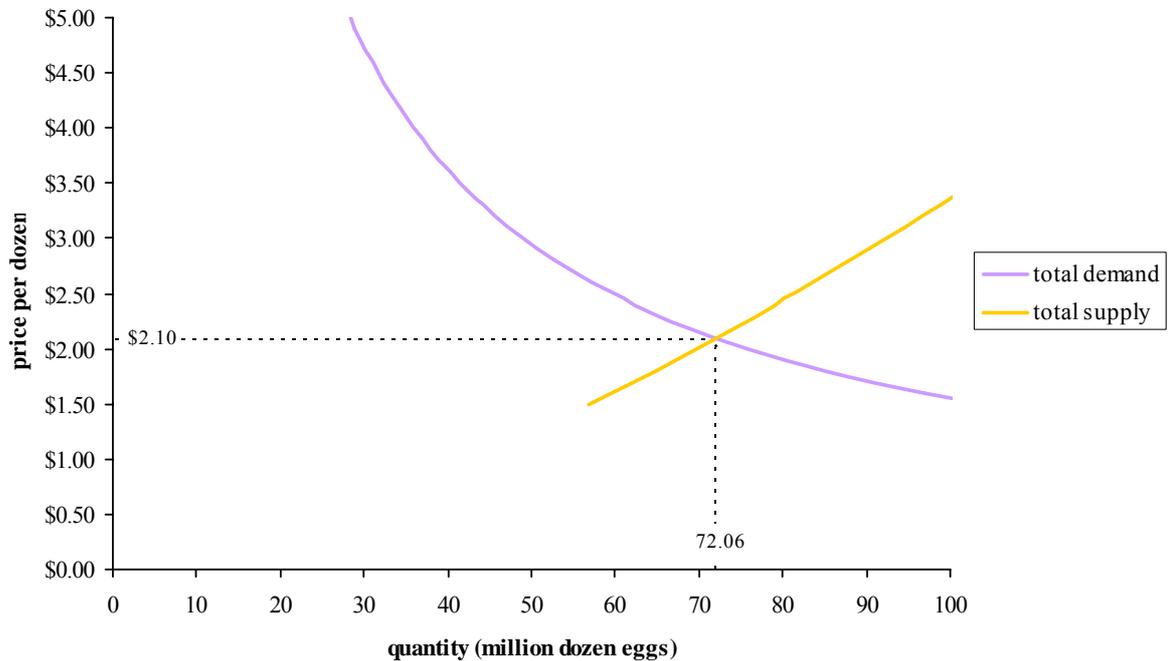
5.6. FARM PROFITABILITY

In the absence of information on farm profitability over time, it is assumed that farms are currently making normal levels of profit so that there won't be entry or exit from the industry except for that caused by the Code. If farms have been making above-normal profits, it would be expected that there would be entry into the market and more farms affected by changes to

the Code. If farms have been making below-normal profits, it would be expected that there would be exit from the market and fewer farms affected by changes to the Code.

5.7. COMPLYING WITH THE CURRENT CODE

By 2014, farms that haven't already done so will need to modify their systems so that cages have at least 550 square centimetres in floor space. Small farms already have floor space of at least 550 square centimetres; it is the medium and large farms that will incur costs to comply with the current Code.

An increase in space per bird requires new sheds and cages to be built if farms wish to house the same number of birds.

Costs

Some annual costs[25] farms currently face with producing eggs are detailed in the table below:

Table 5.4: Variable costs per year for an egg-producing bird

Cost	Small farms	Medium farms	Large farms
Feed per bird	$23.51	$21.88	$20.50
Labour per bird	$6.00	$6.00	$7.00
Egg packaging per bird	$2.85	$3.87	$3.87
Egg distribution per bird	$2.50	$2.50	$3.50
Bird purchase price	$2.88	$2.81	$2.75
Bird rearing cost	$4.46	$3.81	$3.71
Total variable cost per bird	$42.20	$40.87	$41.33
Total variable cost per dozen	$1.69	$1.63	$1.65

According to the Egg Producers Federation and the Nimmo-Bell survey, for the move to 550 square centimetres:
- small farms will:
  - incur no costs because those that will continue are already complying with this requirement;
- medium farms will:
  - wait to see what future Codes will look like before building new sheds and cages and, instead;
  - temporarily reduce bird numbers by 7%[26]; and
  - have negligible change to variable costs and productivity; and
- large farms will:
  - build new sheds and cages by 2014 for 10% of their birds at a cost of $20 per bird for the shed and $20 per bird for the cage;
  - secure resource consent at a cost of $21,000; and
  - have negligible change to variable costs and productivity.

MAF has not verified these assumptions, though they are similar to the assumptions used in the analysis of the 2005 Code.

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[25] Birds are used in production for about 56 weeks, so the purchase price and rearing cost per bird has been spread over 1.08 years

[26] Medium farms will replenish their stock of birds at the time compliance with future restrictions is required.

Depreciation and the lifetime of sheds and cages

The Inland Revenue Department[27] uses straight-line depreciation rates of 4% for sheds and 13.5% for cages. This implies that sheds take 25 years, and cages take 7.41 years, to fully depreciate. It is assumed that farms will spread the cost of financing capital expenses over a term of 25 years for sheds and 7.41 years for cages. The Egg Producers Federation says that generally last longer than can be inferred from the Inland Revenue Department's depreciation rates; up to 25 years. The estimated impacts for if cages last 20 years and if cages last 25 years are included in the sensitivity analysis. When cages last longer, the capital cost can be spread over more years meaning that the annual impact of a move to colony cages is less. 7.41 years is used for cages so as to not underestimate the long-term impact.

For large farms, the cost of getting resource consent and building sheds for 10% of their birds is $452,900. The annual cost is $45,600 if financed over 25 years at a financing cost of 9%.

The cost to a large farm of building cages for 10% of its birds is $431,900. The annual cost is $80,100 if financed over 7.41 years and a cost of 9%.

The total annual cost is $125,700.

Estimated impacts

As noted in Chapter 4.1, the model was run three times, using small farms, medium farms, and large farms as the representative farm, but this report only presents the results for when large farms are the representative farm.

Estimated impact with large farms

In the short-term, the increase in capital costs lowers farm profit by $125,700 (compared to normal profits of $300,000). Over time, some producers will decide to exit the industry, decreasing the market supply and increasing the price for remaining farms until profits are returned to normal in the long-term. This can take a number of years.

The estimated impacts in the long-term are:
- the price of eggs increasing by 1.19%;
- the quantity of eggs decreasing by 1.29%; and
- 2.10% of farms exiting the industry; with
- remaining farms each producing 0.83% more eggs than currently.

5.8. "EXPORTING" WELFARE

Price increases cause decreases in the quantity demanded by supermarkets and other retailers for fresh eggs, and by industrial users for fresh and processed egg. Fresh eggs can't be imported, but processed egg can.

It is assumed that all of the decrease in the quantity demanded by industrial users is matched by an increase in imports of processed egg which may have been farmed using lower welfare standards. Because the welfare of the birds that produce these eggs is controlled overseas, this is sometimes called "exporting" welfare.

To estimate the increase in the number of birds housed overseas, it is assumed that birds overseas produce the same number of eggs as domestic birds, that is, 25 dozen per bird per year.

There is estimated to be a decrease in eggs demanded by industrial users of 0.23 million dozen eggs causing an 9,300 increase in the number of birds farmed overseas. This compares to 2,845,300 birds farmed in New Zealand at 550 square centimetres.

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[27] https://interact1.ird.govt.nz/forms/depnrates/.

The amount of exported welfare appears to be small relative to the number of birds housed in cages with 550 square centimetres in floor space per bird in New Zealand.

6. Alternative Codes

This chapter covers a number of options for changing the Code. Among the options are no move to colony cages; requiring a move to colony cages at some date following the move to 550 square centimetres; and replacing the requirement for 550 square centimetres with a move to colony cages at some date.

The later option may mean a later date for an increase in floor space for birds as farmers need time to plan changes to their farms, secure finance, and train in new animal management techniques. However, because this option would not require farms to make two changes – the move to 550 square centimetres and the move to colony cages – this option may mean the transition to colony cages can occur sooner.

6.1. ASSUMPTIONS FOR ALL OPTIONS

Nimmo-Bell's survey asked farms what their likely response would be to a Code that required colony cages with 750 square centimetres of floor space per bird as a minimum standard. The largest response was that farms would install colony cages. Four of the 41 farms said they would convert to free-range or barn production.

Nimmo-Bell constructed an average response for each of the small, medium, and large farms where farms install colony cages. These responses are used for this analysis.

Costs

According to the Egg Producers Federation and the Nimmo-Bell survey, for the move to colony cages:
- small farms would:
  - alter existing sheds at a cost of $5 per bird;
  - purchase colony cages at a cost of $29 per bird (colony cages cost $9 per bird more than current cages);
  - secure resource consent at a cost of $21,000; and
  - have negligible change to variable costs and productivity;
- medium farms would:
  - replenish their stock of birds after the temporary 7% reduction;
  - build new sheds for 51% of their birds at a cost of $20 per bird;
  - purchase colony cages for all their birds at a cost of $29 per bird;
  - secure resource consent at a cost of $21,000; and
  - have negligible change to variable costs and productivity;
- large farms would:
  - build new sheds for 50% of their birds at a cost of $20 per bird;
  - purchase colony cages for all its birds at a cost of $29 per bird;
  - secure resource consent at a cost of $21,000; and
  - have negligible change to variable costs and productivity.

Depreciation and the lifetime of sheds and cages

MAF has not been able to source the age distribution of cages and sheds. MAF has, therefore, used a conservative approach.

The latest farms will build new cages to comply with the current code is 2014. Assuming that sheds have a useful life of 25 years and that cages have a useful life of 7.41 years[28], in eight

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[28] Note that if cages last longer, then the annual repayment on borrowings to pay for the cages is lower and so the annual impact of a change to the Code would be lower. The total impact will, however, be higher and the date at which existing cages are fully paid off will be later.

years (2022), those cages will have fully depreciated and farms will be looking to replace them at a cost of $20 per bird.

If colony cages are required by some date before 1 January 2022, there will be a period of time where farms may be purchasing colony cages at $29 per bird while still financing existing cages. For instance, if colony cages are required by 1 January 2018, there may be up to four years (1 January 2018 to 1 January 2022) where farms are paying for two sets of cages. The additional cost of two sets of cages as opposed to just one is $29 per bird. This drops to $9 for any year after 2022 since farms would be paying $20 per bird to replace old cages.

If colony cages are required by some date after 1 January 2022, there is no time period where farms are paying for two sets of cages, and the additional cost of cages from the Code is $9.

Tables 6.1 and 6.2 present the annual costs to farms if the shed and resource consent cost is financed over 25 years and the cage cost is financed over 7.41 years at a cost of 9% per annum:

Table 6.1: Per farm annual cost for converting to colony cages <u>before</u> existing cages fully depreciate

Cost	Small farms	Medium farms	Large farms
Sheds	$9,000	$61,700	$218,100
Cages	$96,400	$320,300	$1,171,200
Resource consent	$2,100	$2,100	$2,100
Total	$107,600	$384,100	$1,391,400

Table 6.2: Per farm annual cost for converting to colony cages <u>after</u> existing cages fully depreciate

Cost	Small farms	Medium farms	Large farms
Sheds	$9,000	$61,700	$218,000
Cages	$29,900	$213,000	$765,000
Resource consent	$2,100	$2,100	$2,100
Total	$41,100	$276,800	$985,100

Sensitivity analysis

Appendix 3 presents estimated results if the assumptions are changed. Two important assumptions are the elasticity of demand and the lifetime of cages. The sensitivity analysis considers the change in impacts in demand is less price sensitive and if cages last longer.

6.2. COLONY CAGES REQUIRED BY CERTAIN DATES

Again, results are only presented for where large farms are the representative farm. The results in the column "Impact by 1 January 2014" of Table 6.3 can be interpreted as the estimated impacts of a minimum standard only requiring an increase in space to 550 square centimetres per bird. The results in the last two columns can be interpreted as the total impact from minimum standards requiring 550 square centimetres by 1 January 2014 and then colony cages at some later date.

Table 6.3: Long-term market impact with large farms

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13 (1.19%)	$2.39 (14.03%)	$2.32 (10.41%)
Quantity (mil. dozen) – total domestic production	72.06	71.13 (-1.29%)	62.46 (-13.32%)	64.69 (-10.22%)
Quantity – supermarkets and other retailers	58.94	58.25 (-1.18%)	51.69 (-12.30%)	53.39 (-9.43%)
Quantity – industrial users	13.12	12.89 (-1.77%)	10.77 (-17.88%)	11.31 (-13.80%)
Equivalent no. of farms	13.35	13.07 (-2.10%)	10.55 (-20.93%)	11.18 (-16.23%)
Quantity per farm (dozen)	5,398,700	5,443,800 (0.83%)	5,918,400 (9.63%)	5,786,100 (7.18%)
No. of birds in colony cages in New Zealand			2,498,500	2,587,800
Increase in birds overseas		9,300	93,800	72,400

The longer farms have to convert to colony cage systems, the smaller the price increase, the smaller the decrease in eggs produced and consumed, the lower the number of industry exits, and the larger the number of birds kept in colony cages net of the amount of exported welfare.

Key Model Result:

The model estimates that minimum standards requiring at least 550 square centimetres in floor area followed by colony cages <u>before 1 January 2022</u> will cause:
- a 14.03% higher cage egg price until 1 January 2022, falling to 10.41% higher after;
- the quantity of cage eggs produced and consumed to be 13.32% lower until 1 January 2022, falling to 10.22% lower after; and
- industry exits of 20.93% (remaining farms.63% larger) until 1 January 2022, falling to 16.23% (remaining farms 7.18% larger) after.

Requiring at least 550 square centimetres in floor area followed by colony cages <u>after 1 January 2022</u> is estimated to cause:
- a 10.41% higher cage egg price;
- the quantity of cage eggs produced and consumed to be 10.22% lower; and
- industry exits of 16.23% (remaining farms 7.18% larger).

The test under the Act is whether the estimated impacts trigger the exceptional circumstances section discussed in Chapter 2.4. There are, then, several crucial questions that need to be answered.

Questions:

1. Are the estimated impacts of a move to colony cages <u>before 2022</u> large enough to trigger the exceptional circumstances section of the Act?
2. If the answer to 1 is "no", what is the earliest date by which egg farms could physically make the change?

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3. If the answer to 1 is "yes", the next question is whether the estimated impacts of a move to colony cages <u>after 2022</u> are large enough to trigger the exceptional circumstances clause.

6.3. REMOVING THE 550 SQUARE CENTIMETRE REQUIREMENT BY 2014

The estimated impacts if a new Code requires colony cages, but no longer requires 550 square centimetres by 2014, are presented in Tables 6.6, 6.7 and 6.8. Because this option does not require two changes by farms, existing cages will be fully depreciated by 2019 rather than 2022. Correspondingly, the impacts of a change in the Code fall in 2019 rather than 2022.

Table 6.4: Long-term market impact with large farms

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32
		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	72.06	62.94	64.74
		(-12.65%)	(-10.16%)
Quantity – supermarkets and other retailers	58.94	52.06	53.42
		(-11.68%)	(-9.37%)
Quantity – industrial users	13.12	10.89	11.32
		(-17.00%)	(-13.72%)
Equivalent no. of farms	13.35	10.69	11.19
		(-19.93%)	(-16.14%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		2,517,700	2,589,400
Increase in birds overseas		89,200	72,000

The difference in the annual impact between keeping and removing the 550 square centimetre requirement is small. For instance, the quantity decrease with an early requirement for colony cages is estimated to be 12.65% without, and 13.32% with, the 550 square centimetre requirement. The date by which the impacts decrease, though, is three years earlier as cages will have fully depreciated by 1 January 2019.

Key Model Result:

The model estimates that replacing the minimum standard of 550 square centimetres with a minimum standard requiring colony cages <u>before 1 January 2019</u> will cause:
- a 13.23% higher cage egg price until 1 January 2019, falling to 10.34% higher after;
- the quantity of cage eggs produced and consumed 12.65% lower until 1 January 2019, falling to 10.16% lower after; and
- industry exits of 19.93% (remaining farms 9.09% larger) until 1 January 2019, falling to 16.14% (remaining farms 7.13% larger) after.

Replacing the 550 square centimetres minimum standard with a minimum standard requiring colony cages <u>after 1 January 2019</u> is estimated to cause:
- a 10.34% higher cage egg price;

- quantity of cage eggs produced and consumed 10.16% lower; and
- industry exits of 16.14% (remaining farms 7.13% larger).

The graph below illustrates the impact on the market for cage eggs with the 550 square centimetre minimum standard replaced with a minimum standard requiring colony cages before 1 January 2019.

Figure 6.1: Moving to colony cages before 1 January 2019
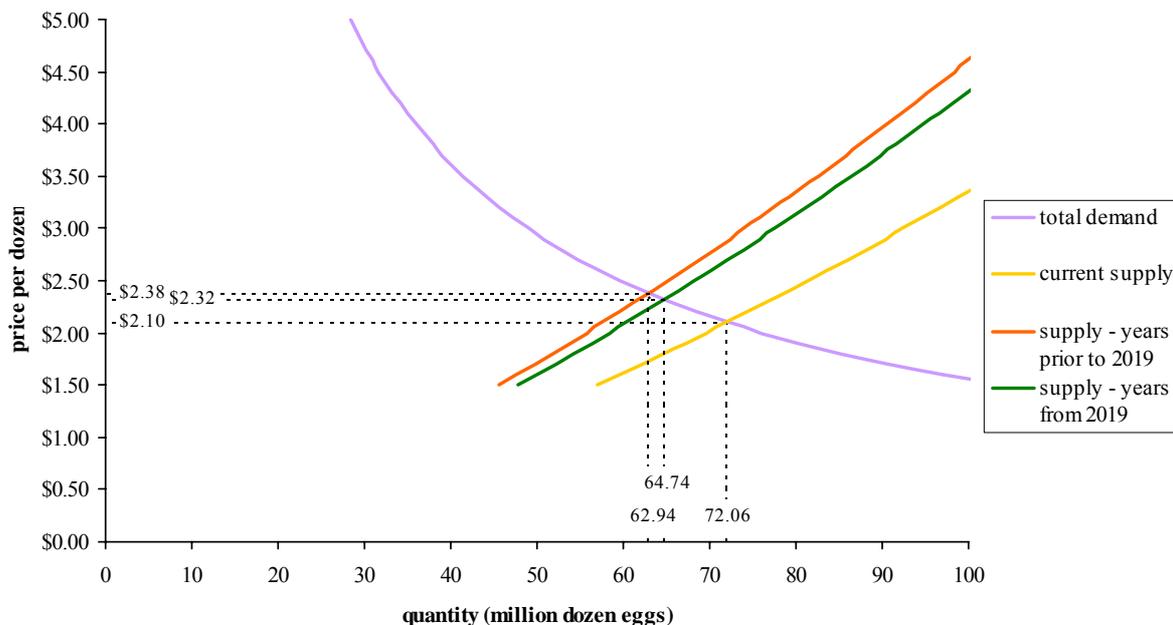
If the percentage increase in farm gate prices filters through as the same percentage increase in retail egg price, the supermarket price of eggs would increase from about $3.36 per dozen to $3.80 per dozen before 1 January 2019 and $3.71 per dozen after 1 January 2019.

The estimated decrease in eggs produced and purchased is equivalent to setting egg production back about two years, as shown in the figure below.

Figure 6.2: Domestic production of eggs (caged and free-range)
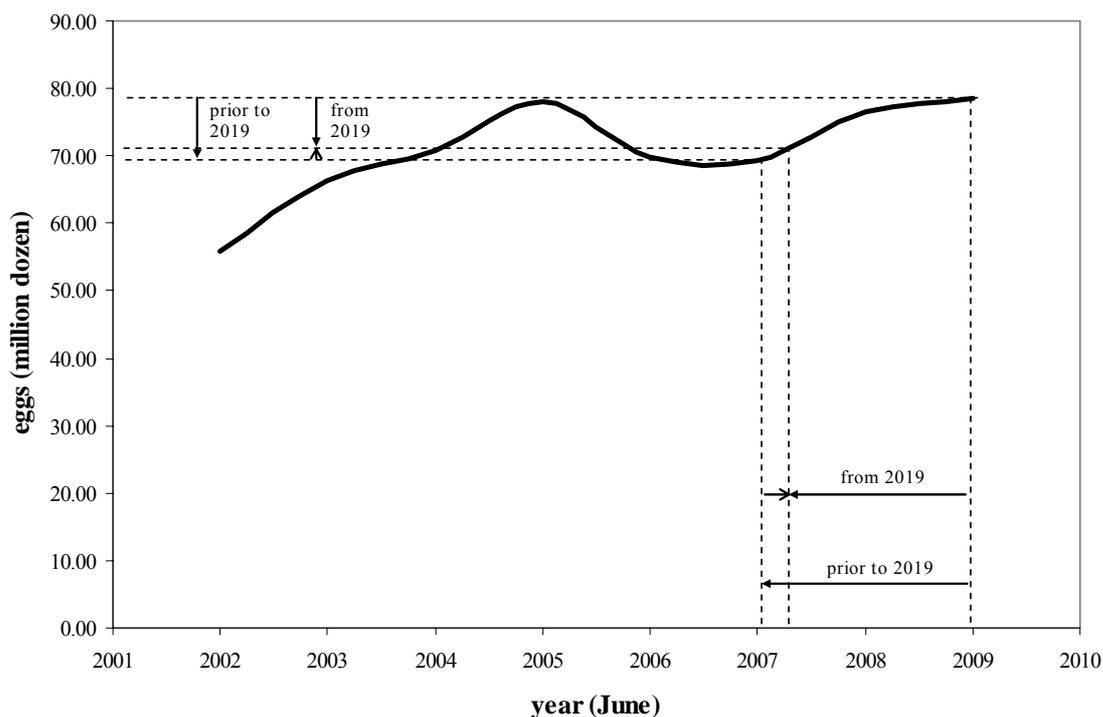
6.4. CONSUMER SURPLUS, PRODUCER SURPLUS, AND TOTAL IMPACT

Previous chapters presented estimated impacts on the price and quantity of eggs as they are important and easily understood results for the public and, quantity especially, are most important to the question of exceptional circumstances.

This chapter presents the total cost to New Zealand producers and consumers of cage eggs and the total cost per bird.

Consumer surplus

A measure of the total impact on consumers from higher prices and restricted access to eggs is "consumer surplus". Consumer surplus measures the difference between what consumers are prepared to pay for a dozen eggs (the price on the demand curve) and what they actually pay (the market price). This is the additional value consumers put on eggs above what they actually pay. In this analysis, supermarkets, other retails, and industrial users face a loss of consumer surplus due to higher farmgate prices and decreased availability of eggs.

Requiring at least 550 square centimetres in floor area followed by colony cages at a later date is estimated to cause a per annum loss of consumer surplus of:
- $19.75 million until 1 January 2022, falling to $14.91 million after if colony cages are required before 1 January 2022; and
- $14.91 million if colony cages are required after 1 January 2022.

Replacing the minimum standard of 550 square centimetres with a minimum standard requiring colony cages is estimated to cause a per annum loss of consumer surplus of:
- $18.70 million until 1 January 2019, falling to $14.83 million after if colony cages are required before 1 January 2019; and
- $14.83 million if colony cages are required after 1 January 2019.

Producer surplus

A measure of the total impact on producers from higher costs and sales of eggs is "producer surplus". Producer surplus measures the difference between the price producers are willing to sell a dozen eggs for (the price on the supply curve) and the price they actually receive (the market price).

In a competitive market, producer surplus is zero in the long-term as the difference between the return they are making and the return they could get doing other things is zero (if the return is positive, there will be entry into the cage egg market until profits return to normal levels). In the long-term, all costs are eventually borne by consumers.

The loss of producer surplus, therefore, is technically zero. This isn't a particularly interesting result, so this chapter instead reports the loss of accounting profit – the decrease in the number of farms multiplied by the profits farms normally receive – and calls it "producer surplus".

Requiring at least 550 square centimetres in floor area followed by colony cages at a later date is estimated to cause a per annum loss of consumer surplus of:
- $0.84 million until 1 January 2022, falling to $0.65 million after if colony cages are required before 1 January 2022; and
- $0.65 million if colony cages are required after 1 January 2022.

Replacing the minimum standard of 550 square centimetres with a minimum standard requiring colony cages is estimated to cause a per annum loss of consumer surplus of:
- $0.80 million until 1 January 2019, falling to $0.65 million after if colony cages are required before 1 January 2019; and
- $0.65 million if colony cages are required after 1 January 2019.

Total impact

Compared to the current situation, requiring at least 550 square centimetres in floor area followed by colony cages at a later date is estimated to cost New Zealand a per annum total of:
- $20.59 million (equivalent to $8.24 per bird in colony cages) until 1 January 2022, falling to $15.56 million (equivalent to $6.01 per bird in colony cages) after if colony cages are required before 1 January 2022; and
- $15.56 million (equivalent to $6.01 per bird in colony cages) if colony cages are required after 1 January 2022.

Replacing the minimum standard of 550 square centimetres with a minimum standard requiring colony cages is estimated to cause a per annum loss of consumer surplus of:
- $19.49 million (equivalent to $7.74 per bird in colony cages) until 1 January 2019, falling to $15.47 million (equivalent to $5.97 per bird in colony cages) after if colony cages are required before 1 January 2019; and
- $15.47 million (equivalent to $5.97 per bird in colony cages) if colony cages are required after 1 January 2019.

Key Model Result:

The cost to New Zealand of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date is estimated to be:

- $8.24 per bird in colony cages until 1 January 2022, falling to $6.01 per bird in colony cages after if colony cages are required before 1 January 2022; and

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- $6.01 per bird in colony cages if colony cages are required after 1 January 2022.

The cost to New Zealand of replacing the minimum standard of 550 square centimetres with a minimum standard requiring colony cages is estimated to be:

- $7.74 per bird in colony cages until 1 January 2019, falling to $5.97 per bird in colony cages after if colony cages are required before 1 January 2019; and
- $5.97 per bird in colony cages if colony cages are required after 1 January 2022.

Appendix 1: Economic theory

METHODS OF PAST ECONOMIC ASSESSMENTS

"Economic impact analyses" are often limited in how accurately they analyse what is likely to happen as a result of a regulatory change. The main cause of this limitation is an explicit assumption that prices do not change, that is, prices never rise following cost increases. These analyses are more accurately called "financial analyses" and have been used in past reviews of codes[29].

These analyses typically:

> (A) consider the current profitability or welfare of affected farms or parties;
>
> (B) total up the cost of complying with amended regulation; and
>
> (C) subtract (B) from (A) to find a new level of profitability or welfare.

This approach can lead to a number of strange conclusions, as demonstrated in some illustrative examples below.

Example 1: profitable farms

If farms were making profits, and then incur costs from a regulatory change that leaves the farms profitable, the likely future state is often described as just that: farms making lower profits. The economic impact is the cost farms incur from the regulatory change.

Example 1: profitable farms	
Number of farms	100
Current profit per farm	$100,000
Additional cost from amended regulation	$20,000
New profit per farm	$80,000

Here, all farms still make a profit, the per farm impact is $20,000, and the total economic impact is $2,000,000 ($20,000 per farm × 100 farms). Because prices are assumed not to change, the impact is borne by farms, with no impact on consumers.

Example 2: marginally profitable farms

If farms were making profits, and then incur costs from a regulatory change that leaves the farms unprofitable, the likely future state is described as some or all farms being unsustainable and eventually ceasing operation. Again, the assumption that prices do not change prevents price rises from the decrease in supply that occurs when farms exit an industry. This will result in an overestimate of the number of farms that exit the industry. Although there is sometimes discussion of which farms are most likely to exit the industry, there is seldom analysis of what effect this will have on remaining farms, that is, whether fewer competitors means that the profitability of remaining farms is improved.

Example 2: marginally profitable farms	
Number of farms	100

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[29] This is not meant to be critical of the work done in these assessments, as they were consistent with the terms outlined. However, their scope does limit the usefulness of the assessments.

Current profit per farm	$15,000
Additional cost from amended regulation	$20,000
New profit per farm	-$5,000

The economic impact described in this situation can range from the total of the cost of change to farms that remain (as in example 1) to no farm can afford to make the change and, therefore, they all exit the industry.

Example 3: unprofitable farms

If farms were making losses, and then incur costs from a regulatory change that leaves the farms even less profitable, the likely future state is often described as all farms being unsustainable and eventually ceasing operation. This suffers from the same problems as in example 2, but with an additional strange conclusion. Because farms were making losses, and are likely to exit the market as a result of the regulatory change, the loss of those farms is counted by those analyses as a benefit to the economy (fewer negative profits in the economy).

Example 3: unprofitable farms	
Number of farms	100
Current profit per farm	-$20,000
Additional cost from amended regulation	$20,000
New profit per farm	-$40,000

OVERALL APPROACH OF THIS ANALYSIS

The key difference between this analysis and many past analyses is that prices are allowed to change in response to changes to the Code. As costs rise, some farms exit the industry causing supply to decrease and the price received by remaining farms to increase.

DEMAND AND SUPPLY – THEORY

Demand curves slope downwards. The higher the price, the less consumers are prepared to buy of that product. The lower the price, the more consumers are prepared to buy. In the graph below, at a price of $4.00 consumers want to buy 28 items. If the price falls to $3.00, consumers want to buy 50 items.

When the price of one product increases, consumers want to buy less of that product, and generally more of other products (or save more). For example, if the price of eggs increases, fewer people would buy eggs, instead perhaps buying other protein sources, or maybe eating fewer protein sources overall and buying completely different products.

Figure A1.1: Demand
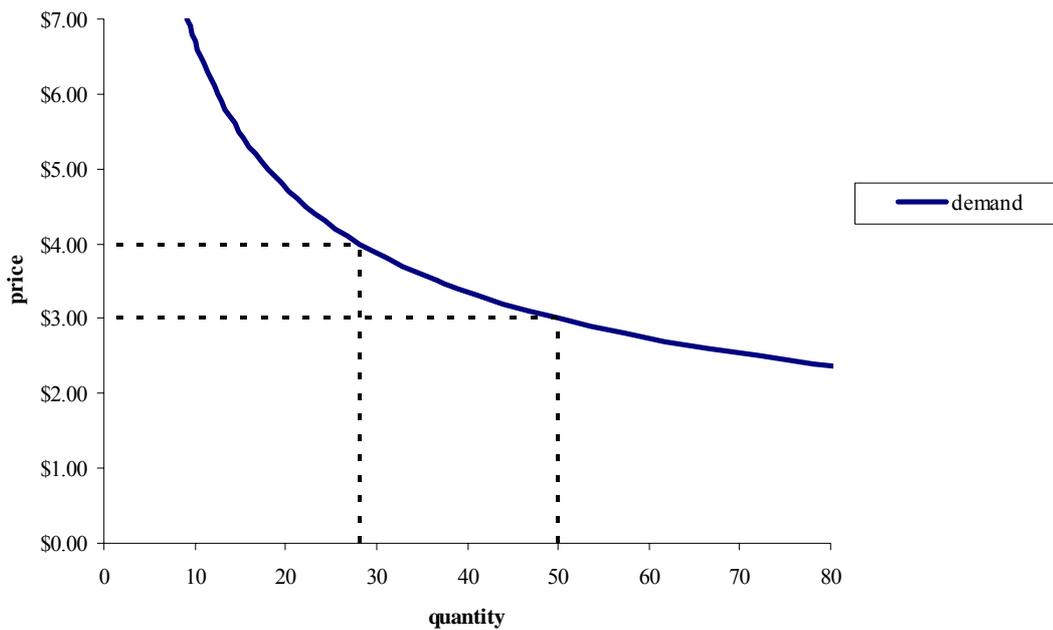
Supply curves slope upwards. The higher the price, the more producers are prepared to sell of that product. The lower the price, the less producers are prepared to sell. In the graph below, at a price of $4.00 producers want to sell 50 items. If the price falls to $3.00, producers want to sell 28 items.

When the price of one product increases, producers want to sell more of that product. For example, if the price of eggs increases, existing producers will be enticed to produce more and new producers will enter the market.

Figure A1.2: Supply
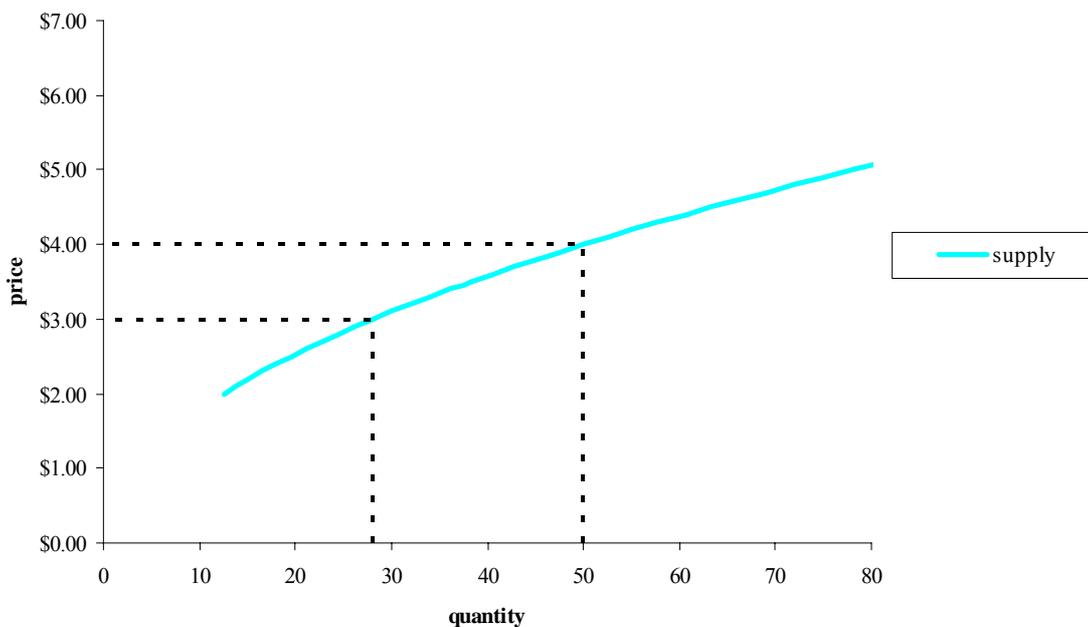
In a market, prices tend to adjust to change the amount consumers want to buy and producers want to sell until there is an equilibrium where producers are producing the amount consumers want to buy. At a price of $4.00, producers want to sell 50 items, but consumers only want to buy 28 items. The excess supply drives the price down, encouraging consumers

to buy more and producers to sell less. At a price of $3.00, producers want to sell 28 items, but consumers want to buy 50 items. The excess demand drives the price up, encouraging producers to produce more and consumers to buy less. An equilibrium price and quantity is found where the demand and supply curves intersect. In this example, the equilibrium price is $3.46 and the equilibrium quantity is 37.5 items.

Figure A1.3: Demand and supply
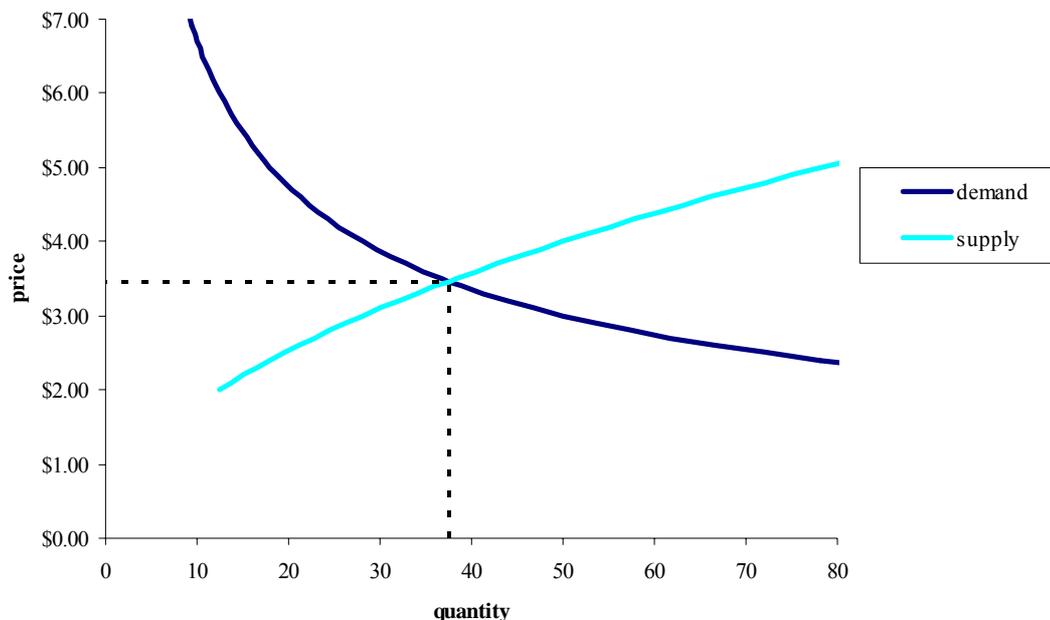
ELASTICITY OF DEMAND AND ELASTICITY OF SUPPLY

Where a price increase causes a relatively large reduction in the quantity demanded by consumers, demand is "elastic". When a price increase causes a relatively small reduction in the quantity demanded by consumers, demand is "inelastic". For example, products with easily accessible substitutes are likely to have elastic demand curves.

In the graph below, an increase in the price from $3.00 to $4.00 causes the quantity demanded to decrease from 50 items to 46 items with the inelastic demand curve, and from 50 items to 28 items with the elastic demand curve.

The implication of this is that prices can increase without losing many sales when demand is inelastic. When demand is elastic, many sales are lost when prices increase.

Figure A1.4: Elastic and inelastic demand
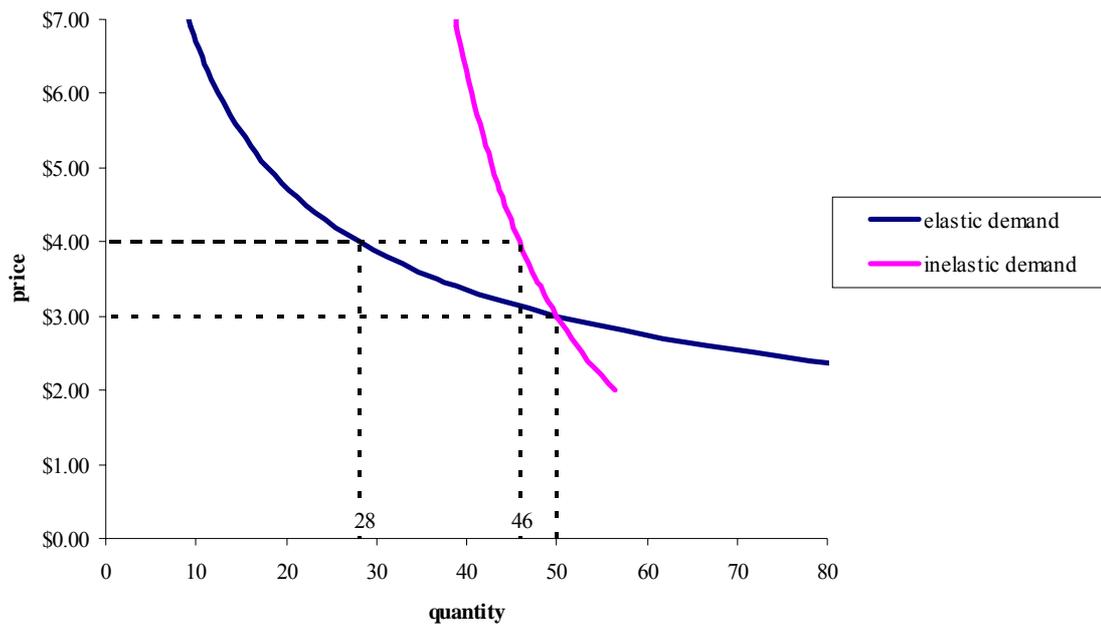
The same applies to supply curves. Where a price increase causes a relatively large increase in the quantity supplied by producers, supply is elastic. Where a price increase causes a relatively small increase in the quantity supplied by producers, supply is inelastic.

Appendix 2: Estimated demand and supply curves

DEMAND

Using the 58.94 million dozen eggs for supermarkets and other retailers with a -1.0 elasticity of demand, 13.12 million dozen eggs for industrial users with a -1.5 elasticity of demand, the price of $2.10 per dozen, and the and the demand curve relationship, $Q=AP^{\varepsilon}$, the demand curves for cage eggs are estimated as:

- $Q = 123,778,800(P)^{-1.0}$ for supermarkets and other retailers; and

- $Q = 39,919,700(P)^{-1.5}$ for industrial users.

SUPPLY

Using the total production of 72.06 million dozen eggs with a 0.7 elasticity of supply, the price of $2.10 per dozen, and the supply curve relationship, $Q=AP^{\varepsilon}$, the supply curve for cage eggs is estimated as $Q = 42,869,300(P)^{0.7}$.

Appendix 3: Sensitivity analysis

The estimated results using the main assumptions are presented in the tables immediately below.

The results from changes to assumptions are then presented in the rest of this appendix.

The risk to the industry is much lower if demand is less elastic than the estimates used below.

The risk to the industry is also lower if cages last longer. If cages last longer, the date by which cages fully depreciate is later, but the cost of cages is spread over more years. This lowers the per annum cost of paying for two sets of cages if colony cages are required before existing cages fully depreciate.

MAIN ASSUMPTIONS

The main assumptions are:
- demand for eggs does not change over time;
- the elasticity of demand for eggs is -1.0 for supermarkets and -1.5 for industrial users;
- the elasticity of supply of eggs is 0.7;
- farms that use cages will install colony cages rather than switch to free-range or barn production (the costs of this change are set out in Chapter 6.1); and
- cages have a useful lifetime of about eight years, and farms finance the cost of converting to colony cages at a cost of 9% per annum compounding monthly.

The estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
- a 14.03% higher price until 1 January 2022, falling to 10.41% higher after; and
- quantity 13.32% lower until 1 January 2022, falling to 10.22% lower after.

The estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
- a 13.23% higher price until 1 January 2019, falling to 10.34% higher after; and
- quantity 12.65% lower until 1 January 2019, falling to 10.16% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.39	$2.32
		(1.19%)	(14.03%)	(10.41%)
Quantity (mil. dozen) – total domestic production	72.06	71.13	62.46	64.69
		(-1.29%)	(-13.32%)	(-10.22%)
Quantity – supermarkets and other retailers	58.94	58.25	51.69	53.39
		(-1.18%)	(-12.30%)	(-9.43%)
Quantity – industrial users	13.12	12.89	10.77	11.31
		(-1.77%)	(-17.88%)	(-13.80%)
Equivalent no. of farms	13.35	13.07	10.55	11.18
		(-2.10%)	(-20.93%)	(-16.23%)
Quantity per farm (dozen)	5,398,700	5,443,800	5,918,400	5,786,100

	(0.83%)	(9.63%)	(7.18%)
No. of birds in colony cages in New Zealand		2,498,500	2,587,800
Increase in birds overseas	9,300	93,800	72,400
Change in consumer surplus	-$1,796,200	-$19,751,100	-$14,914,400
Change in producer surplus	-$84,300	-$838,000	-$650,000
Total change in surplus	-$1,880,400	-$20,589,100	-$15,564,400
Cost per bird		$8.24	$6.01

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32
		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	72.06	62.94	64.74
		(-12.65%)	(-10.16%)
Quantity – supermarkets and other retailers	58.94	52.06	53.42
		(-11.68%)	(-9.37%)
Quantity – industrial users	13.12	10.89	11.32
		(-17.00%)	(-13.72%)
Equivalent no. of farms	13.35	10.69	11.19
		(-19.93%)	(-16.14%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		2,517,700	2,589,400
Increase in birds overseas		89,200	72,000
Change in consumer surplus		-$18,696,800	-$14,825,400
Change in producer surplus		-$797,900	-$646,400
Total change in surplus		-$19,494,800	-$15,471,800
Cost per bird		$7.74	$5.97

LESS ELASTIC DEMAND 1

If the elasticity of demand is -0.3 for supermarkets and -1.5 for industrial users:
- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 14.03% higher price until 1 January 2022, falling to 10.41% higher after;
  - quantity 6.41% lower until 1 January 2022, falling to 4.91% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 13.23% higher price until 1 January 2019, falling to 10.34% higher after; and
  - quantity 6.09% lower until 1 January 2019, falling to 4.88% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.39	$2.32
		(1.19%)	(14.03%)	(10.41%)
Quantity (mil. dozen) – total domestic production	72.06	71.62	67.44	68.53
		(-0.61%)	(-6.41%)	(-4.91%)
Quantity – supermarkets and other retailers	58.94	58.73	56.67	57.22
		(-0.36%)	(-3.86%)	(-2.93%)
Quantity – industrial users	13.12	12.89	10.77	11.31
		(-1.77%)	(-17.88%)	(-13.80%)
Equivalent no. of farms	13.35	13.16	11.39	11.84
		(-1.44%)	(-14.63%)	(-11.27%)
Quantity per farm (dozen)	5,398,700	5,443,800	5,918,400	5,786,100
		(0.83%)	(9.63%)	(7.18%)
No. of birds in colony cages in New Zealand			2,697,600	2,741,000
Increase in birds overseas		9,300	93,800	72,400
Change in consumer surplus		-$1,802,400	-$20,520,900	-$15,349,000
Change in producer surplus		-$57,500	-$585,800	-$451,400
Total change in surplus		-$1,859,900	-$21,106,800	-$15,800,400
Cost per bird			$7.82	$5.76

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32
		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	72.06	67.67	68.55
		(-6.09%)	(-4.88%)
Quantity – supermarkets and other retailers	58.94	56.79	57.23

		(-3.66%)	(-2.91%)
Quantity – industrial users	13.12	10.89	11.32
		(-17.00%)	(-13.72%)
Equivalent no. of farms	13.35	11.49	11.85
		(-13.91%)	(-11.21%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		2,706,900	2,741,800
Increase in birds overseas		89,200	72,000
Change in consumer surplus		-$19,384,800	-$15,254,900
Change in producer surplus		-$557,000	-$448,900
Total change in surplus		-$19,941,700	-$15,703,800
Cost per bird		$7.37	$5.73

LESS ELASTIC DEMAND 2

If the elasticity of demand is -0.3 for supermarkets and -0.5 for industrial users:
- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 14.03% higher price until 1 January 2022, falling to 10.41% higher after;
  - quantity 4.32% lower until 1 January 2022, falling to 3.27% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 13.23% higher price until 1 January 2019, falling to 10.34% higher after; and
  - quantity 4.09% lower until 1 January 2019, falling to 3.25% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.39	$2.32
		(1.19%)	(14.03%)	(10.41%)
Quantity (mil. dozen) – total domestic production	72.06	71.77	68.95	69.70
		(-0.40%)	(-4.32%)	(-3.27%)
Quantity – supermarkets and other retailers	58.94	58.73	56.67	57.22
		(-0.36%)	(-3.86%)	(-2.93%)
Quantity – industrial users	13.12	13.04	12.28	12.48
		(-0.59%)	(-6.35%)	(-4.83%)
Equivalent no. of farms	13.35	13.18	11.65	12.05
		(-1.22%)	(-12.72%)	(-9.75%)
Quantity per farm (dozen)	5,398,700	5,443,800	5,918,400	5,786,100
		(0.83%)	(9.63%)	(7.18%)
No. of birds in colony cages in New Zealand			2,758,000	2,788,100
Increase in birds overseas		3,100	33,300	25,300
Change in consumer surplus		-$1,804,400	-$20,758,300	-$15,484,000
Change in producer surplus		-$49,000	-$509,200	-$390,400
Total change in surplus		-$1,853,400	-$21,267,500	-$15,874,400
Cost per bird			$7.71	$5.69

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32
		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	72.06	69.11	69.72
		(-4.09%)	(-3.25%)
Quantity – supermarkets and	58.94	56.79	57.23

other retailers		(-3.66%)	(-2.91%)
Quantity – industrial users	13.12	12.33	12.49
		(-6.02%)	(-4.80%)
Equivalent no. of farms	13.35	11.74	12.05
		(-12.08%)	(-9.69%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		2,764,500	2,788,600
Increase in birds overseas		31,600	25,200
Change in consumer surplus		-$19,597,200	-$15,388,300
Change in producer surplus		-$483,600	-$388,100
Total change in surplus		-$20,080,800	-$15,776,400
Cost per bird		$7.26	$5.66

MORE ELASTIC SUPPLY

If the elasticity of supply is 1.5:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 15.01% higher price until 1 January 2022, falling to 11.31% higher after;
  - quantity 14.12% lower until 1 January 2022, falling to 11.01% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 14.11% higher price until 1 January 2019, falling to 11.18% higher after; and
  - quantity 13.38% lower until 1 January 2019, falling to 10.90% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.42	$2.34
		(1.31%)	(15.01%)	(11.31%)
Quantity (mil. dozen) – total domestic production	72.06	71.04	61.88	64.12
		(-1.41%)	(-14.12%)	(-11.01%)
Quantity – supermarkets and other retailers	58.94	58.18	51.25	52.95
		(-1.29%)	(-13.05%)	(-10.16%)
Quantity – industrial users	13.12	12.86	10.64	11.17
		(-1.93%)	(-18.92%)	(-14.85%)
Equivalent no. of farms	13.35	12.90	9.29	10.11
		(-3.32%)	(-30.37%)	(-24.23%)
Quantity per farm (dozen)	5,398,700	5,505,300	6,658,900	6,340,100
		(1.97%)	(23.34%)	(17.44%)
No. of birds in colony cages in New Zealand			2,475,400	2,564,900
Increase in birds overseas		10,200	99,300	77,900
Change in consumer surplus		-$1,969,600	-$21,031,700	-$16,137,500
Change in producer surplus		-$132,900	-$1,216,200	-$970,100
Total change in surplus		-$2,102,500	-$22,247,900	-$17,107,600
Cost per bird			$8.99	$6.67

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.40	$2.33
		(14.11%)	(11.18%)
Quantity (mil. dozen) – total domestic production	72.06	62.42	64.21
		(-13.38%)	(-10.90%)
Quantity – supermarkets and	58.94	51.65	53.02

other retailers		(-12.36%)	(-10.05%)
Quantity – industrial users	13.12	10.76	11.19
		(-17.96%)	(-14.70%)
Equivalent no. of farms	13.35	9.48	10.14
		(-28.94%)	(-23.99%)
Quantity per farm (dozen)	5,398,800	6,580,800	6,328,900
		(21.89%)	(17.23%)
No. of birds in colony cages in New Zealand		2,496,600	2,568,200
Increase in birds overseas		94,200	77,100
Change in consumer surplus		-$19,855,700	-$15,959,800
Change in producer surplus		-$1,158,900	-$960,800
Total change in surplus		-$21,014,600	-$16,920,600
Cost per bird		$8.42	$6.59

LESS ELASTIC DEMAND, MORE ELASTIC SUPPLY

If the elasticity of demand is -0.3 for supermarkets and -0.5 for industrial users, and the elasticity of supply is 1.5:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 15.01% higher price until 1 January 2022, falling to 11.31% higher after;
  - quantity 4.59% lower until 1 January 2022, falling to 3.54% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 14.11% higher price until 1 January 2019, falling to 11.18% higher after; and
  - quantity 4.34% lower until 1 January 2019, falling to 3.50% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.42	$2.34
		(1.31%)	(15.01%)	(11.31%)
Quantity (mil. dozen) – total domestic production	72.06	71.75	68.75	69.51
		(-0.44%)	(-4.59%)	(-3.54%)
Quantity – supermarkets and other retailers	58.94	58.71	56.52	57.08
		(-0.39%)	(-4.11%)	(-3.16%)
Quantity – industrial users	13.12	13.03	12.23	12.43
		(-0.65%)	(-6.75%)	(-5.22%)
Equivalent no. of farms	13.35	13.03	10.32	10.96
		(-2.36%)	(-22.65%)	(-17.86%)
Quantity per farm (dozen)	5,398,700	5,505,300	6,658,900	6,340,100
		(1.97%)	(23.34%)	(17.44%)
No. of birds in colony cages in New Zealand			2,750,100	2,780,400
Increase in birds overseas		3,400	35,400	27,400
Change in consumer surplus		-$1,979,400	-$22,177,100	-$16,806,100
Change in producer surplus		-$94,600	-$906,800	-$715,200
Total change in surplus		-$2,074,000	-$23,083,900	-$17,521,200
Cost per bird			$8.39	$6.30

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.40	$2.33
		(14.11%)	(11.18%)
Quantity (mil. dozen) – total domestic production	72.06	68.93	69.54
		(-4.34%)	(-3.50%)

Quantity – supermarkets and other retailers	58.94	56.65 (-3.88%)	57.10 (-3.13%)
Quantity – industrial users	13.12	12.28 (-6.39%)	12.44 (-5.16%)
Equivalent no. of farms	13.35	10.48 (-21.52%)	10.99 (-17.68%)
Quantity per farm (dozen)	5,398,800	6,580,700 (21.89%)	6,328,900 (17.23%)
No. of birds in colony cages in New Zealand		2,757,400	2,781,500
Increase in birds overseas		33,500	27,100
Change in consumer surplus		-$20,873,500	-$16,613,300
Change in producer surplus		-$861,700	-$708,000
Total change in surplus		-$21,735,200	-$17,321,300
Cost per bird		$7.88	$6.23

LOWER INTEREST RATE

If the interest rate is 7%:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 12.82% higher price until 1 January 2022, falling to 9.44% higher after;
  - quantity 12.31% lower until 1 January 2022, falling to 9.36% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 12.08% higher price until 1 January 2019, falling to 9.39% higher after; and
  - quantity 11.68% lower until 1 January 2019, falling to 9.31% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.12	$2.37	$2.30
		(1.07%)	(12.82%)	(9.44%)
Quantity (mil. dozen) – total domestic production	72.06	71.23	63.19	65.32
		(-1.15%)	(-12.31%)	(-9.36%)
Quantity – supermarkets and other retailers	58.94	58.32	52.24	53.86
		(-1.06%)	(-11.36%)	(-8.63%)
Quantity – industrial users	13.12	12.91	10.95	11.46
		(-1.58%)	(-16.55%)	(-12.66%)
Equivalent no. of farms	13.35	13.10	10.76	11.36
		(-1.89%)	(-19.41%)	(-14.91%)
Quantity per farm (dozen)	5,398,700	5,439,100	5,874,400	5,750,600
		(0.75%)	(8.81%)	(6.52%)
No. of birds in colony cages in New Zealand			2,527,600	2,612,600
Increase in birds overseas		8,300	86,900	66,400
Change in consumer surplus		-$1,608,100	-$18,156,500	-$13,595,400
Change in producer surplus		-$75,500	-$777,200	-$596,900
Total change in surplus		-$1,683,600	-$18,933,700	-$14,192,200
Cost per bird			$7.49	$5.43

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.35	$2.30
		(12.08%)	(9.39%)
Quantity (mil. dozen) – total domestic production	72.06	63.64	65.35
		(-11.68%)	(-9.31%)
Quantity – supermarkets and	58.94	52.59	53.88

other retailers		(-10.78%)	(-8.58%)
Quantity – industrial users	13.12	11.05	11.47
		(-15.73%)	(-12.59%)
Equivalent no. of farms	13.35	10.88	11.37
		(-18.46%)	(-14.83%)
Quantity per farm (dozen)	5,398,800	5,847,500	5,748,700
		(8.31%)	(6.48%)
No. of birds in colony cages in New Zealand		2,545,700	2,614,000
Increase in birds overseas		82,500	66,100
Change in consumer surplus		-$17,174,600	-$13,522,400
Change in producer surplus		-$739,200	-$593,900
Total change in surplus		-$17,913,800	-$14,116,300
Cost per bird		$7.04	$5.40

HIGHER INTEREST RATE

If the interest rate is 11%:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 15.31% higher price until 1 January 2022, falling to 11.43% higher after;
  - quantity 14.36% lower until 1 January 2022, falling to 11.12% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 14.44% higher price until 1 January 2019, falling to 11.35% higher after; and
  - quantity 13.66% lower until 1 January 2019, falling to 11.05% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.42	$2.34
		(1.33%)	(15.31%)	(11.43%)
Quantity (mil. dozen) – total domestic production	72.06	71.03	61.71	64.05
		(-1.43%)	(-14.36%)	(-11.12%)
Quantity – supermarkets and other retailers	58.94	58.17	51.12	52.89
		(-1.31%)	(-13.28%)	(-10.26%)
Quantity – industrial users	13.12	12.86	10.59	11.15
		(-1.96%)	(-19.24%)	(-14.99%)
Equivalent no. of farms	13.35	13.04	10.35	11.00
		(-2.34%)	(-22.49%)	(-17.61%)
Quantity per farm (dozen)	5,398,700	5,448,900	5,964,800	5,823,700
		(0.93%)	(10.48%)	(7.87%)
No. of birds in colony cages in New Zealand			2,468,500	2,561,900
Increase in birds overseas		10,300	100,900	78,600
Change in consumer surplus		-$1,997,400	-$21,417,300	-$16,302,200
Change in producer surplus		-$93,600	-$900,400	-$705,000
Total change in surplus		-$2,091,000	-$22,317,800	-$17,007,200
Cost per bird			$9.04	$6.64

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.40	$2.34
		(14.44%)	(11.35%)
Quantity (mil. dozen) – total domestic production	72.06	62.22	64.10
		(-13.66%)	(-11.05%)
Quantity – supermarkets and	58.94	51.50	52.93

other retailers		(-12.62%)	(-10.20%)
Quantity – industrial users	13.12	10.71	11.16
		(-18.32%)	(-14.90%)
Equivalent no. of farms	13.35	10.49	11.01
		(-21.44%)	(-17.50%)
Quantity per farm (dozen)	5,398,800	5,933,300	5,820,900
		(9.90%)	(7.82%)
No. of birds in colony cages in New Zealand		2,488,800	2,563,800
Increase in birds overseas		96,100	78,200
Change in consumer surplus		-$20,289,300	-$16,195,800
Change in producer surplus		-$858,300	-$700,800
Total change in surplus		-$21,147,600	-$16,896,600
Cost per bird		$8.50	$6.59

CAGES LAST LONGER 1

If cages last 20 years (depreciate at 5% per annum):

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 9.07% higher price until 1 January 2034, falling to 6.96% higher after;
  - quantity 9.02% lower until 1 January 2034, falling to 7.07% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 8.60% higher price until 1 January 2031, falling to 6.92% higher after; and
  - quantity 8.60% lower until 1 January 2031, falling to 7.03% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2034	Impact after 1 January 2034
Farm gate price (per dozen)	$2.10	$2.12	$2.29	$2.25
		(0.86%)	(9.07%)	(6.96%)
Quantity (mil. dozen) – total domestic production	72.06	71.39	65.56	66.96
		(-0.93%)	(-9.02%)	(-7.07%)
Quantity – supermarkets and other retailers	58.94	58.44	54.04	55.11
		(-0.85%)	(-8.31%)	(-6.51%)
Quantity – industrial users	13.12	12.95	11.52	11.86
		(-1.27%)	(-12.21%)	(-9.60%)
Equivalent no. of farms	13.35	13.14	11.43	11.83
		(-1.52%)	(-14.39%)	(-11.35%)
Quantity per farm (dozen)	5,398,700	5,431,200	5,737,000	5,659,200
		(0.60%)	(6.26%)	(4.82%)
No. of birds in colony cages in New Zealand			2,622,300	2,678,500
Increase in birds overseas		6,700	64,100	50,400
Change in consumer surplus		-$1,293,400	-$13,084,100	-$10,155,300
Change in producer surplus		-$60,800	-$576,100	-$454,500
Total change in surplus		-$1,354,300	-$13,660,200	-$10,609,800
Cost per bird			$5.21	$3.96

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2031	Impact after 1 January 2031
Farm gate price (per dozen)	$2.10	$2.28	$2.25
		(8.60%)	(6.92%)
Quantity (mil. dozen) – total domestic production	72.06	65.87	66.99
		(-8.60%)	(-7.03%)
Quantity – supermarkets and	58.94	54.27	55.13

other retailers		(-7.92%)	(-6.47%)
Quantity – industrial users	13.12	11.59	11.87
		(-11.64%)	(-9.55%)
Equivalent no. of farms	13.35	11.52	11.84
		(-13.73%)	(-11.29%)
Quantity per farm (dozen)	5,398,800	5,719,700	5,657,600
		(5.95%)	(4.80%)
No. of birds in colony cages in New Zealand		2,634,600	2,679,700
Increase in birds overseas		61,100	50,100
Change in consumer surplus		-$12,438,200	-$10,094,800
Change in producer surplus		-$549,600	-$451,900
Total change in surplus		-$12,987,800	-$10,546,700
Cost per bird		$4.93	$3.94

CAGES LAST LONGER 2

If cages last 25 years (depreciate at 4% per annum):

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 8.61% higher price until 1 January 2039, falling to 6.65% higher after;
  - quantity 8.61% lower until 1 January 2039, falling to 6.77% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 8.17% higher price until 1 January 2036, falling to 6.61% higher after; and
  - quantity 8.20% lower until 1 January 2036, falling to 6.73% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2039	Impact after 1 January 2039
Farm gate price (per dozen)	$2.10	$2.12	$2.28	$2.24
		(0.83%)	(8.61%)	(6.65%)
Quantity (mil. dozen) – total domestic production	72.06	71.41	65.86	67.18
		(-0.90%)	(-8.61%)	(-6.77%)
Quantity – supermarkets and other retailers	58.94	58.46	54.27	55.27
		(-0.82%)	(-7.93%)	(-6.23%)
Quantity – industrial users	13.12	12.96	11.59	11.91
		(-1.23%)	(-11.65%)	(-9.20%)
Equivalent no. of farms	13.35	13.15	11.51	11.90
		(-1.47%)	(-13.74%)	(-10.88%)
Quantity per farm (dozen)	5,398,700	5,430,000	5,720,100	5,647,500
		(0.58%)	(5.95%)	(4.61%)
No. of birds in colony cages in New Zealand			2,634,400	2,687,200
Increase in birds overseas		6,400	61,100	48,300
Change in consumer surplus		-$1,247,300	-$12,451,900	-$9,710,000
Change in producer surplus		-$58,700	-$550,200	-$435,600
Total change in surplus		-$1,305,900	-$13,002,100	-$10,145,600
Cost per bird			$4.94	$3.78

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2036	Impact after 1 January 2036
Farm gate price (per dozen)	$2.10	$2.27	$2.24
		(8.17%)	(6.61%)
Quantity (mil. dozen) – total domestic production	72.06	66.15	67.21
		(-8.20%)	(-6.73%)
Quantity – supermarkets and	58.94	54.49	55.29

other retailers		(-7.55%)	(-6.20%)
Quantity – industrial users	13.12	11.66	11.92
		(-11.12%)	(-9.15%)
Equivalent no. of farms	13.35	11.60	11.90
		(-13.11%)	(-10.82%)
Quantity per farm (dozen)	5,398,800	5,703,900	5,646,000
		(5.65%)	(4.58%)
No. of birds in colony cages in New Zealand		2,646,000	2,688,300
Increase in birds overseas		58,300	48,000
Change in consumer surplus		-$11,845,300	-$9,651,600
Change in producer surplus		-$525,100	-$433,200
Total change in surplus		-$12,370,400	-$10,084,700
Cost per bird		$4.68	$3.75

LOWER CAPITAL COSTS

If capital costs (including resource consent costs) are 10% lower:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 12.56% higher price until 1 January 2022, falling to 9.30% higher after;
  - quantity 12.09% lower until 1 January 2022, falling to 9.24% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 11.85% higher price until 1 January 2019, falling to 9.25% higher after; and
  - quantity 11.48% lower until 1 January 2019, falling to 9.19% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.12	$2.36	$2.30
		(1.07%)	(12.56%)	(9.30%)
Quantity (mil. dozen) – total domestic production	72.06	71.23	63.35	65.40
		(-1.15%)	(-12.09%)	(-9.24%)
Quantity – supermarkets and other retailers	58.94	58.32	52.37	53.93
		(-1.06%)	(-11.16%)	(-8.51%)
Quantity – industrial users	13.12	12.91	10.98	11.48
		(-1.58%)	(-16.26%)	(-12.49%)
Equivalent no. of farms	13.35	13.10	10.80	11.38
		(-1.88%)	(-19.07%)	(-14.72%)
Quantity per farm (dozen)	5,398,700	5,439,000	5,864,900	5,745,600
		(0.75%)	(8.63%)	(6.43%)
No. of birds in colony cages in New Zealand			2,534,000	2,616,200
Increase in birds overseas		8,300	85,300	65,500
Change in consumer surplus		-$1,605,400	-$17,809,100	-$13,408,200
Change in producer surplus		-$75,400	-$763,800	-$589,300
Total change in surplus		-$1,680,800	-$18,572,900	-$13,997,400
Cost per bird			$7.33	$5.35

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.35	$2.29
		(11.85%)	(9.25%)
Quantity (mil. dozen) – total domestic production	72.06	63.79	65.44
		(-11.48%)	(-9.19%)
Quantity – supermarkets and	58.94	52.70	53.95

other retailers		(-10.59%)	(-8.47%)
Quantity – industrial users	13.12	11.09	11.49
		(-15.46%)	(-12.43%)
Equivalent no. of farms	13.35	10.92	11.39
		(-18.15%)	(-14.64%)
Quantity per farm (dozen)	5,398,800	5,838,900	5,743,600
		(8.15%)	(6.39%)
No. of birds in colony cages in New Zealand		2,551,600	2,617,600
Increase in birds overseas		81,100	65,200
Change in consumer surplus		-$16,857,200	-$13,333,800
Change in producer surplus		-$726,800	-$586,200
Total change in surplus		-$17,584,000	-$13,920,000
Cost per bird		$6.89	$5.32

HIGHER CAPITAL COSTS

If capital costs (including resource consent costs) are 10% higher:
- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 15.51% higher price until 1 January 2022, falling to 11.52% higher after;
  - quantity 14.53% lower until 1 January 2022, falling to 11.20% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 14.62% higher price until 1 January 2019, falling to 11.45% higher after; and
  - quantity 13.81% lower until 1 January 2019, falling to 11.13% lower after.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	Current	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.43	$2.34
		(1.32%)	(15.51%)	(11.52%)
Quantity (mil. dozen) – total domestic production	72.06	71.03	61.59	63.99
		(-1.42%)	(-14.53%)	(-11.20%)
Quantity – supermarkets and other retailers	58.94	58.17	51.03	52.85
		(-1.31%)	(-13.43%)	(-10.33%)
Quantity – industrial users	13.12	12.86	10.57	11.14
		(-1.95%)	(-19.45%)	(-15.09%)
Equivalent no. of farms	13.35	13.04	10.31	10.98
		(-2.33%)	(-22.73%)	(-17.73%)
Quantity per farm (dozen)	5,398,700	5,448,700	5,972,200	5,827,000
		(0.93%)	(10.62%)	(7.93%)
No. of birds in colony cages in New Zealand			2,463,700	2,559,600
Increase in birds overseas		10,300	102,100	79,200
Change in consumer surplus		-$1,989,900	-$21,683,100	-$16,422,900
Change in producer surplus		-$93,200	-$910,300	-$709,800
Total change in surplus		-$2,083,100	-$22,593,300	-$17,132,600
Cost per bird			$9.17	$6.69

Long-term market impact with large farms – only colony cages

Variable	Current	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.41	$2.34
		(14.62%)	(11.45%)
Quantity (mil. dozen) – total domestic production	72.06	62.11	64.04
		(-13.81%)	(-11.13%)
Quantity – supermarkets and	58.94	51.42	52.89

other retailers		(-12.76%)	(-10.27%)
Quantity – industrial users	13.12	10.69	11.15
		(-18.51%)	(-15.00%)
Equivalent no. of farms	13.35	10.46	11.00
		(-21.66%)	(-17.62%)
Quantity per farm (dozen)	5,398,800	5,940,000	5,824,200
		(10.03%)	(7.88%)
No. of birds in colony cages in New Zealand		2,484,400	2,561,500
Increase in birds overseas		97,100	78,700
Change in consumer surplus		-$20,529,300	-$16,318,800
Change in producer surplus		-$867,300	-$705,700
Total change in surplus		-$21,396,600	-$17,024,500
Cost per bird		$8.61	$6.65

CONSUMERS SWITCH TO FREE-RANGE 1

If demand for free-range eggs increases at the expense of cage eggs such that there is a 10% drop in demand for cage eggs by supermarkets and other retailers:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 14.03% higher price until 1 January 2022, falling to and 10.41% higher after;
  - quantity 13.41% lower until 1 January 2022, falling to 10.29% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 13.23% higher price until 1 January 2019, falling to 10.34% higher after; and
  - quantity 12.74% lower until 1 January 2019, falling to 10.23% lower after.

These results are for the cage egg market only. It should be noted that the quantity supplied of free-range eggs will increase as a result of the change in demand.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	After demand change	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.39	$2.32
		(1.19%)	(14.03%)	(10.41%)
Quantity (mil. dozen) – total domestic production	66.17	65.31	57.29	59.36
		(-1.30%)	(-13.41%)	(-10.29%)
Quantity – supermarkets and other retailers	53.05	52.42	46.52	48.05
		(-1.18%)	(-12.30%)	(-9.43%)
Quantity – industrial users	13.12	12.89	10.77	11.31
		(-1.77%)	(-17.88%)	(-13.80%)
Equivalent no. of farms	12.26	12.00	9.68	10.26
		(-2.11%)	(-21.01%)	(-16.30%)
Quantity per farm (dozen)	5,398,700	5,443,800	5,918,500	5,786,100
		(0.83%)	(9.63%)	(7.18%)
No. of birds in colony cages in New Zealand			2,291,700	2,374,200
Increase in birds overseas		9,300	93,800	72,400
Change in consumer surplus		-$1,649,300	-$18,127,300	-$13,689,000
Change in producer surplus		-$77,700	-$772,600	-$599,300
Total change in surplus		-$1,727,000	-$18,899,900	-$14,288,200
Cost per bird			$8.25	$6.02

Long-term market impact with large farms – only colony cages

Variable	After demand change	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32

		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	66.17	57.74	59.39
		(-12.74%)	(-10.23%)
Quantity – supermarkets and other retailers	53.05	46.85	48.08
		(-11.68%)	(-9.37%)
Quantity – industrial users	13.12	10.89	11.32
		(-17.00%)	(-13.72%)
Equivalent no. of farms	12.26	9.80	10.27
		(-20.01%)	(-16.21%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		2,309,500	2,375,800
Increase in birds overseas		89,200	72,000
Change in consumer surplus		-$17,159,700	-$13,607,600
Change in producer surplus		-$735,600	-$596,000
Total change in surplus		-$17,895,300	-$14,203,600
Cost per bird		$7.75	$5.98

CONSUMERS SWITCH TO FREE-RANGE 2

If demand for free-range eggs increases at the expense of cage eggs such that there is a 25% drop in demand for cage eggs by supermarkets and other retailers:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 14.03% higher price until 1 January 2022, falling to 10.41% higher after;
  - quantity 13.58% lower until 1 January 2022, falling to 10.43% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 13.23% higher price until 1 January 2019, falling to 10.34% higher after; and
  - quantity 12.90% lower until 1 January 2019, falling to 10.37% lower after.

These results are for the cage egg market only. It should be noted that the quantity supplied of free-range eggs will increase as a result of the change in demand.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	After demand change	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.39	$2.32
		(1.19%)	(14.03%)	(10.41%)
Quantity (mil. dozen) – total domestic production	57.32	56.57	49.54	51.35
		(-1.31%)	(-13.58%)	(-10.43%)
Quantity – supermarkets and other retailers	44.21	43.68	38.77	40.04
		(-1.18%)	(-12.30%)	(-9.43%)
Quantity – industrial users	13.12	12.89	10.77	11.31
		(-1.77%)	(-17.88%)	(-13.80%)
Equivalent no. of farms	10.62	10.39	8.37	8.87
		(-2.13%)	(-21.17%)	(-16.42%)
Quantity per farm (dozen)	5,398,700	5,443,800	5,918,500	5,786,100
		(0.83%)	(9.63%)	(7.18%)
No. of birds in colony cages in New Zealand			1,981,600	2,053,900
Increase in birds overseas		9,300	93,800	72,400
Change in consumer surplus		-$1,428,800	-$15,689,600	-$11,851,000
Change in producer surplus		-$67,900	-$674,300	-$523,200
Total change in surplus		-$1,496,700	-$16,363,900	-$12,374,100
Cost per bird			$8.26	$6.02

Long-term market impact with large farms – only colony cages

Variable	After demand change	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32

		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	57.32	49.93	51.38
		(-12.90%)	(-10.37%)
Quantity – supermarkets and other retailers	44.21	39.04	40.06
		(-11.68%)	(-9.37%)
Quantity – industrial users	13.12	10.89	11.32
		(-17.00%)	(-13.72%)
Equivalent no. of farms	10.62	8.48	8.88
		(-20.16%)	(-16.33%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		1,997,200	2,055,300
Increase in birds overseas		89,200	72,000
Change in consumer surplus		-$14,852,900	-$11,780,600
Change in producer surplus		-$642,100	-$520,300
Total change in surplus		-$15,494,900	-$12,300,900
Cost per bird		$7.76	$5.99

CONSUMERS SWITCH TO FREE-RANGE 3

If demand for free-range eggs increases at the expense of cage eggs such that there is a 50% drop in demand for cage eggs by supermarkets and other retailers:

- the estimated impacts of a minimum standard requiring at least 550 square centimetres in floor area followed by colony cages at a later date are:
  - a 14.03% higher price until 1 January 2022, falling to 10.41% higher after;
  - quantity 14.02% lower until 1 January 2022, falling to 10.41% lower after; and
- the estimated impacts of a minimum standard replacing the 550 square centimetres requirement with a colony cage requirement are:
  - a 13.23% higher price until 1 January 2019, falling to 10.34% higher after; and
  - quantity 13.32% lower until 1 January 2019, falling to 10.71% lower after.

These results are for the cage egg market only. It should be noted that the quantity supplied of free-range eggs will increase as a result of the change in demand.

Long-term market impact with large farms – 550 square centimetres then colony cages

Variable	After demand change	Impact by 1 January 2014	Impact before 1 January 2022	Impact after 1 January 2022
Farm gate price (per dozen)	$2.10	$2.13	$2.39	$2.32
		(1.19%)	(14.03%)	(10.41%)
Quantity (mil. dozen) – total domestic production	42.59	42.01	36.62	38.00
		(-1.36%)	(-14.02%)	(-10.77%)
Quantity – supermarkets and other retailers	29.47	29.12	25.84	26.69
		(-1.18%)	(-12.30%)	(-9.43%)
Quantity – industrial users	13.12	12.89	10.77	11.31
		(-1.77%)	(-17.88%)	(-13.80%)
Equivalent no. of farms	7.89	7.72	6.19	6.57
		(-2.18%)	(-21.57%)	(-16.75%)
Quantity per farm (dozen)	5,398,700	5,443,800	5,918,500	5,786,100
		(0.83%)	(9.63%)	(7.18%)
No. of birds in colony cages in New Zealand			1,464,700	1,520,000
Increase in birds overseas		9,300	93,800	72,400
Change in consumer surplus		-$1,061,300	-$11,626,700	-$8,787,500
Change in producer surplus		-$51,500	-$510,500	-$396,300
Total change in surplus		-$1,112,800	-$12,137,200	-$9,183,900
Cost per bird			$8.29	$6.04

Long-term market impact with large farms – only colony cages

Variable	After demand change	Impact before 1 January 2019	Impact after 1 January 2019
Farm gate price (per dozen)	$2.10	$2.38	$2.32

		(13.23%)	(10.34%)
Quantity (mil. dozen) – total domestic production	42.59	36.92	38.03
		(-13.32%)	(-10.71%)
Quantity – supermarkets and other retailers	29.47	26.03	26.71
		(-11.68%)	(-9.37%)
Quantity – industrial users	13.12	10.89	11.32
		(-17.00%)	(-13.72%)
Equivalent no. of farms	7.89	6.27	6.57
		(-20.54%)	(-16.66%)
Quantity per farm (dozen)	5,398,800	5,889,300	5,783,700
		(9.09%)	(7.13%)
No. of birds in colony cages in New Zealand		1,476,600	1,521,100
Increase in birds overseas		89,200	72,000
Change in consumer surplus		-$11,008,100	-$8,735,400
Change in producer surplus		-$486,200	-$394,200
Total change in surplus		-$11,494,300	-$9,129,600
Cost per bird		$7.78	$6.00