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Egg market Dynamics – An Investigation into the Impact of Changed Production Requirements

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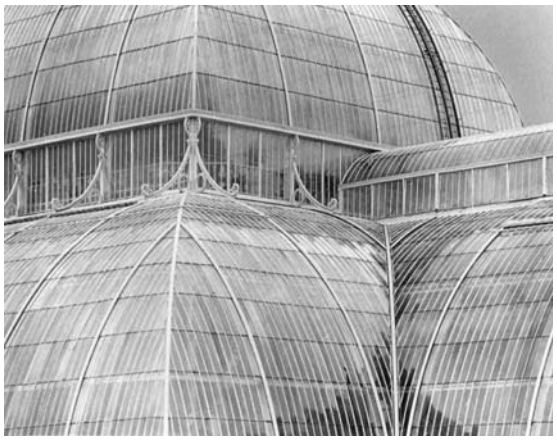

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1 Background

LECG have been asked to examine the possible impacts on the New Zealand egg market of the proposed changes to the Code of Welfare for Layer Hens currently being considered by the National Animal Welfare Advisory Committee (NAWAC).

The proposed Code changes will require production from caged egg farms to move from what are known as battery cages to colony systems. This will impose costs on producers because:

- Existing cage systems cannot be modified to meet the requirements of the Code, and therefore will need to be replaced.
- Increasing from 550 sq cm to 750 sq cm per bird will reduce the total number of birds able to be housed in existing sheds.
- The number of birds housed may be reduced further because the number of rows or tiers may also reduce capacity.

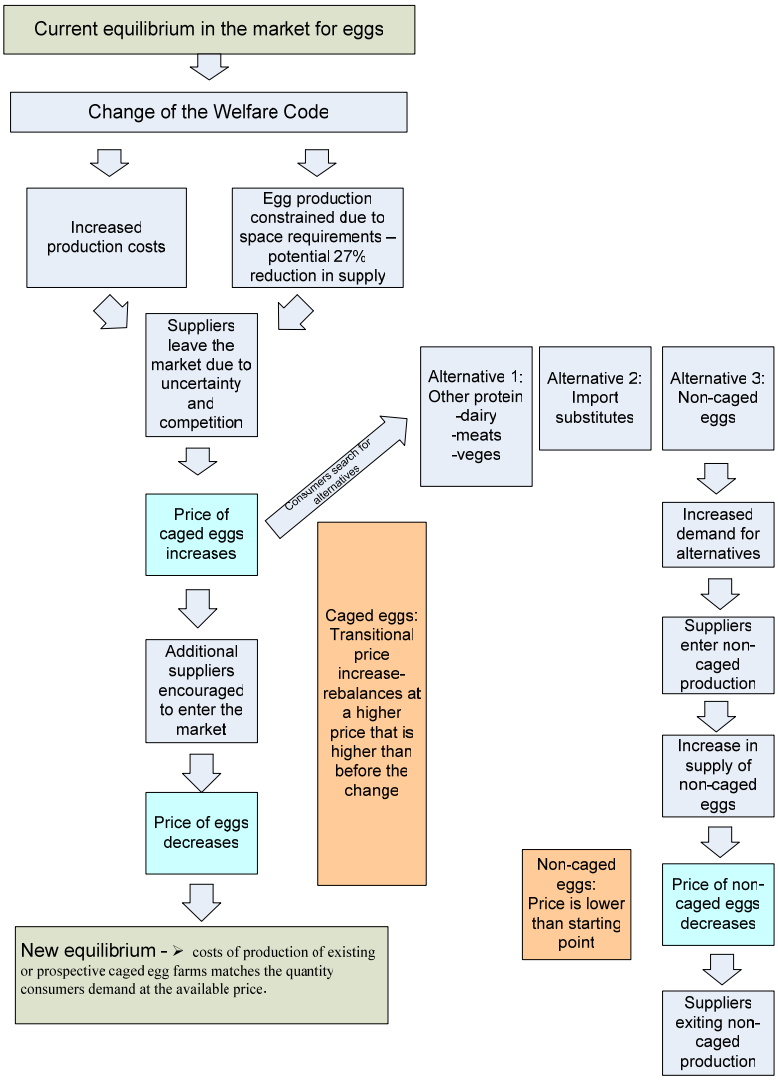
This report considers the impact which the proposed code changes will have on egg supply and demand and the ability of producers to pass on cost increases. The following findings have been made:

- The introduction of the proposed welfare code changes is expected to disrupt current market dynamics. The overall result is one where egg production from colony cages is expected to decrease with resulting higher egg prices for consumers. Analysis indicates that in certain circumstances there could be a large increase in egg prices.
- The non-colony market should increase supply in response to demand with some lowering of prices. Those non-colony operations that currently have marginal profitability could be forced out of the industry, replaced by lower-cost non-colony operations.
- Timing of the code introduction, the length of time allowed for transition and the actual outcomes all introduce a degree of uncertainty.
- A rapid introduction could make prices highly volatile and disrupt the balance in both the egg and protein markets.
- An early introduction may see a large investment in capital infrastructure made obsolete where a longer time-frame could allow replacement near the end of economic life.
- Movements into and out of different sections of the egg market, and the possible demand and price impacts contributes to the risks faced by egg farming businesses and can have its own impact on prices.

2 Key findings on egg market dynamics

The following section outlines the relationship between supply and demand given changes in the cost of production and the resulting price paid for eggs by consumers. The commencing proposition is that there is currently a balance in total egg numbers of approximately 60 million dozen with the existing cost/price structure seen by egg farms and the price/benefit received by consumers.

Chart: Map of egg market dynamics



In the first instance, ignoring substitution or other external factors, the introduction of the welfare code will displace the current equilibrium. There are examples of where changed production costs have resulted in a change in prices to end-users (increased grain and feed prices is the example given during 2008).[1]

While there are relevant examples of the increased costs being passed through to the consumer, the degree to which this is possible has not been tested. Therefore, an assessment of whether the full costs from the new animal welfare code will be passed on to consumers remains untested.

2.1 Initial Price Response – Increased Cost and Decreased Supply

Consumers, for their part, when faced with an increase in price will moderate their demand for eggs. Conversely, when faced with a reduction in availability, prices would rise. The purchasing behaviours change so that the price consumers are prepared to pay matches the available supply at that price.

This establishes a basic framework with the following factors:

- The cost of production will increase and supply will decrease because of the introduction of the new welfare code.
- The increase in costs should be able to be passed on to consumers either in full or in part.
- The restriction on supply will also contribute to increased costs due to scarcity pricing.
- Consumers, faced with an increase in price, will reduce their demand for eggs so that supply and demand match at a common price.

Beyond these first order impacts, there are consequential impacts for both supply and demand. In the first instance it would appear that the number of eggs will be significantly constrained due to the new space requirements. Assuming a short transition period with little time for adjustment:

- The potential reduction in supply is linked to the ratio of space requirements under different welfare standards. The increase of 550 cm^2 to 750cm^2 represents a reduction of 27% before taking into account further reductions in the number of rows or tiers of cages in laying sheds.

[1] In some markets when inputs costs subsequently fall, the price does not necessarily return to the lower level. This can be due to expectations of future price increase, a desire to smooth prices over a longer period, or from low price sensitivity amongst consumers prepared to continue to pay the higher price.

- With a price elasticity of -0.3, and the potential for a 27% reduction in supply, this suggests prices could double (price change = change in supply / elasticity = -27% / -0.3 ~= 100%).
- With higher prices, available margins for egg production would be higher, encouraging additional suppliers to enter the market. Thus supply would increase moderated by a fall in prices from supplier competition.
- A new equilibrium will be reached were the costs of production of existing or prospective egg farms matches the quantity consumers demand at the available price.

2.2 Colony Cages and Non-Colony Egg Production – Exit and Entry

The second consequence expected from the increased production costs is a redistribution of egg farms. A survey of colony system egg suppliers suggests a range of actions including changes to production, moving to free-range or barn eggs, and exiting the industry.

Colony Systems

- Replacement of colony system egg production with free-range or barn eggs will have consequential changes to the supply in those markets, and further restrict the supply of colony cage based eggs.
- Similarly, suppliers exiting the industry will reduce colony system egg production.
- As covered above, a reduction in supply will be offset by increased prices and encourage the entry into colony system egg production by new suppliers.

Overall, the number of colony system eggs would be expected to fall, and the price is expected to rise.

Non-Colony

- Normally when faced with an increase in demand, prices increase based on existing supply. However, the magnitude of the demand increase is sufficiently large to introduce a new supply cost structure.
- For the free-range and barn egg markets, increased supply would be expected to:
  - drive prices downward due to increased supply, and,
  - consequently increase demand in the non-colony market.
- With increased demand, new entrants are encouraged into the non-colony market.
- With lower prices, some non-colony producers may find it uneconomic and choose to exit the industry

As the converse of the colony system market, overall the number of non-colony eggs is expected to increase with a fall in prices.

2.3 Market Substitution – Egg for Egg

A complicating factor in the egg market dynamic is that of substitution. While we do not expect the price movement in the supply in the free-range and barn egg markets to result in a price lower than that for colony system eggs, the margin between the two is expected to shrink. This reduced gap between the markets may encourage consumer behaviour that factors the production method into their purchasing decision to further enhance the non-colony demand. That is, when faced with similar prices, consumers may actively choose eggs from what they perceive as "happy chickens".

An extension of this concept is a situation where the demand for non-colony eggs and economies of scale factors displaces colony system eggs as the lowest price option. We do not foresee this occurring due to a number of external factors including the underlying cost of production from different methods.

2.4 Market Substitution – Imports

The egg market not only has a dimension of colony system versus non-colony, but also has a dimension in format: shell eggs, powdered, liquid or frozen eggs. Processed egg consumption can represent 20% of the egg market.

In the face of increased production costs, some consumers would look to substitute supplies, including importing eggs. On investigating this aspect there are several barriers.

- The geographical location of New Zealand would add a significant logistics costs.
- Current imports around $1 million per year come from a limited number of countries with Canada and Denmark being the largest suppliers.
- There are currently bio-security restrictions prohibiting or limiting the import of eggs restricting the imports to powdered forms.

2.5 Market Substitution – Protein Substitution

A third area of substitution is the switching to meats, dairy or vegetable sources of protein. The use of these sources for nutrition has a behavioural component as well as a cost component. Dairy is an unlikely substitute, as demonstrated by consumer behaviour in response to recent price increases in that sector.

Research into cross-price elasticity also suggests that an increase in egg prices will not have a marked impact on other replacements food (with substitution elasticities close to zero).[2]

There also exists the potential for egg ingredient substitutes. However, we consider this of low likelihood because eggs have unique qualities and uses – such as in baking. Furthermore, if the pricing difference was already narrow, it is likely to have already been used in those processes anyway.

[2] This result was determined in the National Food Survey 2000 looking at the behaviour of consumers in the England market where a change in the price of eggs did not alter the purchasing of alternative proteins such as meat.

3 Approach and Analysis

To investigate egg market dynamics, some quantification of the elements of cost, price, supply and demand is required. To provide this context we have drawn on information from a range of sources including:

- Nimmo-Bell costings for egg farms including the costs for the revised welfare code.
- Published material on the demand elasticity of eggs.
- Price data and trends from Neilsen data on sales via supermarkets.
- CPI food price index data.

3.1 Cost of Eggs

One of the fundamental considerations when looking at the egg market is the cost of production. Some aspects are highly variable, linked to the number of birds, while other costs are largely fixed or capital costs.

Variable (per/bird)		Capital and fixed costs	
Item	Estimated Cost	Item	Estimated Cost
Feed	$20.50	Land	$600,000
Labour	$7.00	Sheds for 25,000 birds	$500,000
Packaging	$3.87	Rearing shed	$500,000
Day old purchase price	$2.96	Manure shed	$24,000
Rearing	$4.00	Buildings	$50,000
Distribution	$3.50	Resource consent	$25,000
		Grading Floor	$200,000
		Grader	$350,000
		Equipment	$50,000
		Vehicles	$450,000
		Houses/other buildings	$220,000
		Cages per 25,000 bird shed	$750,000
		Rearing Cages	$824,093
		Feed mill	$982,040
Total per bird	$41.83	Total for a seven shed farm	$19 million

The above table illustrates a number of important points. First, the cost of feed per bird ($20.50) makes up half of the total variable cost of production ($41.83). Thus, any movement in feedstock pricing has a direct impact on the cost of egg production. The second point to note for a reasonably sized operation (in this case, 175,000 birds) is that despite the estimated capital tied up in production infrastructure ($19 million) the variable costs of bird feed over the life of the capital items still exceeds one third of all input costs. Past experience has demonstrated that movements in the cost of feed can be passed onto consumer suggesting there is a balance in pricing power between suppliers and supermarkets as a sales channel.

An estimate of the cost of an egg was viewed as an important reference point to assess the consequence of proposed code changes. This is to help quantify the degree of change and provide some guidance on the level of price movement.

With the available data on production costs from the Nimmo-Bell analysis two different methods have been adopted to estimate the change in costs of egg production. Two methods were tested to assess the robustness of assumptions adopted. Method 1 being designed to replicate a whole of farm model comparable to Nimmo-Bell's analysis. Method 2 is an incremental approach leaving the detailed workings of the egg farm static and just examining the changes due to the welfare code change.

Method 1: First was a re-working of the Nimmo-Bell analysis for a standardised egg farm using the costings provided in their report. Their approach appeared to assume cash-funding for all expenditure rather than looking at the farming operation over time. Reconsidering the farm economics we constructed a simple component based cost structure for large and medium sized farms. This provided estimates of both the variable cost and the capital commitment for the establishment of an egg farm.

This allowed the values expressed in $/bird to be matched to the capital outlay for assets such as sheds, machinery, grading equipment and land. With production of 300 eggs per year and a sale price of $2.11 per dozen, a rate of return on investment could be calculated.

Modifying the structure to allow for the revised welfare standard and utilising the new costs for buildings, cages and infrastructure provides a steady-state estimate of costs. This excludes the cost of transition and therefore provides a floor for the increase in production costs.

The magnitude of the production cost is secondary to the observed movement in cost between the two cases. This is due to a number of the assumptions that might not hold true in practice (such as useful asset lives or localised costs), and differencing helps to minimise the impact on the price calculation.

The calculated increased production cost of $0.20 per dozen appears to be quite modest, but the underlying costs of $1.70 per dozen are reasonable when compared with a nominal $2.11 per dozen sale price.

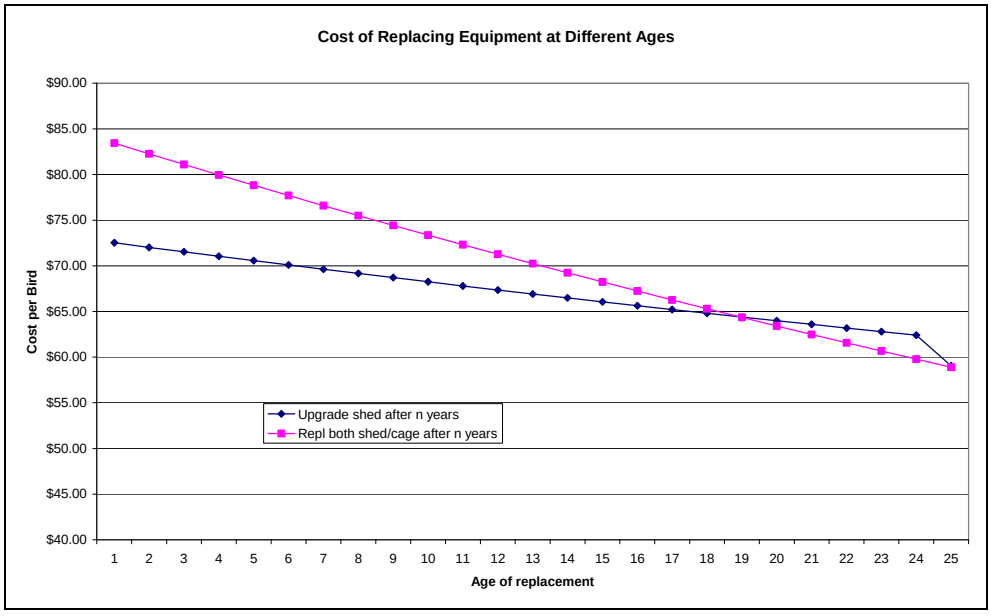
Method 2: A much simpler approach examined the choice available to egg farmers to either replace existing shed and cage equipment or retro-fit existing sheds with new cages. As this is a per bird calculation, it leaves the detailed assumptions other aspects of farm costs alone. However, as these other costs are similar in the before and after scenarios, they would not impact on the changed caging requirements.

By testing different timing for the change in cage technology across the 25 year life of the assets, it is possible to measure the financial impact of bringing forward or delaying the replacement or upgrade.

The minimum cost option is to allow replacement at the end of the current asset life. Bringing forward the replacement or upgrade imposes those additional costs early, and the difference in cost for the different timing provides the extra costs faced.

This can be shown graphically by calculating the cost per bird of a change in each year. In the case of upgrading a laying shed and installing new colony cages in year 1, the cost is approximately$73 per bird. The cost is high because the existing cages are still new with a high remaining value. Delaying until year 24 produces a cost of $63 per bird because of the $5 per bird retrofit cost, but little lost value from older cages. A delay until year 25 avoids the retrofit and lost cage value, and just includes the ongoing costs for new sheds and colony cages.

Similarly, if sheds and cages are replaced in year 1, not only is substantial value from the current cages lost, so is the value of the near new sheds. As the change-over is delayed, eventually the cages and sheds would be replaced in year 25.



In most cases, we expect that retro-fit is the cheaper option because of the potential lost value in replacing the laying sheds. When sheds are nearing the end of their useful economic life there would be some cost saving in replacement, but the gain is small and other factors might deliver other benefits from upgrading a 20 year old facility.

Using the upgrade costs, we can then calculate the difference between an implementation of the welfare code between two years. For illustration, a difference in ten years is expected to cost approximately $7 per bird in present value terms. Spread across expected production, this gives an increased cost of $0.28 per dozen eggs.

3.2 Egg Price Elasticity

The scope of this investigation does not extend to empirical testing of consumers demand for eggs at different prices. There is some information available covering the domestic price of eggs and the volume of eggs. However, this clouds the identification of the price elasticity because of changes in population and short term variations in price. Therefore, we have drawn on previous work on price elasticity that has looked specifically at eggs and the interaction of eggs with other food groupings.

The literature search provided an estimate for the price elasticity for eggs of -0.3. Uncertainty in measurement of the true value means that the elasticity could be higher or lower as different factors can influence the value across time and in different regions or counties. This value is not specific to New Zealand but comes from:

- United Kingdom longitudinal food survey -0.28
- Studies by Agriculture and Agri-Foods Canada-0.35

These countries have different characteristics to the New Zealand market, particularly with the allocation of production quota in the Canadian market. However, these differences in supply should not significantly impact the consumption pattern due to cultural similarities.

This elasticity value reflects the decline in volumes demanded for a change in price. Therefore, a 10% increase in price could be expected to decrease demand by 10% * 0.3 or 3%.

Turning to the supply side of the egg industry, we have an expected increase in the cost of production. An increase of $0.28 per dozen on a sale price of $2.11, the price the egg farm sees, is 13.3%. Further, without additional replacement production, the overall number of birds are expected to reduce by approximately 27% due to the move from 550 sq cm to 750 sq cm per bird. Therefore we could formulate a *constrained* elasticity as:

Elasticity = % change in supply / % change in price

= -26.7% / 13.3%

= -2.0

We have notated this *constrained* elasticity because the reduction in supply is an enforced reduction due to space considerations and is thus an artificial shift in supply. The underlying supply elasticity could be much closer to the demand elasticity value of -0.3.

Re-stating this concept, with no change in the price paid and an increase in costs of 13%, there would be a reduction in the volume supplied. At an elasticity level of -1.0, this would be reflected as a 13% reduction in supply, rather than the larger fall of 27%.

This result implies that with increased costs, the supply of eggs would fall, but that there would be additional capacity put in place to balance the supply and demand at the new cost/price level.

4 Other Issues

This section address a number of issues and questions not otherwise covered that are relevant to the egg market and introduction of the revised welfare code.

To what extent do supermarkets have pricing power? This is untested, but background evidence suggests they are not able to completely dictate the price paid to producers. Additionally, supermarkets, while they are a large sales channel, are not the only option for sellers. Further, while demand from customers will influence the shelf price paid, that demand is also reflected to egg producers who are competing to sell their available supply profitably.

How sensitive or responsive are egg producers to changes in egg prices? During our analysis of egg costs and supply elasticity, we have calculated that the margins available provide sufficient headroom, and producers would be sensitive to movements in the price received. Therefore, an increase in the price paid to suppliers would encourage additional egg producers, but the corresponding decrease in demand would ultimately free fewer colony system birds.

5 Summary

The investment in egg farming and egg farms is significant. While many costs are variable, they are dominated by the cost of feed, and the infrastructure needed to house the bird population.

Introducing a change to the welfare code has impacts across the egg production sector as a whole with significant uncertainty introduced into the colony system and non-colony markets. The transition and outcomes following the imposition of colony systems may see churn of egg farms, new entrants and producers exiting the industry.

The core result in amongst the uncertainty is that the changes in welfare and costs will increase the price of eggs and that the overall number of eggs produced will fall.

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