SALES OF CAGE-FREE EGGS

The Impact of Proposition 12 on Egg Prices and Consumer Welfare in California

Abstract
California’s Proposition 12, which outlaws the use of cages in the egg production process, went into effect on January 1, 2022. The main focus of this study is to follow the trend of weekly Californian and national egg price changes before and after the implementation of Proposition 12. Using the price series reported by the United States Department of Agriculture (USDA), structural break tests and Ordinary Least Squares (OLS) regressions are carried out to directly measure the economic impacts of this new regulation on egg prices. With different models used, this study shows that California consumers now pay an additional $0.25 to $0.73 for a dozen eggs due to the new regulation, resulting in a state-level annual loss in consumer surplus of $223 million to $664 million.

Keywords
animal welfare, Proposition 12, price analysis, consumer welfare, structural break test, OLS regression

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INTRODUCTION

Proposition 12, also known as California’s Prevention of Cruelty to Farm Animals Act, went into effect on January 1, 2022. As a strengthening ballot measure of the previous Proposition 2, this new act establishes stricter regulations on farmers’ production practices with regard to egg-laying hens, breeding pigs, and veal calves. Although a California judge decided to delay the enforcement of this proposition on pigs in January, the portion of the proposition that prohibits the in-state sales of eggs produced in any cages has remained effective since the beginning of 2022 (California Department of Food and Agriculture, 2022).

Improving animal welfare in the egg industry is a growing trend that has attracted attention both domestically and globally. On the international stage, the European Union’s Directive 1999/74/EC eliminated the use of battery cages across E.U. members in 2012 (EUR-Lex, 1999). Domestically, more and more states, including Massachusetts, Michigan, Ohio, Oregon, and Washington, have also passed their own regulations that would eventually lead to the limited use of battery cages in the states’ egg industry (Mullally & Lusk, 2018). As one of the newest and strongest animal welfare laws, Proposition 12 became a national focus and raised concerns from both producers and consumers. It is obvious that egg producers are particularly worried since such a regulation would require them to produce in a more expensive housing system without an expected increase in demand (Malone & Lusk, 2016). Consumers are also concerned because an increasing egg price caused by the proposition would result in a loss in their welfare. Therefore, determining the actual economic impacts of this law is of significant interest to producers and consumers in the market and has broad implications for animal welfare legislation in other states or markets.

Previous research has studied the economic impacts of Proposition 2, which bans the sales of battery-caged eggs in California. For example, Malone and Lusk (2016) relied on a difference in differences estimate to measure price changes and reduction in consumer surplus due to Proposition 2 using the price series of both California egg prices and the national average before and after this new regulation went into effect. They found that, on average, California consumers pay $0.48–$1.48 more for a dozen eggs.
eggs due to this proposition, which suggests an annual reduction of between $400 million to $850 million in consumer surplus. Mullally and Lusk (2018) applied structural break tests and forecasting methods to monthly data on egg production and input prices, concluding that there would be a 35% decrease in the number of eggs and hens with the implementation of Proposition 2. They also discovered that the average egg price per dozen increased by 22% due to this proposition, which indicates an expected annual welfare loss of approximately $25 million for California consumers. Carter et al. (2021) used a conceptual model to construct the demand and supply of eggs with and without the implementation of Proposition 2 and numerically determined the market equilibria under the two scenarios. In the long run, they estimated an increase of around 39 cents per dozen in California and an increase of only 7–10 cents for other states.

This study contributes to the nascent literature on the direct measurement of the price changes and consumer surplus reduction caused by Proposition 12. Although some studies identified the numerical economic impacts of the “cage-free” requirement, they only included estimations under a certain hypothetical regulatory scenario. For instance, Allender and Richards (2010) estimated consumers’ willingness to pay for cage-free eggs with household-level purchase data. Their study suggested an additional $0.54 for a dozen cage-free eggs and a decrease of around $106 million in California consumer welfare reduction due to a mandate over cage-free egg production. Oh and Vukina (2022) used a partial equilibrium model to estimate the welfare changes due to Proposition 12 and found that this new regulation would bring about welfare losses for both producers and consumers. Their estimation indicated a state-level reduction in consumer welfare of approximately $72 million and an 18% decrease in the quasi-profits for the egg industry.

The primary objective of this research is to determine the actual economic impacts of Proposition 12 on egg prices and consumer surplus in California. Initially, a structural break test is carried out to identify the breakpoints after the implementation of Proposition 12. Then, two basic econometric approaches are fitted for the difference between California and national egg prices. Depending on the specific model used, Proposition 12 would have a statistically significant impact on California egg prices, causing an increase of approximately $0.25 to $0.73 per dozen and resulting in a loss of $223 million to $664 million in consumer welfare.

**BACKGROUND**

To determine the actual economic impacts of Proposition 12, this study first takes a look at the price difference between the California average and the national average before and after the new regulation went into effect. Figure 1 shows the national and California weekly prices of FOB large shell eggs from January 3, 2020, to September 30, 2022, which was obtained from the USDA Agricultural Marketing Service (2022). This is a reasonable representation of the overall egg prices since nearly all eggs produced in California are marketed as shell eggs, and shell egg consumption accounts for roughly 80% of the state’s total consumption (Sumner et al., 2010). As Figure 1 indicates, the distance between the two price series suddenly widened after January 1, 2022, when Proposition 12 was enacted in California. However, after roughly three months, it can be seen that the gap between national and California egg prices became smaller, indicating a gradually decreasing economic impact after the initial shock.

The economic impact of the new regulation can also be found in the descriptive statistics in Table 1. Although both national and California egg prices experienced a dramatic increase over the past 33 months, their price difference has gone up from $40.68 to $65.34. During the same time period, California egg prices went through a larger increase than national egg prices. Although the implementation of Proposition 12 is an important cause of this increase, numerous other factors may also be responsible for this trend and should be considered and controlled in the model.

**METHODS**

To measure the actual effects of Proposition 2, Malone and Lusk (2016) used a general model including variables affecting arbitrage opportunities across states, potential demand shifters, monthly and day-of-the-week dummy variables, and indicators of avian influenza cases. Adopted from their model, this study chooses to carry out OLS regressions in the following general form:
The price series were obtained from the National Shell Egg Index Price Report published by the USDA Agricultural Marketing Service; \(pdiesel, ir, \) and \(pcorn\) are the diesel fuel price, interest rate, and corn price, which serve as the proxies for the cost of arbitrage across states. Weekly national average prices for diesel fuel were

\[
P_{\text{CA},t} - P_{\text{US},t} = \gamma_0 + \gamma_p pdiesel_t + \gamma_i ir_t + \gamma_p pcorn_t + \gamma_s w_{\text{CA},t} + \gamma_s w_{\text{US},t} + \gamma_s (w_{\text{CA},t} - w_{\text{US},t}) + \gamma_s (ur_{\text{CA},t} - ur_{\text{US},t}) + \gamma_a + \sum_{k=1}^{5} \beta_k m_k + \epsilon_t
\]  

where the dependent variable \(P_{\text{CA},t} - P_{\text{US},t}\) is the price difference between California and national eggs for the week \(t\). The price series were obtained from the National Shell Egg Index Price Report published by the USDA Agricultural Marketing Service; \(pdiesel, ir, \) and \(pcorn\) are the diesel fuel price, interest rate, and corn price, which serve as the proxies for the cost of arbitrage across states. Weekly national average prices for diesel fuel were

![Weekly prices of free on board (FOB) large shell eggs in California and the United States (unit: cents). Source: USDA Agricultural Marketing Service National Shell Egg Index Price Weekly Report (2022).](image1)

**TABLE 1.** Descriptive statistics for FOB large shell egg prices in California and United States before and after Proposition 12 went into effect (unit: cents/dozen).

<table>
<thead>
<tr>
<th></th>
<th>Before Implementation</th>
<th>After Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Min</td>
</tr>
<tr>
<td>National</td>
<td>68.31 (34.02)</td>
<td>32.11</td>
</tr>
<tr>
<td>California</td>
<td>108.99 (38.38)</td>
<td>52.00</td>
</tr>
<tr>
<td>Price Difference</td>
<td>40.68 (18.37)</td>
<td>-43.00</td>
</tr>
</tbody>
</table>

Notes: The data set includes 108 observations before and 36 after implementation. “Before Implementation” refers to the data from January 3, 2020, to December 31, 2021, while “After Implementation” consists of all observations from January 7, 2022, to September 30, 2022. The date labeled on each observation is the Sunday of that week, and the numbers in parentheses are the respective standard deviations.
downloaded from the U.S. Energy Information Administration (2022). The interest rate was represented by the monthly bank prime loan rate, which was retrieved from the Board of Governors of the Federal Reserve System (2022). USDA weekly data on corn prices associated with Chicago export grain bids from the Livestock Marketing Information Center (2022) was also used; \( (w_{\text{CA},t} - w_{\text{US},t}) \) represents the difference between the California average hourly wage rate with that number nationwide. Similarly, \( (ur_{\text{CA},t} - ur_{\text{US},t}) \) is the difference between the California unemployment rate and the national average. Both variables are viewed as potential demand shifters and were obtained as monthly measures from the U.S. Bureau of Labor Statistics (2022a, 2022b); avian, is the cumulative number of millions of birds infected with avian influenza until week \( t \) after deleting all cases associated with backyard chickens and turkeys. This data was retrieved from the USDA Animal and Plant Health Inspection Service (2022).

The Bai and Perron (1998) test was then applied to equation (1) to identify structural breaks in this time-series data. When the number of break points was set to be below five, the procedure returned outcomes as shown in Table 2. The model with only one break point on December 24, 2021, has the lowest Bayesian information criterion (BIC) value of 1,309, indicating that it is the most fitted model among the six. As this break point is very close to the effective date of January 1, 2022, it can be concluded that the implementation of Proposition 12 did have a significant impact on the California egg price. Since this study primarily focuses on the economic impacts of Proposition 12, another critical break point after January 1, 2022, would be March 25, 2022, which is roughly three months after the implementation of the new regulation. This is consistent with the prior observation that the impact of this mandate would shrink after the initial shock. To numerically determine the actual effects on egg price, two approaches were carried out after introducing different dummy variables representing the overall impact and initial impact of the first three months.

Approach 1 focuses on the measurement of Proposition 12’s overall economic effect on California egg prices. Therefore, only one dummy variable is added to equation (1), representing the implementation of the new regulation on January 1, 2022. For Approach 1, OLS regressions of the following general form are carried out:

\[
P_{\text{CA},t} - P_{\text{US},t} = \gamma_0 + \alpha, \text{Prop12} + \gamma, p\text{diesel}, + \gamma, ir, + \gamma, p\text{corn}, + \gamma, (w_{\text{CA},t} - w_{\text{US},t}) + \gamma, (ur_{\text{CA},t} - ur_{\text{US},t}) + \gamma, \text{avian}, + \sum_{i=1}^{11} \beta_i m_i + \epsilon_i
\]  

where Prop12 is the dummy variable that takes 1 when the data point is observed after January 1, 2022, and 0 when it is observed beforehand. In this approach, the numerical value and statistical significance of is of primary interest for this study since it represents the comparison in difference between the California egg price and the national average before and after Proposition 12 went into effect.

Approach 2 focuses on the initial impact of Proposition 12 in the first three months. To divide the “After Implementation” period into two intervals, two dummy variables are added to equation (1), representing the implementation of the new regulation on January 1, 2022. For Approach 1, OLS regressions of the following general form are carried out:

\[
P_{\text{CA},t} - P_{\text{US},t} = \gamma_0 + \alpha, \text{Prop12} + \alpha, \text{Prop12} + \gamma, p\text{diesel}, + \gamma, ir, + \gamma, p\text{corn}, + \gamma, (w_{\text{CA},t} - w_{\text{US},t}) + \gamma, (ur_{\text{CA},t} - ur_{\text{US},t}) + \gamma, \text{avian}, + \sum_{i=1}^{11} \beta_i m_i + \epsilon_i
\]  

where Prop12 is the dummy variable that takes 1 when the data point is observed after January 1, 2022, and 0 when it is observed beforehand. In this approach, the numerical value and statistical significance of is of primary interest for this study since it represents the comparison in difference between the California egg price and the national average before and after Proposition 12 went into effect.

<table>
<thead>
<tr>
<th>Number of Break Points</th>
<th>Structural Break Points</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>m = 0</td>
<td></td>
<td>1372</td>
</tr>
<tr>
<td>m = 1</td>
<td>12/24/2021</td>
<td>1309</td>
</tr>
<tr>
<td>m = 2</td>
<td>6/12/2020</td>
<td>1341</td>
</tr>
<tr>
<td>m = 3</td>
<td>10/29/2021</td>
<td>1349</td>
</tr>
<tr>
<td>m = 4</td>
<td>11/27/2020</td>
<td>1392</td>
</tr>
<tr>
<td>m = 5</td>
<td>3/25/2022</td>
<td>1450</td>
</tr>
</tbody>
</table>
becomes 1. Otherwise, both \(Prop_{12i}\) and \(Prop_{12l}\) take the value of 0. In this approach, and are of critical significance to this study since they represent the initial impact of Proposition 12 and its effect after the first three months, respectively.

After determining the price change due to Proposition 12 in Approaches 1 and 2, the annual loss in consumer surplus can be calculated. As the “cage-free” requirement of Proposition 12 is estimated to increase the cost for producers, the supply curve would shift up, as shown in Figure 2. Based on the assumption that the demand curve would not change after the implementation of this new regulation, the equilibrium egg price would increase from \(P\) to \(P'\) while the equilibrium quantity decreases from point \(Q\) to \(Q'\), resulting in a reduction in consumer surplus (CS) equal to the area \(PP'EE\). This area can also be expressed in the following algebraic equation:

\[
\Delta CS = [(P' - P) \times Q' - Q] + \frac{1}{2} [(P' - P) \times (Q - Q')]
\]

where \(Prop_{12i}\) is equal to 1, and \(Prop_{12l}\) is equal to 0 when the observation date is after January 1, 2022, but before April 1, 2022. When the observation date is after April 1, 2022, \(Prop_{12i}\) takes the value of 0 while \(Prop_{12l}\)

![FIGURE 2. Reduction of consumer welfare due to the implementation of Proposition 12.](image)

### TABLE 3. Factors contributing to the California and national egg price differences—Approach 1 (January 3, 2020–September 30, 2022).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>40.679* (2.273)</td>
<td>50.772* (7.088)</td>
<td>93.493* (16.280)</td>
<td>137.066* (55.687)</td>
<td>–20.990 (60.537)</td>
</tr>
<tr>
<td>Diesel price</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Interest rate</td>
<td>–</td>
<td>–</td>
<td>–6.200 (3.166)</td>
<td>–12.612* (4.929)</td>
<td>8.157 (6.208)</td>
</tr>
<tr>
<td>Corn price</td>
<td>–</td>
<td>–</td>
<td>–7.744* (2.801)</td>
<td>–7.396* (3.325)</td>
<td>–9.618* (3.091)</td>
</tr>
<tr>
<td>Wage difference</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2.422 (10.703)</td>
<td>17.044 (10.286)</td>
</tr>
<tr>
<td>Unemployment rate difference</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–8.775 (5.387)</td>
<td>–7.457 (4.961)</td>
</tr>
<tr>
<td>Cumulative bird flu cases</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–2.129* (0.435)</td>
</tr>
<tr>
<td>Month effects</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of parameters</td>
<td>2</td>
<td>13</td>
<td>16</td>
<td>18</td>
<td>19</td>
</tr>
<tr>
<td>Number of observations</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>R squared</td>
<td>0.183</td>
<td>0.313</td>
<td>0.386</td>
<td>0.399</td>
<td>0.496</td>
</tr>
<tr>
<td>Adjusted R squared</td>
<td>0.178</td>
<td>0.250</td>
<td>0.314</td>
<td>0.318</td>
<td>0.423</td>
</tr>
</tbody>
</table>

Notes: Statistical significance at = 0.05 or lower is denoted by single asterisks in this table. Numbers in parentheses are the corresponding standard errors.
**RESULTS**

Both approaches find that the difference between California and national egg prices is approximately 25 to 73 cents more than it would be without the new mandate. Table 3 shows the results produced by Approach 1, suggesting that California consumers have to pay an additional 25 cents to 73 cents for a dozen eggs due to the implementation of Proposition 12. The simplest model, including only a dummy variable for the proposition, estimates the economic effect of the regulation to be roughly 25 cents. Proposition 12’s effect increases to over 27 cents with the monthly effects dummy variables added. After adding the parameters controlling for arbitrage possibilities, the regulation’s effect increases to 40 cents per dozen. Introducing another two variables representing the potential demand shifters leads to another slight increase to 43 cents. Model 5 here includes a variable controlling for the widespread avian influenza cases happening in 2022 and leads to a higher economic effect of approximately 73 cents. These results in Model 3 and Model 5 show that the economic effect of Proposition 12 would be much higher without those changes in diesel fuel price, interest rate, corn price, and avian influenza cases. Statistically speaking, Model 5 appears to be the best-fitted one because of the largest adjusted $R^2$ value.

A similar pattern has been found in the results from Approach 2 as the initial impact of the regulation increases after adding the other variables. However, it is clear that the implementation of Proposition 12 has a much more significant initial effect on egg price since the coefficients for Proposition 12 Enforced (Initial) are generally higher, ranging from 52 to 73 cents. The effect decreases after the first three months in all cases except Model 5, which is consistent with prior findings from the graph and structural break tests. Statistically speaking,


<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>40.679* (2.076)</td>
<td>51.513* (6.665)</td>
<td>45.763* (19.318)</td>
<td>18.726</td>
<td>–21.070 (60.779)</td>
</tr>
<tr>
<td>Proposition 12 Enforced (Initial)</td>
<td>52.283* (6.482)</td>
<td>52.918* (7.305)</td>
<td>59.143* (8.518)</td>
<td>64.151* (8.965)</td>
<td>73.319* (9.541)</td>
</tr>
<tr>
<td>Diesel price</td>
<td>–</td>
<td>–</td>
<td>12.167 (6.721)</td>
<td>7.000</td>
<td>7.213 (6.757)</td>
</tr>
<tr>
<td>Interest rate</td>
<td>–</td>
<td>–</td>
<td>5.064 (4.070)</td>
<td>1.344</td>
<td>8.272 (6.292)</td>
</tr>
<tr>
<td>Corn price</td>
<td>–</td>
<td>–</td>
<td>–8.054* (2.646)</td>
<td>–9.999* (3.194)</td>
<td>–9.557* (3.136)</td>
</tr>
<tr>
<td>Wage difference</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>14.770 (10.516)</td>
<td>16.960 (10.346)</td>
</tr>
<tr>
<td>Unemployment rate difference</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–8.503 (5.074)</td>
<td>–7.409 (4.994)</td>
</tr>
<tr>
<td>Cumulative bird flu cases</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–2.236* (0.906)</td>
</tr>
<tr>
<td>Month effects</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
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<td>Yes</td>
</tr>
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<td>Number of parameters</td>
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<td>Number of observations</td>
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<td>144</td>
<td>144</td>
<td>144</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.324</td>
<td>0.398</td>
<td>0.457</td>
<td>0.471</td>
<td>0.496</td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td>0.314</td>
<td>0.337</td>
<td>0.388</td>
<td>0.395</td>
<td>0.419</td>
</tr>
</tbody>
</table>

Notes: Statistical significance at $=0.05$ or lower is denoted by single asterisks in this table. Numbers in parentheses are the corresponding standard errors.
TABLE 5. Expected annual loss in consumer surplus due to the impact of Proposition 12 under different assumed demand elasticities.

<table>
<thead>
<tr>
<th>Price Elasticity of Demand</th>
<th>Annual loss in consumer surplus (using $\alpha_1$ from Approach 1)</th>
<th>Annual loss in consumer surplus (using $\alpha_1$ from Approach 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.08</td>
<td>[$225,190,751, $662,442,696]</td>
<td>[$474,972,667, $663,505,066]</td>
</tr>
<tr>
<td>-0.18</td>
<td>[$223,922,698, $651,272,324]</td>
<td>[$469,274,089, $652,298,347]</td>
</tr>
<tr>
<td>-0.27</td>
<td>[$222,781,451, $641,218,990]</td>
<td>[$464,145,370, $642,212,299]</td>
</tr>
</tbody>
</table>

Model 5 appears to have the best fit since it has the largest R² adjusted value of 0.419. Also, it is worth noting that the coefficient for cumulative avian influenza cases is statistically significant and negative in both approaches. This is perhaps because avian influenza disproportionately impacted the California egg industry in 2022. Compared with the research on Proposition 2 published by Malone and Lusk (2016), this study’s estimations of the economic effects of Proposition 12 are generally smaller.

With the economic effect on egg price determined, this study continues to calculate the expected annual loss in California consumer welfare due to Proposition 12. This can be done with an assumed demand elasticity for egg consumption, which was determined to be -0.08, -0.18, and -0.27 in previous papers, respectively (Andreyeva et al., 2010; Kastens & Brester, 1996; Okrent & Alston, 2011). There are 39,237,836 residents in California (U.S. Census Bureau, 2021), and each individual consumes 280.50 eggs annually (U.S. Department of Agriculture, 2022). The estimated quantity of eggs demanded before the regulation (Q) should be around 917 million dozens. As shown in Table 1, the average U.S. egg price was $1.79 per dozen after the first day of 2022. From Model 1 of Table 3, the California egg price is at least approximately 41 cents higher, adding up to $2.20 per dozen ($P$). The economic effect of Proposition 12 is found to be between 25 to 73 cents in Approach 1, suggesting that the egg price after the regulation’s implementation ($P'$) would be between $2.45 to $2.93. If the egg’s price elasticity is assumed to be -0.08, the change in egg price here would result in a lower quantity demanded by 0.90% to 2.66%. Using equation (4) listed above, the dollar loss of consumer surplus, in this case, will be between $225 million to $662 million. Calculations under other assumptions are similar, and the corresponding results are shown in Table 5.

A similar welfare calculation was also applied to the results produced by Approach 2. As the economic effects on egg prices were determined to be between 52 cents to 73 cents, the annual loss in consumer surplus caused by the initial impact of Proposition 12 is expected to be between $464 million to $664 million, which can also be found in Table 5. Overall, both approaches indicate an expected loss in consumer surplus are also generally lower when compared with the results of Proposition 2 from Malone and Lusk (2016).

CONCLUSIONS

With the data obtained from the USDA Agricultural Marketing Service, this study estimated the price change and consumer welfare reduction due to the implementation of Proposition 12. Using structural break tests and OLS regressions, the results are consistent and significant. As improving animal welfare in the egg industry is now a global trend, there is a growing need for a more comprehensive and in-depth understanding of this policy’s economic costs. This study suggests that the “cage-free” requirement proposed by Proposition 12 caused a significant increase in the California egg price and therefore led to a sizable reduction in consumer surplus. A larger initial impact in the first four months of implementation is also detected.
If similar regulation is carried out in any other state or even in other countries, consumers living in those areas are expected to see an 11% to 33% increase in egg prices. With the presumed price elasticity of demand, such a price change would result in a considerable annual decrease between $223 million to $664 million in the overall consumer surplus, which is much bigger than the estimation made by Oh and Vukina (2022). For now, no suggestions regarding whether such a policy should be carried out can be offered since the economic benefits of this piece of animal welfare legislation have not been determined in this study. However, it does offer an estimation of the potential cost for consumers, which could be used in the later benefit-cost analysis.

Certainly, as with any other research, this study also has some limitations. The most noteworthy one is the relatively small adjusted R² values in both approaches. As shown in Table 3 and Table 4, the adjusted R² for these 10 models ranges from 0.178 to 0.423, which is not very good statistically. Although the descriptive power of the regression models is not of interest to the study, conducting proper model transformations might be a good way to increase adjusted R². Another limitation relates to the incomplete welfare calculation since this study did not make an analysis of the economic effects on the egg producers. A future study might include an estimation of the potential cost for producers due to the implementation of Proposition 12. Moreover, the calculation of consumer welfare reduction in this study assumes no demand shift due to this new regulation. This assumption may not be plausible since previous research has shown that consumers are generally willing to pay more for eggs produced following certain animal welfare rules. For example, Heng, Peterson, and Li (2013) suggested in their paper that consumers would be willing to pay an average premium of $0.25 for eggs laid by hens that have outdoor access.

Also, it is worth noting that animal welfare regulations could be carried out in many different kinds of forms. Proposition 12, along with the previous Proposition 2, is a kind of prescriptive regulation that directly outlaws certain production practices. As many studies have proposed, policies in the form of market incentives may be less costly in terms of economic consequences. For example, Cowen (2006) proposed a tax on the marginal allocation of animals to the sectors with a low level of animal welfare and a subsidy on those going to sectors with good animal welfare conditions. Lusk (2011) put forward a separate decoupled market for animal welfare, giving rights of “animal well-being units” to farmers and providing a market for these units to be traded independently of meat. Generally speaking, as the command-and-control policy such as Proposition 12 is found to cause considerable economic consequences for consumers, future studies may find it helpful to look into market-based alternatives that would promote animal welfare in the egg industry.

REFERENCES


