**Continuation of Related, Current, and Previous Work**

***Economic Impact and Consumer Choices.*** Increased public concern about animal welfare has led to grocery retailers, food service suppliers, and legislation to shift towards a perceived improvement in animal welfare for egg production. This mounting pressure on the egg industry has led to the development and adoption of alternative egg production systems (e.g., enriched colony, cage-free aviary, free-range housing) that aim to better accommodate natural behaviors of birds (e.g., perching, nesting, dustbathing, foraging); thereby, yielding plausibly improved animal welfare (Xin and Liu, 2017). As a result, there has been a transition to alternative housing systems and creation of a host of new management challenges. There is an important need for science-based evidence to evaluate the effectiveness of management and optimal conditions (Liu, 2017).

The major issue in the egg industry continues to be the rapid change towards extensive production systems that would meet the desire of consumers for improved animal welfare. The shift from cages to cage-free egg production started with California's Prevention of Farm Animal Cruelty Act (Proposition 2) in 2008. Several other states introduced or passed similar measures. This trend is likely going to continue, and it is reasonable to expect that more states will adopt similar measures. California even went further by passing an even stricter regulation that would ban even enriched colonies and would allow only the open floor (free-range) production. This law has passed state assembly and is being reviewed by the Senate. The ban on the sales of off cage eggs, besides California, is currently in effect only in Massachusetts.

As a result of the implemented or anticipated regulatory measures banning the conventional cages, the cage-free production of table eggs in the United States is continually increasing. During June 2018, the U.S. weekly production of table eggs totaled 1.9 billion eggs and table egg flock comprised of 313.8 million layers. Since the USDA started the collection of detailed data on cage-free production in 2016, the size of the cage-free layer flock increased from 10.2% of the total flock in August 2016 to 17.43% in June 2018. During the same period, the cage-free egg production increased from 8.49% to 15.02% of total eggs produced in the country. The production of cage-free eggs almost doubled during this less than two year long period from 161 million to 288 million eggs weekly. At the same time, the increase in the production of organic eggs, which are automatically cage-free, increased only modestly from 71.3 million to 82.3 million eggs weekly.

The widespread adoption of the ban on cages by an increased number of states changes the egg industry in fundamental ways and requires a more comprehensive study of the effects of regulation at the national level. In addition to California, there are now 6 other states that have banned cage production of table eggs: Ohio, Oregon, Washington, Michigan, Massachusetts and Rhode Island and in several other states similar regulation is pending.

Using nationally representative survey data, Heng et al. (2013) estimated that 85% of consumers were willing to pay about $0.49 per dozen more for cage-free eggs. Richards et al. (2013) used non-hypothetical experimental auctions and found a 65% value premium for cage-free eggs, while Norwood and Lusk (2009) used a similar approach and found a 70% value premium. Other ex-ante studies have used secondary data to estimate changes in consumer and producer surplus resulting from animal welfare policies (Chang, Lusk, and Norwood, 2010). Allender and Richards (2010) used scanner data to estimate the ex-ante welfare impacts of a change in egg prices due to the policy change. They found that only about 21% of households were willing to pay the premium for cage-free eggs, and argued that the effect of the policy would be highly regressive. They projected that large households with lower incomes would experience the most significant welfare loss from the policy change. Norwood and Lusk (2011) used equilibrium displacement models to project the consumer and producer surplus effects of a ban on battery cages. They calculated that converting all cage eggs to cage-free in the United States would result in a $1.87 billion decline in consumer surplus and a $187 million decline in producer surplus, assuming no consumer demand shift in response to change in the type of eggs sold.

Two studies investigated estimated ex-post changes in egg prices due to Proposition 2. Mullally and Lusk (2015) used retail scanner data to compare prices and quantities in three California markets (Los Angeles, San Francisco, and San Diego) to determine the overall economic consequences of the egg policy. These authors found that the policy increased the price of eggs by over 20%. In the second study, Malone and Lusk (2016), using the data collected by the USDA, utilized a difference in differences approach analyzed how the spread between the United States and California egg prices before January 1, 2015, compared with the same difference after that date. Regardless of the approach used, they found the law had a statistically and economically significant impact on California egg prices, ranging from about $0.48 to $1.08 per dozen, representing anywhere from a 33% to a 70% price increase.

With the legislation in California and other states becoming more stringent on the production of poultry and poultry products, it is imperative to take a holistic approach to investigate the potential impact on the industry, farmers and the consumer. The economic impact of housing/production system changes needs to be more extensively investigated in light of the increased demand for ABF broilers and turkeys, as well as poultry produced from other sustainable production systems such as organic and free-range.