

Proposed changes in living conditions for broilers under the National Organic Program will have limited economic effects

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Primary Audience: Researchers, Policy Analysts, Organic Producers

SUMMARY

In the current paper, we estimate the costs and benefits of implementing the proposed rule for changes in living conditions for organic broilers. In contrast to the effects of the proposed rule for changes in living conditions for laying hens, the effects of the rule on organic broilers is anticipated to be relatively limited. All producers are already in compliance with option 2 of the rule, and changes required under option 3 are minimal for most producers. Using the per-farm estimated regulatory costs and the estimates of production volumes and actual prices, the total estimated annual industry cost under option 3 is \$2.4 million, which represents 0.1% of total industry revenue. The estimated benefits associated with this type of perceived animal welfare improvement are high enough to cover the anticipated cost, and the proposed option easily passes the benefit-to-cost ratio test.

Key words: organic, broiler, living conditions, benefit-cost analysis

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DESCRIPTION OF PROBLEM

In a recent paper, Vukina et al. [1] analyzed the economic effect of proposed changes in living conditions for laying hens under the USDA National Organic Program (NOP), which is administered by the USDA, Agriculture Marketing Service. In addition to proposed changes in living conditions for laying hens, the NOP has proposed changes for organic broilers. With the potential changes in the requirements for living conditions for organic poultry, the NOP must consider the economic effects of these changes on each of the regulated products. As described in Vukina et al. [1], the current NOP regula-

tions do not set specific stocking rates for either inside housing or the outside access areas for poultry. The NOP issued a general policy memo in October of 2002 affirming that outside access areas are required, but it did not specify size or other details. The NOP subsequently provided a memo regarding an exemption to outside access for purposes of biosecurity, as well as a decision that outside access could be provided in a fenced, roofed, and floored outside area (a “porch or veranda” attached to a poultry house). To obtain organic certification, poultry producers must submit to NOP an organic system plan (OSP) describing outside access. The OSP is subsequently reviewed by USDA-accredited

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certification agents, who then interpret the regulations, review the OSP for sufficiency, and conduct on-site inspections to verify compliance by organic operations.

The National Organic Standards Board (NOSB), the NOP citizen advisory panel, made recommendations in April 2002, November 2009, and December 2011 on animal welfare issues concerning appropriate living conditions for poultry. On December 2, 2011, based on the NOSB recommendation and independent animal welfare standards, NOP submitted 3 options for regulations regarding outdoor access for poultry [2]. The specific regulatory options that were considered are (1) make no substantial changes to the existing regulation, (2) adopt modified animal welfare standards similar to existing standards, and (3) adopt animal welfare standards that differ substantially from existing standards. The implementation period for options 2 and 3 is 5 yr.

Option 1 provides for no substantial changes to existing regulations for organic poultry. Living conditions under 205.239 do not specify indoor or outdoor stocking rates, but require maintaining year-round living conditions that accommodate the health and natural behavior of animals. All animals must have year-round access to the outdoors, shade, shelter exercise areas, fresh air, clean water, and direct sunlight suitable to the species, stage of life, and climate. Use of covered porches or runs is acceptable and soil contact is not required.

Option 2 is similar to existing animal welfare standards. Broilers must have stocking densities of no more than 3.18 kg of live weight per 929 cm² (7 lb per 1 ft²). Other requirements are similar across all poultry. Specifically, in indoor housing, birds must be able to move freely and engage in natural behaviors (turn around, flap wings, scratch, and dust bathe) and must have natural light. Scratch areas and dust baths must be provided, and houses must be equipped with 61 cm (24 in) wide by 46 cm (18 in) high exit doors. Ventilation must be sufficient to ensure less than 25 ppm ammonia.

Regarding outdoor access under option 2, broilers must have outdoor access by 4 wk of age provided that the outside temperature is above 50°F, and the outdoor areas must provide direct sunlight, although solid roofs are allowed.

The surface of the run can be concrete, but must have a well-maintained substrate of sawdust and wood chips; scratch areas and dust baths in soil or suitable substrate must be available. Broilers must have a minimum of 1,858 cm² (2 ft²) per bird for a minimum of 5% of the total flock population. Mobile outdoor pen units must provide a minimum of 1,858 cm² (2 ft²) per bird and be movable to provide vegetative cover at all times.

Option 3 modifies the indoor living conditions (205.239) under option 2 to provide more indoor space, increases minimum requirements for scratch areas and dust baths, increases the exit door area, modifies outdoor living conditions to eliminate solid roofs, specifies stocking rates, requires soil scratching areas, and requires year-round vegetative cover. Under option 3, maximum indoor stocking rates for broilers are 2.27 kg (5 lb) of live weight per 929 cm² (1 ft²). Scratch areas and dust baths must be available for at least 30% of available floor space. Houses must be equipped with exit doors with a minimum of 1.8 m (6 ft) per 1,000 birds and a minimum height of 35 cm (14 in).

Regarding outdoor access under option 3, birds must have direct sun exposure, no solid roofs are permitted except for shade structures, and birds must have soil contact. The new outside stocking rates would require a maximum of 2.27 kg (5 lb) of live weight per 929 cm² (1 ft²) of outdoor space, except for mobile pen units where the outdoor stocking rates of 1,858 cm² (2 ft²) per bird have been proposed. In addition, 50% vegetative cover must be provided year-round.

The overall objective of the current paper is to provide an independent economic effect analysis of proposed regulatory changes. As with the previous analysis for laying hens in Vukina et al. [1], the intention was for these results to help guide the decisions of NOSB when contemplating the adoption of any of the proposed regulatory proposals. As it appears at the time this paper was written, NOP does not anticipate addressing the NOSB proposals on animal welfare in the near future.

MATERIALS AND METHODS

The benefit-cost analysis approach used to evaluate the rule follows Vukina et al. [1]. This approach relies on measuring benefits and costs associated with the proposed project or policy

and then determining if the benefits are larger than the costs (that is, if the benefit-to-cost ratio is greater than 1), in which case the proposal passes the test and could be potentially approved.

Benefits of Regulation

For both options 2 and 3, the nonmonetary benefits of the rule include fostering transparency of standards for living conditions for organic poultry and facilitating enforcement of animal welfare standards for organic poultry. Estimation of the monetary benefits of the regulatory options in the current study relies on the benefits transfer approach, which consists of a systematic review of the economics literature to determine if benefits estimates can be transferred from other similar studies and adjusted to reflect the regulatory proposals. The most important part of the proposed regulations for living conditions for organic poultry relates to reducing stocking densities, both indoors and outdoors; thus, studies addressing this particular aspect of animal welfare improvement are most relevant. The economics literature shows that consumers value improvements in perceived animal welfare, and the hypothetical willingness to pay for increased animal space could be quite substantial.

For the organic broilers industry segment, as shown herein, the representative organic broiler producers already satisfy the regulatory requirements related to stocking rates proposed in option 2; hence, the willingness to pay for the reduction in animal density to below 3.18 kg per 929 cm² (7 lb per 1 ft²) has been already incorporated into the price of organic poultry. Therefore, no additional benefits are associated with option 2. In contrast, option 3 should generate additional benefits valued at a 30% increase in willingness to pay above current market prices. This estimate is obtained by taking the lower bounds of the obtained intervals of individuals' stated preferences for increased animal space found in the related literature as the upper bounds for our regulatory benefit estimates [3].

Cost of Regulation

We turn now to the methodology for estimating the increased costs associated with the

proposed regulations. As in Vukina et al. [1], the employed methodology relies on the standard enterprise budgeting techniques [4]. In constructing the budgets, we focused primarily on the cost aspects because these are most relevant in analyzing the economic effects of various regulatory scenarios. The imputed values for total revenue were calculated based on the break-even price, which implicitly assumes the zero-profit condition [5]. The cost estimation methodology involved 2 steps: establish the baseline cost structure and the break-even price and then analyze whether any of the specific regulatory requirements in options 2 and 3 will have an effect on the established baseline cost structure.

All regulatory proposal items that could have an effect on the representative operation's baseline costs were quantified to obtain the new (postregulation) cost structure and the new break-even price. The comparison of the new (postregulation) and old (baseline) break-even prices is finally expressed as a percentage increase in the break-even price relative to the baseline and represents the cost increase due to regulation.

To study the effects of proposed regulations on the cost of producing organic poultry, we focused our analysis on 2 representative sizes of operations: small and large flocks. In selecting the representative technology, the problem is that many production systems are used in organic production, particularly for small scale units. We decided to use pasture with pens, commercial breed, seasonal production of 4 batches per year, with the total placement of 1,250 birds/yr as a representative of the small-scale production unit and the two 4,645-m² (50,000 ft²) houses with 50,000 commercial breed birds per flock and 6 flocks/yr as the representative large-scale production unit. In line with this approach, we developed structured interview guides [6] where the first group of questions focused on the basic cost structure of the enterprise and the second group of questions focused on the typical costs involved in complying with the proposed regulations. When conducting industry interviews, we employed a method consistent with the limitations on the number of establishments that may be contacted (fewer than 9) without requiring prior approval from the Office of Management

and Budget. Under the Paperwork Reduction Act, Office of Management and Budget approval is required before collecting data from more than 9 entities under government-sponsored studies [7].

Baseline Cost Estimation

The baseline scenarios reflect the average situations for the most frequently observed configurations of production space. The basic assumptions employed throughout are the same as for organic egg production stated in Vukina et al. [1] and can be summarized as

- simple linear (straight-line) depreciation of assets with zero salvage value;
- annual opportunity cost of capital of 3%;
- homogenous labor hired at \$13.25 per hour;
- property tax rate of 0.8% of the value of the assets;
- annual insurance costs of 0.5% of the value of the assets; and
- price variability for inputs according to the size of the flock.

In addition to those assumptions, land prices were constructed based on average real estate values for farm land per acre in 2011 [8]. Land prices were calculated as the average of the published land prices in the top 4 organic broiler-producing states (California, Iowa, Oregon, and Pennsylvania). The average state-level prices were averaged again to obtain a land price of \$4,800 per acre. The annual rental rate was obtained by multiplying the value of land with the 3% interest rate, resulting in annual rates of \$140 per acre.

Labor costs were estimated using data obtained on hourly wages for farming, fishing, and forestry occupations published by the Bureau of Labor Statistics for states with high concentrations of organic egg and broiler production. We calculated an average hourly wage rate using wage rates from 8 states—California, Iowa, Massachusetts, Michigan, New York, North Carolina, Oregon, and Pennsylvania—resulting in an average hourly wage rate of \$13.25. Organic certification costs were calculated as the average of California Certified Organic Farmers

and Iowa Organic Certification Program posted fees for each organic production sales range category.

The baseline budgets for 2 representative size categories presented in the left panels of Tables 1 and 2 were prepared based on the approaches in the existing literature [9–12], personal communications with extensions specialists and industry leaders, and the authors' expert opinions and insights based on their research on the poultry industry. The budgeting analyses show that the baseline break-even organic price is \$7.96/kg (\$3.617/lb) of live weight for a representative small organic broiler operation and \$2.29/kg (\$1.04/lb) of live weight for a large organic broiler operation.

Regulatory Cost Estimation

Using the baseline enterprise budgets developed in the first step of the cost estimation methodological approach, in the second step, we analyzed the effect of the regulation on the baseline cost structure. Because the effects of the proposed changes vary by size of operation, we first determined the size categories to use for the analysis. We relied on the data on the number of certified organic egg producers and operations in 2011 obtained by the USDA, Agricultural Marketing Service survey of 36 USDA-accredited state and private organic certifiers (for details see [6]). Corresponding to our baseline enterprise budget scenarios, we divided the organic broiler industry into 2 segments: a small producer producing fewer than 100,000 birds per year and a large producer producing more than 100,000 birds per year. In the case of broilers, it does not matter how one defines the small producer category, because for anywhere between 3,000 and 100,000 birds, the percentage share of this size category is essentially the same.

To obtain the distribution by the defined size categories, we used the same approach described in Vukina et al. [1]. First, we calculated the average producer's size for each certifying agency by dividing the number of birds produced by the number of producers that each individual certifying agency certified in 2011. Next, we calculated the percentage share of each certifying agency in the industry total and we mul-

Table 1. Baseline enterprise budget for small organic broiler operations¹

Item	Quantity	Cost per unit	Total fixed costs (\$)			Annual fixed costs (\$)			Estimated regulatory annual cost (\$)		
			Price	Value	Years	Depreciation	Interest (3%)	Annual	Option 2	Option 3	
Fixed cost											
Brooder house	1		5,000	5,000	20	250	75	325	325	325	
Pen	4		200	800	5	160	12	172	172	172	
Composter	1		500	500	10	50	8	58	58	58	
Waterer and feeder	5		60	300	3	100	5	105	105	105	
Brooder	1		125	125	7	18	2	20	20	20	
Dolly								20	20	20	
Pasture land (acre)	1							120	120	120	
Organic certification								500	500	500	
Insurance								34	34	34	
Property tax								54	54	54	
Total fixed cost				6,725				1,406	1,406	1,406	
Variable cost											
Chick (per chick)	1,250	1.00						1,250	1,250	1,250	
Wood chip (total)	1	150.00						150	150	150	
Utilities (total)	1	50.00						50	50	50	
Feed (per ton)	18,750	0.35						6,563	6,563	6,563	
Labor											
Brooder labor ² (per hour)	28	13.25						371	371	371	
Field labor ³ (per hour)	356	13.25						4,452	4,452	4,452	
Processing fee (per bird)	1,060	2.50						2,650	2,650	2,650	
Miscellaneous (per total)	1	400.00						400	400	400	
Total variable cost								15,886	15,886	15,886	
Total cost								17,292	17,292	17,292	
Total cost per live pound								3.617	3.625	3.625	
Break-even price calculation											
Birds for sale								1,063	1,063	1,063	
Pounds for sale								4,781	4,781	4,781	

Continued

Table 1 (Continued). Baseline enterprise budget for small organic broiler operations¹

Item	Quantity	Cost per unit	Total fixed costs (\$)			Annual fixed costs (\$)			Estimated regulatory annual cost (\$)			
			Price	Value	Years	Depreciation	Interest (3%)	Annual	Option 2	Option 3		
Break-even revenue												
Break-even price per pound of live weight								17,292		17,292	17,292	17,292
Percentage increase in break-even price								3.617		3.625	3.625	3.625

¹Among the assumptions were type of operation: small flock, commercial breed (Cornish-Cross); production configuration: pasture with pens; production cycle: seasonal production (spring, summer, and fall), 4 batches per year; birds placed each year: 1,250, equally spaced in 4 pens; grow-out period: 8 wk (56 d); mortality rate: 15% (derived from required industry surveys); dressed weight: 4.5 lb; feed consumption: 15 lb/bird; birds are marketed directly to customers, no labels.

²Brooder labor assumes 0.5 h/d × 14 d × 4 batches.

³Field labor assumes 0.5 h per day per pen × 4 pens × 42 d × 4 batches.

plied this percentage share with the average producer size for this certifying agency. Finally, we summed these numbers in each of the individual size categories to obtain the percentage shares of each size category in the industry total. As shown in Table 3, only 1% of production is produced by small producers, but they represent 68% of producers. In contrast, 99% of production is produced by large producers, but they represent only 32% of producers.

RESULTS AND DISCUSSION

The analysis of the proposed rules showed negligible effects of either regulatory option on small organic broiler producers and negligible effects of option 2 on large organic broiler producers. In these cases, based on results of industry interviews, organic broiler producers are already operating under conditions that satisfy the regulatory options. In contrast, option 3 will have multiple effects on the cost structure of a representative large-scale organic broiler producer through

- a one-time (fixed) cost associated with retrofitting the house to install more exit holes;
- an increased requirement for more outdoor access, which would be reflected in the increased cost of land; and
- increased mortality associated with a substantially increased outdoor area.

The most significant effects occur because of the requirements for outdoor space. The combined effect of all 3 effects on the cost structure for large producers is estimated to be rather small, at only a 2.25% increase in the break-even price relative to the baseline scenario. We describe the derivation of this estimate herein.

Small Operations (Approximately 1,250 Birds per Year)

As the last 2 columns of Table 1 indicate, as far as indoor housing requirements are concerned, a typical small organic producer likely satisfies all of the regulatory option 2 requirements. The same is true for the outdoor access requirement. As a result, the percentage increase in the break-even organic price relative to the

Table 2. Baseline enterprise budget and regulatory cost estimates for large organic boiler operations¹

Item	Quantity	Cost per unit	Total fixed costs (\$)				Annual fixed costs, \$			Estimated regulatory annual cost (\$)		
			Price	Value	Years	Depreciation	Interest (3%)	Annual	Option 2	Option 3		
Fixed cost												
Tunnel house	2		180,000	360,000	20	18,000		5,400	23,400	23,400	23,400	23,400
Equipment	2		110,000	220,000	10	22,000		3,300	25,300	25,300	25,300	25,300
Land	2		4,800	9,600					288	288	432	432
Insurance									2,948	2,948	2,959	2,959
Property tax									4,717	4,717	4,735	4,735
Organic certification									2,650	2,650	2,650	2,650
Total fixed cost				589,600					59,303	59,303	59,656	59,656
Variable cost												
Labor ² (per hour)	1,200	13.25							15,900	15,900	15,900	15,900
Feed ³ (per pound)	2,486,250	0.35							870,188	870,188	856,800	856,800
Chick (per chick)	300,000	1.00							300,000	300,000	300,000	300,000
Medication, vaccination (per chick)	300,000	0.20							60,000	60,000	60,000	60,000
Harvesting and transport (per chick)	300,000	0.03							7,500	7,500	7,500	7,500
Utilities (per flock)	6	2,500							15,000	15,000	15,000	15,000
Repairs and maintenance (per house)	2	2,000							4,000	4,000	4,000	4,000
Miscellaneous	2	2,000							2,000	2,000	2,000	2,000
Total variable cost									1,274,588	1,274,588	1,261,200	1,261,200
Total cost									1,333,890	1,333,890	1,320,856	1,320,856
Total cost per square foot									26.6778	26.6778	26.4171	26.4171
Total cost per pound of live weight									1.0401	1.0401	1.0635	1.0635
Break-even price calculation												
Live pounds sold ⁴									1,282,500	1,282,500	1,242,000	1,242,000
Break-even revenue									1,333,890	1,333,890	1,320,856	1,320,856
Break-even price per pound of live weight									1.0401	1.0401	1.0635	1.0635
Percent increase in break-even price									0.00	0.00	2.25	2.25

¹Baseline budget assumptions included: type of operation: large flock, commercial breed; production configuration: two 50 × 500 ft (50,000 ft²) single-level house with side curtains, dirt floors, and natural light; outdoor access: soil 50% covered in vegetation year-round, 20% of the indoor space (total of 10,000 ft²), 8 exit doors distributed around the building (24 in wide × 18 in high, each); production cycle: 6 flocks per year; indoor stocking rate: 1 ft² per bird (for 50,000 birds); outdoor stocking rate: 0.2 ft² per bird; grow-out period: 6 wk (42 d); mortality rate: 5% and increases to 8% in option 3 (derived from required industry surveys and [13, 14]); feed conversion: 1.9 (8.5 lb of feed for a 4.5-lb bird); average live weight of finished birds: 4.5 lb.

²Labor cost assumes 200 h per flock.

³Feed cost assumes \$700 per ton, 8.5 lb of feed per bird, and 5% mortality evenly distributed.

⁴Producer sells live birds to a processor.

Table 3. Estimated number of certified organic broiler operations and producers by size, 2011¹

Operation size	Estimated			
	Number of birds	Percentage of production	Number of producers ²	Percentage of producers
All	30,049,372	100	288	100
Small (less than 100,000 birds per year)	300,494	1	195	68
Large (more than 100,000 birds per year)	29,748,878	99	93	32

¹Based on information collected by USDA, Agricultural Marketing Service from 36 USDA-accredited state and private organic certifiers in 2011 [13].

²The number of producers for each size category was estimated by assigning all producers of each certifying agency to a size category based on the average production of operations under the certifying agency.

baseline is 0%. The identical result is obtained under the option 3 scenario. As far as indoor housing requirements are concerned, a typical small organic broiler producer should automatically satisfy all of the regulatory option 3 requirements described previously. The same is true for the outdoor access requirement. Consequently, the percentage increase in the break-even organic price relative to the baseline is 0%. Because most small organic broiler operations would be able to reasonably accommodate the regulatory requirements under either scenario, they would not experience any increase in costs. Therefore, the estimated break-even organic price per pound is the same under either scenario, as shown in Table 4, which summarizes the results for small organic broiler producers.

Large Operations (Approximately 50,000 Birds per Flock)

A typical large organic broiler operation is also likely to already satisfy all regulatory op-

tion 2 requirements (see the last 2 columns in Table 2). In particular, according to option 2, broilers are required to have no more than 3.18 kg of live weight per 929 cm² (7 lb per 1 ft²) of indoor space. In a representative large operation used to estimate regulatory costs, 50,000 birds are housed in 4,645 m² (50,000 ft²) of indoor space with 25,000 birds per 2,323 m² (25,000 ft²) of house. An average 5% mortality rate and an average 2.04 kg (4.5 lb) of live weight results in 1.94 kg (4.275 lb) of live weight per 929 cm² (1 ft²). Also, a representative house is equipped with enough exit doors of the correct size to satisfy the requirements. Next, because the typical house has dirt floors (with shavings), ample scratch areas and dust baths are available. Further, the ventilation is assumed to be able to reduce the ammonia concentration below 25 ppm. Finally, ample natural light is available in houses of this type. Regarding the outdoor space requirements, in a typical large organic broiler operation, the birds are allowed to go outside by 4 wk of age when outside temperatures are over

Table 4. Estimated costs of producing organic broilers under various scenarios, small operations, 2011

Item	Baseline	Option 2	Option 3
Production volume			
Number of birds per operation	1,250	1,250	1,250
Pounds per operation (live)	4,770	4,770	4,770
Costs per farm (\$)			
Total fixed costs	6,725	6,725	6,725
Annualized fixed costs	1,406	1,406	1,406
Variable costs	15,886	15,886	15,886
Total annual costs	17,292	17,292	17,292
Costs per pound (\$, unless otherwise noted)			
Break-even price per pound (live) ¹	3.07	3.07	3.07
Break-even price per pound (dressed)	3.63	3.63	3.63
Percentage increase over baseline (%)		0.0	0.0

¹Break-even price per live pound based on an average dressed weight of 2.04 kg (4.5 lb) per bird and a \$2.50 per bird processing fee.

Table 5. Estimated costs of producing organic broilers under various scenarios, large operations, 2011

Item	Baseline	Option 2	Option 3
Production volume			
Number of birds per operation	300,000	300,000	300,000
Pounds per operation (live)	1,282,500	1,282,500	1,242,000
Costs per farm (\$)			
Total fixed costs	589,600	589,600	594,400
Annualized fixed costs	59,303	59,303	59,689
Variable costs	1,274,588	1,274,588	1,261,200
Total annual costs	1,333,890	1,333,890	1,320,889
Costs per pound (\$, unless otherwise noted)			
Break-even price per pound (live)	1.04	1.04	1.06
Break-even price per pound (dressed) ¹	0.81	0.81	0.83
Percentage increase over baseline		0.0	2.25

¹Break-even price per pound based on an average live weight of 2.0 kg (4.5 lb) per bird and a dressing percentage of 78%.

50°F and they are exposed to direct sunlight. Because option 2 requires that broilers must have 1,858 cm² of space per bird, for a minimum of 5% of the total flock population, this requirement is assumed to be automatically satisfied because 5% of 1.858 cm² (2 ft²) is 93 cm² (0.1 ft²), whereas the typical operation of this type has 186 cm² (0.2 ft²) per bird. Next, because the surface of the typical operation is soil, scratch areas and dust bathing are available.

According to option 3, the indoor housing stocking rate for broilers requires no more than 2.27 kg (5 lb) of live weight per 929 cm² (1 ft²) of indoor space, and the representative operation has 1.94 kg (4.275 lb) of live weight per 1 ft², which satisfies the requirement. Next, because the typical house has dirt floors (with shavings), ample scratch areas and dust baths are available. Further, the ventilation is assumed to be able to reduce the ammonia concentration below 25 ppm. Also, ample natural light is available in houses of this type, so no improvements are required. However, when it comes to exit doors, the typical production unit will not satisfy the option 3 regulatory requirement of 1.8 m (6 ft) of exit doors per 1,000 birds. For a typical house, this requirement amounts to 7.62 m (25 ft) of doors per house, and the house has only 4.88 m (16 ft) of doors. This means that there is still another 2.74 m (9 ft) required per house, which translates into a requirement of 5 additional doors (2.74/0.61 m or 9/2 ft = 4.5 doors) per house, or 10 additional doors for the entire production unit. The one-time installation cost is estimated to be \$120 per door plus 2 h of labor

per door, which is valued at a price of \$50/hour. Hence, the total cost of 10 additional doors is estimated at \$2,200 and is reflected in the increased cost of equipment. The amortization (10 yr) plus the opportunity cost of capital (3%) associated with this fixed cost amounts to \$180 per year plus the associated additional charges for insurance and property taxes, all of which have been added to the cost of regulatory option 3. No additional operating costs are associated with 10 additional exit doors. When it comes to outdoor access, the representative producer will not satisfy the outdoor stocking rate requirement of no more than 2.27 kg (5 lb) of live weight per 929 cm² (1 ft²) of outdoor space. The currently available outdoor space amounts to 929 m² (10,000 ft²), and given the average live broiler weight of 2.04 kg (4.5 lb), the new requirements would amount to an additional 3,253 m² (35,000 ft²) of outdoor space. To satisfy this requirement, we assumed that the operator is in position to buy or lease an additional 1 acre of land and expand the outdoor access to satisfy this requirement. Using the price of land of \$4,800 per acre and 3% discount rate, this amounts to an additional land rental cost of \$144 per year. This amount has been added to the annual cost of land. However, it is widely believed that the increased outdoor space requirement will increase the mortality throughout the production cycle because larger outdoor areas will become more difficult to defend from predators and diseases. In our calculation, this is reflected in an increase in mortality rate, from 5 to 8%, calculated from research reports on range production

Table 6. Total estimated annual industry costs of regulation on the organic broiler industry under option 3

Item	Production (%)	Baseline number of units ¹ (lb, dressed; $\times 10^3$)	Total industry revenue in 2011 ¹ (\$; $\times 10^3$)	Regulatory cost per unit (\$)	Total industry cost (\$; $\times 10^3$)
Total organic broiler production ²	100	105,473	247,862	0.02	2,448
Broilers, small operation	1	1,055	2,479	0.00	0
Broilers, large operation	99	104,419	245,384	0.02	2,448

¹Revenue derived from production estimates obtained by USDA, Agricultural Marketing Service from 36 USDA-accredited state and private organic certifiers in 2011 [15] and prices based on simple averages of monthly prices provided by Lawrence Haller, Chief Economist, USDA, Agricultural Marketing Service, Poultry Programs.

²Total estimated ready-to-cook organic chicken based on organic broiler numbers from USDA, National Agricultural Statistics Service [16], and data obtained by USDA, Agricultural Marketing Service from 36 USDA-accredited state and private organic certifiers in 2011 [15], with an average weight of 2.04 kg (4.5 lb) of live weight per bird and a dressing percentage of 78%.

density [13, 14] and the corresponding effect on the reduced feed consumption and the available pounds of live weight that can be sold. All other outdoor access requirements for option 3 are automatically satisfied.

The summary of the cost of regulation estimation results for large broiler producers is presented in Table 5. Large organic broiler producers currently operate under indoor and outdoor husbandry practices that satisfy option 2; therefore, we estimated no cost increases due to this proposed regulation. Under option 3, however, large organic broiler operations would need to make several changes to production operations to comply with the indoor stocking rates and outdoor access requirements. The combined effect of all adjustments needed to satisfy the regulatory requirements amounts to a 2.25% increase in the break-even price relative to the baseline cost scenario.

Estimated Total Industry Costs

Using the per-farm estimated regulatory costs above and the estimates of production volumes and actual prices, we calculated the total estimated industry costs due to option 3 and contrasted these numbers with the industry total revenue. Table 6 shows that the estimated total organic broiler industry cost under option 3 is \$2.4 million. This cost represents a negligible 0.1% of total industry revenue.

Note that the results are based on the assumption that a representative producer represents the industry structure adequately. To the extent that the organic broiler industry is fairly homogenous with respect to its cost structure within

each size category, the representative producer approach is appropriate. However, if the industry is technologically heterogeneous, then the representative producer approach is not going to capture all specific nuances and idiosyncrasies of different production processes, and a complete industry survey would be required.

All cost-shift scenarios are based on the intermediate length of the run (5-yr horizon), where changes in variable cost through inputs and output adjustments are possible together with some changes in fixed cost through smaller adjustments in land, buildings, and equipment. The potential entry and exit of firms that would be caused by regulation are unlikely and hence not considered in the current analysis.

CONCLUSIONS AND APPLICATIONS

1. Under option 2, the regulatory costs are estimated to be zero because most producers are already in compliance with the requirements. In addition, the anticipated benefits are also estimated to be zero because current market prices already reflect consumers' willingness to pay for existing perceived animal welfare conditions. However, some nonmonetary benefits may be realized because of the transparency in the marketplace and enhanced ability to enforce animal welfare standards.
2. Under option 3, before market adjustments, the regulatory burden is estimated to be zero for small broiler operations and less than \$0.01/kg (\$0.02/lb) for large broiler operations. Assuming

a maximum estimated benefit of 30% for option 3 due to improved perceived animal welfare conditions and applying this percentage to the average price per pound for broilers of \$5.17/kg (\$2.35/lb) results in estimated benefits per pound of \$1.54/kg (\$0.70/lb). Therefore, the proposed option easily passes the benefit-to-cost ratio test and could potentially be adopted.

3. Finally, in conducting data collection and analyses for the regulatory options, we identified several concerns regarding the feasibility of complying with the requirements under option 3 for organic broiler production. Specific concerns identified by organic broiler industry participants and other experts were two-fold. First, the number and size of exit doors appears to be excessive because their installation could sometimes jeopardize the physical integrity of the housing structure, rendering it unusable for continued production. Second, the proposed regulation for increased outdoor space appears to be excessive because broilers tend to concentrate around the sources of feed and are unlikely to venture very far away from the chicken house; hence, significant areas of added space could be left unused.

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