Economic Effects of Proposed Restrictions on Egg-laying Hen Housing in California

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University of California Agricultural Issues Center

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Executive Summary

A ballot initiative in California that would place restrictions on the housing of commercial egg-laying hens is scheduled for the fall 2008 election. The specific wording of the initiative is imprecise. Nonetheless, informed expectations and careful assessments are that, if passed, the resulting regulations would eliminate the use of cage systems for laying hens in California and may be even more restrictive. If passed, the initiative would mean that remaining egg production in California would be from non-cage systems and could mean that typical non-cage systems would be restricted as well. The restrictions imposed by the new policy would take effect at the beginning of 2015, allowing about six years for adjustment.

The California egg industry has a significant role in California agriculture. It produces almost five billion eggs per year from almost 20 million laying hens. Value of production was about $213 million in 2006, and about $337 million in 2007, due to much higher egg prices. Major production comes from San Diego, San Bernardino and Riverside Counties in Southern California; Merced, Stanislaus and San Joaquin Counties in the Central Valley; and Sonoma County on the North Coast. Production in California has declined substantially since its peak of about nine billion eggs in 1971, when California was shipping eggs to out-of-state consumers. In 2008, California is a substantial net importer of eggs produced in other states, producing about six percent of the national total of table eggs and consuming about 12 percent, based on population share. Shipments into California come from a broad portfolio of states including

Iowa, Minnesota, Utah, Missouri, Michigan and several other important sources. A large share of the eggs shipped into California are in liquid form, but about one third of the shell eggs consumed in California are produced out of the state. The relative size and competitive position of the California egg industry are important factors in understanding the likely economic impacts of the initiative.

Non-cage production does occur now in California and in other U.S. states. However, the share of non-cage production is quite small, about 5 percent of the total, including the non-cage eggs that also qualify as organic. (Organic production imposes a number of additional production limits, including the use of organic feed and limits on the use of medicines.) Despite its limited share of production and consumption, a variety of different non-cage systems are in use, and data on the costs of production, prices and marketing in these systems are limited.

The best evidence from a variety of sources suggests that (non-organic) non-cage systems incur costs of production that are at least 20 percent higher than the common cage housing systems. The sources of these added costs per dozen range across the major categories including: (a) higher feed costs (due to more feed consumption per laying hen and fewer eggs per laying hen), (b) higher laying hen mortality, which leads especially to higher pullet cost per dozen eggs amortized over the life of the flock, (c) higher direct housing costs per dozen eggs (because there are fewer hens per flock and fewer marketable eggs over the life of each hen entering the flock), and (d) higher labor costs (due to fewer hens per flock, fewer eggs per hen and more labor per dozen in gathering eggs). In making these assessments, we use cost information from farms that use both cage-free and typical cage systems. Such data allow more direct comparisons of costs than do data comparing specialized farms, which may have different scale economies and hence different costs per dozen eggs for reasons other than the housing system used.

Retail prices for non-organic non-cage eggs are at least 25 percent higher than those for eggs produced in cage systems, reinforcing the information from estimates of cost differentials. The 25 percent differential was measured in April 2008, at a time of very high retail prices for all eggs and when the differential between cage and non-cage eggs had declined. These retail price comparisons apply to cage and non-cage eggs of the same grade, size, color and brand of eggs and sold in the same supermarkets. Average retail prices of non-cage eggs have often been double the prices of conventionally produced eggs, especially if one does not standardize fully for characteristics of the product and market considerations.

Despite transport costs of feed and of eggs, there is now a national market for eggs in the United States. Based on the evidence we have examined, the California egg industry competes vigorously with egg production in other states. This competition is indicated by the fact that shipments of eggs into California comprise a large and growing share of shell egg consumption in California, as well as the dominant share of liquid egg use in food service and food processing. Thus, any regulation or other factor that raises the costs of egg production in California relative to the cost of egg production in other states will strongly favor expansion of the share of out-of-state eggs in the California market. And, since the proposed restrictions on production methods apply only to eggs produced in California, the regulations implied by a successful initiative would raise costs of California producers by at least 20 percent relative to its out-of-state competitors.

The market impact of such a cost increase hinges on several facts outlined above and on some basic economic principles. First, with six years to adjust to the new market situation and given the less than the two-year life cycle of a typical laying hen flock, there is time for complete adjustments to expand production in other states so that they can meet the new market opportunities in California. Since national egg demand would not change significantly, the anticipated adjustment does not require additional pullets, additional feed or more inputs on a national basis. The relocation of egg production can be relatively rapid. Second, the new market opportunities for shipments into California entail an expansion of production in other states by less than 10 percent, which would be spread across many locations and farms that already have well-established relationships with buyers in California. The implication is that substantial new out-of-state egg supply could be forthcoming within a six-year horizon at little, if any, additional per-unit cost, and much less than the additional cost that a shift to non-cage housing would entail for California producers.

One consequence of the expansion of shipments of eggs into California at little additional cost is that prices to egg buyers and consumers would increase only slightly. Since more than a third of the shell eggs consumed in California already come from out-of-state, because expansion of production in other states would not entail additional per-unit costs, and because many out-of-state locations and farms already compete in the California market, we would expect little, if any, cost increase and no substantial impact on prices to California consumers.

Within California, a reduction in the number of eggs produced using the typical cage system could also occur within the six-year adjustment horizon. In the egg industry, direct operating costs comprise most of the annual cost of production per dozen eggs. Furthermore, most of the current housing units could not be converted to non-cage housing without significant investment for retrofitting. Therefore, operations could not continue to produce eggs in California without new capital investment, and such investment could not be justified when California costs of production would be far higher than costs in other states.

Our analysis indicates that the expected impact would be the almost complete elimination of egg production in California within the six-year adjustment period. Non-cage production costs are simply too far above the costs of the cage systems used in other states to allow California producers to compete with imported eggs in the conventional egg market. The most likely outcome, therefore, is the elimination of almost all of the California egg industry over a few years.

A small amount of non-cage or other specialty egg production may continue in California. However, since the large farms that now produce most of the eggs in cage systems also produce most of the non-cage eggs, it is unclear if they would remain competitive even in non-cage production. If the farms that produce most of the eggs using the non-cage systems were to eliminate their production using the caged housing systems, their operations would be much smaller and they would fail to capture the economies of scale that currently allow them to be efficient producers of both caged and non-cage eggs. Producers outside California may be able to use the scale economies of their production using cage systems to produce non-cage eggs at lower cost than the remaining California farms that would be only allowed to specialize in this very small segment of the market. That said, it is likely that there would continue to be some small-scale niche-market producers remaining in California.

The economic logic behind these significant economic results is straightforward. Under new rules that eliminated the use of conventional low-cost cage housing systems, the costs of production in California would be significantly higher than out-of-state farms that have already demonstrated their ability to compete successfully in the California market. Thus the impact of the initiative would not affect *how* eggs would be produced, only *where* eggs would be produced. Furthermore, because out-of-state eggs are already a major share of the California market, and many producers compete actively in this market, no significant consumer price increases would be expected.

Employment and related broader economy-wide information about the egg industry in California is limited. Egg production and on-farm processing likely employs about three thousand workers concentrated in Southern California, the Central Valley and Sonoma County. Egg production is a sizeable part of the local economies, especially in several rural communities. Typically, each job within a farming industry adds an additional job in other local employment, and the egg industry follows a similar pattern. Egg production is particularly important to the rural economy of Merced County, which has a much higher poverty rate than the California average and unemployment rates approximately double the California average. Therefore elimination of egg industry jobs there would be especially troublesome. In addition, besides the overall effects on economic activity and employment, elimination of the egg industry would reduce state and local tax revenues.

Three implications of our analysis should be reinforced. First, the elimination of the cage housing system in California alone would not affect how the eggs consumed in California would be produced. Those eggs would continue to be produced using cage housing systems outside of California. We find that the main implication of the initiative would be on where eggs consumed in California would be produced. Second, imposing additional regulations that effectively eliminated most commercial egg production in California would reinforce the impressions that food producers have about the difficulty of maintaining a dynamic, competitive and sustainable agricultural industry in California. Investment and innovation requires confidence inspired by a climate of security. Severe regulatory dislocation sends another discouraging signal, even to farms, processors, input suppliers and marketers that are not directly connected to the egg industry. This broad impact may be the most significant economy-wide implication of the initiative.

Third, let us consider a scenario beyond the California initiative. If a shift to non-cage production were to be imposed nationwide, the implications are different. We would expect consumer costs to rise substantially, by at least 25 percent, and perhaps much more. Under this scenario, lower-cost eggs produced from caged hens would not be available to supply U.S. consumers, unless it was possible to expand low-cost egg production in Canada or Mexico for shipments to U.S. markets. Egg production in the United States would continue with reduced volumes, but consumers would pay more and consume fewer eggs because of the higher price.

Finally, this study has considered only the economic implications of regulations that would eliminate the use of cage housing systems for egg production in California. We do not analyze implications for animal welfare, except to the extent that additional hen mortality and other hen health problems affect the cost of production. Nor do we analyze perceptions or preferences of the general population concerning egg production systems. Hence, our analysis cannot lead to overall recommendations about the initiative.

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I. Introduction

I.1 The content of the initiative

On August 9, 2007, a petition was filed with the State's Attorney General to include the Treatment of Farm Animals Statute[1] on the November 2008 General Election ballot. The initiative qualified for the ballot on April 9, 2008, as Proposition 2. This proposed ballot initiative, if passed by California voters, would take effect on January 1, 2015 and would mandate limits on the minimum space in which certain farm animals (veal calves, pregnant pigs and egg-laying hens) may be confined:

> *In addition to other applicable provisions of law, a person shall not tether or confine any covered animal, on a farm, for all or the majority of any day, in a manner that prevents such animal from:*
>
> *(a) Lying down, standing up, and fully extending his or her limbs; and*
> *(b) Turning around freely.*

As indicated, the parameters that define the mandated minimum size do not constitute a specific measurement but rather are dictated by the ability of the animal to perform particular behaviors. For egg-laying hens confined for the purpose of egg production, "fully extending his or her limbs" is further defined as follows.

> ***Fully extending his or her limbs***: *"fully extending all limbs without touching the side of an enclosure, including, in the case of egg-laying hens, fully spreading both wings without touching the side of an enclosure or other egg-laying hens."*

(California Attorney Gen. File #: 2007-041)

[1] The initiative was originally titled "The Prevention of Farm Animal Cruelty Act".

I.2 Content and purpose of this report

This report considers the economic implications of the initiative, if passed. To consider these implications, the rest of this section provides definitions and interpretations of the initiative. We then describe the European experience with non-cage egg production. Section III supplies information about the market for eggs in California and the rest of the United States. Information about the cost of production of eggs in California is crucial to analysis of the initiative, and this background along with a detailed consideration of the degree to which costs differ in different housing systems for hens is the topic of Section IV. Finally, we analyze how complying with the initiative would affect the quantity and location of egg production and how shifts in the location of the industry would affect the broader economy in California.

I.3 Review of laying hen housing systems

The choice of a particular housing system for laying hens involves considerations of production costs, management capability, hen health and welfare, food safety, and environmental issues. No housing system is without drawbacks, and relative performance is dependent on management techniques. Measures of performance will therefore vary significantly within systems as well as between systems. Under poor management, hen welfare and productivity will likely suffer regardless of the housing system utilized. Moreover, certain management practices that can impact welfare and productivity are independent of the housing system, such as the decision to molt.

Hen housing systems are divided into two broad types: cage and non-cage. These systems are described and their hen welfare advantages and disadvantages are discussed in Appleby et al. (2004), the European Food Safety Authority report on hen welfare (EFSA 2005), and the LayWel report funded by the European Union (LayWel 2007). Cage systems are classified as either conventional or furnished. Conventional cages (also referred to as battery cages) are the most common system used for the commercial production of eggs in the United States and worldwide (IEC 2007). These cages are made of wire and have sloping floors that cause the eggs to roll to the front of the cage for automatic egg collection. A typical conventional cage houses five to eight hens. Most wire cages used in the United States for laying hens have a height of 15 to 16 inches at the rear of the cage, and are slightly higher at the front of the cage. The floor space varies from 12 by 18 inches to 24 by 20 inches, with fewer birds in the smaller cages.

Modern cage systems may use an offset or stair-step arrangement so that cages can be stacked and manure can drop below the cage without landing in the lower cages. When more than two tiers are used in this arrangement, cages are partially off-set and include a board to shield manure from the lower tiers. Other modern systems use manure belts to allow cages to be stacked without off-sets so that more tiers are feasible and space is utilized more efficiently (Bell 2002c).

The primary advantages of a cage system compared to a non-cage system are: better hygiene; easier to manage; cleaner eggs; generally lower mortality; a low risk of disease and parasitism; fewer problems with aggression and injurious behaviors like feather pecking and cannibalism because of the small group size in the cage; better foot health; and fewer problems with air quality (dust and ammonia). The primary disadvantages of conventional cages are that they restrict the hens' movement (which leads to poor bone strength due to disuse osteoporosis), and also restrict the hens' behavior because they do not contain a nesting area, litter material used by hens to clean their plumage (dust bathing), or a perch. The behavioral restrictions in conventional cages are inherent features of the system.

Furnished cages (also called enriched or modified cages), were developed in Europe to try to address some of the welfare concerns associated with both conventional cages and non-cage systems. They are similar to conventional cages but provide more space for each hen. Furnished cages are equipped with perches, nesting areas, and sometimes litter material. However, some behaviors (e.g. flying, foraging) are still restricted as compared to non-cage systems, due to space limitations. Furnished cages are most common in the EU, where they are required to provide 750 cm^2 (116 in^2) of space per hen and have a height of 45 cm (18 in) or more (EU directive 1999/74/EC). To our knowledge, no commercial producer in the U.S. uses furnished cages. In general, furnished cages are intermediate between conventional cages and non-cage systems in terms of their advantages and disadvantages, although this depends greatly on the design features of the particular furnished cage system (LayWel 2007). In terms of the cost of egg production, furnished cages are not at a significant disadvantage compared to conventional cages (Agra CEAS 2004, p.vi).

Non-cage systems are also of two general types: floor systems (referred to in Europe as barn systems or single-tier systems) and aviaries (multi-tier systems), each typically housing thousands or tens of thousands together. In floor systems, the hens are housed on the floor of a building instead of in cages; the building contains nest boxes, which are typically configured to allow automatic egg collection. In the EU, hens in floor systems must be provided with litter and perches, although the floor cannot be completely covered with litter because this contributes to certain air quality and health problems. In the U.S., however, there are no regulations regarding the configuration of these systems, and there is consequently wide variation – hens may be housed in all-litter systems; or completely on wire, slatted or perforated floors with no litter provided; or in a combination litter-wire/slat/perforated flooring system. Perches may or may not be provided to the hens. Floor systems have higher production costs than conventional or furnished cages, but significantly lower production costs than free-range systems (Appleby et al. 2004; Bell 2005).

Aviaries are similar to floor systems, but have multi-tiered platforms that allow the hens to make use of the height of the building. The ground level is usually covered with litter material, and the perforated upper level platforms are arranged so that manure does not fall on the hens below. Aviary systems have perching surfaces and nest boxes, and food and water are typically provided on each level. The group size is similar to that of floor systems, although each hen is given less space than in a floor system. These systems have been widely adopted in the EU, but are less common in the United States. Aviaries have lower production costs than free-range systems, but higher costs than cage systems (Appleby et. al. 2004).

Aviary and floor systems have similar advantages and disadvantages as compared to conventional cages (LayWel 2007). The advantages include providing more freedom of movement for the hens, as well as the opportunity to nest, perch and dust bathe (at least if the system is appropriately configured). Disadvantages include: more difficult to manage; generally higher mortality; more problems due to feather pecking and cannibalism, particularly if the hens are not beak-trimmed; high rates of bone fractures during the laying period; higher incidence of infection with internal and external parasites; higher risk of the hens piling on top of and smothering one another (hysteria); health problems related to higher levels of ammonia and dust if litter is present; and increased difficulty in inspecting and catching hens. Some of the health problems associated with non-cage systems can probably be decreased (although not necessarily eliminated) by system design, improved management, selection of appropriate genotypes of hens, and/or use of veterinary (e.g. vaccination) or chemical control (e.g. pesticide application to control external parasites) methods.

Free-range egg systems imply (at least to consumers) that the laying flock is allowed outdoors for at least part of the day; however, unlike in the EU, there are no legal marketing or regulatory standards in the United States, except that the National Organic Standards require that the hens be provided with "access" to the outdoors. Either a floor system or an aviary system can have an outdoor area to meet this provision. In some cases, outdoor access may consist only of an outlet from the barn to a small yard or other fenced area that allows the birds to move freely (California Certified Organic Farmers 2007). In a fully free-range system (e.g., pastured production) where the hens are actually housed outdoors for most of the day, an indoor area or shelter is typically provided for use at night or in poor weather. Stocking density, group size, and housing vary significantly from one producer to another. Automation of egg collection and feeding is possible in some systems. The advantages and disadvantages are similar to those of other non-cage systems, with the main differences being that hens that access the outdoors have additional behavioral freedom, but also potentially higher disease risks due to contact with wild birds. In addition, hens on range may be exposed to predators and temperature extremes that can result in higher mortality. Free-range eggs fall within the non-cage egg market and command a significant premium (Patterson et al. 2001). However, widespread commercial adoption is unlikely even if the California initiative passes because of disease and biosecurity concerns (e.g. avian influenza) and because production costs are the highest of all non-cage systems (Appleby et al. 2004; Trewin 2002).

I.4 UEP guidelines

In the United States, there are no government regulations concerning housing standards for laying hens. However, the United Egg Producers (UEP) established standards and these cover about 80 percent of the U.S. egg producers and about 70 percent of the U.S. table egg-laying flock. In 1999, UEP established an independent advisory committee to recommend scientifically based housing and management standards for caged laying hens (Mench 2003), resulting in a set of UEP guidelines and an auditing program, the UEP Certified Program. Among the key components of the program was a gradual adjustment to increase the floor space allowances in conventional cages from the 48-52 inches^2 per hen that was the industry norm at that time. The phase-in period for UEP guidelines ended on April 1, 2008. Producers were expected to provide a minimum of 67 inches^2 for each White Leghorn hen and 76 in^2 for each brown egg-laying hen (UEP 2008, p.14).

In 2008, the UEP guidelines were expanded to include non-cage systems. According to the guidelines, each hen should receive a minimum of 1.5 ft^2 (216 in^2) of space per hen in a floor system, and at least 15 percent of the usable floor area should be covered with litter (UEP 2008). If producers provide a perching area over a manure pit, then the minimum is 1.2 ft^2 (173 in^2) of space per hen for brown egg-laying hen and 1 ft^2 (144 in^2) for White Leghorns. In multi-tier systems (aviaries) that allow at least 55 percent of the hens to perch simultaneously, then 1 ft^2 (144 in^2) per hen should be provided. For every 100 laying hens, at least 9 ft^2 (1296 in^2) of nest space should be provided (UEP 2008). Usable floor space is considered the interior width multiplied by the interior length of the house for all pullets hatched before April 1, 2008. By January 2010, only 75 percent of the nest space can be included when calculating usable floor space per hen. This percentage decreases by 25 percent increments annually, until reaching zero in January 2013. As is true for caged hens under the UEP guidelines, beak trimming is permitted, but the practice is recommended only when necessary to stop feather pecking and cannibalism in non-docile breeds.

In this report, we have based our economic assessments on comparing the non-cage systems configured according to the 2013 provisions of the UEP guidelines with cage housing systems that comply with UEP guidelines. We note, however, that in the absence of federal or state regulatory standards for the configuration of these systems that other configurations are possible – for example all-wire or all-litter systems, or systems without perches. Economic considerations may differ in such systems. For example, all-wire systems are associated with higher rates of cannibalism and thus higher rates of mortality than systems with litter (Appleby et al., 2004), but the costs associated with purchasing, managing and disposing of litter would be eliminated in such systems. Due to the wide variation in non-cage systems, a complete survey of all possible configurations would prove impractical. Therefore, as mentioned, we will adopt the UEP's 2013 guidelines for non-cage systems as the standard and assume that all non-cage systems will be in accordance with the requirements stated therein.

I.5 Interpretation of initiative

The Treatment of Farm Animals Statute, as it applies to the table-egg industry, does not provide a numerical requirement for the amount of space that must be provided for each hen. Instead, the space required will be based on the space the hen needs to lie down, stand up, turn around freely, and fully spread both wings without touching the sides of the enclosure or another hen. This is an ambiguous standard that is open to different interpretations. The space required to perform these behaviors will also vary depending upon the age and breed of the hen (brown medium-hybrids are larger than white light-hybrids). However, general observations can be made that allow these spatial parameters to be defined within certain bounds.

Dawkins and Hardie (1989) measured the space necessary for medium-hybrid brown hens to perform various behaviors. They found that individually caged hens used between 75 and 92 in^2 (482-592 cm^2 to stand, and between 156 and 252 in^2 (978-1626 cm^2) to turn (they did not measure lying down). However, they also found that hens could actually perform both these behaviors, although in a compressed fashion, when they were housed with other hens in cage and given much less space (70 in^2, or 450 cm^2 per hen).

Hens housed in conventional cages under the minimum space provisions of the UEP Certified program thus appear to already have sufficient space to stand and turn around (although in the latter case it would depend upon how the word “freely” is defined in the statute). Dawkins and Hardie (1989) also found that individually housed hens used between 168 and 403 in^2 (1085-2606 cm^2) to fully stretch both wings (wing flap), but again could still perform this behavior under the more confined conditions referred to above by using the space in the cage above the other hens. However, they could not do this *without* touching the sides of the enclosure or another hen. The typical wingspan of a commercial hen is about 28 inches (O’Sullivan, personal communication). Many conventional cages are only 24 inches wide, meaning that wing-flapping as defined in the initiative would be precluded simply by the size of these cages even if the hen was housed alone, and would certainly be precluded when other hens were present in the cage, even in a wider cage. Conventional cages would thus be banned under the California initiative.

For the same reasons, it is likely that furnished cages would not be acceptable under the initiative, so for that reason they are not discussed further in this report.

It is worth noting that the initiative does not state whether all hens have to be able to fully stretch their wings simultaneously, or if not, how many hens must be able to stretch their wings simultaneously. If the initiative is interpreted to mean the former, then current space provisions in non-cage systems (1-1.5 ft^2 or 144-216 in^2 per hen) will have to be increased, since each hen may require as much as 2.8 ft^2 (403 in^2) of space (Dawkins and Hardie 1989). This will be associated with corresponding increases in the cost of non-cage production. However, if the initiative is interpreted to mean that at least one hen at a time is able to wing flap, then the current space allowances in typical non-cage systems will allow this. The large overall size of these systems creates more “effective” space, meaning that when the majority of hens in the building are clustered together, there will be some empty space in the house that will provide one or more hens with sufficient space to wing flap. For the purposes of this report, we have interpreted the language of the initiative to mean that at least one hen must be able to flap her wings, and therefore to permit non-cage systems at currently accepted stocking densities.

It should be noted that this interpretation represents the probable minimum necessary adjustments for producers to comply with the initiative. Regulations based on the initiative would be very unlikely to permit less space per hen than that available under the currently accepted stocking densities for non-cage production. However, it may be that the initiative would be interpreted as requiring significantly more space per hen, to the point that free-range production would be the only system capable of meeting its provisions. Below we focus on the non-cage systems, but note that the more restrictive interpretation is possible and would raise costs of production by even more than would a shift to current non-cage systems.

II. European experience with non-cage systems and other housing systems

The European Commission issued its first directive (86/113/EEC) regarding the housing of laying hens in 1986. Two years later, it was superseded by another directive (88/166/EEC) which clarified the minimum acceptable standards for conventional cages. Among these requirements was that all newly installed conventional cages provide at least 450 cm^2 (70 in^2) of floor space per laying hen. By 1995, all cages needed to meet this requirement.

Public pressure led the Commission to issue another directive in 1999. Under Council Directive 1999/74/ECC, no new conventional cages could be built after January 1, 2003. Since then, existing conventional cages have been required to provide at least 550 cm^2 (85 in^2) of floor space per hen, and newly constructed housing must consist of either furnished (enriched) cages or “alternative” (non-cage) systems. Furnished cages require a minimum provision of 750 cm^2 (116 in^2) of floor space per hen. “Alternative” systems consist of “barns” or aviaries with about 1,100 cm^2 (171 in^2) of floor space per hen or free-range systems with no more than nine hens per square meter. (In keeping with the terminology adopted by the European studies, we refer to non-cage floor systems as “barns” in this section.) The directive also introduced an egg tracing system which required eggs to be labeled with a tracking number, the country of origin and the production method utilized.

II.1 Sweden

According to Directive 1999/74/EC, conventional cages will be banned across the EU in 2012. However, two EU member countries, Sweden and Germany, have already enacted more stringent standards. In 1988, Sweden introduced animal welfare legislation that prohibited beak trimming and required that all production be converted to non-cage systems by 1999. Shortly after Sweden joined the EU in 1995, this legislation was reconsidered, since producers were unable to meet the 1999 deadline (Jendral 2005) at least in part because it proved difficult to keep untrimmed hens in non-cage systems without incurring unacceptably high rates of mortality due to cannibalism (Hadorn et al. 2000; Tauson et al. 1999). The complete cage ban was replaced with a ban on conventional cages, which corresponded with the EU directive 1999/74/ECC but took effect in 1999 instead of 2012. In 2000, Sweden became the first country to introduce furnished cages on a commercial basis. In 2006, 39 percent of Swedish egg production came from furnished cages and 61 percent came from barns or aviaries (IEC 2007, p.41).

Between 1990 and 1999, the Swedish laying hen population decreased from 6.4 million to just over 5.6 million hens (Figure II.1). When the conventional cage ban took effect in 1999, the laying hen population increased slightly until 2001 and then began to decline, falling to 4.5 million by 2003. Since then, the national flock has increased so that the laying-hen population is now more than five million. Between 1990 and 1999, egg production fluctuated around 1.8 billion eggs. Following the ban, egg production fell to a low of 1.6 billion eggs in 2004 and then rose to about 1.7 billion eggs in 2005.

Swedish egg prices fluctuated widely before and after the ban in 1999 (Figure II.2). Prices fell by nine percent from 1998 to 1999, but then rose by 17 percent from 1999 to 2003 before collapsing again in 2004 and 2005 and rising in 2006 (Figure II.2).

Nonetheless, producers have been able to earn high gross margins with furnished cages due to high egg prices in Sweden (Agra CEAS 2004, p.53). In 2006, per capita consumption was 164 shell eggs and the equivalent of 34 eggs in product form (IEC 2007, p.41). Imports have increased considerably after the ban, going from 12 thousand metric tons in 1999 to 19 thousand metric tons in 2005 (EUROSTAT). The import share of eggs thus rose from about 10 percent to 16 percent (Figure II.3). Processed egg products made up an increasingly large share of these imports (IEC 2007, p.41).

II.2 Germany

Germany passed a national measure in 2006 that would ban conventional cages by 2009 and furnished cages by 2012. The German egg industry is among the largest in Europe, yet the country is the world's largest importer of shell eggs. In 2006, Germany had a laying hen population of approximately 43 million hens. Around 14 percent of these hens were kept in free-range systems and 15 percent were kept in barn systems (IEC 2007, p.27). In 2006, egg production was over 12 billion eggs and the country was roughly 71 percent self-sufficient in eggs. Between the introduction of the measure in 2002 and its final passage in 2006, producers were operating under a great deal of uncertainty as to which production systems would be permissible, and there was likely no investment in new facilities. As a result, the laying hen population fell by about 5 million hens and domestic egg production witnessed a concomitant fall of about 2 billion eggs (EUROSTAT). These declines are considerably less dramatic when one considers the German egg industry's trend of falling output over the last three decades (Figure II.4). Egg prices rose by about 15 percent between 2002 and 2003, but fell over the next few years until settling just above 2002 levels in 2006 (Figure II.5).

Although Germany exports a considerable number of eggs, it is a heavy net importer of eggs from within the EU. German egg imports make up almost half of EU imports, and the country has been the leading importer for several decades. Almost 80 percent of Germany's imports come from the Netherlands (Windhorst 2007, p.11). In fact, Germany received 72.3 percent of Dutch egg exports in 2005, valued at about U.S.$239 million (IEC 2007; FAOSTAT). Egg imports increased steadily after briefly dipping to a 5-year low of 372 thousand metric tons in 2000. In 2006, egg imports increased sharply to 455 thousand metric tons (EUROSTAT). Figure II.6 shows that the import share rose from just under 30 percent in 2000 to about 37 percent in 2006.

II.3 Switzerland

Switzerland is not a member of the EU, but has also effectively banned the use not just of conventional, but also furnished cages. In 1981, Switzerland passed legislation (the Animal Protection Act) which mandated the provision of 800 cm^2 (124 in^2) of space per hen. Although this act did not explicitly forbid the use of conventional cages, the act effectively ended their use by requiring that all systems have slatted floors or perches, in addition to nest boxes that were darkened and soft-floored. Producers were given a ten year transition period to comply and governmental permission was necessary before producers could use any cages that housed 40 or more hens. Furnished cages that housed over 40 hens were approved for use, but the systems suffered from high rates of mortality due to cannibalism. Citing several problems, the Federal Veterinary Office rescinded the permits and all cage systems were withdrawn from production. (Wechsler 2004; Froehlich and Oester 1989; Froehlich and Oester 2001).

As a result, Swiss egg production has been entirely in non-cage systems since 1992. In 2006, 40 percent of production came from barn systems, while 60 percent came from free-range systems (IEC 2007, p.42). The national flock is currently about 2.2 million laying hens, providing the country with a self-sufficiency rate of about 73 percent. Between the introduction of the act and the end of the transition period, the national flock decreased from about 3 million laying hens to about 2.4 million laying hens. Egg production fell from more than 45,000 metric tons in 1983 to about 36,000 tons in the early 1990s. Thereafter, egg production climbed until reaching almost 40,000 metric tons in 2006, despite a nearly 30 percent reduction in flock size compared to 1990 (IEC 2007; FAOSTAT) (Figure II.7).

Switzerland has high labor and feed costs, the latter due to tariffs protecting the Swiss agricultural market. As such, Switzerland has consistently had higher egg production costs than its neighbors, and the conventional cage ban contributed to even higher prices for Swiss consumers. However, as producers adjusted to the non-cage production methods, prices began to decline, falling almost 30 percent between 1991 and 2000. Since then, prices have risen, but are still below those recorded in the early years of the ban (Figure II.8). Nonetheless, as recently as 2003, the average price for an egg in Switzerland was double that in bordering EU countries (Agra CEAS 2004, p.85).

Swiss egg consumption fell between 1985 and 1995 but stabilized thereafter. The proportion of eggs consumed in processed egg products increased significantly after 1990. Most of this rise has been accommodated through increased imports of egg products, which rose from 32 (shell egg equivalent) eggs per capita in 1990 to 62 eggs per capita in 2003. As the import share of egg product consumption rose, the import share of shell egg consumption fell considerably (Agra CEAS 2004, p.85). Some consumers have responded to the mandatory labeling system by choosing domestically produced shell eggs over imports. Swiss regulations require imported eggs produced in cages to carry a label explaining that the eggs were “produced in cages that are not permitted in Switzerland” (Landwirtschaftsgesetz Art. 18, SR 910.1). Accordingly, imported shell eggs fell from 74 to 37 per capita. In 2006, the country imported 29,209 metric tons of shell eggs and 7,439 metric tons of liquid egg product (IEC 2007). Figure II.9 shows that the share of shell eggs imported has fluctuated between 36 percent and 46 percent, and was about 42 percent in 2005.

II.4 Estimated impact of EU regulations

In a 2004 report submitted to the European Commission, it was estimated that the 2012 ban could cost the EU-15 egg industry up to €315 million, depending on the production system producers chose to adopt (Agra CEAS 2004 p.92). (See also the review of Bell 2005a.) Cage systems (traditional and furnished) were compared to alternative systems (free-range and barn). The costs of furnished cage production were judged to be roughly similar to those of conventional cages. Barn production was expected to increase variable costs by an average of 12 percent and total costs by 26 percent (Agra CEAS 2004, p.45). Free-range production was determined to be the most expensive alternative, with variable costs about 22 percent higher and total costs 45 percent higher than conventional cages (Agra CEAS 2004, p.45). With a 20 percent increase in variable costs, which approximates the costs involved with adopting free-range systems, the EU-15 egg industry would lose a producer surplus of €315 million. Consumer surplus would fall by roughly €55 million. Prices for conventionally produced shell eggs and processed eggs would increase by less than one percent, but the price for "alternative" eggs would increase by over seven percent. Egg imports from non-EU countries would rise by over two percent, and EU egg production would fall by about five percent (Agra CEAS 2004, p.92).

The costs associated with a switch to the barn system would be roughly half of those for the free-range system, entailing a loss of producer surplus of about €160 million and a reduction in consumer surplus of about €28 million (Agra CEAS 2004, p.92). Prices for conventionally produced shell eggs and processed eggs would increase by less than half of one percent, but the price for eggs produced using “alternative” systems would increase by more than three percent. Egg imports from non-EU countries would rise by over one percent, and domestic egg production would fall by about 2.5 percent (Agra CEAS 2004, p.92).

In another study of the potential impact of the European ban, van Horne and Bondt (2003) suggest that the production costs associated with furnished cages are at least 13 percent higher than those for conventional cages. Aviaries have production costs of about 21 percent above conventional cages (van Horne and Bondt 2003, p.25). (Notice that the EU study reviewed above treats the costs of furnished cages as no higher than conventional cages.) Following the adoption of a conventional cage ban, the EU egg industry would remain competitive in the production of shell eggs due to the high transport costs involved in their import from non-EU countries (van Horne and Bondt 2003, p.29). Van Horne and Bondt (2003) found that if import tariffs were lowered by 36 percent and the EU currency appreciated by 15 percent, it would be possible for India and Ukraine to compete effectively in the European shell egg market. As regards whole egg powder, which has much lower transport costs than shell eggs, only Brazil and India could compete with the EU egg industry. The United States could only compete if tariffs fell by 36 percent and non-EU currency exchange rates fell by 15 percent – a so-called “worst-case scenario” for the EU egg industry (van Horne and Bondt 2003, p.34).

Thus, it seems that barring an improbable confluence of factors, the EU egg industry will withstand the increased costs associated with Directive 1999/74/EC. Nonetheless, the authors suggest that the ban will cause egg production to fall by an average of about 11 percent in high-cost Northern European countries and by about four percent in the less capital-intensive Southern European countries. Increased production in Eastern Europe will partially compensate for this reduction in output (van Horne and Bondt 2003, p.40).

Before and after comparisons cannot provide definitive information on the impacts of changing regulations. In particular, costs of production for eggs depend especially on feed prices, and grain prices are highly variable. Therefore, while understanding the European experience is helpful, we cannot simply assume that the price and costs differences before and after the changes in regulations imply causation.

III. Background on egg production and marketing in California and the rest of the United States

This section provides historical background relevant to current economic issues facing the egg industry in California. It also puts the California industry in the context of the national industry in terms of production and market trends.

III.1 Economic history of the California egg industry, with emphasis on housing systems

Early farms raised small flocks of chickens for meat and egg production. These hens were usually free-range and fed on insects and waste grain (Appleby et al. 1992, p.24). With the development of the artificial incubator and the increased availability of commercial feed during the 1920s, the egg industry began to grow. It was soon discovered that laying hens could be kept indoors in wire cages because cod liver oil could provide vitamin D in place of sunshine (Rahn 2001, p.1).

Production of eggs in caged housing systems yielded significant labor and capital efficiencies (Rahn 2001, p.2). Furthermore, by separating laying hens from their manure, cages reduced the incidence of parasitic infections such as coccodiosis and round worms (DAFF 2007, p.2). The early use of cages also allowed poor laying hens to be culled and allowed a more precise feeding (Appleby et.al 1992, p.27). For these reasons, the cage system was widely adopted during 1930s, and became the most popular system for producing eggs in California (Rahn 2001, p.1). These early cages typically housed a single bird. The cages were usually covered by a roof, but the housing structures only rarely had sidewalls (Rahn 2001, p.1). In 1939, California had close to 11 million laying hens, and ranked tenth among states in the United States in egg production, producing about half as many eggs as Iowa (USDA, ERS 1997).

During the Second World War, per capita consumption of eggs increased due to widespread meat shortages and demand for egg products by the armed forces. In addition, the government initiated several programs aimed at stimulating egg production (Watt Poultry 1995). After the war, California expanded the caged laying hen system. The new farms that appeared across Southern California were recognized as model operations and served as the basis for production facilities in other states and around the world. Throughout the 1950s, rapid population growth in California increased the demand for eggs locally and producers responded by continually adding laying hens to their operations. This continued growth resulted in California displacing Iowa as the top egg producing state by the end of the decade. By the late 1950s, California egg production outstripped the demand for eggs within the state (Bell 1993, p 58).

The cage system experienced further gains in efficiency during the 1960s because of improvements in housing design. Among the most significant modifications was the addition of insulation and power ventilation. Concurrent advances in genetics, nutrition and disease control led most farmers to increase the number of hens per cage, and it became common to house colonies of three laying hens in 12”x 18” cages, organized in a stair step arrangement (Rahn 2001, p.2). As operations increased the size of their flocks, farms with 100,000 laying hens became commonplace (Bell 1993, p.59).

California egg producers continued to modify their cages and increase laying hen density. By the 1970s, the most popular cage sizes were the 20”x 16” cage with six or seven birds, and the 12”x 18” cage with three or four birds. As farmers increased laying hen density, California’s laying hen population reached nearly 42 million in 1971. The ensuing production capacity provided a shell egg supply to California consumers that was approximately 40 percent greater than in-state demand (Bell, 1988 p.4). Combined with California’s high production costs caused by import of feed, lower average prices caused by shipping eggs to out of state markets led to slim profit margins and occasionally caused prices to fall below production costs (Bell 1993, p.59). California production declined dramatically in 1972 due to an outbreak of Exotic Newcastle Disease, which led to the eradication of more than 10 million laying hens (USDA, SRS 1973 and 1974).

By 1974 the number of laying hens recovered to nearly pre-disease numbers (USDA, SRS 1975). From this point on, California’s laying hen population would begin a decline, as per capita consumption of eggs continued to fall nationwide and California lost market share to production elsewhere. Between 1971 and 2007, California’s egg-laying flock declined from nearly 42 million to about 19 million laying hens, as shown in Table III.1. However, since egg production per hen increased from 217 in 1971 to 257 in 2006, overall egg production declined less rapidly than the number of laying hens. Over the same period that California's laying hen population was falling, California's population increased from just over 20 million people to over 36 million people. This California population growth raised the demand for eggs in California. At the same time, the rapid spread of urban areas, especially in Southern California, raised costs and encouraged relocation of facilities because of increasing land costs and local nuisance issues.

As early as 1993, 45 companies owned 90 percent of the state's laying flock (Bell 1993, p.59). Through the 1980s and into the 1990s, California's laying hen population declined and production became even more concentrated as the industry underwent significant structural change. As a result, U.S. egg marketers shifted investment to Iowa and other Midwest areas, financing new production facilities that supplied a large portion of shell eggs and egg products for consumers in California, New York, Illinois and other deficit states. (USDA, ERS 1997).

The consolidation of the California egg industry followed a nationwide trend of concentration. In 1978, 34 U.S. companies owned more than one million laying hens, and together they accounted for 27 percent of the nation's laying flock (Bell et al. 2001, p.1). By 2003, 62 firms had over one million laying hens, and they produced over 84 percent of the country's eggs (Agra 2004). The unification of production phases within larger firms led the egg industry to build larger and new facilities, thereby adopting some of the most highly automated and intensive production methods of all animal production industries (Appleby et al., 2004)

The egg industry also underwent a shift from contract production to independent production in company-owned facilities. Under the contract system, a contract grower is paid for the egg output by a contractor who supplies pullets and feed services. Whereas contract production represented 45 percent of U.S. egg production in 1973, it made up only 25 percent of production in 2000 (Bell 2002b, p.946). Having been most popular in the Southern states, contract production diminished as egg production relocated closer to urban markets and feed sources. Although the California producers also faced the industry-wide trend of consolidation, they did not experience a shift from contract to independent production, since independent production had long been standard practice in California (Bell 2002b, p.963).

While other regions adopted production facilities similar to those used in California, California lost its standing at the forefront of egg production technology. Reduced profitability relative to other states limited the incentive for California producers to invest. In 1993, it was estimated that the average age of laying hen housing and cage systems in California was over 25 years (Bell 1993, p.61). Only 60 percent of operations had mechanical feeding equipment, compared to the U.S. average of 91.6 percent (Bell 1993, p.61). Whereas 81.4 percent of U.S. operations had belt egg collection, California operations averaged 32 percent (Bell 1993, p.61). The failure of many California producers to adopt these new systems contributed to their progressively less competitive position. As egg production in California declined relative to demand, more eggs began to be imported from other states. Between 1991 and 1995, California's laying hen population fell by an average of nearly four percent per year, and California's egg production fell by an average of 3.5 percent per year. California's share of U.S. table egg production fell from over 12 percent to about 10 percent over this period.

In 1997, Ohio displaced California as the top egg-producing state, a position that California had held since 1959 (USDA, ERS 1997). Shortly thereafter, Iowa regained its position as top egg-producing state that it had held in 1958. California's laying hen population stabilized over the next five years, with average annual declines of only 0.72 percent. Yet, shipments into California from other states had already reached close to 2 billion eggs by the time California producers were again struck by an outbreak of Exotic Newcastle Disease in 2003. That year, California's laying hen flock and egg output each fell by about 13 percent. Thereafter, the rate of decline in California's laying hen population and egg output slowed considerably. Nonetheless, California egg production did not recover to pre-disease levels and shipments from other states continued to grow until they accounted for nearly a third of all California shell egg consumption in 2006. As other states increased egg production, California's share of total U.S. table egg output declined from about 10 percent in 1997 to about 6 percent in 2007 (USDA, NASS 2008).

III.2 Profile of the egg industry in California and the United States

i. Supply

In 2007, the United States produced over 77 billion table eggs. The national table egg flock numbered about 284 million of egg-laying hens (USDA, NASS 2008). Figure III.1 shows the trends in both laying hen population and eggs for the last 25 years. The top five producing states accounted for 43 percent of laying hens, and the top 10 producing states accounted for 64 percent (Table III.2). Iowa was the largest producer of eggs with output approaching 14 billion eggs or about 15 percent of total U.S. production (USDA, NASS 2008) (Table III.2). Table egg production in 2007 was about one percent lower than in 2006 (USDA, NASS 2008).

The United States is the third largest producer of eggs in the world after China and the EU (See Table III.3). Other significant producers of eggs include India, Japan, the Russian Federation, Mexico and Brazil. While U.S. and EU production has fallen since the 1980s, Chinese production has grown significantly. India and Mexico have also increased production (FAOSTAT). International trade in shell eggs is limited by the difficulty of retaining egg quality over long-distance transport. Processed eggs in liquid, frozen or powder form are significantly easier to transport. Over the last thirty years, the proportion of processed eggs has grown to around 30 percent of all non-hatching egg production in the United States, yet almost all of these processed eggs are consumed within the domestic market.

Table III.1 shows that in 2007, California farms had just over 19 million laying hens and produced close to five billion eggs (USDA, NASS 2008). The total value of egg production was roughly $213 million dollars in 2006 (USDA, NASS 2008), but with much higher egg prices, the value of output rose to $337 million in 2007 (Table III.4). California production and value of table eggs is about two percent below these totals to account for the small quantity of hatching eggs that continue to be produced. California represented about six percent of U.S. table-egg production, making California the fifth largest table egg producer in the country (Table III.2). This represents about half of the California share of U.S. table egg production in 1976.

California's productivity as measured by egg output per laying hen has been below the national average for table eggs for many years. (Figure III.3).

The 2002 *Census of Agriculture* reports that over 3000 farms in California have laying hens aged twenty weeks or older. However, most of these farms are small operations with no significant statewide commercial presence. Only 65 of these farms had more than 20,000 laying hens on hand and only 44 farms had more than 100,000 laying hens (Figure III.4). According to Watt Poultry's *Egg Industry* (2007), there were four firms in California with at least a million laying hens on hand. The largest had about three million hens and the average flock size among these firms was about 2.2 million. Several of the larger operations have investments in other states. For example, Norco Ranch is owned by Moark LLC, which is itself a subsidiary of Land O' Lakes, a farmer cooperative based in Minnesota. Moark LLC has 17 egg-production facilities spread across 8 states and the company markets the output of more than 24 million hens (www.moarkllc.com). It is the third largest egg producer in the country and four of its shell egg facilities are located in California.

Based on *Census of Agriculture* data, more than 90 percent of laying hens in California belong to farms in six counties: Riverside, Merced, San Diego, Stanislaus, San Bernardino and San Joaquin (Table III.5). Riverside County has the largest number of laying hens in the state. In the 1987 U.S. *Census of Agriculture* the table egg producers of Riverside County declared a hen population of over 11 million birds or close to 37 percent of the statewide flock. Although Riverside County producers have maintained their position as the top egg-producing county in the state, the size of their overall flock has steadily decreased. In the most recent 2002 U.S. *Census of Agriculture* the reported size of the laying hen flock for Riverside County was 5.4 million hens. This represents a 50 percent decline in the flock size in about 15 years. Over this same 15-year period the state of California as a whole experienced a decline of 12.2 million hens, which represents a decrease of about 38 percent.

As egg production declined in Southern California, it expanded in Merced County. Merced County has increased from having just over five percent of the state's flock in 1987 to more than 22 percent of the state's flock in 2002. Of the top table egg producing counties in California, Merced County is the only county to experience growth in flock size from 1987 to 2002. Laying hen flock size for Merced County in 1987 was reported as 1.8 million hens. By 2002, this flock size had increased to 4.5 million hens, which represents an increase of almost 150 percent.

ii. Recent demand for eggs in the United States and California

In 2005, Americans consumed over 75 billion eggs, which implies a per capita consumption of about 254 eggs. Historically speaking, this is a low rate of consumption and well below rates recorded in the 1950s and 1960s. Between 1960 and 1979, consumption of eggs across the United States fell from 321 to 278 per capita (USDA, ERS 1997). This decline accelerated during the 1980s, with per capita consumption falling to 236 by 1990. Much of the decline can be attributed to changing lifestyles, including less time taken for breakfast and a growing concern regarding the possible negative health impact of eggs' high cholesterol content (Wang, Jensen and Yen 1996; Brown and Schrader 1990). During the 1990s, egg consumption stabilized around 235 per capita, and then began to increase at the end of the decade. An increase in the consumption of processed egg products accounted for most of this rise. In the early 1990s, just over 20 percent of eggs were consumed in processed form. Since then, the share of processed eggs has risen to about 30 percent of U.S. egg consumption (Figure III.5 and Table III.6).

Lacking government data on shell egg production in California, we estimate that about 93 percent of California egg production is marketed in the state as shell eggs, based on information from industry sources and hen numbers reported in Table III.2. Our approximation indicates that Californians consumed just under 6.8 billion shell eggs in the year 2000. From 2000 to 2002, the quantity of eggs consumed in the state grew by 10 percent to 7.5 billion shell eggs. Shell egg consumption in California then declined by about eight percent from 2002 to 2005. (See Table III.7 and Figure III.6.) Figure III.7 shows more clearly the changes in shell egg consumption in recent years as California population increased. Using our estimates of shell egg production, California per capita consumption was approximately 213 eggs annually at the 2002 peak. The per capita consumption dropped to about 187 eggs per person in 2007. This reflects a decrease of 12.8 percent from peak consumption in 2002 (Figure III.8).

The total California expenditure and the per capita expenditure on shell eggs has fluctuated less than quantities because quantities and prices move inversely (Figure III.9 and Figure III.10). In 2000, annual expenditure on table eggs in California was approximately $22 per person. This expenditure increased to more than $28 per person in 2004 as prices also rose. After declining with price in 2005, per capita shell egg expenditures rose back to about $27 as average egg prices reached about $1.70 per dozen.

Between 1983 and 2007, the national average farm price received for table eggs fluctuated, between a low of 35 cents per dozen in 2005 and a high of 66.5 cents per dozen in 1986 (USDA, NASS 2008). In 2006, the national average price was 40.7 cents per dozen for table eggs. In 2007, the farm price received for table eggs jumped to 79 cents per dozen, a record high.

Farm prices are characterized by significant seasonality and vary considerably from month to month. Demand for eggs is traditionally weakest during the summer months and strongest during the late fall and winter. Higher prices are received for table eggs during these months (Figure III.11). Figure III.11 also shows the degree to which farm prices for table eggs have increased each year since 2005. Following a sharp rise in prices beginning in the middle of 2006, the average price per dozen was higher yet in 2007. In March 2008, the farm price of table eggs reached an all-time high of about $1.30 per dozen (USDA, NASS 2008).

Retail prices averaged $1.68 per dozen in 2007, a record high. Since 1990, U.S. retail prices for Grade A large eggs have fluctuated between a low of 90 cents per dozen in July of 1990 and a high of $2.20 per dozen in March of 2008 (BLS).

The farm to retail price spread fluctuated between about 30 cents per dozen and 48 cents per dozen from 1983 to 1997. During this period, producers received between 52 percent and 65 percent of the retail egg price, with a gradual downward trend (Figure III.12a). From 1998 through 2007, the farm share of retail egg price was usually below 50 percent (Figure III.12b). The farm gate price of eggs stayed relatively flat from 1983 to 2006, while the egg price faced by retail customers has trended upward, especially from 2002 through 2006, resulting in a widening of the gap between retail and farm price of eggs (Figure III.13 and Table III.8). The very high farm prices in 2007 narrowed the gap slightly.

The farm price of table eggs has also risen in California. In the first six months of 2008, the average price received for table eggs was $1.07 per dozen in California compared to a national price of 88.4 cents per dozen (USDA, NASS 2008) (Table III.9).

Production from non-cage systems represents only a small share of overall U.S. egg production. As of 2006, only about two percent of U.S. egg production came from non-cage systems (IEC 2007, p.45). These eggs receive a price premium relative to conventional eggs. A survey of retail prices from a major retail chain across 15 U.S. cities in April of 2008 indicated an average retail price of about $2.86 per dozen large AA white eggs and $3.07 for large grade A brown eggs. The average price for non-organic, non-cage brown eggs was $3.59. A comparison between brown eggs produced in conventional cage systems and those produced in non-cage systems thus yields an average premium of about 17 percent. The average price was $2.92 per dozen large AA white eggs and $3.69 for large brown eggs in six cities in California. The average prices for the non-organic, non-cage eggs were $3.69 for white eggs and $4.76 for brown eggs. In California, the premium for non-cage white eggs was about 26 percent and for non-cage brown eggs is about 29 percent. The average premium in California for all types of non-cage eggs was about 92 cents or 28 percent over the cost of eggs from conventional cages. These comparisons are for the same brands and exclude organic and other specialty eggs.

During the 1960s and 1970s, California was an exporter of eggs, averaging a 14 percent ratio of exports to production between 1967 and 1975 (Smith 1983, p.12). Shipments from other states now account for most of California consumption of egg products and about one-third of California consumption of shell eggs. In 2001 and 2002, when California had approximately 23 million laying hens, California received about 1.2 billion shell eggs from other states (CDFA; Bell 2008b). Toward the later part of 2002 and into early 2003, California experienced an outbreak of Exotic New Castle Disease, which reduced the state hen population by about 3.5 million hens by July 2003. Shipments into California responded by increasing their 2003 shipments by about 90 percent to 2.2 billion eggs. Shipments into California reached more than 2.4 billion eggs in 2006 and 2007. Figure III.14 shows major sources of shipments into California in 2006 and 2007. Iowa accounted for more than 40 percent of shipments. Minnesota and Utah accounted for another 20 percent of the total shipped into California (CDFA: Bell 2008).

IV: Egg production costs, prices and differences across regions and housing systems

This section provides data on table egg production costs and major categories of costs. Major cost categories are discussed in order to better understand what affects the costs of egg production. Regional patterns in costs, focusing on transport costs for feed and eggs, are used to better understand the potential responses of egg shipments to changes in relative costs. We then develop estimates of cost differences by housing system. Finally, data is presented on prices of eggs produced in different systems. This information is used in Section V to analyze implications of the California initiative that would likely mandate the end of cage housing for eggs produced in the state.

Table IV.1 shows the evolution of egg production costs based on data for feed costs and assumptions about other production and marketing costs. This data series from the USDA Economic Research Service was discontinued after 2003. Feed costs remained in the range of 30 cents per dozen for the full period from 1973 to 2003. Over the past 30 years, prices of corn and oilseeds, the main feed components, increased. However, efficiency in the production of eggs per ton of feed also improved, such that there was no identifiable trend in feed costs per dozen eggs. Movements around the average of 10 to 20 percent have been common, with a notable jump in feed costs in 1996.

In this data series, farm costs other than feed costs were approximated by USDA (ERS 2006) as constant at 18.2 cents per dozen from 1984 to 2003. Thus, the “Farm Production Costs” series changes only with changes in feed costs, which according to these calculations has been about 60 percent of farm production costs—more in high feed-price years and less in low feed-price years.

Producers’ net returns depend on the difference in value between the eggs they sell and the cost to produce those eggs. More than 80 percent of the variable costs, and two-thirds or more of the total costs of egg production can be attributed to two factors: feed and pullets (Rahn 2001, p.12). Feed costs and pullet costs display a great deal of variation from year to year, which results in net returns being highly variable.

From 1990 to 2003, USDA used a constant margin of 20.5 cents per dozen to approximate the costs from farm to wholesale markets. Using the 20.5 cent figure for wholesale costs per dozen, farm production costs comprised about 70 percent of wholesale production costs over this period.

IV.1 Trends in feed and pullet costs

Overall feed costs are determined by the amount of feed necessary for a laying hen to produce a dozen eggs, known as the conversion ratio, and the per-unit price of feed. The conversion ratio has slowly improved over the past few decades, largely as a result of the efforts of poultry breeders, which comprise a separate industry from the table egg industry (Aho 2002 p.804). Individual producers can improve the conversion ratio through management techniques, but for the most part, they cannot influence it significantly in the short-run. The price of feed, consisting mainly of corn and soybean meal, has risen since the early 1970s and is at record high levels in 2008. As shown in Table IV.2, the U.S. price for poultry laying feed increased from $101.4 per ton in 1987 to $182.5 per ton in 1996. After falling to $123.8 per ton in 2000, it reached $185.5 per ton in 2007 (USDA, NASS 2007).

Figure IV.1 summarizes the relationship between egg prices and feed costs using the egg-feed price ratio. The egg-feed price ratio is the number of pounds of laying feed equal in cost (at current prices) to the farm price of one dozen market eggs. Despite falling egg prices between 1996 and 2000, the egg-feed ratio for market eggs rose from 8.6 to 10.5 due to a substantial fall in feed prices. The ratio then fell back to 8.6 over the course of the next two years as feed prices increased sharply. In 2003, the ratio reached 10.6 when the price for market eggs increased 41 percent over the previous year and the price for feed remained almost unchanged. The ratio fell to a low of 6.9 in 2005, as market egg prices fell and feed prices rose. Since 2006, the ratio has increased, averaging 10.1 in 2007 and 10.75 over the first four months of 2008. This increase has occurred despite record high feed prices due to the disproportionate rise in egg prices, which also reached record high levels.

Cost of pullets is another significant cost of production that differs by flock over time. Most egg producers purchase day-old chicks or ready-to-lay commercial pullets from hatcheries that specialize in raising flocks of up to 200,000 pullets at a time. Column one of Table IV.2, based on USDA data, shows that the cost for chicks was roughly constant from 1987 to 2006, ranging from about $50 to $54 per hundred chicks, before rising substantially in 2006 and 2007. These data which apply to the whole egg industry, including small operations, may not fully reflect discounts available to larger operations (Bell 2008b). The cost to raise the chicks to maturity, when they enter the laying flock, represents the second highest expenditure for most commercial egg producers (Bell 2002a). The cost of a pullet entering the laying flock is highly dependent on the price of feed, which means that pullet costs have risen with the price of the pullet feed ration, as shown in table IV.3. Pullet costs per dozen are also determined by the time at which the hen begins laying eggs, since if hens come into lay late there will be a shorter laying cycle, typically resulting in pullet costs being amortized over fewer eggs. Mortality rates during the period before the pullets enter the laying flock and over the period in which the flock is in the laying facility both affect pullet costs per dozen eggs by affecting the total number of eggs per pullet.

The productivity of laying hens has been increasing for the better part of a century. On average, a laying hen today will produce almost twice as many eggs in a given year than a laying hen did 80 years ago. Table III.4 shows that eggs per hen in California rose from about 140 eggs per hen per year in the 1920s to about 260 eggs per hen per year after 2000. Much of this rise can be attributed to genetic selection by breeders for early sexual maturity (early age at which first egg is laid) and a higher rate of lay (Coon 2002 p.267). Various chapters in Bell and Weaver, eds. (2002) provide an extensive discussion of production practices, productivity and costs.

IV.2 Differences in costs by housing system

This subsection considers how costs of egg production differs by housing system. We draw on evidence from published literature and from information provided by California producers and discuss the differences in costs of feed, pullets and other expenses in terms of costs per dozen marketable eggs.

Feed usage per dozen eggs is considerably higher in non-cage systems than in typical modern cage systems. The greater freedom of movement allowed by the non-cage system increases laying hens' physical activity, and the lower stocking density and open space reduce the efficiency of maintaining optimal house temperatures. Both of these circumstances lead to higher feed consumption (Gibson et al. 1988; Appleby et al. 1992, p.59). (Refer to Section I.2 for a description of laying hen housing systems.)

Pullet costs per dozen represent the cost of the hen as she enters the laying house divided over her lifetime production of eggs. Pullet cost per dozen marketable eggs is influenced by the original cost of the chick, rearing costs and the number of marketable eggs the hen produces over her lifetime. Evidence summarized here suggests that marketable egg production per hen is lower and mortality is higher for non-cage housing. In California, producers tend to use pullets raised in cage systems in their cage laying hen facilities and pullets raised in non-cage systems in their non-cage egg-laying facilities. Pullets entering non-cage housing also tend to be brown breeds, which contributes to higher chick costs and higher pullet feed consumption. This leads to higher costs for pullets entering the laying flock in non-cage housing rather than cage housing.

Data supplied by California producers that use both conventional cage systems and non-cage systems indicate that non-cage production systems have higher hen mortality rates, in conjunction with an overall shorter productive hen lifespan. Producers using both systems report that hens in non-cage systems lay eggs, on average, for 60 weeks, compared to 80 weeks for hens in a cage housing system. Also, producers report a higher mortality rate for non-cage hens, which results in a loss of production over the lifespan of the flock.

The scientific literature also suggests that laying hens that are kept in non-cage systems tend to have higher mortality rates than hens in cages. Egg-laying hens kept in the large groups characteristic of non-cage systems are at increased risk of exhibiting cannibalistic behavior (an abnormal behavior where the hens tear at and consume the flesh of other hens) compared to conventionally caged hens (Appleby et al., 2004). Furthermore, unlike caged laying hens, hens in non-cage systems are usually exposed to their own droppings, which increases their risk of contracting disease and parasitic infections (EFSA, 2005). Of course, outbreaks of disease can occur in any housing system, and cannibalism can also represent an extremely serious problem in any system if the hens are not beak-trimmed. A review of published studies shows that there can thus be considerable variation in hen mortality rates during a laying cycle (e.g. EFSA, 2005), even within particular housing systems. Nonetheless, most experimental studies and on-farm comparisons have reported that mortality is higher (either numerically or statistically) in non-cage systems than in conventional cage systems.

One difficulty in interpreting published mortality figures is that the length of time over which the data were collected is not always clear. In addition, important factors aside from the housing system *per se* (e.g. hen genotype, system design elements, management) that might have affected the results may not be included as a component in the analysis. With these caveats in mind, we discuss several recent European surveys of laying hen mortality in different systems.

In one of the first meta-analyses of mortality data in different systems, Aerni et al. (2005) reviewed data from studies published between 1980 and 2003 comparing conventional cages (26 flocks) with aviaries (36 flocks). They used only studies in which hen genotype and age were the same in both systems. Since there was such wide variation among studies in terms of the time period over which the hens were studied (ranging from 13-73 weeks), they standardized mortality to a rate per four weeks. Their analysis showed that mortality rates in cages and aviaries were similar. However, as the LayWel (2007) report notes, many of these data are older and thus possibly not representative of current cage and non-cage systems, since both have undergone significant development and improvement in recent years.

The LayWel database (2007) contains information from 230 cage and non-cage flocks in the EU over a two-year period. The flocks were housed under both commercial and experimental conditions. Their data analysis showed 8.3 percent mortality over a laying cycle in conventional cages and 11.8 percent in non-cage systems. The report notes that the value for conventional cages reported is unusually high due to a hen health problem experienced by one producer involved in the study; the typical mortality rate in conventional cages in the EU is about 3 to 5 percent (Blokhuis, personal communication 2008). A just-published survey of 39 well-managed beak-trimmed commercial U.K. flocks by Elson (2008) found that mean mortality from 16-70 weeks of age in conventional cages was 4 percent, compared to 6 percent in non-cage systems and 14 percent on free range. Similarly, Rodenburg et al. (in press) surveyed 13 commercial flocks housed either in furnished cages or in non-cage systems in Belgium, the Netherlands and Germany, and found that mortality rates to 60 weeks were statistically significantly higher in non-cage systems than in furnished cages: 8 percent versus 2.5 percent. Despite the fact that all hens were beak-trimmed except in two of the cage flocks, the major source of mortality in non-cage systems was feather pecking and cannibalism, along with smothering (due to birds piling up on top of one another) or infection with *E. coli*, mites, or infectious bronchitis.

Labor costs differ between systems and also depending on the configuration of particular systems. The adoption of the cage system has allowed the widespread automation of the daily tasks performed by egg producers. This has led to lower labor requirements, as feed and water distribution, manure disposal, and egg collection and packaging are all performed by machines. As a result, one worker can usually oversee more than 100,000 caged laying hens, possibly achieving labor costs as low as one cent per dozen (Bell 2002b). In comparison, a worker in a non-cage operation will typically manage 30,000 hens. Automation of egg collection is possible within non-cage systems, but eggs that are not laid in the nest box must still be collected by hand. Other contributors to higher labor costs are associated with maintaining good litter quality and nest box cleanliness, and identifying and catching sick and injured hens. Information from California producers that non-cage systems require a substantially greater amount of effort to manage than a cage system.

Eggs from non-cage systems are more likely to be uncollectable, downgraded or unmarketable because some of these eggs are laid outside of the nest box (so-called floor eggs), where they may be eaten by the hens or become cracked, dirty, and/or contaminated with bacteria. This is particularly a problem in free-range systems (EFSA, 2005), but also occurs in floor systems and aviaries. This can be a major sanitary and economic problem in non-cage systems.

Floor laying differs not just between systems but within systems, and even from flock to flock. Many factors, including management, system configuration, pullet rearing conditions, and hen genotype influence rates of floor laying (Appleby et al., 2004). In severe cases, as many of 40-50 percent of eggs may be laid on the floor (Appleby et al., 2004). More typical reported figures range from two percent to 10 percent (EFSA, 2005). Eggs from non-cage systems are more likely to be downgraded than those from cages (EFSA, 2005). Causes of downgrading are stains, blood spots, cracks, pimpling and holes (USDA). The shells of eggs produced by hens in non-cage systems are thinner than those of the eggs produced by caged hens, which is a risk factor for cracks, although some studies find the percentage of cracked eggs to be similar between non-cage systems and conventional cages (see EFSA, 2005).

The LayWel (2007) database from Europe probably provides the most comprehensive information available about egg production and quality characteristics in different systems. These data show that about five percent of eggs were laid outside of the nest boxes in the non-cage systems included in the analysis. The percentage of cracked eggs from cages and non-cage systems was similar (ranging from one percent in single-tier systems to approximately three percent in conventional cages and aviaries). However, eggs from non-cage systems were more likely to be soiled (7.7 percent to 8.4 percent) than those from cage systems (4.9 percent). Of the eggs collected, 7.8 percent of eggs from non-cage systems were downgraded as compared to 6.5 percent from conventional cages. Overall production was lower in non-cage systems (76 percent to 80 percent per hen per day) than in conventional cages (86 percent per hen per day), likely due to uncollectable eggs. In European data, the eggs from the non-cage system were also on average smaller (62 to 63 grams) than those from the cage system (65 grams). The total egg mass produced was thus greater (21.4 kg) in cage than in non-cage (19.4 kg) systems. These results were similar to those of previously published system comparisons (see EFSA, 2005).

For conventional cage systems, housing costs are a relatively small part of total egg production costs. Nonetheless, cages represent the durable asset that limits the number of hens and quantity of egg production in the short run (Rahn 2001, p.12). The initial investment per facility involved in constructing a typical cage system is significantly higher than the investment required for a non-cage floor operation (Bell 2002c, p 1008). However, since non-cage operations have many fewer birds per facility, the housing costs per bird or dozen eggs are higher in non-cage systems.

In our categorization, housing costs for each system include the cost of the physical structure, the equipment within the structure, the utilities to operate the equipment and the maintenance, service and supplies necessary to maintain operations. The complex design and larger space requirements per bird of a modern non-cage layer house make this system more expensive to construct per bird. Once constructed, non-cage houses take more resources per bird to maintain and service than a cage system. For example, design limitations often make manure collection and removal from a non-cage system more complicated and costly.

Clearly, costs also differ across flocks and across farms within housing systems. These within-system cost differences may be attributed to several factors. The performance of a flock depends on random disease experience, weather and similar variables outside producer control. California egg producers may manage as many as 25 different flocks of various sizes at one time. Each flock has a different rate of mortality and rate of lay, and these different rates cause differences in costs between flocks. Furthermore, comparisons over time depend significantly on feed prices during the period. For instance, the average cost of 100 pounds of pullet feed delivered in California rose from $8.03 in 2006 to $10.32 in 2007, a jump of approximately 29 percent from one year to the next (Table IV.3).

The range of estimates presented in Table IV.4 incorporates the experience of California farms that produce eggs using both conventional cage housing systems and non-cage systems. These costs apply to non-cage systems actually in use, and do not include costs for organic or free range systems. These estimates are derived from several farms over the last three years and the range in costs reflects differences in the experience of individual flocks with the feed costs that applied during the period examined. Some variation across farms reflects differences in accounting systems in terms of how costs are categorized. All these differences are reflected in the ranges for each cost category.

The general experience is that non-cage housing systems imply substantially higher cost in each of the main categories. Using the midpoints of the ranges reported, pullet cost per dozen for non-cage systems is approximately 5.5 cents per dozen higher, or about 55 percent higher, than for conventional cage systems. Feed costs for the laying hen flock are about six cents per dozen higher for the non-cage housing or about 17 percent higher. This relatively small percentage feed cost differential (compared to the differences in other cost categories) is accounted for by the very high feed costs in some of the most recent flocks that are included in the estimates for the cage housing systems. A high base feed cost implies a lower percentage difference for the same difference in cents per pound. Per-dozen housing and labor costs were also substantially higher for non-cage systems. These relatively large differentials measured at the midpoint reflect very high housing and labor costs for some non-cage systems.

Based on the midpoints of the ranges reported for the four itemized costs, the non-cage system's production costs per dozen were 58 percent higher than those for the cage systems used on these farms. At the midpoints, the sum of itemized costs are $0.94 per dozen in the non-cage systems and $0.595 per dozen in the cage systems. Based on the midpoints of the reported total costs, non-cage system costs of production per dozen were about 41 percent higher than those for the cage systems used on these farms. Total cost at the midpoints are $1.05 per dozen for the non-cage systems and $0.745 per dozen for the cage systems. Note that these data do not account for the finding reported above that eggs produced in non-cage systems tend to be smaller than those produced in cage systems.

Another way to use the cost data provided by farms is to consider the low cost cases with each system. Such a calculation is appropriate if these costs reflect the best production methods within each housing system, and reflect disease and feed costs that apply in more "normal" conditions. These calculations using the low-cost cases are reported in the final column of Table IV.4. Using the low costs for each cost category under the two systems, the sum of the cost differential is $0.20 per dozen. That is, itemized costs are about 44% higher for the non-cage system. Using the low cost cases for reported total costs, the differential is $0.40 per dozen. That is, total costs are about 70 percent higher for the non-cage system.

As shown in Section V, these substantial cost differentials do not need to be estimated with any further precision to draw the most important economic implications concerning the proposed initiative. We therefore have not attempted to refine the calculations and narrow the range of estimates. Such an analysis would be more relevant to an alternative policy question dealing with a restriction on the housing systems available nationwide that affected all eggs consumed in California, rather than just those eggs produced in California with no restriction on eggs produced elsewhere.

The above assessments of costs compared conventional cage housing systems to commonly used non-cage systems. All evidence suggests that costs of free range systems are substantially above those of aviaries and floor systems and even further above conventional cage housing systems. If commonly used non-cage systems were also precluded in California, production costs would rise 50 percent (or perhaps much more) above those of the current cage system (Appleby et al. 2004; Bell 2005).

IV.3 Regional comparisons and transport costs

The ability of Midwest egg producers to compete for a substantial share of the California egg market lies in their significant feed cost advantage. The primary ingredients in layer-hen feed are corn and soybean meal. Based on the work of Bell (2008a), Table IV.5 shows that during the first three weeks of May 2008, the delivered cost of formulated poultry feed was much lower in the West North Central (represented by feed prices in Minneapolis and Kansas City) than in the West (represented by feed prices in Los Angeles and San Francisco). Figure IV.2 shows that the West has had higher feed prices for many years. Table IV.6, adapted from Bell (2007a), highlights total cost differences per dozen by region attributed to higher laying flock feed and pullet cost. During January to June 2007, before the recent jump in grain and oilseed prices, Bell estimated that costs of production were about eight cents per dozen lower in the West North Central than in the West.

Midwest producers have an advantage in lower feed and other costs of production. However, they face high costs of transporting fresh in-shell eggs to the California market. Table IV.7 compares the costs of shipments of eggs to the cost of transporting the feed. Using information provided by shell egg producers in California, the May 2008 average cost of shipping one truckload of 23,400 dozen table eggs from a Midwest origin was $3,100. This yields a transportation cost of $0.13 per dozen eggs. The cost of shipping the feed equivalent of 23,400 dozen eggs, at a rate of 3.5 pounds of feed per one dozen eggs and using the average May 2008 feed prices, results in a cost of between $0.07 per dozen and $0.09 per dozen. Since shipments continue to arrive from the Midwest, some producers there must have costs low enough to make them competitive in the California market.

IV.4 Economic significance of cost differences

This section has documented a number of differences in costs and underlying factors affecting differences in costs between cage housing systems and non-cage housing systems for egg production in California. A variety of evidence from many studies and from information provided by California producers leads to the conclusion that costs per dozen are substantially higher for the non-cage systems than for the conventional cage systems.

With a great variety of evidence, there is no clear consensus about the specific magnitudes of the differences in underlying factors contributing to cost differentials. The direction and range of magnitudes are well documented, however. For example, average mortality is clearly higher for the non-cage systems and this contributed to the higher pullet costs per dozen eggs. The data also clearly show higher feed, housing and labor costs per dozen eggs. For the purposes of this report and the economic analysis of Section V, we do not need to determine a specific best estimate of the underlying factors or the overall cost differentials. All the evidence indicates cost differentials of 20 percent or more. As we detail in Section V, with cost differential of this magnitude, California producers using non-cage systems simply would not be able to compete with eggs produced using conventional cage housing systems that would be shipped into California.

V. Likely economic effects of the proposed California initiative

This section reviews the key economic data provided in earlier sections and applies some basic economic reasoning to those data to assess likely economic impacts on egg production, consumption and price in California and the rest of the United States of regulations restricting the use of conventional cage housing systems. We then use these egg industry findings to assess the broader economic consequence of the proposed initiative.

V.1. The economic situation of the California egg industry

The California egg industry remains a significant and vibrant part of the national egg market in the United States. Yet, while the demand for eggs in California has grown over the past two decades, egg production in the state has fallen. This means that rather than ship eggs to the rest of the United States, California is now a net destination for eggs produced elsewhere. Evidence presented in Section III indicates that California produces about 6 percent of the table eggs in the United States. (California produces a smaller share of total eggs, since California produces very few hatching eggs for either the broiler or table egg industries.)

California consumes about 12 percent of the table eggs in the United States based on population. These figures imply that more than half the eggs consumed in California are shipped in. Some of the net shipments into California come in the form of processed food products (bakery products, noodles and similar products), some come in the form of liquid eggs used in the food processing and food service industries and some eggs are shipped as in-shell table eggs for the wholesale and retail markets. Based on USDA and other data summarized in Section III, we estimate that almost all California production is distributed as shell eggs and that about one-third of the shell eggs consumed in California are shipped in from other states.

These data are important to our assessment of the likely impact of the initiative because they show that, while the industry remains viable, the California egg industry faces strong competition from eggs produced in other states. Even in the shell egg market, where egg shipping costs are relatively high, shipments into California from out of state have been increasing gradually in competition with California production. The data show that most of the California industry has maintained its competitive position relative to in-shipments in the fresh shell egg market. Although feed costs and other factors provide cost disadvantages, high shipping costs for fresh eggs allow most of the California industry to remain competitive.

This competitive balance, however, makes California production vulnerable to any factors that raise California costs relative to costs in other states. Data presented in Section IV show that regulations that would eliminate the option of producing eggs in conventional cage housing systems would raise production costs substantially. The increase in costs would take two forms, both of which are important.

First, variable costs of production would rise by at least 20 percent and perhaps substantially more. Underlying these higher costs per dozen eggs are higher feed use per bird, higher cost per pullet, lower average productive life of a hen, higher mortality rates, fewer eggs of premium size or acceptable marketability, fewer birds per facility and higher labor costs. There is a variety of evidence on all these points.

The second major cost impact of the initiative is that compliance with new laying hen housing regulations would require substantial investment in new or retrofitted housing facilities. Based on information provided by farm accountants, a new or converted non-cage housing facility costs in the range of $10 to $40 per bird. With some 18 million hens in cage housing in California, about 600 new or retrofitted buildings at about 30,000 birds each would be needed to be constructed within six years. The capital investment required to provide approved housing for those hens is between $200 million and $800 million dollars. Producers would also need access to more land. Further, they would face zoning and other regulations that have limited relocating or expanding facilities for animal agriculture in California.

Naturally, such major investments in new housing facilities would be undertaken only if farms had confidence that the long-lasting investments could be repaid with net returns over the productive life of the investment. As established in Section IV, the regulations would cause California variable costs of production to rise relative to variable costs for out-of-state eggs, where no new capital investment would be mandated. Therefore, it is unlikely that producers would expect new housing investment in California to be profitable.

The California egg industry has made substantial investments in non-cage housing systems in recent years in order to supply eggs to the specialty markets for non-cage and organic eggs. The market for eggs from non-cage housing systems remains a very small share of the total market for table eggs. Nonetheless, these investments can be profitable for a limited volume of production when the eggs are marketed to supply specialty egg demand. Producers supplying these markets have similar costs, and therefore the price of specialty eggs is substantially higher than the price of eggs produced under conventional cage housing systems. It is important to note, however, that there has been no investment in non-cage housing facilities by farms with an expectation that they will be able to compete directly with eggs produced using conventional cage housing systems. The lack of such investment is further confirmation that farms in the business of making these investments have not found non-cage housing systems cost-competitive, unless they are able to supply eggs to a market where other farms are also restricted in the housing systems allowed. The European experience in this regard, reviewed in Section II, reinforces the experience in the United States.

V.2 Illustration of the economic impacts of regulations that limit cage housing systems for egg production in California

The adjustments in the California egg industry following a successful initiative may be illustrated in the familiar supply and demand framework used by economists. In this subsection, we use three characterizations of the appropriate markets to indicate the implications of regulations that would restrict the use of conventional cage housing systems for egg production in California.

Consumers currently have the option to buy eggs produced using non-cage housing systems. Most do not and we see no plausible reason that the initiative would change those choices, since a regulation restricting consumer choices is not implied by the initiative under consideration. We therefore characterize the initiative as shifting cost or supply conditions, not demand conditions. In these illustrations, we focus on the bulk of the market for table eggs and do not include the very small and largely separate market for specialty eggs now produced using non-cage, free range or organic production methods. Before outlining these models, we must first discuss the nature of the supply and demand functions themselves.

Under the initiative, suppliers have about six years to make the needed adjustments to comply with new regulations. As discussed just above, compliance by California egg producers would require significant new investment in housing facilities. Over the six-year planning horizon, quantity of production from both in-state and out-of-state producers would adjust with investments and disinvestments. Over this time horizon, adjustments by producers in California would not be constrained by contractual relationships or fixed capital assets. Furthermore, prices of key inputs, feed and pullets, would not fall significantly because reductions in California production would be replaced by increases in production outside California. The result is a very elastic supply response, as relatively small shifts in marginal cost or price would cause large quantity changes.

Producers outside of California would expand their production while incurring only slight increases in the marginal cost of production. There are no limiting factors to a relatively large increase in quantity produced in each state. The egg industry purchases of corn and soybeans are a small share of total corn and soybean output, and in the national market there would be no shift in overall purchases of grain or other inputs by the egg industry. The rapid expansion of egg shipments into California following the Exotic Newcastle Disease outbreak in 2003 illustrates the capacity for expansion outside California. And, a six-year horizon is enough time to carry out the relatively small expansions in egg producing facilities required to expand supplies to the California market from out of state.

Overall national consumer demand for eggs is relatively unresponsive to adjustments in market price. This means that small percentage increases in market prices for eggs would imply even smaller percentage reductions in quantities of eggs consumed. This inelastic demand response to price applies to overall table egg consumption and to shell eggs available to California consumers, which is the submarket in which most California-produced eggs are sold.

Figure V.1 illustrates the national market for table eggs. The national demand curve for table eggs is labeled “Demand U.S.” while the dotted upward sloping line representing the national supply curve is labeled “Supply U.S.” The price of eggs is shown on the vertical axis and the quantity of eggs produced and purchased is shown on the horizontal axis. The price and the quantity correspond to the point where the demand curve crosses the supply curve. This illustration of the national market for eggs does not include hauling costs and the market price may be thought of as net of cost of transporting eggs to each specific location in the national market.

The quantity of eggs produced in California is shown in figure V.1. as the “Initial Q, CA” where the marginal costs of production in California equals the market price that is determined in the national market. The national supply is comprised of the (horizontal) sum of the supply produced in California and the supply produced in the rest of the United States (not shown separately). Notice that, in the figure, as in reality, California produces a relatively small share of the eggs in the national market.

The California initiative would cause an increase in costs of production for California producers, which is shown as a shift to the “New marginal cost/supply, CA.” In Section IV we find that the increase in costs would be substantial, at least 20 percent or more. This shift is not calibrated precisely in figure V.1, but the basic result is shown clearly. The quantity produced in California falls to zero, quantity produced outside California expands to fill the gap, and the national price and quantity of eggs either do not change or change so little that they cannot be illustrated in the figure without undue clutter. The main results hinge on the conditions of supply in the egg market, which are that: 1)

California production is a relatively small part of the national supply; 2) the quantity of eggs produced outside California may be expanded with little or no cost increase; and 3) egg quantity reductions in California would not cause substantial declines in marginal costs of production in the state. Under these conditions, a substantial increase in costs of production imposed on California production and not on production elsewhere would eliminate egg production in the state.

Let us look more specifically at the market for fresh shell eggs sold in California, which is the sub-market of most importance to California producers. Figure V.2 illustrates the supply and demand consideration in this market under the initiative that increases marginal cost of production in California. In figure V.2, the quantities and prices are for shell eggs consumed in California. The demand is that from California consumers. On the supply side, most of the initial production is from quantity produced in California, shown as “Initial Q, CA producers”. The production of shell eggs shipped into California is implicit in figure V.2 and makes up the difference between the shell eggs consumed in California and those produced in California. The quantity shipped into California can be expanded readily should the California price rise above that shown by the intersection of the demand for shell eggs in California and the price of shell eggs. With these market conditions, a substantial increase in the marginal cost of production, up to the curve labeled “New marginal cost/supply, CA producers,” would cause production in California to fall to zero. Notice in this illustration that the price of shell eggs in California does not change. A slight increase in the price of shell eggs in the California market might occur if an increase in costs by national suppliers accompanied their expansion to replace eggs formerly produced in California. We expect any such increase in price to be small because there are no limiting factors that would cause costs to rise for producers outside of California, given that they would have a six-year adjustment period before the regulations under the initiative would apply and California output would be curtailed.

Figure V.3 examines specifically the market facing California egg producers. In Figure V.3, the quantity on the horizontal axis is the production of eggs in California and the price is the price received by California producers. The supply functions for California producers are as represented in Figures V.1 and V.2, but now the demand function is *not* the overall demand for eggs in the national market or in the California market. In Figure V.3 the demand function is almost horizontal because it represents the demand for eggs produced in California, and eggs produced elsewhere are a very close substitute for eggs produced in California. Figures V.1 and V.2 implicitly assume, quite reasonably, that most consumers do not identify eggs according to where they are produced. However, Figure V.3 allows eggs produced outside California to be close but less than perfect, substitutes for eggs produced in California. In Figure V.3, the demand curve is nearly flat because an increase in the price of California-produced eggs would induce many consumers to shift to eggs shipped into California, and the supply of those eggs can be readily expanded (as noted in the discussion of Figure V.2).

As before, the regulations that follow from the California initiative would cause a shift up in marginal costs for eggs produced in California. This increase in costs would be enough to eliminate California production, as eggs produced elsewhere are shipped into the state. Currently, we see little or no price differential for eggs produced in California relative to those shipped into the state. Indeed, eggs are generally not identified by location of the production facility and the close substitutability among eggs produced in different locations is one reason that there is competition in the California egg market. The elastic demand facing California production is a consequence of potential substitution of lower-priced eggs from elsewhere for eggs produced here. The result is that a substantial cost increase for eggs produced in California means elimination of California-produced eggs, except in specialized markets.

Finally, we should consider the potential for part of the California egg industry to remain in business. California buyers currently purchase a relatively small quantity of specialty eggs from various non-cage systems that may meet the housing regulations implied by the initiative. This production would not be directly challenged by new regulations, but may be affected indirectly. Most of the eggs sold in the non-cage and organic markets are now produced by the same farms that supply the conventional egg markets that are illustrated above. We have established that this conventional production would be eliminated in California. Much of the infrastructure of feed mills, cleaning and processing facilities and management expertise is used for both the non-cage and the conventional cage production systems. If the conventional cage production is eliminated, firms may choose to move their whole operations out of state or may lose scale economies that make them competitive in the non-cage markets. Thus, we may expect a reduction in non-cage production in California, even though such production meets the regulations under the initiative.

V.3 Regional and Statewide Spillover Impacts of the Reduced Size of the California Egg Industry: Multiplier Effects

Changes that affect production and employment in an industry have broader effects on the economy. These broader economic effects are often referred to as “multiplier effects.” One way to assess some of these impacts quantitatively is to use a model that starts with direct impacts within an industry and data showing the historical relationships of that industry with other industries to derive an expanding, but dampened set of ripple effects through the economy. This analysis is provided in this subsection.

Input/output models that generate multiplier effects are designed to measure the impacts of a change in an industry. The information produced by input/output models capture the value added activities that each industry produces as production, input use and employment change in response to policy and market forces. We employ a standard model for such analysis, the IMPLAN Pro® version 2.0 software and accompanying 2002 input/output dataset. Another popular input/output model is RIMS II, which is maintained by the Bureau of Economic Analysis, an agency within the U.S. Department of Commerce. Unfortunately, both IMPLAN and RIMS II have a limited set of aggregations by output product and location. No information, from either model, is available for an industry as specific as the California egg industry. IMPLAN has grouped available information on the egg industry into a category of ‘Poultry and Egg Production'. In California, turkeys and broilers are a larger share of this IMPLAN classification than is the egg component. Therefore some approximation is required to assess the contribution of the egg industry.

IMPLAN utilizes a series of equations designed to capture the interrelationships between the economic sectors in the state and regional economies. The model employs historical base tables to show transactions in input and output markets among sectors. For any given industry, the model enables quantification of outputs (value of production), jobs, labor income and value added, both before and after taking into account the ripple effects on the entire economy. These ripple effects are expressed as dollar values and as industry multipliers. Industry multipliers are typically a ratio between 1.3 and 2.0, meaning that the broad economic impacts are much larger than the direct impacts within an industry. Initial multipliers include specific input purchases and output marketing. Further downstream impacts include local or statewide consumption purchases by employees. Here we focus on the initial multipliers because they are more readily connected to a specific industry.

Multiplier effects are typically smaller at the local level than state level. A farm that buys feed locally has local multiplier impacts while a farm that buys feed from an outside region but within the state will have multiplier impacts within the state but not within the local region. The larger gross levels of economic activity at the regional and state levels create this difference in reported industry multipliers. The industry multipliers are essentially the ratio of total effects to direct effects for each industry.

Table V.1, based on the IMPLAN model and data set, shows that the direct effect for all of California from ‘poultry and egg production’ was 2,341 jobs, the total effect (direct, indirect and induced) was 4,260 jobs. In Table V.1, the California employment multiplier was 1.82 (meaning that an additional 0.82 jobs are lost for every job lost in ‘poultry and egg production’). Here we can see that the multiplier of 1.82 can be derived by dividing the total effect (4,260) by the direct effect (2,341). Table V.2 lists the employment, labor income and value added multipliers for “poultry and egg production”. The employment multiplier is based on a ratio of output per worker per dollar of income for the industry. It presents a measure of how an increase, or decrease, in industry activity will impact employment.

We have included estimations of the multiplier for ‘poultry and egg production’ in Stanislaus, Merced, Riverside, San Bernardino, Sonoma, San Joaquin and San Diego counties, the entire state of California and for the combined areas of San Bernardino and Riverside counties and Stanislaus and Merced counties.

Because IMPLAN includes egg production within the “poultry and egg production” aggregation, we accessed public data from the Census of Agriculture and conducted a number of phone and email interviews with California egg industry leaders to develop information specific to the egg industry in California. Based on data presented in Section III, we estimate the California egg industry produced 4.9 billion eggs and generated an average gross farm value of production of about $200 million from 2002 through 2006. Because egg prices jumped in 2007, the value of production rose to $337 million.

The IMPLAN documentation acknowledges that the input data used for agricultural industries is not well founded and encourages users to use better industry data if available (IMPLAN). Because we suspected that the IMPLAN employment numbers were biased downward, we investigated alternative estimates of employment. Based on interviews with industry participants, we estimate the California egg industry has about 3,000 direct employees. These egg-specific numbers indicate that for each $1 million in sales, the industry directly employed about 7.4 individuals in 2007. The value of output per employee is about $135,000 in 2007, up from about $80,000 per employee earlier in the decade. Note that the number of jobs reported for the egg industry is substantially larger than that implied by the 2,341 jobs that the IMPLAN data set includes for the whole poultry industry in California. In 2002, the year of the IMPLAN data, the egg industry was about 25 percent of the total value of output of the total “poultry and egg” industry in California. If the ratio of employment to value of output was the same across segments in the combined industry, this implies that egg employment was only about 585 jobs. Using this much smaller jobs number, the value of output per employee is much larger than we calculated above.

Our assessment is that the IMPLAN data substantially undercounts the number of jobs in the egg industry by misclassifying some of the jobs as associated with other industries. Our egg employment number is based on employment in a sample of egg producing farms and is extrapolated to the whole industry based on the number of hens per employee. The total employment number includes production, on-farm processing, shipping, administration and maintenance, with about half the employment involved in the processing arm of the business. Since the other parts of the poultry business do not include processing as a part of the farm operation, the IMPLAN numbers may not include these workers. We do not include feed milling and transportation, which are also part of the operations for some egg-producing farms in California.

Based on gross revenue, the egg industry is approximately 25 percent of the value added in the combined “poultry and egg” industry in California. Therefore the value added of the egg industry was about $75 million of the $300 million of the combined industry in 2002. We can estimate the value added activities of the California egg industry by applying the multipliers listed in Table V.2 to our estimates of industry output and employees. Based on the multiplier in Table V.2, we estimate that a $1 million decrease in California egg industry labor income will result in an additional loss of $710,000 in the value of wages, salaries and other proprietary income throughout California. Labor income multipliers do not convey a direct measure of the impact of industry change on taxes. It is therefore not possible to accurately measure the decrease in tax revenue based upon labor income multipliers. Table V.2 lists the multiplier for value added for poultry and egg production as 1.48. A $1 million decrease in the California egg industry value added will decrease value added in other industries by $480,000.

Merced County would experience one of the largest decreases in agricultural value from a decline in the California egg industry. Furthermore, the relative importance of the egg industry in this rural county makes the impacts more important to the local economy. Merced County generated about $9 billion in overall economic output and employed almost 87,000 workers in 2002. According to the IMPLAN data set, the poultry and egg industry contributed almost $100 million in output and 178 jobs in 2002. These employment numbers are far smaller than those implied by the Merced County share (about 20 percent) of the 3,000 statewide employees we find for the egg industry alone.

The IMPLAN data and the ratio of the value of egg output to the total value of poultry and egg output imply that the egg industry within Merced County employed around 50 individuals or 22 percent of the 178 employees in the poultry and egg industry in 2002. Using our eggs-specific estimates and, based on the hen population in the state, we would expect that the Merced County egg industry would employ about 20 percent of the 3,000 California egg industry workers or about 600 employees. Our estimates of egg industry employment are more accurate, but also more inclusive than the data used in the IMPLAN model.

According to the IMPLAN data, the elimination of the egg industry within Merced County would cause a decrease in direct egg industry economic output in the county of $70 million and a loss of all 50 jobs. Using the employment multiplier of 0.72 implies an additional 36 jobs for a total loss in Merced country of 86 jobs or about one percent of the total in the county. Using our egg-specific employment data, the total is about 600 jobs directly affected; using a multiplier of 0.72 (Table V.2) we expect a loss of an additional 420 jobs. This loss of 1020 jobs would be about 10 percent of the total in Merced County. The range of impact between a job loss of one percent and 10 percent is the likely impact in Merced County. This is a large impact in a rural county with unemployment in 2007 of more than 10 percent and typical unemployment well above the state average.

V.4 Summary of main economic effects

We have shown in this section that regulations that eliminate the use of cage housing systems by the egg industry in California would likely curtail egg production in California except for a very small residual of specialty producers that would supply part of the market for eggs produced in non-cage systems. This result follows from the supply and demand conditions that characterize the market and specifically the ability of eggs produced out of state to compete effectively for demand from California buyers. The elimination of most of the California egg industry would have broader economic implications. The loss of about 3,000 jobs in the industry would be multiplied by a factor of about 0.9 to imply a statewide loss of jobs of about 5,750 jobs. The loss in overall economic activity in the state is also larger than the gross sales of about $370 million in 2007 because of the ripple effects that affect upstream and downstream industries.

This report has analyzed the economic impacts of the California initiative that would affect how eggs are produced in California. We have not explored in detail the consequences of regulations that would effectively ban the use of conventional cage housing for all egg production throughout the United States. Although the initiative applies only in California, and there is no clear relationship between regulations here and elsewhere, it may nonetheless be useful to consider briefly the broad implications of such regulations that applied either at the Federal level or individually in each significant egg-producing state.

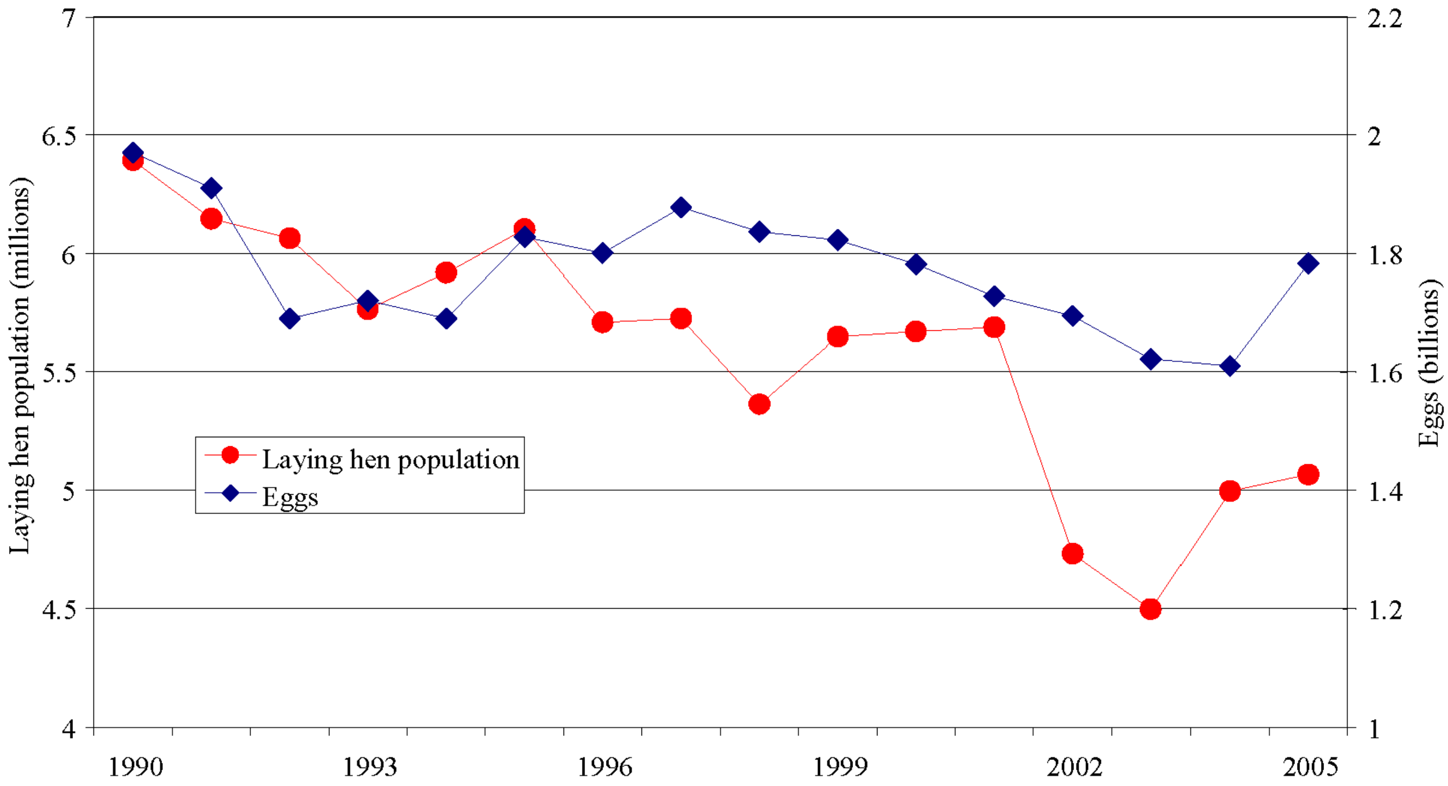
Based on our analysis reported above, there would be two major consequences of an effective national ban on eggs produced from hens in conventional cage housing. First, the cost of egg production would increase substantially throughout the United States. Second, the implication of higher costs for all producers would be higher farm prices and a significant increase in wholesale and retail prices facing buyers.

If national or widespread state regulations were to be imposed on a piecemeal basis and with considerable uncertainty, the egg industry would be likely to make new investments in non-cage housing only slowly. The disruption caused by such a regulatory approach would be imposed on the egg producers, consumers and the economy as a whole. If the limits on using cage housing were imposed on just some egg-producing states, production would decline in the states with the cost-increasing regulations and production would expand in the states without the regulations. The higher the share of relatively low-cost egg producing states that were covered by the housing regulations, the more national marginal cost of production would rise and the more prices would rise as a consequence. These same considerations apply to the imports of eggs from other countries. Given high transport costs, relatively high production costs overseas and the government-imposed production quota system in Canada, the most likely supplier of eggs exported into the United States is Mexico. Mexico is geographically close to population centers in the Southwest, but Mexican eggs have not been competitive under current market conditions, probably because feed and other costs are high in Mexico. However, if cage housing were banned in the United States, production in Mexico may become competitive despite higher costs of feed.

Finally, we must mention a broader economic consequence that is difficult to quantify. Farm and agribusiness industries in California already face more severe regulations that cause higher costs of production than many out of state competitors. Many in agriculture perceive that the economic and regulatory prospects in California are less supportive of investments than elsewhere. A legitimate concern about this initiative is that it represents an acceleration of a tendency for regulations in California to make agribusiness particularly difficult here. The result would be dampening of investment and consequent reductions in job growth at a time when population is expected to expand and the number of job seekers is expected to rise. Thus, the broad economic consequences of the initiative could be significantly more severe than those measured by considering solely egg production and industries directly linked to egg production through upstream and downstream markets.

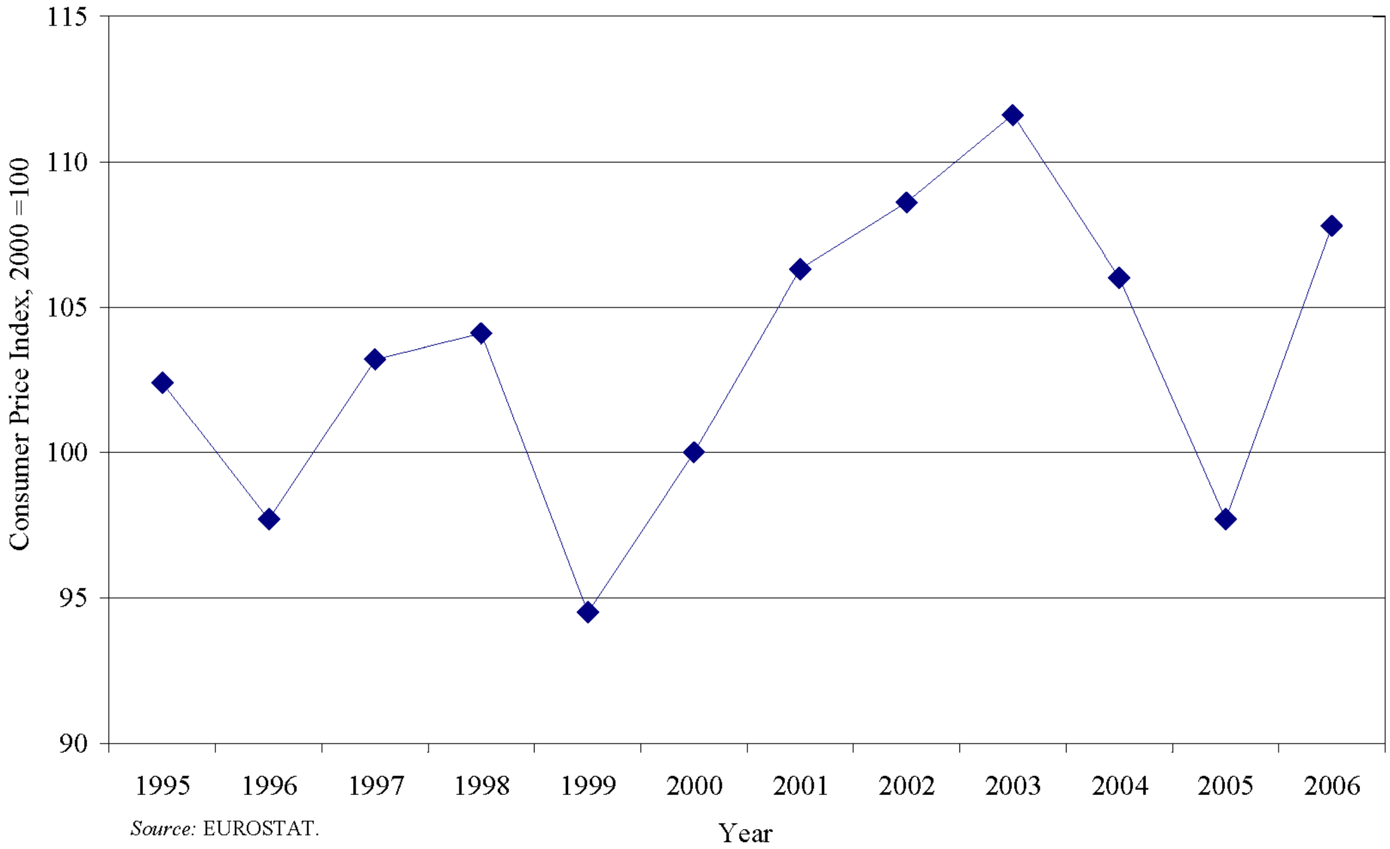
Figures

Figure II.1 Sweden: Laying hen population and egg production, 1990-2005



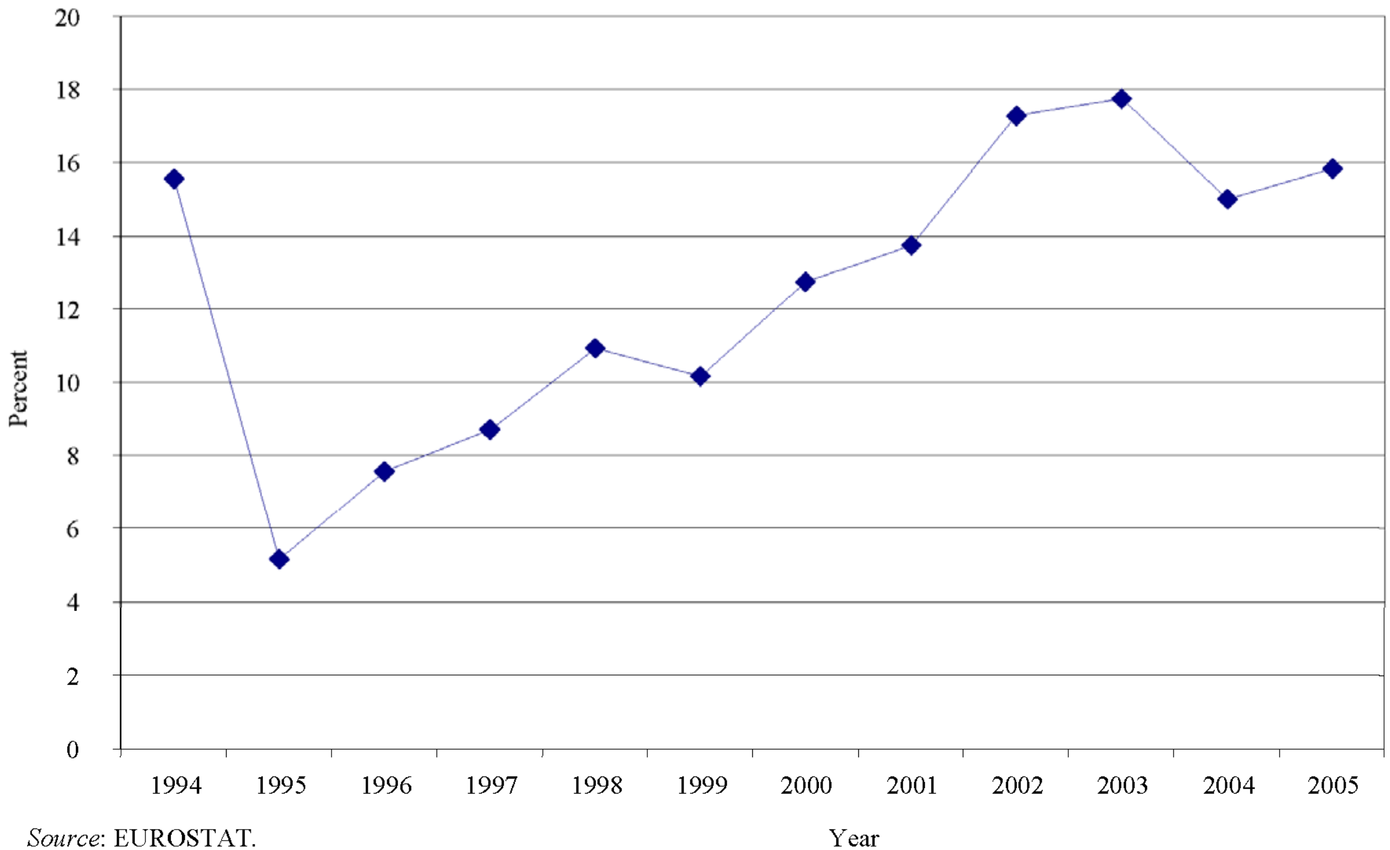
Source: EUROSTAT.

Figure II.2 Sweden: Egg prices, 1995-2006



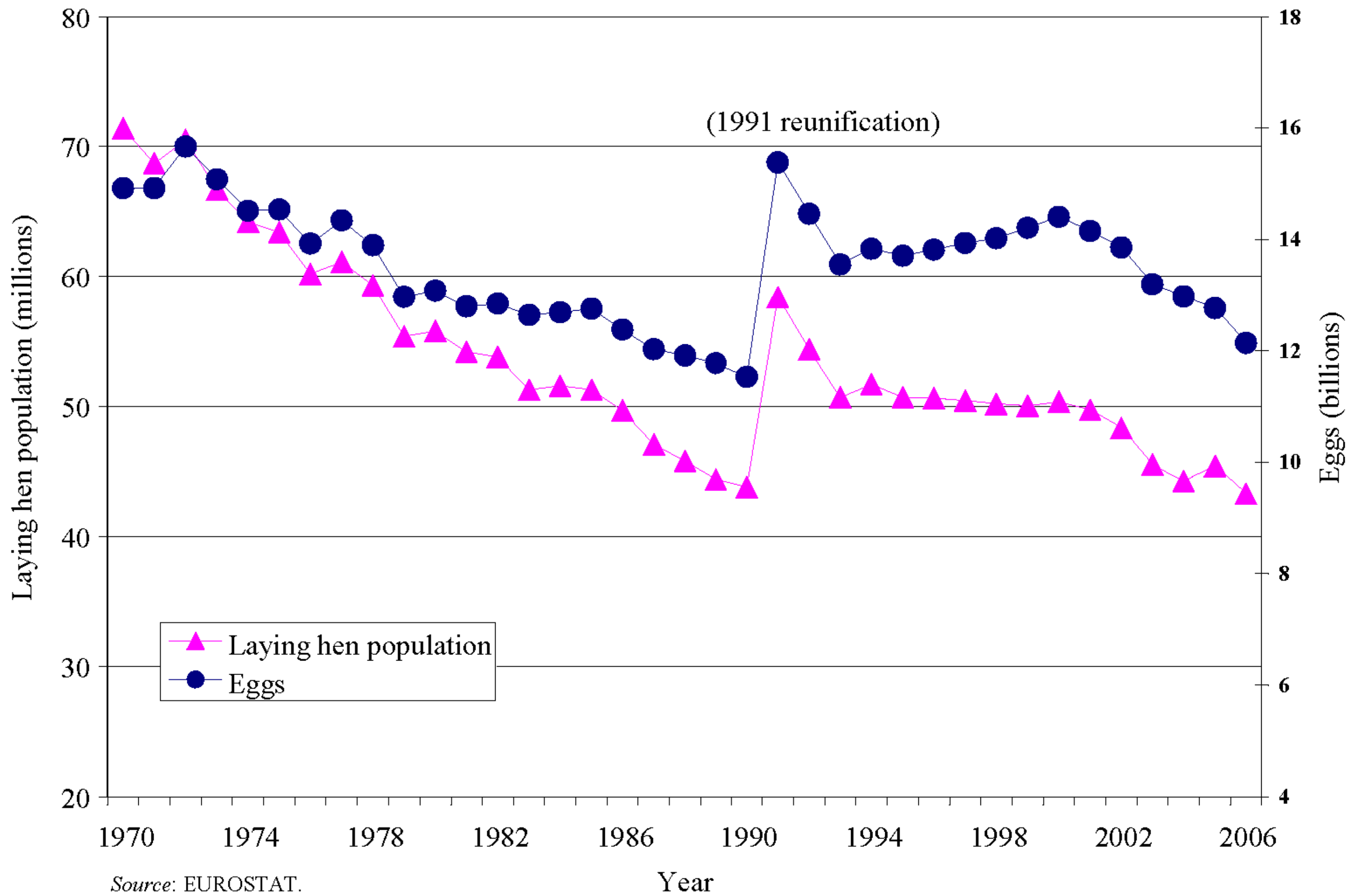
Source: EUROSTAT.

Figure II.3 Sweden: Import share of shell eggs, 1994-2005



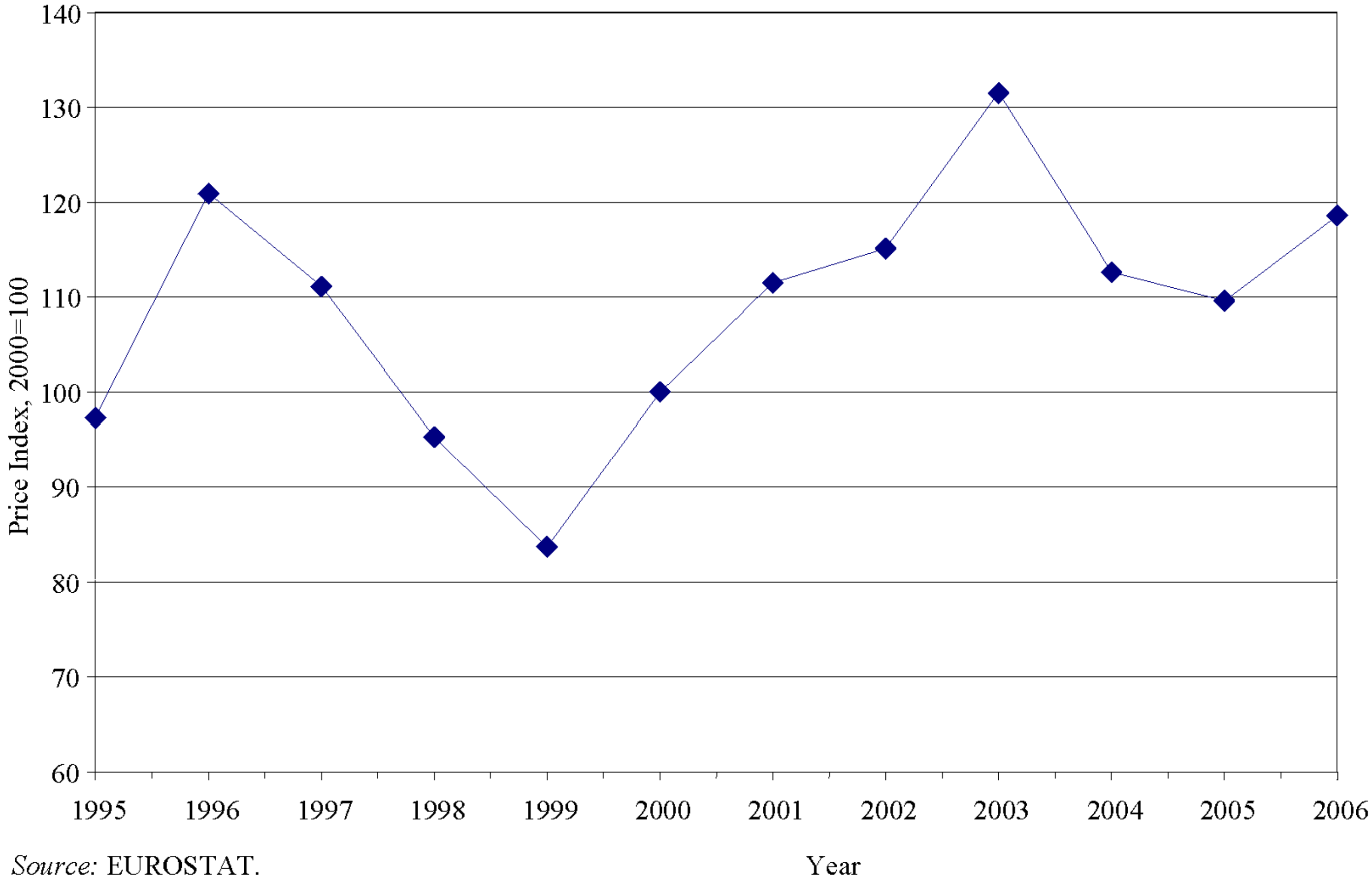
Source: EUROSTAT.

Figure II.4 Germany: Laying hen population and egg production, 1970-2006



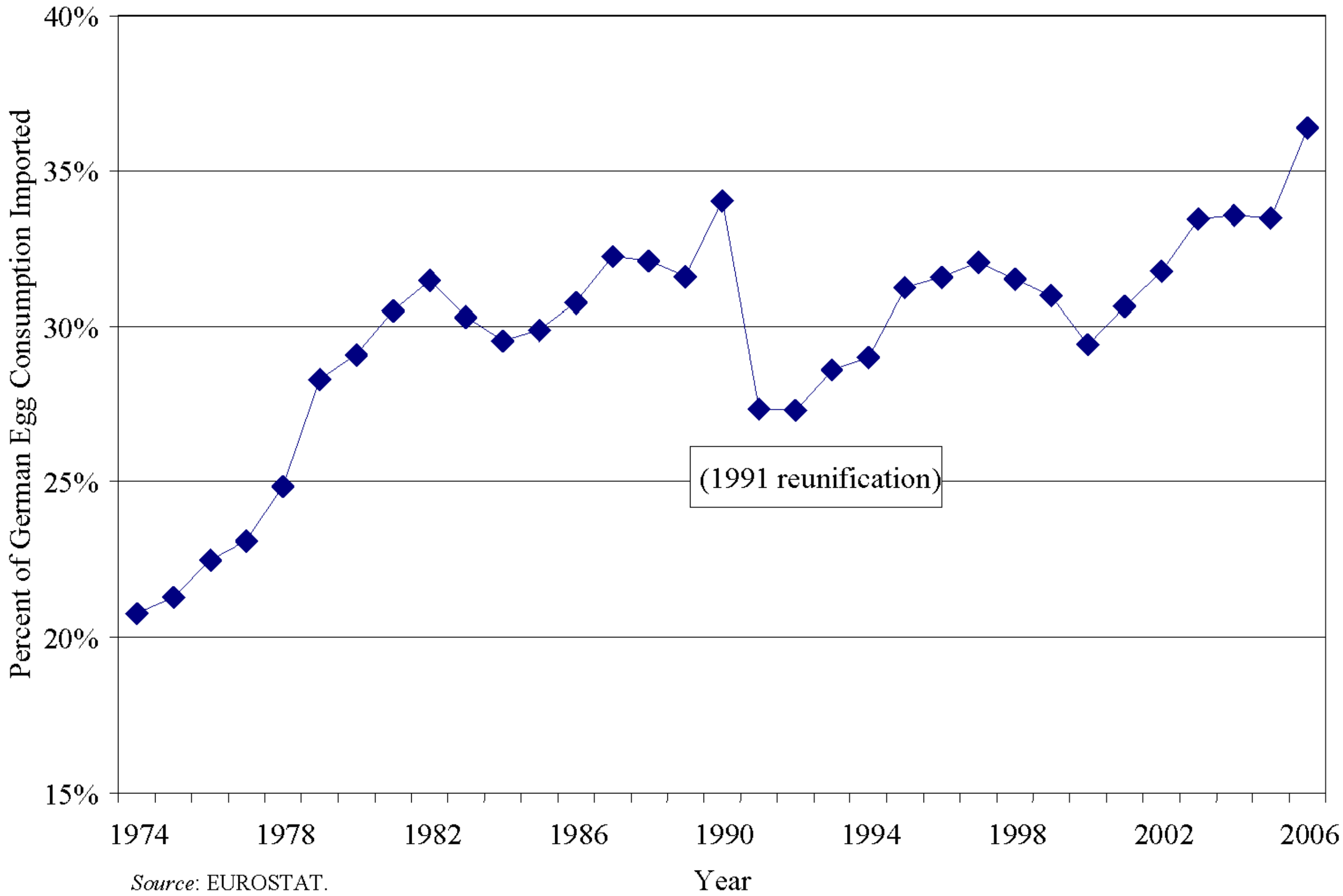
Source: EUROSTAT.

Figure II.5. Germany: Egg prices, 1995-2006



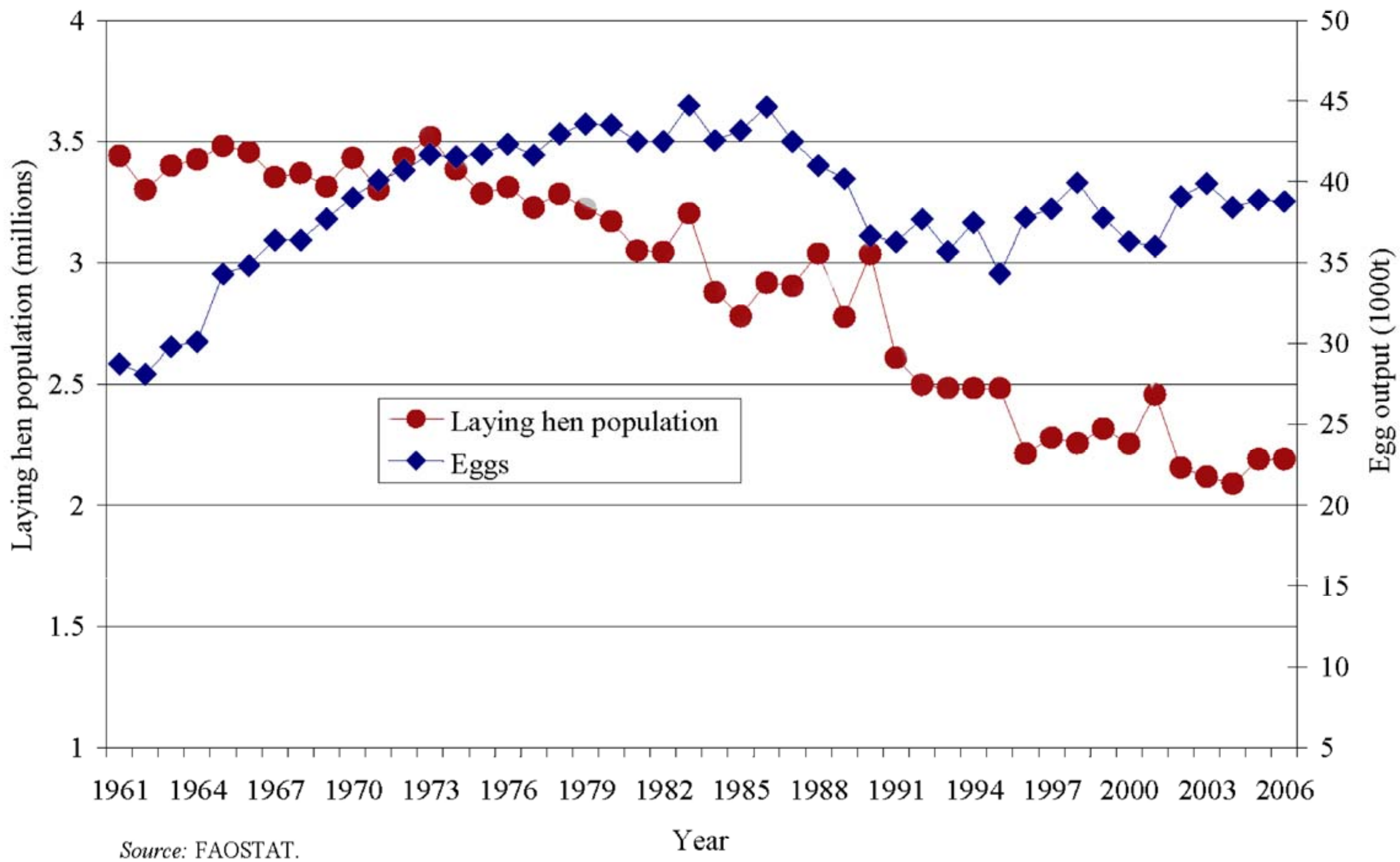
Source: EUROSTAT.

Figure II.6. Germany: Import share of shell eggs, 1974-2006



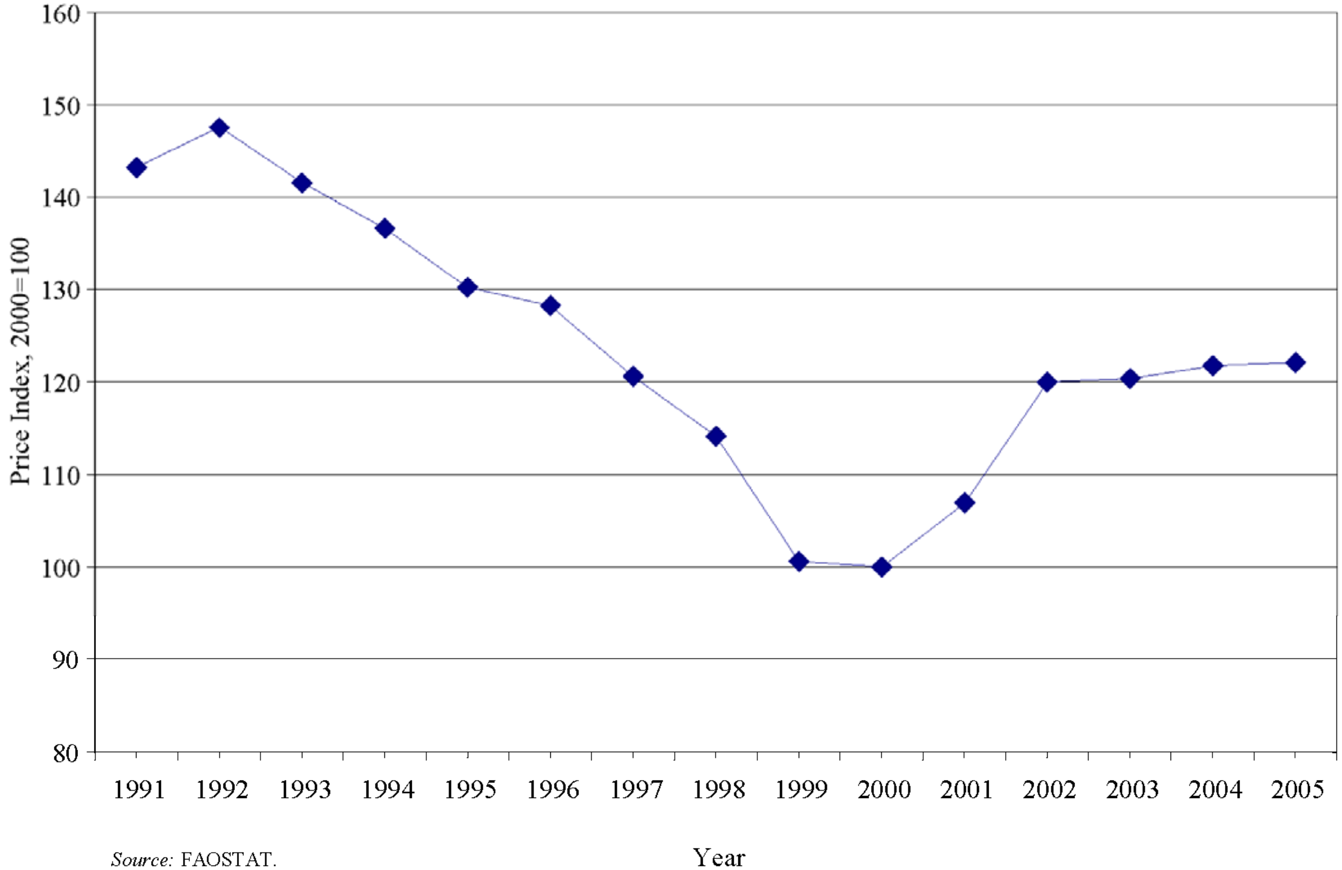
Source: EUROSTAT.

Figure II.7. Switzerland: Laying hen population and egg production, 1961-2006



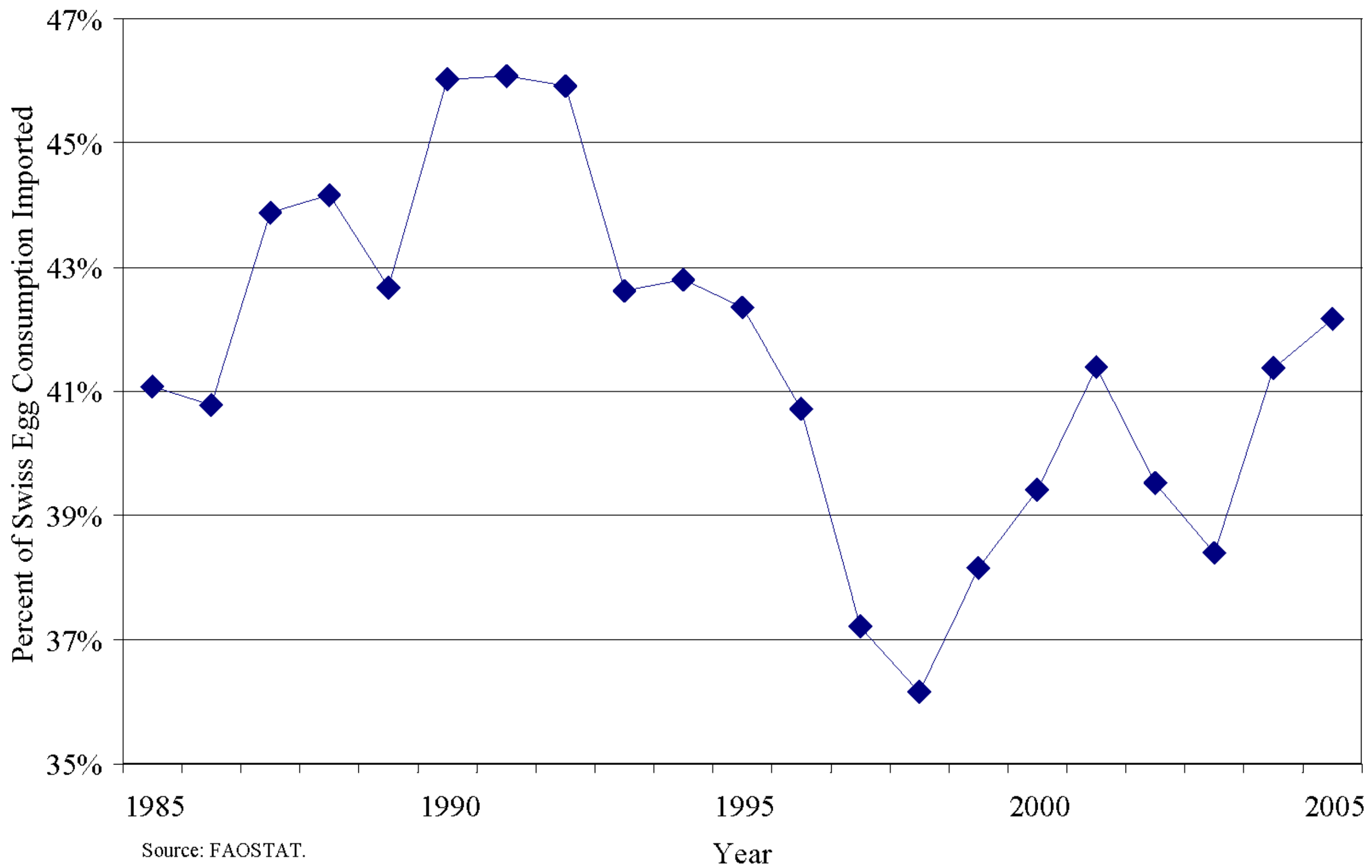
Source: FAOSTAT.

Figure II.8. Switzerland: Egg prices, 1991-2005



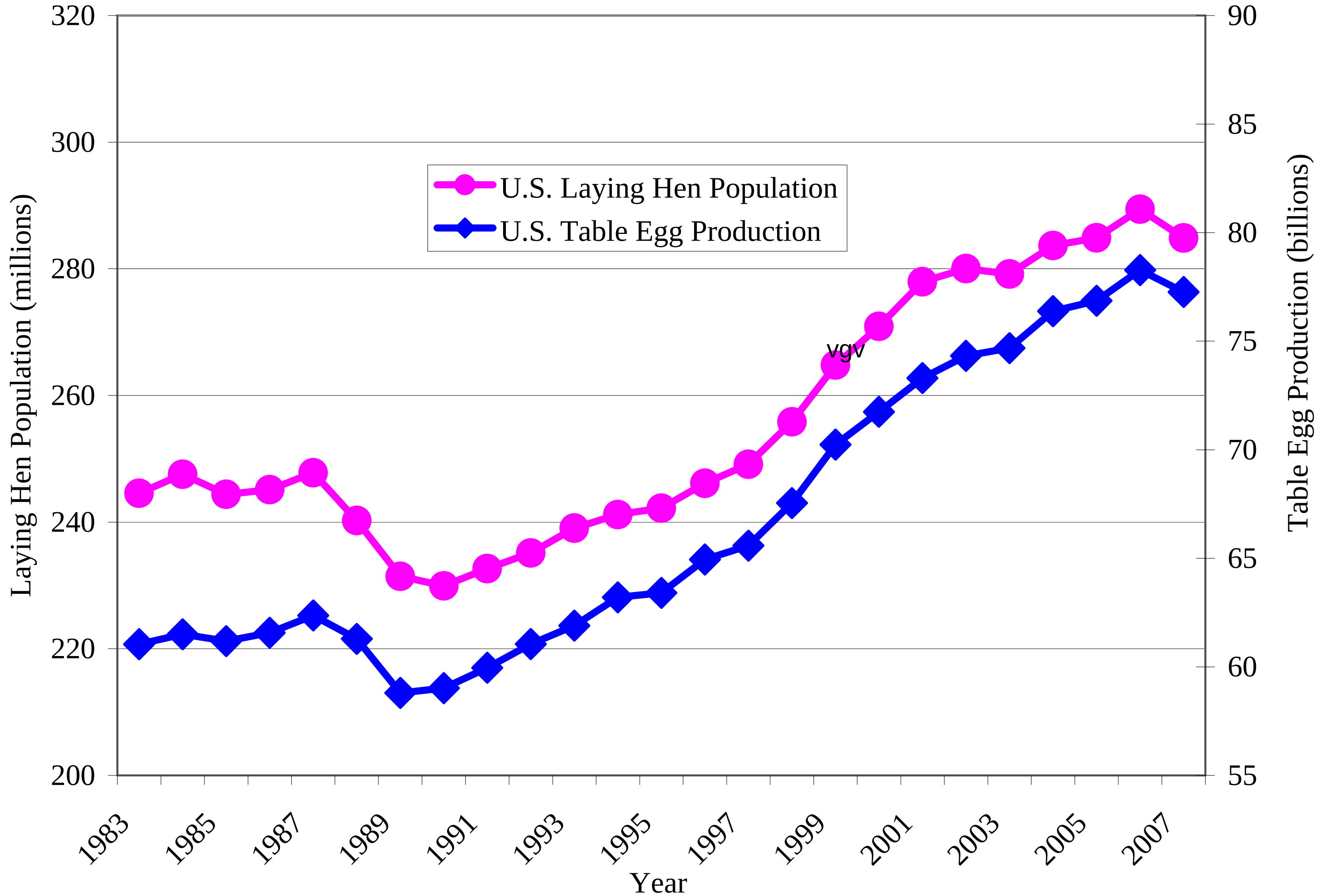
Source: FAOSTAT.

Figure II.9. Switzerland: Import share of shell eggs, 1985-2005



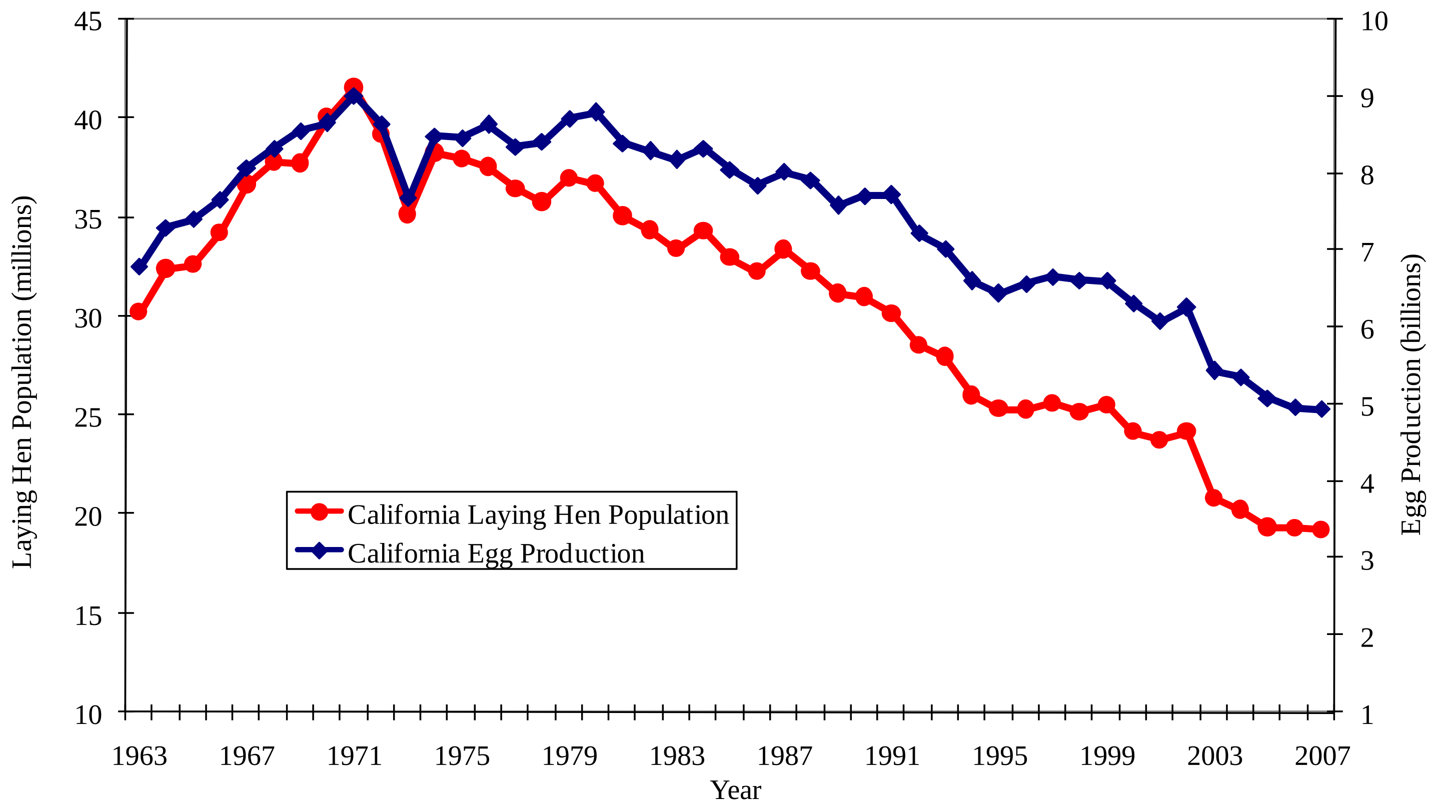
Source: FAOSTAT.

Figure III.1. United States: Laying hen population and table egg production, 1983-2007



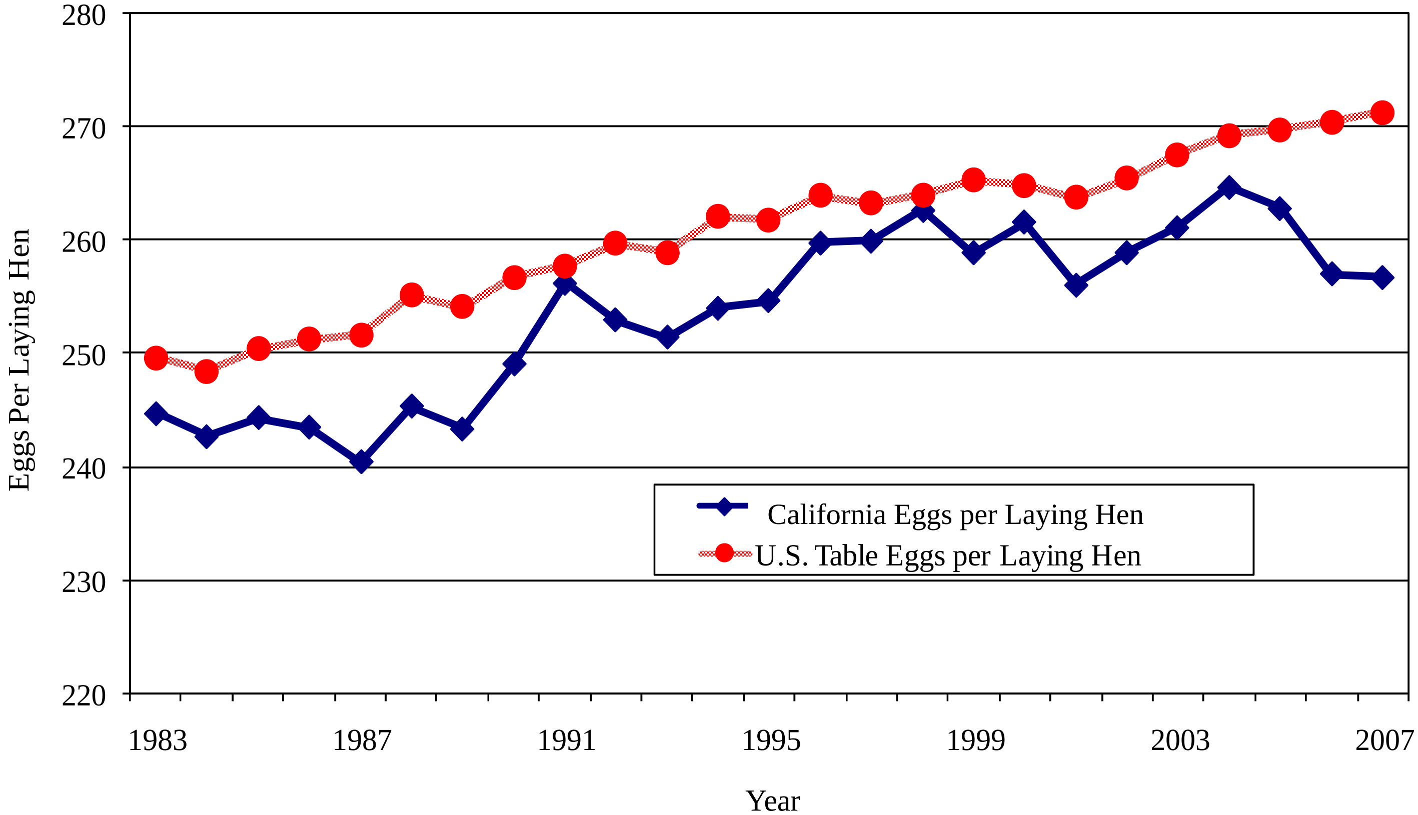
Source: USDA NASS, *Poultry Production and Value Annual Summary* and *Layers and Egg Production Annual Summary*, various editions.
Note: Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries.

Figure III.2. California laying hen population and egg production, 1963-2007



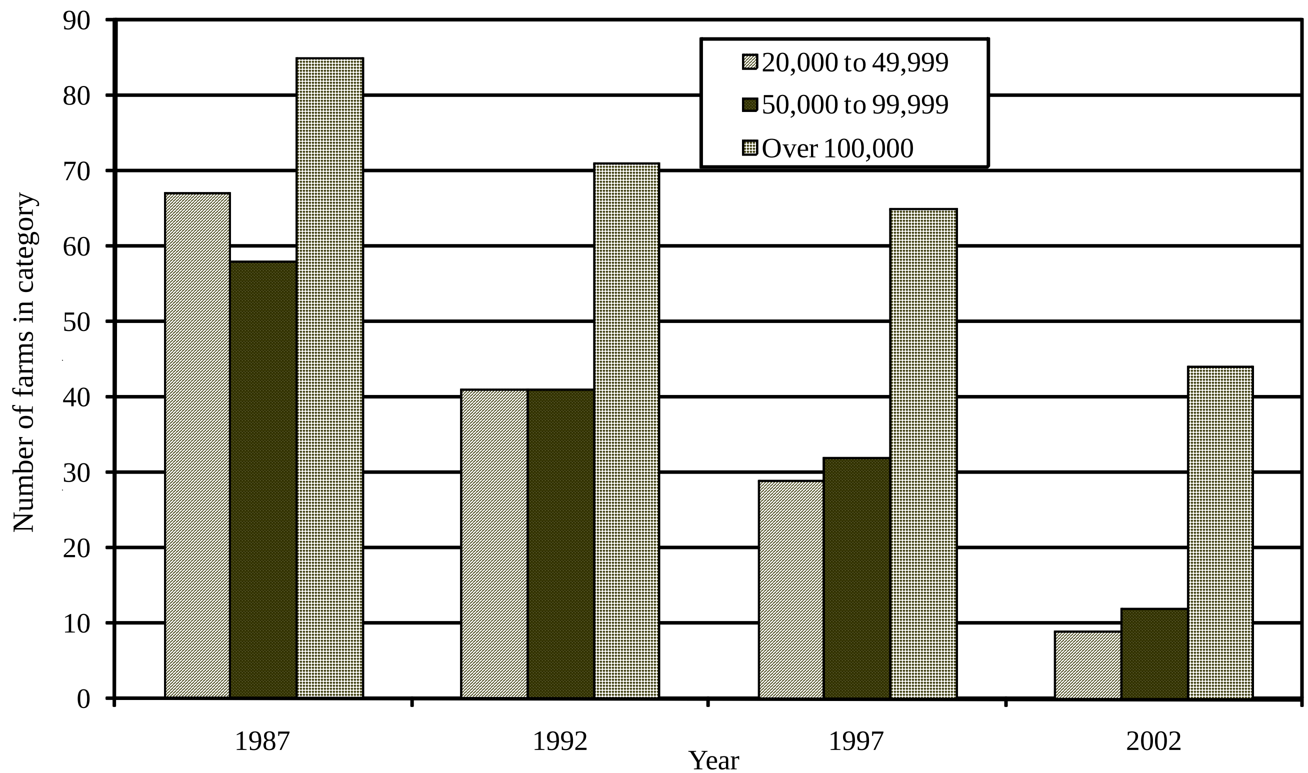
Source: USDA NASS *Chicken and Eggs Annual Summary*.
Note: Egg production includes hatching eggs. Hatching eggs comprised a declining share of total output over this period and, based on industry sources and data in Table III.2, hatching eggs are estimated to be about two percent of California egg production currently (Bell 2008b).

Figure III.3. California and U.S. table egg production per laying hen, 1983-2007



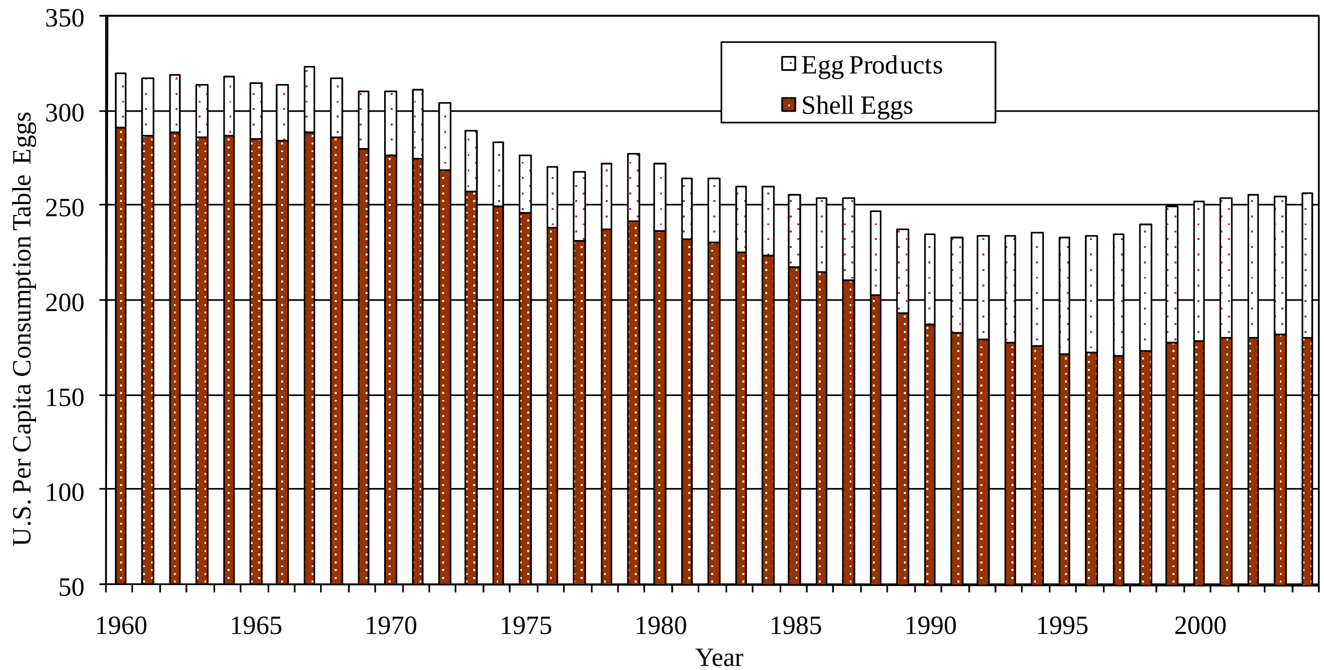
Source: USDA NASS Chicken and Eggs Annual Summary.
Note: Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries. Data on table eggs are available for the United States as a whole. Hatching eggs comprised a declining share of California output over this period and, based on industry sources and data in Table III.2, hatching eggs are estimated to be about two percent of California egg production currently (Bell 2008b). There are no separate data on hatching eggs in California, but based on industry sources we estimate that, currently, about 98 percent of California eggs are table eggs. The data in this figure are *not* adjusted to remove an estimate of hatching eggs.

Figure III.4. California egg farms categorized by laying hen population



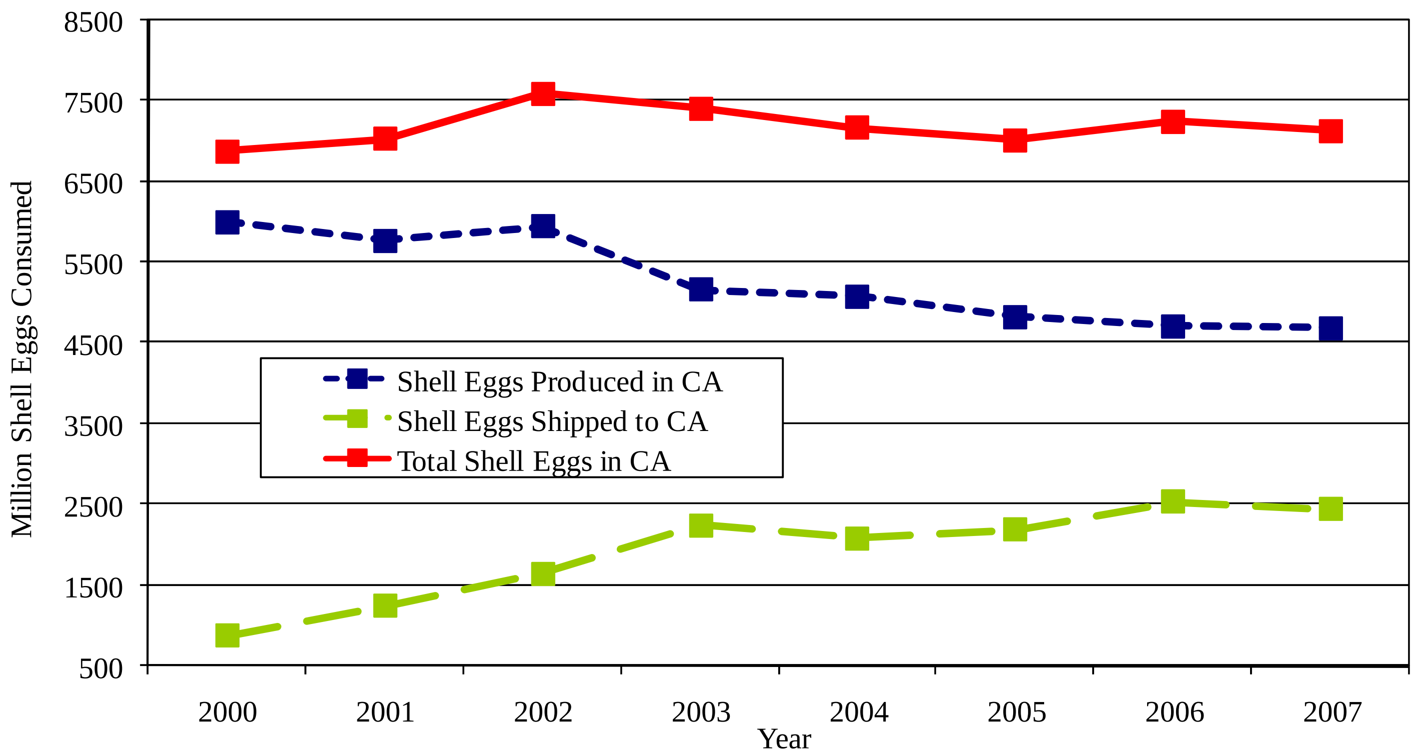
Source: USDA NASS *Census of Agriculture*.

Figure III.5. U.S. per capita consumption of table eggs, 1960-2004



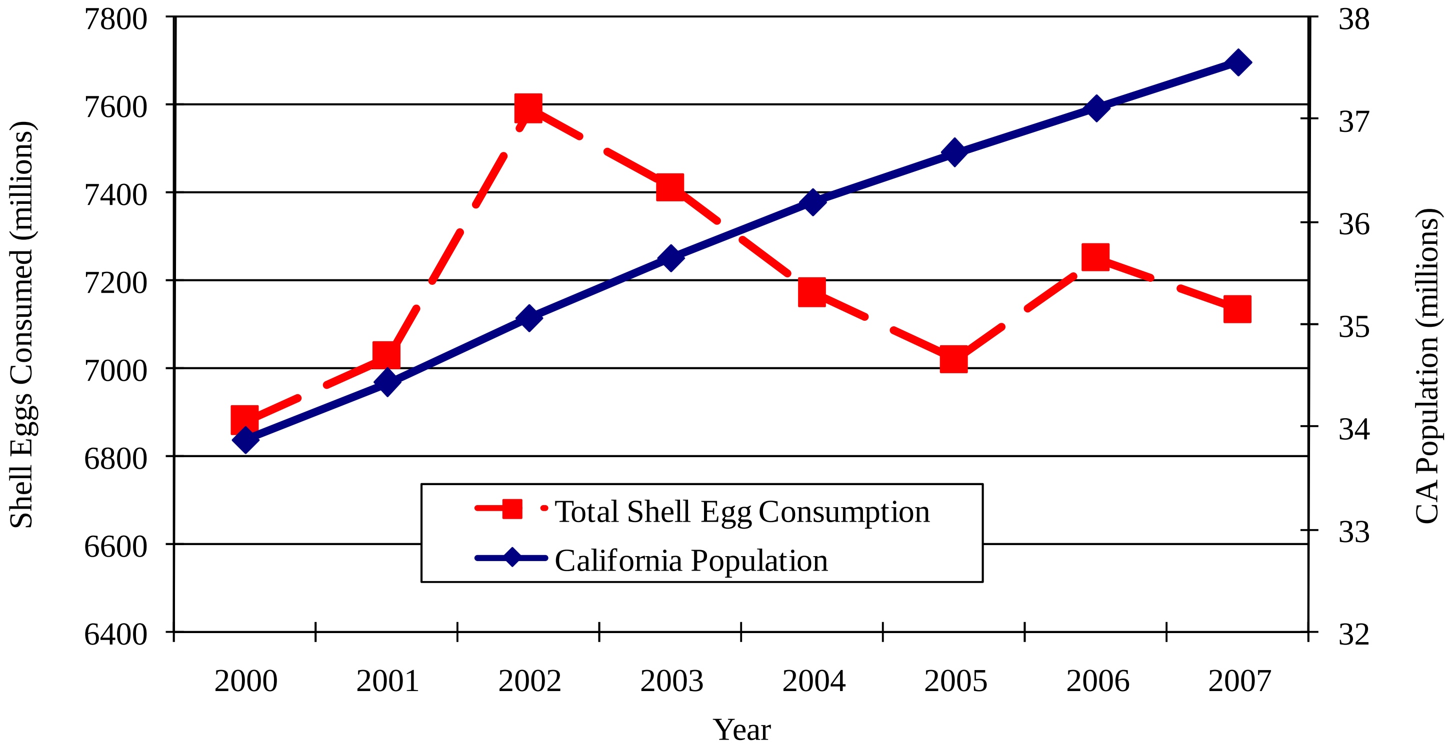
Source: USDA ERS, *Poultry Yearbook*, Tables 29 and 43, 2006
Note: This data series ended in 2004.
Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries. Data on table eggs are available for the United States as a whole.

Figure III.6. Estimated shell eggs consumed in California, 2000-2007



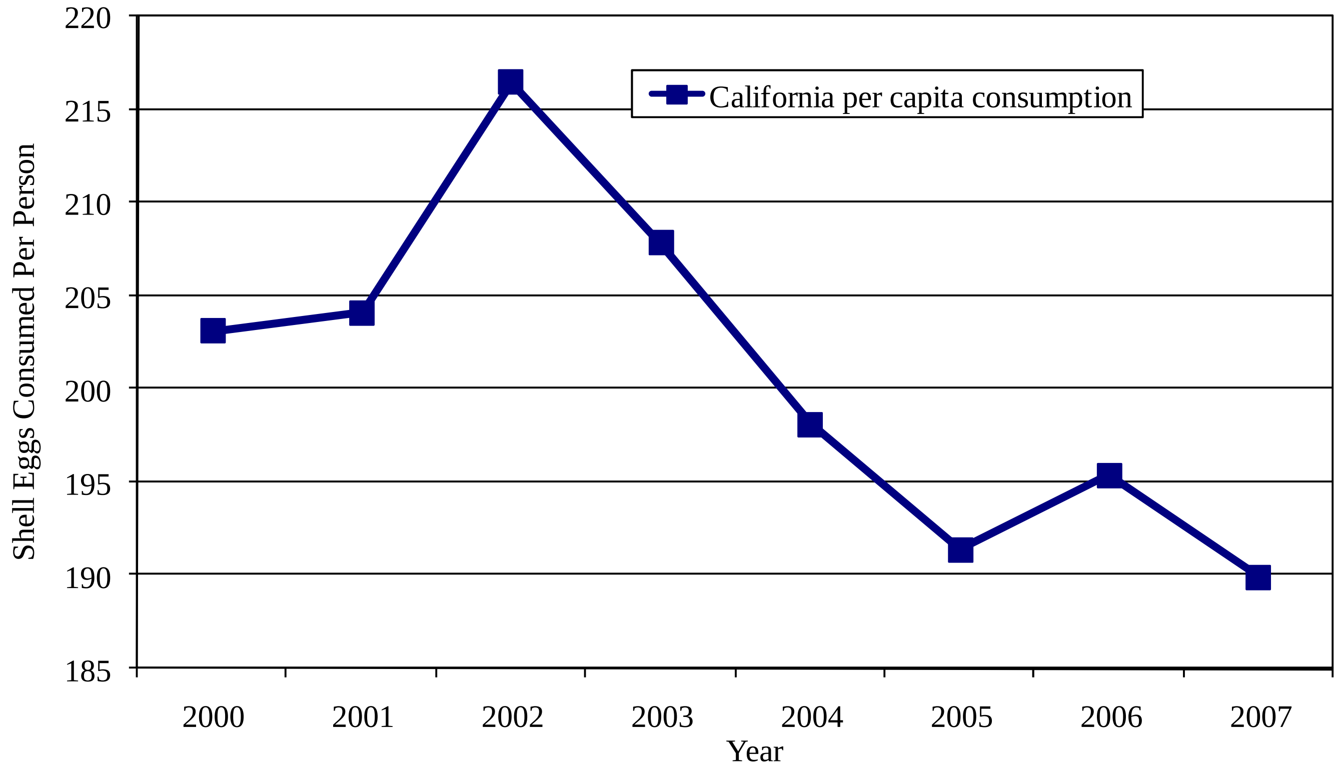
Sources: Shell egg consumption comes from USDA NASS data and CDFA data compiled by Don Bell in "Annual Egg Industry Statistics."
Note: Total shell egg consumption is the sum of shell eggs produced in California plus total out of state shipments of shell eggs into California.
Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources and Table III.2 we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs. The data in this figure have been adjusted accordingly.

Figure III.7. Estimated California shell egg consumption and state population, 2000-2007



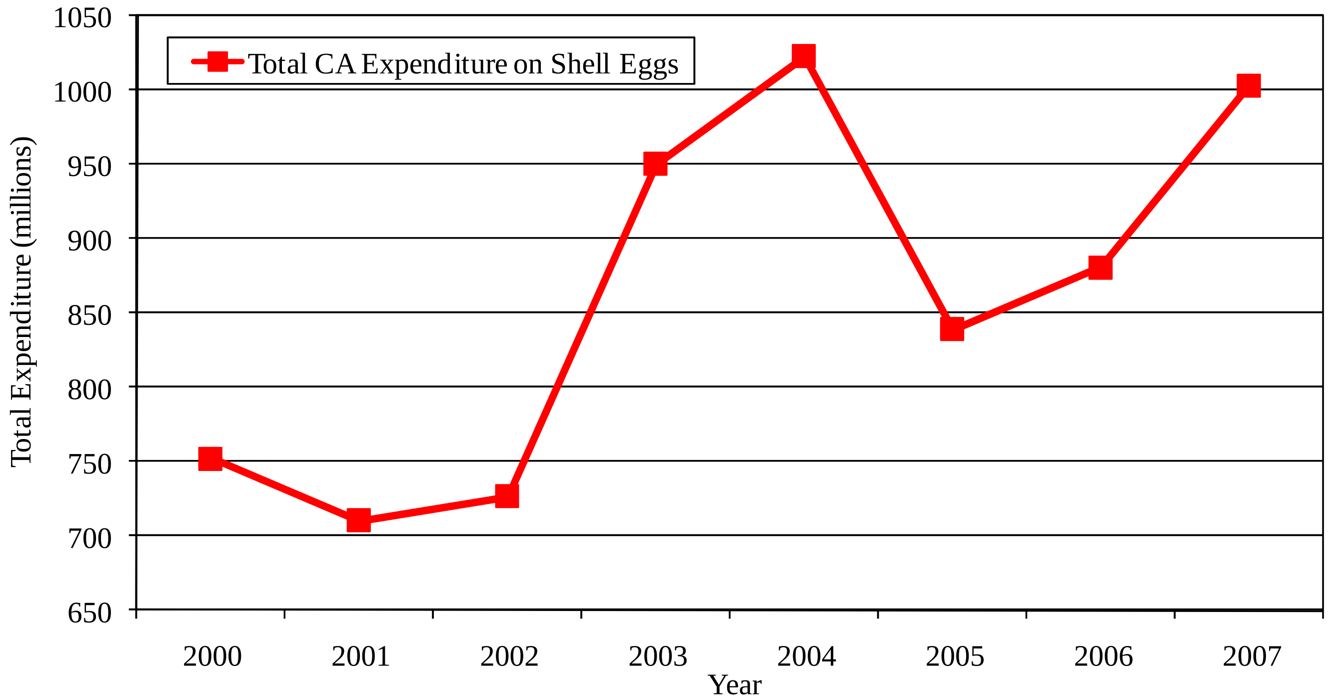
Sources: Shell egg consumption comes from USDA NASS data and CDFA data compiled by Don Bell in "Annual Egg Industry Statistics." Population data comes from California Department of Finance, Economic Research Unit.
Note: Shell egg consumption estimated by summing California shell egg production and total out of state shipments of shell eggs into California.
Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources and Table III.2 we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs. The data in this figure have been adjusted accordingly.

Figure III.8. Estimated California per capita shell egg consumption, 2000-2007



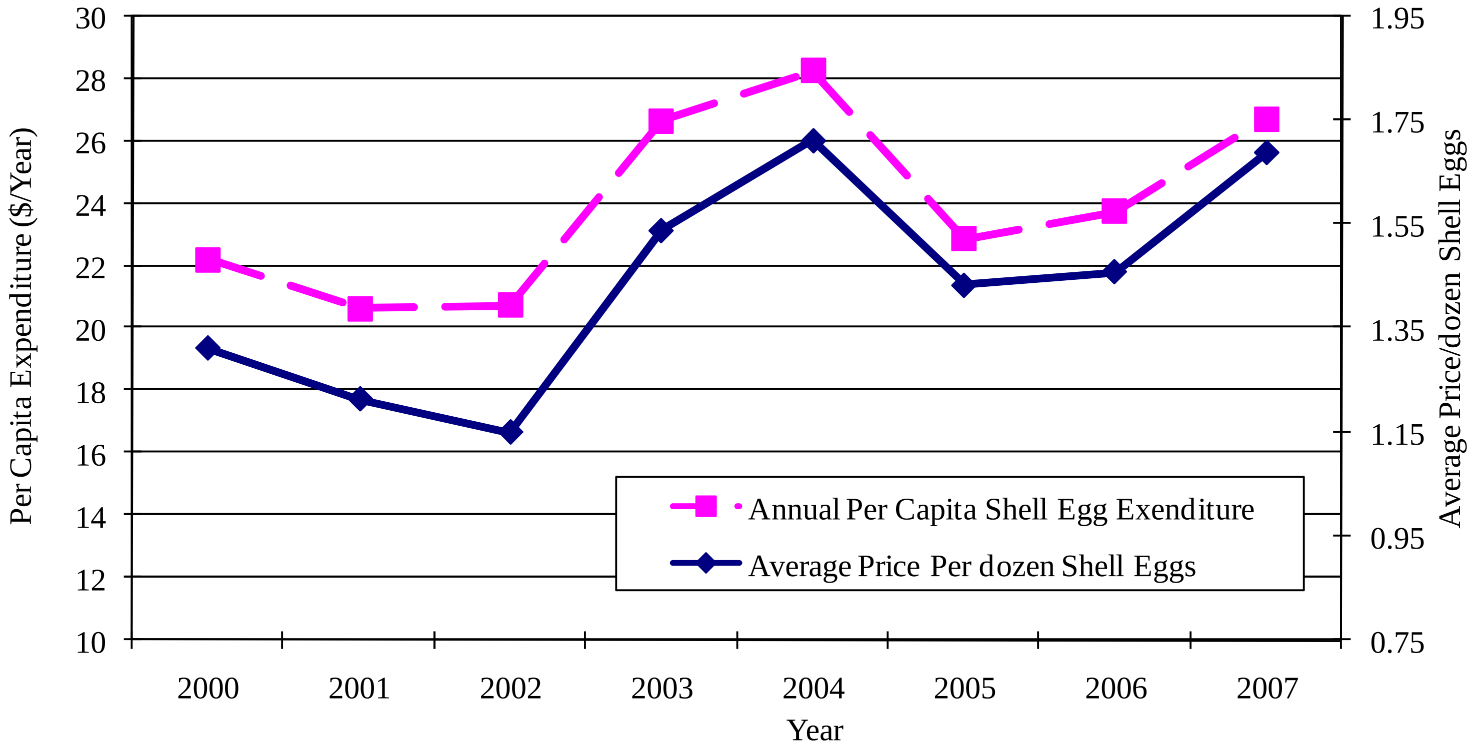
Source: Shell egg consumption comes from USDA NASS data and CDFA data compiled by Don Bell in "Annual Egg Industry Statistics." Population data comes from California Department of Finance, Economic Research Unit.
Note: Per capita shell egg consumption estimated by dividing total annual California shell egg consumption by annual population.
Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources and Table III.2 we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs. The data in this figure have been adjusted accordingly.

Figure III.9. Estimated total California expenditure on shell eggs



Source: Shell egg consumption comes from USDA NASS data and CDFA data compiled by Don Bell in "Annual Egg Industry Statistics." Shell egg retail price data comes from U.S. Department of Labor, Bureau of Labor Statistics.
Note: Total California expenditure is estimated using the product of the annual retail price per dozen large Grade AA eggs in the western urban region of the U.S. and total California consumption of shell eggs.
Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources and Table III.2 we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs. The data in this figure have been adjusted accordingly.

Figure III.10. Annual California per capita expenditure and average price per dozen shell eggs, 2000-2007

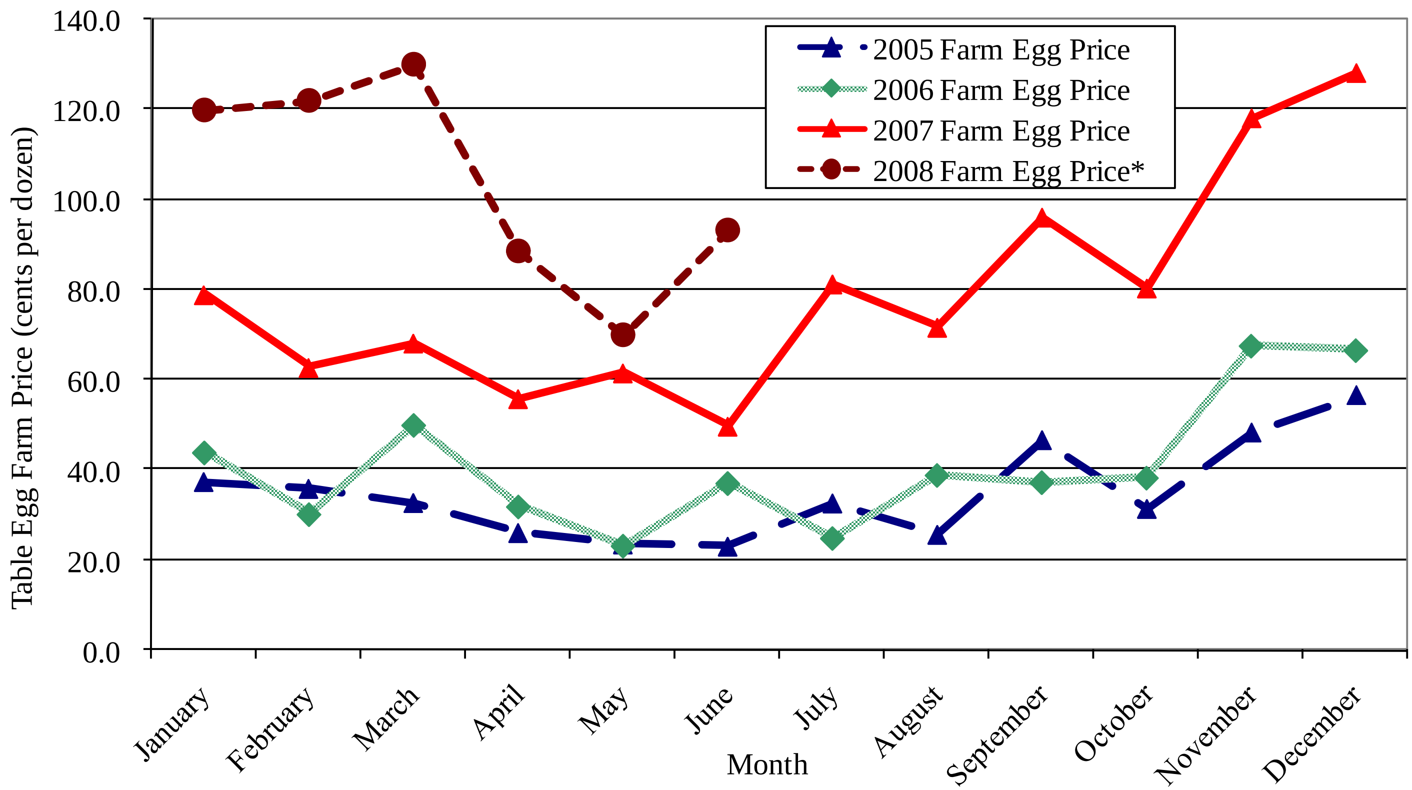


Sources: Shell egg consumption comes from USDA NASS data and CDFA data compiled by Don Bell in "Annual Egg Industry Statistics." Shell egg retail price data is the annual retail price per dozen large Grade AA eggs in the western urban region of the U.S and comes from U.S. Department of Labor, Bureau of Labor Statistics. Population data comes from California Department of Finance, Economic Research Unit.

Note: Per capita California expenditure is estimated by dividing total California shell egg expenditure by state population.

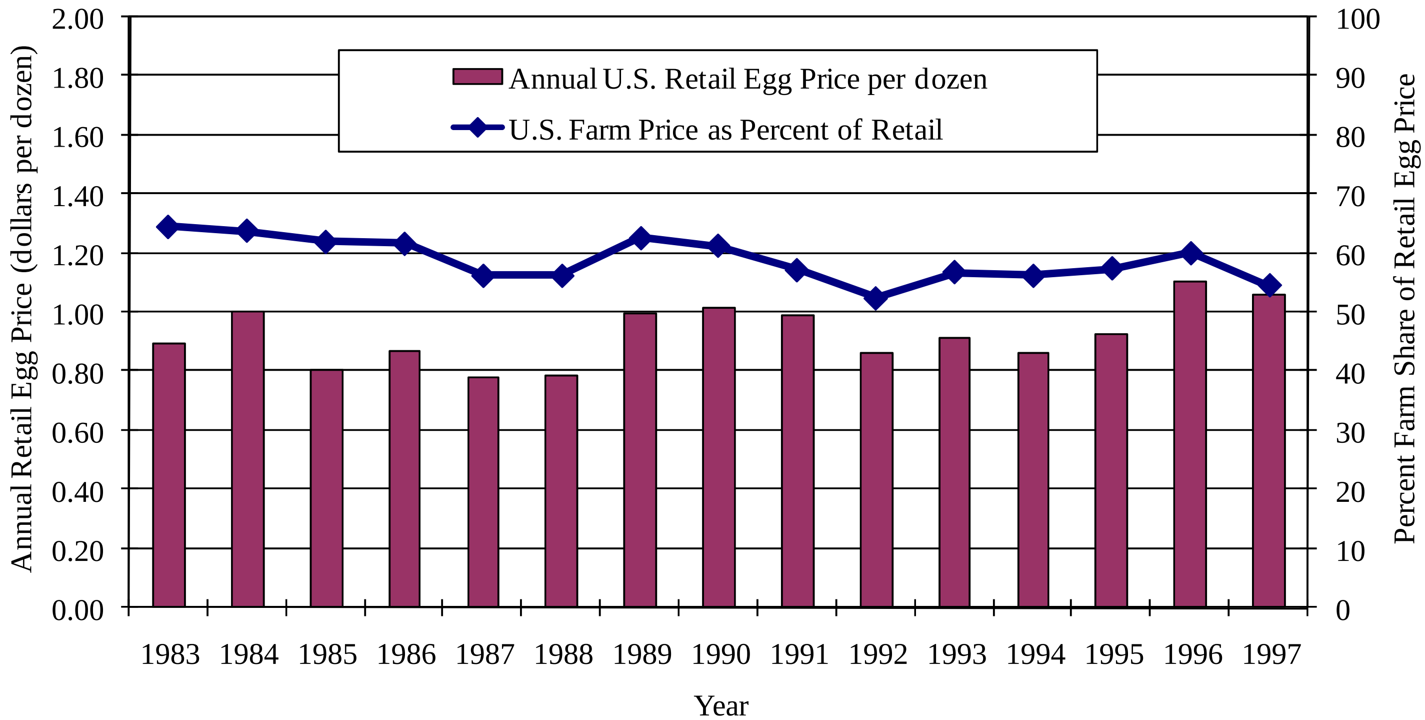
Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources and Table III.2 we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs. The data in this figure have been adjusted accordingly.

Figure III.11. U.S. mid-month farm table egg price, 2005-2008



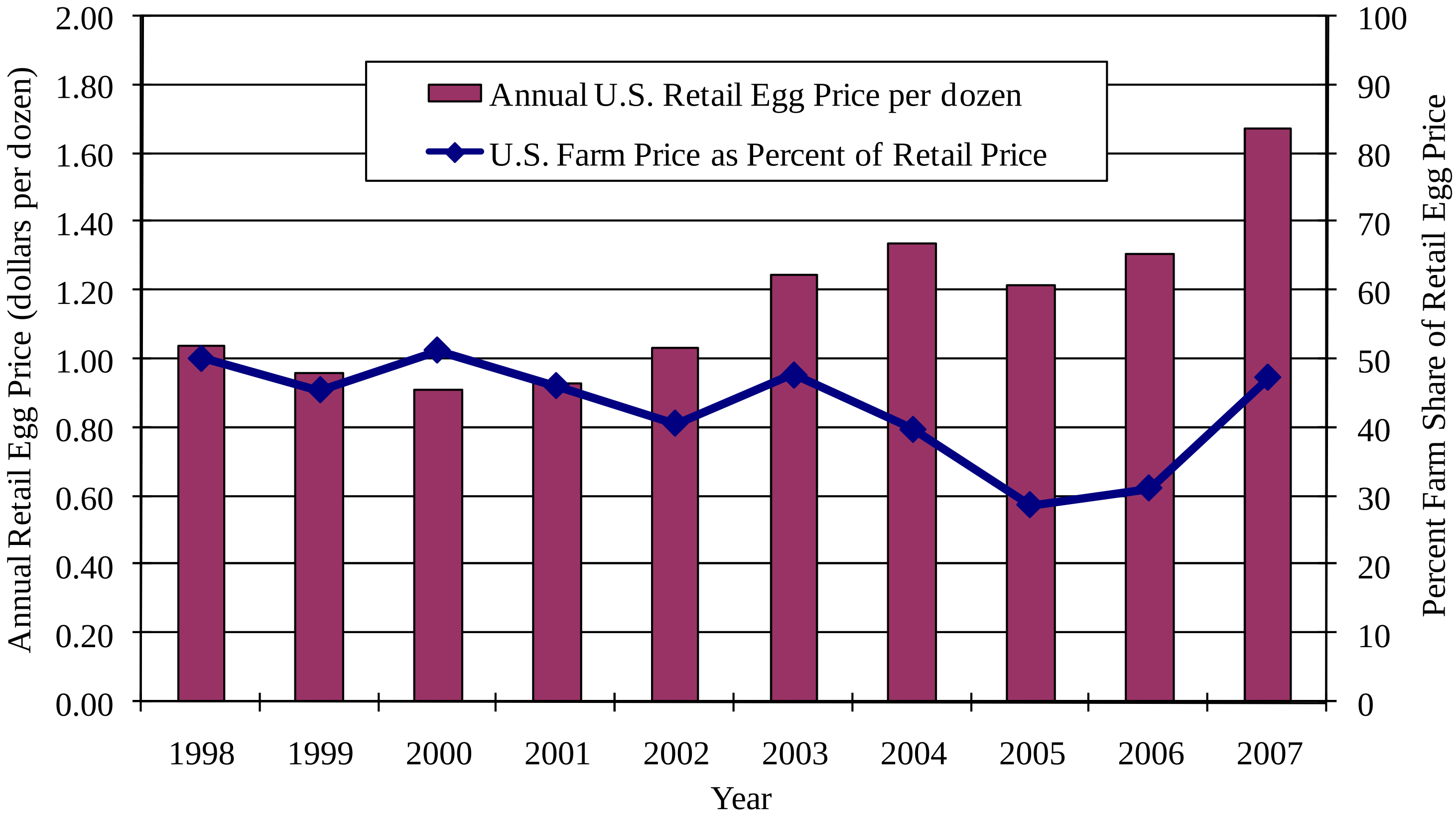
Source: USDA NASS, *Agricultural Prices*.
Note: Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries. Data on table eggs are available for the United States as a whole.

Figure III.12a. Percent farm share of retail price, 1983-1997



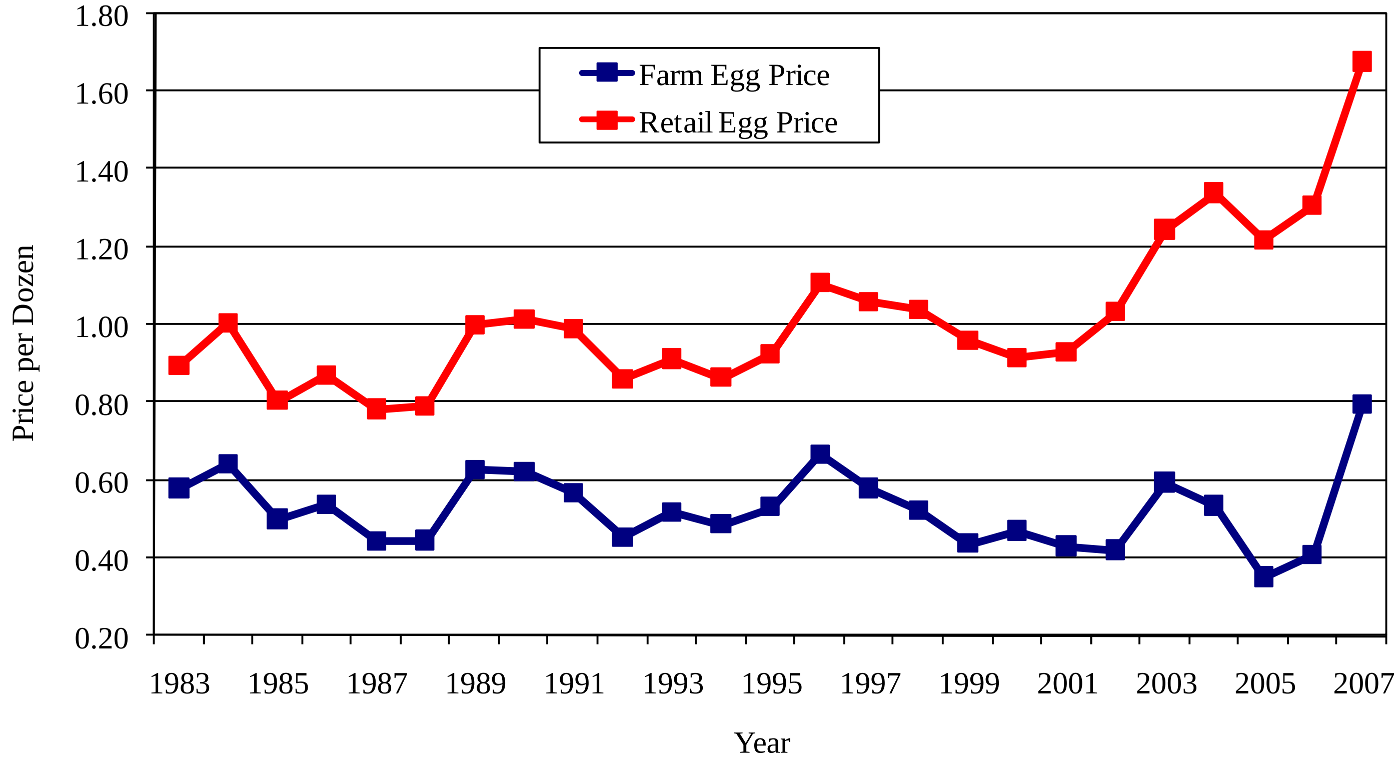
Source: Farm price data from USDA NASS, *Agricultural Prices*. Retail egg price data from U.S. Department of Labor, Bureau of Labor Statistics.
Note: Retail price is the annual U.S. retail price for one dozen grade AA large eggs. U.S. Farm price is the 12 month average for table eggs.
Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries.
Data on table eggs are available for the United States as a whole.

Figure III.12b. Percent farm share of retail price, 1998-2007



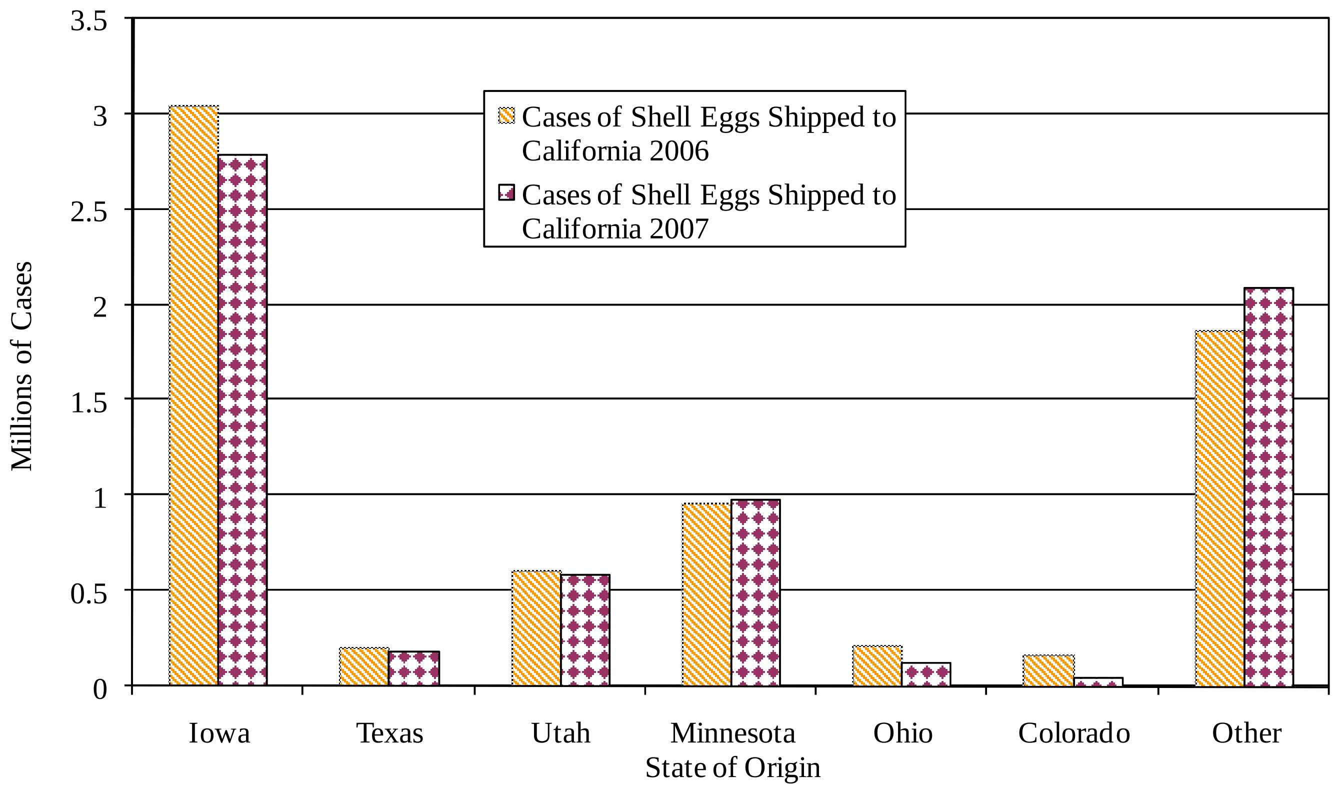
Sources: Farm price data from USDA NASS, *Agricultural Prices*. Retail egg price data from U.S. Department of Labor, Bureau of Labor Statistics.
Note: Retail price is the annual U.S. retail price for one dozen grade AA large eggs. U.S. Farm price is the 12 month average for table eggs.
Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries.
Data on table eggs are available for the United States as a whole.

Figure III.13. U.S. farm table egg and retail egg prices, 1983-2007



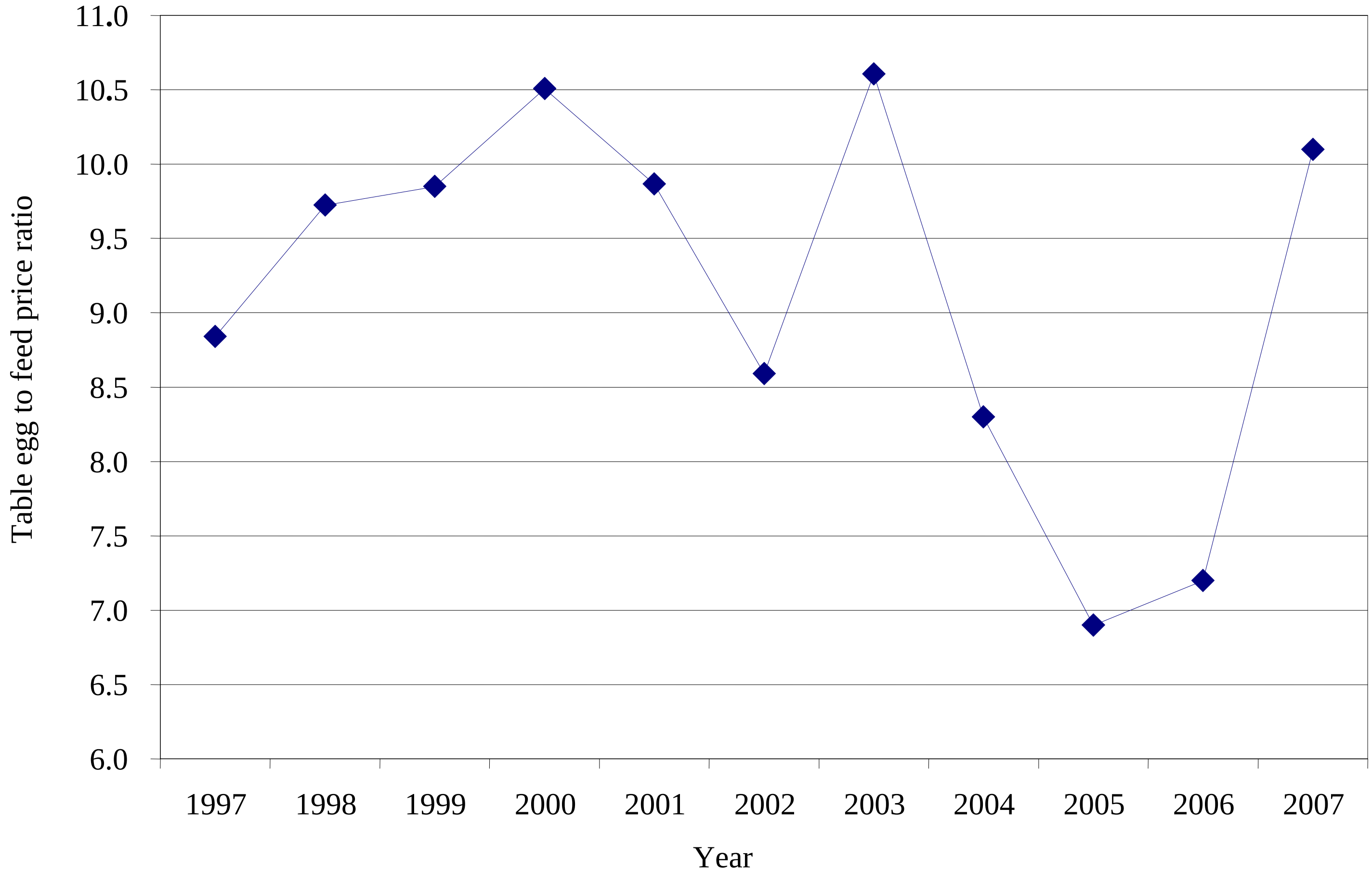
Sources: Farm price data from USDA NASS, *Agricultural Prices*. Retail egg price data from U.S. Department of Labor, Bureau of Labor Statistics.
Note: Retail price is the annual U.S. retail price for one dozen grade AA large eggs. U.S. farm price is the 12 month average for table eggs.
Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries. Data on table eggs are available for the United States as a whole.

Figure III.14. Shipments of shell eggs into California, 2006 and 2007



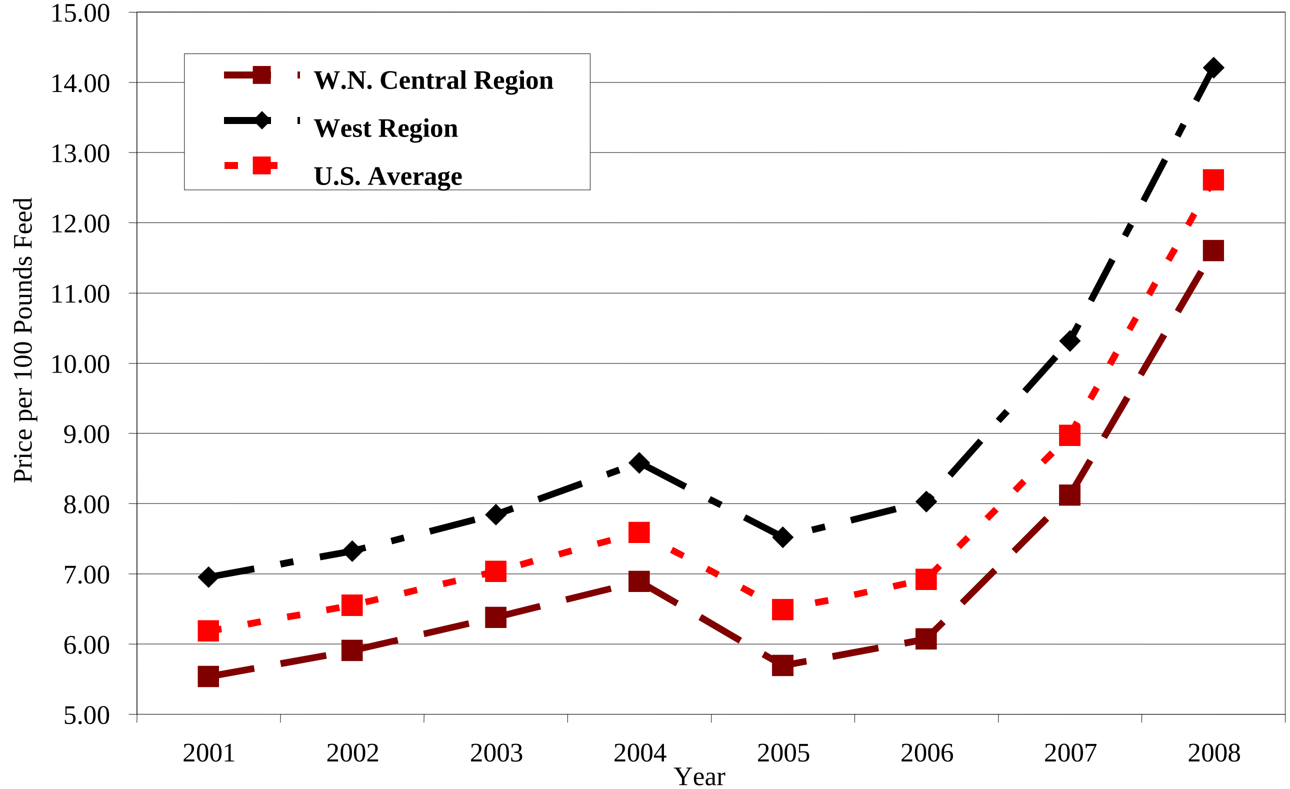
Source: CDFA data compiled by Don Bell in "Annual Egg Industry Statistics."
Note: Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs.

Figure IV.1. Ratio of table egg price to feed cost, 1997-2007



Source: USDA NASS, *Agricultural Prices*, 1997-2007.

Figure IV.2. Regional comparison of poultry feed prices, 2004-2008



Source: Bell (various years) based on feed price data published in *Feedstuffs*.

Figure V.1. Representing the market effects of restrictions on using cage housing for egg production in California in the national market for eggs

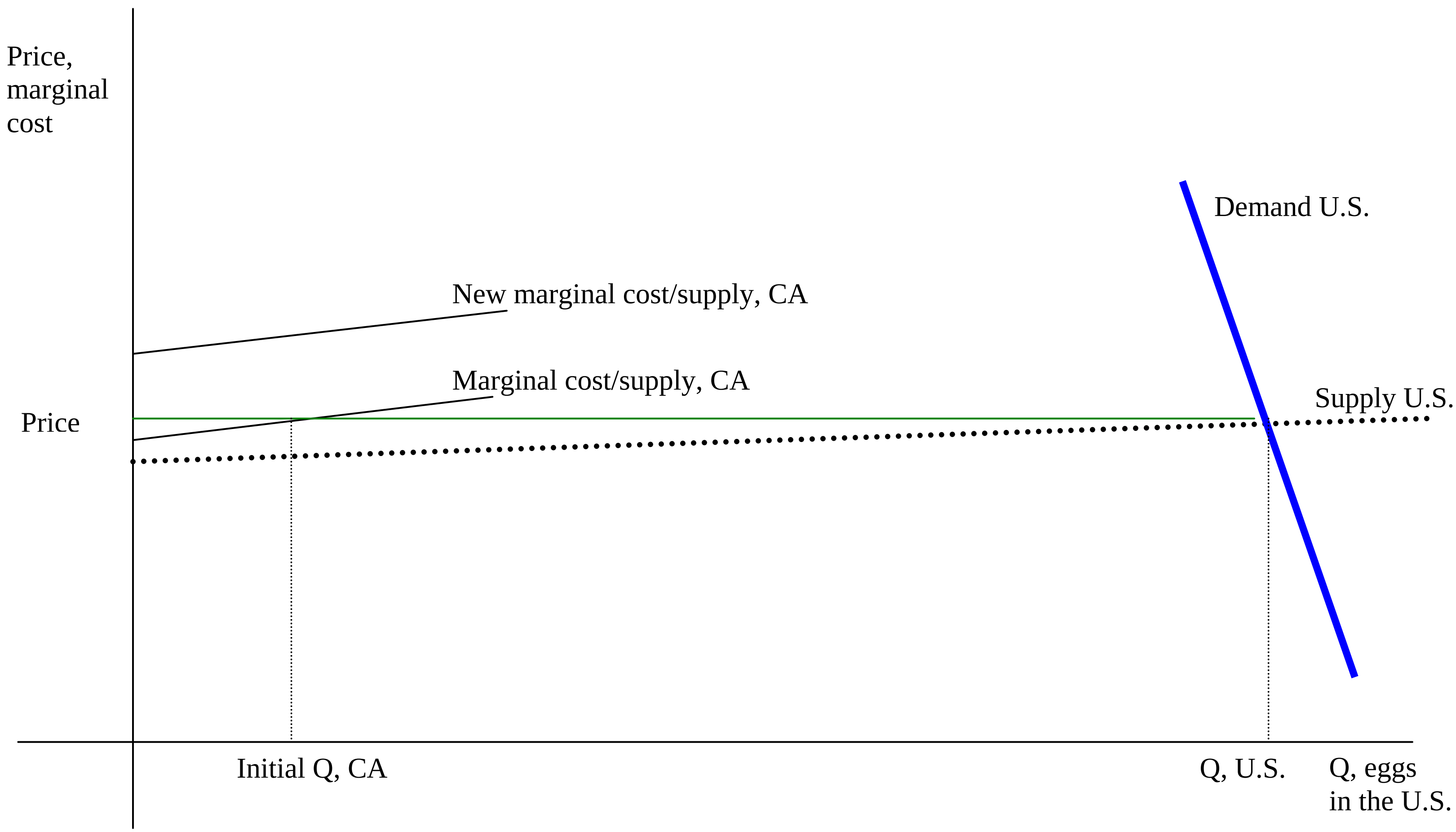


Figure V.2. Representing the market effects of restrictions on using cage housing for egg production in California in the market for shell eggs consumed in California

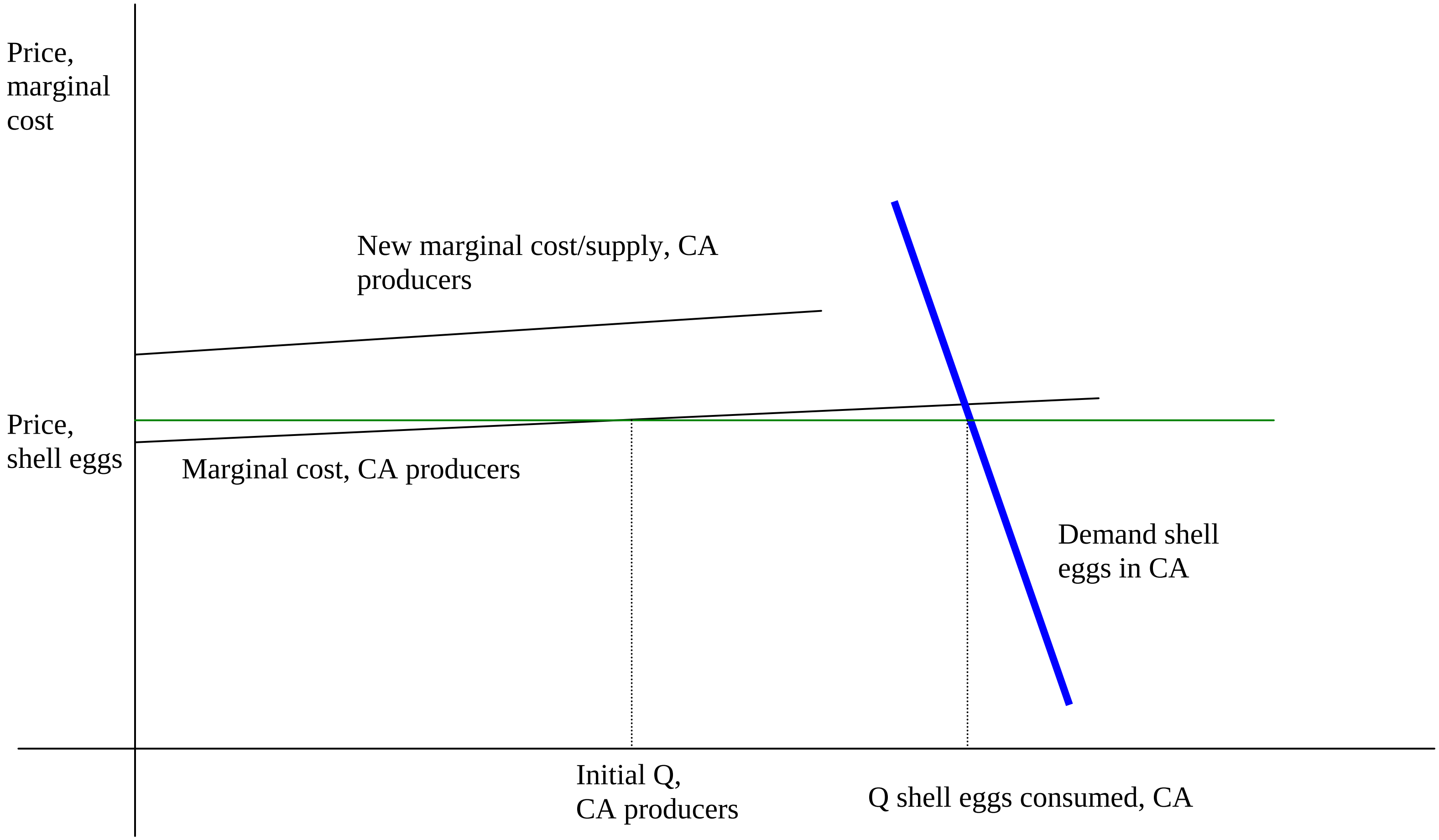
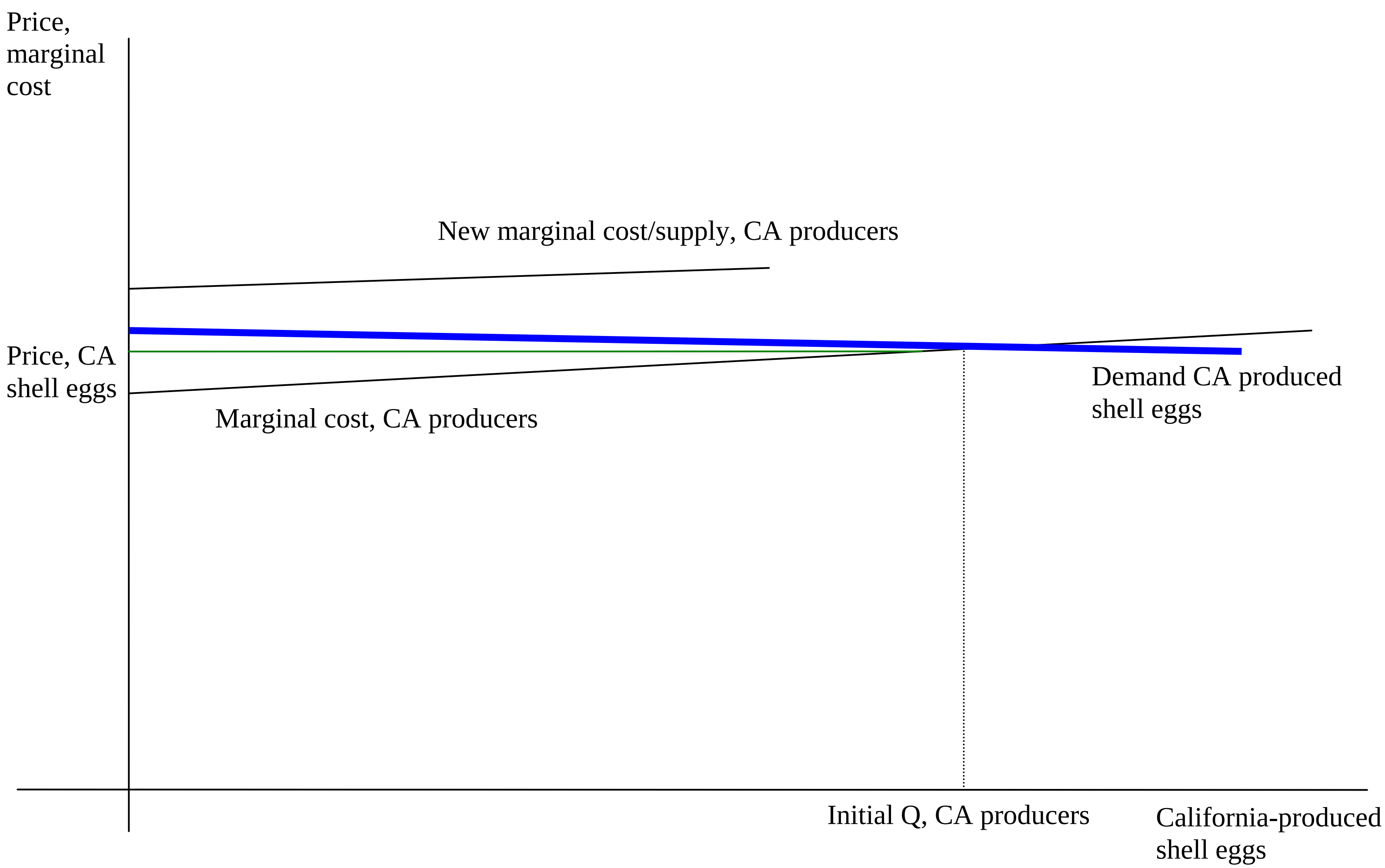


Figure V.3. Representing the market effects of restrictions on using cage housing systems for egg production in California in the market for California-produced shell eggs



Tables

Table III.1 Average annual number of laying hens and eggs produced in California and the United States, 1925-2007

	California		United States	
Year	Average number of laying hens on hand[1]	Eggs[2]	Average number of laying hens on hand[3]	Eggs[4]
	Thousands	Millions	Thousands	Millions
1925	10,517	1,452	311,340	34,969
1926	11,519	1,701	315,047	37,248
1927	13,415	1,791	329,576	38,627
1928	14,168	2,053	326,118	38,659
1929	14,825	2,038	317,642	37,921
1930	15,458	2,242	321,893	39,067
1931	13,792	2,187	303,013	38,532
1932	12,981	1,898	299,054	36,298
1933	12,221	1,736	299,713	35,514
1934	12,129	1,775	290,677	34,429
1935	11,902	1,759	276,403	33,609
1936	13,138	1,958	284,885	34,534
1937	13,447	2,096	288,003	37,564
1938	11,973	1,778	275,919	37,356
1939	10,881	1,661	289,554	38,843
1940	11,305	1,761	296,594	39,707
1941	11,282	1,743	300,864	41,894
1942	12,461	2,001	341,641	48,610
1943	14,569	2,225	382,987	54,547
1944	15,105	2,538	395,796	58,537
1945	14,380	2,337	369,430	56,221
1946	15,225	2,516	357,592	55,962
1947	14,131	2,481	345,117	55,384
1948	14,798	2,673	331,589	54,899
1949	17,292	3,117	330,699	56,154
1950	18,043	3,469	339,540	58,954
1951	18,112	3,485	327,831	58,063
1952	18,111	3,574	320,491	58,068
1953	20,639	4,183	312,086	57,891
1954	20,854	4,350	314,153	58,933
1955	20,847	4,404	309,297	59,526
1956	20,608	4,500	310,672	61,113
1957	20,761	4,603	306,676	61,026

Table III.1. (continued) Average annual number of laying hens and eggs produced in California and the United States, 1925-2007

California			United States	
Year	Average number of laying hens on hand[1]	Eggs[2]	Average number of laying hens on hand[3]	Eggs[4]
	Thousands	Millions	Thousands	Millions
1958	21,624	4,871	304,441	61,607
1959	22,884	5,236	305,720	63,335
1960	24,837	5,582	295,284	61,602
1961	27,270	6,105	296,648	62,423
1962	29,376	6,581	299,834	63,569
1963	30,198	6,788	298,476	63,500
1964	32,409	7,304	301,136	65,215
1965	32,599	7,406	301,053	65,560
1966	34,233	7,663	303,832	66,205
1967	36,667	8,081	313,717	69,327
1968	37,833	8,332	309,824	68,156
1969	37,740	8,557	306,886	67,546
1970	40,060	8,658	312,759	68,212
1971	41,553	9,012	312,886	69,649
1972	39,201	8,652	304,504	69,219
1973	35,147	7,680	290,588	66,039
1974	38,276	8,485	284,732	65,620
1975	37,940	8,467	278,101	64,626
1976	37,557	8,635	274,135	64,511
1977	36,469	8,345	274,875	64,602
1978	35,767	8,412	281,544	67,157
1979	37,005	8,713	288,623	69,209
1980	36,684	8,796	256,622	62,836
1981	35,054	8,400	255,276	N/A
1982	34,363	8,288	N/A	N/A
1983	33,396	8,173	244,549	61,039
1984	34,305	8,325	247,552	61,500
1985	32,960	8,052	244,391	61,187
1986	32,250	7,850	245,116	61,569
1987	33,376	8,023	247,795	62,362
1988	32,279	7,917	240,250	61,285
1989	31,145	7,579	231,426	58,801
1990	30,966	7,711	229,924	59,020

Table III.1. (continued) Average annual number of laying hens and eggs produced in California and the United States, 1925-2007

California			United States	
Year	Average number of laying hens on hand[1]	Eggs[2]	Average number of laying hens on hand[3]	Eggs[4]
	Thousands	Millions	Thousands	Millions
1991	30,134	7,721	232,658	59,955
1992	28,565	7,224	235,133	61,049
1993	27,960	7,029	239,062	61,896
1994	25,995	6,602	241,196	63,200
1995	25,312	6,444	242,200	63,407
1996	25,292	6,569	246,130	64,946
1997	25,632	6,663	249,130	65,584
1998	25,161	6,608	255,832	67,545
1999	25,526	6,606	264,790	70,240
2000	24,163	6,319	270,903	71,748
2001	23,757	6,082	277,964	73,299
2002	24,165	6,257	280,023	74,324
2003	20,831	5,439	279,174	74,683
2004	20,222	5,352	283,671	76,384
2005	19,336	5,082	284,888	76,859
2006	19,313	4,962	289,415	78,276
2007	19,234	4,938	284,871	77,266

Source: USDA, NASS California Field Office. "California Egg Production and Value 1924-2006." USDA, NASS *Chicken and Eggs Annual Summary*, various years

[1] Total laying hens, including those used for hatching purposes.

[2] Total eggs, including hatching eggs. Hatching eggs comprised a declining share of total output over this period and, based on industry sources and data in Table III.2, hatching eggs are estimated to be about two percent of California egg production currently (Bell 2008b).

[3] Figures prior to 1980 include total laying hens, including those used for hatching purposes; subsequent years include only laying hens used for table egg production. Data were not available for 1982.

[4] Figures prior to 1980 include total eggs, including hatching eggs; subsequent years are only table eggs. Data were not available for 1981 and 1982.

Note: USDA definitions and methodology changed periodically between 1925 and 2007, so figures for different years may not be directly comparable.

Table III.2. Annual average number of laying hens and table egg production, by state[1, 2]

State	Average number of table-egg laying hens		Table-egg production		2007 Share of U.S. table-egg production (percent)
	Thousands		Millions		
	2006	2007	2006	2007	
Alabama	1,634	1,245	449	341	0.4
Arkansas	4,294	4,292	1,170	1,181	1.5
California	18,827	18,879			
Colorado	3,267	3,237			
Connecticut	2,763	2,830			
Florida	10,569	10,270	2,848	2,773	3.6
Georgia	9,734	9,671	2,614	2,576	3.3
Hawaii	433	365	98.3	81.8	0.1
Illinois	4,583	4,768	1,261	1,314	1.7
Indiana	24,417	24,195	6,596	6,526	8.4
Iowa	50,788	51,487	13,655	13,690	17.7
Maine	3,956	3,837			
Maryland	2,565	2,501	712	680	0.9
Michigan	8,321	8,695			
Minnesota	10,605	10,176	2,843	2,781	3.6
Mississippi	1,637	1,583	461	452	0.6
Missouri	6,082	5,819			
Nebraska	11,643	10,870	3,129	2,984	3.9
New York	3,683	3,687			
North Carolina	3,390	4,343	993	1,269	1.6
Ohio	27,853	26,032			
Oregon	2,532	2,334	748	702	0.9
Pennsylvania	21,856	20,850	6,444	6,161	8.0
South Carolina	3,819	3,495	1,042	929	1.2
South Dakota	3,147	3,068	865	843	1.1
Texas	14,397	14,319			
Virginia	1,415	1,365	402	382	0.5
Washington	5,370	5,550			
Wisconsin	4,180	4,370			
Other States[3]	15,803	15,514	1,459	1,423	1.8
U.S. Total	283,563	279,645	78,276	77,266	100.0

Source: NASS, Agricultural Statistics Board, *Chicken and Eggs 2007 Summary*, February 2008 p.3, 10-13

[1] Annual estimates based on monthly averages covering the period December 1 previous year through November 30

[2] Totals may not add due to rounding

[3] Data not available from some States to avoid disclosing individual operations, data included in US totals.

Note: Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries.

Table III.3. World production of eggs

Country	Egg production (metric tons)	Approximate share of world production (percent)
China	24,348,250	50.45
United States	4,403,475	9.12
India	2,492,000	5.16
Japan	2,465,000	5.11
Russian Federation	2,054,000	4.26
Mexico	1,906,476	3.95
Brazil	1,560,000	3.23
France	1,045,000	2.17
Indonesia	876,000	1.82
Turkey	830,000	1.72
Germany	798,000	1.65
Ukraine	735,000	1.52
Spain	725,000	1.50
Italy	700,000	1.45
Iran	610,000	1.26
Netherlands	595,000	1.23
Korea	570,000	1.18
United Kingdom	551,900	1.14
Poland	520,000	1.08
Nigeria	476,000	0.99
Total	48,261,101	100

Source: FAOSTAT.

Table III.4. California laying hen productivity and total egg value, 1925-2006[1]

Year	Average eggs per layer per year	Received farm price	Value of eggs per layer	Total farm value
		Cents per dozen	Dollars per hen	$1,000
1925	138	36.0	4.1	43,560
1926	148	31.1	3.8	44,084
1927	134	27.2	3.0	40,596
1928	145	28.4	3.4	48,588
1929	137	32.0	3.7	54,347
1930	145	26.6	3.2	49,698
1931	159	19.9	2.6	36,268
1932	146	17.2	2.1	27,205
1933	142	17.2	2.0	24,883
1934	146	19.0	2.3	28,104
1935	148	25.2	3.1	36,939
1936	149	23.2	2.9	37,855
1937	156	23.9	3.1	41,745
1938	149	23.9	3.0	35,412
1939	153	21.6	2.8	29,898
1940	156	20.3	2.6	29,790
1941	154	27.8	3.6	40,380
1942	161	34.0	4.6	56,695
1943	153	42.2	5.4	78,246
1944	168	37.6	5.3	79,524
1945	163	43.4	5.9	77,252
1946	165	44.8	6.2	87,024
1947	176	53.5	7.8	102,497
1948	181	54.8	8.3	114,304
1949	180	51.4	7.7	126,358
1950	192	41.5	6.6	114,298
1951	192	54.2	8.7	151,083
1952	197	47.0	7.7	134,655
1953	203	53.2	9.0	180,126
1954	209	38.5	6.7	136,097
1955	211	41.7	7.3	149,425
1956	218	39.6	7.2	145,002
1957	222	36.9	6.8	138,283
1958	225	38.9	7.3	154,628
1959	229	31.5	6.0	135,450

Table III.4. (continued) California layer productivity and total egg value, 1925-2006[1]

Year	Average eggs per layer per year	Received farm price	Value of eggs per layer	Total farm value
		Cents per dozen	Dollars per hen	$1,000
1960	225	35.6	6.7	166,875
1961	224	33.7	6.3	173,751
1962	224	30.4	5.7	174,040
1963	225	31.4	5.9	193,006
1964	225	31.5	5.9	203,989
1965	227	30.2	5.7	186,385
1966	224	36.0	6.7	229,890
1967	220	28.3	5.2	190,576
1968	220	28.4	5.2	197,191
1969	227	34.1	6.4	243,161
1970	216	33.8	6.1	243,867
1971	217	25.5	4.6	191,505
1972	221	28.1	5.2	202,601
1973	219	50.6	9.2	323,840
1974	222	47.9	8.8	338,693
1975	223	49.8	9.3	351,381
1976	230	53.5	10.3	384,977
1977	229	50.8	9.7	353,271
1978	235	46.0	9.0	322,460
1979	235	50.8	10.0	368,850
1980	240	50.5	10.1	370,165
1981	240	56.9	11.4	398,300
1982	241	52.6	10.6	363,290
1983	245	54.6	11.1	371,872
1984	243	59.0	11.9	409,313
1985	244	50.0	10.2	335,500
1986	243	53.1	10.8	347,362
1987	240	46.0	9.2	307,548
1988	245	46.2	9.4	304,805
1989	243	65.9	13.4	416,213
1990	249	63.3	13.1	406,755
1991	256	58.4	12.5	375,755
1992	253	47.6	10.0	286,552
1993	251	49.1	10.3	287,603
1994	254	46.4	9.8	255,277

Table III.4. (continued) California layer productivity and total egg value, 1925-2006[1]

Year	Average eggs per layer per year	Received farm price	Value of eggs per layer	Total farm value
		Cents per dozen	Dollars per Hen	$1,000
1995	255	53.7	11.4	288,869
1996	260	67.1	14.5	367,317
1997	260	62.1	13.5	344,810
1998	263	56.1	12.3	309,019
1999	259	47.9	10.3	263,663
2000	262	45.3	9.9	238,796
2001	256	47.1	10.0	238,951
2002	259	39.2	8.5	204,232
2003	261	62.3	13.6	282,458
2004	265	64.4	14.2	287,392
2005	263	42.9	9.4	181,655
2006	257	51.5	11.0	212,889
2007	257	82.0	17.6	337,430

Source: USDA NASS CA Field Office. "California Egg Production and Value 1924-2006."
2007 total value calculated using USDA NASS *California Poultry Reports*, USDA NASS *Agricultural Prices.*

[1] includes hatching eggs; it is estimated that hatching eggs currently represent no more than two percent of California egg production; Note that higher average prices received for hatching eggs means that total farm value of California egg production may be more than two percent higher than the corresponding table egg output would suggest.

Table III.5 California laying hen population by county

County	1987		1992		1997		2002	
	Number of Hens (millions)	Percentage of California Hens	Number of Hens (millions)	Percentage of California Hens	Number of Hens (millions)	Percentage of California Hens	Number of Hens (millions)	Percentage of California Hens
Riverside	11.8	29.1	9.3	29.7	8.4	27.8	5.4	23.9
Merced	1.8	4.4	2.4	7.6	2.9	9.7	4.5	19.6
San Diego	4.9	12.0	3.9	12.6	3.7	12.0	2.7	12.0
Stanislaus	4.6	11.2	3.9	12.5	3.9	12.9	2.4	10.4
San Bernardino	3.8	9.4	2.8	9.1	3.9	12.7	2.2	9.4
San Joaquin	5.2	12.8	3.6	11.4	3.8	12.7	1.8	7.8
Rest of California	8.6	21.1	5.4	17.2	3.7	12.3	3.8	16.8
California Total	40.7	100	31.2	100	30.4	100	22.8	100

Source: USDA *Census of Agriculture*.
Note: Number of hens represents a count of layers 20 weeks old and older on hand at the time of the census. These numbers differ from those reported in Table III.1.

Table III.6. Annual U.S. per capita consumption of shell eggs and egg products, 1960-2008

United States annual per capita consumption of eggs			
Year	Total	Shell eggs	Egg products (shell egg equivalent)
1960	320.7	291.6	29.1
1961	318.3	287.9	30.4
1962	319.6	289.5	30.1
1963	314.1	286.4	27.7
1964	318.7	288.0	30.7
1965	315.3	286.2	29.1
1966	314.7	284.7	30.0
1967	323.6	289.2	34.4
1968	317.8	286.3	31.5
1969	311.0	280.5	30.5
1970	310.7	277.2	33.5
1971	311.6	275.5	36.1
1972	304.9	269.1	35.8
1973	290.1	258.3	31.8
1974	284.1	250.5	33.6
1975	277.4	246.7	30.7
1976	271.4	238.7	32.7
1977	268.3	232.1	36.2
1978	272.6	238.4	34.2
1979	277.9	242.4	35.5
1980	272.5	237.4	35.1
1981	265.4	233.3	32.1
1982	265.1	231.5	33.6
1983	261.1	226.4	34.7
1984	260.8	224.0	36.8
1985	256.0	217.9	38.1
1986	254.9	215.8	39.1
1987	255.0	211.6	43.3
1988	247.8	203.6	44.2
1989	238.6	194.0	44.5
1990	236.0	187.8	48.2
1991	234.6	183.2	50.8
1992	235.1	180.5	54.4
1993	234.5	178.6	56.0

Table III.6 (continued). Annual U.S. per capita consumption of shell eggs and egg products, 1960-2008

United States annual per capita consumption of eggs			
Year	Total	Shell eggs	Egg products (shell egg equivalent)
1994	236.4	176.2	60.4
1995	233.6	172.1	61.7
1996	234.4	173.4	61.2
1997	235.4	171.0	64.5
1998	240.3	173.9	66.5
1999	250.7	178.5	72.2
2000	253.0	179.1	73.8
2001	254.2	181.0	73.2
2002	256.0	180.7	75.3
2003	255.6	182.5	73.0
2004	257.3	180.8	76.5
2005	255.8		
2006	257.8		
2007	250.1		
2008*	247.0		

Source: ERS USDA, *Poultry Yearbook* 2006, Tables 29 and 43, series discontinued in 2004
2005-2008 data from ERS USDA, *Livestock, Dairy, and Poultry Outlook*
* average for Jan-June 2008
Note: Shell eggs are those table eggs marketed in the shell. Egg products are those table eggs marketed in liquid form most often to the food processing or food service industries.

Table III.7. Total California consumption and consumption per capita for shell eggs, 2000-2007

Year	Shell Eggs Produced in California	Shell Eggs Shipped to California	Total California Shell Egg Consumption[1]	California Population	California Per Capita Consumption of Shell Eggs[2]
	million eggs				
2000	5877	877	6754	33.87	199.4
2001	5656	1249	6905	34.43	200.6
2002	5819	1646	7465	35.06	212.9
2003	5058	2243	7302	35.65	204.8
2004	4977	2087	7065	36.20	195.2
2005	4726	2191	6918	36.68	188.6
2006	4615	2537	7151	37.11	192.7
2007	4592	2442	7035	37.56	187.3

Sources: Shell egg consumption comes from USDA NASS data and CDFA data compiled by Don Bell in "Annual Egg Industry Statistics." Population data comes from California Department of Finance, Economic Research Unit

[1] Total California consumption estimated by summing California production of shell eggs plus total shipments of shell eggs into California.

[2] Per capita shell egg consumption estimated by dividing total annual California shell egg consumption by annual population.

Note: Shell eggs are those table eggs marketed in the shell. Breakers are those table eggs marketed in liquid form most often to the food processing or food service industries. There are no separate data on shell eggs in California, but based on industry sources and Table III.2 we estimate that, currently, about 95 percent of California table eggs and about 93 percent of all California eggs are marketed as shell eggs. The data in this figure have been adjusted accordingly.

Table III.8. U.S. average farm prices and retail prices, 1983-2007

Year	U.S. farm price received for table eggs	US retail price for grade A large	Spread between price received and retail price	Price received as a share of retail price (percent)
	(cents per dozen)			
1983	57.8	89.4	31.6	64.7
1984	64.0	100.5	36.5	63.7
1985	49.9	80.4	30.5	62.1
1986	53.7	87.0	33.3	61.8
1987	44.1	78.3	34.2	56.4
1988	44.4	79.0	34.6	56.2
1989	62.5	99.8	37.3	62.6
1990	62.0	101.4	39.4	61.1
1991	56.7	98.9	42.2	57.3
1992	45.1	86.0	40.9	52.4
1993	51.7	91.1	39.4	56.7
1994	48.5	86.3	37.8	56.2
1995	53.0	92.5	39.5	57.3
1996	66.5	110.6	44.1	60.1
1997	57.8	105.8	48.0	54.6
1998	52.1	103.7	51.6	50.2
1999	43.6	95.9	52.3	45.5
2000	46.9	91.4	44.5	51.3
2001	42.9	92.9	50.0	46.2
2002	42.0	103.2	61.2	40.7
2003	59.4	124.4	65.0	47.7
2004	53.4	134.0	80.6	39.9
2005	35.0	121.8	86.8	28.7
2006	40.7	130.6	89.9	31.2
2007	79.3	167.6	88.3	47.3

Source: USDA NASS *Agricultural Prices* and Department of Labor, Bureau of Labor Statistics, "Consumer Price Index - Average Price Data."
Note: Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries.

Table III.9. Mid-month farm table egg price in selected states, January 2008 to June 2008

State	January	February	March	April	May	June	Average Jan to June
Alabama	1.32	1.32	1.37	1.01	0.78	0.94	1.12
Arkansas	1.24	1.24	1.3	0.90	0.69	0.90	1.05
California	1.20	1.25	1.33	0.93	0.73	0.96	1.07
Connecticut	1.15	1.15	1.20	0.80	0.66	0.88	0.97
Florida	1.34	1.30	1.35	0.97	0.68	0.88	1.09
Georgia	1.35	1.30	1.36	0.96	0.76	0.95	1.11
Indiana	1.21	1.24	1.34	0.85	0.70	0.97	1.05
Iowa	1.17	1.18	1.25	0.82	0.63	0.88	0.99
Maine	1.51	1.52	1.49	1.13	0.95	1.14	1.29
Michigan	1.17	1.20	1.29	0.80	0.66	0.96	1.01
Minnesota	1.27	1.27	1.33	0.94	0.74	0.98	1.09
Mississippi	1.25	1.25	1.31	0.89	0.70	0.93	1.06
Missouri	1.17	1.18	1.25	0.81	0.66	0.88	0.99
New York	1.28	1.25	1.31	0.86	0.70	0.95	1.06
North Carolina	1.19	1.21	1.29	0.87	0.70	0.89	1.03
Ohio	1.22	1.22	1.31	0.96	0.76	0.95	1.07
Pennsylvania	1.06	1.12	1.22	0.83	0.67	0.89	0.97
South Carolina	1.08	1.08	1.13	0.85	0.67	0.82	0.94
Texas	1.20	1.23	1.29	0.90	0.69	0.92	1.04
Washington	1.26	1.35	1.43	1.01	0.82	1.02	1.15
U.S.	1.20	1.22	1.30	0.88	0.70	0.93	1.04

Source: USDA NASS, *Agricultural Prices.*
Note: Table eggs include all eggs produced for human consumption, excluding hatching eggs used to produce replacement chickens for the egg and broiler industries.

Table IV.1. U.S. feed costs, farm production costs and wholesale costs for eggs, 1972-2003

Year	Feed costs (cents per dozen)	Total farm costs minus feed cost[1] (cents per dozen)	Total farm production costs (cents per dozen)	Wholesale minus farm cost[2] (cents per dozen)	Wholesale costs (cents per dozen)	Feed costs/ farm costs (percent)	Farm costs/ wholesale costs (percent)
1972	17.30	11.60	28.90	14.40	43.30	59.9	66.7
1973	29.20	12.50	41.70	16.40	58.10	70.0	71.8
1974	31.00	14.40	45.40	18.10	63.50	68.3	71.5
1975	29.00	14.50	43.50	18.30	61.80	66.7	70.4
1976	28.50	13.00	41.50	18.40	59.90	68.7	69.3
1977	27.40	13.50	40.90	19.00	59.90	67.0	68.3
1978	27.20	14.10	41.30	19.20	60.50	65.9	68.3
1979	30.00	15.10	45.10	20.50	65.60	66.5	68.8
1980	32.79	16.30	49.09	21.31	70.40	66.8	69.7
1981	35.47	16.30	51.77	21.03	72.80	68.5	71.1
1982	29.79	15.50	45.29	21.01	66.30	65.8	68.3
1983	34.14	17.50	51.64	20.46	72.10	66.1	71.6
1984	33.80	18.20	52.00	20.30	72.30	65.0	71.9
1985	27.40	18.20	45.60	20.40	66.00	60.1	69.1
1986	25.55	18.20	43.75	20.35	64.10	58.4	68.3
1987	23.36	18.20	41.56	20.44	62.00	56.2	67.0
1988	30.27	18.20	48.47	20.43	68.90	62.5	70.3
1989	31.06	18.20	49.26	20.64	69.90	63.1	70.5

Table IV.1. (continued) U.S. feed costs, farm production costs and wholesale costs for eggs, 1972-2003

Year	Feed costs (cents per dozen)	Total farm costs minus feed cost[1] (cents per dozen)	Total farm production costs (cents per dozen)	Wholesale minus farm cost[2] (cents per dozen)	Wholesale costs (cents per dozen)	Feed costs/ farm costs (percent)	Farm costs/ wholesale costs (percent)
1990	28.42	18.20	46.62	20.50	67.12	61.0	69.5
1991	28.04	18.20	46.24	20.50	66.74	60.6	69.3
1992	28.05	18.20	46.25	20.50	66.75	60.6	69.3
1993	27.73	18.20	45.93	20.50	66.43	60.4	69.1
1994	28.94	18.20	47.14	20.50	67.64	61.4	69.7
1995	28.82	18.20	47.02	20.50	67.52	61.3	69.6
1996	39.57	18.20	57.77	20.50	78.27	68.5	73.8
1997	33.45	18.20	51.65	20.50	72.15	64.8	71.6
1998	26.99	18.20	45.19	20.50	65.69	59.7	68.8
1999	23.69	18.20	41.89	20.50	62.39	56.6	67.1
2000	24.58	18.20	42.78	20.50	63.28	57.5	67.6
2001	25.00	18.20	43.20	20.50	63.70	57.9	67.8
2002	26.18	18.20	44.38	20.50	64.88	59.0	68.4
2003	28.08	18.20	46.28	20.50	66.78	60.7	69.3

Source: USDA ERS *Poultry Yearbook* 2006, Tables 47, 48 and 49.
[1] Represents housing costs, pullet costs, labor costs and other costs.
[2] Includes costs such as packaging and shipping costs.
Note: averages weighted by monthly production; series discontinued in 2004.

Table IV.2. U.S. prices paid by farmers for table egg type chicks and poultry laying feed, 1987-2007

Year	Prices paid by farmers for table egg type chicks	Prices paid by farmers for poultry laying feed
	(dollars per 100)	(dollars per ton)
1987	51.13	101.4
1988	50.73	145.8
1989	50.35	135.7
1990	50.80	128.8
1991	51.20	126.9
1992	54.60	135.5
1993	53.80	134.6
1994	49.70	145.7
1995	49.80	149.9
1996	53.80	182.5
1997	53.10	160.0
1998	53.70	139.6
1999	52.60	124.3
2000	48.00	123.8
2001	53.90	124.9
2002	52.00	143.1
2003	50.50	142.8
2004	53.60	173.2
2005	53.50	163.5
2006	66.50	163.7
2007	69.40	185.5

Source: USDA ERS *Poultry Yearbook* 2006, Tables 45 and 46. 2005-2007 data from ERS, *Agricultural Outlook*, Table 13 and NASS, *Agricultural Prices*.
Note: Laying feed prices calculated from price ratios that were revised February 1995.
These data are different from those used by Bell in his calculations of egg costs per dozen (Bell 2008b)

Table IV.3. Summary of *Feedstuffs* West Regional Feed Price 2001-2007

Year	Average Annual Cost of 100 lbs of Pullet Feed
2001	$6.96
2002	$7.32
2003	$7.85
2004	$8.58
2005	$7.72
2006	$8.03
2007	$10.32

Source: Bell (various years) based on feed price data published in *Feedstuffs*.

Table IV.4. Comparison of production costs between cage production system and non-cage production system in cost per dozen

Production factor	Cage production system range and median (dollars per dozen)	Non-Cage production system range and median (dollars per dozen)	Cost Differential Non-Cage minus Cage System using mid-points	Cost differential Non-Cage minus Cage System using low costs
Pullets	0.09 - 0.11 0.10	0.14 - 0.17 0.155	0.55	0.05
Feed	0.28 - 0.45 0.365	0.35 - 0.50 0.425	0.06	0.07
Housing	0.05 - 0.14 0.095	0.09 - 0.37 0.23	0.135	0.04
Labor	0.03 – 0.04 0.035	0.07 – 0.19 0.13	0.095	0.04
Sum of the itemized costs and difference at the mid-points	0.595	0.94	0.345	
Sum of the itemized costs and differences at the low costs	0.45	0.65		0.20
Percentage cost difference based on the sum of items			0.345/0.595= 58%	0.20/0.45= 44%
Total Cost	0.57 - 0.92 0.745	0.97 – 1.13 1.05	0.305	0.40
Percentage cost difference			0.305/0.745 = 41%	0.40/0.57 = 70%

Source: Authors' calculations based on data from California egg producers.
Note: Pullet cost is the original cost of the hen averaged over the hen's lifetime egg production.
Housing cost aggregates the cost of the housing structure, housing equipment, maintenance, service, supplies and utilities. Labor cost represents only labor allocated to the layer house.
Total Cost constitutes a sum of the four cost categories plus additional costs such as overhead, taxes and miscellaneous costs, which are not listed separately.

Table IV.5. Formulated feed prices by region - May 2008 (3 weeks)

Region	Corn $/ton	Soybean meal $/ton	Corn (67%)	Soybean meal (22%)	Calcium and Other (11%)	Transport and Milling ($/ton)	Total ($/ton)	$/100lbs
W.N. Central average	193.61	333.58	129.72	73.39	15.80	13.00	231.91	11.60
West average	260.67	366.67	174.65	80.67	15.80	13.00	284.11	14.21
U.S. average of all regions	219.47	347.45	147.04	76.44	15.80	13.00	252.28	12.61

Source: Bell (2008a) based on feed price data published in *Feedstuffs*.

Table IV.6. Table egg production costs by region, January to June 2007

Region	Feed (dollars per 100 lbs) [1]	Pullets (dollars per bird) [2]	Feed cost (cents per dozen)	Pullets (cents per dozen) [3]	Total (cents per dozen)
W.N. Central					
January	5.72	2.16	20.3	6.4	39.4
February	5.66	2.15	20.5	6.3	39.5
March	5.62	2.15	20.0	6.3	39.0
April	5.84	2.18	20.3	6.4	39.4
May	5.88	2.19	20.3	6.4	39.4
June	5.84	2.18	20.0	6.4	39.1
Average Jan-June	5.76	2.17	20.2	6.4	39.3
West					
January	7.75	2.57	27.5	7.6	47.8
February	7.57	2.54	27.4	7.5	47.6
March	7.58	2.54	26.9	7.5	47.1
April	7.61	2.54	26.5	7.5	46.7
May	7.69	2.56	26.5	7.5	46.8
June	7.74	2.56	26.5	7.5	46.7
Average Jan-June	7.66	2.55	26.9	7.5	47.1

Source: Bell (2007a) based on feed price data published in *Feedstuffs*.
[1]Based on corn and soybean meal prices as published in *Feedstuffs* for each month.
[2] Pullet cost differences are based upon differences in feed and chick costs.
[3]Based on 34 dozen eggs per hen over hen's life.

Table IV.7. Comparison of transportation costs between shell eggs and feed equivalent from midwest markets to California during May 2008

Cost per Dozen Eggs to Transport 1 Truck of Shell Eggs from the Midwest (May 2008)	
Number of eggs per truck May 2008 Shipping Cost of 1 Truck Cost per Dozen Shipping 1 Truck	23,400 Dozen $3100.00 - $4300.00 $3100.00 / 23,400 = $0.13 To $4300.00 / 23,400 = $0.18
Cost per Dozen Eggs to Transport Feed Equivalent of 1 Truck of Shell Eggs from the Midwest (May 2008)	
Number of eggs per truck	23,400 Dozen
Amount of Feed per 1 Dozen Eggs	3.45 Pounds
Amount of Feed per 1 truck equivalent of fresh shell eggs	80,730 Pounds
May 2008 Delivered Price of Feed in California.	$14.21 per 100 Pounds
Transportation Cost of Feed from Midwest to California Minneapolis / Kansas City	$2.61 per 100 pounds
Total Transportation Cost of Feed Equivalent to 1 truckload of fresh shell eggs Minneapolis / Kansas City	$2.61 X 807.30 = $2107.05
Transportation Cost per Dozen Eggs of Feed Equivalent. Minneapolis / Kansas City	$2107.05 / 23,400 = $.09

Source: Cost of feed shipment data from Bell (2008a) based on feed price data published in *Feedstuffs*, Egg transportation data comes from industry sources and represents a range of transportation prices.

Table V.1. Direct and total effects of the "Poultry and Egg Production" industry in 2002 for California and in selected regions

	Direct effects				*Total effects*[1],[2]		
	Industry output (sales) [3]	Employment [4]	Labor income [5]	Value added [6]	Employment	Labor income	Value added
Stanislaus	89	188	11	31	357	17	41
Merced	99	178	13	35	306	17	43
Riverside	52	181	9	18	279	13	24
San Bernardino	25	59	5	9	99	6	11
Sonoma	41	232	10	14	302	13	19
San Joaquin	34	80	4	12	142	7	15
San Diego	27	97	4	10	141	5	13
California	861	2,341	120	300	4,261	205	444
San Bernardino and Riverside	77	239	14	27	382	19	36
Stanislaus and Merced	189	365	24	66	708	36	85

Source: UC Agricultural Issues Center, using the IMPLAN Pro V.2.0 software package and the 2002 dataset.
[1] Total effects include direct, indirect and induced effects of the industry.
[2] Values that utilize multiplier effects cannot be aggregated to get totals.
[3] Industry output: value of production in millions of dollars (i.e. total sales).
[4] Employment: number of jobs directly employed by the industry.
[5] Labor income: value of employee compensation and proprietor income in millions of dollars.
[6] Value added equals sum of labor income, property income and indirect business taxes in millions of dollars. This is the same as total sales (industry output) less purchased inputs and services.

Table V.2. "Poultry and egg production" multipliers by egg production areas in California

	Employment Multipliers	Labor Income Multipliers	Total Value Added Multipliers
Stanislaus	1.90	1.53	1.32
Merced	1.72	1.38	1.23
Riverside	1.54	1.40	1.34
San Bernardino	1.68	1.36	1.34
Sonoma	1.30	1.29	1.31
San Joaquin	1.78	1.50	1.31
San Diego	1.45	1.51	1.33
CA all	1.82	1.71	1.48
San Bernardino and Riverside	1.60	1.41	1.36
Stanislaus and Merced	1.94	1.51	1.30

Source: UC Agricultural Issues Center, using the IMPLAN Pro V.2.0 software package and the 2002 dataset.

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