Case Study

Capital Budgeting Analysis of a Vertically Integrated Egg Firm: Conventional and Cage-Free Egg Production

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Abstract
This case features a financial analyst building a capital budgeting model of a stylized vertically integrated egg firm. The case describes the egg industry and the role played by large firms, and highlights the potential for continuing fast growth of cage-free eggs in the near future. Cage-free eggs may grow rapidly at the expense of conventional eggs because of (1) recent regulation requiring producers to switch from conventional to cage-free production, and (2) pledges by large egg buyers such as McDonalds, Starbucks, Walmart, and more than 200 restaurants and supermarkets, to buy cage-free only products by 2025. The case discusses how investment, production, and financial statement parameters are collected and assembled by the analyst to prepare a capital budgeting model, which might be used to evaluate the financial performance of an egg firm managing a portfolio of conventional and cage-free eggs. The reader is challenged to analyze how investment, leverage, and profitability may change under two hypothetical investment policies. A quick-investment policy would capture a scenario on which the cage-free market grows quickly in the following years and therefore the egg firm would invest aggressively in cage-free facilities, in sync with the market. A second investment policy captures a slower cage-free growth scenario.

1 Introduction

In the spring of 2020, Stephanie Adler, a financial analyst working for a bank serving the agribusiness sector was analyzing the U.S. egg industry. The bank anticipated increasing loan requests from this industry because recent changes in regulation might accelerate investment in egg production facilities. Stephanie had recently examined the financials of an egg producer—at the farm level—and realized that additional analysis was needed from the perspective of a vertically integrated egg firm. A vertically integrated firm owned flocks of laying hens; raised replacement hens; collected, packaged, and marketed shell eggs and egg products; and finally sold the hens that were no longer efficient layers. First, she needed to take a closer look at the shell egg industry, perhaps looking at a Porter's Five Forces analysis of the characteristics of this industry. She also had two quantitative tasks: (1) to analyze a capital budgeting model (spreadsheet) she had already prepared, and (2) to evaluate whether the vertically integrated egg firm should change its portfolio of products (e.g., the mix of conventional and cage-free volume), and if so, how quickly investments should be made. Such an analysis was needed given that the U.S. egg industry was likely to transition from conventional to cage-free production because of both consumer demand and recent changes in regulation. In November 2018, the Prevention of Cruelty to Farm Animals Act was approved, requiring all eggs sold in California to come from cage-free production by 2022. Other states had also passed cage-free laws.

To accomplish her goal, the financial analyst needed to look closely at the assumptions of her capital budgeting model. She knew that the model was built with assumptions that might not be realistic.

She wanted to identify and critique those assumptions in an articulated manner so that she would be well prepared to explain the model to potential users. She also needed to explain to her boss how two cage-free investment policies would impact both firm profitability and leverage.[1]

2 Background

2.1 Production and Consumption Statistics on Egg Production

In 2019, 9.438 billion dozen eggs were produced in the United States, compared with 9.173 billion in 2018 and 8.887 billion in 2017 (U.S. Department of Agriculture, National Agricultural Statistics Service 2020).[2] Almost all eggs produced were consumed domestically, with only 3 percent being exported in 2019 (American Egg Board 2020). Americans consumed annually, on average, 292.9 eggs per capita in 2019, with consumption recently growing between 1 and 2 percent. As of 2019, consumption was projected to reach 294.7 eggs in 2020 and 297.4 in 2021 (U.S. Department of Agriculture, Agricultural Marketing Service Farm Service Agency 2020).

Seven large companies including Cal-Maine Foods Inc., Rose Acre Farms Inc., Rembrandt Enterprises, Michael Foods Inc., Hillandale Farms Inc., Sparboe Companies, and Opal Foods LLC captured roughly one third of the chicken table egg industry in terms of total production volume and revenues in 2019 (Table 1). It was estimated that 63 firms with at least 1 million hens each produced 86 percent of total eggs in the United States (Wong 2017). Most large egg firms were highly mechanized, vertically integrated, and highly cost effective. To illustrate how cost effective the overall egg industry was, one dozen eggs equivalent was sold slightly above $1.00 to retail stores, "egg breakers," and food service companies in 2019.[3] While small farmers have historically made up the egg industry, integration of large companies has increased concentration over the last 5 years, leaving small producers as contract growers for large companies (IBISWorld 2019). As of 2019, Cal-Maine Foods Inc. was the only publicly traded firm in the United States focused exclusively on eggs production and commercialization.

Table 1. Large Egg Producers in the United States as of 2019

Firm	Hens (Million)	Share (%)	Revenues ($ Million)	Market Share (%)
Cal-Maine Foods Inc.	42.5	12.5%	1,460.0	15.5%
Rose Acre Farms Inc.	24.8	7.3%	578.8	6.1%
Rembrandt Enterprises	14.5	4.3%	338.4	3.6%
Michael Foods Inc.	11.3	3.3%	264.4	2.8%
Hillandale Farms Inc.	9.0	2.6%	210.0	2.2%
Sparboe Companies	7.2	2.1%	209.6	2.2%
Opal Foods LLC	5.4	1.6%	126.0	1.3%
Others	225.3	66.3%	6,241.3	66.2%
Total	340.0	100.0%	9,428.5	100.0%

Sources: Assembled by authors with information in IBISWorld (2019). Total hens population is from United Egg Producers (2020).

[1] After completing this case, students should be able to: (1) analyze the egg industry, using a systematic analysis framework, (2) critique the assumptions of a stylized capital budgeting model of a vertically integrated egg firm, (3) discuss alternative financial metrics to evaluate capital budgeting decisions and recommend the technique(s) that are most appropriate for this case, and (4) evaluate the impact of two cage-free investment policies on firm profitability and leverage.

[2] The egg industry could be divided in two categories: shell or table eggs (with 87.5 percent share in terms of revenues in 2019) and hatching eggs (12.5 percent), the latter typically used by egg producers to replace and grow the egg-laying flock. This case study focuses on shell eggs.

[3] In 2019, it was estimated that 60 percent of total shell egg production was sold through retail stores, 30 percent was sold to egg breakers who further processed eggs for manufacturers, 7 percent went to the food service or institutional industry, and 3 percent was exported (American Egg Board 2020).

2.2 Egg Production Systems

There are three main production systems: conventional or cage production, cage-free, and free-range. In conventional production, chickens are confined to a small space within cages (e.g., 80 square inches of floor space per hen), and egg collection and feeding are largely automated. Eggs produced under cage production are commercialized as conventional or nonspecialty eggs. In a cage-free production system, chickens are housed indoors in large aviaries rather than in cages. Each chicken is provided more space than in cages (144 square inches), and cage-free facilities allow hens to perform natural behaviors such as perching, scratching, dust bathing, and nesting.[4] In a free-range system, chickens are cage-free, have access to the outdoors, and are produced typically following organic production practices (i.e., certified organic eggs). Eggs produced under cage-free and free-range systems are referred to as specialty eggs. (Eggs with additional nutritional attributes were also part of the specialty eggs category). In 2019, conventional production was the prevalent production system, with a 76.4 percent share. Cage-free and free-range or organic had a combined 23.6 percent share, as shown in Figure 1.

2.3 Cage-Free Eggs: A Growing Segment

While cage-free production is not a new production method, it has grown rapidly during the previous 5 years. From 2008 to 2014, cage-free production represented only between 5 and 6 percent of the U.S. egg market (Toffel and Van Sice 2013; Kesmodel 2015; Egg Industry Center 2019). The rapid growth in cage-free production is because of (1) recent regulation requiring producers to switch from conventional to cage-free production, and (2) pledges by large egg buyers such as McDonalds, Starbucks, Walmart, and more than 200 restaurants and supermarkets, to buy cage-free only products by 2025 (Markets Insider 2017).

The industry has become increasingly regulated to protect hens caged in very small spaces. A *New York Times* article noted that 80 square inches of floor space per hen was "not much higher than a shoe box" (Gelles 2016). Animal welfare groups considered caged laying hens to be one of the most abused

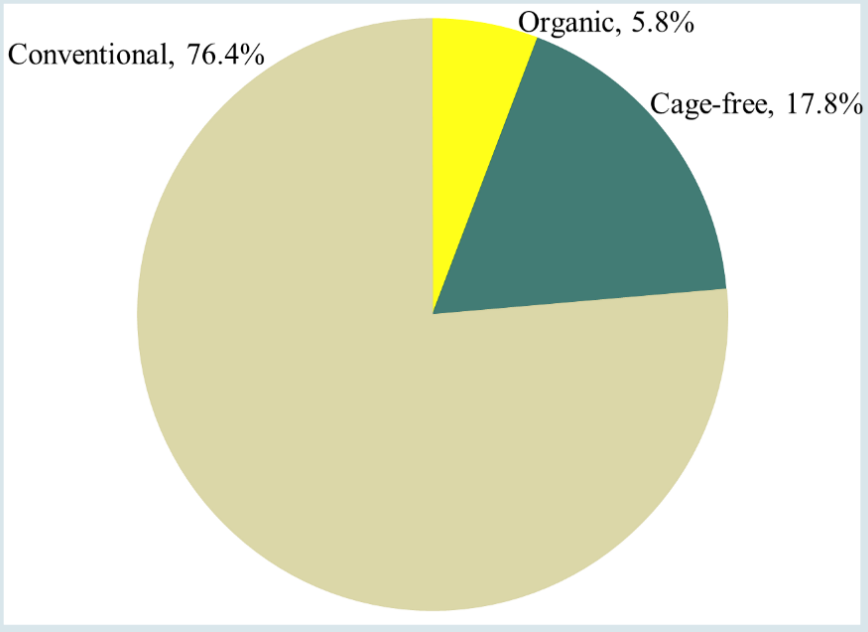

Figure 1. Laying Hens by Production System in the United States in 2019

Source: STATISTA (2020)
Note: All organic producing hens in this figure are produced following free-range practices.

[4] For more technicalities on production systems, refer to United Egg Producers (2017) and Coalition for Sustainable Eggs Supply (2015).

animals, because they were confined in such very small cages (Kesmodel 2015). From this perspective, low egg production costs and low consumer prices were possible at the expense of abused animals. After many years of gradual regulations aimed to protect laying hens (and other animals), on November 6, 2018, California voters approved the Prevention of Cruelty to Farm Animals Act, which required all eggs sold in California to come from cage-free production by 2022. Michigan, Washington, Ohio, Massachusetts, and Oregon have also passed laws regulating laying hen environments.

The big question in the industry was whether egg producers would be able to adjust their laying hen housing systems to comply with expected cage-free demand. All producers listed in Table 1 produced cage-free eggs in 2019, but at relatively low proportions, which illustrated the relatively low market penetration of cage-free eggs. Several forces were impacting the change from conventional toward cage-free production. First, it was costlier, by 41 percent, to produce cage-free eggs, and the price premium paid by consumers over the price of conventional eggs sometimes did not cover the extra costs (Trejo-Pech and Thompson 2020). Second, while large buyers were pledging more cage-free eggs, it was not clear they would be willing to sacrifice profits for the extra cost of producing those eggs. As an example, in 2019 Cal-Maine Foods Inc. noted that the changes it made to its procedures and infrastructure to comply with cage-free regulations resulted in additional production costs that the company was unable to directly pass onto consumers (IBISWorld 2019). Another unknown was whether cage-free rules would continue to gain traction in other states in the future. The preconception that cage-free chickens were treated more humanely was relatively clear to American consumers, as Figure 2 shows. Consumers

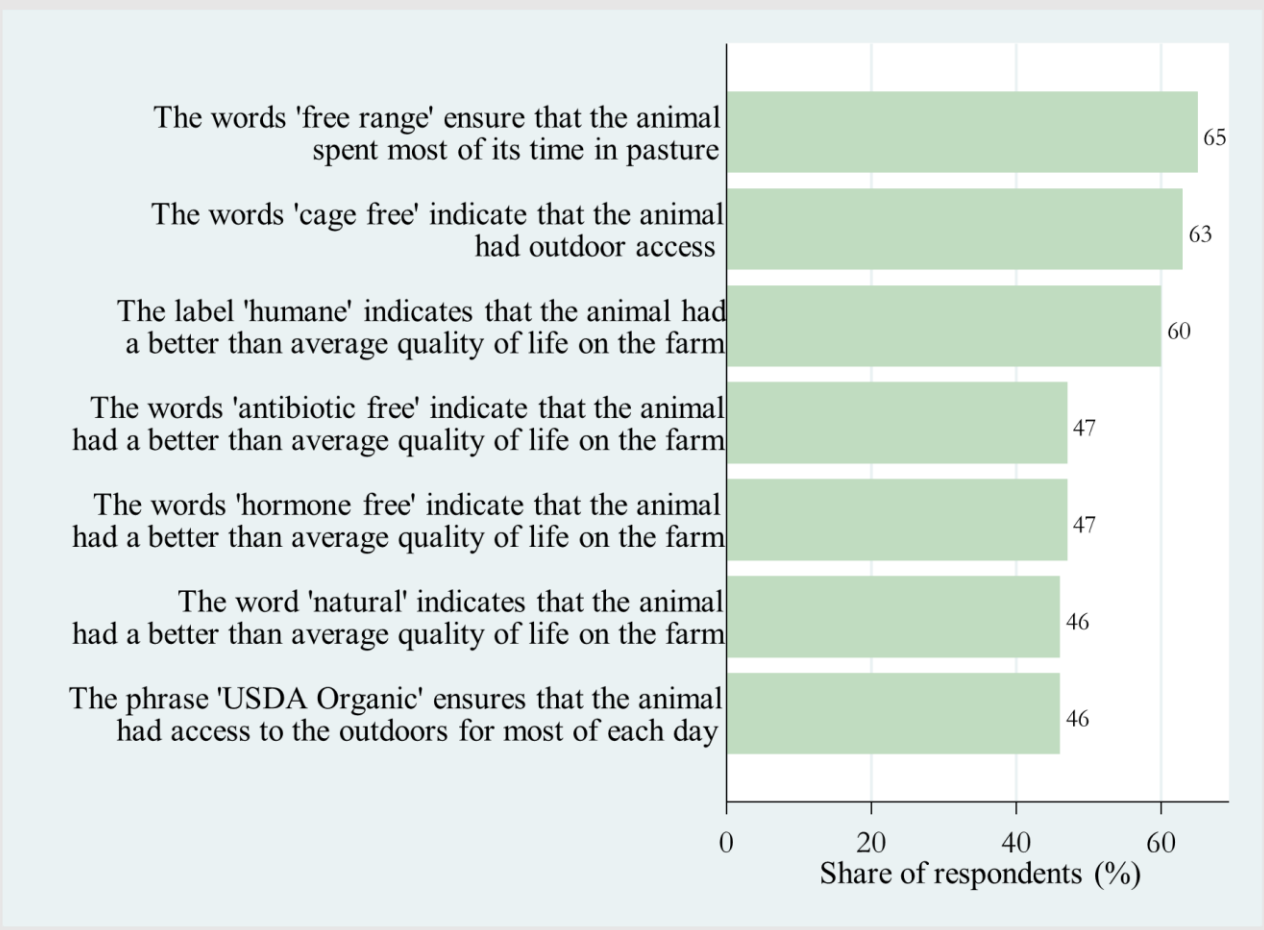

Figure 2. Consumer Perceptions Regarding Animal Welfare Phrases of the Food Products in the United States

Source: STATISTA (2016). Survey conducted by Lake Research Partners (Lake Research Partners 2016).

appeared to be willing to pay more for eggs produced under cruelty-free conditions, but it was not clear how much they were willing to pay. A recent research study surveying consumers had reported that egg consumers were willing to pay for cage-free eggs, on average, $1.16 per dozen above the regular price paid for conventional eggs (i.e., cage-free price premium). However, half of the consumers surveyed said they were willing to pay no more than $0.30 per dozen cage-free price premium, suggesting that a small fraction of consumers were willing to pay sizable amounts for cage-free eggs (Lusk 2019).

Overall, by early 2020 it was unclear whether cage-free production was a better production system for the well-being of animals and workers and for low-income households who were more sensitive to potential egg price increases as cage-free eggs displaced conventional production.

3 A Capital Budgeting Model for a Vertically Integrated Firm

Vertically integrated egg firms engage in all aspects of this business, including the production of pullets or young hens, and the production, grading, packaging, marketing, and distribution of shell eggs. Typically, these firms also prepare hen feed rations and sell egg products such as liquid, frozen, and dried eggs.[5] All firms listed in Table 1 engaged in all or most of these activities and operated two business segments, mainly: (a) conventional and (b) cage-free and other specialty eggs (IBISWorld 2019).

The bank's financial analyst, Stephanie, needed a spreadsheet capturing the business model of a vertically integrated firm, which at the same time needed to be simple and easily adaptable to different potential firms and clients of the bank. The bank was anticipating unusual investment amounts—and financing needs—by egg firms as they transition to produce more cage-free eggs. The model would be useful for financial evaluation and loan adjudication decisions.

Stephanie conceptualized a capital budgeting model in which a firm invested in a given number of conventional and cage-free facilities and produced and processed eggs during the useful life of the facilities, expecting that projected cash flows discounted at a risk-adjusted cost of capital would at least equal to the value of investment. The model would accommodate future investment in cage-free facilities and evaluate its impact on profitability and leverage.

3.1 Price and Cost Parameters

Finding reliable production, cost, investment, and price parameters for the capital budgeting model was a challenge itself since all egg firms, with the exception of Cal-Maine Foods Inc., were privately held firms, which meant they did not disclose their complete financial statements to the public. Even annual financial statements released by Cal-Maine to the public did not provide the level of detail needed to build a model. Stephanie needed to read and analyze historical 10-Q and 10-K reports issued by Cal-Maine Foods Inc. to the Securities Exchange Commission to obtain certain parameters (by business segment), which she required for the modeling effort.[6] Stephanie compiled and processed data reported by Cal-Maine from 2017 to 2019. To standardize the financial information, Stephanie had converted some dollar values into dollars per dozens of eggs, which was the metric commonly used in the egg industry. Other values were expressed as a percentage of revenues. Table 2 provides the parameters Stephanie decided to use as representative for a stylized income statement of a "typical" vertically integrated egg firm.[7]

Stephanie knew that price and cost parameters would vary between firms and thought that the descriptive statistics presented in Table 2 could serve as a basis for a sensitivity or scenario analysis. Regarding the firm size for the typical egg firm modeled, Stephanie was aware that prospective large egg firms for this bank would not be as large as Cal-Maine Foods, which was the largest firm in the country

[5] By-products could include hard cooked eggs, hatching eggs, hens, and manure.

[6] Annual financial statements typically do not breakdown financial data by business segments. Business segments data is usually discussed in the quarterly or annual reports (10-Q and 10-K, respectively) firms file with the Securities Exchange Commission. In this case, the relevant business segments are specialty and nonspecialty eggs.

[7] The term stylized is used to denote the fact that the modeling is kept as simple as possible. Stylized facts are discussed below and indicated in Table 4.

Table 2. Income Statement Parameters

Item	Average	Min	Max	Std. Dev.
Prices:				
Conventional shell eggs ($ per dozen)	0.991	0.705	1.226	0.216
Specialty shell eggs ($ per dozen)[a]	1.928	1.916	1.939	0.009
Egg products and other (% of revenue)[c]	3.4%	3.3%	3.5%	0.1%
Farm production cost:				
Total farm production cost ($ per dozen)	0.701	0.688	0.725	0.017
Conventional shell eggs ($ per dozen)[b]	0.637	NA	NA	NA
Specialty shell eggs ($ per dozen)[a, b]	0.898	NA	NA	NA
Egg products and other (% of total costs)[c]	2.6%	2.0%	3.2%	0.5%
Processing and packaging ($ per dozen)	0.206	0.196	0.214	0.007
Selling, General, and Administrative (SG&A) expenses (% of revenue):				
Marketing of specialty eggs[a,d]	11.0%	10.6%	11.5%	0.4%
Other nonspecific SG&A	9.4%	8.3%	10.9%	1.1%

Sources: Several 10-Q and 10-K Cal-Maine Foods Inc. reports from 2017 to 2019. Accessed in June 2020, available at https://www.sec.gov/edgar/search-and-access.

Note: Cost and expenses include depreciation.

[a] We assume that specialty eggs are cage-free eggs only. However, specialty eggs sold by Cal-Maine may include cage-free and other specialty eggs such as organic. Organic eggs, however, have a small market share (Figure 1).

[b] Farm production costs are estimated by dividing total farm production cost by the number of dozen eggs produced. Farm production cost of conventional and cage-free eggs are estimated by authors considering that Cal-Maine Foods produced, on average, 75 percent conventional and 25 percent specialty eggs during the 3-year period, and assuming that it costs 41 percent more to produce specialty eggs according to Trejo-Pech and Thompson (2020).

[c] Egg products included liquid, frozen, and dried eggs; "others" included hard-cooked eggs, hatching eggs, hens, and manure.

[d] Marketing of specialty eggs are expressed in relation to specialty revenue only, and other nonspecific SG&A are in relation to total revenue.

(Table 1). The Risk Management Association defined egg firms with more than $50 million annual revenue as large companies (IBISWorld 2019). Based on this definition, Stephanie built her baseline model assuming that the firm would have ten conventional and ten cage-free housing facilities.[8]

3.2 Investment and Production Parameters

Stephanie further considered that firm size would affect the cost structure. Relatively small firms might have higher fixed costs. However, given that the bank's goal was to have a benchmark model for large egg firms, she considered that a scale effect factor was not necessary for her initial projections. The characteristics of the 20 housing facilities by production type are given in Table 3.

Data in Table 3 are from a study by the Coalition for Sustainable Egg Supply comparing conventional and cage-free production at the farm level. The Coalition for Sustainable Egg Supply is an entity composed of leading animal welfare scientists, egg farmers, food service firms, and food retailers. Table 3 provides average values of two production flocks in 2010 and 2011. Stephanie adjusted values from the Coalition for Sustainable Egg Supply study into end of 2019 dollar values by using the U.S. Producer Price Index (U.S. Department of Labor, Bureau of Labor Statistics 2020).

Stephanie's assumption to model a firm having the same number (i.e., 10) of conventional and cage-free housing facilities had an added advantage. Such a firm could be seen as managing a portfolio of

[8] Expected revenues of a firm with ten conventional and ten cage-free facilities were estimated to be $89.2 million (Table 4).

Table 3. Investment and Production Data for Conventional and Cage-Free Production Types

Item	Conventional	Cage-Free	Total
Investment ($/facility)			
Land	22,774	11,387	34,161
House plus equipment	3,359,182	2,220,476	5,579,658
Number of housing facilities assumed	10	10	20
Production data			
Total hens purchased (units/flock/housing facility)	196,128	49,760	245,888
Eggs produced per flock (dozens/flock/housing facility)	5,928,337	1,423,795	7,352,132
Dozen eggs produced per hen/flock/housing facility	30.2	28.6	29.9
Shares in terms of number of eggs	81%	19%	100%
Shares in terms of number of hens	80%	20%	100%
Shares in terms of investment value	60%	40%	100%

Source: Coalition for Sustainable Eggs Supply (2015). Dollar values were adjusted into end of 2019 dollar values by using the U.S. Producer Price Index (U.S. Department of Labor, Bureau of Labor Statistics 2020).

two products, with approximately 80 percent and 20 percent conventional and cage-free shares in terms of volumes, respectively, which resembled the composition of the U.S. market in 2020 (Figure 1).

Budgeting investment and operating profits for a representative vertically integrated egg firm was very challenging since values would vary depending on farm location, firm size, hen strain, location of buyers, among other factors. Thus, Stephanie was aware that her model was a "stylized" model at best, but should be useful to estimate financial benchmarks, and most importantly, to evaluate the effect of potential investing and financing decisions as firms started to displace conventional with cage-free eggs.

3.3 Baseline Output

Stephanie had prepared the baseline capital budgeting model (Table 4) using data in Tables 2 and 3 and other assumptions specified in Table 4 footnotes. For this baseline model, free cash flows were projected in real terms (i.e., with no inflation projected), and assuming that prices, costs, and egg production quantities would be constant during eight flock production cycles, equivalent to 10 years (i.e., each flock cycle is assumed to last 15 months). Stephanie thought stylizing a model made it efficient but at the same time made it look unrealistic.[9]

There are alternative financial metrics to evaluate an investment, and Stephanie preferred to use rates of return rather than absolute values such as the net present value. She estimated the internal rate of return for this baseline model obtaining 16.7 percent per 15-month flock.[10] Compared with a 10 percent discount rate used in a previous analysis in this industry (Bir et al. 2018), it seemed that the project was financially sound. She has recently learned that the discount rate could be used to calculate the modified internal rate of return (MIRR).[11] Using the 10 percent discount rate, MIRR was equal to 13.2 percent per flock.[12] Stephanie wondered what rate of return provided a more accurate assessment of a project's internal profitability and why.

[9] A discussion on relaxing some assumptions is provided in the teaching notes that accompanies this paper.
[10] This is approximately equivalent to 13.4 percent annually (e.g., 16.7 percent * (12/15)).
[11] Modified internal rate of return (MIRR) provides a measure of internal profitability, based on the timing and magnitude of a project's cash flows, just as internal rate of return does. MIRR, however, assumes that intermediate cash flows are reinvested at the firm's cost of capital, while IRR assumes reinvestment at the IRR rate.
[12] Discounting projected real cash flows (without projected inflation rates) with a nominal opportunity cost of capital provides a conservative valuation. This is discussed in the teaching notes that accompany this paper.

4 The Financial Analysis Task

By 2020, it was unclear whether the cage-free egg supply would grow fast enough to honor the pledges made by large egg buyers to buy cage-free eggs only in the mid-term future. Analysts estimated that fully honoring those pledges would imply that the market share of cage-free would need to roughly jump to 70 percent by 2026 (Markets Insider 2017). Nobody knew how quickly the market would displace conventional eggs, however, because of the high cost of new cage-free housing investments,[13] higher cage-free operating costs, higher mortality rates in cage-free production (i.e., lower eggs per hen, as Table 3 shows), and unknown limits of consumers' willingness to pay higher prices for eggs. What was more certain, however, was that egg firms would make additional investments to change the conventional/cage-free mix in their portfolio of products to remain competitive, in sync with changes in the overall egg market mix.

Firms' future cage-free investments might have several effects. First, cage-free eggs would likely cannibalize conventional eggs since they were substitutes and egg consumption was projected to grow at low rates in the mid term.[14] The implication of this is that investing in cage-free facilities might require disinvestment in conventional production facilities to avoid overproducing, with the added complication that one conventional facility produced approximately four times the number of eggs produced by a cage-free facility, as shown in Table 3. Second, cage-free investment and conventional disinvestment could occur at such speed that cash flows might drastically change and increase firm leverage, which would in turn make a firm riskier from the perspective of the bank. Third, the baseline model assumed that cage-free egg prices would remain high (relative to conventional eggs) through the complete eight flock cycles (Table 4). It is likely, however, that cage-free prices would decrease as cage-free market share grew because of the combination of mandated regulation and large buyers' demand, but not necessarily from demand created by the final consumer. It might be the case that up to a certain level of cage-free market share, additional buyers were not able to pay a high premium for cruelty free eggs. Stephanie was wondering how to incorporate this potential decrease in cage-free price as firms invested in additional cage-free production.

Stephanie needed to prepare an investment schedule capturing the implications just discussed. The investment schedule would in turn feed into the baseline model (Table 4) to evaluate the financial effects of new cage-free investments. She recognized that there were many possible combinations of growing cage-free in the portfolio mix. To make her analysis as simple as possible, she defined two investment policies. A quick-investment policy would capture a scenario on which the cage-free market grows quickly in the following years and therefore the egg firm would invest aggressively in cage-free facilities, in sync with the market. A second investment policy captures a slower cage-free growth scenario. Table 5 captures the two hypothetical investment policies. By investing quickly, the egg firm would achieve a 71 percent cage-free and 29 percent conventional mix by the end of the fourth flock cycle. In contrast, under a slow investment policy, the firm would achieve 55 percent cage-free and 45 percent conventional by the end of the sixth flock cycle.

Stephanie was about to start her analyses with some questions in mind. Were those investment policies financially feasible at all given financing constraints? A typical egg firm operating with this bank (her employer) had about 30 percent leverage ratio, defined as total debt divided by total assets, and paid about 20 percent of dividends as a percentage of net income. The bank typically charged a 6 percent interest rate and considered firms with leverage above 50 percent to be highly risky. Stephanie also wondered which of the two investment policies in Table 5 was more profitable. Profitability was important to her employer. When a bank loaned money, its main consideration would be whether the client would be able to pay back the loan. The more "cushion" in profitability the better; in other words, finance a project so that there is income to spare, and it is easier for the client to pay back the borrowed

[13] Converting conventional hen houses and equipment facilities were too costly to a point that it was probably more efficient for firms to demolish conventional facilities rather than remodel them and build cage-free facilities from scratch.
[14] By 2019, the volume of egg substitute products in the United States was negligible (STATISTA 2020).

funds. The bank's concern about leverage entered into her considerations as well. How much more would taking on either project impact the client's existing capital structure? Would one investment policy be better than the other in terms of leverage and risk? While Stephanie was excited about promoting more cage-free investment, from her new banking perspective, she didn't want to encourage ventures that might end in disaster for the bank. In addition, from a client's perspective, what were advantages and disadvantages of following a quick investment policy instead of slower investment?

Stephanie's preliminary results showed that both investment policies yielded a higher MIRR compared with the baseline scenario, with the quick investment policy being slightly better than the slow investment policy. This was consistent with the fact that quantity produced would slightly grow under both investment policies by about 1 percent annually, on average. Under the quick-investment policy, firm' leverage would grow from 30 percent in the baseline to around 50 percent, and the company would need to cut dividends since it would experience economic losses in some years. In contrast, under the low-investment policy, leverage would be low, around current levels of 30 percent, because the firm would be able to generate cash for projected investments.

Stephanie was ready to complete her analysis. She needed to show her boss and colleagues in the bank that she was knowledgeable on the shell egg industry. She also wanted to be able to explain them the capital budgeting model, the assumptions behind it, and how both cage-free investment policies might impact both firm profitability and leverage. To guide her analysis, she prepared a list of questions she thought may help her.

Table 5 shows additional housing facilities planned for the following flock cycles. Positive numbers imply investment and negative numbers imply disinvestment (e.g., demolishing a conventional housing facility). Investments and disinvestments are assumed to occur one flock prior to producing. For instance, the demolition of two conventional facilities and the construction of ten cage-free facilities by the end of flock one affects quantities produced in flock two. In practice, it may take between 1 to 2 years to build a cage-free house (Ibarburu 2019).

5 Discussion Questions

1. Perform an industry analysis of the egg production business using Porter's Five Forces.
2. Discuss the assumptions of the baseline capital budgeting model. What assumptions would you relax to make the model more realistic? Explain.
3. Given the differences between the calculated internal rate of return and the modified internal rate of return for the baseline model, what rate of return do you think more accurately represents the project's internal profitability and why?
4. Identify and discuss what inputs you would need to update/change in the baseline capital budgeting (spreadsheet) model to re-estimate profitability (i.e., IRR and MIRR) and estimate leverage under the two investment policies described in Table 5. Be specific as possible. For example, when considering investments in additional facilities, discuss how depreciation schedules would change.
5. From the perspective of the egg firm, what are advantages and disadvantages of following a quick-investment policy instead of slower investment?

Table 4. Baseline Capital Budgeting Model for a Stylized Vertically Integrated Egg Firm in the United States Assuming Ten Conventional and Ten Cage-Free Housing Facilities

Flock cycle	0	1	2	=>	8
CAPEX ($ thousand)	66,372.1	0.0	0.0	…	0.0
Conventional ($ thousand)	33,819.6	0.0	0.0	…	0.0
Cage-free ($ thousand)	22,318.6	0.0	0.0	…	0.0
Other facilities ($ thousand)	10,233.9	0.0	0.0		0.0
Revenues ($ thousand)		89,235.9	89,235.9	…	89,235.9
Conventional ($ thousand)		58,743.4	58,743.4	…	58,743.4
Cage-free ($ thousand)		27,454.8	27,454.8	…	27,454.8
Egg products and others ($ thousand)		3,037.6	3,037.6	…	3,037.6
Price conventional ($ per dozen)		0.99	0.99	…	0.99
Price cage-free ($ per dozen)		1.93	1.93	…	1.93
Total eggs (thousand dozens)		73,521.3	73,521.3	…	73,521.3
Conventional (thousand dozens)		59,283.4	59,283.4	…	59,283.4
Cage-free (thousand dozens)		14,238.0	14,238.0	…	14,238.0
Farm prod cost ($ thousand)		50,528.0	50,528.0	…	50,528.0
Conventional ($ thousand)		37,745.8	37,745.8	…	37,745.8
Cage-free ($ thousand)		12,782.1	12,782.1	…	12,782.1
Conventional ($ per dozen)		0.637	0.637	…	0.637
Cage-free ($ per dozen)		0.898	0.898	…	0.898
Egg products and other ($ thousand)		2,074.8	2,074.8		2,074.8
Processing and packaging ($ thousand)		15,117.0	15,117.0	…	15,117.0
Processing and packaging ($ per dozen)		0.206	0.206	…	0.206
SG&A ($ thousand)		11,410.2	11,410.2	…	11,410.2
Mkt cage-free eggs ($ thousand)		3,028.6	3,028.6	…	3,028.6
Mkt cage-free eggs (% of c.f. egg rev.)		11.0%	11.0%	…	11.0%
Other nonspecific SG&A ($ thousand)		8,381.6	8,381.6	…	8,381.6
Other nonspecific SG&A (% of revenue)		9.4%	9.4%	…	9.4%
Total costs and expenses ($ thousand)		79,130.0	79,130.0	…	79,130.0
Operating income ($ thousand)		10,105.9	10,105.9	…	10,105.9
Operating margin (%)		11.3%	11.3%	…	11.3%
NOPAT ($ thousand)		7,377.3	7,377.3	…	7,377.3
NOPAT margin (%)		8.3%	8.3%	…	8.3%
Depreciation ($ thousand)		8,253.8	8,253.8	…	8,253.8
Conventional ($ thousand)		4,199.0	4,199.0	…	4,199.0
Cage-free ($ thousand)		2,775.6	2,775.6	…	2,775.6
Other facilities ($ thousand)		1,279.2	1,279.2		1,279.2
Free cash flow ($ thousand)	(66,372.1)	15,631.1	15,631.1	…	15,631.1

Notes: CAPEX stands for capital expenditures; SG&A stands for selling, general, administrative expenses; and NOPAT is net operating profits after taxes. Assumptions for this *baseline* model: 1. No inflation rate forecasted; quantities are the same from flock two to flock eight, 2. Prices and variable cost change with units produced/sold, 3. No investment in working capital, 4. No residual value at the end of the eight flock cycle. In other words, initial investments are fully depreciated, and zero residual market value is assumed, 5. Income tax rate is 27 percent (KPMG 2018).

Table 5. Two Possible Investment Policies for a Prospective Firm Growing Cage-Free Production

Investment policies per flock cycle	1	2	3	4	5	6
Quick investment policy:						
Additional conventional egg facilities	-2	-2	-2	0	0	0
Additional cage-free egg facilities	10	10	10	0	0	0
Share of conventional eggs (%)	81%	62%	45%	29%	29%	29%
Share of cage-free eggs (%)	19%	38%	55%	71%	71%	71%
Slow investment policy:						
Additional conventional egg facilities	0	-1	-1	-1	-1	0
Additional cage-free egg facilities	0	5	5	5	5	0
Share of conventional eggs (%)	81%	81%	71%	62%	54%	45%
Share of cage-free eggs (%)	19%	19%	29%	38%	46%	55%

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