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## Teaching and Educational Methods

# Using Music to Teach Agricultural, Applied, and Environmental Economics

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### Abstract

Education scholars (Brewer 1995; Jensen 2000) have long known that using music to teach can improve learning. In this article, we discuss songs that educators can use to teach agricultural, applied, and environmental economics topics. We also show how educators can easily and freely access these songs and suggest strategies for including them when teaching.

## 1 Introduction

Economics has a history of being taught using “chalk-and-talk” techniques. In recent years, however, many economists have highlighted the use of media to help educate students (Becker and Watts 1996, 2001; Becker, Becker, and Watts 2006; Watts and Schaur 2011; Ongeru 2017; Picault 2019). Examples of alternative media include historical novels (Cotti and Johnson 2012), works of art (Watts and Christopher 2012; Al-Bahrani et al. 2016), movies (Mateer and Stephenson 2011; Mateer, O’Roark, and Holder 2016), television series (Hall 2005; Gillis and Hall 2010; Ghent, Grant, and Lesica 2011; Kuester, Mateer, and Youderian 2014; Patel et al. 2014; Tierney et al. 2015; Wooten and Staub 2017; Wooten, J., K. Staub, and S. Reilly. 2018; Muchiri, Paraschiv, and Wooten 2020; Wooten, Geerling, and Calma 2020; Geerling et al. 2021), and social media (Al-Bahrani and Patel 2015). Picault (2021) highlights the many ways economists have integrated projects where students create media.

By incorporating media, educators are attempting to better reach students. Research—along with anecdotal evidence from educators—shows us that students have different learning styles (Hawk and Shah 2007; Schmeck 2013). Incorporating media is a way to be a more inclusive teacher and for the economics profession to broaden its appeal to diverse populations (Lage, Platt, and Treglia 2000; Steele 2011). By incorporating different media, educators can better engage a wider percentage of their students.

Perhaps more than other media—the use of music might be a highly effective medium for teaching economic concepts, as students can relate to songs and often spend time memorizing lyrics. Students are also more likely to discuss economics outside of class when the lesson is contained in a song, finding that learning economics through music can be enjoyable. There is vast literature on music’s impact on both cognition and mood (e.g., see Stratton and Zalanowski 1991). Playing music before or during class can assist in classroom engagement and improving students’ attitudes regarding a class. Not only is music effective in improving cognition—some research shows it to be more effective than other alternative instruction methods (Standley 1996).

Tinari and Khandke (2000) published the first scholarly economics paper on the benefits of using music to teach. Since Tinari and Khandke’s paper, many others have illustrated the benefits of using music to teach economics. These include general papers helping to convince the profession that music can and should be used to teach economics, like those by Mateer and Rice (2007); Hall, Lawson, and Mateer (2008a); and Holder, Mateer, and O’Roark (2016). Other authors examine how to use specific songs or song genres to teach. For example, see Krasnozhon (2013), Melichar (2018), and Rousu (2018a).

And finally, there are scholarly papers that examine how to use songs to teach topics within economics, like those by Hall et al. (2008b), Hall and Lawson (2008), Raehsler (2013), Van Horn and Van Horn (2013), and Rousu (2018b). None of these papers/books have focused on teaching agricultural, applied, and environmental economics courses, however.

In this paper, we present songs that can be used to teach applied economics topics. We provide details on how to use songs to teach various topics in agricultural, applied, and environmental economics. In addition to an in-depth discussion of a selection of songs, we provide a table listing these and ninety-seven additional songs that can also be used in teaching economics. All songs discussed in this paper can be found on public websites and can be accessed, for free, by educators.<sup>1</sup> Our table with one hundred and seven songs is formatted by going chapter-by-chapter through a popular agricultural economics textbook, *Principles of Agricultural Economics* (Barkley and Barkley 2020) and indicates songs to use to cover specific topics for ease of implementation.

## 2 How to Use Music to Teach

There are several ways educators can implement songs into their teaching to become more effective. Educators could play a song prior to the beginning of class, with the song ending at about the time class starts. This is a low-cost way to introduce music as it takes no class time, and students get the benefit of additional content when they arrive early and wait for classes to begin. It also can help set up the daily lesson. This method might provide the lowest benefits, however, as it won't benefit students who do not arrive early.

Another option is to occasionally play a song mid-lesson, to reinforce a particular topic and to recapture students' attention. This allows educators to reach all students in a class and could be incorporated as a pedagogical strategy to take a break from a lecture or discussion; however, it is costlier given the opportunity cost of the in-class instruction time.

A third option is to assign students an assignment of listening to a song and to explain how it relates to the coursework. This could be as simple as describing how the lyrics represent the economic concept or theory or could be more involved and require students to collect data, make calculations, and analyze the results more thoroughly.

Various methods of formative assessment can then be used to ensure that students are comprehending the material. In the appendices, we present four lesson plans educators can use to integrate music into their lessons. These lesson plans cover agribusiness and the shut down rule (Appendix 1), international trade (Appendix 2), the production possibilities frontier (Appendix 3), and public goods (Appendix 4).

A low-cost way to increase student engagement is through a Think, Pair, Share approach. This method can be used in classrooms of varying size, but may be best suited for large lecture halls or breakout rooms in online learning environments. Students form small groups (2–3 students) and discuss questions posed by the professor. The professor can then randomly call on the groups for their response. Classroom polling can be a good way to gauge student comprehension and is relatively easy to implement. Professors can create multiple choice questions, true/false, word clouds, or other options. Various learning management systems and platforms include these options, including Poll Everywhere, Kahoot!, and Top Hat.<sup>2</sup>

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<sup>1</sup> For songs we discuss in great detail, only two have been presented in previous papers (to our knowledge); however, we discuss them in a different manner. The table at the end will include the ten songs from this paper's discussion as well as ninety-seven others, several covered in previous papers. This is done to make it easier for educators to find songs for teaching these topics. Of course, we cite the original paper that highlighted how the song can be used to teach economics so interested readers can read and learn more.

<sup>2</sup> These sites can be accessed at [polleverywhere.com](https://www.poll.everywhere.com), [Kahoot.com](https://www.kahoot.com), and [Tophat.com](https://www.tophat.com).

Regardless of the method used, incorporating music into lessons on agricultural, applied, and environmental economics can yield large benefits. Students come to classes with different learning styles, and using music can help educators reach students that may struggle with traditional chalk-and-talk techniques. For students who learn well with chalk-and-talk, reinforcing concepts through music can still improve their learning by keeping them engaged and thinking about economics outside of the classroom.

### 3 Where Can You Access Songs?

In Table 1 we present a list of songs that can be used to teach. This table presents the song’s title, artist, and the specific topics the song covers. We also have a column illustrating the chapter in Barkley and Barkley’s (2020) textbook, *Principles of Agricultural Economics*, where we think the song could be used. This should make it easy for instructors using this textbook, or any agricultural economics textbook, to always have access to songs that cover common topics addressed.

In addition to Table 1, we want to outline six general sources where you can find most of the songs discussed in this paper. All six sites fall under the Educational Fair Use laws, where media can be used for educational purposes so long as the sites are not monetized, and there is a clear description of the educational purpose of the song. Each song also displays the lyrics as it plays, to ensure accessibility for students who have hearing difficulties.

**Table 1. Song List for use in Agricultural, Applied and Environmental Economics Courses**

Song No.	Title	Artist	Book Chapter	Song Topics Covered	Source
1	Dear Sweet Sewing Machine+	Fiddler on the Roof	The Economics of Production	Economic growth, factors of production, PPF	<a href="#">Broadway Economics</a>
2	In Color	Jamey Johnson	The Economics of Production	Great Depression, technological advances with production	<a href="#">EconGoneCountry</a>
3	Stress	Big Jim’s Ego	The Economics of Production	Diminishing marginal utility, productivity, costs	<a href="#">Critical Commons</a>
4	Trouble in the Fields**	Nanci Griffith	The Economics of Production	Great Depression, 1980s Farm Crisis, factors of production, technology, PPF	<a href="#">EconGoneCountry</a>
5	10,000 Hours	Dan + Shay	The Costs of Production	Marginal cost/benefit	<a href="#">EconGoneCountry</a>
6	Ain’t Worth the Whiskey	Cole Swindell	The Costs of Production	Opportunity cost, tradeoffs	<a href="#">EconGoneCountry</a>

**Table 1 continued.**

7	Amish Paradise	Weird Al Yankovic	The Costs of Production	Opportunity costs, inefficiency, exchanges with the modern world, lack of technology, and meaning of a Robinson Crusoe economy	<a href="#">Critical Commons</a>
8	Beer or Gasoline	Chris Young	The Costs of Production	Opportunity cost, tradeoffs, money, medium of exchange, unit of account	<a href="#">EconGoneCountry</a>
9	Chillin' It	Cole Swindel	The Costs of Production	Opportunity cost	<a href="#">EconGoneCountry</a>
10	Diamonds and Gasoline	Turnpike Troubadours	The Costs of Production	Opportunity cost, tradeoffs	<a href="#">EconGoneCountry</a>
11	Five More Minutes	Scotty McCreery	The Costs of Production	Marginal cost/benefit	<a href="#">EconGoneCountry</a>
12	I'm Gonna Miss Her	Brad Paisley	The Costs of Production	Opportunity cost, tradeoffs	<a href="#">EconGoneCountry</a>
13	Leave the Night On	Sam Hunt	The Costs of Production	Marginal cost/benefit	<a href="#">EconGoneCountry</a>
14	Let it Go+	Frozen	The Costs of Production	Sunk costs	<a href="#">Broadway Economics</a>
15	Love or Money	Sammy Hagar	The Costs of Production	Opportunity cost, cost of international trade, currencies	<a href="#">YouTube</a>
16	Poker Face	Lady GaGa	The Costs of Production	Risk and reward tradeoff	<a href="#">Music4Econ</a>
17	Right Where I Need to Be	Gary Allan	The Costs of Production	Opportunity cost, tradeoffs	<a href="#">EconGoneCountry</a>
18	Summertime Blues	Alan Jackson	The Costs of Production	Opportunity cost, tradeoffs	<a href="#">EconGoneCountry</a>
19	Think a Little Less	Michael Ray	The Costs of Production	Marginal cost/benefit	<a href="#">EconGoneCountry</a>
20	Time Is Love	Josh Turner	The Costs of Production	Opportunity cost	<a href="#">EconGoneCountry</a>
21	Wasted Time	Keith Urban	The Costs of Production	Opportunity cost	<a href="#">EconGoneCountry</a>

**Table 1 Continued.**

22	Hippies and Cowboys	Cody Jinks	Profit Maximization	Opposite of profit maximization; determinants of demand (tastes and preferences, inferior goods)	<a href="#">EconGoneCountry</a>
23	I Wish Grandpas Never Died	Riley Green	Profit Maximization	Profit maximization, economies of scale	<a href="#">EconGoneCountry</a>
24	Keep Your Eye on the Money	Motley Crue	Profit Maximization	Minimizing cost, maximizing profit	<a href="#">YouTube</a>
25	\$ave Dat Money	Lil Dicky	Optimal Input Selection	Optimal input selection, unnecessary expenditures	<a href="#">Econ.Video</a>
26	Easy Money	Brad Paisley	Optimal Input Selection	Productivity and earnings, value of time	<a href="#">EconGoneCountry</a>
27	If You've Got the Money, I've Got the Time	Willie Nelson	Optimal Input Selection	Time as an input, value of time	<a href="#">YouTube</a>
28	Rain Is a Good Thing	Luke Bryan	Optimal Input Selection	Production, resources, inputs, specialization, comparative advantage	<a href="#">EconGoneCountry</a>
29	Shiftwork	Kenny Chesney	Optimal Input Selection	Productivity and earnings, value of time	<a href="#">EconGoneCountry</a>
30	Sittin on the Dock of the Bay	Otis Redding	Optimal Input Selection	Productivity, resource use	<a href="#">Critical Commons</a>
31	Spoonful of Sugar	Mary Poppins	Optimal Input Selection	Optimal input selection	<a href="#">Broadway Economics</a>
32	Break Up with Him	Old Dominion	Consumer Choices	Sunk costs, status quo bias, rationality	<a href="#">Music4Econ</a>
33	Gone Country	Alan Jackson	Consumer Choices	Free markets, consumer preferences	<a href="#">EconGoneCountry</a>



**Table 1 continued.**

34	I Want It That Way	Backstreet Boys	Consumer Choices	Wants, resource allocation, constraints, maximizing utility	<a href="#">Broadway Economics</a>
35	Kill This Love	BLACKPINK	Consumer Choices	Sunk costs, loss aversion, preferences, marginal cost, marginal benefit	<a href="#">Music4Econ</a>
36	Little Bit of Everything	Keith Urban	Consumer Choices	Consumer preferences, diminishing marginal utility	<a href="#">EconGoneCountry</a>
37	More and More	Twice	Consumer Choices	Maximize utility, limited resources, budget constraints, indifference curve, diminishing marginal utility	<a href="#">Music4Econ</a>
38	Mr. Brightside	The Killers	Consumer Choices	Behavioral-econ, bounded rationality, loss aversion	<a href="#">Critical Commons</a>
39	Playinwitme (feat. Kehlani)	Kyle	Consumer Choices	Behavioral-econ, bounded rationality, loss aversion, sunk costs	<a href="#">Econ.Video</a>
40	Another Day of Sun+	La Land	Supply	Demand and supply, land prices	<a href="#">Broadway Economics</a>
41	Blankets and Bedding	Come From Away	Supply	Demand and supply	<a href="#">Broadway Economics</a>
42	Irreplaceable*,##	Beyoncé	Supply	Elasticity of demand and supply, scarcity	<a href="#">YouTube</a>
43	Short Supply	Tracy Chapman	Supply	Supply, shortages	<a href="#">YouTube</a>
44	You Make My Dreams	Daryl Hall & John Oates	Supply	Demand and supply	<a href="#">YouTube</a>
45	Alright	Darius Rucker	Demand	Inferior goods	<a href="#">EconGoneCountry</a>

**Table 1 continued.**

46	American Kids	Kenny Chesney	Demand	Complimentary goods	<a href="#">EconGoneCountry</a>
47	Champagne Night	Lady A	Demand	Determinants of demand, normal goods, inferior goods, inflation, nominal vs. real	<a href="#">EconGoneCountry</a>
48	Fix a Drink	Chris Janson	Demand	Complements	<a href="#">EconGoneCountry</a>
49	For a Boat	Luke Bryan	Demand	Money, scarcity, value, medium of exchange, leisure, normal goods	<a href="#">EconGoneCountry</a>
50	I Hold On	Dierks Bentley	Demand	Demand, income, normal goods	<a href="#">EconGoneCountry</a>
51	I Want it All	Queen	Demand	Demand, wants	<a href="#">YouTube</a>
52	If I Die Young	The Band Perry	Demand	Tastes and preferences, price	<a href="#">EconGoneCountry</a>
53	If I Had a Million Dollars	The Barenaked Ladies	Demand	Normal goods, inferior goods	<a href="#">Econ.Video</a>
54	Parachute	Chris Stapelton	Demand	Elasticity of demand	<a href="#">EconGoneCountry</a>
55	Rich	Maren Morris	Demand	Determinants of demand, income, normal goods, inferior goods	<a href="#">EconGoneCountry</a>
56	She Only Smokes When She Drinks	Joe Nichols	Demand	Demand, complements	<a href="#">EconGoneCountry</a>
57	Sucker	Jonas Brothers	Demand	Inelastic demand,	<a href="#">Critical Commons</a>
58	Wing\$	Macklemore and Ryan Lewis	Demand	Increases in demand, differentiation, cycle of consumption	<a href="#">Music4Econ</a>
59	A Country Boy Can Survive	Hank Williams, Jr.	Markets	Interest rates, stock market	<a href="#">YouTube</a>
60	Big Money	Garth Brooks	Markets	Labor market, compensating wage differentials	<a href="#">Music4Econ</a>

**Table 1 Continued.**

61	Country Boy	Aaron Lewis	Markets	Free markets, laissez-faire	<a href="#">EconGoneCountry</a>
62	eBay*	Weird Al Yankovic	Markets	Consumer surplus, demand, equilibrium price, markets, producer surplus, supply, willingness to pay, willingness to sell	<a href="#">YouTube</a>
63	Give Them What They Want+	Dirty Rotten Scoundrels	Markets	Competition, markets, demand and supply	<a href="#">Broadway Economics</a>
64	Keep the Wolves Away	Uncle Lucius	Markets	Market failure, negative externalities, pollution	<a href="#">EconGoneCountry</a>
65	Let the Dollar Circulate	Billy Paul	Markets	Interest rates, unemployment, stagflation, pollution, money circulation, velocity of money	<a href="#">YouTube</a>
66	Brackets	J. Cole	Government Policies	Taxes	<a href="#">Econ.Video</a>
67	Here's to the Farmer	Luke Bryan	Government Policies	Taxes and subsidies, supply and demand, land prices	<a href="#">EconGoneCountry</a>
68	Lose Yourself++	Eminem	Government Policies	Business cycle, fiscal and monetary policy, famine, government policies	<a href="#">YouTube</a>
69	Money's Too Tight to Mention	Valentine Brothers	Government Policies	Reganomics, government's role in the economy	<a href="#">YouTube</a>
70	Pharaoh's Dreams Explained+	Joseph and the Amazing Technicolor Dreamcoat	Government Policies	Opportunity cost, government policy, poverty	<a href="#">Broadway Economics</a>

**Table 1 continued.**

71	Rain on the Scarecrow**	John Mellencamp	Government Policies	Discouraged worker, price supports, foreclosure	<a href="#">YouTube</a>
72	Shock the Monkey	Peter Gabriel	Government Policies	Interest rates, inflation	<a href="#">Business Insider</a>
73	Shuttin' Detroit Down	John Rich	Government Policies	Moral hazard, financial crisis, recessions, fiscal policy	<a href="#">EconGoneCountry</a>
74	Song of the South	Alabama	Government Policies	Keynesian econ, fiscal policy, spending multiplier, recessions, business cycle, cyclical unemployment, great depression	<a href="#">EconGoneCountry</a>
75	The Taxman#	The Beatles	Government Policies	Taxes	<a href="#">Econ.Video</a>
76	Combination Pizza Hut And Taco Bell	Das Racist	The Competitive Firm	Differentiation, complementary products	<a href="#">Econ.Video</a>
77	Hot Cheetos and Takis	Y.N. RichKids	The Competitive Firm	Complements, substitutes	<a href="#">Econ.Video</a>
78	I Like Beer*	Tom T Hall	The Competitive Firm	Imperfect substitutes, imperfect competition, inelastic demand, utility	<a href="#">YouTube</a>
79	I Want You to Want Me	Cheap Trick	The Competitive Firm	Competition	<a href="#">YouTube</a>
80	It's Still Rock and Roll to Me	Billy Joel	The Competitive Firm	Innovation, preferences, competition	<a href="#">YouTube</a>
81	Shot Me Down	David Guetta	The Competitive Firm	Competition, first mover advantage	<a href="#">Music4Econ</a>
82	7 Rings	Ariana Grande	Market Power	Price taker	<a href="#">St. Louis Fed</a>
83	Come to the Fun Home+	Fun Home	Market Power	Competition, market structure	<a href="#">Broadway Economics</a>

**Table 1 continued.**

84	Video Killed The Radio Star	The Buggles	Market Power	Creative-destruction, preferences	<a href="#">Critical Commons</a>
85	American Made	Oak Ridge Boys	Agricultural and the Global Economy	Trade, specialization, comparative advantage	<a href="#">EconGoneCountry</a>
86	American Saturday Night	Brad Paisley	Agricultural and the Global Economy	Comparative advantage, gains from trade, international trade, consumer preferences	<a href="#">EconGoneCountry</a>
87	Cost of Livin'	Ronnie Dunn	Agricultural and the Global Economy	Business cycle, recession, cyclical unemployment, job search, inflation, normal goods, spending multiplier	<a href="#">EconGoneCountry</a>
88	Gaston+	Beauty and the Beast	Agricultural and the Global Economy	Absolute advantage, competitive advantage, trade	<a href="#">Broadway Economics</a>
89	I'll Name the Dogs	Blake Shelton	Agricultural and the Global Economy	Specialization, division of labor, comparative advantage, trade	<a href="#">EconGoneCountry</a>
90	Made in America	Toby Keith	Agricultural and the Global Economy	Trade, specialization, comparative advantage, opportunity cost	<a href="#">EconGoneCountry</a>
91	Open Up the Border*	Clutch	Agricultural and the Global Economy	Barter, free trade, gains from trade, open markets, trade barriers, international trade	<a href="#">YouTube</a>
92	Pretty Good at Drinkin' Beer	Billy Currington	Agricultural and the Global Economy	Comparative advantage vs. absolute advantage	<a href="#">EconGoneCountry</a>

**Table 1 continued.**

93	Red, White, and Pink Slip Blues	Hank Williams, Jr.	Agricultural and the Global Economy	International trade, specialization	<a href="#">EconGoneCountry</a>
94	Somethin' I'm Good At	Brett Eldredge	Agricultural and the Global Economy	Comparative advantage	<a href="#">EconGoneCountry</a>
95	We Can't Make It Here#	James McMurty	Agricultural and the Global Economy	Gains from trade	<a href="#">YouTube</a>
96	Why We Build the Wall	Hadestown	Agricultural and the Global Economy	Immigration, purchasing power	<a href="#">Broadway Economics</a>
97	Gone Green	Brad Paisley	Economics, Agriculture, and the Environment	Environment, negative externalities, market failure, technological change	<a href="#">EconGoneCountry</a>
98	I'd Love to Change the World*	Ten Years After	Economics, Agriculture, and the Environment	Externalities, market failure, pollution, population growth, redistribution	<a href="#">YouTube</a>
99	Mercy Me	Marvin Gaye	Economics, Agriculture, and the Environment	Externalities, pollution	<a href="#">YouTube</a>
100	No Man's Land	Billy Joel	Economics, Agriculture, and the Environment	Economic growth, urban-sprawl	<a href="#">Critical Commons</a>
101	River Runs Red**	Midnight Oil	Economics, Agriculture, and the Environment	Pollution, natural resources, externalities, scarcity	<a href="#">YouTube</a>
102	Santa Fe	The Newsies	Economics, Agriculture, and the Environment	Public goods	<a href="#">Broadway Economics</a>

**Table 1 continued.**

103	Scarecrow in the Garden	Chris Stapelton	Economics, Agriculture, and the Environment	Climate change, environment, factors of production, PPF, immigration, economic growth	<a href="#">EconGoneCountry</a>
104	Sunrise, Sunburn, Sunset	Luke Bryan	Economics, Agriculture, and the Environment	Public goods	<a href="#">EconGoneCountry</a>
105	Closing Time	Semisonic	Agribusiness Management	Profit maximization, closing a firm, fixed and variable costs, marginal cost and revenue, management	<a href="#">YouTube</a>
106	One Big Country Song	LOCASH	Agribusiness Management	Profit maximization, closing a firm, fixed and variable costs, marginal cost and revenue, management	<a href="#">EconGoneCountry</a>
107	The Gambler	Kenny Rodgers	Agribusiness Management	Costs, game-theory, loss-aversion, output selection	<a href="#">Critical Commons</a>

### 3.1 BroadwayEconomics.com

BroadwayEconomics.com contains over 70 songs from show tunes that illustrate economic concepts (Rousu 2016). Only some of the songs that are relevant for agricultural economics are presented in this paper, as there are many others on topics like demand and supply, elasticities, and dozens of other economics topics. The songs on the site can be browsed or searched by topic, and there are sample discussion questions for educators to use posted with each song. Every song includes a description, video with call-outs, and discussion questions that could be used for in-class discussion, as homework assignments, or on quizzes or exams.

### 3.2 CriticalCommons.org

Critical Commons hosts more than just music and is a website where dozens of registered users have posted clips that can help with teaching. By using the search phrase “music for econ,” you’ll find dozens of songs on many different economic topics. Critical Commons also contains movie, TV, and news clips that cover economic topics that can be used to stimulate discussion, assigned as homework, or used on quizzes and exams.

### 3.3 DirkMateer.com

DirkMateer.com contains a plethora of econ-related teaching materials for both educators and students, including over a dozen songs, each with a description and video. There is a section for educators to share best practices and ask questions to one another, as well as a section for students to ask Dr. Mateer questions about economic topics.

### 3.4 EconGoneCountry.com

EconGoneCountry.com is designed to illustrate economic concepts in popular country music (Melichar 2018). The goal of the website is to make economics more relatable to undergraduate students by illustrating that economics is all around them. Definitions of economic concepts with links to relevant songs are contained in an index page, and there is also a search bar, which allows educators to find content that best fits their needs. As agriculture is often an important theme in country music, the website contains numerous examples for agricultural and environmental economics.

### 3.5 Econ.Video

Economics Media Library (Wooten 2018; Hobbs and Wooten 2021) hosts dozens of songs that can be used to teach economics. Like Critical Commons, this site also has clips from TV shows, movies, and more. All of the clips on the site provide a video along with a description. Some clips include discussion questions as well. These materials can be used either in class to stimulate discussions, be assigned to homework, or even be utilized as a more interactive portion of quizzes and exams.

### 3.6 Music4Econ.com

Music4Econ.com contains dozens of songs that can be used to teach economics. Each clip provides a video and description. There are also in-depth teaching guides that assist in implementing some of the songs in the classroom. The teaching guides provide questions (and answer keys) and course materials that can be implemented in class or for assignments.

## 4 Agricultural and Environmental Economics Songs

We highlight a select number of songs that can be used to teach five different topics within environmental economics: agribusiness, production and the firm, international trade, externalities, and public goods. Educators can find songs for other topics in Table 1.

### 4.1 Agribusiness

*Semisonic—“Closing Time”* (Semisonic 1998)

Semisonic sings “Closing Time,” which refers to the closing of a bar for the night. Although this bar isn’t closing permanently, there are several economic lessons that can be taken from this song. First, firms should stay open another hour (when legally allowed) when the marginal revenue exceeds the additional cost for remaining open. Presumably when a bar closes for the night, like when all firms close for the night, marginal costs exceed marginal revenue.

This song could also be used to introduce students to the idea on when a firm should shut down permanently. A firm should shut down in the short run when they cannot cover their fixed costs, and in the long run, if they cannot earn a profit. In this song, it is a short-run shut down that is considered. At closing time, the bar owner must think that the additional revenues brought in won’t cover the extra wages, materials, electricity, and so on, to keep the bar open.



Riley Green—*“I Wish Grandpas Never Died”* (Green 2019)

Riley Green’s *“I Wish Grandpas Never Died”* provides a list of wishes, one of which is: *“I wish the price of gas was low and cotton was high”* (Green 2019). This could be a good song to illustrate to students that many agricultural markets are close to perfectly competitive, with numerous producers that are price takers. Farmers, therefore, are at the whim of the market when it comes to commodity prices. Conversely, this song could also be used to discuss hedging strategies that can be taken against price fluctuations. For example, farmers are able to manage price risk through the use of futures and options contracts. Since a futures contract is an agreement to buy or sell a commodity at a predetermined price at a specific future date, farmers can hedge against price risks for a commodity by guaranteeing an established price before harvest (U.S. Department of Agriculture, 2020b). A study from 2016 found that over 47,000 U.S. farms used futures or options contracts to hedge price risk (U.S. Department of Agriculture, 2020b). Later in the song, they wish that *“farms never got sold”* (Green 2019). One of the major issues facing family farms today is competition from larger commercial operations, which take advantage of economies of scale. U.S. farms in 1945 averaged about 195 acres, whereas the average farm in 2019 was 444 acres (U.S. Department of Agriculture 1945, 2020a).<sup>3</sup>

## 4.2 Production Economics, Firm Behavior, and Profit Maximization

Luke Bryan—*“Rain Is a Good Thing”* (Bryan 2009)

*“Rain Is a Good Thing”* by Luke Bryan can be used for several purposes in teaching economics, including to discuss specialization, comparative advantage, and the difference between final goods and intermediate goods. Luke Bryan likes the rain, as it is an essential resource needed for the production of corn, which can then be used in the production of whiskey. He and his significant other both enjoy whiskey. Not only is rain good for Luke, but the farmers who he discusses at the beginning of the song also stress the importance of rain in farming.

The amount of rainfall, or lack thereof, also helps explain why different parts of the country specialize in different crops. For example, Iowa receives an average rainfall of 32 inches, while Kansas only receives 27 inches. As corn is a water-intensive crop to grow compared to wheat, it should be of no surprise that Iowa is typically one of the largest corn producing states, while Kansas is typically the top wheat producing state.

Nanci Griffith—*“Trouble in the Fields”* (Griffith 1987)

Continuing in the theme of rain as an important input in the agricultural production process is *“Trouble in the Fields”* by Nanci Griffith.<sup>4</sup> The song is set during the farm crisis of the 1980s, but a reference is made to the drought of the Dust Bowl. They sing:

*Our parents had their hard times fifty years ago  
When they stood out in these empty fields in dust as deep as snow  
...  
If this rain can fall, these wounds can heal* (Griffith 1987)

Without irrigation to supplement a decrease in the rainfall (an input), crop yield (an output) fell to zero during the Dust Bowl years of the Great Depression. The drought was so extreme that large parts of the High Plains received less than 10 inches of precipitation over several years (US Department of Commerce, N. O. A. A, 2019). However, farmers are aware that when the rain returns, agricultural production and life will return to normal. Using the production possibilities frontier (PPF), an instructor can show the decrease in rain during the Dust Bowl decreased the production possibilities of the High

<sup>3</sup> The USDA adjusted their figures for coverage after 1997.

<sup>6</sup> See Tinari & Khandke (2000) for other concepts from *“Trouble in the Fields”*

Plains, shifting the PPF inward. However, when the drought finally ended, and the rains returned, the PPF shifted back outward.

This song can be used to teach students about the three main inputs in the production process: land, labor, and capital. Water is categorized as land in the production process, but educators could also use this song to pivot and discuss other inputs. Modern agricultural production is heavily dependent on capital such as tractors, trucks, combines, and so on. During tough times, such as the 1980s farm crisis, farmers may have had to sell equipment to keep their farms, reducing their productivity. The song alludes to this when Griffith sings:

*But if we sell that new John Deere  
 Then we'll work these crops with sweat and tears.  
 You'll be the mule, I'll be the plow.  
 Come harvest time we'll work it out (Griffith 1987)*

This example can also be used to discuss productivity and the capital-to-labor ratio, which is falling as farm equipment is sold off.

“Trouble in the Fields” can also be used to teach about technological change and its impact on production. Prior to steam-powered or internal combustion engines, agricultural production depended quite literally on horsepower and physical, manual labor. These technological advancements expanded our ability to produce a final product, as seen through the PPF.

### 4.3 International Trade and Demand

*Beauty and the Beast*—“Gaston” (Disney 1991)

No one does anything like Gaston from the movie (and musical) *Beauty and the Beast*. He’s the best! (Just ask him.) In “Gaston,” we learn about how he is better than anybody else at just about any task. The people praising Gaston sing:

*No one hits like Gaston  
 Matches wits like Gaston  
 In a spitting match nobody spits like Gaston  
 ...  
 Who has brains like Gaston?  
 Entertains like Gaston?  
 Who can make up these endless refrains like Gaston? (Disney 1991)*

It is clear Gaston has an absolute advantage in production. This is a good song to use when teaching about trade because while Gaston has an absolute advantage, this does not mean that he cannot benefit from trade. This, of course, is because trading occurs based on comparative advantages. So just because no one “*hits like Gaston*” does not mean that Gaston cannot enjoy the benefits of trading with others (Disney 1991).

*Toby Keith*—“*Made in America*” (Keith 2011)

One of the main reasons economists support free trade is that it leads to specialization and greater efficiency. These lower production costs can then be passed along to consumers in the form of lower prices. As a result, purchasing products made in the United States often comes with a higher price tag. In “*Made in America*” by Toby Keith, an elderly farmer is willing to “*spend a little more in the store for a tag in the back that says U.S.A.*” (Keith 2011). Interestingly, this song can also be used to discuss determinants of demand, specifically tastes and preferences. It is often said that consumers “*vote with their wallets,*” and paying more for American-made products is a great example of this (Keith 2011).

Although the song may make it seem that international trade is detrimental and we should only purchase domestic goods and services, it is important to remember that economies have limited resources and must deal with opportunity cost. In “Made in America,” *“it breaks his heart seein’ foreign cars, filled with fuel that isn’t ours, and wearin’ cotton we didn’t grow,”* but what is the opportunity cost of increasing U.S. cotton production (Keith 2011)? There is only so much arable land, and much of it may be better suited for producing other crops such as corn, soybeans, and wheat. The United States may have a comparative advantage in corn and would be better off focusing resources on that commodity, as there may be a high opportunity cost of producing more domestic cotton. This song is great for illustrating the advantages of specialization and free trade, which can result in more goods and services at a lower price, benefiting domestic consumers.

#### 4.4 Externalities

*Ten Years After—“I’d Love to Change the World”* (Ten Years After 1972)

In the song “I’d Love to Change the World,” Ten Years After discusses environmental economics issues. The song starts by discussing population growth. A higher population creates a higher demand for food, having a negative impact on the environment. This idea has caused many to think overpopulation would lead to disastrous consequences from Thomas Malthus (1798) in the 1700s and others more recently (Sabin 2013), but doomsday predictions have turned out to be incorrect based on tremendous productivity growth in agriculture.<sup>5</sup>

*Uncle Lucius—“Keep the Wolves Away”* (Lucius 2012)

The negative effects of pollution on society’s standard of living can also be viewed through “Keep the Wolves Away” by Uncle Lucius. In the song, there are multiple references to market failures and negative externalities. The song tells the story of a young boy growing up in a lower middle-class family south of Houston, TX. The skyline where he grew up is *“colored by chemical plants,”* and in the music video, a drawing shows his house overshadowed by smokestacks and pollution (Lucius 2012). As a teenager, an oil tanker spills *“poison”* into Galveston Bay in the Gulf of Mexico, creating large external costs. Living in polluted areas decreases standards of living and can lead to negative health outcomes, so the family moves away *“where the sky isn’t heavy with refinery clouds”* (Lucius 2012).

Externalities that are uncorrected by proper taxation will mean there is too much pollution, relative to the optimal amount, given that firms are not internalizing the pollution costs. This song gives a good opportunity to introduce externalities and also discuss policies (e.g., taxes or cap-and-trade) that can bring pollution down to an economically optimal level.

#### 4.5 Public Goods

*Newsies—“Santa Fe”* (Menken 1992)

The other most common market failure discussed in applied economics courses are that of public goods. There are songs that can be used to teach about public goods as well. In both the prologue and the reprise of “Santa Fe,” from the musical *Newsies*, Jack sings about the clean air in Santa Fe, New Mexico. Clean air is a public good as its value does not diminish when an additional person consumes it, and it is difficult to exclude people from consuming it, even if the person is unwilling to pay. “Santa Fe” is a great song to play for students to set up a discussion about public goods.

*Luke Bryan—“Sunrise Sunburn Sunset”* (Bryan 2017)

Another example of public goods can be heard in “Sunrise Sunburn Sunset” by Luke Bryan. One of life’s great pleasures is watching a beautiful sunrise or sunset. What makes this experience even better is that any one individual’s consumption of a sunrise doesn’t make it any less beautiful or stunning for others.

<sup>5</sup> Some still make similar claims today (e.g., Prasad 2013; Hincks 2018).

The song also describes a full moon and a night sky lit up with stars, which a group of friends are all able to enjoy without decreased utility for any one individual.

## 5 Conclusion

Using music can help engage students. Given many songs have economic themes, some economists have created lists of songs educators can use to parlay the love of music into improved learning. But to this point there hasn't been a focus on songs that specifically work for agricultural, environmental, and applied economics.

In this paper, we highlight songs that can be used when teaching these topics. We've provided details on ten songs that cover topics on agribusiness, production and the firm, international trade, externalities, and public goods, providing a table that contains these songs plus an additional ninety-seven songs that can be used for teaching economic topics. All songs can be accessed for free.

We also include four lesson plans that educators can use to integrate songs and other activities to make their teaching more impactful in the attached appendices. Integrating the use of some of these songs into teaching is a low-cost way to become a better educator, provide lessons that reach more students, and help foster a love of economics among students.

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## Appendix 1: Lesson Plan on Agribusiness and the Shut Down Rule

### Teaching the Shut Down Rule Using Music and a Think-Pair-Share

#### Goals:

1. Students will understand a firm should shut down if  $P < AVC$  in the short run.
2. Students will understand a firm should stay open if  $P < ATC$  in the long run.

#### Time Needed:

25 minutes

#### Materials Required:

None

#### Overview:

Understanding firm decisions in the short run and long run can be a confusing concept for students. In the short run, a firm would choose to stay open if the price they are receiving for a product exceeds the average variable cost. Using a bar's closing time as an example can be ideal for this, as it should be easy for students to understand the variable costs involved in staying open another hour (bartender labor, input costs for alcohol), and the fixed costs that aren't factored (the rent for the bar).

#### Plan for the Classroom:

Note: the general concepts of average fixed costs, average variable costs, average total costs, and so on, should already have been covered prior to this lesson.

1. Have students come up with a list of all the variable and fixed costs of running a bar. Three key costs that should eventually get listed are hourly wages for bartenders (variable), input costs for drinks (variable), and the rent for the bar (fixed).
2. Play "Closing Time" by Semisonic.
3. Have students do a think-pair-share, and ask the following question. "Thinking about profits/losses, if a bar has total control over when they choose to close for the night, why would a bar choose to close down at 2:00 A.M. instead of 3:00 A.M.?"

#### Discussion:

Discuss that for a bar to stay open, the money the bar is bringing in during that last hour should exceed the variable costs.

- a. The money customers spend should exceed the hourly wage for the bartender and the costs for the drinks.
- b. Could discuss that it isn't the most profitable hour—and if every hour was like that, the bar wouldn't make a profit because they couldn't pay the rent. But staying open in the short run isn't about prices being more than *average total cost*, it is about prices being more than *average fixed cost*.

## Appendix 2: Lesson Plan on International Trade

### Teaching International Trade Using a Trading Game

**Goals:**

1. Teach students about agricultural international trade using music.
2. Allow students to experience trade and gains from trade in a simulation using candy.

**Time Needed:**

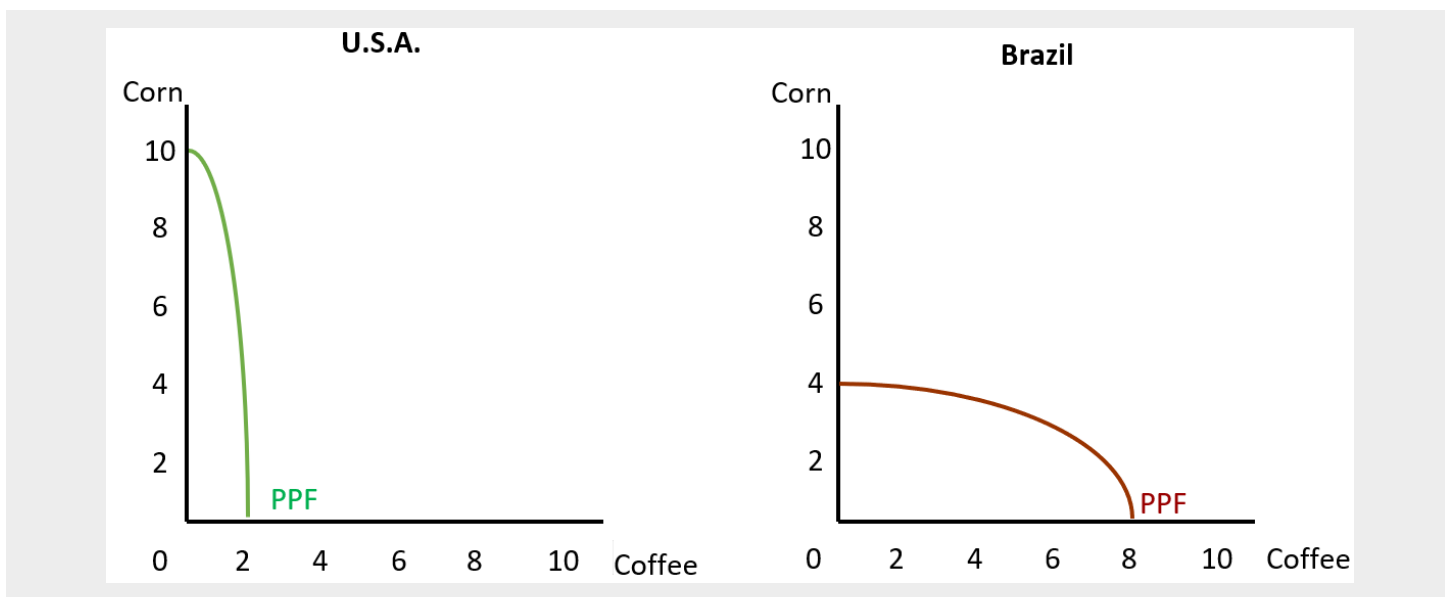
30 minutes

**Materials Required:**

Assorted candy (like the kind commonly sold around Halloween)

**Overview:**

International trade is the exchanging of capital, goods, and services, and in this case agricultural products across the borders from one country to another. The amount of production a country is able to produce is shown by the production possibilities frontier (PPF). The goal of international trade is for one country to acquire these goods/services that either cannot be produced domestically, or domestic production is not able to meet the demand (i.e., the quantity is outside of the PPF). This is especially important in agricultural economics, as not every country has the capabilities to produce all of the goods (e.g., the U.S. is very good at producing the crops of corn, cotton, soybeans, and wheat; however, we cannot produce enough coffee or cocoa to satisfy the demand of the entire country). Being the leading producer of a certain good is a lot like Gaston in the *Beauty and the Beast*, as Gaston is the best, having an absolute advantage. Having an absolute advantage does not mean that a country is not able to benefit from trade. A country can also have a comparative advantage, which is the production of a certain good at a lower opportunity cost. Let's look at an example of this using the hypothetical production of corn and coffee between the U.S. and Brazil:



We can see that the U.S. has an absolute advantage in corn ( $10 > 4$ ) while Brazil has an absolute advantage in producing coffee ( $8 > 2$ ). We can calculate the comparative advantage of each country by calculating the opportunity cost for each country to produce either good:

**U.S.:**

Cost of producing corn:  $10 \text{ corn} = 2 \text{ coffee}$  or  $1 \text{ corn} = \frac{1}{5} \text{ coffee}$

Cost of producing coffee:  $2 \text{ coffee} = 10 \text{ corn}$  or  $1 \text{ coffee} = 5 \text{ corn}$

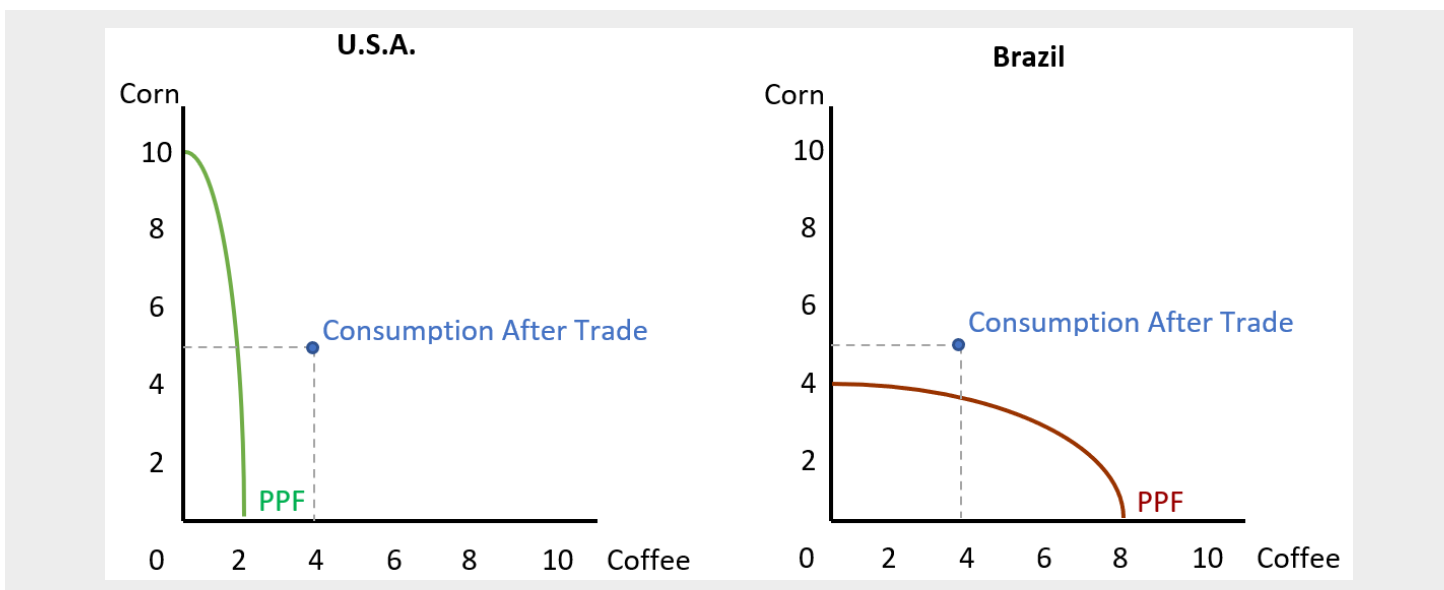
**Brazil:**

Cost of producing corn:  $4 \text{ corn} = 8 \text{ coffee}$  or  $1 \text{ corn} = 2 \text{ coffee}$

Cost of producing coffee:  $8 \text{ coffee} = 4 \text{ corn}$  or  $1 \text{ coffee} = \frac{1}{2} \text{ corn}$

*This U.S. has a competitive advantage in producing corn (since  $\frac{1}{5} < 2$ ), and Brazil has a competitive advantage in producing coffee (since  $2 < 5$ ).*

It makes a lot of sense for the U.S. to specialize in crops that we are good at producing efficiently and at a relatively low cost (such as corn, cotton, soybeans, and wheat) and export the surplus of these products to other countries. Similarly, we will import crops (such as coffee or cocoa) that we are not able to produce as efficiently. This is known as specialization and trade. The song “Made in America” discusses the importance of domestic production, especially when the product is something that the country specializes in, such as cotton. With specialization and trade, countries specialize in producing one good and trade it to another country; this allows both countries to consume outside of their PPF. For example, if the U.S. produces 10 corn, trading half to Brazil, and Brazil produces 8 coffee, trading half to the U.S., the production will look like this:



Since countries can consume outside of what they can domestically produce, they have received gains from trade.

**Demonstration/Activity:**

After defining and ensuring the students have an understanding of the terms above, tell each student they will now represent a country and will trade with other countries. Provide each student with a bag of 3–4 pieces of candy (be sure to get a wide variety of candy to ensure that everyone’s preferences can be met to a certain extent with trade), a slip of paper with the below table, and explain to them that these are the agricultural goods that they are able to produce given their country’s resources. Explain that this candy is theirs to keep or trade.

Name:	Round 1	Round 2	Round 3
	No Trade	Regional Trade	International Trade
Did you trade? (yes/no)	no		
Utility (1–10)			

Tell the students of all the different types of candy that are available in the room (they may not know what others have since they only have 3 pieces). After students are aware of the candy available, ask them to rank their utility from 1 to 10 with their items relative to everything that is available in the Round 1 column on their table.

After students have all rated their utility of what their country is able to produce without trade, allow them to trade with 1 other student only that is sitting next to them if they wish. After students have experienced regional trade, ask for a show of hands to see who traded and have the students record their results in the Round 2 column.

Now, allow them to trade internationally—with anyone in the class—if they wish. After students have experienced international, ask for a show of hands to see who traded and have the students record their results in the Round 3 column.

Collect the sheets of paper to enter the utility into excel and produce a graph of class total utility after each round to show how the utility increases with each round as trade becomes freer.

**Discussion:**

After the activity, ask for a show of hands to see if anyone did not trade at all? Ask what these individuals did not trade (perhaps nobody wanted to trade with them, or they did not wish to trade anything away). Next, ask for a show of hands to see if student’s individual utility increase? Make it a point to acknowledge how most individuals’ utility increased after trading with others. Next, ask students what their goal of trading was (perhaps they were more focused on obtaining their favorite type of candy, or some may have been focused on getting rid of something they particularly do not enjoy). Ask the students how this activity of trade within the classroom may apply to countries who wish to participate in international trade (and what would it be like if a country could only consume goods/services that they can produce)? End the discussion by asking for a show of hands of who thinks trade and free/open markets are good and who benefits?

## Appendix 3: Lesson Plan on Production

### Teaching the PPF Using Luke Bryan’s “Rain Is a Good Thing”

#### Goals:

1. Students will understand the purpose of the production possibilities frontier (PPF).
2. Students will learn that an increase in inputs/resources expands the set of production possibilities.

#### Overview:

Individuals and society must decide how to efficiently allocate scarce resources. The production possibilities frontier (PPF) model illustrates the combinations of two goods or services that an individual or society can produce if all resources are being used efficiently. The inputs, or resources, used in the production process include land, labor, and capital. Land is the geographic location used in production, labor is the physical and mental talents of workers, and capital is manufactured goods used to produce other final goods and services. In the PPF model, it is assumed that both the resources and technology used in the production process are constant or fixed. As a result, production is limited by the available resources and current level of technology.

But if inputs change, the PPF can change. Luke Bryan’s “Rain Is a Good Thing” can be used to help illustrate this.

#### Plan for the Classroom:

1. Do a think-pair-share where students graph a PPF for corn and soybeans.
  - a. Students create a PPF on their own.
  - b. Then compare with students next to them.
    - i. May wish to reassure students that each graph will likely be a bit different.
2. Have one student come up to the board and graph their PPF for the classroom.
3. Play “Rain Is a Good Thing” by Luke Bryan.
4. Tell students to assume that their first graph was with suboptimal rain conditions, but that an optimal amount of rain is now falling. Have students graph a new PPF for corn and soybeans.
5. Second graph should be further out than the first graph, noting increased efficiency.
  - a. With optimal rain levels, more corn, soybeans, or both corn and soybeans can be produced.

## Appendix 4: Lesson Plan on Public Goods

### Teaching Public Goods with Music and Games

#### Goals:

1. Students will be able to define a public good.
2. Students will understand the free-rider effect.
3. Students will understand that public goods tend to be underprovided in market environments.

#### Time Needed:

25 minutes

#### Materials Required:

Incentives, which could be money, candy, extra credit points, or something else.

#### Overview:

A public good is a product with two features:

- The quality does not diminish when an additional user consumes the product.
- It is difficult/impossible to exclude people from consuming the product.

Public goods will be underprovided in a pure market economy as individuals have an incentive to free-ride—i.e., consume what others purchase. Using both a simple game and the song “Santa Fe” from Newsies, this is a fun lesson for students to learn about public goods.

#### Plan for the Classroom:

1. Play the contributions game. If you have students contribute money, it is easy to do for money. Otherwise, you may need to find some other mechanism—like extra credit points. Two options are provided at the end of this lesson, feel free to edit to your taste.
2. Discuss public goods and their features. Key things to address:
  - a. Quality doesn’t drop with additional users.
  - b. Cannot exclude people, even if they don’t pay.
  - c. This leads to an incentive for individuals to free ride.
    - i. Can look at the game—all would be better if they contributed. But each individual had an incentive not to.
3. Play the song “Sante Fe” from Newsies. Before playing, ask the students to determine what public good is referenced.
  - a. Link here: <http://broadwayeconomics.com/santa-fe-newsies/>
4. Have the students get into small groups to determine:
  - a. What public good is referenced, and
  - b. Why it satisfies the features of a public good.
5. Discuss that because of the free-rider effect, too few public goods will be provided without intervention.

#### Discussion:

A public good has two key features, nonexcludable and nonrival. That is, the public cannot easily exclude somebody from consuming it, and the quality of the good does not diminish if additional users consume it. Because of these features, individuals have an incentive to free ride, or not pay for public goods themselves but enjoy what others provide.

This is considered a market failure because, unlike for most products, markets won't lead to the optimal quantity being produced. With public goods, too few will be produced without intervention. Usually, this intervention comes in the form of governments collecting taxes and then providing the good.

There are alternatives to government intervention, however. Elinor Ostrom won the 2009 Nobel Prize in economics (the first woman to win the prize) by showing that individuals can often create their own rules to combat market failures without the government intervening.

**Contributions Experiments (Option for Money)**

Name # \_\_\_\_\_

You have the choice to donate \$2 to the group from your personal account. If you do, everyone in class today (including yourself) will have \$0.35 contributed to their account.

For every person in the class who contributes, \$0.35 will be contributed to your account. (This is regardless of whether you contribute or do not contribute.)

Your choice (circle one)    **CONTRIBUTE / DO NOT CONTRIBUTE**

**Contributions Experiments (Option for points)**

Name # \_\_\_\_\_

You have the choice to donate 5 points from your grade. If you do, everyone in class today (including yourself) will have 1 point added to their grade.

For every person in the class who contributes, 1 point will be contributed to your account. (This is regardless of whether you contribute or do not contribute.)

Your choice (circle one)    **CONTRIBUTE / DO NOT CONTRIBUTE**



## Teaching and Educational Methods

# Structure, Flexibility, and Consistency: A Dynamic Learning Approach for an Online Asynchronous Course

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JEL Codes: A20, A22

Keywords: Asynchronous, economics, group learning, online teaching, videos, teaching

### Abstract

COVID-19 forced many instructors to migrate their practice online and created a need to develop a new online teaching model. This article proposes an online asynchronous model specifically designed for an economics course. This teaching model was designed with three objectives: consistency, structure, and flexibility. It builds on the capability of learning management systems (LMSs) to create a straightforward learning path for students. The model delivers theoretical and practical knowledge and, although asynchronous, describes the instructor's key role. It embraces strategies to reduce social isolation arising from online, asynchronous teaching models.

## 1 Introduction

The COVID-19 crisis has forced a majority of instructors to move their teaching online. This move was abrupt and unexpected. Although the profession has shown remarkable adaptation to the new circumstances, there is a growing need to document online teaching practice and to disseminate online teaching methods.

Before the COVID-19 crisis, students could select their preferred content delivery method (online or in person) by enrolling in courses or universities offering online content. At many colleges and universities around the world, students did not choose the online model; it was imposed on them. The online model has created motivation and engagement challenges for the students who did not choose it (Wooten, Geerling, and Thomas 2020), and it has reinforced in-person modalities' existing challenges, such as attendance, participation, and resource availability (Alawamleh 2020). Moreover, it has increased students' anxiety about their educational, personal, and financial situations (Aucejo et al. 2020; Aristovnik et al. 2020; Aguilera-Hermida 2020; Brown et al. 2021; Roux et al. 2021).

Kofoed et al. (2021) and Orlov et al. (2021) show evidence of average learning losses in their surveyed economics courses during the COVID-19 pandemic. However, Orlov et al. (2021) show that strategies similar to those discussed in this article can mitigate negative effects. For instructors, online teaching imposes new constraints, but it also relaxes some in-person teaching constraints. One of the latter is the administratively defined length of a lecture, typically 75 to 80 minutes for twice-weekly classes and 50 minutes for thrice-weekly classes. Online teaching provides greater flexibility in the allocation of teaching time, especially in asynchronous or self-paced teaching modalities. For instance, the teaching model discussed in this article proposes learning blocks of 30 or fewer minutes, giving students a high degree of flexibility when organizing their learning schedules.

Distance education and asynchronous online courses existed before the COVID-19 pandemic. Significant literature supports the design of such courses. Swan (2001) shows that students' learning and satisfaction with a course are improved by a straightforward course design, regular communications with instructors, and ability to interact with other students. Connections between instructors and students are

a key educational need in asynchronous online approaches. In their extensive review of the relevant education literature, Conley, Lutz, and Padgitt (2017), Niess and Gillow-Wiles (2013), and Yuan and Kim (2014) report that students typically feel less supported by both instructors and other students in asynchronous online modalities. They also report the literature's concerns about social isolation when students learn online, especially asynchronously. Yuan and Kim (2014) provide four sets of guidelines to create learning communities in online courses. These guidelines help instructors answer four significant questions about building learning communities: when, who, where, and how. For instance, Yuan and Kim (2014) suggest that community building be a continuous term-long objective pursued by both students and instructors and that course design allow for task-oriented collaborative interactions. The teaching model presented in this article includes a group project designed according to Yuan and Kim's (2014) guidelines. Through randomized control trials conducted in Germany, Hardt, Nagler, and Rincke (2020) show that community-building strategies effectively increase students' morale and motivation. Specifically, they showed that regular mentoring sessions benefit students' learning in an online learning environment.

This article presents an online, asynchronous teaching model for economics courses. This Dynamic Learning model allows students to access course material and all the necessary guidance for accommodating different learning styles. Evidence that such a model is valuable for students' engagement and learning is provided by Conley, Lutz, and Padgitt (2017); Hardt, Nagler, and Rincke (2020); and Orlov et al. (2021). The model was created with the CANVAS Learning Management System (LMS). CANVAS's capabilities should be replicable in most other LMSs because it uses only basic features of those systems. In addition to presenting the Dynamic Learning model, this article explains how to adapt it.

## 2 The Course: Theory and Practice

The Dynamic Learning model was created to facilitate delivery of content for a cost-benefit analysis course. This course is offered at the third-year level and has first-year prerequisites. Thirty-four students were enrolled in fall 2020, when the course was offered.

Course components and their grade distributions are as follows:

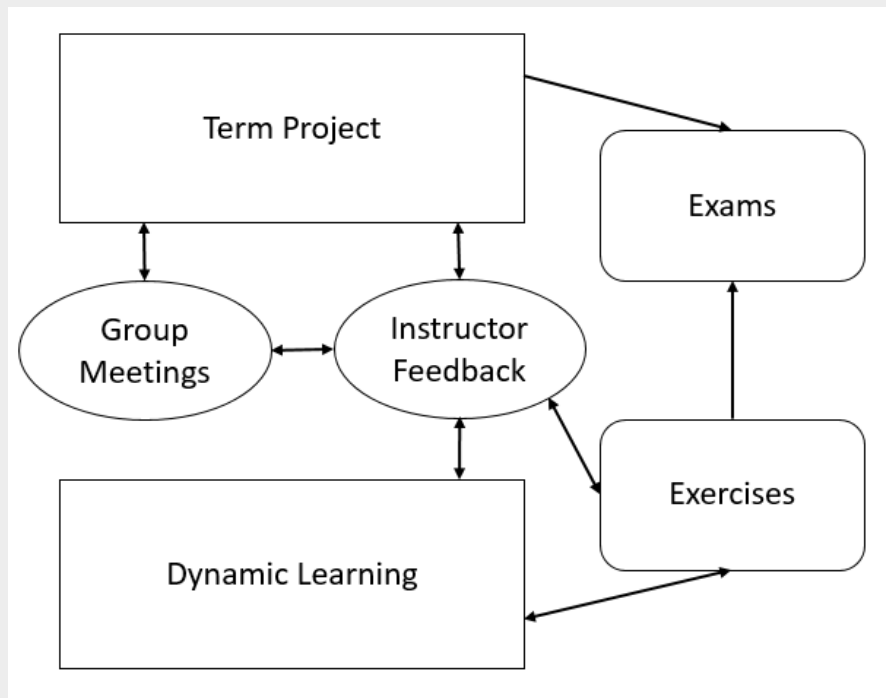
- |                                  |            |
|----------------------------------|------------|
| • Dynamic Learning Quizzes       | 5 percent  |
| • Team Project                   | 40 percent |
| • Midterm Exam (chapters 1 to 4) | 20 percent |
| • Final Exam                     | 35 percent |

The course helps students understand the theoretical origins of cost-benefit analysis and the way to perform it. The theory is supported by the midterm and final exams, and the practical application is supported by the term project. In turn, the project provides real-life examples to support the theory.

## 3 Theoretical Path and Dynamic Learning

Students study the theory using an online, asynchronous model in the course LMS. This Dynamic Learning model gives students access to all the information required to complete the course and the opportunity to revisit already learned material at their convenience. It emphasizes high-frequency, low-stakes assessment. The graded basic quizzes aim to verify basic knowledge rather than deep understanding. That understanding is tested during the midterm and final exams with questions and exercises relating to the course's most challenging content. A group project allows students to develop practical knowledge. The following subsections describe in detail what Dynamic Learning is and how to create it.

**Error! Reference source not found.** provides a schematic of the teaching model, in which the instructor is the center. In an in-person course with a group project, the instructor potentially interacts at the class, group, and individual levels. The model was created with these three levels in mind. Similar levels of interaction are discussed in Picault (2021a). Dynamic Learning provides for intervention at the class level and gives the instructor flexibility to interact at the group and the individual level.



**Figure 1. The Teaching Model**

### 3.1 Primary Objectives: Structure and Flexibility

Students that had transitioned online in the previous term were asked about their expectations of an online course. They indicated the need for both structure and flexibility. Although structure and flexibility appear antithetical, an asynchronous, scaffolded model for content delivery can provide both. Scaffolded delivery facilitates structure, whereas asynchronous delivery increases flexibility, a requirement given that students in the course would be located in different time zones. The asynchronous, scaffolded model for content delivery would require a redesign of course content around concepts.

### 3.2 Course Content Redesign

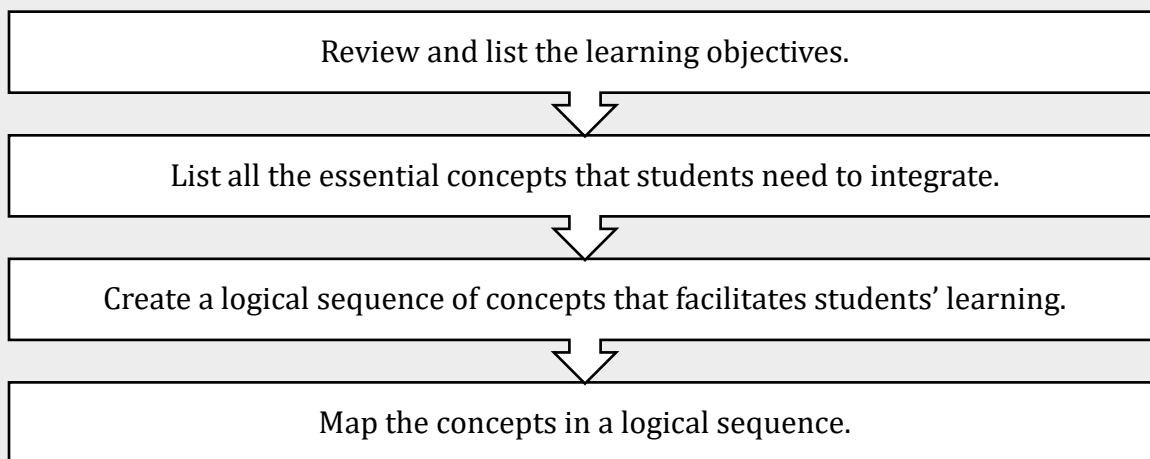
Directly transferring face-to-face practices to an online learning environment and focusing on disciplinary-appropriate content are insufficient to generate cognitive engagement and a positive learning experience (Aguilera-Hermida 2020; Lemay, Doleck, and Bazelais 2021). Therefore, the content of the cost-benefit analysis course needed to be adapted to the online environment. It required a significant restructuring for scaffolded delivery and logical content progression.

Economics content related to COVID-19 was contemplated. Such content is available in Mateer and Coppock (2020) and Zhang and Ramse (2020). However, Wooten and Al-Bahrani (2020) recommend care when referring to the pandemic, which has had mental, physical, and economic consequences for some students.

Discussions with students highlighted the need to keep divisions of course material consistent with chapters in the course textbook. This feedback led to an LMS module for each chapter in the textbook. But for structure and flexibility, the model's primary organizing factor was course concepts.

Structure is accommodated because the scaffolding process moves from concept to concept following a logical order. Flexibility is accommodated because students learn each concept in a short amount of time (the course was designed so that each concept would be studied for 30 or fewer minutes). In other words, students gained flexibility when organizing their time. Instead of fitting hour or longer lectures into their schedule, they only had to fit 30-minute course concepts.

For each chapter in the course, the concept-oriented content redesign followed the four-step process presented in **Error! Reference source not found.**



**Figure 2. Redesign process**

The content map was then used to create chapter modules in Canvas. **Error! Reference source not found.** shows how a typical chapter appears in Canvas.

### 3.3 Dynamic Learning in Practice

The goal of the Dynamic Learning model is to guide students along a path from which they will not stray. For consistency, each book chapter has its own module, within which, for structure, students progress through a logical sequence of concepts (**Error! Reference source not found.**). Each concept is explored in a brief description, a lecture video, and a quiz.<sup>1</sup> Integrating all the material about a concept gives students the flexibility to use the material in a way that makes sense to them.

The lecture videos were specifically designed and recorded to present the course concepts. They last between 5 and 15 minutes, in line with the typical student's attention span for such videos (Geri, Winer, and Zaks 2017; Guo, Kim, and Rubin 2014). Hew (2016) recommends providing lecture slides with videos. Students can use the slides to take notes or review material.

Depending on video length and content difficulty, quizzes could consist of 3, 5, or 8 questions.<sup>2</sup> **Error! Reference source not found.** shows the instruction part of a quiz with a lecture video and a link to the slides. The quizzes were not designed to test deep learning or skills utilization.<sup>3</sup> Their objective is to give students the opportunity to immediately reflect on the concept at hand. Because access to course content relating to the subsequent concept is unavailable until a quiz score of 6/8, 4/5, or 3/3 is attained, students are forced to progress through the logical sequence of concepts.

<sup>1</sup> When possible, other relevant resources were embedded in the course material. Briguglio et al. (2020), Picault (2019), Picault (2021b), and Wooten (2018) list videos and other resources suitable for online economics instructions.

<sup>2</sup> The majority of quizzes had eight questions.

<sup>3</sup> Midterm and final exams are used to test deep learning and skills utilization.

▼ Chapter 3: Conceptual Foundations of Cost-Benefit Analysis <span style="float: right;">Prerequisites: Chapter 2: Predicting and Monetizing Impacts</span>	
<span style="border: 1px solid gray; border-radius: 15px; padding: 2px 10px;">Complete All Items</span> <span style="float: right;">⋮</span>	
<b>Conceptual and Practical Bases for CBA</b> Mark done	⋮
<b>Pareto Efficiency</b> Mark done	⋮
<b>Pareto Efficiency</b> 8 pts   Score at least 6.0	⋮
<b>Potential Pareto Efficiency</b> Mark done	⋮
<b>Potential Pareto Efficiency</b> 8 pts   Score at least 6.0	⋮
<b>Fundamental Issues with WTP</b> Mark done	⋮
<b>Fundamental Issues with WTP</b> 8 pts   Score at least 6.0	⋮
<b>Concluding Remarks - 3</b> Mark done	⋮

**Figure 3. Example of A Chapter Module**

## Instructions

The goal of this part of the module is to define and explain the Pareto efficiency concept, its appeal for decision-making, and its practical limitations.

First, watch the following course video (corresponding slides are available [here](#) ).

Then, answer the following questions. You need to score 6 out of 8 to access the next part of the module.



**Figure 4. Instructions and Introduction for A Typical Quiz**

Appreciation for the Dynamic Learning model was expressed in students’ evaluations, from which the following anonymous comments were drawn:

*“The lecture video, followed by a brief quiz afterwards kept me on top of the course material. I also liked the feature that prevented you from entering a module if you had not completed the previous module as it allowed me to stay organized when learning the course material.”*

*“I loved the shorter videos with the quiz. I found it so much easier to engage with and get done.”*

*“(T)he content was structured in such a way that makes sense for this format (short, concise videos for the lecture material with frequent small quizzes to test knowledge and encourage active recall).”*

### 3.4 Weekly Progression

Although the Dynamic Learning model creates a straightforward learning path, it does not help students know when to work on what. One solution is to provide a course schedule that identifies the progression of course objectives. A weekly schedule keeps attainment of the objectives manageable. For the cost-benefit analysis course, the weekly objective was simply learning a core concept, which means working through a module’s components, including taking quizzes and completing exercises. **Error! Reference source not found.** shows the course schedule provided to students on CANVAS. The course schedule allowed students to plan study time for the course. It was accessible from day one on the first page of the LMS, where it could not be missed.

Week 1: Course Presentation	
Week 2: <a href="#">Chapter 1</a> and <a href="#">Chapter 2</a>	
Week 3: <a href="#">Chapter 2</a> and <a href="#">Chapter 3</a>	
Week 4: <a href="#">Chapter 4</a>	Topic Announcement and Team Contract (due September 28th)
Week 5: <a href="#">Chapter 5</a>	
Week 6: Midterm - Oct 16th - 10:30	
Week 7: <a href="#">Chapter 6</a>	
Week 8: <a href="#">Chapter 7</a>	Progress Report (due Oct 30th)
Week 9: <a href="#">Chapter 8</a>	
Week 10: <a href="#">Chapter 9</a>	
Week 11: Group Work	
Week 12: Group Work	Video Presentation (due November 23rd)
Week 13: Final report	Final Report (due November 30th)

**Figure 5. Course Schedule**

### 3.5 Exercises

The Dynamic Learning model is useful for delivering content and testing basic understanding. However, students must be prepared for the midterm and final exams that test higher levels of understanding, including mathematical, statistical, and graphical aptitudes. Such preparation requires students to complete problem-solving exercises directly targeting these higher levels of understanding. Therefore, a list of exercises from the textbook and from past exams for each course chapter was provided with the chapter's content. The week after students were instructed to solve a problem, they could access a video demonstrating the problem's solution, as shown in **Error! Reference source not found.**

#### Ex 2

A town's recreation department is trying to decide how to use a piece of land. One option is to put up basketball courts with an expected life of eight years. Another is to install a swimming pool with an expected life of 24 years. The basketball courts would cost \$180,000 to construct and yield net benefits of \$40,000 at the end of each of the eight years. The swimming pool would cost \$2.25 million to construct and yield net benefits of \$170,000 at the end of each of the 24 years. Each project is assumed to have zero salvage value at the end of its life. Using a real discount rate of 5 percent, which project offers larger net benefits?



**Figure 6. A Typical Exercise with a Video Demonstrating the Solution to a Problem**

## 4 Building the Community Feeling

The Dynamic Learning model might appear to allow the instructor to be absent. It actually relies strongly on instructor-student interaction in accordance with the literature emphasizing how essential this interaction is for student engagement (Swan 2001) and in response to the literature raising concerns about students' social isolation in online asynchronous course settings (Niess and Gillow-Wiles 2013; Yuan and Kim 2014). The Dynamic Learning model reflects five community-building guidelines:

*Guideline 1 (when):* The effort to build a learning community should be made from the beginning of a course and continued throughout the term.

*Guideline 2 (who):* Both students and instructors should be involved in building the learning community.

*Guideline 3 (where):* Use both synchronous and asynchronous technologies to create a shared space in which students and instructors interact.

*Guideline 4 (how):* Encourage both task-oriented discussions and social interactions.

*Guideline 5 (how):* Assign students tasks that require collaboration.

Instructor-student meetings were facilitated by calendly.com, which allows students to directly book Zoom meetings during the instructor's windows of availability.<sup>4</sup> One-on-one meetings were very popular with students, who used them to discuss course material and any concerns. They allowed multiple such meetings for every student registered in the course.

Meetings of groups with the instructor were necessitated by group projects. The minimum time requirement for these meetings was 15 minutes every second week, but the teams of four to five students were informed that it was possible and preferable to interact more often. Most teams met once or twice a week with and without the instructor. These small-group meetings led to productive instructor-guided and peer-guided discussions. Hogan, Nastasi, and Pressley (1999) note the importance of both types of discussions, finding teacher-guided discussions to be an "efficient means of attaining higher levels of reasoning and higher-quality explanations" and peer discussions to be "generative and exploratory" (Hogan, Nastasi, and Pressley 1999, 379).

Although the meeting strategy required a substantial time commitment, students recognized it as an advantageous, as suggested by these anonymous comments in instructor evaluations:

*"[The instructor] worked hard to develop a strong line of communication between himself and his students given the online situation."*

*"He made himself approachable and made students feel connected to the course in a similar way to in-class lectures."*

*"He made me feel more connected through bi-weekly mandatory meeting with our group project and helped in any way he could with the content."*

## 5 The Group Project

For the cost-benefit analysis course, students must perform a cost-benefit analysis of a project or a policy of their choice. Students are instructed to follow the 10 steps of a cost-benefit analysis presented in Boardman, Greenberg, Vining, and Weimer (2017). In other economics courses, the group project could focus on any relevant and real-life-related project, such as an industry analysis or a policy proposal.

The group project requires students to apply the theory they learn in the Dynamic Learning model, and it is critical for community building because it facilitates interactions among students and between students and the instructor. Working as a small group is recommended in asynchronous frameworks because it increases the frequency and quality of discussions (Bliss and Lawrence 2009).

Some students appreciated the way that the group project brought together the course's theoretical and practical elements and created a community feeling.

*"The term project was very good at giving students a chance to put into use the skills the course was meant to teach."*

*"Working on an actual CBA was my favorite part and also meeting regularly with him [the instructor] was very helpful. The fact that this was a group project helped a lot with making new connections and learning skills like coordinating through time zones and delegating tasks."*

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<sup>4</sup> Use of Calendly was suggested by Abdullah Al Bahrani and Paloma Raggo.



## 5.1 Timeline and Grade Distribution

The group projects begin the day after announcement of the teams' composition.<sup>5</sup> Teams were randomly formed because the online format made it difficult for students to establish their own groups. **Error! Reference source not found.** shows the deadlines for the project. The group project followed a four-step process that allows students to regularly work together and clearly understand deliverables.

**Table 1. Important Dates for the Team Project**

Dates	Work
September 28	Topic Announcement
October 30	Progress Report
November 23	Video Presentation
November 30	Report

The group project is worth 40 percent of the final grade. This 40 percent is distributed among three project components as shown in **Error! Reference source not found.**.

**Table 2. Grade Distribution**

Progress Report	Video Presentation	Report
10 percent	10 percent	20 percent

## 5.2 Topic Announcement

A week after the beginning of the group project, students must briefly describe the project or policy they want to analyze and sign a team contract. The contract requires the students to set internal dates for drafts, to book regular group meetings, and to set internal rules for discussion and conflict resolution. The instructor provides feedback on the chosen projects' relevance as well as feasibility within the given timeframe and then invites students to their first team-instructor meeting. Teams in the cost-benefit analysis course refined the scope of their projects on the basis of the instructor's feedback.

## 5.3 Progress Report

A progress report is due about a month after the topic is defined. The progress report allows the instructor to verify that students are making sufficient progress and for students to demonstrate that they (1) have completed the project's first steps and (2) have a plan for the project's next steps. These objectives entail provision of a bibliography and a description of how each reference will be used in the final project report. The syllabus states that

- Students themselves must write summaries; a copy/paste of the abstract is not an acceptable summary.
- The bibliography must include multiple academic references.
- Most of the information/data used in the final report should be presented in this bibliography.

Work on the bibliography was designed not only to ensure that students access existing knowledge—proficiency #1 in Hansen (2001) but also to give the instructor an opportunity to provide more targeted feedback and verify the intake of coaching in group meetings. If the bibliography is of insufficient quality, the instructor has an opportunity to advise the group to reframe their project.

<sup>5</sup> In the institutional setting of the course presented in this article, many students move from course to course before making their final selections. To avoid the need to rebalance teams in the event that some students exit the course after the start of the learning term, the group project does not begin when the course begins. Another benefit of this strategy is to allow students to adapt to the Dynamic Learning model before having responsibilities related to the group project.

## 5.4 Video Presentation

At the end of the learning term, students must hand in a video. The video (15 minutes long) must demonstrate that students were able to select and organize the essential information—not an easy task when lot of content has been produced, as is typically the case. The video describes the project, important costs and benefits, principal sources of risk, and recommendations. The videos give the instructor an opportunity to offer additional feedback before final reports are delivered one week later.

## 5.5 Report

The final report is submitted on the last day of class. The report (50 or so pages in length) must document the process, conclusions, and recommendations of the team's cost-benefit analysis.

## 5.6 Work Submission

Deliverables can be directly uploaded on the LMS in a module explicitly created for the group project. **Error! Reference source not found.** shows how the module is organized.

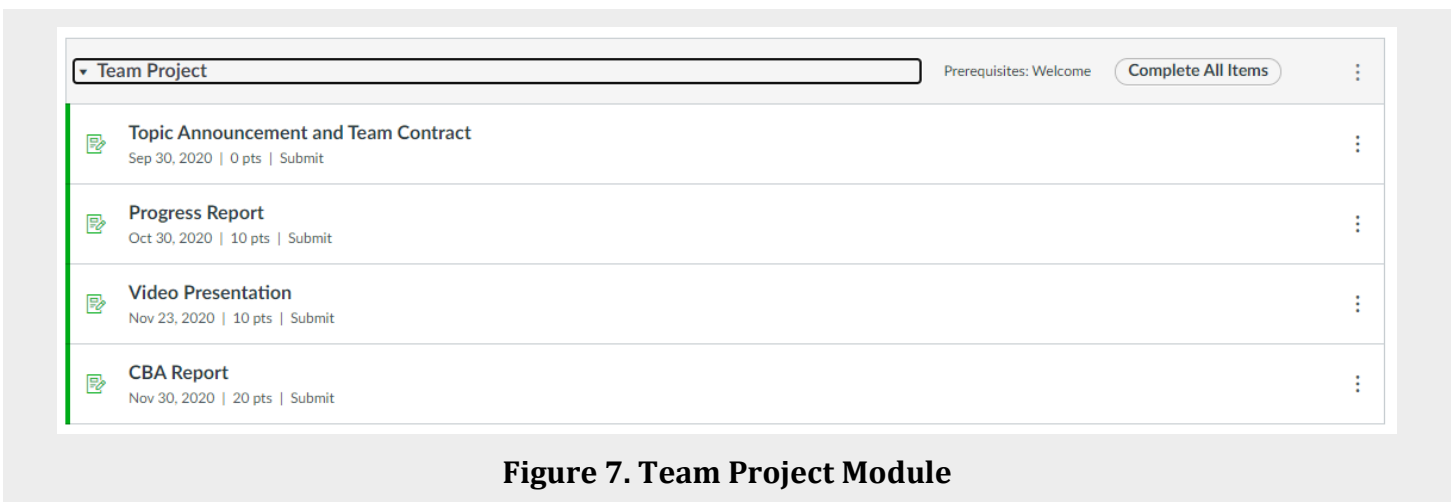


Figure 7. Team Project Module

## 5.7 Group Dynamics

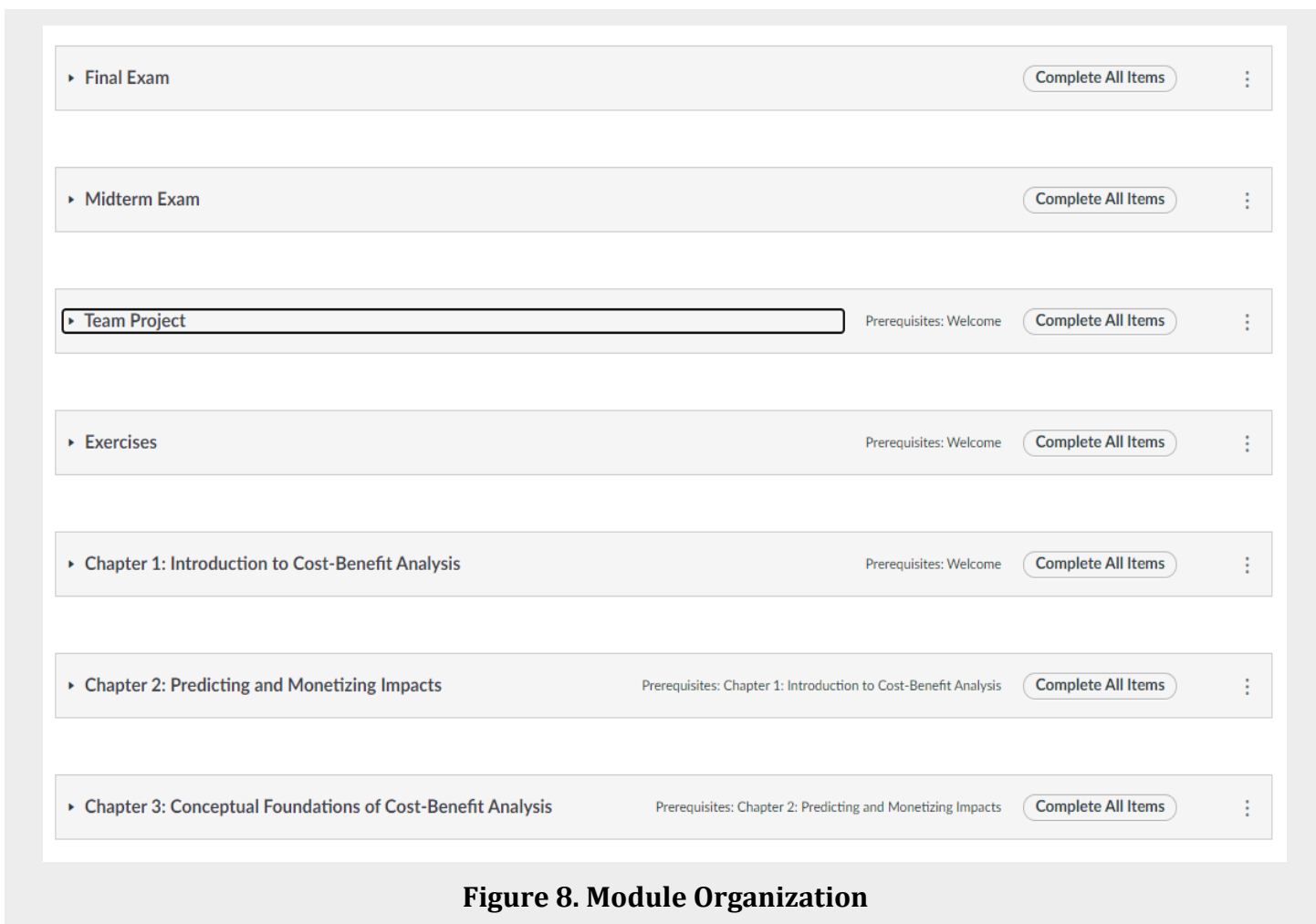
As Watkins (2004) and Davies (2009) suggest, students sometimes do not behave fairly to one another when working in groups. Free riding, sucker effects, and other issues may arise. It is therefore essential to have strategies to mitigate negative behaviors as much as possible.

The cost-benefit analysis course followed Davies' (2009) recommendations for mitigating negative behaviors. Specifically, students were instructed (1) to report any negative behaviors to the instructor (without fear of being identified as the giver of this feedback to other students), (2) to remain in one group for the whole term to foster socialization and solidarity, (3) to sign a team contract containing one set of rules for all groups as well as any other rules desired by team members (4) to create a task checklist, and (5) to voluntarily (and anonymously) nominate for extra credit another group member who made an exceptional contribution.<sup>6</sup> In addition to these measures, regular group meetings allowed the instructor to observe any negative behaviors.

<sup>6</sup> One section of the contract addresses how to behave respectfully in a group, acknowledging diversity of backgrounds and opinions.

## 6 Visual Organization of the LMS

Swan (2001) describes how a straightforward course structure and content delivery method facilitates students' interaction with course material. Both are essential for an online, asynchronous course because students must find their way mostly independently. Therefore, each important course element—textbook chapters, exercises, exams, and the team project—has its own module. **Error! Reference source not found.** shows some of the modules.



**Figure 8. Module Organization**

A Welcome module was designed to provide information about the instructor and the course. It included the syllabus, a short video of the instructor, the course schedule, and an FAQ page. Excellent visual organization improves the experience of students by creating consistency and structure, thereby engendering trust in the learning platform.

## 7 Concluding Remarks

This article presented an asynchronous content delivery model created in response to the COVID-19 crisis with three objectives: consistency, structure, and flexibility. At its core is the Dynamic Learning model, which helps students understand course theory and prepares them to apply it. The model was supported by an extensive offering of virtual office hours and group meetings to build a feeling of community among students.

Students responded positively to the asynchronous content delivery model, and they performed as well as students who had taken the course in person. The model seems to have created the guidance students were looking for during this abrupt but essential transition to online learning. However, further

research is necessary for this online teaching model to be applied efficiently to courses with large student enrollments. In such courses, frequent one-on-one meetings with students and management of large-scale group projects may not be feasible.

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## Teaching and Educational Methods

# Integrating Experiential Learning into a Food Systems Framework: An Application to Promote Food Deserts and Food Access Concepts Among College Students

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JEL Codes: A, I

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### Abstract

Food access is a transdisciplinary topic that may or may not be included in college curricula. Central to this concept is the notion of a “food desert,” or an area without access to food outlets that sell nutritious foods at affordable prices. The U.S. Department of Agriculture provided competitive grants to higher education institutions to develop course modules that raise awareness of the issue of food deserts among future decision makers and equip them with the problem-solving skills needed to address this social problem. In this paper, we describe the outcome of one such educational grant, a course module focused on the introduction of food deserts and the factors involved in addressing the problem of access to healthy food for lower socioeconomic segments of the population.

## 1 Introduction

*“Tell me, and I will forget. Show me, and I may remember. Involve me, and I learn.”*

—Benjamin Franklin

The issue of poor food access—the inability or difficulty to procure healthy foods at an affordable price—is a critical one, as it is a fundamental component of an individual’s ability to achieve food security (FAO 2008; Caspi et al. 2012). Studies have shown a relationship between the inability to access healthy, fresh foods and negative health outcomes, such as obesity and diabetes, which is why many global health organizations have made it a priority to provide resources to underserved communities in an effort to alleviate the burdens associated with poor food access (Wrigley et al. 2003; Moore and Diez Roux 2006; Black and Macinko 2008; Treuhaft and Karpyn 2010; Ver Ploeg and Wilde 2018; Office of Disease Prevention and Health Promotion 2019). The inability to access fresh food has only intensified as the COVID-19 pandemic has heightened our awareness of the hardships people living in low-access areas face in order to safely secure nutritious foods. Given the significance of this topic, its persistence in society, and the lack of formal coursework on this issue, this paper provides a framework for instructors to integrate a 1-week learning module on this topic into undergraduate courses in agribusiness and/or other pertinent courses.

The concept of food access is made up of many components. Caspi et al. (2012) identify one dimension of food access as “food accessibility,” which refers to the geographic or locational aspect related to acquiring food and is often measured as the physical distance to the nearest supermarket or large grocery store. The U.S. Department of Agriculture (USDA) defines areas with extreme food inaccessibility, “food deserts,” as “urban neighborhoods and rural towns without ready access to fresh,

healthy, and affordable food” (USDA 2020). Not only are these communities devoid of supermarkets and large grocery stores generally associated to carry fresh produce and perishable items (Cobb et al. 2015; Chenarides and Jaenicke 2018), but they are often overwhelmingly served by fast-food restaurants and convenience stores that offer few healthy, affordable food options (Cooksey-Stowers et al. 2017). An estimated 17.1 million Americans, or 5.6 percent of the population, reside in so-called food deserts (USDA-Economic Research Service 2019) despite attention given in the popular press to the issue of food deserts; the challenge of improving food access persists, with the USDA noting the number of low-income, low-supermarket-access census tracts increasing slightly over the 5-year period from 2010 to 2015 (Rhone et al. 2017).

Considerable research suggests that areas of poor food access are the result of conditions that would not make it profitable for a supermarket or large grocer to enter (Bitler and Haider 2011; Ellickson 2007, 2013; Cleary et al. 2018). These factors include low demand coupled with high fixed costs of entry. A myriad of policies exist to incentivize demand (e.g., SNAP) and offset costs for retailers to enter those areas (e.g., Healthy Food Financing Initiative), yet countless communities remain without adequate access to affordable, healthy food.

Understanding the issue of food access requires a firm grasp of topics that span supply chain management, agribusiness, economics, marketing, sustainability, and nutrition, among other fields. Through informal conversations with several faculty at the authors’ institutions, it was learned that the issue of food deserts is not widely discussed in business and agribusiness classes. Further, upon querying students in their classes—representing core business disciplines—the authors discovered that their upper-level college students (from two higher education institutions in the Southwest and Northwest) are largely unfamiliar with the term food desert and with the broader issue of fresh food inaccessibility in lower socioeconomic neighborhoods. Addressing the issue of food deserts involves the coordination of several fields; due to its transdisciplinary nature, it is critical that students from a diverse set of disciplines be educated on the issue of food accessibility. Moreover, an appreciation of the multitude of lenses through which professionals from diverse fields might approach this issue is essential (Abubakari 2018).

When seeking to address the issue of poor food access, and the resultant host of social, health, and economic costs of insufficient access, university classrooms can serve as a platform to educate future professionals on these issues and challenges. Indeed, the project presented in this paper was funded by a USDA educational challenge grant. The USDA lists as one of their strategic initiatives for 2018–2022, the provision to all Americans of “access to a safe, nutritious and secure food supply,” specifically, stating the goal of “ensuring Americans have access to food and a healthful diet” (USDA 2018). In this paper, we present a course module that aligns with the USDA initiative.

## 2 Issue and Objectives

There is a void in business and agribusiness educational material on food deserts. The authors searched large databases in the fields of agriculture and business (e.g., Agricola) for college-level instructional materials on food deserts. While much research has been done in this area, the authors did not find any type of instructional module similar to what they have compiled. Additionally, the aforementioned USDA grant was awarded because of the perceived need for such a module. The teaching module presented in the current paper addresses this need by offering a brief, 1-week course module that integrates a current policy issue with research training. The authors aimed to educate college students on food deserts—what they are and why they exist—and to use the example of food deserts to guide students in developing critical and creative problem-solving.

Food deserts are an outcome of a complex food system. Introducing students to the Food Systems Framework (National Research Council 2015), which illustrates the complexity of the food system, along with its interconnectedness to the environment, provides students a robust framework to address a variety of food supply, distribution, and consumption issues. Mere lecturing or reading about these



problems, the authors believe, are not as compelling as “doing” or “experiencing.” Access to food is regarded as a key indicator of well-being for American households (Azétsop and Joy 2013), yet students may be graduating college without having an understanding of the food system and its complexity. Thus, the objectives of this project and paper are to provide college educators with a 1-week course module that engages students and meets the following learning objectives:

1. Introduce students to the concept of food access and deserts, as well as their antecedents and consequences;
2. Introduce and incorporate a Food Systems Framework into the discussion of food deserts;
3. Discuss the different approaches to research and their importance and value;
4. Impart an appreciation for the complexity of approaches and solutions needed in addressing complex social issues, such as food access and food deserts.

The current paper aims to present the efficacy, in terms of engagement, output, and student evaluation, of an experiential learning (EL) lesson that utilizes a Food Systems Framework to educate students on the issue of food deserts.

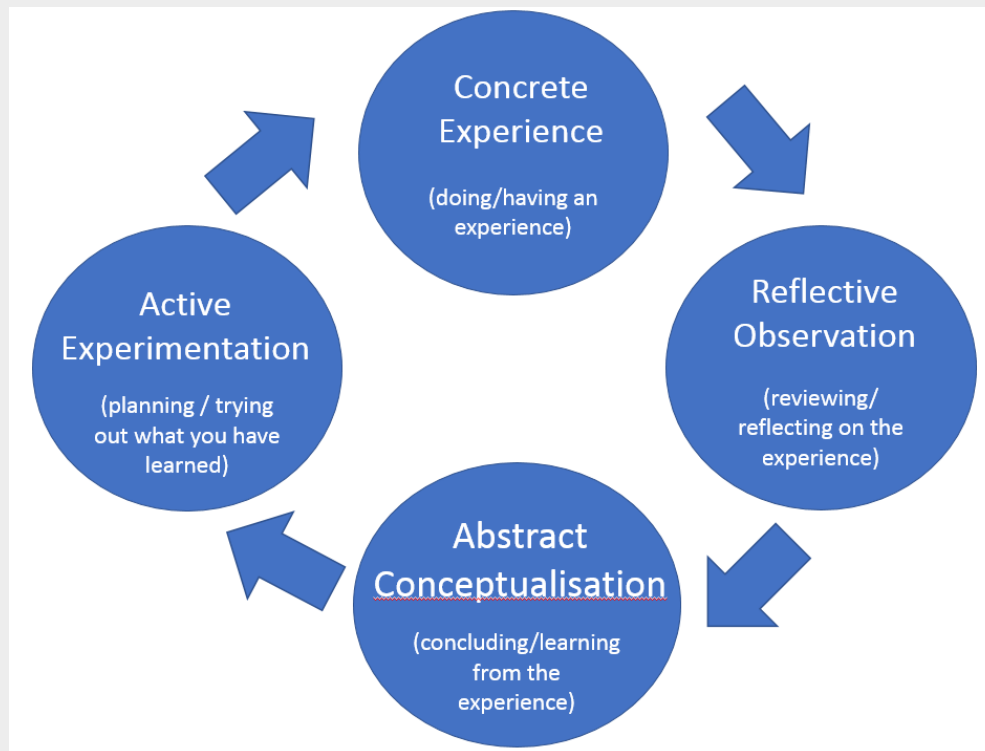
This paper is organized as follows. It begins with a discussion of EL and Kolb’s Learning Theory, the framework upon which the module was designed. Following this, the goals and components of the course module, and the methodology used to develop them are presented. To determine efficacy, a post-execution assessment of students’ interest, engagement, and subject matter knowledge is developed and administered. The paper concludes with a discussion of limitations, educational outcomes attained, and implications.

### 3 Experiential Learning (EL) Theory

The issue of food deserts presents a subject matter that lends itself readily to EL. EL has been demonstrated to more effectively engage students (Kolb 1984) and to allow students to think more deeply about complex issues. Unlike traditional lecture and reading approaches, EL enables the issue of food availability to become more tangible to students. Engaging in activities where they can directly manipulate data and see outcomes, students become more involved with the issue, than simply hearing the data in lecture format. Reflection is a key component in the learning process as it allows students to process the information provided during the experience and learn from their experience. Therefore, the authors based their module on one of the most widely used learning theories—Kolb’s Experiential Learning Cycle (Kolb 1984). EL allows students to grapple with the issues, while removing the risks inherent in an actual decision scenario. This frees students of the possibly negative outcomes associated with suboptimal decisions and allows for the development of more creative, or potentially risky, ideas. Kolb’s theory also allows for different learning styles.

Kolb offers educators a learning framework in which he posits a four-stage process by which learning takes place (see Figure 1).

Briefly, for effective learning to occur, Kolb identifies a series of stages through which students should progress: (1) first, students must be actively involved in the experience (termed “concrete experience”); this is followed by (2) observation of and reflection on that experience (i.e., “reflective observation”), which leads to (3) the analysis and conceptualization of the experience (“abstract conceptualisation”), which culminates in (4) new ideas gained from the development and testing of hypotheses (“active experimentation”). A key feature of Kolb’s theory is that individuals pass through each stage of the learning cycle, and that activities and material are developed to take students through the entire process, so as to ensure different learning styles are accommodated. Intertwined with this framework is the assertion that individuals have different learning styles; what may work well for one



**Figure 1. Kolb's Experiential Learning Cycle**

Source: Kolb 1984.

person, may not work as well for another. Kolb advanced his learning cycle based on the learning preferences of individuals. The key point is that following the sequence of stages ensures that students are exposed to each learning style, resulting in greater efficacy, regardless of an individual's preferred method of learning. It is for that reason that Kolb posits effective learning only occurs when a learner is able to execute all four stages of the model. Table 1 depicts how Kolb's Cycle of Experiential Learning is employed in the design of the food desert course module.

EL encompasses a more robust theory of learning that includes both cognitive and behavior-based learning. It is the learning "by doing" aspect which differentiates EL from traditional classroom learning. Included in EL are activities (e.g., cases, projects, simulations) that seek to emulate or address real-world issues and provide students with hands-on experience addressing these issues. Several researchers have documented the efficacy of EL techniques, with publications citing evidence of greater learning and engagement, enhanced critical thinking and problem-solving skills, and greater retention of material and understanding of the issues (see Hickcox 1991 for a review; Radford et al. 2015). Galea (2007) notes there are many pedagogical merits of EL, which have been widely documented; "however, one that is often overlooked is that teaching and learning in an experiential setting is great fun—for both teachers and students alike. And there's nothing like having fun to really generate one's creative juices and to make real learning stick" (Galea 2007, p. 10). As the workplace has continued to shift toward a knowledge-based economy where creative thinking and ingenuity are a requisite for successful employees (and companies), it is the task of educators to adapt to the considerably different learning needs that such a shift demands. Notably, Galea (2007, p. 10) states "there is a need for new and non-traditional teaching approaches that deep learning needs ultimately to be experiential: that is, learning while doing rather than a passive absorption of facts and figures." Perrin (2014) notes that EL is an ideal approach to achieving the tenets of an empowering education, allowing students the opportunity to gain

**Table 1. Food Desert Module Components Using Kolb’s Cycle of Experiential Learning Framework**

Stage	Activities Employed
<p><b>Concrete experience</b> (Task in which students are actively involved)</p>	<p>External readings; Hands-on experimentation with Food Access Research Atlas; students identify the region’s food deserts and fast-food outlets; visit to a food desert; qualitative data gathered via observation and interviews; analysis of data and identification of themes.</p>
<p><b>Reflective observation</b> (Reflecting upon what has been experienced and the information gathered; discussion with teammates)</p>	<p>Consideration of the region’s food deserts and related demographic indices; interpretation of data; reflection report on research findings (e.g., observations and conversations). In the reflection, identify the pertinent issues. Meet with teammates to discuss issues and identify problems.</p>
<p><b>Abstract conceptualization</b> (Making sense of what has happened; involves interpreting the events and understanding the relationships between them. Information from all sources is synthesized; theories, models, strategies are the result of using extant and learned knowledge)</p>	<p>Developing suggestions to address the issues identified; turning their ideas into a paper and presentation.</p>
<p><b>Active experimentation</b> (How is new knowledge relevant to practice; place in relevant context)</p>	<p>Suggestions presented to class; role-play as simulations; practical exercises, e.g., making a presentation, debate.</p>

Source: University of Leicester 2019.

greater control over their learning experiences, further increasing learning engagement. Experience-based projects allow instructors “to deliver content holistically,” connecting subject-matter “to broader disciplines, and connecting learners to each other in collaborative environments that reinforce development of problem-solving and interpersonal skills” (Radford et al. 2015, p. 468). In a university setting, internships and class projects are common EL tools employed, and other tools, such as experiencing and/or executing concepts and ideas, may lead to the discovery of new relationships and theories. EL tactics all serve to achieve the same end goal—engaging students more deeply in the ideas, concepts, and material presented to them.

## 4 Course Module Development

The module is created to be applicable across pertinent fields of study, including agribusiness, business, economics, nutrition, social work, sustainability, and other fields relevant to the issue. The teaching materials are designed for students in their junior or senior year of college. The course module encompasses three distinct aspects of food deserts, which, in their entirety, address the issue of “access.” The three module units are explained in the following. For instructors on a twice-a-week schedule, Units 1 and 2 can be combined into one session.

## 4.1 Unit 1: Food Access and Food Deserts

The first unit of the module is discussion-based. The goal of this unit is to introduce and discuss the concepts of food deserts, food access, and the consequences of inadequate access to affordable and fresh food (e.g., health and societal outcomes, ethical considerations). The official definition and characterization of a food desert, based on the USDA description, are presented, as well as the other terminology (e.g., food swamp). More recently, the USDA has minimized the use of the term “food desert” in favor of the more general term “access.” Subsequently, a discussion of framing the issue of access is also presented. Societal implications of food deserts, such as poor health, which may contribute to a host of negative individual and societal consequences, are also discussed. During these discussions, student input is actively solicited and probed. At the end of this discussion, students are introduced to the USDA’s Food Access Research Atlas (formerly the Food Desert Locator), a mapping tool that provides a geographic overview of food access indicators by census tract using different measures of supermarket accessibility (e.g., car ownership and distance from a supermarket; USDA- Economic Research Service 2019). With the Food Access Atlas, students can look specifically at census tracts in their region to assess supermarket accessibility. For their first assignment, students experiment with the Food Desert Locator individually. Students are asked (1) to identify the food deserts in their region—city, county, state (using the Food Access Research Atlas on the USDA, Economic Research Service site) and (2) to find the number of fast-food restaurants, convenience stores, and grocery stores on neighborhood maps. Additionally, they are asked to think about and be ready to discuss the consequences associated with these findings. Our experience is that this hands-on tool is an eye-opener for virtually all of the students, as regions of low accessibility are identified within close environs. Students are required to identify regions relatively close to campus. The learning objectives of this unit are to impart knowledge and understanding of the issues of food deserts and food access and to apply the USDA’s Food Access Research Atlas to identify food deserts in specific regions.

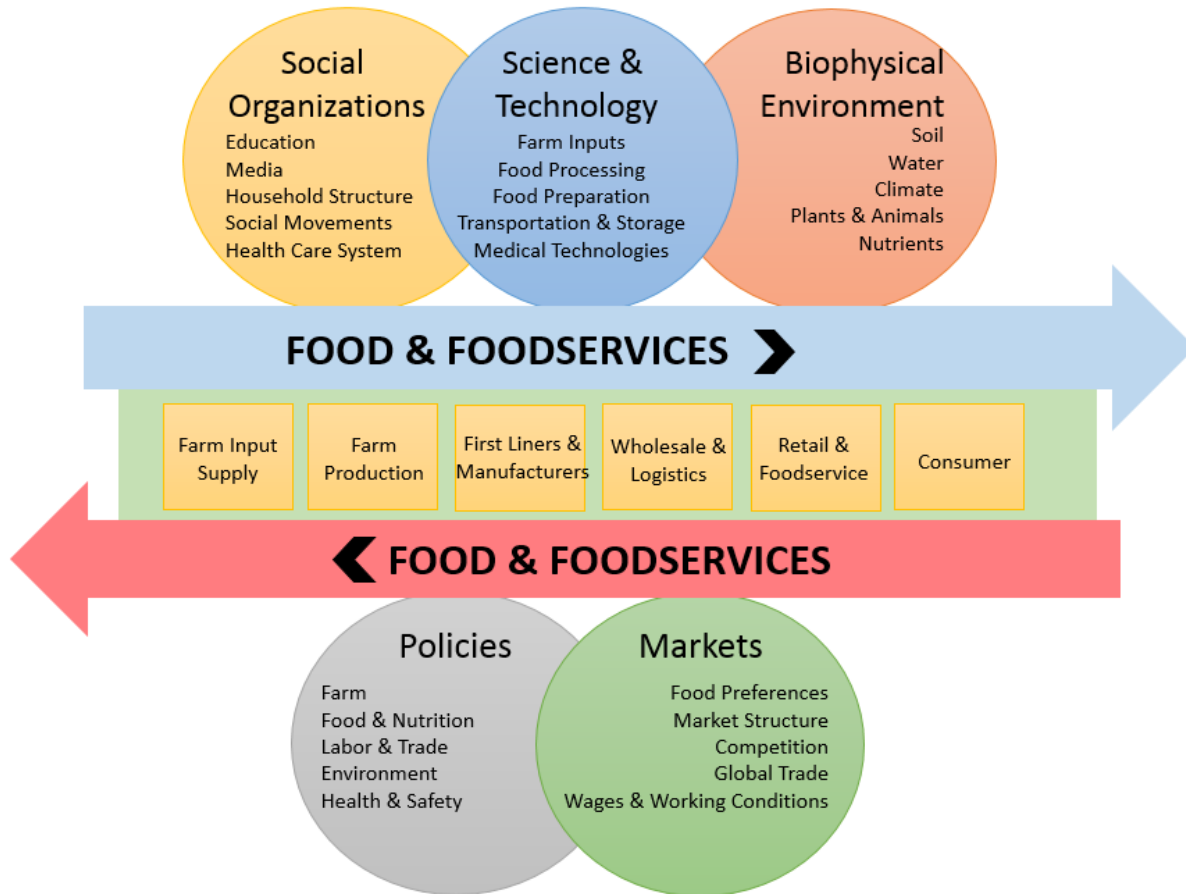
## 4.2 Unit 2: Food Systems

The goals of the second unit are to introduce students to the Food System Framework (see Figure 2) and to impart the necessity of a systems approach to problem-solving. Discussion is focused on introducing students to the complexity of the food system and encouraging students to consider the interconnectedness of its facets in addressing the food deserts issue.

Central to the Food System Framework is the illustration and explanation of the retail fresh produce supply chain. Issues of timing, storage, and transportation are introduced and discussed. The topic of food deserts, at its core, requires a general awareness of supply chain logistics, and the Food System Framework presents the intricacies in safely delivering fresh foods to retail outlets, which might further illuminate the outcome of poor food access in some communities.

Students are also instructed to use the USDA’s Food Environment Atlas, another data-driven resource provided by the Economic Research Service. Factors such as “store/restaurant proximity, food prices, food and nutrition assistance programs, and community characteristics, interact to influence food choices and diet quality” (USDA-Economic Research Service 2020, p. 1). These interactions help inform some of the factors that need to be considered in designing effective policy interventions. They also provide a hands-on tool with which students can experiment.

In Unit 2, the perspectives of other important stakeholders are discussed; drawing from the literature to inform these viewpoints. For example, Bitler and Haider (2011) present a model consistent with economic theory that explains the supply and demand side forces that give rise to food deserts (the “why food deserts exist” question), but argue that data challenges prevent researchers from empirically answering the “whether food deserts exist” question. At the time of their publication, little empirical evidence existed; thus, much uncertainty remained regarding the consequences of living in food deserts.



**Figure 2. A Framework for Assessing Effects of the Food System**

Source: National Research Council 2015.

Since 2010, more research on this topic has been conducted. Zhen (2021) presents an extensive review of the literature published since 2010 that empirically examines the causal relationship between living in food deserts and nutritional disparities. He finds that nutritional disparities are explained by food demand or consumer preferences rather than the supply of supermarkets that sell healthy foods. Thus, in Unit 2, we acknowledge both the theoretical framework, as presented in Bitler and Haider (2011), without undermining the findings from recent empirical studies, as discussed in Zhen (2021). Students also learn the importance of understanding the consumer decision-making process; specifically, key factors that influence consumer decision making are discussed. These include personal, social, psychological, and situational factors that affect consumer choices and demand. It is emphasized that availability is only one factor in the purchase and consumption of fresh food.

Students are instructed to form self-selected groups of a minimum of three and a maximum of four students per group. For their second assignment, students are provided access to various qualitative data in the form of interviews with growers and distributors. These interviews are conducted to understand the barriers in providing fresh produce to food deserts. Students are instructed to read the transcripts and identify themes that are conveyed by growers and distributors; essentially, to identify the issues surrounding the supply of fresh produce to these areas. Students are encouraged, but not required, to visit an area—in the neighborhood—designated as “low access” on the Food Access Research Atlas. They are also encouraged to envision having to secure affordable groceries to prepare dinner. It is suggested,

but again, not required, that they talk to store owners and residents about the issue of accessing fresh food. If unable to visit a region, students are instructed to research secondary information about their areas. If possible, recommendations include identifying local markets and calling store owners to discuss barriers to carrying perishable food.

Being equipped with the knowledge and information provided by the previously assigned readings, the interview data, and class discussions, students are challenged to think creatively and holistically about the issue of food deserts and to write and present a report about next steps or considerations needed, in order to address food deserts. In doing so, they have to consider the various stakeholders. Additionally, students are told that the written report should include an introduction, review of the literature, statement of the problem, and recommended considerations/next steps. Table 2 includes grading rubrics for both assignments.

Last, a brief discussion on creativity and how creativity is fostered, is delivered and students are directed to employ some creativity techniques in arriving at their suggestions. Creativity is defined simply as thinking outside of the box, or in an original or unconventional way. The creativity discussion is accompanied by viewing a former Nightline episode, which features a product design firm, IDEO (Films Media Group 1999). Students are challenged to adopt some of the techniques (e.g., no “nay-saying” ideas, brainstorming with post-it notes, and piggy-backing on outrageous suggestions) in an effort to develop creative suggestions.

**Table 2. Grading Rubrics**

**Grading Rubric (First Assignment): Mapping Food Deserts**

Scoring: 0 = lowest                      100 = highest

**Skills Assessed:**

**Discipline-specific knowledge:** (40 points)

- Identifies food deserts using the USDA Food Access Research Atlas
- Identifies the number of fast-food restaurants, convenience stores, and grocery stores on neighborhood maps using Google Maps
- Use of required external readings and additional external research to identify the issues surrounding supplying fresh produce to food deserts

*Discipline-specific knowledge score =*

**Critical thinking:** (40 points)

- Analyzes and uses supporting information
- Draws conclusions from the facts in the case

*Critical thinking score =*

**Communication:** (20 points)

- Uses appropriate and relevant discipline-specific concepts and terminology
- Demonstrates proper use of mechanics—spelling, grammar, and punctuation

*Communication score =*

**TOTAL POINTS =**

**Table 2 continued.****Grading Rubric (Second Assignment): Written Report**

Scoring: 0 = lowest                      100 = highest

**Skills Assessed:****Discipline-specific knowledge: (40 points)**

- Identifies themes/barriers to providing fresh produce in food deserts using interview transcripts with growers and distributors
- Use of required external readings and additional external research to identify the issues surrounding supplying fresh produce to food deserts
- Consideration of environmental stakeholders (e.g., nutrition, sustainability, supply chain)

*Discipline-specific knowledge score =***Critical thinking: (40 points)**

- Summarizes the problem or issue
- Identifies the main points in the case
- Analyzes and uses supporting information
- Draws conclusions from the facts in the case

*Critical thinking score =***Communication: (20 points)**

- Uses appropriate and relevant discipline-specific concepts and terminology
- Demonstrates proper use of mechanics—spelling, grammar, and punctuation

*Communication score =***TOTAL POINTS =**

The learning objectives of Unit 2 are to evaluate the complexity of the food system and its role in addressing the food deserts issue and to apply the USDA's Food Access Research Atlas to identify food deserts in specific regions.

**4.3 Unit 3: Exploring Ideas**

In the final unit, students are required to synthesize their knowledge and the information available, and prepare a set of considerations, ideas, and/or recommendations to address the food deserts issue. The goal here is reflective “abstract conceptualization,” learning from their experiences. Students are given leeway to present a “next step” in addressing the issue of food deserts, a discussion of alternative channels of distribution that have the potential to be successful in the distribution of fresh produce to food deserts, or to hone in on a particular obstacle and discuss it.

Drawing on both primary and secondary research, students present their thoughts for next steps, issues that need to be addressed and/or recommendations to the class. They are tasked with considering the challenges from the perspective of various stakeholders involved, including consumers, retailers, distributors, growers, and health care professionals, among others, spanning the fields of supply chain management, agribusiness, economics, marketing, sustainability, and nutrition. Consequently, students need to consider the interests of these stakeholders. It is emphasized that identifying the obstacles and considerations inherent in alleviating poor food access (identifying the issues surrounding supplying fresh produce to food deserts) is just as important as developing recommendations. Indeed, identifying

stakeholder interests is the task at hand, but students seem keen on wanting to advance recommendations, as well. As mentioned earlier, students are required to provide a written report, in which the issue, objectives, and considerations/recommendations are discussed. The learning objective of this unit is to examine the information/data available and prepare a set of considerations, ideas, and/or recommendations pertaining to food deserts.

Each unit’s purpose, learning objectives, approaches, and pertinent materials (e.g., readings, videos, activities, assignments) are included in Table 3. Additionally, lecture slides are available from the lead author upon request.

## 5 Module Evaluation

The course module was delivered at two universities. In total, the food desert module was implemented in four classes: upper-level classes in agribusiness, marketing, sustainability, and business consulting. Class sizes ranged from eight to seventeen students. At the beginning of each class, students were queried on their familiarity with the term “food deserts.” The Sustainability class was the only class in which more than one student indicated their familiarity with the term. Students were also asked about their knowledge of the issue of food accessibility in lower socioeconomic neighborhoods, as well as whether students had been introduced to this topic in other classes. Again, the students in the sustainability class were the only students in which more than a couple of students indicated that they had previous knowledge and/or had been exposed to discussion of this issue in other classes. These polls were done informally, in a discussion forum.

**Table 3. Supplemental Materials**

<b>Module Unit (i) Purpose and (ii) Learning Objectives</b>	<b>State in Kolb’s Experiential Learning Cycle/Approach</b>	<b>Readings/Activities/Assignments— Instructors may choose which to assign.</b>
<p><b>I. Food Access and Food Deserts</b></p> <p>(i) To introduce and discuss the concepts of food deserts, access, and the consequence of inadequate access to affordable and fresh food.</p> <p>(ii) To impart knowledge and understanding of the issues of food deserts and food access.</p> <p>To apply the USDA’s Food Access Research Atlas to identify food deserts in specific regions.</p>	<p>Active Experimentation</p> <p>Interactive Lecture &amp; Discussion/Individual Hands-on Activity/Assignment</p>	<p><b>Readings for Instructors and/or Students:</b> <i>Access to Affordable, Nutritious Food Is Limited in “Food Deserts”</i>(Ver Ploeg 2010)</p> <p><i>Access to Affordable and Nutritious Food: Measuring and Understanding Food Deserts and Their Consequences, Report to Congress</i> (Ver Ploeg et al. 2009)</p> <p><b>Assignment: Mapping Food Deserts</b> Using the Food Access Research Atlas found on the USDA, Economic Research Service site, identify the food deserts in your region (city, county, state). Were your results surprising? Explain. Then, using Google Maps, identify the number of fast-food restaurants, convenience stores, and grocery stores on neighborhood maps. Discuss your findings and offer an opinion on whether the presence or lack of presence of these establishments has positive or negative consequences.</p>



**Table 3 continued.**

<b>Module Unit</b> <b>(i) Purpose and</b> <b>(ii) Learning Objectives</b>	<b>State in Kolb’s</b> <b>Experiential Learning</b> <b>Cycle/Approach</b>	<b>Readings/Activities/Assignments—</b> <b>Instructors may choose which to assign.</b>
<p><b>II. Food Systems</b></p> <p>(i) To introduce students to the Food System Framework and to impart the necessity of a systems approach to problem solving. To impart an understanding, and encourage consideration, of the dynamic environmental opportunities, constraints, and conditions that impact the supply of food.</p> <p>(ii) To evaluate the complexity of the food system and its role in addressing the food deserts issue. To apply the USDA’s Food Access Research Atlas to identify food deserts in specific regions.</p>	<p>Concrete Experience                      Reflective Observation</p> <p>Interactive Lecture &amp;                      Discussion / Group                      Activity and Group                      Assignment</p>	<p><b>Readings for Instructors and/or Students:</b>  <i>A Framework for Assessing Effects of the Food System</i> (Institute of Medicine and National Research Council 2015)</p> <p>Article and brief video to illustrate the importance of systems thinking:</p> <p><i>Slashing Food Stamps Hurts the Poor. It Also Hurts Their Supermarkets</i> (Meyersohn 2020)</p> <p><i>Video: Slashing Food Stamps Hurts the Poor. It Also Hurts Their Supermarkets</i><sup>1</sup></p> <p><i>Conceptualizing Food Systems for Global Environmental Change Research</i> (for instructors) (Ericksen 2008)</p> <p><i>An Economic View of Food Deserts in the United States</i> (for instructors) (Bitler and Haider 2011)</p> <p><i>Food Deserts: Myth or Reality?</i> (for instructors) (Zhen 2021)</p> <p><b>Activity: Tapping Into Creativity</b>                      Watch this Nightline classic of IDEO, <i>The Deep Dive</i>. Show in class or assign; discuss the main takeaways.<sup>2</sup></p> <p>For additional reference: IDEO U <i>Observe Experts Brainstorming</i> (2 minutes and worthwhile)<sup>3</sup></p> <p>Ted Talk <i>How to Build Your Creative Confidence</i>/ David Kelley (12 minutes, for students and/or instructor)<sup>4</sup></p> <p><b>Activity: Visiting a Food Desert</b>                      Understanding the perspective of residents (consumers) and retailers (store owners). Go to a food desert. Imagine you had to go</p>

**Table 3 continued.**

<b>Module Unit (i) Purpose and (ii) Learning Objectives</b>	<b>State in Kolb’s Experiential Learning Cycle/Approach</b>	<b>Readings/Activities/Assignments— Instructors may choose which to assign.</b>
		<p>grocery shopping for groceries for the week. Park and attempt to do so. Is there a market (of any kind) in the region you chose? If so, locate it. What could you buy for dinner for the night? For the week? Describe your efforts to procure groceries. Talk to the store owner. Does s/he encounter any challenges in carrying perishable proteins and produce? NOTE: Most low access areas near campus are safe neighborhoods. However, be sure to know where students intend on going. If they visit an area designated as a food desert, follow these simple guidelines to help ensure their safety: go during the day; go with a group; be respectful of the people and the neighborhood you are visiting; only get out of your car or public transportation, if you feel it is safe to do so. If visiting a food desert is not viable, provide transcripts of interviews—with growers and distributors—to students and have them interpret the transcripts. Also, rely on the suggested readings for Unit I.</p> <p><b>Activity: Data Analysis</b> Students are provided transcripts of interviews with growers, retailers, and distributors. The interviews focus on the activity of supplying fresh food to food deserts. Respondents are queried on their beliefs about the challenges, opportunities, and criteria required for successful supply. Six interview transcripts are provided to students. Students then analyze the transcripts and include their analyses in the written reports.</p>

**Table 3 continued.**

Module Unit (i) Purpose and (ii) Learning Objectives	State in Kolb’s Experiential Learning Cycle/Approach	Readings/Activities/Assignments— Instructors may choose which to assign.
<p><b>III. Exploring Ideas</b></p> <p>(i) To encourage critical and creative thinking. Reflective “abstract conceptualization,” learning from experiences.</p> <p>(ii) Examine the information/data available and prepare a set of considerations, ideas, and/or recommendations pertaining to food deserts.</p>	<p>Abstract Conceptualization</p> <p>Group Assignment</p>	<p><b>Assignment: Written Report. Developing Ideas/Next Steps</b></p> <p>Based on the previously assigned readings, interviews data, and class discussions, students should now be equipped with enough knowledge and information to develop their own ideas, employing a systems perspective, to address the problems associated with living in a food desert. They do not need to “solve” the problem of food deserts, they can simply choose one obstacle that should be addressed, or a “next step.” The requirement for this project will include a written report and/or oral presentation. The report should have an introduction, review of the literature, statement of the problem, and recommended considerations, next steps and/or suggestions.</p> <p><b>How the Food Desert Issue Has Been Addressed</b></p> <p>Instructors may want to wait until after students present their ideas to discuss what has been done. The list below contains several examples of communities that have successfully employed innovative ideas to distribute fresh produce to food deserts. You can either present/read and synthesize for students, or direct them to the readings. A word of caution—local food is not a perfect solution. It requires extensive resources: external funding, time, and commitment, and oftentimes, poor financial return and the lingering issue of rapid perishability. You can use this as another point of discussion.</p> <p><i>Know Your Farmer Know Your Food</i> (USDA 2012): Provides several examples of communities successfully distributing fresh produce to food deserts.</p>

**Table 3 continued.**

Module Unit (i) Purpose and (ii) Learning Objectives	State in Kolb’s Experiential Learning Cycle/Approach	Readings/Activities/Assignments— Instructors may choose which to assign.
		<p><i>Community Gardens</i> (Centers for Disease Control and Prevention 2010): When discussing Community Food Gardens, this website should be useful.</p> <p><i>Why Whole Foods Is Moving Into One of the Poorest Neighborhoods in Chicago</i> (Badger 2014): This <i>Washington Post</i> article is a good article that talks about food deserts and why companies may want to rethink their strategies. It ties together many of the concepts discussed in the module and may provide a good article to assign post-module coverage to encourage students to consider the possibilities.</p> <p>Related: <i>OPINION: Englewood Whole Foods Doesn’t Adequately Improve Access to Fresh Food in Neighborhood</i> (Mitchell 2019)</p> <p><i>What Really Happens When a Grocery Store Opens in a ‘Food Desert’?</i> (Devitt 2019) Presents considerations and reinforces the necessity of taking a systems approach in understanding how to alleviate the problem of healthy food consumption.</p> <p><i>Food Deserts in America (Infographic)</i> (Tulane University 2018). Published on the blog page of Tulane University’s School of Social Work. Provides a wealth of information about food deserts and current innovations in addressing this problem. Designed in an informative and interesting format.</p>

<sup>1</sup> <https://www.cnn.com/2020/01/29/business/grocery-stores-food-stamps-snap/index.html>

<sup>2</sup> <https://digital.films.com/PortalPlaylists.aspx?wID=11854&xtid=9249>

<sup>3</sup> <https://www.youtube.com/watch?v=WIVlACbAWio>

<sup>4</sup> [https://www.ted.com/talks/david\\_kelley\\_how\\_to\\_build\\_your\\_creative\\_confidence?language=en](https://www.ted.com/talks/david_kelley_how_to_build_your_creative_confidence?language=en)

Upon completion of the module, students were given a survey that included questions asking them to comment on their evaluation of the course module and topic area, as well as whether the project differed from other class projects. The surveys were anonymous, and the instructor left the classroom

while students completed them. Students were told that the instructor was evaluating whether to keep, modify, or eliminate the week's lesson from future courses. We chose to rely on qualitative research due to the rich insights qualitative research provides. Additionally, we anticipated small class (and hence, sample) sizes because this module was administered in upper-level elective classes, which tend to be much smaller than introductory and/or required courses.

The qualitative responses (students' evaluations) were categorized into several themes that included module evaluations of the following categories: awareness; engagement; applied and EL; creative critical thinking; and a systems approach to problem-solving. These themes are discussed briefly next.

### **5.1 Awareness**

Many of the students indicated that they had been unaware of the issue of food deserts and/or food inaccessibility, and many indicated they were surprised to learn of the pervasiveness of poor food access. Several responses mirrored the sentiment expressed by Student 17, "I didn't know what a food desert was until this project." Some mentioned experimentation with the Food Desert Locator as being enlightening, and their surprise in learning about nearby regions that constituted low access regions. As Student 14 stated, "I never thought that going to a grocery store would be hard in [location named] because they're everywhere. This has made me realize that's not always the case for everyone." Student 4 echoed this heightened awareness, "It was eye-opening to actually go to a food desert. It was someplace that I could see driving through and not thinking that this is a food desert, but now that I know what a food desert is, I'm aware of the issue."

### **5.2 Engagement**

Many students also indicated that the module was "interesting," "valuable," "worthwhile"—in a nutshell, "engaging." In explaining their responses, students pointed to the idea that their work mattered because they were addressing a current issue. "It was different because it focused on a very current and relevant issue in our country" (Student 17). Several students explicitly mentioned that addressing a "real-world" problem that focused on developing solutions helped to make the project more interesting. Examples of responses are: "It was really fun to create a solution to a real-world problem" (Student 9); "I was implementing a plan to help society" (Student 8); "People are really trying to tackle this problem and could even use some of our solutions" (Student 24).

### **5.3 Applied and Experiential Learning**

Some comments also indicated that the experience of visiting a region on the Low Access Map made the experience more real and more understandable. "I didn't think downtown [location omitted] was a food desert, but the food desert map said it was, so we went down there. It didn't feel poor, but there weren't any grocery stores, and we saw a couple of homeless people on the corner. So, I guess it was helpful to actually go down and see the neighborhoods" (Student 23). "It was cool getting out of our car and saying ok, we don't have a car, where's the closest grocery store. And it was about 2 miles away. There was no way I'd walk four miles with groceries. We parked our car at a mini-mart that was pretty sketchy. It was the middle of the day, and we were in a group, so I didn't feel unsafe. But it was kind of unsettling" (Student 14).

### **5.4 Creative Critical Thinking**

Responses also included direct reference to the creative component of the module and project. Students were encouraged to be creative in their suggestions, and naysaying was discouraged. Several students indicated their appreciation of this aspect of the project: "It was a good learning exercise. I liked that we could get creative in our suggestions" (Student 6); "There was more than one right way" to address the

problem (Student 14); “It had more opportunities to find creative solutions” (Student 19).

## 5.5 Systems Approach to Problem-Solving

Especially gratifying, were the comments that students made that indicated their view of the issue of food access had been broadened. “This module had you think in a more political way than a consumer way. It was interesting to find a way to create a policy around market research” (Student 15). One student (Student 8) was motivated to keep exploring this issue: “I’m a senior and looking for a thesis ... and haven’t covered this topic in any of my classes. It seems like a good fit for the supply chain.” And, one business student suggested that incorporating more material from other fields would help him/her better understand the issue: “I think it would be great to incorporate documentaries about food scarcity and the impact of nutritional eating habits” (Student 15).

Overall, the comments written were overwhelmingly positive. As the response from Student 5 illustrates, “I thoroughly enjoyed the class. I respect this side of marketing immensely. Thank you for keeping us all intrigued and excited to learn.”

## 6 Limitations

An important limitation of the module is that it has only been deployed in relatively small-sized classes. Nevertheless, with adequate teaching support, instructors could successfully transfer the lessons to larger-sized classes. Using the suggested teaching supplements (see Table 3), there are materials that can be easily scaled to larger-sized classes (e.g., readings and videos). Additionally, for larger-sized classes, the use of clickers has been shown to enhance students’ engagement and participation in course material, as well as their performance and satisfaction (Premuroso et al. 2011; Rana and Dwivedi 2016). This learning module lends itself well to the types of questions used with clickers to engage students. For example, questions pertaining to knowledge of food deserts, beliefs about consumer behavior, constraints to supplying fresh food, and so on, provide good questions with which to launch class involvement and discussion. Further, group work is still highly recommended. Having larger group sizes (e.g., four to five students) may allow for greater allocation of the work, which addresses the time challenge that students mentioned in their evaluation of this module. Nevertheless, with larger-sized classes, class presentations might not be feasible due to time constraints. One suggestion to overcome this is to have groups record their presentations and post to the course website. Students can then be required to view and comment on the presentations posted. The instructor can also ask students to think about one key point of these presentations and, when they meet in class, have them discuss their takeaway with the person next to them. The use of technology—for example, clickers and web-based course management software—helps students be actively involved in large classrooms and encourages them to stay on task (Lloyd-Strovas 2015). It is also believed, and hoped, that the module can be deployed successfully across a greater number of disciplines. It would be a great opportunity to reach across disciplines and invite supply chain management, marketing, sustainability, nutrition, and other discipline-related faculty to guest speak.

One caveat, as it relates to these units, is that it is not recommended to suggest students visit food desert areas if the instructor is not personally involved; among other information, instructors should be apprised of, and approve of, the time of day, mode of transportation, number of students, and areas to be visited.

Other limitations stem from the student feedback received. These include the need to make the goals and expectations clearer before starting the module, provide more background to help with recommendations, and to incorporate documentaries and TED Talks about food scarcity. Furthermore, there are a few students who believe that the amount of time allocated for the module is not sufficient.

## 7 Conclusion

The goal of this course module is to raise students' awareness of the plight of inadequate access to nutritious food and to equip them with the problem-solving skills needed to address this social problem. The module that has been developed does just that. In developing this module, contributions from faculty in agribusiness, marketing, nutrition, and sustainability are elicited. Using Kolb's Theory of Experiential Learning as a framework, within which to develop and incorporate learning activities, along with a systems approach to framing the problem, it enables students to realize the complexity of the issue, as well as the interconnectedness of actions. Systems thinking recognizes that systems are inherently interconnected and dynamic; a change in one component of the system may affect other components. As such, a systems approach to problem solving requires deep exploration, critical thinking, and holistic consideration (Palmberg et al. 2017). It encourages looking at relationships between and among the parts of a system, rather than solely the parts themselves, and it helps to understand the implications of those relationships over time. Palmberg et al. (2017, p. 4) state that "The challenge for education is to develop a pedagogy that provides individuals with knowledge about how different choices affect society." Students grapple with the implications of various actions while simultaneously analyzing "real-world" problems; this initiative moves students to appreciate their complexity.

There are several beneficial outcomes of this module. Briefly, the module:

- Provides a cross-disciplinary, systems approach to a complex issue that historically has not been introduced across disciplines. This may lead to more awareness of the issue and more creative ideas when these students enter the workforce.
- Aids professors in the preparation and development of a course module that presents a current issue.
- Provides a module that is easily transferred across disciplines.
- Provides a module that is well received by students across disciplines.
- Exposes students with differing academic backgrounds to a current issue and recognizes the importance of their contributions.
- Exposes students to the importance of taking a systems approach to problem solving.
- Facilitates EL, resulting in deeper comprehension of material.

Overall, upon completion of the module, students indicate increased awareness and interest in the issue of food accessibility. They learn that there are myriad factors contributing to the poor health of residents who live in food deserts—access being only one of them. Students also learn that addressing the problems associated with food deserts involves the coordination of several fields, among which include agribusiness, economics, marketing, nutrition, supply chain management, and sustainability. Subsequently, to effectively consider the issue of low access, students need an appreciation of the food systems operating within these regions. The identification of the viewpoints of multiple stakeholder disciplines can provide this appreciation, as well as a more complete approach to addressing the issue of food deserts.

Using the topic of food access and food deserts, it can be stated that understanding and developing solutions to complex social issues require a multidisciplinary approach. Actively involving students from a diversity of disciplines moves society closer to developing long-lasting, effective solutions to the issue of healthy food access. It also enhances the learning process and leads to greater creativity. "Some of the most meaningful learning occurs when students are asked to reflect on the link between the concepts they learn and real-world issues, their lives and how their learning is likely to change them personally and professionally" (Gravois et al. 2017, p. 72). The EL approach—which includes experimentation with the Food Access Research Atlas, visiting low access neighborhoods, and presenting team recommendations—instills a deeper understanding and appreciation of the issues involved. A

multidisciplinary view is not only espoused in teaching, but reflected in our sample, which, in two of the classes, includes a mix of majors. This is promising as the module is implemented successfully to students in a diversity of disciplines.

While a limitation of the module is that it has only been deployed in relatively small-sized classes, it is believed that instructors will have success transferring the lessons to larger sized classes, as well. Additionally, it is hoped that the module is deployed successfully across a greater number of disciplines, and instructors will continue to tweak and improve upon the module advanced in this paper. As one reviewer notes, assigning groups to represent different stakeholders and their interests, would be one way of illuminating their different, and often competing, interests and concerns.

Finally, the issue of food access has been highlighted by the current environment brought on by COVID-19 (O'Hara and Toussaint 2021). Now, addressing concerns about poor food access are quite timely as "individuals living in neighborhoods with already limited access to grocery stores and restaurants are likely experiencing additional difficulties due to business closures and transit restrictions" (Siddiqi et al. 2020, p. 1). Providing students an understanding of the roles, functions, and viewpoints of multiple stakeholder disciplines is a more complete approach to help them appreciate the underlying issue resulting in the lack of access to fresh foods in some communities, which may leave nutritional inequalities intact.

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## Case Study

# Market Power in the United States Potato Industry

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JEL Codes: L1, L2, L4, Q13

Keywords: Antitrust, Capper-Volstead Act, cooperatives, potato industry, price-fixing, seller market power, supply management, Sherman Act

### Abstract

This case study is motivated by developments in the U.S. potato industry involving implementation of a potato supply management program by a nationwide group of cooperatives of potato growers from 2005 to 2010. This program aimed to mitigate potato oversupply, which adversely affected potato growers' profitability. The potato supply management program raised legal issues leading to antitrust lawsuits filed by potato buyers against potato growers and their cooperatives, which resulted in a large settlement. The case study introduces economic, business, and legal issues related to the program's implementation. It presents a theoretical economic framework, which explains the conduct and performance of the U.S. potato industry under alternative market scenarios, along with a basic market and price analysis. The intended audiences are undergraduate and graduate students as well as extension and outreach communities. A teaching note discusses teaching objectives, teaching strategies, and student background knowledge. In addition, it includes multiple-choice questions and suggested answers to discussion and multiple-choice questions.

## 1 Introduction

The motivations for this case study relate to developments in the U.S. potato industry involving implementation of a potato supply management program by a nationwide group of cooperatives of potato growers from 2005 to 2010.<sup>1</sup> This program aimed to (1) mitigate an oversupply of potatoes, which adversely affected profitability of potato growers; (2) control potato supply and price volatility; and (3) provide fair returns for potato growers. The potato supply management program combined a potato acreage management (control) program and a set of marketing programs. The potato acreage management program was used to control the number of potato acres planted each year between 2005 and 2010.

In 2010, a group of buyers of potatoes filed class action antitrust lawsuits alleging that the potato supply management program, and in particular the potato acreage management program, was a form of illegal price-fixing leading to increased potato prices for buyers. The potato buyers argued that the potato acreage management program was not immune to the Capper-Volstead Act (1922) and that it violated Section 1 of the Sherman Act (1890). The cooperatives of potato growers settled these lawsuits for \$25 million in 2015 (O'Connell 2018). In addition, according to the settlement agreement, cooperatives of potato growers agreed that they would make no attempt to manage potato acreage prior to the potato planting season for seven years.

This case study introduces economic, business, and legal issues related to implementation of the potato supply management program. The case study also provides simple contemporary applications of economic models of the profit-maximizing behavior of firms with seller market power in the U.S. potato

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<sup>1</sup> Students are encouraged to read an article published in the *Wall Street Journal* (Martin 2006) and to listen to an NPR episode discussing the program and cooperatives (Godoy 2013).

industry. In particular, the case study presents a theoretical framework, which explains conduct and performance of the U.S. potato industry (which includes all potato growers) under alternative market scenarios, as well as basic market and price analyses based on publicly available data reported by the U.S. Department of Agriculture. The case study is suitable for a variety of undergraduate and graduate courses taught in agricultural economics and agribusiness programs, including microeconomics, agricultural economics, managerial economics, agricultural (agribusiness) marketing, agricultural markets and prices (or agricultural prices), agribusiness management, supply chain management, and applied industrial organization. The case study is also suitable for extension and outreach audiences.

The case study has the following student learning objectives (SLOs).

*SLO #1:* Students should be able to explain economic forces leading to the idea of a potato supply management program in the U.S. potato industry, the role of cooperatives of potato growers in developing and implementing this program, and program design and implementation procedures.

*SLO #2:* Students should learn a theoretical economic framework of seller market power in the potato industry and be able to apply this framework to evaluate potato price-quantity relationships and industry profitability under alternative market scenarios that differ due to the potato quantity produced, potato price, and industry profit (i.e., a potato oversupply scenario; a perfectly competitive industry scenario; a potato-supply management scenario, in which sellers have a small degree of market power; and a hypothetical monopoly scenario).

*SLO #3:* Students should be able to apply the theoretical economic framework to perform an analytical analysis of potato price-quantity relationships and industry profitability in alternative market scenarios by using the potato inverse demand and constant marginal cost functions.

*SLO #4:* Students should be able to conduct an analytical analysis of welfare transfer due to seller market power in the U.S. potato industry.

*SLO #5:* Students should be able to conduct a basic market and price analysis using U.S. Department of Agriculture (USDA) data before, during, and after the program was active to evaluate market and price effects of the potato supply management program.

*SLO #6:* Students should be able to explain legal (antitrust) issues related to implementation of the potato supply management program and discuss the role of the Capper-Volstead Act in regulating collective agricultural marketing activities of agricultural producers, as applied to the analyzed industry setting.

## 2 U.S. Potato Industry

Depending on the harvesting season, potatoes are classified as fall, winter, spring, or summer potatoes. Most of the potatoes produced in the United States are fall potatoes.<sup>2</sup> Fall potatoes are planted in the spring (April/May) and are harvested in the fall (September/October). The most common potato types include Russets, Reds, Whites, and Yellows.

The U.S. potato industry has two major segments: a fresh potato segment and a processing potato segment. Figure A1, presented in the Appendix, depicts the potato supply chain. Potatoes produced for the fresh market are washed, graded, and packaged in different types of packs before being shipped to

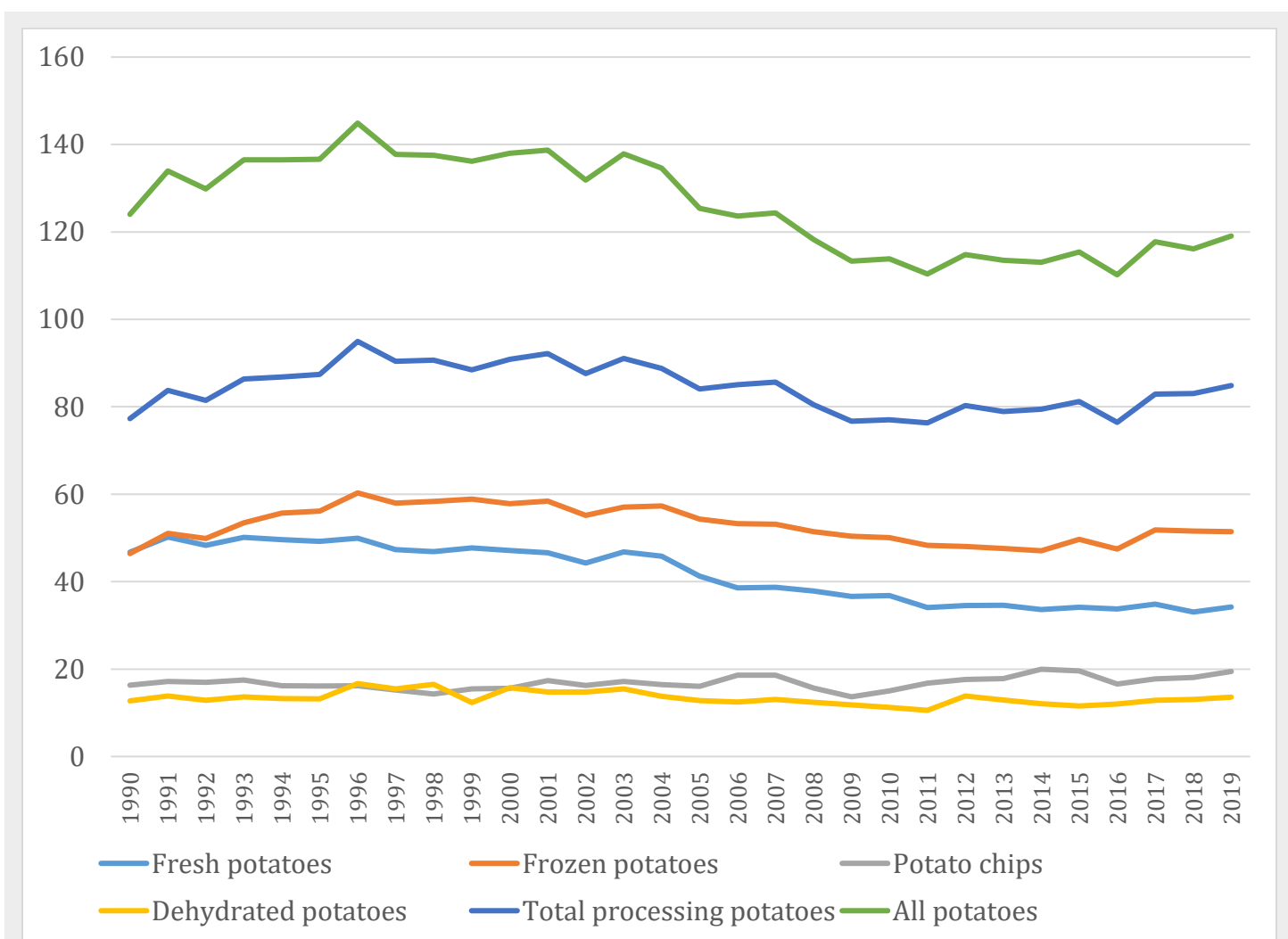
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<sup>2</sup> In recent years, fall potato production has made up 90 percent of total potato production (USDA NASS 2021).

wholesalers and retailers. Fresh potato prices are determined in a spot market setting. Fresh potato prices are based on potato grade, variety, and pack size and type (USDA AMS 2021). Potato shipping points are located in the major potato-growing regions.

Potatoes produced for the processing market go through processing before they reach consumers. The most popular processed potato products are French fries, potato chips, and dehydrated potatoes. Processing potato prices are determined by contracts signed by potato growers and potato processors before the potato planting (production) season begins. These contracts specify a base price and a set of adjustments to this price (bonuses and penalties) for presence, absence, or both of certain potato quality characteristics, which are important for the quality of processed potato products (Bolotova and Patterson 2009).

Figure 1 depicts the U.S. potato consumption per capita for various potato product categories in the period 1990–2019. The figure indicates a decrease in all potato consumption beginning in the 2000s. The decrease in fresh potato consumption was greater than that in processing potato consumption.



**Figure 1. U.S. Potato Consumption in Pounds Per Capita, 1990-2019.**

Source: USDA ERS (2021).

Table 1 provides data characterizing the U.S. potato industry structure in 2004, the year prior to implementation of the potato supply management program. The data for the largest fall potato states are presented in Table 1. In that year, the United States had 9,408 potato growing farms. Among states, Idaho and Washington had the largest potato production, in terms of potato area planted, total potato quantity produced, and value of potato production. In 2004, of 1,040,700 fall potato acres planted nationally, 355,000 acres and 160,000 acres were planted in Idaho and Washington, respectively.

**Table 1. U.S. Fall Potato Industry Structure: Nine Leading States, 2004**

State	Acres planted	Production	Price	Value of production	Number of potato farms <sup>a</sup>
	acres	million cwt	\$ per cwt	million \$ (percent in total)	farms (percent in total)
<i>US Total</i>	<i>1,040,700</i>	<i>410.7</i>	<i>5.12</i>	<i>2,092.5 (100.0)</i>	<i>9,408 (100.0)</i>
Idaho	355,000	132.0	4.25	560.9 (26.8)	818 (8.7)
Washington	160,000	93.8	4.90	459.7 (22.0)	408 (4.3)
North Dakota	105,000	26.8	5.80	155.2 (7.4)	216 (2.3)
Wisconsin	71,000	30.5	5.80	176.6 (8.4)	399 (4.2)
Colorado	65,000	23.8	4.50	107.1 (5.1)	229 (2.4)
Maine	63,500	19.1	6.50	123.9 (5.9)	444 (4.7)
Minnesota	48,000	19.4	5.50	106.4 (5.1)	284 (3.0)
Michigan	43,000	13.7	6.95	94.9 (4.5)	395 (4.2)
Oregon	37,000	19.8	5.05	99.9 (4.8)	278 (3.0)

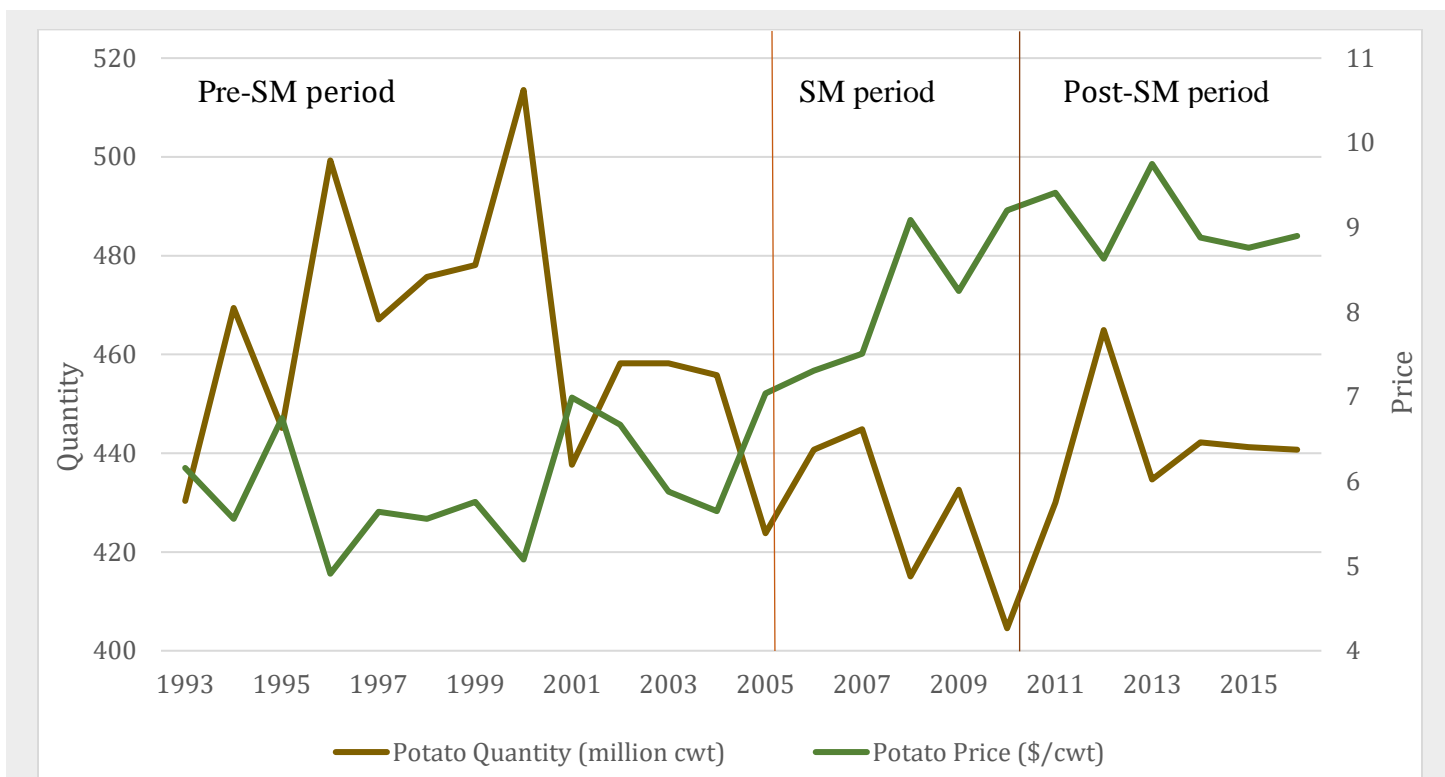
<sup>a</sup>The number of potato farms is for 2002.

Data sources: USD NASS (2021) and USDA Census of Agriculture (2002).

The 2004 U.S. value of potato production was \$2,092.5 million. The market shares of Idaho and Washington were 26.8 percent and 22.0 percent, respectively. North Dakota and Wisconsin were the next two largest potato-producing states with market shares of 7.4 percent and 8.4 percent, respectively, followed by Colorado, Maine, and Minnesota. Though Idaho and Washington were the largest potato producers in the nation in 2004, potato prices received by growers in these states were below the U.S. average potato price. Although the U.S. average potato price was \$5.12 per cwt (one hundredweight or 100 pounds) in 2004, the average potato prices received by growers in Idaho and Washington were \$4.25 per cwt and \$4.90 per cwt, respectively.

As Table 1 shows, Idaho had the lowest potato prices of potato-producing states. Potato prices received by growers in Idaho, the country’s leading potato-producing state, were below potato production costs in a few years prior to the potato supply management program. Potato growers in Idaho received on average \$3.89 per cwt when they sold their potatoes, but potato production costs were in the range of \$4.63 per cwt to \$5.23 per cwt (Bolotova et al. 2008, Table 5).

Figure 2 depicts the U.S. yearly total potato quantity produced and the yearly average potato price in the period 1993–2016. Total potato quantity was much larger and potato prices received by growers were much lower before the potato supply management program than during it (2005–2010). The large potato quantity (supply) and low potato prices, as well as a high volatility of potato supply and price prior to 2005, reflect a potato oversupply problem, which adversely affected potato growers’ profitability.



**Figure 2. U.S. Yearly Potato Production and Yearly Average Potato Prices Before, During, and After the Potato Supply Management (SM) Program, 1993—2016.**

Data source: USDA NASS (2021).

Note: Pre-SM period, SM period, and post-SM period are the pre-supply management program, supply management program, and post-supply management program periods, respectively.

### 3 Cooperatives of Potato Growers and Potato Supply Management Program

This section discusses cooperatives of potato growers, as well as the objectives, design, and implementation procedure of the potato supply management program.<sup>3</sup>

The economic forces that led to the development of a potato supply management program were a potato oversupply, increasing potato supply and price volatility, declining demand for fresh potatoes, and increasing competition from the Canadian potato industry due to international trade liberalization as a result of the North America Free Trade Agreement (NAFTA). These economic forces adversely affected the profitability of both individual potato growers and their industry.

#### 3.1 Cooperatives of Potato Growers

The idea of the potato supply management program originated in Idaho. The United Fresh Potato Growers of Idaho (UFPGI), a cooperative of fresh potato growers, was formally organized in November 2004. At that time, UFPGI represented approximately 85 percent of fresh potato growers in Idaho. A key to the success of the program was the participation of other potato-producing regions. Cooperatives with similar objectives were organized in other leading potato-growing regions and in Canada. The United Potato Growers of America (UPGA), a national-level cooperative providing coordinating functions, was

<sup>3</sup> A discussion presented in this section was developed using the information collected from newsletters and guidelines, which were available for public access on the webpages of cooperatives of potato growers in the period of the potato supply management program.



formed in March 2005. At that time, UPGA represented approximately 70 percent of fresh Russet potato growers in the country.<sup>4</sup>

Although the potato supply management program originally targeted the fresh potato market, processing and seed potato growers also joined the cooperatives. The fresh potato market is strongly affected by the processing and seed potato markets: a surplus of potatoes originally grown for the processing market and eventually sold in the fresh potato market would decrease prices for fresh potatoes and increase fresh potato price volatility. Therefore, the cooperation of fresh, processing, and seed potato growers was crucial for program success. The cooperatives of potato growers and individual potato growers presumed that their potato supply management program, as a form of collective agricultural marketing, was within the scope of Capper-Volstead Act (1922) immunity.

### 3.2 Potato Supply Management Program

The potato supply management program was developed and implemented for the first time in the spring of 2005. The program objectives were to (1) mitigate a potato oversupply adversely affecting potato growers' profitability, (2) gain control of potato supply and price volatility, and (3) provide fair returns for potato growers. The originally developed potato supply management program combined a potato acreage management (control) program and a set of marketing programs.

#### 3.2.1 Potato Acreage Management Program

The potato acreage management program (2005–2010) was used to control the number of potato acres planted each year. The program used a bid buy-down program.<sup>5</sup> Potato growers submitted bids reflecting the amount of money they would need to be compensated in order not to plant, and the cooperatives accepted the best bids. The acreage bid buy-down program was financially supported by the cooperatives.

The guidelines developed by the cooperatives established a potato acreage reduction target on a yearly basis. In the first years of program implementation, potato planting area was to be reduced by 15 percent, relative to 2004 acreage, which served as the base acreage. Base acres were acres on which potatoes had been planted since the 2003–2004 crop year, regardless of whether they were registered with the cooperatives. Each base acre was assessed at \$50.

Potato growers in the cooperatives who reduced their potato planting area by 15 percent owed no assessment. Potato growers in the cooperatives who reduced their potato planting area by less than 15 percent were assessed a pro-rated percentage of \$50. If a potato grower's acreage reduction was between 10 percent and 14.99 percent, the grower paid \$20 per base acre. If the acreage reduction was between 5 percent and 9.99 percent, the grower paid \$30 per base acre. If the acreage reduction was between 0 percent and 4.99 percent, the grower paid \$50 per base acre.

A potato grower (a cooperative member) who planned to expand potato acreage could pursue the following strategies. First, the grower could buy or rent base acres. In this case, the grower had to participate in the program (i.e., reduce potato planting by 15 percent or pay a pro-rated \$50 per acre assessment). Second, the grower could plant base (year 2004) acres by paying \$50 per acre. Third, the grower could buy or rent acres without base or accelerate a normal rotation of crops, resulting in the planting of acres without base.

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<sup>4</sup> Russet is the most popular potato type. Russet potatoes have large tubers, which are suitable for baking, mashing, and manufacturing frozen French fries. Russet Burbank is the most popular Russet variety. In 2006, the share of Russet Burbank in the total area of fall potatoes planted was 46 percent nationally, followed by Russet Norkotah (13.1 percent) and Ranger Russet (9.5 percent) (Bolotova et al. 2008).

<sup>5</sup> The acreage bid buy-down program was based on a model of the Cooperatives Working Together (CWT) herd retirement program implemented in the U.S. dairy industry (Bolotova 2015).

Acres without base were acres on which no potatoes had been planted since the 2003–2004 crop season. Planting on acres without base was a “mindless expansion” because this strategy took advantage of improved market conditions facilitated by the cooperatives and their program. This type of conduct (expanding without base) was against the mission of the cooperatives because it led to potato overproduction and represented a threat to program success. Potato growers were penalized for planting on acres without base. These growers were assessed \$100 per acre on all acres (expansion plus base acres). The assessments collected by the cooperatives were used to “buy out” acres elsewhere.

To ensure that the potato acreage management program was implemented effectively, the cooperatives conducted field audits. The goal of field audits was to verify the compliance of members of the cooperatives with rules of the acreage reduction and bid buy-down programs. At the beginning of potato planting seasons, growers filled out the Planting Intension Form. In this form, growers recorded the base acreage in 2004 for fresh, seed, and processing potatoes by potato variety. In addition, growers declared their current year planting intentions by potato variety. The Planting Intension Form was the grower’s commitment against which actual performance was evaluated. The documents used to assess actual acreage were aerial photography and copies of USDA Farm Service Agency (FSA) Form 578.<sup>6</sup> The growers authorized FSA to release this information to the authorized representatives of the cooperatives.<sup>7</sup>

Accurate prediction of potato yield per acre was important for program success. The cooperatives encouraged each member to perform a series of field digs. The first and second digs were performed by growers in August. The third dig was performed by the cooperatives’ representatives at harvest. All volunteer growers were sent instructions on how to perform field digs, along with record-keeping forms.<sup>8</sup>

### 3.2.2 Potato Marketing Programs

The marketing programs included a potato flow control program, exchanges of market information, and secondary marketing programs.

Before the potato supply management program, uncoordinated potato flow to the fresh potato market often resulted in the oversupply of fresh potatoes, leading to low fresh potato prices and high fresh potato price volatility. The potato flow control program was used to control fresh potato shipments throughout the marketing year. Warehouses participating in this program regularly entered information on capacity, stocks, and pack-outs on cooperatives’ webpages. This information, along with other information (prices, demand and supply trends, weather), was discussed during conference calls twice a week at the state level and once a week at the national level. The results of these discussions were summarized in a price advisory, which was posted on the cooperatives’ webpages. The price advisory was used as a pricing strategy for the coming week.

To remove the surplus of already-produced potatoes, the cooperatives implemented secondary marketing programs. At the beginning of 2005, these programs removed approximately 8 percent of potato stock from the market. The potato surplus in 2004 was diverted to charities and food banks and as dehydrated potatoes for humanitarian services. One of the successfully implemented marketing

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<sup>6</sup> USDA FSA Form 578 is a report of acreage.

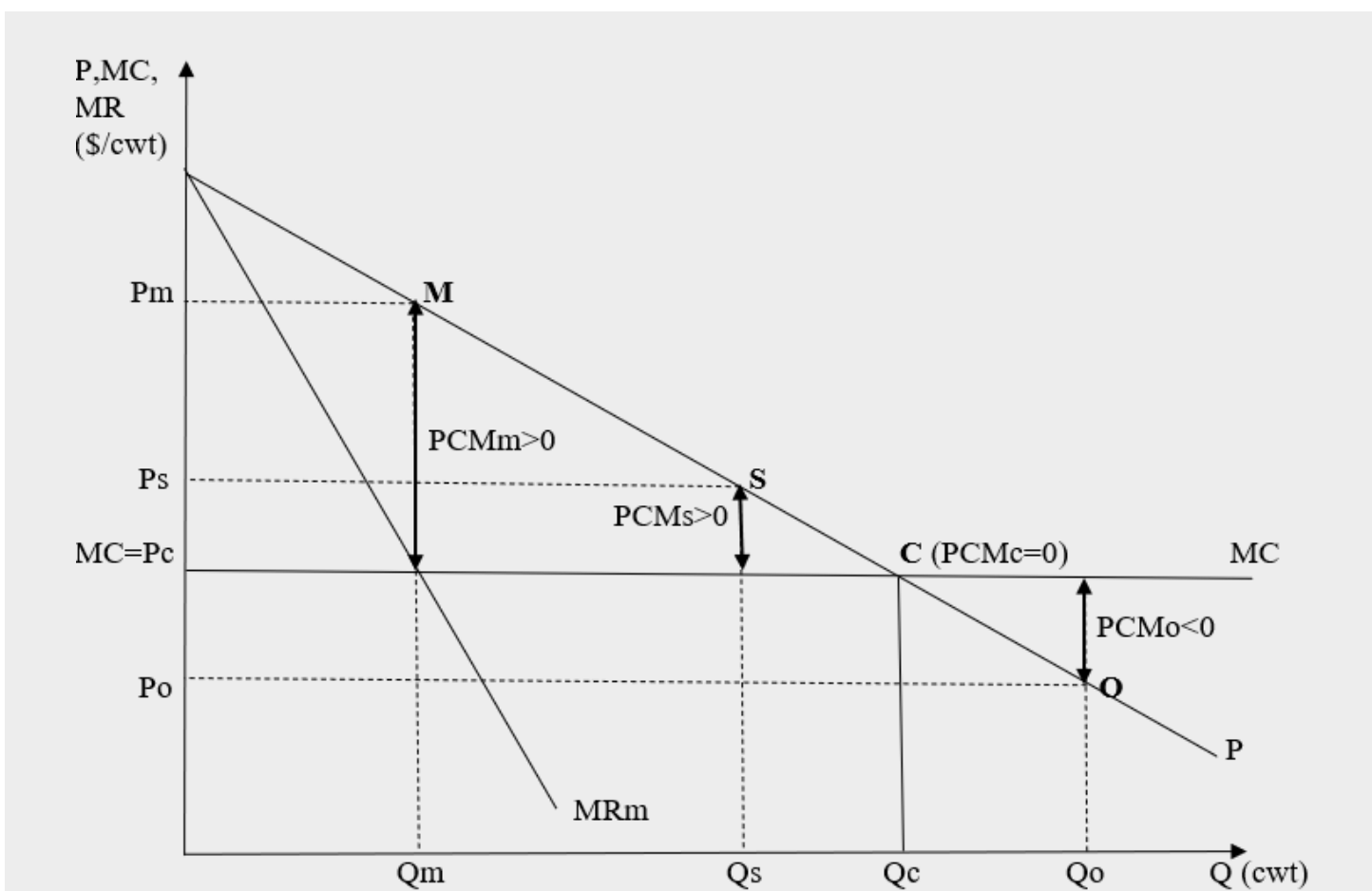
<sup>7</sup> The field audit proceeded as follows. The cooperatives’ representative reviewed the grower’s planting intentions submitted to the cooperative, filed maps, and FSA Form 578. Then, the representative inspected each parcel of land to verify actual plantings and reductions. Using special software, the representative compared actual acreage planted with information on FSA Form and submitted planting intentions. The results of the audit were reported to the Future Crop Committee and the board of the cooperatives.

<sup>8</sup> Potato growers who participated in the field digs were required to sample each field. The growers had to select a spot of the field representing the average soil and growing conditions for that field. The grower had to dig a 10-foot strip to check the quality and quantity of potato tubers. The tubers were segregated by sizes to determine the total weight for each size group. This information was recorded by the grower and was faxed to the cooperative’s office.

strategies was obtaining USDA procurement contracts.

### 4 Theoretical Framework: Seller Market Power in the U.S. Potato Industry

Figure 3 is a graphical representation of a theoretical framework incorporating the potato industry’s seller market power and four alternative market scenarios. The potato inverse demand curve (labeled “P”) is a graphical representation of a potato inverse demand function at the farm stage of the potato supply chain. The marginal cost curve (labeled “MC”) is a graphical representation of the constant marginal cost function. The market scenarios depicted in Figure 3 differ due to total potato quantity produced, potato price, and industry profit.<sup>9</sup> The marginal cost is assumed to be the same in the four analyzed market scenarios.<sup>10</sup> Table 2 summarizes price, quantity, and profit information for these scenarios.



**Figure 3. Alternative Market Scenarios for the U.S. Potato Industry.**

Note: Point O at  $Q_o$  and  $P_o$  is a potato oversupply scenario. Point C at  $Q_c$  and  $P_c$  is a perfectly competitive industry scenario. Point S at  $Q_s$  and  $P_s$  is a potato supply management (a small degree of seller market power) scenario. Point M at  $Q_m$  and  $P_m$  is a hypothetical monopoly scenario.

<sup>9</sup> In this case study, “profit” refers to economic profit, which is different from accounting profit. Accounting profit is equal to revenue minus costs associated with generating that revenue. Economic profit is equal to revenue minus costs associated with generating that revenue and minus opportunity cost. Opportunity cost is the forgone benefit of using capital in an alternative business venue. A simple example is earning interest on the money deposited in a savings account in a bank.

<sup>10</sup> These market scenarios can be thought of as different years. Marginal cost can change from year to year, but for the purpose of identifying the effects of seller market power on industry profit, it is assumed to be the same in the analyzed scenarios.

**Table 2. Alternative Market Scenarios for the U.S. Potato Industry**

Scenario	Price and quantity depicted in Figure 3 <sup>a</sup>	Comparison of scenarios' prices and quantities	Profit
Perfect competition	Scenario C: Q <sub>c</sub> and P <sub>c</sub>	P <sub>c</sub> =MC	PCM <sub>c</sub> =P <sub>c</sub> -MC=0 Zero profit for the industry and firms
Potato oversupply	Scenario O: Q <sub>o</sub> and P <sub>o</sub>	Q <sub>o</sub> >Q <sub>c</sub> P <sub>o</sub> <MC	PCM <sub>o</sub> =P <sub>o</sub> -MC< 0 PCM <sub>o</sub> <PCM <sub>c</sub> Loss for the industry and firms
Potato supply management (a small degree of seller market power)	Scenario S: Q <sub>s</sub> and P <sub>s</sub>	Q <sub>s</sub> <Q <sub>c</sub> P <sub>s</sub> >MC	PCM <sub>s</sub> =P <sub>s</sub> -MC>0 PCM <sub>s</sub> >PCM <sub>c</sub> Profit for the industry and firms
Hypothetical monopoly	Scenario M: Q <sub>m</sub> and P <sub>m</sub>	Q <sub>m</sub> <Q <sub>s</sub> <Q <sub>c</sub> P <sub>m</sub> >P <sub>s</sub> >MC	PCM <sub>m</sub> =P <sub>m</sub> -MC>0 PCM <sub>m</sub> >PCM <sub>s</sub> >PCM <sub>c</sub> Profit for the industry and firms

<sup>a</sup> Q (cwt), P (\$ per cwt), MC (\$ per cwt), and PCM (\$ per cwt) are quantity, price, marginal cost, and price-cost margin, respectively. Subscripts “c,” “o,” “s,” and “m” denote a *perfectly competitive industry scenario*, a *potato oversupply scenario*, a *potato supply management (a small degree of seller market power) scenario*, and a *hypothetical monopoly scenario*, respectively.

The potato quantity (Q) used in the analysis is the total potato quantity produced by all growers in the potato production season (“potato production”). The potato price (P) is the yearly average potato price received by growers in the following marketing season. The total potato quantity produced affects potato prices received by growers: potato price is a function of potato quantity (inverse demand).<sup>11</sup>

Agricultural industries are often characterized as perfectly competitive industries. There are many agricultural producers in these industries who act as price-takers. To maximize their profit, they produce output quantity (Q<sub>c</sub>) at the point at which the prices they receive are equal to the marginal costs of producing their outputs (P<sub>c</sub>=MC). The economic profit is zero in perfectly competitive industries (PCM<sub>c</sub>=0). The first market scenario is a perfectly competitive industry scenario, which is used as a benchmark scenario to evaluate actual potato industry market situations before, during, and after the potato supply management program.<sup>12</sup>

The second market scenario is a potato oversupply scenario, which reflects a market situation prior to the potato supply management program. In this scenario, the potato industry produces a potato quantity (Q<sub>o</sub>) larger than that produced in a perfectly competitive industry scenario (Q<sub>c</sub>). As a result, potato prices received by growers are below marginal cost (P<sub>o</sub><MC=P<sub>c</sub>), and the price-cost margin (profit) is negative (PCM<sub>o</sub><0). The industry and growers incur losses.

To correct the adverse potato oversupply situation, cooperatives of potato growers developed and implemented the potato supply management program. The potato acreage management program directly affected potato area planted each year and total quantity of potatoes produced. In the first years of

<sup>11</sup> A discussion of potato production and price cycle in light of a similar theoretical framework is presented in Bolotova (2019).

<sup>12</sup> In Figure 3, the profit-maximizing quantity in a perfectly competitive industry scenario is at the intersection of the inverse demand and marginal cost curves. The profit-maximizing pricing rule P=MC is used to calculate quantity. This quantity and the inverse demand function are used to calculate price. Note that output price (P) is equal to marginal revenue (MR<sub>c</sub>) in perfectly competitive industries.

program implementation, the objective was to reduce potato acreage by 15 percent relative to potato acreage in 2004.

Effective implementation of the potato acreage management program was expected to increase seller market power in the potato industry. A decrease in the potato area planted and total potato quantity produced would increase potato prices and profit. The industry would move to a perfectly competitive industry scenario and possibly to a scenario in which potato growers (sellers) attained a small degree of market power.<sup>13</sup>

The third market scenario is a potato supply management scenario in which potato growers have a small degree of seller market power. This scenario reflects the market situation in the period of the potato supply management program. In the scenario, the potato industry produces a potato quantity ( $Q_s$ ) smaller than that produced in a perfectly competitive industry scenario ( $Q_c$ ). As a result, potato prices received by growers are above marginal cost ( $P_s > MC = P_c$ ), and the price-cost margin (profit) is positive ( $PSMs > 0$ ). The industry and growers earn profit.

The fourth market scenario is a hypothetical monopoly scenario, representing the extreme case of seller market power.<sup>14</sup> According to the economic model of the profit-maximizing behavior of a monopoly operating in a market with linear demand and constant marginal cost, the profit-maximizing output quantity under monopoly ( $Q_m$ ) is 50 percent of the profit-maximizing output quantity under perfect competition ( $Q_c$ ). The potato industry never would have been able to reach monopoly market power because it was not cutting potato production by an amount close to 50 percent.

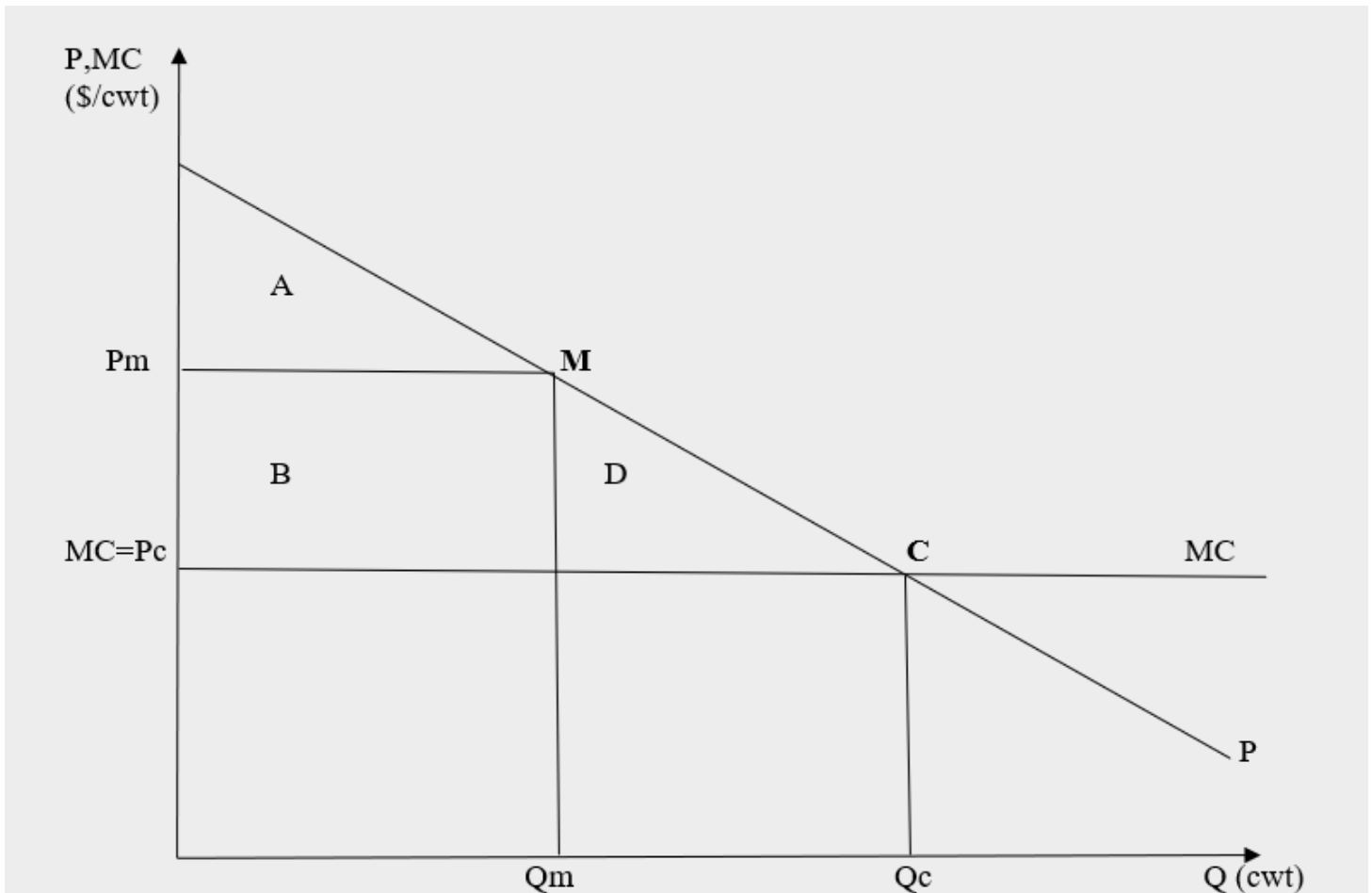
The market situation in the period following the potato supply management program theoretically could be described as a small degree of seller market power scenario if the industry does not increase potato production or as a perfectly competitive industry scenario if the industry increases potato production to a relatively small extent. Absent the potato acreage management program, potato growers have incentives to increase potato production in response to increased potato prices they received in the period of the potato supply management program.

Although potato growers are better off in market scenarios with decreased potato production and increased potato prices (seller market power scenarios), potato buyers are worse off. Potato buyers have access to a smaller potato quantity and pay higher potato prices. Although potato buyers are better off in a market scenario with increased potato quantity and decreased potato prices (potato oversupply scenario), potato growers are worse off. Potato growers cannot sell their potatoes at profitable prices. Potato growers receive potato prices lower than potato production costs and incur losses.

A simple welfare analysis for the U.S. potato industry is presented in Figure 4. The two market scenarios depicted in this figure are a perfectly competitive industry scenario and a generic market power scenario. The latter encompasses any scenario in which a potato acreage management program decreases potato quantity and increases potato price relative to a perfectly competitive industry

<sup>13</sup> The total potato quantity produced each year is determined by potato area planted (and harvested) and potato yield per acre.

<sup>14</sup> In Figure 3, the profit-maximizing monopoly quantity ( $Q_m$ ) is at the intersection of the marginal revenue for monopoly curve ( $MR_m$ ) and the marginal cost curve ( $MC$ ). In the case of a linear inverse demand curve, the marginal revenue for monopoly curve is twice as steep as the inverse demand curve; both curves have the same Y-axis intercept. Using a general version of a linear inverse demand function  $P = a - bQ$ , a marginal revenue function for monopoly is  $MR_m = a - 2bQ$ . Note that marginal revenue is the derivative of the total revenue ( $TR$ ) with respect to quantity ( $Q$ ):  $MR_m = dTR/dQ = d(PQ)/dQ = d((a - bQ)Q)/dQ = a - 2bQ$ . The profit-maximizing pricing rule  $MR_m = MC$  is used to calculate monopoly quantity. This quantity and the inverse demand function are used to calculate monopoly price.



**Figure 4. Welfare Analysis of the U.S. Potato Industry.**

Note: Point C at  $Q_c$  and  $P_c$  is a *perfectly competitive industry* scenario. Point M at  $Q_m$  and  $P_m$  is a *generic market power* scenario.

scenario. Table 3 summarizes welfare elements for both scenarios and changes in these elements.<sup>15</sup>

The following changes in market welfare occur due to the potato supply (acreage) management program. Consumer surplus decreases from the triangle area (A+B+D) to the triangle area A, and producer surplus increases by the rectangle area B. Triangle area D is consumer deadweight loss due to the decrease in potato quantity and increase in potato price. Some consumers do not buy potatoes because of increased potato prices. Consumers who purchase potatoes pay higher potato prices. Rectangle area B is the producers' profit, also referred to as cartel overcharge. The overcharge is a welfare transfer from consumers to producers (potato growers) because of the producers' seller market power. The total \$ overcharge  $(P_m - P_c) \cdot Q_m$  is the basis for damages that potato buyers aimed to recover during the potato antitrust litigation.<sup>16</sup>

<sup>15</sup> In standard microeconomics textbooks, the explanation of a market welfare analysis in seller market power cases relies on an upward sloping marginal cost (supply) curve. Using this cost assumption, producer surplus is positive under perfect competition, and producer deadweight loss occurs because of seller market power. In this case study, Figure 4 depicts a constant marginal cost curve for the welfare analysis to be consistent with the theoretical framework depicted in Figure 3 and with the analytical analysis included in the discussion questions. Given a constant marginal cost curve, producer surplus is equal to zero under perfect competition (the area below actual market price  $P_c$  and above marginal cost curve in Figure 4 is equal to zero because  $P_c = MC$ ). There is no producer deadweight loss due to seller market power.

<sup>16</sup> Buyers purchasing potatoes directly from potato growers were entitled to recover treble damages under the Clayton Act (1914) (a federal law).

**Table 3. Welfare Analysis for the U.S. Potato Industry**

Welfare element	Perfectly competitive industry scenario	Generic market power scenario	Difference between the market power and perfectly competitive industry scenarios
Consumer surplus	A+B+D	A	- (B+D)
Producer surplus	0	B	B
Consumer deadweight loss	0	D	D
Producer deadweight loss	0	0	0
Total market deadweight loss	0	D	D
Welfare transfer from consumers to producers: overcharge (producer profit)	0	B	B

## 5 Empirical Market and Price Analysis in the U.S. Potato Industry

This section presents a basic market and price analysis in the U.S. potato industry in the three periods of interest: the period prior to the potato supply management program (2000–2004), the period of the program (2005–2010), and the period following it (2011–2016). These periods are referred to as pre-SM period, SM period, and post-SM period, respectively. The purpose of this analysis is to identify and evaluate changes in the potato market and price behavior to provide evidence of program effectiveness. The analysis uses publicly available data from the U.S. Department of Agriculture National Agricultural Statistics Service Quick Stats database (USDA NASS 2021). The analysis is conducted at the farm stage of the potato supply chain.

### 5.1 An Analysis of Yearly Potato Production and Price

To analyze changes in potato production and price over the three periods of interest, the yearly averages and coefficients of variation are calculated for potato area harvested, potato yield per acre, potato production (quantity), and potato price.<sup>17</sup> Table 4 summarizes descriptive statistics and presents changes in the averages and coefficients of variation among the analyzed periods. Figure 2 depicts yearly potato production and price in the period 1993–2016.

#### 5.1.1 Pre-Supply Management Period

In the pre-SM period, the yearly average potato area harvested is 1,250 thousand acres, potato yield is 372 cwt per acre, potato production is almost 465 million cwt, and potato price is \$6.05 per cwt.<sup>18</sup> Potato area harvested and potato production are the largest and potato yield per acre and potato price are the lowest in the pre-SM period, as compared with the SM and post-SM periods. This potato price-quantity relationship (large quantity and low price) in the pre-SM period, as compared with the SM and post-SM periods, reflects a potato oversupply problem. As indicated by the coefficients of variation, the volatility

<sup>17</sup> Coefficient of variation is chosen to measure the volatility of the analyzed variables in this case study. Although other measures of volatility are available, for example, standard deviation and variance, an advantage of the coefficient of variation is that it measures the standard deviation relative to the mean of the analyzed variable. The coefficient of variation can also be expressed in percentage form.

<sup>18</sup> The area harvested may be smaller than the area planted due to crop failure (because of weather, insects, and diseases), lack of labor, low market prices, or other factors (USDA ERS 2019). Total potato quantity produced (“potato production”) is approximately equal to the area harvested times potato yield per acre.

**Table 4. U.S. Potato Industry: Acres Harvested, Yield, Production, Price, 2000—2016**

	Acres harvested (acres)	Yield (cwt per acre)	Production (cwt)	Price (\$ per cwt)
<b><i>Pre-supply management period (2000–2004)</i></b>				
Average <sup>a</sup>	1,249,980	372	464,678,600	6.05
CV <sup>b</sup>	0.053	0.037	0.062	0.128
<b><i>Supply management period (2005–2010)</i></b>				
Average	1,071,400	398	426,927,667	8.07
CV	0.043	0.021	0.036	0.115
<b><i>Supply management period, relative to pre-supply management period</i></b>				
Average percentage change	-14.29	7.14	_____	_____
CV percentage change	-19.78	-42.54	_____	_____
<b><i>Post-supply management period (2011–2016)</i></b>				
Average	1,063,517	416	442,293,167	9.06
CV	0.041	0.031	0.027	0.048
<b><i>Post-supply management period, relative to supply management period</i></b>				
Average percentage change	-0.74	4.48	_____	_____
CV percentage change	-4.61	44.79	_____	_____
<b><i>Post-supply management period, relative to pre-supply management period</i></b>				
Average percentage change	-14.92	11.93	_____	_____
CV percentage change	-23.48	-16.81	_____	_____

<sup>a</sup> Averages are yearly averages.

<sup>b</sup> CV is the coefficient of variation (the ratio of standard deviation to the average).

Data Source: USDA NASS (2021).

Note: Students should perform relevant calculations to record their answers in cells with missing answers (Discussion Question 6.1).

of potato acres harvested, potato production, and potato price is the highest in the pre-SM period, as compared with the SM and post-SM periods.

### 5.1.2 Supply Management Period, as Compared with Pre-Supply Management Period

The following changes take place in the SM period, as compared with the pre-SM period. The yearly average potato area harvested decreases by 14.29 percent. This percentage decrease in the potato area harvested is very close to the 15 percent target potato acreage reduction established by the guidelines developed by the cooperatives. Because the yearly average potato yield per acre increases by approximately 7 percent, the yearly average potato production decreases only by approximately 8 percent. According to the theoretical framework (inverse demand), total potato production affects potato prices. The yearly average potato price received by potato growers (this is the price paid by potato buyers) increases by approximately 33 percent. As indicated by the coefficients of variation, the volatility of potato area harvested, potato production, and potato price decreases by approximately 20 percent, 41 percent, and 10 percent, respectively.

The empirical evidence on changes in the level and volatility of U.S. potato industry production and price in the SM period, as compared with the pre-SM period, indicates that industry conduct and performance reflect the effects of the potato supply management program. The potato area harvested decreases by a targeted percentage, which causes potato production to decrease and potato price to increase. These changes in potato production and price indicate that the potato industry effectively managed a potato oversupply problem, which was one of the objectives of the potato supply management program. In addition, the volatility of potato production and price decreases. Control of potato supply and



price volatility was another objective of the potato supply management program. In summary, the empirical evidence is consistent with the program's effective implementation.

It should be emphasized that total annual potato production, which affects potato prices received by growers, is determined by both the potato area harvested and potato yield per acre. Although potato growers were able to affect potato area planted each year, they did not have complete control over potato yield per acre. Over time, increasing potato yield per acre (for example, due to improvements in potato varieties and agronomical practices) might have diminished the anticipated effects of potato acreage reduction on potato prices.

### 5.1.3 Post-Supply Management Period, as Compared with Supply Management Period

The following changes take place in the post-SM period, as compared with the SM period. The yearly average potato area harvested decreases by 0.74 percent, and the yearly average potato yield per acre increases by approximately 4.5 percent. As a result, yearly average potato production increases by 3.6 percent, and the yearly average potato price increases by approximately 12 percent. As indicated by the coefficients of variation, the volatility of potato area harvested, potato production, and potato price decreases by approximately 4.6 percent, 25 percent, and 58.6 percent, respectively.

The empirical evidence of changes in the level and volatility of U.S. potato industry production and price in the post-SM period, as compared with the SM period, indicates that industry conduct and performance might still reflect some of the effects of the potato supply management program. First, although the yearly average potato area harvested is slightly smaller in the post-SM period than in the SM period, area harvested is approximately 15 percent smaller in the post-SM period than in the pre-SM period. The yearly average potato area harvested did not increase in the post-SM period, although the potato acreage management program was not enforced. Second, the volatility of both potato production and price continues to decrease.

An analysis of changes in yearly potato production and price in the post-SM period provides additional details on industry dynamics in the absence of the potato acreage management program.<sup>19</sup> In 2010, the last year of the SM period, potato area planted and potato production were the smallest and yearly average potato price was one of the highest in the SM and post-SM periods. The potato area planted increased 6.9 percent, from 1,009 thousand acres in 2010 to 1,078.5 thousand acres in 2011, the first year of the post-SM period. Given a decrease in the potato yield per acre in 2011, potato production increased 6.3 percent, from 404.5 million cwt in 2010 to 430 million cwt in 2011, and the yearly average potato price increased 2.3 percent, from \$9.20 per cwt in 2010 to \$9.41 per cwt in 2011. In 2012, potato area planted further increased 5.6 percent to 1,138.5 thousand acres. Given an increase in the potato yield per acre, potato production increased 8.1 percent to 465 million cwt, and the yearly average potato price decreased 8.3 percent to \$8.63 per cwt.

In response to high potato prices in 2010 and 2011—prices likely due to effective implementation of the potato acreage management program—potato growers increased potato area planted in 2011 and 2012, when the potato acreage management program was no longer in effect. This expansion led to increased potato production and a lower yearly average potato price in 2012. In response to this lower potato price, potato growers decreased potato area planted in 2013 by 7.7 percent to 1,051 thousand acres. Despite an increase in the potato yield per acre, potato production decreased by 6.5 percent to 434.7 million cwt, and the yearly average potato price increased by 13 percent to \$9.75 per cwt. In the following years, 2014 and 2015, potato area planted remained virtually unchanged, but in 2016 it decreased to 1,008 thousand acres, the smallest potato area planted in both the SM and post-SM periods. Given a constantly increasing potato yield per acre, potato production reached 441 million cwt in 2016, and the yearly average potato price was \$8.90 per cwt.

<sup>19</sup> The teaching note includes an Excel file with all data used in the analysis presented in this case study.

The patterns of changes in potato production and price in the post-SM period indicate that potato growers' experience with the potato acreage management program might have helped them stabilize the industry. Initially they expanded potato area planted in response to high potato prices. The consequence was lower potato prices in 2012. In the following years, the growers decreased and then maintained potato area planted to keep potato prices at a reasonable level.

### 5.2 An Analysis of Monthly Fresh, Processing, and All Potato Prices

This section presents a disaggregated price analysis for the two major potato categories—fresh and processing—as compared to the yearly all potato price analysis presented in the previous section. The monthly averages and coefficients of variation are calculated for fresh, processing, and all potato prices for the three periods of interest. The all potato price combines the fresh and processing potato prices. Table 5 summarizes descriptive statistics and presents changes in the averages and coefficients of variation among the analyzed periods. Figure 5 depicts monthly prices for fresh, processing, and all potatoes.

**Table 5. U.S. Potato Industry: Fresh, Processing, and All Potato Prices (\$ per cwt), 2000—2016**

	Fresh potato price	Processing potato price	All potato price
<b><i>Pre-supply management period (January 2000–July 2005)</i></b>			
Average price <sup>a</sup>	8.21	5.14	6.18
CV <sup>b</sup>	0.34	0.08	0.18
<b><i>Supply management period (August 2005–August 2011)</i></b>			
Average price	11.48	6.71	8.19
CV	0.32	0.17	0.18
<b><i>Supply management period, relative to pre-supply management period</i></b>			
Average price percentage change	39.80	_____	_____
CV percentage change	-5.49	_____	_____
<b><i>Post-supply management period (September 2011–December 2016)</i></b>			
Average price	10.61	8.25	9.03
CV	0.23	0.09	0.12
<b><i>Post-supply management period, relative to supply management period</i></b>			
Average price percentage change	-7.62	_____	_____
CV percentage change	-27.57	_____	_____
<b><i>Post-supply management period, relative to pre-supply management period</i></b>			
Average price percentage change	29.15	_____	_____
CV percentage change	-31.55	_____	_____

<sup>a</sup> Average prices are monthly averages.

<sup>b</sup> CV is the coefficient of variation (the ratio of standard deviation to the average).

Data Source: USDA NASS (2021).

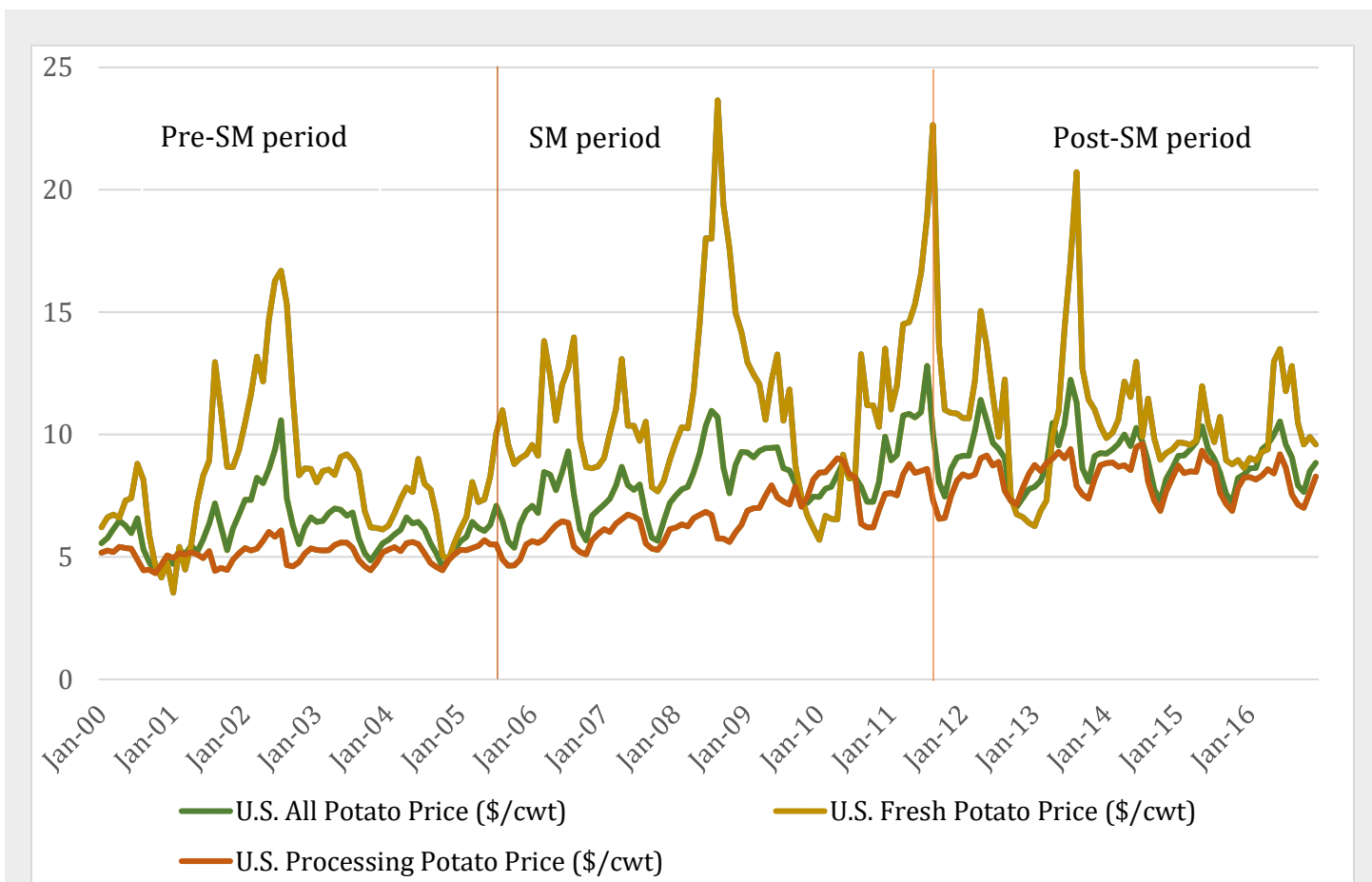
Note: Students should perform relevant calculations to record their answers in cells with missing answers (Discussion Question 6.2).

In the pre-SM period, the monthly average prices are \$\_\_\_\_ per cwt for fresh potatoes, \$\_\_\_\_ per cwt for processing potatoes, and \$\_\_\_\_ per cwt for all potatoes.<sup>20</sup> As indicated by the coefficients of variation, the volatility of fresh potato price is approximately \_\_\_\_ times the volatility of processing potato price.

<sup>20</sup> In the three paragraphs describing monthly average prices and changes in these prices and their volatility, students should fill in missing answers by using data presented in Table 5.

In the SM period, as compared with the pre-SM period, the monthly average fresh potato price, processing potato price, and all potato price increase by approximately \_\_\_ percent, \_\_\_ percent, and \_\_\_ percent, respectively. The volatility of fresh and all potato prices decreases by \_\_\_ percent and \_\_\_ percent, respectively. The volatility of processing potato price increases by almost \_\_\_ percent.

In the post-SM period, as compared with the SM period, the monthly average fresh potato price decreases by \_\_\_ percent, and the monthly average processing and all potato prices increase by \_\_\_ percent and \_\_\_ percent, respectively. The volatility of fresh, processing, and all potato prices decreases by almost \_\_\_ percent, \_\_\_ percent, and \_\_\_ percent, respectively.



**Figure 5. U.S. Monthly Fresh, Processing, and All Potato Prices: Before, During, and After the Potato Supply Management (SM) Program, 2000—2016.**

Data source: USDA NASS (2021).

Note: Pre-SM period, SM period, and post-SM period are the pre-supply management program, supply management program, and post-supply management program periods, respectively.

The empirical evidence indicates some differences in the price behavior of fresh and processing potatoes over the three analyzed periods, but both fresh and processing potato prices increase in the SM period, as compared with the pre-SM period. This behavior is consistent with that of yearly potato prices described in the previous section. The potato supply management program originally targeted the fresh potato segment, but later it started affecting the processing potato segment as well. Increasing fresh and processing potato prices and decreasing volatility of fresh potato prices in the SM period, as compared with the pre-SM period, reflect the effective implementation of the potato supply management program.

The monthly average fresh potato price decrease in the post-SM period reflects the fact that the potato supply management program (in particular, the potato acreage management program) is no

longer in effect. The monthly average processing potato price increase in the post-SM period might reflect the fact that processing potato prices are negotiated by potato growers and potato processors in contracts signed prior to the potato production season. In addition, potato growers in the major potato-producing regions are represented by bargaining organizations (cooperatives) in contract negotiations with potato processors when they negotiate contract prices and other terms of trade. In summary, the fresh potato and processing potato segments of the industry have distinct marketing and pricing institutions (spot market and pre-production season contracts, respectively) that affect potato price behavior in each of these segments and in the entire potato industry.

## 6 Potato Supply Management Program and Antitrust

The cooperatives of potato growers presumed that their potato supply management program was within the scope of Capper-Volstead Act immunity. The Capper-Volstead Act (1922) provides limited antitrust immunity from Section 1 of the Sherman Act for collective agricultural marketing activities of agricultural producers implemented through their organizations.<sup>19</sup>

Section 1 of the Sherman Act (1890) makes illegal agreements among competitors (firms producing and selling the same or similar products) that aim to affect product quantities, prices, or both in interstate commerce.<sup>22</sup> These agreements are often referred to as cartels, price-fixing cartels, or price-fixing conspiracies. Agricultural producers are competitors, and collective agricultural marketing activities (programs) that affect agricultural product prices, quantities, or both are agreements among competitors. In the absence of the Capper-Volstead Act, collective agricultural marketing activities would have violated Section 1 of the Sherman Act.

Beginning in 2010, a group of buyers of fresh potatoes and processed potato products that purchased these products directly from potato growers (wholesalers and retailers) and indirectly (final consumers) filed class action antitrust lawsuits against the cooperatives of potato growers and individual potato growers.<sup>23</sup> These buyers (plaintiffs) alleged that the potato supply management program, and in particular the potato acreage management program, was a form of illegal price-fixing violating Section 1 of the Sherman Act.

The plaintiffs argued that the cooperatives of potato growers (defendants) acted as a classic price-fixing cartel, setting potato prices above a competitive level. Potato buyers had to pay higher potato prices and were overcharged. The cooperatives of potato growers settled these lawsuits for \$25 million in 2015 (O'Connell 2018). In addition, according to the settlement agreement, the cooperatives agreed that they would make no attempt to manage potato acreage prior to the potato planting season for seven years (O'Connell 2018).

The main legal issue raised in the potato antitrust litigation is whether the potato acreage management (control) program was within the scope of Capper-Volstead Act immunity. Apparently, no well-developed case law interpreted the legal status of agricultural supply management programs and, in particular, programs implemented at the agricultural production stage in light of the Capper-Volstead Act.

In December 2011, a U.S. district court for the first time in the history of the Capper-Volstead Act evaluated the legal status of agricultural production restrictions in a lawsuit against a group of cooperatives of potato growers and individual potato growers. After conducting a comprehensive

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<sup>21</sup> The organizations of agricultural producers must conform to the Capper-Volstead Act standard established in Section 1 of the act.

<sup>22</sup> Section 1 of the Sherman Act refers to these agreements as contracts, combinations, or conspiracies in restraint of trade.

<sup>23</sup> The Clayton Act (1914) allows private parties (individuals and firms) to recover treble damages and reasonable attorney fees for violations of the Sherman Act.

analysis, the court concluded, in its advisory opinion, that “acreage reductions, production restrictions, and collusive crop planning are not activities protected by the Capper-Volstead Act.”<sup>24</sup>

One of the main arguments of the defendants (cooperatives) was that if the Capper-Volstead Act cooperatives were allowed to fix prices, they should be allowed to restrict production.<sup>25</sup> This argument did not persuade the court, which responded that “Individual freedom to produce more in times of high prices is a quintessential safeguard against Capper-Volstead Act abuse, which Congress recognized in enacting the statute.”<sup>26</sup>

Recent legal decisions and related legal discussions establish that the types of agricultural supply management programs—whether implemented at the pre-agricultural production stage, agricultural production stage, or post-agricultural production stage—affect their legal status in light of the Capper-Volstead Act (Frackman and O’Rourke 2011; Hibner 2011; Bolotova 2014 and 2015; Peck 2015). It is crucial whether the collective agricultural marketing activities (programs) in question can be interpreted as “marketing” under Section 1 of the Capper-Volstead Act.

Collective agricultural supply management activities implemented at the post-agricultural production stage are more likely to be interpreted as marketing and therefore are likely to be within the scope of Capper-Volstead Act immunity. An example is the potato flow control program, through which a cooperative withholds already-produced product from the market in the anticipation of higher prices. Collective agricultural supply management activities implemented at the pre-agricultural production and agricultural production stages are not likely to be interpreted as marketing and therefore are outside the scope of Capper-Volstead Act immunity. The potato acreage management program is an example. The courts interpret the legal status of collective agricultural marketing activities on a case-by-case basis.

## 7 Discussion Questions

The teaching note provides additional guidance for responding to selected discussion questions and suggested answers to all discussion questions. In addition, the note includes multiple choice questions, which can be used as in-class assignments, quizzes, and exam questions.

1. Discuss the U.S. potato industry structure and economic forces leading to the idea of a potato supply management program.
2. Explain objectives of the potato supply management program and the role of cooperatives of potato growers in developing and implementing this program. Discuss the design of the potato acreage management program and the procedure of its implementation. Discuss a set of potato marketing programs.
3. Using a graphical analysis, explain a theoretical framework that incorporates seller market power in the U.S. potato industry and that describes potato price-quantity relationships and industry profitability for four alternative market scenarios: potato oversupply, perfectly competitive industry, potato supply management (a small degree of seller market power), and hypothetical monopoly.

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<sup>24</sup> In Re: Fresh and Process Potatoes Antitrust Litigation No. 4:10-MD-2186-BLW (D.Id.). 2011.  
[https://scholar.google.com/scholar\\_case?case=3083777526870283711&q=Re:+Fresh+and+Process+Potatoes+Antitrust+Litigation+&hl=en&as\\_sdt=3,33](https://scholar.google.com/scholar_case?case=3083777526870283711&q=Re:+Fresh+and+Process+Potatoes+Antitrust+Litigation+&hl=en&as_sdt=3,33).

<sup>25</sup> Case law has established that price-fixing activities of agricultural cooperatives are generally within the scope of Capper-Volstead Act immunity because “price-fixing” is a form of pricing activities, which are essential elements of “marketing” mentioned in Section 1 of the Capper-Volstead Act. Frederick (1989; 2002) provides a detailed analysis of the act.

<sup>26</sup> In Re: Fresh and Process Potatoes Antitrust Litigation No. 4:10-MD-2186-BLW (D.Id.). 2011.

4. Perform an analytical analysis of the potato price-quantity relationships and industry profitability for the four market scenarios mentioned in the previous question. To complete this analysis, use the following assumptions. The potato inverse demand function is  $P = 20.45 - 0.026Q$  ( $P$  is in \$ per cwt, and  $Q$  is in million cwt), and the marginal cost of producing potatoes is \$9.00 per cwt. Marginal cost is the same in these four scenarios.<sup>27</sup> Assume that the U.S. potato industry produces the following total potato quantity under the four alternative market scenarios: 460 million cwt, 440.3846 million cwt, 420 million cwt, and 220.2 million cwt.

4.1. Using the assumptions on potato inverse demand, marginal cost, and quantities, calculate the following economic measures to complete a profitability analysis of the potato industry. For each market scenario, calculate potato price in \$ per cwt, total costs in \$, total revenue in \$, total profit in \$, and price-cost margin (profit) measured in \$ per cwt and as a percentage of the potato price (Lerner Index of market power). Classify each scenario as potato oversupply, perfectly competitive industry, potato supply management, or hypothetical monopoly.

4.2. Discuss the results of your analysis. First, draw a figure similar to Figure 3 of the case study to show the four analyzed market scenarios: show relevant curves, price-quantity combinations, and price-cost margins. Second, explain the patterns of potato price-quantity relationships and industry profitability in each scenario. In which scenario(s) are potato growers better off? In which scenario(s) are potato growers worse off? In which scenario(s) are potato buyers better off? In which scenario(s) are potato buyers worse off? Explain your reasoning.

5. Perform a welfare analysis for the U.S. potato industry.

5.1. Show on a graph relevant curves and potato price-quantity combinations for a perfectly competitive industry scenario and a generic market power scenario reflecting the potato supply management program. On the same graph, show market welfare elements for both scenarios. Explain the market welfare elements and discuss changes in these elements caused by implementation of a potato supply management program.

5.2. On the graph you developed in Question 5.1, show potato price-quantity combinations for a perfectly competitive industry scenario ( $Q_c=440.4$  million cwt and  $P_c=\$9.00$  per cwt) and a generic market power scenario reflecting the potato supply management program ( $Q_m=420$  million cwt and  $P_m=\$9.53$  per cwt). The Y-axis intercept is 20.45. Perform a welfare analysis for the U.S. potato industry by calculating market welfare elements and their changes from one to the other scenario. In the case of each scenario, calculate consumer surplus, producer surplus, consumer deadweight loss, producer deadweight loss, total market deadweight loss, and producer profit (cartel overcharge). Discuss the results of your analysis from the perspectives of potato growers (producers) and potato buyers (consumers).

6. Perform a basic market and price analysis of the U.S. potato industry.

6.1. Evaluate changes in yearly potato area harvested, yield per acre, production, price, and their volatility in this case study's three periods of interest: prior, during, and after the potato supply management program.

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<sup>27</sup> The potato inverse demand function is estimated using USDA NASS yearly potato production and price data (Bolotova 2017). The marginal cost assumption is developed using production costs reported in the potato production budgets (Patterson 2015).

6.1.1. Reproduce calculations of changes in yearly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are provided in Table 4.

6.1.2. Calculate changes in yearly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are not provided in Table 4.

6.1.3. Describe the results of your analysis. Explain which patterns of changes in potato area harvested, yield per acre, production, and price and which changes in their volatility are consistent with the effective implementation of the potato supply management program.

6.2. Evaluate changes in monthly fresh, processing, and all potato prices as well as in their volatility in the three periods of interest.

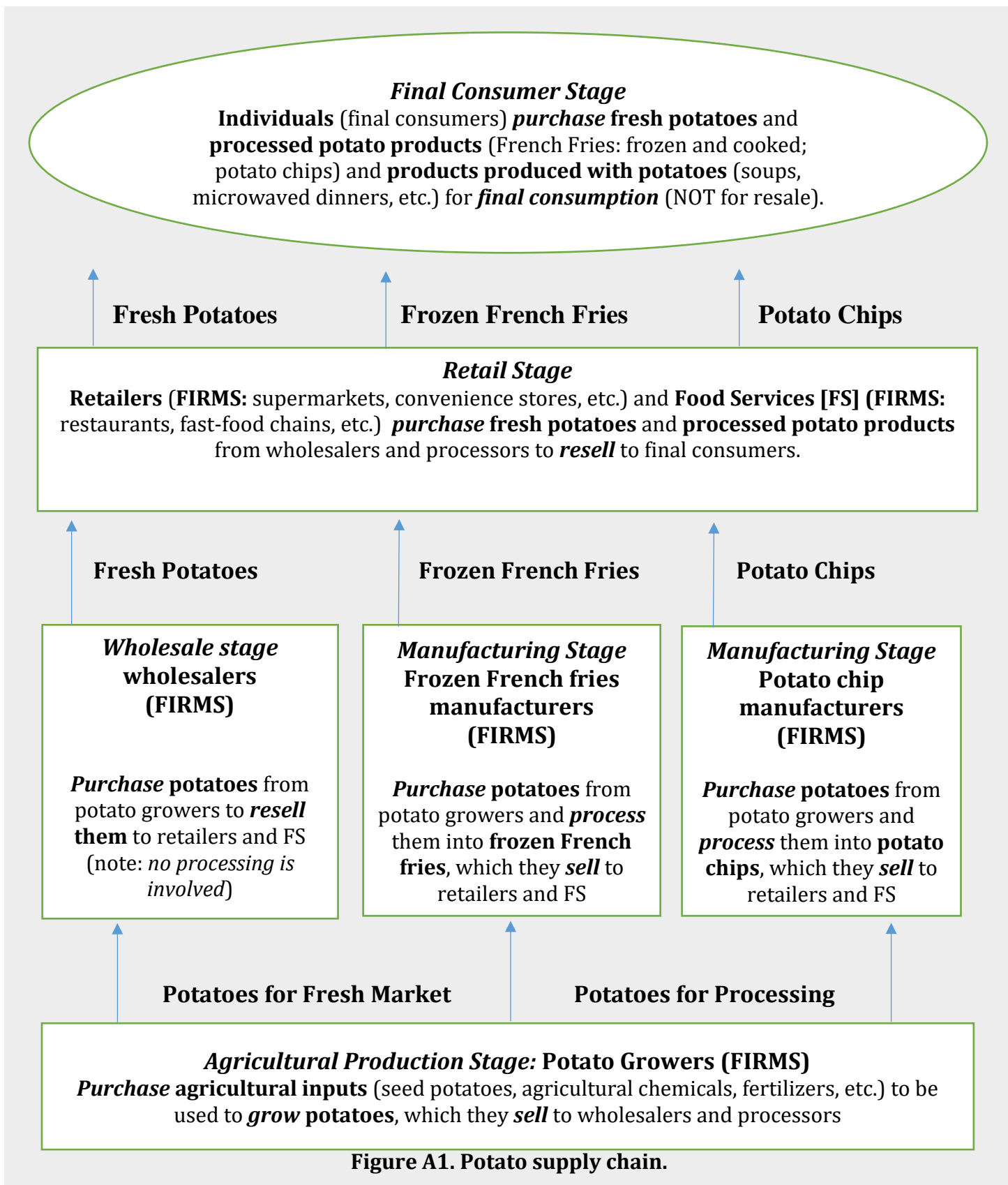
6.2.1. Reproduce calculations of changes in monthly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are presented in Table 5.

6.2.2. Calculate changes in monthly averages and coefficients of variation among the analyzed periods for the economic variables for which answers are not presented in Table 5.

6.2.3. Compare fresh potato price behavior and processing potato price behavior. Explain which patterns of changes in potato prices and their volatility are consistent with effective implementation of the potato supply management program.

7. Explain why potato buyers filed antitrust lawsuits against the cooperatives of potato growers and individual potato growers. Explain the outcome of the potato antitrust litigation. Discuss the role of the Capper-Volstead Act in regulating collective agricultural marketing activities in the industry setting discussed in this case study.

## Appendix





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## Case Study

# High Stakes: Managing Risk and Policy Uncertainty in the Market for CBD Food Products

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### Abstract

Consumer demand for food products containing cannabidiol (CBD) has skyrocketed in recent years. This spike in demand has presented an opening for entrepreneurial small businesses to seize a lucrative market opportunity. However, sourcing CBD is risky due to volatile prices and spotty availability in the wholesale market. Consequently, some entrepreneurs have considered producing their own CBD by growing hemp and vertically integrating their supply chains. This strategy poses its own risks: hemp that contains too much tetrahydrocannabinol (THC) must be destroyed; hemp yields are variable; and state- and federal-level policies about hemp production are changing rapidly. This case study follows the story of Levi Budz, a young entrepreneur from northeast Wisconsin, as he founded and grew Budz Butter: a 2017 startup company that produced CBD food products. This case focuses on risk management and decision making under uncertainty with particular attention to a shifting policy landscape, price volatility for a key input (CBD extract), hemp production risks, and uncertainty about consumer demand and competition in the retail marketplace. These themes are broadly applicable to other emerging opportunities in the agricultural and food sectors, and especially applicable to entrepreneurial ventures.

JEL Codes: A22, M13, Q13, Q14, Q18

Keywords: CBD, hemp, risk, start-up, uncertainty

## 1 Introduction

As a new college graduate from Green Bay, Wisconsin, Levi Budz moved to Colorado in 2015 to start his first job in a small, fast-growing supply chain management company. His new employer specialized in the food service industry, and Levi quickly excelled at his job. Even though Levi's creative thinking and shrewd negotiating skills were bringing in hundreds of thousands of dollars in revenue for his company, he felt frustrated that he was not earning more money from his hard work. Soon, Levi began forming ideas for a business of his own.

With the passage of Amendment 64 in 2012, Colorado became the first state to legalize recreational marijuana (Reed 2018). The first retail sales outlets, called dispensaries, opened two years later in 2014 (Reed 2018). By the time Levi arrived in Colorado, hundreds of dispensaries were selling marijuana flower (or "bud") for smoking and other edible products infused with tetrahydrocannabinol (THC), the psychoactive compound in marijuana that creates a "high" or euphoric sensation. THC-infused food products like candies and baked goods were popular, but Levi noticed that many people preferred to make their own THC-infused foods at home. Getting the desired amount of THC in a home-baked product was quite challenging since the process included heating the marijuana flowers to low temperatures to "decarboxylate" the cannabinoid compounds in the plant. Getting this process wrong could lead to unpredictable levels of THC in the resulting product. Levi saw an opportunity to create branded THC-infused cooking products such as butter, peanut butter, coconut oil, or olive oil that contained predictable levels of THC for customers who wanted to make their own THC baked goods.

After eliciting feedback from friends and colleagues about his idea and creating some prototype products, Levi decided to take the first steps toward starting a new business producing THC-infused food

ingredients. Capitalizing on a bit of good fortune with his family name, he decided to call the business “Budz Butter.” Using some of his own money and a zero-interest loan from his parents, Levi founded Budz Butter, LLC in July 2017. He moved quickly to find a building, procure equipment, and satisfy any regulatory requirements to begin production. He soon discovered, however, that starting Budz Butter would be more complicated than he expected.

This case follows Levi’s journey of growing Budz Butter from an idea to an actual business while navigating risk and uncertainty from many sources. In particular, Levi had to manage a shifting policy landscape, input price volatility, agricultural production risks, and uncertainty about consumer demand and competition in the retail marketplace. This case provides an opportunity to examine decision making under uncertainty in the context of an entrepreneurial start-up in a fast-growing product sector.

## 2 THC or Cannabidiol (CBD)?

Even though Colorado had legalized the recreational use of marijuana, it remained a Schedule 1 drug under the Federal Controlled Substances Act (CSA). This meant that cannabis (another name for the marijuana plant) was an illegal substance in the eyes of the federal government, making it difficult for businesses producing or selling cannabis products to access basic tools like banking services (Parker et al. 2019; Abbott and Zack 2018). Levi had to ensure he did not locate his new processing facility in one of Denver’s “dry zones” where manufacturing THC products was prohibited. To start the process of obtaining a zoning permit for Budz Butter, Levi set up a meeting with Colorado’s Marijuana Enforcement Division (MED). While on the phone to schedule the meeting, an MED officer asked Levi if his attorney was planning to attend as well. Levi did not have an attorney and immediately felt discouraged. Was there a feasible path forward for Budz Butter if the regulatory requirements were so onerous that he would need a lawyer?

At this point, Levi put his plans on hold as he reassessed his options. He began to consider reorienting his business plan around a different aspect of the cannabis plant: CBD. CBD is a chemical compound found in cannabis that is purported to provide relief from seizures, anxiety, joint pain, menstrual cramps, nausea, insomnia, inflammation, and moodiness, among other ailments. However, unlike THC, CBD does not activate the brain’s cannabinoid receptors to produce a “high” feeling. Additionally, CBD can be found in hemp—a variety of the *Cannabis sativa* plant with much lower levels of THC that has been cultivated for centuries for its fiber to make rope and other products.

Despite its long agricultural history, hemp was not commonly grown in the United States in the early twenty-first century due to the CSA’s prohibition of cannabis. That started to change, however, in 2014. The Agricultural Act of 2014, known more commonly as the 2014 Farm Bill, was signed into law on February 7 of that year. Section 7606 of the legislation defined “industrial hemp” as distinct from marijuana and authorized limited production of hemp in states that legalized its cultivation. Most of this production occurred as part of research as part of state-level pilot programs permitting farmers to grow industrial hemp. Later, in the 2018 Farm Bill (officially known as the Agriculture Improvement Act of 2018), the federal government legalized the production of hemp as an agricultural commodity and removed it from the list of controlled substances. The legislation defined industrial hemp as the plant *Cannabis sativa L.* with a THC content of less than 0.3 percent. After the passage of the 2018 Farm Bill, individual states began to adopt their own statutes about how to regulate the production of industrial hemp. As the regulations on industrial hemp began to loosen, entrepreneurs increasingly eyed this agricultural product as a source of CBD.

In 2016, the total retail value of “Hemp CBD” products sold in the United States was \$130 million and growing at an annual rate of 53 percent (Hemp Business Journal 2017). Despite this booming market, CBD’s legal status was still in question. As of August 2016, the U.S. Drug Enforcement Agency (DEA) maintained that “CBD from any source is a Schedule I substance [under the CSA]” (Mead 2017, p. 289). Similarly, the U.S. Food and Drug Administration (FDA) renounced CBD as a dietary supplement

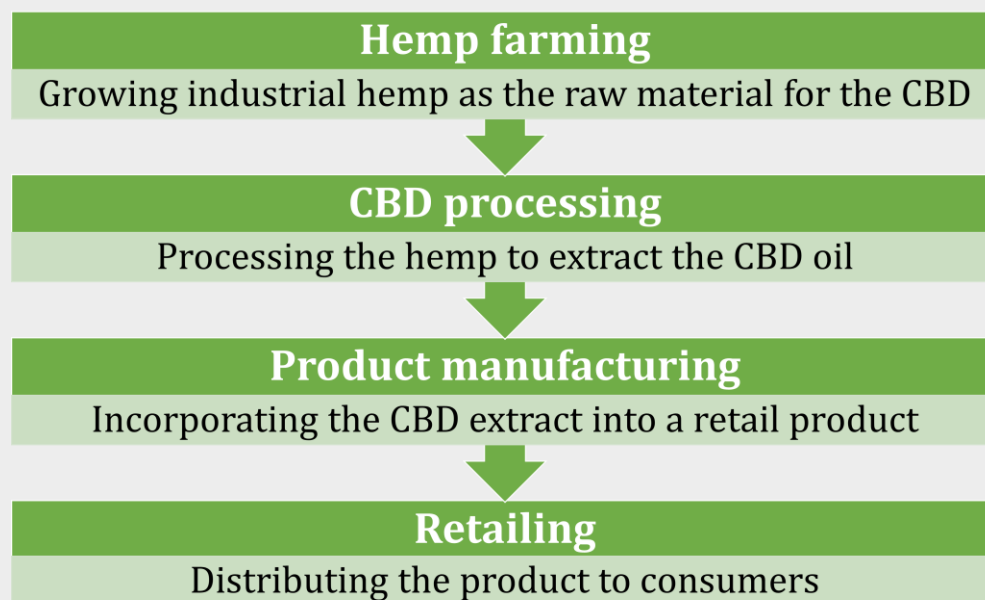
ingredient, thus leaving the substance’s legal and regulatory status “complex and evolving” (Corroon and Kight 2018, p. 193).

Even though there was lingering legal and regulatory uncertainty around CBD products (Raszap Skorbiansky, Thornsbury, and Camp 2021), Levi thought the market for CBD was much less risky than the market for THC. Additionally, CBD products were being sold across the country—not only in states that had legalized marijuana. By focusing on CBD products, Levi could reach a larger pool of potential buyers and tap into a market that was projected to have \$1.9 billion in retail sales by 2020 (Corroon and Kight 2018). Levi decided to reorient Budz Butter from a company that manufactured THC products to one that manufactured CBD products. Using the capital he and his parents had lent the company, Levi purchased the necessary manufacturing equipment and began to produce and sell hemp-derived CBD-infused food products including peanut butter, coconut oil, butter, and olive oil. Once he had made the decision to focus on CBD products, Levi realized he could locate his company in any state. He quickly decided to move back to Wisconsin where he would face less competition and benefit from an existing network of family, friends, and business relationships. Furthermore, real estate and labor were both less expensive in Wisconsin than in Colorado.

### 3 Vertical Integration

In June 2018, Levi moved Budz Butter to northeast Wisconsin where he continued to produce cooking ingredients and food products containing CBD. He also expanded his product offerings to include four different types of CBD tinctures and hemp flowers sold in jars. Upon relocating to Wisconsin, Levi secured a building for Budz Butter’s processing facility for less than a third of what a comparable building would have cost in Colorado. Then, he arranged for his manufacturing equipment to be shipped to the new facility in December of that year. As Levi was setting up his new location, he contemplated how vertically integrated he wanted Budz Butter to be.

The supply chain for CBD food products contained several steps, summarized in Figure 1. Levi knew that the core of Budz Butter’s business model was the product manufacturing step. The bigger question, however, was how many of the other steps he wanted to tackle as well.



**Figure 1. Supply Chain for CBD Food Products**

Although Levi planned to sell Budz Butter products directly to consumers through his company's website, he did not want direct-to-consumer marketing to be his only retail strategy. Leveraging his mother's experience and connections in the area, Levi was able to secure several health and wellness retailers—plus some organic food stores—as sales outlets. He also won the account of a major regional supermarket chain after a year and a half of effort. Building on this success, Budz Butter developed a robust regional network of retailers who carried the company's products. Thus, Levi largely outsourced the “retailing” step of the CBD supply chain.

The next question for Levi was how to source the CBD extract he would use during the product manufacturing step. He had essentially two choices: he could either buy CBD extract on the open market or self-source CBD extract by growing his own industrial hemp. If he decided to grow his own hemp, he would need to either process the hemp biomass himself or find someone else to do the job.

In 2018, CBD extract (also called refined hemp oil) cost roughly \$3,200 per pound on the wholesale market. At this price, the extract represented ninety percent of Budz Butter's cost of goods sold. To make matters worse, Levi did not have a good idea of what CBD extract prices would be in the future. The wholesale market for refined hemp oil was in its infancy, and accurate price data were hard to come by—let alone reliable price forecasts. A 2017 report about the cannabis wholesale market read in part:

*[P]rices have continued to move in unpredictable ways, creating wholesale price uncertainty for buyers, sellers, and the ancillary businesses whose products and services support the primary market participants. Price uncertainty, regarding both today's prices and those in the future, creates risk in the overall economics of this sector. (Cannabis Benchmarks 2017, p. 1)*

The same report noted that the price volatility for cannabis on the U.S. spot market—calculated as the annualized standard deviation of weekly log price changes—was 29.7 percent in 2016, considerably higher than other commodities like corn (22.1 percent), soybeans (17.5 percent), or gold (13.9 percent; Cannabis Benchmarks 2017). Levi knew the wholesale price for CBD extract could easily rise or fall. Exploding demand for CBD products would push prices up, but an expected boom in industrial hemp production could also flood the market with hemp biomass pushing prices down. It was anyone's guess what wholesale prices would do.

Levi ultimately decided to grow his own industrial hemp rather than rely on the wholesale market for CBD extract. Even though he did not have previous farming experience, he felt it was better to vertically integrate his supply chain than to expose himself to the uncertainty of the market for refined hemp oil. He also saw integrated hemp production as an opportunity to diversify his lineup of products. Specifically, Levi wanted to get into the market for smokable CBD products. Many consumers were interested in smoking hemp flowers that contained CBD but that did not have the THC found in marijuana. Traditionally, dried hemp flowers were sold in bags or jars and had to be rolled into cigarettes by the end user. Levi thought there was market opportunity to produce pre-rolled hemp cigarettes. By growing his own hemp, he could produce both hemp biomass (which would be processed into CBD extract) and intact hemp flowers (which he could dry and turn into hemp cigarettes).

Having decided to grow his own hemp, Levi next had to decide whether to process the hemp biomass himself or to outsource that step. Processing hemp to produce CBD extract was a complicated process, and Levi would need to procure expensive machinery to do the work himself. Furthermore, it did not make sense to incur a large fixed cost to buy machinery to handle what would be, ultimately, a relatively modest processing job. Levi decided to try and find a processor who would agree to take Levi's hemp biomass and turn it into CBD extract on a contract basis.

Luck struck again for Budz Butter when a mutual friend introduced Levi to a local hemp seed supplier named Mike. In addition to selling hemp seed and providing farm consulting services, Mike owned the machinery necessary to process hemp biomass into CBD extract. Levi and Mike developed a business relationship where Mike would sell hemp seed to Levi and provide free advice about how to grow the crop. He then agreed to take Levi's hemp biomass and process it into refined hemp oil for a

predetermined cost. The two entrepreneurs also worked together to develop new products for Budz Butter.

Finally, Levi had figured out his vertically integrated CBD supply chain: he would grow his own hemp, pay Mike to process some of the hemp biomass into CBD extract, use the extract to manufacture branded CBD foods and ingredients, and market his products direct-to-consumer through his website and through a regional network of traditional retailers.

## 4 Agricultural Production Risks

Levi had made the decision to grow his own hemp and was planning to plant his first crop in the spring of 2019. He would need to plant seeds in the spring and harvest in the fall. First, he calculated how much CBD extract and how many hemp flowers he would need in order to produce enough of his products to meet internal sales projections. He ultimately decided to grow 3,500 hemp plants. Some of the plants would be harvested for hemp biomass, which Mike would process into CBD extract, and others would be harvested for dried hemp flowers to be used in smokable CBD products. At the start of the season, Levi developed a rough production budget and expected to spend \$12,000–\$13,000 growing and harvesting his hemp crop.

Having decided how many hemp plants to grow, Levi leased a shed, tractor, and three acres of land from his grandmother for \$3,600 and borrowed some additional farming equipment for free from a local farmer who was an old friend. At three acres, Levi's hemp growing operation was on the small side; the average Wisconsin hemp farmer in 2019 grew nearly 13 acres of the crop (Drotleff 2020). Although Levi was confident about his farming operation—after all, he could rely on Mike, family, and friends to answer questions and offer advice—Levi had never farmed before. There were many things that could go wrong, and if he could not produce enough hemp to supply Budz Butter's needs, he would have to incur even more costs to purchase CBD extract from the wholesale market.

There were many risks involved in growing hemp. If the weather was bad or Levi made a mistake like planting his crop too late, his plants might not mature in time for harvest. One estimate suggested that up to 40 percent of planted acres in 2019 would not be harvested due to crop failures (Raszap Skorbiansky, Thornsbury, and Camp 2021). If his hemp plants ended up with too much THC and a state inspector found out through random testing, Levi's entire crop could be destroyed by the state. Indeed, some estimates suggested that 20 percent of lots tested in 2019 would test high for THC content (Raszap Skorbiansky, Thornsbury, and Camp 2021). If Levi lost his hemp crop for either reason, there was no federal crop insurance program that would protect him from his losses. More than anything else, though, Levi was not sure just how much yield he could expect as a first-time farmer growing a relatively uncommon crop.

In early 2019, there was very little public information about how different hemp varieties performed in Wisconsin. There had been hemp variety trials in other states like Kentucky (Williams, Perry, and Keene 2017) and Vermont (Darby 2018), but Levi was relying heavily on Mike's advice. An article written by University of Wisconsin researchers that was posted online in early 2018 provided some more useful, if vague, predictions: "Yields can vary widely depending on the variety, local climatic conditions, cultivation method, and grower experience. For grain, new growers have reported yields between 250–700 lbs/acre. More experienced growers can expect between 800–1,800+ lbs/acre" (Conley et al. 2018).

Levi set out to grow 3,500 hemp plants and started by buying 5,000 seeds from Mike for one dollar each. However, these seeds only ended up yielding 2,000 plants. To make up the difference, he bought 1,500 seedlings from Mike for three dollars each. Luckily, the seedlings survived, and Levi reached his goal of growing 3,500 plants.

Despite a cool, wet spring in 2019 that threatened his seedlings, Levi was able to successfully harvest his crop of hemp plants in the fall with the help of his father and brother. The three Budz men



first cut the hemp plants from their stalks, transported them on flat-bed wagons to a nearby shed, and hung them from rafters to dry for a month. Levi harvested 2,500 pounds of hemp biomass from 3,100 plants and sent this biomass to Mike for processing into CBD extract. The remaining 400 hemp plants yielded 250 pounds of dried hemp flowers that would be used in Budz Butter’s smokable CBD products. In the end, Levi ended up spending nearly \$23,000 to grow and harvest his hemp crop (Table 1). He estimated that his hemp biomass production costs were \$8.00 per pound, not including labor costs. This compared to an average wholesale price of hemp biomass that was around \$40 per pound and an average wholesale price of dried hemp flowers that was around \$400 per pound in mid-2019. By the end of the year, the wholesale price for hemp biomass fell to around \$10 per pound thanks to a boom in hemp production during the 2019 growing season (Owram 2020). After Mike had processed Levi’s hemp biomass into CBD extract, Levi calculated that the effective cost of his extract was about \$225 per pound of extract. This was much lower than the 2019 wholesale price of \$1,600 per pound and just a fraction of the previous year’s wholesale price of \$3,200 per pound.

**Table 1. 2019 Hemp Production Expenses for Budz Butter**

<b>Expense</b>	<b>Cost (\$)</b>
Seeds (5,000 at \$1 ea.)	5,000
Seedlings (1,500 at \$3 ea.)	4,500
Greenhouses (4 at \$200 ea.)	800
Worm castings (fertilizer)	2,400
Other fertilizers	500
Rent (land; shed; water; tractor; drag)	3,600
Electricity	300
Harvest labor	1,000
Licensing and testing	750
Post-harvest processing (hanging, drying, shucking)	4,000
<b>Total</b>	<b>\$22,850</b>

## 5 Assessing Consumer Demand and Competition

In addition to the risks of growing his own hemp, Levi had to weigh the risks of uncertain consumer demand for his products. CBD products were still relatively new in the marketplace, and it was challenging to predict how large and how quickly the market segment would grow. One 2019 report predicted that CBD would grow from a \$4 billion industry that year into a \$24.4 billion industry by 2025 (Brightfield Group 2019). Despite this predicted explosion in consumer demand, Levi was concerned that others would have some of the same ideas as him. Indeed, in a 2019 marketing study, researchers in Wisconsin found that 27 percent of hemp growers had not found a buyer for their crop (Burney and Remble 2020). This suggested that farmers were quickly flooding the market with hemp to supply CBD processors. Even if the consumer segment for CBD products flourished, the high prices of 2017 and 2018 might not be sustainable given an expected boom in supply.

Levi knew that Budz Butter’s success would depend on understanding his consumers’ wants and providing a high-quality product. A 2017 industry study surveyed CBD consumers to compile market research about the sector. Of those who consumed CBD products, 46 percent indicated they consumed high-CBD flowers (like in Budz Butter’s smokable products) and 34 percent indicated they consumed CBD baked goods. Roughly 44 percent spent between \$20 and \$80 per month on CBD products, and 43 percent reported a high degree of brand loyalty, defined as purchasing a particular product at least 75 percent of the time (Brightfield Group 2017).

Levi was confident he had built a strong brand manufacturing products that consumers would enjoy. He had developed a regional network of retailers to distribute his products throughout northeast

Wisconsin. Compared to other CBD startups, Levi felt he had developed a comparative advantage. Nonetheless, as he considered the 2020 growing season, he knew he may be forced to cut his product prices to stay competitive in the marketplace. On the other hand, demand for Budz Butter products might soar along with the entire CBD industry. Levi was struggling with his decision of how much he planned to produce in the new year.

Reflecting on the 2019 growing season, Levi identified three options for 2020: first, he could reduce his hemp production to 750 plants, focus on self-sourcing dried hemp flowers, and purchase any extra needed CBD extract from the wholesale market. This approach would let him emphasize producing high-quality flowers that were harder to procure from the wholesale market than CBD extract. Second, he could double his hemp production to 7,000 plants building on the lessons learned from his first year of farming and hopefully benefit from increasing returns to scale. Finally, he could keep his hemp production at 3,500 plants and seek to replicate his experience in 2019. Each option had its own risks and rewards.

## 6 Policy and COVID-19 Considerations

As Levi considered his options in the spring of 2020, one thing he had not prepared for was a global pandemic. COVID-19 forced much of the world into a lockdown for longer periods of time during 2020, and Budz Butter was forced to suspend in-person product demonstrations at local retailers, thus missing out on potential new customers. The company experienced a slight decline in sales, but thankfully the pandemic did not put Levi out of business. Similarly, the CBD industry continued to expand as consumers spent more of their time at home.

As the COVID-19 pandemic progressed, national- and state-level hemp regulations continued to evolve. After releasing an “Interim Final Rule” for the Domestic Hemp Production Program in late 2019, the USDA Agricultural Marketing Service published the official Final Rule in early 2021 (Raszap Skorbiansky, Thornsby, and Camp 2021). The Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) then updated its own Emergency Rule for hemp producers in 2021 to take advantage of new provisions in the USDA rule (Wisconsin emergency rule EmR2111). These two new rules provided producers like Levi increased confidence about how their crops would be regulated moving forward.

Finally, the federal government began to allow hemp growers to participate in certain federal crop insurance programs, thereby giving producers access to a crucial risk management tool. Specifically, many hemp growers were permitted to participate in the Risk Management Agency’s Multi-Peril Crop Insurance Program, the Noninsured Crop Disaster Assistance Program, the Whole-Farm Revenue Protection Program, and several Nursery Programs (Raszap Skorbiansky, Thornsby, and Camp 2021).

Looking beyond 2020 and the COVID-19 pandemic, the long-run outlook for Budz Butter and the entire CBD industry remained uncertain. One thing was clear, however: if Levi was going to stay in business, there would always be risks and uncertainties to manage.

## 7 Discussion

All entrepreneurs face risks as they start a new business. Levi Budz’s experience with Budz Butter highlights the unique risks faced by an agricultural business operating in a new market segment in an evolving regulatory environment.

First, Levi had to navigate complex and evolving policy at the state and national levels about the legality of cannabis, marijuana, industrial hemp, THC, and CBD. Although THC was legal in Colorado, it was illegal federally and in Wisconsin. And even though sales of CBD were skyrocketing across the country, the DEA still technically considered CBD a controlled substance. The federal government and state governments were also rapidly changing guidance about whether a low-THC variety of the *Cannabis sativa* plant could be legally grown as industrial hemp, and even when it was ultimately permitted, state

regulators were destroying entire crops when plants exceeded maximum THC levels in randomized testing. Hemp farmers were excluded from crop insurance programs and other supports available to most agricultural producers.

Second, Levi had to determine whether to purchase CBD extract as an input or to vertically integrate and grow his own hemp. The wholesale price of refined hemp oil was extremely volatile and very high in the year or two before Levi began operations in Wisconsin. Even so, many people expected prices to fall as more farmers began producing hemp in 2019 and 2020. Growing his own hemp meant that Levi could control this key input, but it would also open him to other agricultural production risks.

Third, Levi had to manage the risks of growing hemp as a first-time farmer. He did not have previous experience growing hemp—or any crop—before, and he did not know how much hemp biomass he could expect to harvest. Available yield estimates varied widely and were not always relevant to the area where Levi was farming. In addition to all these uncertainties, Levi faced the same risks all farmers face: bad weather, hail damage, or pest outbreaks that could decimate his annual harvest.

Finally, Levi had to predict consumer demand for his goods in a rapidly evolving market for CBD products. Industry experts were predicting an explosion in the CBD market sector, but there were many other entrepreneurs like Levi looking to take advantage of this hot new opportunity. Would the expanding consumer demand be enough to maintain the high prices of 2017 and 2018, or would a flood of competitors drive prices down to where Budz Butter would suffer losses? What could Levi do to insure against such an outcome?

The case of Budz Butter is a clear demonstration of how an agricultural business must manage risk and uncertainty. First, a firm must identify the different sources of risk so threats to the business can be addressed. Second, the firm must quantitatively assess how risk might affect its costs, revenues, and profits. This might also include coming up with methods to analyze unknown or uncertain risks. Third, the firm must choose a course of action that balances the risk-reward trade-off. In some cases, a decision might be to insure against a bad outcome or to choose a less volatile course of action. In other cases, a decision might be to take a big risk and hope it pays off. Levi's experience with Budz Butter includes examples of both and demonstrates how even nimble start-ups must carefully consider risk and uncertainty in their businesses.

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