

Case Study

Unraveling the Reintroduction of Hemp in the United States: A Case Study of the Supply and Demand During the (Re)Birth of an Industry

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Abstract

The reintroduction of hemp as a legal enterprise in the United States has been one of the largest-scale exercises in applied agricultural economics in recent history. Hemp has a long and storied past in the United States. The economic forces behind the ups and downs of hemp production, coupled with varying legal status throughout time, make hemp an exciting case study to understand how policy influences the forces of economics. The evolution of this reintroduction provides a real-world opportunity to understand and apply core microeconomic and marketing concepts amid uncertainty and government interventions. This hemp case study explores economic concepts including supply and demand, elasticity, price discovery, government intervention and policy, and agricultural marketing and production contracts on the backdrop of hemp production.

1 Introduction

The Nine Days Wonder Farm (NDWF) is a medium-sized central Kentucky farm that saw hemp production as a potential profit center for its central Kentucky farming operation. NDWF produces corn, soybeans, and tobacco. They shifted ten corn acres to hemp production in 2019. NDWF's production model was to grow floral hemp destined for the Cannabidiol (CBD) market. Unbeknownst to NDWF, they and other producers and processors were engaging in one of the largest-scale exercises in applied agricultural economics in recent history. To understand why NDWF's entrance into hemp production was different from entering into other agricultural production, some background is needed about the evolution of hemp production in the United States and the impact that it has had on the development of hemp markets. With this background, this case study allows the examination of how contracts affected price discovery for NDWF's crop and why participation in the emerging hemp market has not yet developed a transparent supply chain. Unfulfilled contracts and opaque supply chains left NDWF in a position no producer desires: an abandoned contract and a product in storage with no clear buyer or timeline for its sale.

This case study features five interconnected student learning objectives:

1. **Enhance Understanding:** Develop a deeper grasp of supply and demand dynamics and characteristics at various marketing levels for an emerging market with limited market information and competition.
2. **Incorporate Supply and Demand Curves:** Introduce and differentiate primary and derived supply and demand curves into the analysis to see how various shifts and slopes impact market prices and quantities.
3. **Introduce Price Discovery:** Explore the concept of price discovery in thin markets with limited competition.

4. **Examine Government Intervention:** Analyze the impact of government policies on developing agricultural markets.
5. **Introduce and Explore Contracts:** Investigate how production and marketing contracts can affect price discovery in the early stages of emerging markets.

2 History of Hemp Production and Legislation in the United States

Hemp has a long and storied history in the United States, ranging from being an essential resource pre-industrial revolution and during World Wars I and II, to becoming embroiled in drug legislation that outlawed production. Historically, hemp in the United States followed a relatively “normal” existence consistent with standard economic principles and political influence. Before the most recent interest in the reintroduction of hemp production, almost all hemp was grown primarily for its fiber, which was used to produce things such as rope and textiles. However, hemp fiber demand decreased as shipping moved from predominantly wind-driven modes requiring hemp rope and sails to steam-powered methods. Globally, hemp rope demand decreased further as trade increased and access to cheaper substitute goods, primarily abaca, sisal, and jute, became available (Bell 2020). In addition to decreases in demand for hemp, the outlawing of hemp production was due to a changing opinion of marijuana consumption in the United States and subsequent legislation to make it illegal. It is essential to point out that marijuana and hemp are the same plant, *Cannabis sativa*. The only difference between the two is at the chemical level. THC (Delta-9-tetrahydrocannabinol) is the regulated psychoactive chemical that produces the mind-altering effects of *Cannabis sativa* consumption. Hemp is defined, legally, as a *Cannabis sativa* plant that is below 0.3 percent THC content. It does not have psychotropic properties, but it was regulated in the same way as its THC-containing relative.

The U.S. perception of marijuana consumption changed significantly during the 1930s. The Marihuana Tax Act of 1937 made the recreational use of marijuana illegal. It increased the cost of hemp production, decreasing hemp supply while also further decreasing the demand for hemp and hemp products. However, during World War II, the Japanese controlled many areas where the abaca and jute were produced and imported (Bell 2020). This disruption in supply prompted the U.S. Department of Agriculture (USDA) in 1942 to produce a propaganda film, “Hemp for Victory.” The intent was to help influence farmers’ decisions to plant hemp to support the war effort. The Marihuana Tax Act of 1937 was not repealed, but certain U.S. government agencies seemingly “looked the other way” for those producing fiber to help the war effort (Dwyer 1998). The farm that NDWF now operates once had hemp grown on it for the war effort. Local historical records showed that the very land that NDWF was going to plant floral hemp once grew hemp for fiber and sold it to Kentucky River Mills for processing into supplies for the U.S. Navy (Figure 1).

Once the war was over and trade reestablished, hemp fiber’s support again fell victim to cheaper import substitutes. Finally, in 1970, hemp was caught up in the Controlled Substances Act of 1970, resulting in hemp being categorized with marijuana as a Schedule 1 narcotic.

3 Reintroduction of Hemp production in the United States

Just as changing public perceptions helped formulate the law that outlawed hemp production, the pendulum of public perception started to swing in the other direction in recent years. In 2014, Congress passed a Farm Bill allowing hemp to be produced for research. This was the first time hemp was legally grown in the United States since the Controlled Substance Act of 1970 passed. When hemp was first legalized to be grown in the United States via the 2014 Farm Bill, it was done under a State Pilot Program framework. Hemp was touted as another alternative enterprise that could help boost a somewhat depressed agricultural commodity market at that time and help revitalize rural economies. Further, there was existing demand for hemp products in the United States. Even though hemp was illegal to grow in the United States, hemp products were still legal to possess and consume. This created



Figure 1: Historical Marker.

Note: Photo sourced from <http://www.kentuckyhemphighway.com/index.php/franklin/>.

an environment where domestic consumption of hemp products was solely dependent on imports. By September 2019, the United States had imported \$66.6 million of hemp products in that year. Canada accounted for 89 percent of those imports (Hudock 2019). Replacing, at least in part, the imports of raw hemp with domestic production was a political motivator for some politicians promoting the re-legalization of hemp for U.S. production. It was also touted as a potential replacement for other crops that have been subject to decline, such as tobacco. Hemp seemed perfect for Kentucky and other tobacco production states. This was largely because of existing infrastructure (tobacco barns used for drying harvest floral material), and experienced growers of high management and labor intensity crops such as tobacco. Hemp production methodology mirrored closely that of tobacco. In fact, Kentucky Senator Mitch McConnell stated, “We all are so optimistic that industrial hemp can become sometime in the future what tobacco was in Kentucky’s past” (Angel 2018). Hemp can also be grown to make products that traditionally rely on other fibers such as wood and cotton, and it can be used as a renewable energy source for biofuels. Hemp grain (seeds) and seed oil can be used in many food and personal care products. Many media reports indicate more than 25,000 items can be produced from hemp material (Johnson 2018).

While the 2014 Farm Bill removed the illegality of hemp production, potential hemp producers were not given carte blanche. Instead, each state had to develop a pilot program that dictated the specifics of hemp production in that state (Falkner et al. 2023). Not all states simultaneously came online in hemp production, nor was there regulatory consistency across states (Mark et al. 2020).

Hemp production falls into three main categories—fiber, grain, and floral material (Hill et al. 2023). In the early years after the passage of the 2014 Farm Bill, most hemp production was focused on fiber and grain production. For example, Kentucky’s fiber and/or grain production accounted for more than 50 percent of all hemp acres planted in 2014 and 2015. By 2019, the acreage planted to produce hemp floral material destined for CBD production accounted for 92 percent of planted acres (Kentucky Department of Agriculture 2023). This was not just a Kentucky phenomenon. Instead, similar shifts to CBD production were present in almost all states where hemp was being produced. Like other hemp producers in Kentucky, NDWF decided to produce varieties suitable for hemp floral production destined for the CBD market.

In the 2018 Farm Bill, hemp was removed from the scheduled narcotics list. However, CBD remained on the schedule list, making it a grey area of hemp production. However, hemp production under the 2018 Farm Bill required additional oversight. Producers of hemp still had to obtain licenses from the states where they produce and were subject to THC level testing and crop destruction if they were over legal THC limits (currently 0.3 percent by dry weight). Many inexperienced people saw hemp as a gold mine. The passing of the 2018 Farm Bill nationalized hemp production to other states in the United States, which dramatically increased potential supply and arguably was a factor in the overproduction of hemp realized in 2019. In addition, experienced farmers were looking for a new income source to offset declining farm income nationwide. Suddenly, there was a lot of interest in producing hemp for CBD channels all across the United States. Potential hemp producers, including NDWF, signed contracts and were promised by buyers and investors (many new to agricultural markets) lucrative farm-level returns and media reports of a rapidly expanding consumer market for CBD products. CBD was touted as a substance, absent of psychedelic effects, but potentially some of the purported health benefits of the Cannabis sativa plant (MacKeen 2021). In other words, CBD was the answer to potentially better health and pain relief without getting “high.” Not surprisingly, interest in hemp production for CBD dwarfed hemp fiber and grain production for other purposes from 2018 to 2020.

As seen in Figure 2, hemp production (farm-level primary supply) increased from 2016 to 2019 and then decreased in 2020. Many producers/farmers and investors got caught up in the CBD hype. They suffered significant adverse financial consequences as farm-level prices plummeted by 90 percent or more, contract promises were not fulfilled, and marketing infrastructure was not developed (Figure 3).

Economic principles can be utilized to analyze the reintroduction of hemp in the United States, the hype surrounding CBD, and how it affected the decisions of NDWF to step into hemp production. NDWF, like many other producers, learned the hard way that, despite media, producer, and political hype, hemp is still bound by the principles of economics.

4 The Economics of Hemp Production

4.1 Profitability

NDWF experienced difficulty determining the estimated profit potential for hemp production because there was a lack of quality information about the trend of future harvest prices and contract guarantees. This misinformation led NDWF to believe the hype touting large profits associated with floral hemp production. In addition, given its newness as a reintroduced U.S. crop, standard production practices have not been established for hemp, increasing the uncertainty around production and yield. Unlike other commodities where variances in production methods are minimal and have minimal impact on profitability, hemp production methods potentially vary significantly and potentially have very different cost structures (Shepherd and Mark 2019). Floral hemp production primarily followed a tobacco production model or production practices more closely related to field tomato production (i.e.,

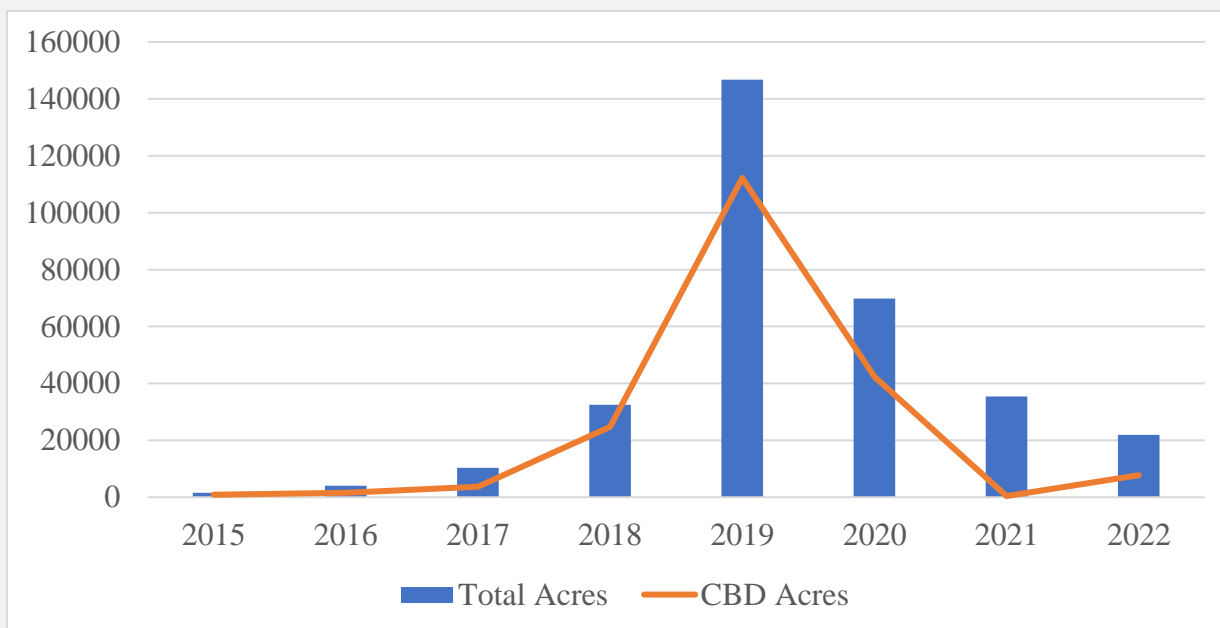


Figure 2: USDA FSA Hemp Crop Acreage Data 2015-2022.

Note: Data sourced from USDA Farm Service Agency (2023) "Crop Acreage Data"

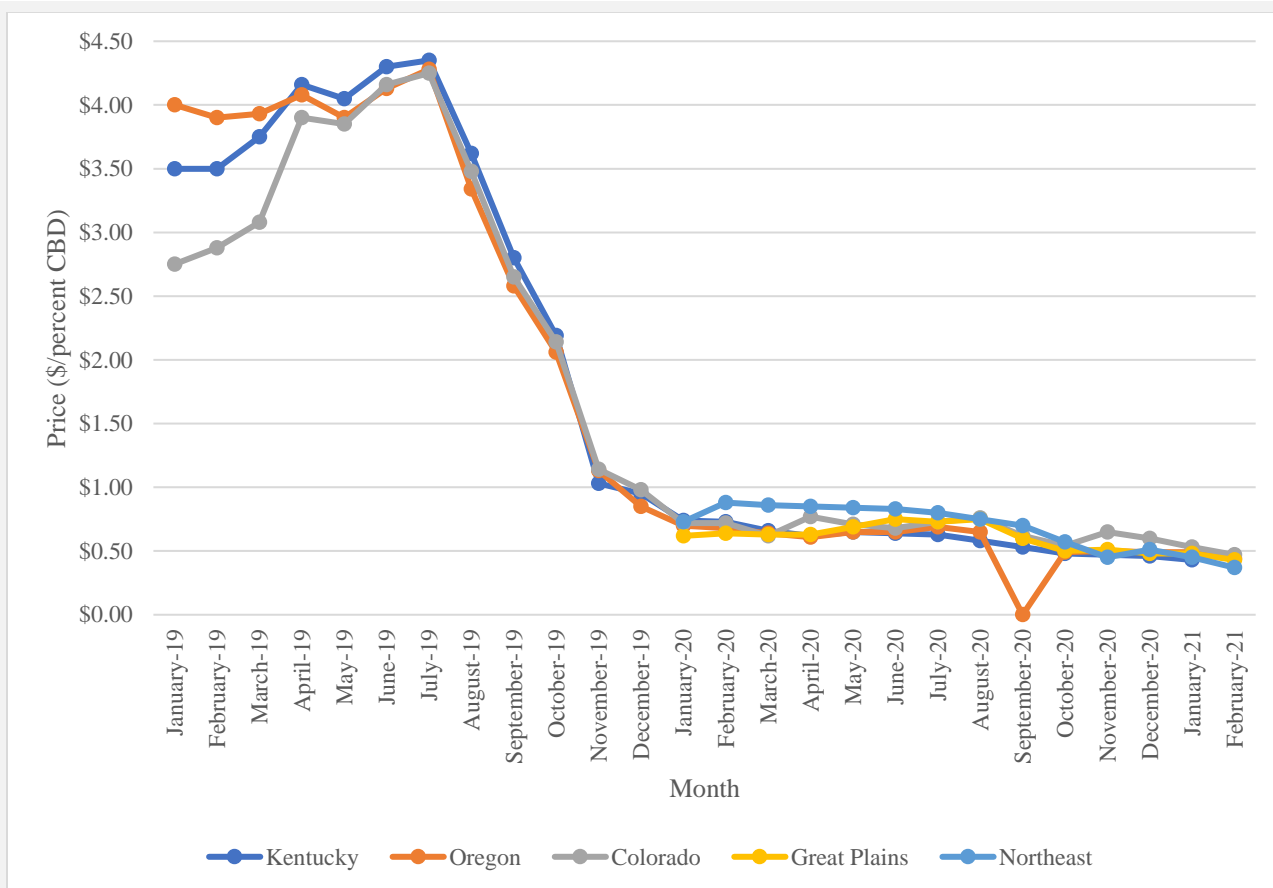


Figure 3: PanXchange Reported CBD Prices Jan 2019-Feb 2021.

Note: Data sourced from the PanXchange hemp price report

plasticulture). However, there were still production methodology variances within these models. Following the floral hemp production boom, hemp fiber and grain returns above variable costs were often estimated at minimal return per acre or negative (Mark and Shepherd 2019). For the same period, returns above variable costs for substitutes in production, such as corn and soybeans in Illinois, were projected to be low, around \$200 per acre before consideration of land costs, and negative when an average land cost was accounted for (Schnitkey 2018). This indicates that hemp fiber and grain prices would need to increase significantly (or costs of hemp production decline considerably) to attract acreages away from corn, soybean, and wheat production. NDWF had been interested in producing hemp as soon as it became legal. However, it knew that profit potential was not significantly high enough to justify the risk of trying a new enterprise and taking away resources from other profit centers in their business.

But in 2019, floral hemp production for CBD was a different story, and NDWF saw this as a potential opportunity to turn a large profit. CBD production on a mass scale and the public availability of the product for retail sale was new. The U.S. media and political interest in the product grew exponentially, and after hearing about the potential for considerable profits, producer interest in floral hemp production grew as well. NDWF chose to shift production to hemp for CBD from corn acres and entered the market to produce floral hemp. Lacasse and Kolodinsky (2022) found that internet searches and articles written about hemp peaked in 2019. Hemp for fiber had been grown in the past, albeit a lot of technical knowledge and plant genetics had been lost to the annals of time. But CBD was a new frontier that seemingly had endless promises and possibilities. While noting the challenges of arriving at accurate profitability estimates for hemp production, the 2019 CBD budgets the NDWF used for planning showed returns above variable costs ranging from \$3,000 per acre to over \$25,000 per acre (Shepherd and Mark 2019). These were unheard-of returns for agricultural products, and NDWF wanted a piece of this profit pie. Despite the uncertainty of the data behind these profitability projections, NDWF and many other producers assumed that even with significant unknowns, profit projections could adjust downward significantly and still be relatively more profitable than traditional commodity crops. Furthermore, the profit potential per acre was supposedly so great that even a few acres were attractive to potential producers new to agriculture. Unfortunately for NDWF and other producers who decided to enter floral hemp production, most producers did not realize the hype and promise of large profits. Let us investigate why using economics.

4.2 Price Discovery, Thin Markets, Oligopsony, and the Role of Contracts

In markets, prices are traditionally determined by buyer and seller interactions through price discovery. These interactions can be in person or via electronic exchanges. Commodity markets provide examples of how the price discovery process works. In the agricultural context, commodities are products with little product differentiation. Corn and soybeans are two examples of agricultural commodities. Price discovery is more straightforward in the commodity markets because goods are not differentiated. Commodities are often traded daily through futures markets that exhibit a competitive marketplace with many buyers and sellers. Here, buyers and sellers of commodities interact, and the settled price is viewable worldwide, providing valuable information on the market price for the commodity. Commodity markets are often used as an example of perfect competition because there are many buyers and sellers and transparent and accurate market signals for price and quality. Under perfect competition, producers are price takers and do not have the market power to influence prices received. In addition, the marketplace exhibits ease of entry and exit, resulting in zero economic profits in the long run as producers receive a competitive return on their land, labor, and other resources. Price discovery is much more complicated for hemp production than other agricultural products traded in greater volumes and intervals, and price information is not readily available, as described below. NDWF had experience growing corn and soybeans, which were traditional commodities, so they were accustomed to the breadth of information detailed above when projecting the future price of their product.

Unlike traditional commodity markets with many buyers and sellers, hemp markets are relatively thin, with few buyers and/or sellers. Thin markets are one in which there are “few buyers” and “low trading volume” (Adjemian et al. 2016). In Kentucky, NDWF only had two companies in their area offering contracts to potential growers. Without more potential buyers, the uncertainty of future prices was increased for NDWF and other producers as competition among processors was limited. The reintroduction of hemp has seen market characteristics closer to oligopsony than perfect competition. Oligopsony is the term used to describe a market with only a few buyers and many sellers (Adjemian et al. 2016). Tobacco production in the United States is one example of oligopsony. According to the 2017 Ag Census, there were 6,237 tobacco farms in the United States (U.S. Department of Agriculture 2019). In 2015, two tobacco manufacturers controlled 81 percent of the tobacco retail market (Levy et al. 2019). There are many tobacco producers, but the number of buyers for tobacco product manufacturing is small. The consequences of thin markets include a lack of competition and imperfect market information, which lead to enhanced price volatility. While NDWF understood that the thinness of the hemp market had the potential to result in price volatility, they still chose to contract with a processor in their area.

In agriculture, both marketing and production contracts are common. Simply defined, a production contract is between the farmer and the buyer in which the buyer dictates most of the production requirements of the agricultural good (Shepherd, Goeringer, and Mark 2021). In return, the buyer agrees to buy the product at a specified price and retains ownership. A marketing contract is an agreement between a producer and buyer where the buyer offers to purchase a specified quantity of certain quality at a given price and time. Under a marketing contract, the producer retains ownership of the product, the buyer is not obligated to buy, and the seller has the ability to sell to a different buyer (MacDonald and Burns 2019). Contracts between hemp processors and producers served as a price discovery tool for floral hemp production. NDWF entered into a production contract with their processor that explicitly dictated the variety of hemp to be produced (provided by the processor as they owned the genetics) when the crop had to be planted, the crop management protocol (fertilization rates, cultivation schedule, etc.), and when the crop was to be harvested and price to be paid upon delivery of the harvested material. However, NDWF’s contract and many other of these production contracts and the associated prices were not honored for various reasons. The most prominent reason was the overproduction of floral hemp for the CBD market. As the 2019 hemp growing season approached harvest, it was clear to investors in hemp processing facilities that supply would outstrip demand. While production exceeded 140,000 acres, the Chief Executive Officer at PanXchange estimated that less than 3,000 acres were needed to supply the U.S. CBD market (Reed 2021). Unfortunately, NDWF received a letter from their processor right after harvest that the company was seeking bankruptcy protection and would not take delivery of the hemp that NDWF had produced. NDWF was now in a position with no buyer for their raw floral hemp product. Still, they were not alone, as many producers had no outlet for their product and turned to storing their unsold hemp instead of selling it for a low price in hopes of better market conditions. In the long run, producers exited the hemp CBD market, which can be seen in the decrease in acreage in Figure 2.

4.3 Derived Demand and Primary Supply

To better understand the economics behind how NDWF found itself in this situation, we explore the concepts of supply and demand. The demand for hemp produced for the grain and fiber markets resembles a “typical” demand in other commodity markets. These substitutes for hemp fiber include wood fibers, abaca, jute, etc. Substitutes for hemp grain include flax, chia, and pumpkin seeds. Often, these substitutes are cheaper and provide similar product attributes, which could largely explain the current lack of hemp for grain and fiber production in the United States. Unlike many other agricultural products, actual demand and supply for the emerging hemp market are unknown and an area of ongoing research.



Figure 4: Understanding Demand for Floral Hemp in 2019.

In contrast, NDWF did not produce hemp for grain or fiber. They produced floral hemp for CBD. Retail-level demand for CBD, which is made from floral hemp, does not currently have close substitutes. For many consumers, no alternative substitutes offer the same attributes they get out of CBD products. For example, if someone is using a CBD tincture for pain relief, the only alternative may be prescription-based products with adverse side effects. It may also be that CBD products are considered more natural and fit into a person's lifestyle better than synthetic options.

Here we focus on farm-level (primary) supply and (derived) demand of floral hemp destined for the CBD retail market, which are the market conditions that NDWF faced when trying to sell their product after their contract was not honored. Derived demand (farm level) is the demand for inputs used to make a final product, in our case the demand for the raw hemp at the farm gate (Tomek and Robinson 1990). Figure 4 shows the relationships between primary and derived demand. Primary supply is the relationship between prices and quantity at the producer level (farm level). Hemp floral material is harvested from the hemp plant (farm gate market), further processed into CBD, and then marketed as a product containing CBD (retail market). While the processes are certainly different, we can compare this to beef production for ease of illustration. What the farmer sells at the farm gate level (a live bovine animal) differs greatly from what the consumer purchases at a grocery store (some type of processed and packaged beef product). Supply and demand conditions vary at the farm gate (derived demand/primary supply) and the retail (primary demand/derived supply) levels. Even though actual primary or derived supply and demand are unknown for any hemp products, some assumed known characteristics coupled with standard supply and demand framework can help us think about what supply and demand would look like hypothetically in the floral hemp markets.

4.4 Simulated Primary Supply and Derived Demand Curves for Floral Hemp During the 2019 Boom

Figure 5 shows expected farm-level supply (primary) and demand (derived) curves for floral hemp during the boom of floral hemp production in 2019 at the farm gate level.

In this figure, DF1 is the hypothetical demand curve for floral hemp NDWF is expected to see when making planting decisions for the 2019 crop. This derived demand was broadly signaled to producers by the hemp processing companies soliciting producers and offering contracts. The supply curve, SF1, is the hypothetical primary supply curve for floral hemp expected when NDWF was making 2019 planting decisions. Price, PF1, and quantity Q1 is the equilibrium price and quantity, representing the expected price floral hemp producers were facing when deciding to plant floral hemp in 2019.

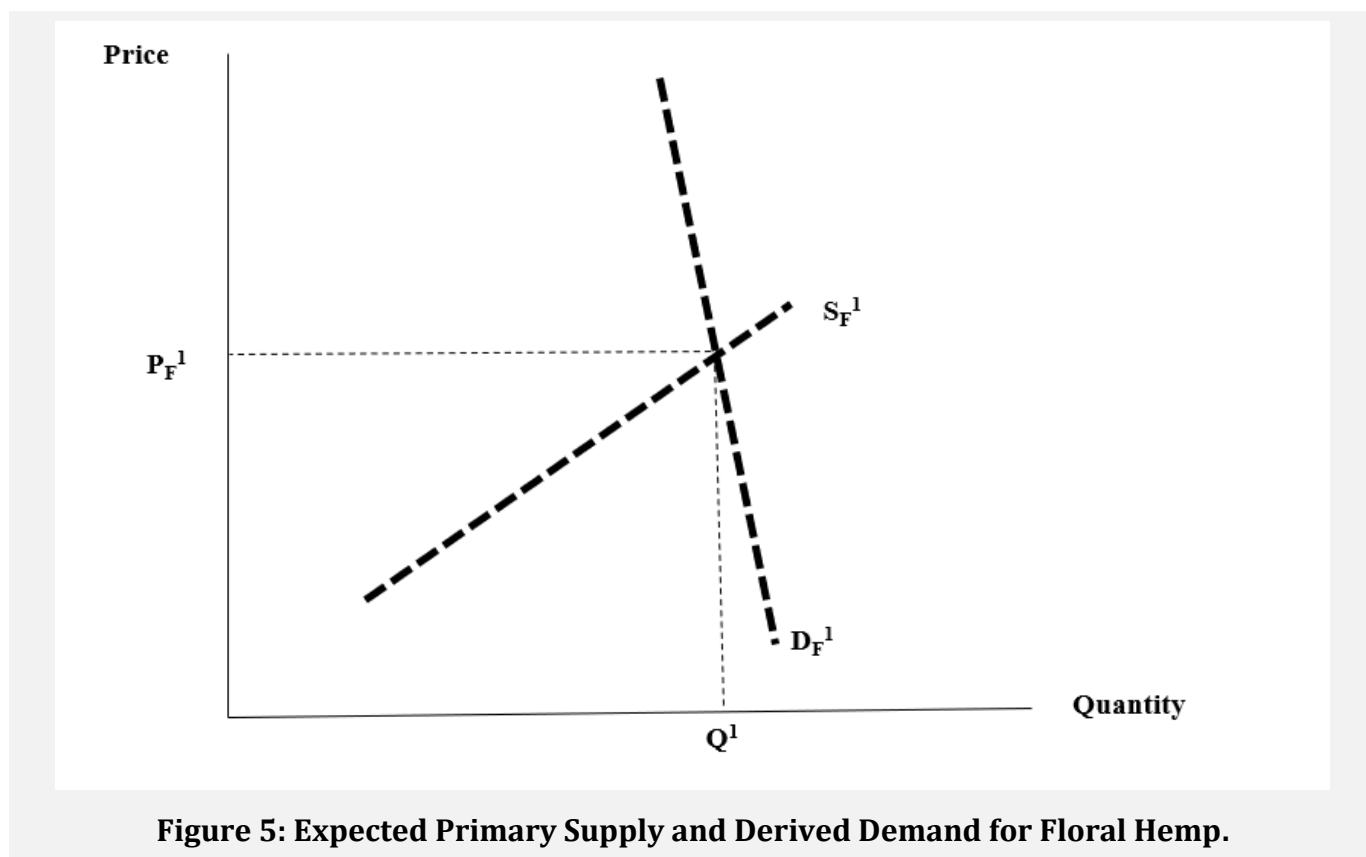


Figure 6 shows the actual primary supply of SF2 that was seen in the 2019 floral hemp market. More floral hemp producers entered the floral hemp sector in 2019 than had been anticipated. While many producers had contracts to grow with processors, there were still non-contracted acres planted as well. Further, given the novelty of this reintroduction, true production yields were estimates at best. This uncertainty potentially resulted in more hemp being produced by contracted growers to ensure contracted amounts were met in addition to the non-contracted amounts grown. As a result, the actual primary supply in the floral hemp market is represented by SF2. Under this shift in supply, the equilibrium quantity would shift to Q2 and the price at PF2. However, demand expectations were highly exaggerated at the farm gate level, processing facilities could not process at their projected capacities, and many processors began to shutter their businesses. The demand for floral hemp at harvest resembled DF2 and not DF1, and both had a lower equilibrium price at PF3 and quantity at Q3 than NDWF anticipated when making cropping decisions (Figure 7).

Processors started experiencing financial difficulties with cash flow as venture capital investment dried up. At the same time, some processors could honor their contracts (at the price of PF1), but many contracts, like that of NDWF, were not honored. This led to an excess supply as shown in Figure 8.

Producers who were able to sell their product sold at the much lower price of PF3, and those producers like NDWF who were not able to sell their product or wanted to hold off in hopes of future price increases put it into storage for future sales, increasing the supply of floral hemp in future periods. NDWF decided to return to corn production in 2020 and sold the hemp in storage from 2019 for a loss in 2020.

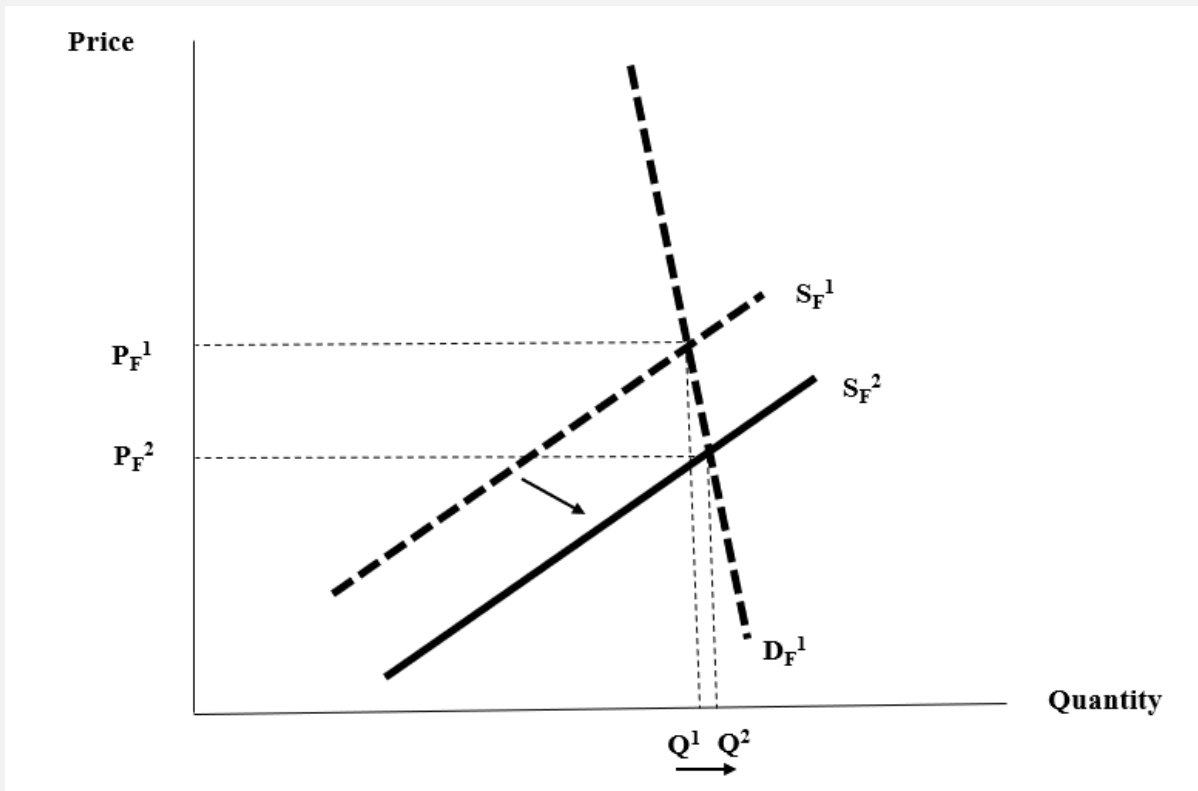


Figure 6: Expected Primary Supply Shift for Floral Hemp 2019.

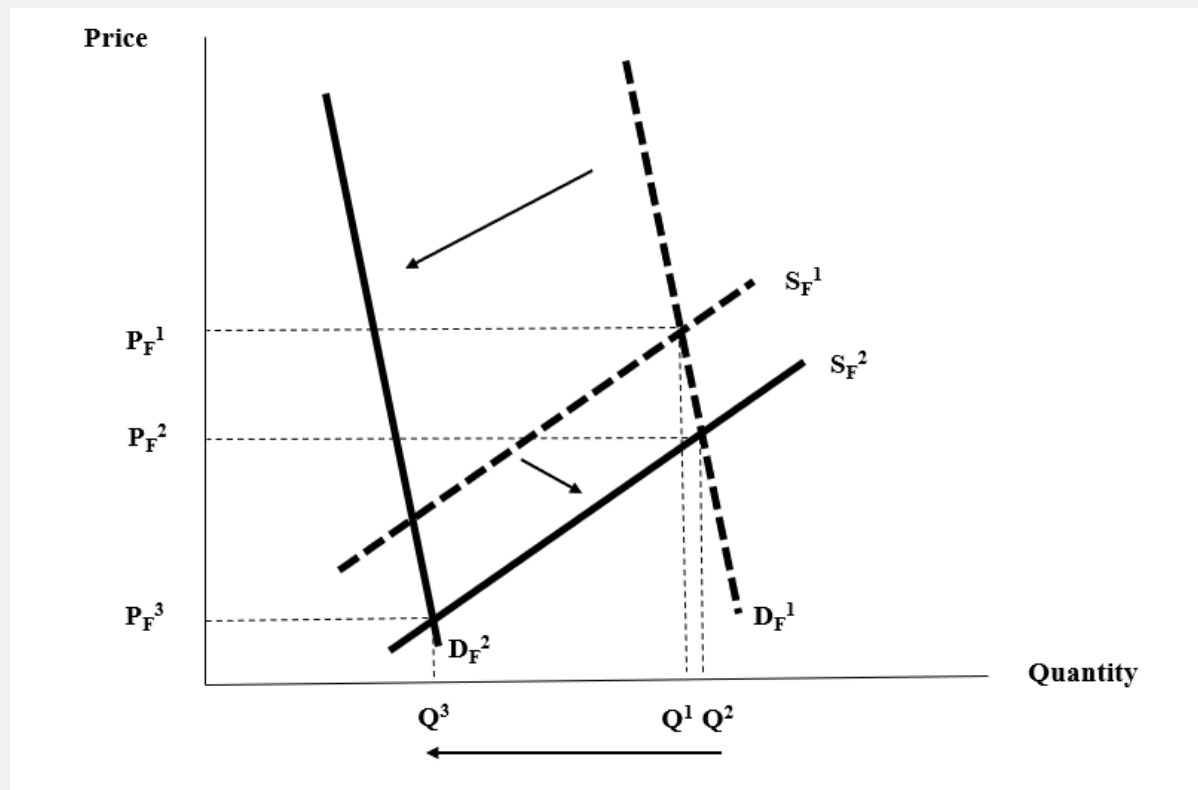


Figure 7: Expected Primary Supply and Demand for Floral Hemp 2019.

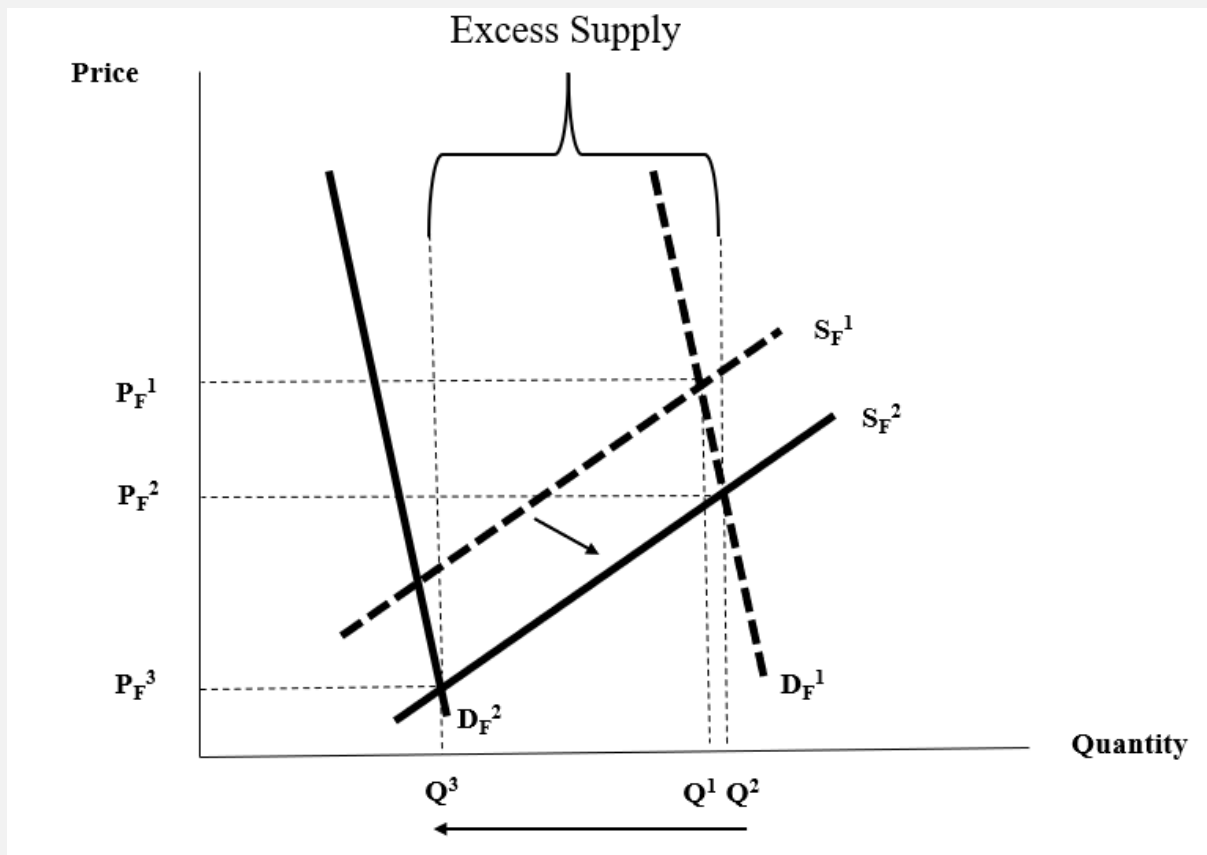


Figure 8: Excess Supply of Floral Hemp 2019

It is important here to realize that what was happening at the farm gate level differed significantly from what was happening at the retail level at the same point in time. The events of derived supply and primary demand are not depicted in Figure 5 because the supply and demand curves for the retail sector would look different and move differently than the shifts depicted here. At the retail level, demand for CBD products was increasing, and as a result, retail prices were also increasing for CBD products. This is the opposite of what producers at the farm gate level were experiencing. Given the novelty of the reintroduction of hemp, primary demand and derived demand were seemingly decoupled in 2019. How could it be that the retail-level demand was increasing for products containing CBD while the demand decreased at the farm level? The answer to this question is that market signals (i.e., growing contracts and generalized interest from the farming public and entrepreneurs alike) motivated the production of floral hemp in great excess of demand. DF1 was really the demand at planting time. However, as the “hemp space” evolved between planting time and harvest time, the real demand for floral hemp resembled DF2. Quite simply more hemp was grown for CBD purposes than the retail market needed, even with increasing demand for CBD products at the retail level. In reality, farmers such as NDWF contributed to significantly oversupplying floral hemp for CBD. NDWF, along with thousands of other farmers, experienced how markets develop and evolve. In the case of floral hemp, the evolution was quick and drastic.

5 Conclusion

Hemp is an emerging agricultural market in the United States and provides a canvas to examine the complexities of equilibrium when introducing a new product. The uncertainty surrounding this crop has led to wide swings in farm gate prices, with a high of \$4.25 per percent CBD in 2019 and a low below

\$0.50 per percent CBD in 2021 (Figure 3). In this case study, we explored, through a supply and demand analysis framework, the situations that led to these drastic price swings and how these were seen on a larger scale at the farm gate instead of the retail markets for CBD. This case study also highlights the importance of the intersection of policy and politics in an applied economic sense. Studying basic supply and demand under the umbrella of hemp production provides many exciting aspects for discussion and grasping these concepts. Unlike many other commodities, the newness of hemp and the regulatory framework surrounding the good adds to what producers and retailers are experiencing and provides teachable concepts that are not readily available in the commodity markets. The hemp industry is still evolving as it works toward stability and commoditization. As a result, research is needed to fully understand and illustrate some of the concepts discussed in this paper. However, with the information reasonably known about the hemp industry in the United States, using it as the basis for understanding applied agricultural economics is a perfect fit.

6 Discussion Questions

1. Put yourself in the shoes of NDWF. You are one of the owners and are interested in producing hemp floral material for CBD production. It is right before the big CBD boom. How would you determine price expectations and profit potential in a market with limited market information?
2. Does the existence of contracts available change your opinion on how NDWF could/should engage in the price discovery process?
3. Given the lessons learned during the height of the CBD boom, discuss the risk(s) associated with contracts in agricultural production.
4. What is the term for a market with only a few buyers but many sellers? Is this state of the market system a concern for producers? Why? Does the market's maturity change your response regarding this market system?
5. Assume the Food and Drug Administration (FDA) publicly announces support of CBD and its purported health benefits. What would happen to supply and demand in the short term? Graph the changes in supply and demand.
6. Assume the FDA outlaws CBD for over-the-counter purchases. What would happen to supply and demand? Graph the changes to the supply and demand curves.
7. In Figures 5 and 6, there are farm-level supply and demand curves. Is the demand curve elastic or inelastic? What about the supply curve? Discuss the implications that the elasticity of supply and demand have on the farm gate floral hemp market and how it impacts price changes with the shifts described in this case study.
8. If you were a policy maker and you read this case study, what policy changes would you recommend if your goal was to support hemp farmers and ranchers in the future?

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References

- Adjemian, M., B. Brorsen, W. Han, T. Saitone, and R. Sexton. 2016. *Thinning Markets in U.S. Agriculture: What Are the Implications for Producers and Processors?* (Economic Information Bulletin No. 148). Washington DC: U.S. Department of Agriculture, Economic Research Service.
- Angel, T. 2018. "Here's Mitch McConnell's New Hemp Legislation Bill." *Forbes*, April 12. <https://www.forbes.com/sites/tomangell/2018/04/12/heres-mitch-mcconnells-new-hemp-legalization-bill/?sh=7938bc85b5bf>.
- Bell, C. 2020. "The Long and Winding History of Industrial Hemp." *Times Recorder*, May 31. <https://www.zanesvilletimesrecorder.com/story/news/local/2020/05/31/long-and-winding-history-industrial-hemp/5255671002/>.
- Dwyer, S.D. 1998. "The Hemp Controversy." *Kentucky Law Journal* 86:1143–1181.
- Falkner, A., J. Kolondinsky, T. Mark, W. Snell, R. Hill, A. Luke, J. Shepherd, and H. Lacasse. 2023. "The Reintroduction of Hemp in the USA: A Content Analysis of State and Tribal Hemp Production Plans." *Journal of Cannabis Research* 5(17):1–12.
- Hill, R., B. Jablonski, L. Van, M. Wang, B. Patalee, J. Shepherd, M. LeRoux, T. Mark, D. Mooney, and D. Thilmany. 2023. "Producers Marketing a Novel Crop: A Field-Level View of Hemp Market Channels." *Renewable Agriculture and Food Systems* 38:E22. doi:10.1017/S1742170523000145.
- Hudock, C. 2019. "Ask Our Experts: How Much Hemp Does the U.S. Import Every Year?" *New Frontier Data*, November 29. <https://newfrontierdata.com/cannabis-insights/ask-our-experts-how-much-hemp-does-the-u-s-import-every-year/>.
- Johnson, R. 2018. *Hemp as an Agricultural Commodity* (CRS Report RL32725). Washington DC: U.S. Congressional Research Service.
- Kentucky Department of Agriculture. 2023. "Goals and Growth of the Hemp Program." <https://www.kyagr.com/marketing/hemp-overview.html>.
- Lacasse, H. and J. Kolodinsky. 2022. "Chapter 14-Consumer Trends and The Consumption of Industrial Hemp-Based Products. *Industrial Hemp* : 367-381. <https://doi.org/10.1016/B978-0-323-90910-5.00011-7>
- Levy, D., F. Chaloupka, E.N. Lindblom, D.T. Sweanor, R.J. O'Connor, C. Shang, and R. Borland. 2019. "The U.S. Cigarette Industry: An Economic and Marketing Perspective." *Tobacco Regulatory Science* 5(2):156–168. <https://doi.org/10.18001/trs.5.2.7>.
- MacDonald, J., and C. Burns. 2019. "Marketing and Production Contracts Are Widely Used in U.S. Agriculture." *Amber Waves Magazine*, July 1. <https://www.ers.usda.gov/amber-waves/2019/july/marketing-and-production-contracts-are-widely-used-in-us-agriculture/>.
- MacKeen, D. 2019. "What Are the Benefits of CBD?" *New York Times*, October 16. <https://www.nytimes.com/2019/10/16/style/self-care/cbd-oil-benefits.html>.
- Mark, T., and J. Shepherd. 2019. "University of Kentucky Industrial Hemp Budgets." University of Kentucky. https://agecon.ca.uky.edu/files/hemp_and_cdb_enterprise_budgets_6_18_2019.xlsx.
- Mark, T., J. Shepherd, D. Olson, W. Snell, S. Proper, and S. Thornsbury. 2020. *Economic Viability of Industrial Hemp in the U.S.: A Review of State Pilot Programs* (Economic Information Bulletin No. 217). Washington DC: U.S. Department of Agriculture, Economic Research Service.
- PanXchange. Hemp Price Report. Subscription Data. 2022

- Reed, D. 2021. "How Much U.S. Farmland Should Be Dedicated to Hemp Crops?" *CBD Today*, March 2. <https://www.cbdtoday.com/how-much-u-s-farmland-should-be-dedicated-to-hemp-crops/>.
- Schnitkey, G. 2018. "Corn and Soybean Budgets for 2018 and 2019: Low Returns Ahead." *Farmdoc Daily* (8):146. Urbana-Champaign IL: Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign.
- Shepherd, J., P. Goeringer, and T. Mark. 2021. "Hemp Contract Considerations." *Economic and Policy Update* (21):3. Lexington KY: Department of Agricultural Economics, University of Kentucky.
- Shepherd, J., and T. Mark. 2019. "The Economics of Hemp Production in Kentucky." *Economic and Policy Update* (19):3. Lexington KY: Department of Agricultural Economics, University of Kentucky.
- Tomek, W., and K. Robinson. 1990. *Agricultural Product Prices*, 3rd. ed. New York: Cornell University Press.
- U.S. Department of Agriculture. 2019. *2017 Census of Agriculture. U.S. Summary and State Data. Vol 1*. Washington DC: U.S. Department of Agriculture, National Agricultural Statistics Service.
- U.S. Department of Agriculture. 2023. "Crop Acreage Data." Washington DC: U.S. Department of Agriculture, Farm Service Agency. <https://www.fsa.usda.gov/news-room/efoia/electronic-reading-room/frequently-requested-information/crop-acreage-data/index>.