



# Marijuana in America

## Part III: The Supply of Marijuana

March, 2018

In Part III of our series exploring the developing industry of marijuana in America, we turn our focus to the suppliers of cannabis. In this installment, we will work to understand what price of marijuana would be acceptable for producers in an environment where cannabis is legal at the federal level. Currently, the price of marijuana is \$320/oz nationally. At that level, every startup in the cannabis space says they are going to make millions for investors. The prospect of easy profit should attract more investment and push prices down, so it is crucial for investors to understand the risks of falling prices before investing. The cannabis market inevitably faces lower prices, and we want understand how far prices can fall.

The Vice Fund (Symbol: VICEX) from USA Mutuals has been investing in alcohol, tobacco, defense, and gaming industries since 2002. The emergence of a 'new' vice industry in cannabis has been, by far, the subject on which we receive the most questions from investors and advisors. Our goal with this series is to assist you in gaining a basic understanding of the financial, economic, and political landscape of the developing marijuana industry. Along the way, these papers will also outline how USA Mutuals has positioned the Vice Fund to benefit potentially from these trends as the marketplace evolves over the next five to ten years. If you have not read our [first paper](#) on the legality of marijuana in America or our [second](#) on the marijuana consumer, please visit [here](#) to download a copy.

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### Summary

As legalization proceeds, marijuana cultivation should benefit from modern agriculture. The marijuana farmer in such a market would be more akin to a tobacco farmer today with potentially similar costs and payoffs. We believe that increased participation by farmers in a legalized environment will drive the price of marijuana down to a point that pressures companies to participate in a tobacco-like market based on higher volumes and smaller margins. Ultimately, our conservative estimates indicate that end users could expect to pay \$16-25 per ounce for marijuana as the market matures. We believe that the start-ups of today must be able to deliver value at much lower price points in order to compete with larger, well-funded competitors from the tobacco and alcohol industries.

## WHERE TO GROW MARIJUANA?

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There are basically two ways to grow marijuana in the current market; indoor and outdoor. Indoor growers have mastered control of the environment in a room to grow cannabis under lights. The reason this skill developed is due to the pressure from years of prohibition. Growers could not cultivate marijuana in a field or a planter outside and so they adapted. Outdoor growers operate more like traditional farming, planting outdoors in the environment. Indoor production is more expensive, yet it has proponents. If we accept that legalization will make marijuana a states' rights issue, more agricultural areas will be able to plant cannabis and potentially ship product across state lines. Under that scenario, would expensive indoor production in Colorado continue when marijuana can be grown more cheaply outdoors in Oregon or California?

The primary support for indoor marijuana is the belief in some circles that indoor produces a better product than outdoor cultivation. Historically, this was with good reason due to the nature of outdoor cultivation in an illegal market. In the past, producers who grew outside were not focusing on harvesting at peak times or harvesting properly. They often did not have enough room to properly cure large harvests. These factors contributed to the perception that outdoor cannabis was a lesser product. Meanwhile, indoor producers worked hard to maximize production and quality from limited space with higher input costs. In a legal marijuana market, the covert nature and timing limitations of outdoor cultivation disappear, so the perception of indoor v. outdoor cannabis deserves a second look. We acknowledge that there is a certain amount of consumer preference here but testing by several growers and labs has shown that the perception of outdoor inferiority is a myth. Tests with clones grown indoor and outdoor have demonstrated that outdoor cultivation produces higher levels of cannabinoids, the drugs that make cannabis appealing. Additionally, the flavor components of cannabis, specifically terpenes, have also been shown to be higher and more diversified in outdoor cultivated cannabis. Given outdoor cannabis has higher cannabinoids and a stronger flavor profile, it is reasonable to assert that, all else being equal, outdoor cultivation is at a minimum not inferior to indoor. However, all things are not equal.

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### **Indoor Cultivation**

Indoor production requires significant outlays in terms of facilities, lighting, ventilation, water, temperature control, etc. Indoor growers typically want temperatures in the high 60's to high 70's for ideal growth.

At temperatures lower than that, the metabolism of the plant is too low and the plant will not reach its potential yield. Above that level, the plant metabolism will accelerate and the plant will require significantly more inputs in the form of water, light, ventilation, and fertilizer. Despite these input costs, there are three main benefits to indoor growth.

1. The primary reason for indoor growth is that it allows for year-round cultivation of cannabis. This is a benefit for growers producing for personal use, but less of an issue for industrial scale production.
2. Indoor production grants control of every aspect of growth for the plant. This has three benefits. First, control allows indoor producers to create much more standardized product with clones going through the exact same growing conditions each time, ideal for medical products. Second, it gives better control over breeding, allowing the grower to select alleles and traits that are appealing in the market. Third, it can reduce the risk of fungal infestations or other environmental factors that outdoor producers must contend with.
3. Indoor production creates a protected environment to produce visually appealing and idealized cannabis buds. This kind of “bag appeal” of the product can affect consumer choices in the end market.

These reasons are significant, particularly in the current and near-term market environment where transportation is limited and prices for marijuana are high enough to support the increased costs.

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## Outdoor Cultivation

With significantly higher production costs, we find it unlikely that indoor producers will be able to compete against outdoor producers in the long-term as outdoor production has several benefits.

1. Indoor growers tend to be less concerned about yield per plant than yield per watt. This is understandable as electricity is their largest input cost. One survey found that indoor growers can expect 1.6 grams of cannabis per watt of lighting, and this focus on power demonstrates the importance of the input. For outdoor growers, the cost for light is zero as the sun is free. Outdoor planting removes the primary input cost. (See Colorado’s Electrical Grid)
2. Outdoor production can result in significantly higher yields. There is some uncertainty in the information we have found as to the current limit in yield per plant or if large growth starts to have a negative impact on flavor.  
However, an indoor grower probably hopes to generate about one pound of uncured cannabis per plant under the best circumstances. Outdoor farmers can push production much higher with reports of seven pounds if not more.
3. Growing cannabis outdoors is better for the environment. No matter the power source, solar production of cannabis via photosynthesis offers the greenest, lowest CO<sub>2</sub> footprint possible. This should make the outdoor product more appealing to consumers who are concerned about environmental factors.
4. Cannabis is extremely adaptable to local climates and pests. This means that farmers can select and breed strains that are ideal for the environment and climate they are growing in, reducing costs for pesticides.

5. Outdoor farmers are able to work within the context of more sustainable growing methods such as intercropping, ground cover, and beneficial ecosystems that can reduce needs for fertilizer. This would likely be unappealing to industrial level production, but these methods offer smaller growers the opportunity to develop reputations for flavor and terroir akin to wine while still reaping many of the cost and yield benefits.

The current price of high quality cannabis averages about \$320/oz nationally, ranging from as low as \$200/oz in Oregon to as high as \$390/oz in North Dakota and \$600/oz in Washington DC. That price reflects the illegality of marijuana at the federal level and supports a disproportionate level of indoor production. It is our view that as legality proceeds and prices fall, outdoor production will grow significantly faster than indoor. Outdoor cultivation's advantages should push prices well below indoor cultivation's competitive price. We believe that the eventual market for marijuana will lean on outdoor production to meet increasing demand.

## Ramping up Supply

Whether indoor or outdoor, we would note the ability of cannabis to grow quickly and increase production to meet demand. The experience of Washington and Oregon demonstrate this ability to ramp up legal production.

In Washington, recreational marijuana was legalized in 2014. The usable weight, i.e. dried and cured, produced legally in the first 12 months to June, 2015 was almost 15 tons. The most recent report from the Washington Liquor and Cannabis Board indicates that as of April 2017, useable weight was almost 113 tons. That is a 7.6X increase in just under 2 years.

## Colorado's Electrical Grid

The legalization of marijuana in Colorado has had an unexpected side effect on the utility companies in the region. Utility companies are obligated to provide power to high use customers like indoor growers as part of their mandate for serving the community. When cannabis was legalized, many legal growing operations started blowing up their transformers. These were not sophisticated engineering operations, and the individuals involved did not realize that the little transformer box in their backyard was a limit on their expanding production. Colorado utilities have begun to work with these operations to make sure they have the proper systems in place.

Unfortunately, legality has prompted many black market growers to pop up as well, placing additional demands on the grid as these producers try to take advantage of the gold rush in delivering cannabis to recreational consumers. These growers can be difficult due to paying cash for their utility service, and they can put utility workers in danger with reports of some customers pulling guns on utility workers. At current prices, these growers are willing to take on the risks of production, and utility companies must shift enforcement to the proper authorities. Another example of the law of unintended consequences.

In Oregon, production growth has been wildly beyond expectations. Even before the state legalized marijuana, Oregon had many environmental benefits that made it an attractive place to grow cannabis. Legalization has caused production to explode. Today, Oregon has the lowest price for cannabis of any state. Depending on the survey, marijuana costs around \$200/oz in Oregon. In February, the US Attorney for the State of Oregon reported that production levels were three times the amount needed for the state. This excess production is spilling over into states where cannabis is legal and illegal causing tension between Oregon and the federal government. We are curious to see how the issue is resolved, but the interesting point from our long-term perspective is how much production has increased with legality. It would indicate the biology of marijuana is not a limit on ramping up production quickly. The current price level pushes suppliers to produce more and drive prices down further. (See An Example in Aluminum)

Marijuana can grow virtually anywhere outside of the desert or Antarctica, yet it is unknown at this point what states would be ideal for outdoor industrial level production as the plant has not been optimized for different climates. To this day, there are wild marijuana varieties growing in the mid-west from Oklahoma to South Dakota. "Ditch weed" is a legacy of a time when planting marijuana or hemp was seen as patriotic given its importance for creating a wide variety of products like rope, paper, and textiles. Despite multiple efforts to get rid of it, the plants continue to thrive. One official in Indiana stated that, "You can eradicate ditch weed as well as you can eradicate dandelion". Given the hardy and resilient nature of the plant, we believe there is little reason to doubt that modern agriculture could grow high quality cannabis on the great plains with potentially enormous yields. Or that tobacco farmers in North Carolina, Kentucky, and Virginia could successfully cultivate the crop as legalization proceeds. The result of these potential new growing areas coupled with the rapid growth rate of

## An Example in Aluminum

When a restricted market is flooded with supply, prices can fall dramatically. Aluminum is the most common metal in the Earth's crust. It is so plentiful today that we make disposable soda cans and foil out of it. Yet historically, there was no easy way to extract it from the minerals it naturally occurred in. It was not until the 1845 that German chemists were able to extract a few flakes and describe the metal. Aluminum's difficulty to isolate and continued rarity made it more valuable than gold. Napoleon III had a special set of aluminum cutlery for special guests, while lesser guests used gold. In 1884, the Washington Monument was capped by a 100oz aluminum capstone, at the time the largest piece of aluminum ever cast, as a demonstration of the United States' industrial prowess and wealth. Two years later, the Hall-Heroult process for isolating aluminum was developed and prices plummeted. Global production jumped from a few ounces a month in the 1850's to 88,000 lbs a day in 1900. Nominal prices fell from \$550/ingot in the 1880's to \$0.25/ingot by 1930.

We see a parallel to the marijuana market. Marijuana is a hardy weed. It grows naturally, abundantly, and could be good cash crop for farmers in a variety of climates. However, its production is artificially constrained by law so its price per ounce is currently eleven times higher than silver and 1/7<sup>th</sup> the price of gold. Marijuana startups are operating with prices like they are selling gold when in reality they will be selling aluminum long term.

the plant means that the supply of marijuana in the United States with legalization could expand exponentially. There would not be any limitation in supply due to the plant itself, and it is likely that our yield assumptions are low as industrial farming techniques increase yields.

## AN AGRICULTURAL OPPORTUNITY

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We believe that the most powerful force driving down prices long term will be the American farmer. There is nothing particularly special about marijuana from an agricultural perspective. In a legalized environment, it would be just another agricultural product. The \$320/oz price of marijuana at the national level is artificially inflated by increased risks and limited participation due to its illegal status on the federal level. If marijuana is made legal at the federal level and becomes a state issue, the price of cannabis must fall nationally as it has in local markets where it is legal. At current prices, marijuana would be the most profitable crop available to farmers, yet they do not participate in this market for many reasons, primarily associated with legality. Limited participation means there has not been a serious attempt at large scale industrial farming of cannabis. The benefits of modern agriculture should logically follow in a legalized future. We want to know how far the future cannabis farmer will drive down the price of marijuana and what that means for the consumer.

### **The Hypothetical Marijuana Farmer**

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To demonstrate the pricing pressures the cannabis industry should face long-term, let us imagine an extremely beneficial scenario for the average hypothetical marijuana farmer. The revenue per acre a domestic farmer can expect to generate is related to the variable costs associated with growing the product. Corn revenues per acre are around \$750, soy at \$650, and wheat at \$370 at current commodity prices. Tobacco is one of the highest revenue generators at \$4,500-\$5,000 per acre. The price is so high because tobacco is one of the costliest, labor intensive agricultural products with costs per acre running between \$2,800-\$3,800. For this extreme example, let's assume cannabis costs are 10 times that of the high-end costs of tobacco. A hypothetical farmer of cannabis would spend \$38,000 for fertilizer, labor, equipment, etc. per acre. We will also assume cannabis is extremely profitable and the market permits farmers make 100% on every \$1 invested. This would make the sale price from an acre of marijuana at \$76,000. To figure out what that means in price/oz, we need to estimate our hypothetical farmer's yields. One acre is 43,560 square feet. Our farmer is spacing out his plants to give them plenty of room to grow so each plant would have a 15ftx15ft block of land. That means 194 plants growing on one acre. Outdoor yields can be quite large and our hypothetical farmer would have access to strains and techniques to boost yields, but we will be conservative and assume that he only gets 1/3 lb of cured marijuana per plant. Our farmer's harvest would be 64 pounds or 1,032 ounces of cannabis. That translates to \$74/oz. With the structure of the market as it is, and similar excise taxes to tobacco, that would mean a price of about \$185/oz. to the end consumer. That seems pretty reasonable compared to today's market price of \$200/oz in Oregon. The problem is the unrealistic assumptions in costs, returns, and yields that were

necessary to get \$76,000 in revenue per acre of marijuana. How unrealistic? The average farm in the US is 434 acres meaning the average farm would generate \$33 million in revenue and \$16 million in profit. In this hypothetical example, there should be no shortage of farmers jumping on that opportunity and driving down the price.

Marijuana farming today has not been industrialized the way every other farmed product has been. In the long term, we feel a good comparable would be the tobacco farmer. As we said, tobacco is one of the most expensive, labor intensive products to get to market. The three cost components of farming tobacco are fertilizer/pesticides, labor, and overhead. You cannot use significantly more fertilizer or pesticides without killing the plant so that would be similar for marijuana. Overhead costs should be fairly comparable for a cannabis farm and a tobacco farm. However, we will double the labor cost to be conservative given the additional labor steps associated with promoting quality cannabis bud growth. Under such a scenario, the cost per acre would be about \$5,000 for farmers. If they get a 50% return on the outlay (slightly better than tobacco's returns), you are looking at \$7,500/acre in revenue...potentially the most profitable crop available to farmers. Our more realistic hypothetical farmer would plant his crop closer together in 10ft x 10ft blocks. If we hold yields at lower levels to be conservative, our acre of land would still produce 145 pounds of usable cannabis. Given these hypothetical yields and returns, the price per ounce on the commodity market would fall to about \$3.23/oz. Using tobacco distribution and taxes as guide, that would equate to a price for cannabis delivered to end users at \$16.91/oz. We acknowledge that the big unknown here is taxes as that could be significantly higher than tobacco but even a 100% excise tax would push the price to \$24.90/oz. Incredibly cheap by today's standards. Still, we feel that these assumptions remain almost comically conservative in the long term and there is room for significantly more pricing pressure.

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## Conclusion

Thinking through the supply chain from farmers to the end user demonstrates how extraordinary the price of cannabis is right now, and how unsustainable it is in a legalized market. The lofty revenue goals of every start up entering the marijuana business are temporary and the extraordinary profitability is not sustainable. Competition driving down prices should occur as markets open up. The start-ups entering every stage of the market today must be able to deliver value and profitability at significantly lower price points as the market matures. Tobacco companies have been competing in a similar market for decades, and we believe they offer the best model to view a more mature marijuana market. Long term, we find it highly unlikely that many of the ventures starting today will be able to survive the pressure of shifting to a higher volume, lower margin business. We would look towards established businesses in the tobacco market as the best way to benefit from the growth of the marijuana market long term as they have the expertise, distribution, and marketing experience necessary to compete in precisely the kind of market that marijuana should develop into.

## Please be on the lookout for our next installment: The Demand and Sales Potential of Marijuana in America

If you would like to know more about how we invest or if you have any questions about the Vice Fund or USA Mutuals, please contact us at 1.800.MUTUALS, email at [FA.sales@usamutuals.com](mailto:FA.sales@usamutuals.com), or visit us at [www.usamutuals.com](http://www.usamutuals.com).

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