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Michigan Craft Beer: An Economic Impact Assessment of the Locally Sourced Supply Chain

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Product Center Food-Ag-Bio
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August 10, 2017

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Introduction

Michigan once had a vibrant brewery industry that spanned the value chain from agricultural production of malting barley and other grains through brewing and distribution networks for reaching consumers. Stroh Brewery, once located at what is now the Eastern Detroit Market, was the third largest beer producer in America at its height but was eventually a casualty of the Miller-Anheuser Busch-Coors price wars of the 1970s and 80s (Scherer 1996). Stroh Brewery grew precipitously in the 1980s through acquisitions, and Michigan suppliers benefited exceedingly through demand for Michigan malting barley, as shown in Figure 1. However, Stroh's competition with the Coors family Brewing Company to remain the third largest producer stretched its finances. Eventually it could not keep pace and shuttered its aging Detroit brewery in 1985 and was eventually acquired by Pabst Brewing Company in 1999. Another casualty of the beer wars were the independent breweries that once dotted the landscape. Leading national brands acquired larger independent breweries, while others struggled fruitlessly to compete with the cost advantages and brand recognition of national brands. This left Michigan with little to no demand for Michigan-grown malting barley.

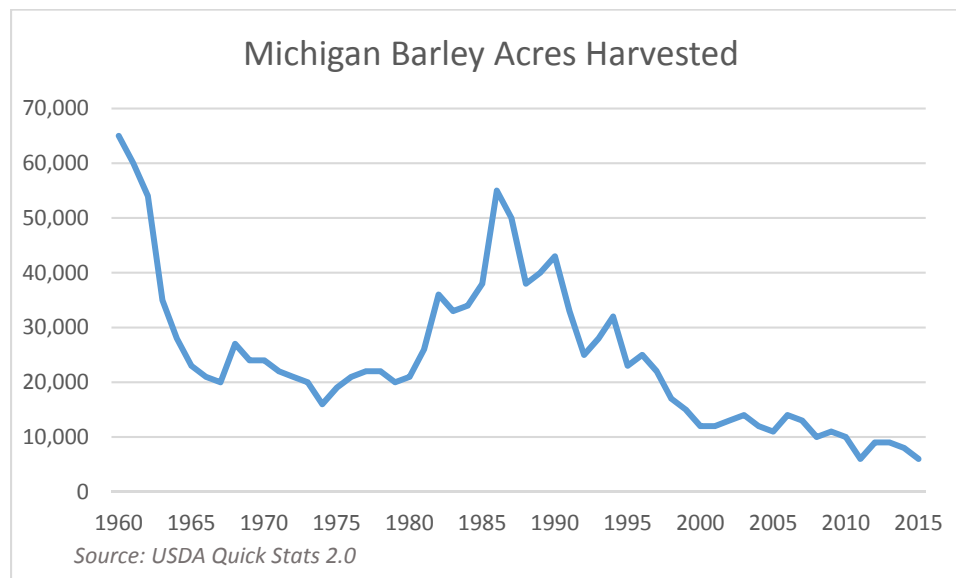


Figure 1: Michigan Barley Acres Harvested

Includes non-malting barley

Historically, barley production has been an important component of Michigan agriculture. Since 2010, Michigan has ranked 23rd in terms of number of acres of barley harvested and ranks 22nd in terms of the value of barley sales. However, Michigan acres have been declining steadily since 2000 and until very recently barley produced in the state has been used for feed. This steady decline is on the heels of steep declines in demand for malting barley following the closure of its East Detroit brewery. In the 30 years since, Michigan's expertise in growing malting barley has atrophied. However, a change in consumer preferences that favors craft beers may provide new impetus to Michigan malting barley production. This is coupled with recent interest in and acres planted in hops – a second key ingredient in beer. The shift in consumer interest in craft beers is not unique to Michigan, as other states have experienced similar growth in consumer sentiment. However, Michigan has potential to capture a greater share of the

economic value of this shift than many states. Michigan's cooler climate favors barley production and its microclimates make hops production appealing. Along with this revival of small-batch brewing is the local food movement that encourages consumers to seek out those products with local appeal.

Industry Trends

With some 241 breweries and brew-pubs in Michigan, Michigan ranks sixth in the nation in terms of craft breweries and 10th overall in terms of craft beer production (Brewers Association 2016), where craft beer is defined as that produced by small, independent breweries under traditional brewing processes (Sirrinc 2016a). Craft beer consumption is the only source of growth in an otherwise stagnant market. According to Mintel, overall beer sales waned with the loss in consumer confidence following the great recession. However, it has since seen steady gains in sales but not in volume (Mintel 2016a). With growing confidence in the stability of the economy, consumers are increasingly shifting to imported and premium beers that command a higher price. Craft beer is a component of this sector – more than doubling its share from 2010 to 2016 (Crowell 2016, Mintel 2016a).

Mintel provides a comprehensive scan of the beer industry (Mintel 2016a). Nationally, beer sales have seen growth since the recession and projections are for further growth. However, much of this growth is in pricing, as volume of beer sales has remained flat or in moderate decline since 2010. National light beer brands, such as Bud Light and Miller Light dominate the market as a single category, commanding some 47 percent of volume sales. This is down from 53 percent of market share by volume in 2010. Light beers' consumer appeal may be most associated with drinkability rather than as a means to control calorie intake. A large segment of beer drinkers are also moving toward more extravagant brews and flavors, as popular brands such as Budweiser, Busch and Miller are also losing market share. Rather consumers are shifting away from major national brands toward more imported and craft beer (Mintel 2016a).

Recent interest in local brewing may have created a market bubble for craft beer (Mount 2015) driven by interests of entrepreneurs and businesses to enter this market. As reported by the USDA National Agricultural Statistics Service, the value of hops production grew by 44 percent in 2015, boosted by growing number of acres planted and more acres planted in expensive varieties. At the same time, off-premise sales of craft beers have leveled off. Should a bubble exist, a foreseeable outcome is a collapse of sustained consumer demand that will ultimately force weaker brewers out of business, and possibly those supplying them. Large brewers are also buying craft brewers or launching their own craft brands. Bart Watson, Chief Economist for the Brewers Association does not see a bubble. Rather reviewing production data against sales data, he shows that sales are leading new business formation. Also, as opposed to the industry shakeout of the 1990, new entrants are not cannibalizing sales of existing craft brewers (Watson 2016). However, craft beer does appear to be chipping away sales of national, national brands, where their shares have declined from 28 percent of market share to 24 percent.

According to Mintel, consumers are not well-versed in beer nuances but are developing a sense of culture around beer (Mintel 2016b). Beer consumers largely fall into two categories: 1) light drinkers who prefer national brands that have flavor profiles that cater to the largest number of consumers; and 2) beer aficionados, who seek to explore the excessively diverse flavors brewers are generating. The prior tend to be much more brand loyal to their preferred brands and less willing to explore other flavors, while the latter seek exploration through a multitude of different offerings across brewing processes and brew types. These consumers have no brand loyalty, but rather seek to sample from a variety of brewers, never

settling for a favorite. While ingredients and processes are key attributes that attract these inquisitors, a geographic lexicon has not been one of the dimensions readily explored.

Consumers will play a significant role in the formation of a local beer industry in Michigan. Though a general consensus shows that consumers are increasingly interested in supporting local food systems (Mintel Group Ltd 2014, Onozaka, Nurse, and McFadden 2010, Food Institute 2014), this mindset's application to beer is in its infancy. Beer has not established geographically based branding that is common in wines. That is, most consumers can identify with Napa Valley wines, but craft beer has limited association with the place of its content. As more consumers have come to appreciate their local wines, it is hoped beer drinkers will do the same. This is a question of terroir – the flavor extracted from the land and environment from which ingredients are produced. Wine connoisseurs contend that geography leaves a distinct signature on the final glass of wine, but the same for beer is subject to debate (Burningham 2013). Unlike wine, beer ingredients are mostly dried before processing (though some brewers may opt to use green hops). Drying barley and hops robs them of terroir, makes it easier to source ingredients from around the world and makes the final product less grounded in place. The general perception is that what happens in the brewing process overwhelms any expression of terroir in the final beer (Bolden 2015). It may be easier to promote terroir in the local market, but the question of whether such branding outside of the immediate local market has appeal will have to be determined over time. The absence or presence of terroir has real implications on the merits of regional branding.

The ingredient that gives beer its body and derives its alcohol content is malted grains. While barley is the primary grain used in beer production, wheat and rye are common beer ingredients. Popular national brands often add rice as a neutral ingredient to the mix of malting ingredients. The primary seasoning comes from hops, which can exhibit bitter or aromatic flavor depending on the acidity of the hops variety. Where most homebrew ingredients call for pounds of barley, they generally measure hops inputs in ounces.

Most barley inputs into Michigan-brewed beer are currently purchased from national suppliers. More so, the market for locally sourced beers is largely untested in Michigan and is mostly in its infancy in other markets. What consumers and producers consider locally sourced is also of question. The definition of what constitutes locally sourced foods is not well defined (Zepeda and Leviten-Reid 2004, Hand and Martinez 2010, Martinez et al. 2010). The same can be said of beer. Because beer inputs are largely dry, they can be stored and shipped from around the world. Grain inputs, including barley, wheat and rye can be grown in those regions where growing them is most efficient and shipped to the brewery. Because of the subtlety of grain terroir, local barley contributes less to the quality concepts of local beer than the social concepts that contribute to consumer preferences for local foods. Hops, on the other hand, give beer its distinctive flavor. If terroir exist in beer, it most likely will come from hops. Like grains, hops are mostly added as a dry ingredient. As such, freshness of ingredients cannot be a selling point for local beers. However, many brewers opt to use wet, or green, hops in their limited run beers – providing a direct link to freshness and place. However, this will not work for core brands processed year-round.

Michigan Local Beer

Michigan can embrace this new budding industry or hamper it. In 2016, legislation was forwarded that would substantially increase the excise tax on Michigan alcohol purchases. However, Michigan brewers and consumers rallied to voice discontent with what they saw as an ideologically driven policy.

Alternatively, Michigan State University Extension, in collaboration with industry groups, like the Michigan Brewers Guild, has bolstered networking and technical assistance in the state by hosting the annual Great Lakes Hop and Barley Conference (MSU Extension 2016) and workshops (Davidhizar 2012), and investing in research and grain testing facilities (McFarland 2016).

Today, much like the nation, Michigan is home to a multitude of new microbreweries popping up in cities and towns and a few scatterings serving geographically diverse markets as regional producers. Most Michigan breweries cater to local demand and many focus on on premise consumption. That is, many Michigan breweries skip the consumer packaging and sale directly to customers. This often entails a kitchen and restaurant coupled with their brewery. Such coupling reduces the need to hire a sales force and vie for shelf space and provides higher margins for reinvestment in the company. Restaurants are notoriously risky ventures, partially because margins are so low. However, coupling a restaurant with a brewing operation allows the brewery to drive higher margins, or returns, to re-invest and build growth (Fixell 2016). Combining beer, food and ambiance enhances the total customer value proposition, allowing the principal to capture a larger share of customer value.

This report will provide a first comprehensive assessment of the budding Michigan local craft beer industry. It starts with one-on-one interviews with Michigan malting houses as the lynchpin to the larger value chain from growers to consumers. Much of this research is exploratory as it is evaluative to better understand the factors driving investment in this industry, but also to better understand the implications of industry growth for both public and policy implications.

Approach

Formal interviews were carried out with Michigan malt houses. These interviews were compiled and aggregated to protect respondents' identities. Maltsters were considered because they represent the best mix of the scale of contribution to a local beer industry and because they represent the source of the largest input into beer production. In this, they can speak to many facets of this developing industry. The compiled interviews were augmented by existing literature, blogs media sources and discussions with other stakeholders. Much of this outside information came from the Michigan Brewer's Guild, the Brewers' Association and the Craft Maltsters Guild. Other, informal interviews were carried out. Other resources are noted throughout.

A set of spreadsheet models were developed to estimate the operational costs of a brewery, per-acre cost profiles of barley and hops production, and a cost profile of a typical malting house. These cost profiles are then modeled based on a given level of locally sourced beer production. We found that barley is the primary limiting factor in the Michigan local beer industry sector. Few Michigan brewers are currently buying malt from Michigan sellers. Rather most malt are being purchased from national and regional suppliers like Briess Malt and Ingredients Co., headquartered in Chilton, WI or Rahr Malting, in Shakopee, MN, or from an international agricultural conglomerate like Cargill and Maleurop. Premium malts may be imported from Northern Europe. In the best case, the low penetration of locally sourced malts may be associated with low availability or the lack of a sufficient market to source local inputs. In a less favorable case, Michigan brew houses, responding to their consumers, are not willing to pay premiums for Michigan-sourced malts. It may be too early to ascertain the true underlying factors at this point.

As this is a newly forming industry, most interviews were not with seasoned veterans or well-established malting houses. Rather various degrees of planning, development and operations were represented in

the interviews. The lack of a clearly established market for Michigan-sourced malts imposes conjectures on reported projections. Such projections can have far-reaching implications on sectors that supply the industry and how the industry will play out over time. For example, while brewers have expressed a significant level of commitment to purchasing only locally sourced malts, few (New Holland being among the exceptions) have actually acted on this commitment.

Additionally, as the primary objective of this research is to build an economic profile of the industry and all associated transactions that generate economic activity, the youth of the micro-brew sector posits a high degree of transition in production processes and associated costs – making standardized estimates difficult. For example, micro-malting operations are unique and new enough for there not to be a turnkey equipment supply network. The lack of such turnkey equipment means that most micro-maltsters are custom developing their equipment. Some have re-purposed dairy equipment to make steeping tanks and other stainless implements, while others start from scratch. Between the two are extremely different cost profiles. Adding to this complexity is vast differences in operating procedures and facilities. For instance, maltsters may choose to invest in labor saving implements that increase their setup costs but reduce their variable operating costs.

Economic impacts were estimated using the Impact and Planning economic modeling tool IMPLAN calibrated for Michigan (IMPLAN Group LLC 2015). This is a standard economic impact evaluation tool that traces transactions across industries. These transactions are for the intermediate inputs used in producing final outputs. As such, barley is an intermediate input to malt production, and hops and malt are intermediation inputs to beer production. Other intermediate inputs include energy purchases in the form of electricity and natural gas, water and water treatment, agricultural bags, bottles and cans, accounting and other business services, and others.

The IMPLAN modeling system allows the user to isolate the transactions of 544 commodities. However, the underlying transactions of these 544 sectors are representative of the transactions taking place across all businesses operating in that sector. The sector must be modified to estimate distinct segments within the industry, such as those operating within a local supply chain. For example, while Michigan has many craft and regional breweries, currently intermediate malt purchases are mostly bought from sellers outside the state. Hence, to capture the hypothetical scenario that malt is supplied in state, the purchase functions must be modified to reflect the higher rate of local self-supply. The interviews with malting houses were used to re-parameterize the model.

We estimate the value chain contributions of each of the primary functions in the local brewery value chain. This includes barley growing, hops growing and processing, malting and beer production for on- and off-premise sales. Each is estimated separately. The IMPLAN model is then used to estimate all the secondary transactions that arise from the direct effects. The secondary transactions start with the intermediate inputs used in the production of the final product. For barley production, this would include fertilizer, fuel, seeds and other direct inputs. Subsequent rounds of secondary transactions are also captured by those supplying intermediate inputs. For example, the fertilizer and fuel producers purchase inputs from the mining sectors. All subsequent secondary transactions are captured. This creates a potential to double count secondary transactions if modeling both outputs and intermediate inputs like beer sales and malt production. Hence, estimated malt production impacts should net out barley production impacts to estimate the marginal or net contribution of malting. Similarly, beer final sales impacts should net out the impacts of barley and hops production and those from malting operations.

In the IMPLAN model, estimating craft beer sales through local channels requires modifying maltsters' intermediate purchases of barley from 46.84 being 100 percent in state. Additionally, beer producers' purchases from local malt suppliers are changed from zero percent to 100 percent. Finally, intermediate beer purchases for final outlets are changed from 61.25 to 100 percent. It should be noted that this does not imply that all beer sales in Michigan are Michigan, but the changes in beer production modeled will draw from these local intermediate inputs. Additionally, because Michigan malting currently does not exist in the data, this industry had to be built up from a representative enterprise budget, as described in the next section.

Finally, the contributions to economic activity of each function are then compared to displaced economic activity that would likely have occurred in the absence of a local craft beer industry. This requires conjecturing what other use of barley acres would take the place of malting barley, and the same for hops. Similarly, consumer purchases of locally-produced craft beers necessarily imply that other beer was not purchased. This displacement of conventional beer sales, and all other displaced economic activity, should be accounted for in estimating the overall industry impact.

Interviews

All interviews started with a discussion on how the business got started and the motivations behind that start. Given that most of the respondents were in the development stage of their business, this was an easy answer for most. The responses ranged wildly, from those wishing to be part of a movement for which they are impassioned, to those seeking a business opportunity. The conventional argument for being one's own boss was cited as often as the desire to be part of a growing movement. Few sought a strict, unimpassioned desire to build wealth.

Most maltsters we talked with indicated some strategy to build competitive advantage against national malt suppliers. These ranged from building personal relationships and communities of interest to providing levels of customer service not attainable by larger, national suppliers. To the prior, maltsters viewed relationship building is an important component of supplying this market based on craft rather than strict formulas. In this, it is clear that their targeted buyers are smaller brewers that are grounded in the craft of brewing and not the formulaic brewers seeking market penetration. While they may see their primary buyers in this light, this is not to suggest that such maltsters will not be in a position to supply larger malt houses. Regardless, their malt house designs tend to be more craft-driven and designed around manual processes. The other group of maltsters target volume and see their primary buyers as larger brewers seeking to maintain consistency. Such maltsters designed their malt houses for efficiency and consistency, with a high degree of measurement and automation.

A few of maltsters we interviewed have agricultural backgrounds and also grow some of the barley they intend to use in their malting operation. Only one indicated they would be a sole supplier of the barley they malt, and that individual had a very different business model that deemphasized malting. Those that also grow barley largely saw a discrepancy between the price they receive for barley and the price maltsters receive. Malting, to them, is a value-added activity to remove the middleman, not unlike other farm-level value added processing of commodities.

Agricultural Inputs

Barley

Maltsters indicated having no problem-finding growers willing to contract with them given current agricultural, commodity prices. Most maltsters indicated that growers are finding them. However, some growers have backed away once seeing the required specs the malting house may place on delivered grains. These specs do not appear to be uniform across maltsters. Rather those who have chosen to adopt standard contracting language provided by commodity associations may be adopting overly stringent grower practices than are necessary. Alternatively, those who have decided to draw their own contracting language may be overlooking some safeguards that commodity groups have identified. Likely, the nature of the contracts will ultimately converge over time, as buyers gain experience working with growers.

In addition to contracted purchases, there exist some opportunities to purchase malting grain on the spot market. For maltsters, the spot market affords greater flexibility, especially for those without a full production schedule, to meet demand and to be selective in quality. However, all maltsters interviewed indicated they prefer to purchase by contract and to build relationships with their growers. This assures them access to the grains needed, and for those targeting relationship building, is a core component of their value proposition.

Barley growers do not necessarily have to change their practices for growing malting barley. While there was some discussion around limiting nitrogen use as a means of controlling protein development in malting barley, most contend that nitrogen caps are not below prescribed application rates. Additionally, while some commentators suggest that malting barley yields tend to be lower than feed-grain barley, the evidence from discussions does not seem to support this contention. Since maltsters generally prefer two-row barley, this notion may result from differences in 6-row and 2-row barley yields. However, recent field experiments in Vermont indicated that yields across common 6-row and 2-row varieties are not systematically different (Darby et al. 2012).

Because the next best option for barley that does not meet buyer specifications is as animal feed, contracting for malt barley can be risky for growers. In this, an insignificant market exists for unloading sub-par barley, where market prices are as low as 25% the value of malting-grade barley. This can pose a significant hit for a grower in light that Pilot malt indicated that they have turned away barley from up to 50 percent of the barley fields they contracted (Basche 2016). While the actual rejection rate is likely to be lower as growers improve on management for meeting maltsters' standards, the relatively high rate of rejection posits a challenge to growers who have to manage risks by diversifying their fields.

The market for malting barley is currently restrictive in Michigan. This can present a challenge for growers who have overruns. Some maltsters choose to contract on volume, leaving the grower to contend with production overruns. With limited marketing options, unloading overruns as feed can be a challenge without taking a steep price cut. Even unloading as feed may have limitations in Michigan, as feed barley is not common. However, as the industry develops and more acres are planted into barley, secondary markets are likely to develop easing such constraints.

Spring barley appears to be the most common barley crop grown for malting in Michigan. However, a few commented that they purchased winter barley. Winter barley does not grow well in Western Michigan because the deep snow cover reduces its viability and does not do well in the UP because of the long winters. Those growing winter barley note that the harvest schedule precedes most other cash crops from

two to three weeks. This helps them manage harvest activities. Winter barley yields tend to be around 80 bushels per acre while spring-planted barley yields tend toward 50. Because barley can be a winter or spring planting, it can be a flexible addition to one's rotation – often taking the place of wheat.

Michigan brewers generally prefer two-row barley. No maltsters we talked with indicated they work with six-row barley. However, six-row barley use is not unusual in beer production, and Michigan brewers' unwillingness to adopt six-row barley is not well understood at this point. Some Michigan brewers suggest that six-row barley has lower quality and lower beer yields relative to two-row barley. The American Home brewers Association (Payne 2016) notes that for brewers, six-row barley can be less expensive relative to two-row barley. Nevertheless, this comes with higher rates of proteins and less starch for converting into sugars. Because of the high protein content, six-row malts are often blended with unmalted cereals in brewing. Regardless, six-row barley trials are underway in the state and they may pose some advantage for growers over two-row.

While maltsters believe they will have no problem finding growers to contract with, agricultural commodity prices have largely been suppressed over the last three years. According to the USDA, commodity grain prices have been in steep decline since 2013 – reaching lows comparable to 2007. Will maltsters be able to find growers when prices improve? All maltsters we talked with believe they will. Part of this confidence arises from their strategy to build relationships with their growers. Others view dealing with growers one-on-one affords them an opportunity that many wholesalers do not have for building long-term partnerships in meeting malting malt demand. This is also true for other malting ingredients including wheat and rye. Some also noted that their relationships have made them a middleman in dealing with other grains and inputs to the malting and distillery process. While no one suggested they become brokers for other commodities, more than a few mentioned delivering non-malted ingredients to both brewers and distillers.

Hops

Hops are often called the spice of beer and are added in the brewing process much like spice is added to a meal. Hops are essential for giving beer the bitterness that offsets the sweetness of the sugars that develop in fermenting and provides the aroma that is distinctive to beer. While, hops use by volume is much less than barley, hops command of high prices has made this an attractive commodity for growers. This price, however, comes with significant setup costs.

Growing hops requires significant initial investment in trellising and drip irrigation. MSU Extension places hop yard preparation and establishment costs at \$13,668 per acre (Sirrione et al. 2014). This includes plantings of 1,000 plants per acre. Hops yields vary by variety, and therefore may differ from estimates used in this report. Based on MSU Extension estimate, we set expected yields at maturity to 1,500 dried pounds per acre, where full maturity takes place by year three of the plantings. Plantings have an estimated life of 20 years. The actual life may be shorter as growers remove varieties that perform poorly in the market place with those exhibiting higher returns. Hops growers will often use a third party to dry and store hops, like Black Creek Hops, in Scottville, MI. For the purpose of this report, we assume all planted hop yards are at maturity and that the costs and returns to drying and pelletizing hops are accrued at the farm.

The actual number of Michigan acres in hops is up for debate. The Brewers Association suggests that Michigan has 800 acres in hops production (George 2016b), though with recent plantings, that number is

likely to be closer to 1,000 acres (Sirrinc 2016b). With this high number of acres, it is evident that some Michigan-grown hops are for export out of the state. Because market estimates in this report are directed at local markets, the numbers will reflect that which is expected to go into brewing for local consumption.

Hops farming can yield high returns – up to \$5,495 per acre (Sirrinc et al. 2014). However, this is likely to vary depending on the variety planted, as different varieties command significantly different prices. Alpha varieties are high in acid and therefore produce a more bitter taste in beer. Such varieties tend to command lower prices than aroma varieties that produce less bitter and more exotic flavors. In the U.S. acres planted to aroma varieties have nearly tripled since 2012, while acres to alpha varieties have shrunk by a third (George 2016a). This is best attributed to demand for aroma hops from small craft brewers (Watson 2015). While Michigan statistics do not allow us to break hops into respective categories, we perceive that most hops acres fall into the aroma varieties. The estimated price of dried and pelletized hops used in this report is \$12 per pound. This is comprised of \$5.00 per pound of fresh barley, \$2.50 per pound for drying, bailing and for initial handling and cold storage, an additional \$2.50 for pelletizing from bails and cold storage of pelletized hops. The final \$2.00 is attributed to marketing and selling costs (Miller 2017). As variety preferences can change, while acres planted to varieties are rigid, any one grower is likely to experience substantial variation in the price they receive.

Brewers

While formal interviews were limited to maltsters under this project, maltsters are largely responding to demand from breweries. More specifically, from local breweries seeking to build on their marketing and production efforts to meet consumer demand. Market insights of the brewing industry were derived from informal discussions with brewers and through third-party market analyses, including Mintel industry reports on beer and, more specifically, craft beer.

Local beer is sold through multiple venues. With regards to small-scale production, on premise consumption appears much more common than off-premise consumption. There is a budding industry analogous to wine tasting rooms, where consumers can sample and purchase bottled beers straight from the brewery for off-premise consumption. This may be one strategy to build the brand recognition necessary for wider distribution. Third party on premise consumption is another option. Restaurants with alcohol service, especially beer on tap, can be an outlet for local breweries. Packaging requirements for filling kegs can be less expensive than bottling or canning for the brewery. However, getting access to on premise sites can be difficult if the brewery has limited brand recognition. Another common outlet is for the brewery to combine operations with a kitchen. Of the 240 breweries we identified, 137 were categorized as a restaurant or pub. In this, the brewery helps to develop a niche that improves the success of the restaurant. As restaurants generally have high failure rates due to low margins on food, the higher margins on tap beer affords a steady flow of revenue for the operation. A scan of Michigan breweries indicates this is a common venue for commercializing the brewery.

Getting beer on retail shelves requires a significant investment and often a minimum scale of operations. First, getting on retail shelves may entail paying slotting fees. These are fees retailers charge manufacturers to get access to their customers. Second, a wholesaler with access to desired retailers must be convinced to carry the beer. It can be difficult to convince wholesalers to carry a new product, and slotting fees may apply here as well. Similarly, selling draughts through a third-party restaurant or pub requires getting a wholesaler to carry the brand and deliver the kegs. Alternatively, there may be opportunities for transacting directly with the retailer, restaurant or pub. Growth opportunities through

such direct channels may be limited, as there may exist legal barriers to direct selling, and the potential market reach may be limited. However, such direct channels may be the best venue to build the brand recognition necessary to garner interest from retailers and restaurants and pubs.

Value Chain Analysis

This section sets out to estimate the actual and potential size of the Michigan local beer market. The overriding assumption is that the Michigan value chain from grower to consumer is totally self-reliant on Michigan inputs.

Interviews with maltsters did not reveal a total size in acres of barley, nor pounds processed. Rather we turn to the Brewers Association (2016) estimated of total in-state sales and production. Hence, we start with total value of Michigan craft beer production and work backward to determine how much input is required. We then parse out input between in-state and out of state sources, where in-state sources build on state level economic activity. We then circle back around to gauge the estimates against national estimates of craft beer sales as a check on estimate accuracy. Table 1 shows initial calculations and the assumed parameters used in those calculations.

	Parameter	Potential	Actual
Michigan Craft Beer production (bbl/year)		769,897	53,893
<i>Malt per bbl (lbs)</i>	69		
Required Malt (lbs)		52,891,924	3,702,435
<i>Shrinkage rate between barely and malt</i>	25%		
Required Barley (lbs)		70,522,565	4,936,580
<i>Barley pounds per bushel</i>	48		
Required Barley (bs)		1,469,220	102,845
<i>Yield per acre (bs)</i>	70		
Number of acres for Malting		20,989	1,469
<i>Rejection Rate</i>	30%		
Number of acres not for malting		8,995	630

Table 1: Number of Barley Acres

First, the Brewers Association estimated that in 2015, Michigan brewers produced just under 770,000 barrels of beer, which translates to approximately 23.9 million gallons. A barrel is roughly twice the size of a standard commercial keg. Craft brewing requires up to four times as much malt input as used in most national brand beers (Philpott 2015). Maltsters provided many estimates that centered around 70 pounds of malt per barrel of craft beer. We used 69. This means if Michigan were to completely self-supply its brewers with malt, it would need 52.9 million pounds of malt. Next, we estimate how much barley that will require. Based on estimates that ranged from 70 percent to 100 percent conversion in barley pounds to malt pounds, we used 75 percent (1-.25 shrinkage). This means that approximately 70.5 million pounds of barely is required to self-supply Michigan breweries. Converting that to bushels based on 48 pounds per bushel suggests a need for 1.46 million bushels of barley. Assuming barley yields are about 70 bushels per acre, we calculate that the total number of acres of malt barley to be 20,989. However, because the rejection rate can be as high as 30 percent another 8,995 acres of barley will be required that is not malted. In total, about 29,984 acres of barley will need to be planted in Michigan to completely self-supply the local craft beer sector.

Next, we calculate the same estimate based on estimates of current self-supply of barely for malting. Working backwards, we estimate the total use of locally sourced barley. These calculations are based on the assumption that seven percent of the required barley in Michigan beer production is supplied by local sources. This seven-percent assumption varied widely in our discussions, but seemed reasonable overall. In this, about 1,714 acres are planted to go to Michigan maltsters. This translates to about 85,705 bushels and 4.1 million pounds of barley. This barley generates about 3.7 million pounds of malt that go into producing 53,893 barrels of Michigan-brewed and sourced beer.

Hops use and production estimates are calculated analogously. Table 2 starts with the estimated state-wide production from the Brewers Association (2016). Hops use per barrel of craft beer tends to be higher than for many national brands at about 1.6 pounds per barrel. Based on production, this means that 1.25 million pounds of hops is required for Michigan’s 770 barrels of craft beer production. It is likely that not all hops going into Michigan brews come from Michigan, but this is what would be required should the state completely self-supply. Given an expected yield of 1,500 dried pounds per acre, this would require 835 acres of Michigan hops – or just under the total number of acres planted in 2016 (Sirriner 2016b), of which, much is currently exported out of the state. Considering that only about 53,893 barrels of Michigan beer is in-state sourced, the actual demand for Michigan hops for Michigan brews is about 85,711 pounds – or the equivalent of about 58 acres of hops production.

	Parameter	Potential	Actual
Michigan Craft Beer production (bbl/year)		769,897	53,893
<i>Hops per bbl (lbs)</i>	1.6		
Required Hops (lbs)		1,253,007	87,711
<i>Hops Yield per acre (lbs)</i>	1,500		
Number of Acres for Local		835	58

Table 2: Number of Hops Acres

Modeling the economic value will require that these measures be transformed into economic values (Table 3). Hence, prices along the value chain are applied. In calculating beer revenues, we first had to break out sales into off- and on premise consumption. We apply a 50/50 ratio, suggesting 50 percent is purchased for off-premise consumption, while the other 50 percent for on premise consumption. This is based on national share of on- and off-premise sales of craft beer (Mintel 2016b). We further estimate that there are 248 16-ounce glasses in a barrel. This is estimated by weight. Off-premise selling prices are about \$1.67 per 16-ounce bottle,¹ while on premise prices is admittedly low at \$3.75 per pint (16 oz).² The price maltsters pay for barley is set at \$8.50 per bushel. Responses, once again varied significantly from this number, but it appeared to be the center point. This suggests that barley cost is 18 cents a pound. Similarly, the target and actual selling price of malt is around 65 cents per pound. This estimate also varied and may be as low as 50 to 46 cents per pound. We say this because many that targeted 65 cents per pound have not actually sold at this price, while those currently selling in the market suggested the going price to be competitive with national suppliers. Finally, pelletized hops are priced around \$13 per pound.

¹ This price also includes earnings from third party retail sales, of which the brewer retains a lower margin compared to direct sales.

² This price also includes earnings from third party restaurants and pubs in the form of kegs. Margins on kegs are much lower than margins earned at one’s own tasting room or pub.

<i>Share Off-premise</i>	50%
Share On-premise	50%
Glasses (16-oz) in barrel	248
<i>Off-premise revenues (per 16-Oz)</i>	\$1.67
<i>On-premise revenues (per 16-Oz)</i>	\$3.75
<i>Price of Barley per bushel</i>	\$8.50
Price of Barley per pound	\$0.18
<i>Price of malt per pound</i>	\$0.65
<i>Hops Price per dried pound (pelletized)</i>	\$12.00

Table 3: Economic Parameters

Table 1 along with Table 3 is used to estimate industry revenues. First growers’ potential revenue should Michigan craft beer be self-sufficient is \$12.5 million in malting barley sales plus \$1.3 million in feed sales based on a 30 rejection rate and a 75 percent discount on the selling price (Table 4). This indicates that barley growers would lose revenues of about \$4.0 million on those fields that do not meet malting specifications. Maltsters will earn about \$34.4 million based on the 65 cents per pound selling price. Additionally, hops growers would expect to generate \$15.0 million in sales if all Michigan craft beer used Michigan hops. If local hops use were similar to barley (seven percent), then actual hops sales going into local craft beer would be about \$1.05 million. Finally, sales for final use will total about \$151.5 million in retail sales and about \$340.1 million in on-site sales. Actual revenues, based on seven percent self-supply would be analogous. These estimates are based on potential sales should Michigan self supply its craft beer production. However, the estimates based on sales of fully Michigan-sourced craft beer is about \$10.6 million from off-site sales and about \$23.8 from on-site sales, with corresponding transactions up the value chain.

	Potential	Actual
Growers' Revenue (Malt)	\$ 12,488,371	\$ 874,186
Growers' Revenue (Feed)	\$ 1,338,040	\$ 93,663
Growers' Lost Revenues (Feed)	\$ (4,014,119)	\$ (280,988)
Growers' Revenues (Hops)	\$ 15,036,088	\$ 1,052,526
Maltsters' Revenues	\$ 34,379,751	\$ 2,406,583
Retail Revenues	\$ 151,458,757	\$ 10,602,113
On-site Revenues	\$ 340,102,000	\$ 23,807,140

Table 4: Economic Values

Malting operating budget

A typical operating budget is developed based on a four-ton per week capacity malt house. This is equivalent to a 200-ton per year operation. A 4-ton malt house is about the size of Pilot Malt in Byron Center, MI. An MSU annual baseline budget for malt houses (Knudson 2014) was used and modified based on discussions with maltsters. As many of the maltsters interviewed have not been operating for a complete year, some could only provide projections. A few were not far along enough in the planning process to have formulated a projection. Regardless, the budget is developed to be representative of the typical 4-ton malt house, which is proposed as typifying the production profile for modeling purposes.

Several assumptions went into the development of the malt house enterprise budget. Many of these assumptions will differ from those in the MSU report (Knudson 2014). First, we raised initial capital investment for equipment from \$100,000 to \$250,000. This is not to suggest that all malt houses will operate with this level of fixed investment, as many indicated strategies for repurposing existing equipment for the purposes of malting, thereby defraying much of the initial expense. The loan repayment is set for 10 years, though the repayment period may be shorter for lower capital investment amounts. Similarly, capital equipment is depreciated over 10 years. This may be shorter as old equipment becomes obsolete, or may be longer if equipment obsolescence is minimal. Additionally, both sales revenues and grain expenditures are higher than MSU baseline estimates, based on \$8.5 per bushel barley prices and \$0.65 per pound for malt. This entails a dry inventory shrinkage of 25 percent from barley to malt, where about 10 percent is from drying. Another key difference from the MSU report is that we assume three employees rather than two. Any number of these employees may be the principle owners, who pay themselves out of proceeds.

The resulting budget estimates are shown in Table 5. Like the MSU feasibility report, the expected revenues largely exceed the costs when operating at capacity. Expected margins, measured by the ratio of net revenues to total expenses (including cost of grains) are under 10 percent.

Income Statement	2016	2017	2018	2019	2020
Sales	\$260,000	\$265,200	\$270,504	\$275,914	\$281,432
Cost of Grains	\$90,667	\$92,480	\$94,330	\$96,216	\$98,141
Net Sales	\$169,333	\$172,720	\$176,174	\$179,698	\$183,292
Other Expenses					
Depreciation	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Interest	\$17,500	\$16,233	\$14,878	\$13,428	\$11,876
Wages and Benefits	\$83,125	\$84,788	\$86,483	\$88,213	\$89,977
Marketing	\$6,000	\$6,120	\$6,242	\$6,367	\$6,495
Rent	\$2,000	\$2,040	\$2,081	\$2,122	\$2,165
Bags	\$7,200	\$7,344	\$7,491	\$7,641	\$7,794
Utilities	\$9,000	\$9,180	\$9,364	\$9,551	\$9,742
Maintenance	\$1,000	\$1,020	\$1,040	\$1,061	\$1,082
Office Expenses	\$500	\$510	\$520	\$531	\$541
Insurance	\$500	\$510	\$520	\$531	\$541
Transportation	\$5,700	\$5,814	\$5,930	\$6,049	\$6,170
Pallets and other costs	\$4,296	\$4,382	\$4,470	\$4,559	\$4,650
Total Expenses	\$161,821	\$162,941	\$164,020	\$165,052	\$166,033
Net Profit	\$7,512	\$9,779	\$12,155	\$14,646	\$17,259

Table 5: 4-ton per week annual enterprise budget

Actual revenues and expenditures will vary from those shown in Table 5. First, if the malt house is designed as a 4-ton operation, deviating from the design capacity will have significant implications on the actual net revenues. Because the interest and depreciation expenses are fixed, they do not decrease if volume targets are missed. They may also differ because the malt house design differs from that exhibited, or because the targeted volume is different from that in Table 5.

Economic Contribution Estimates

Four sets of models are developed for estimating contributions. They are replicated based on potential and actual size of the Michigan local beer market. Contributions are gross impacts on economic activity and do not account for offsetting displacement of economic activity. The section discusses the estimates and calculations for estimating the net impacts.

The underlying data in the IMPLAN model is modified to reflect the transactions underlying a local value chain for Michigan beer production. Estimates are based on the value of economic activities tied to beer produced in Michigan using only Michigan-sourced barley, hops and malt. Only the economic estimates of beer sales represent the full value chain economic contributions, as those of barley and hops production, and that of malt production, are strictly intermediate steps that are fully captured in the beer sales for final consumption contribution estimate. However, they are reported to illustrate the relative contributions of each step from grower to final use.

Actual Contributions

Actual contributions are our best estimates of the actual economic contributions of local craft beer sales. To be sure, local craft beer is that which is produced and consumed in Michigan. Inherent in this is the assumption of 100 percent local ingredients and processes. However, packaging, labeling, equipment and other non-agricultural input and processes may be sourced outside the region.

Barley and Hops Production Contributions

While barley production is a commodity crop, barley for malting may be considered a niche within this sector. Since barley for malting poses a substantial risk to growers, the downside of the market can be substantial, suggesting a level of margins equitable with the standard commodity, barley. Hence, no changes were made to grower margins. Hops, however, may provide a substantial source of margins for growers, willing to invest in the fixed setup costs. However, it too poses a risk that is born by the industry, in that over-supply can erode such margins over time. We use the margins provided by MSUE (Sirrione et al. 2014).

As Michigan malting is in its infancy, the overall economic footprint of barley and hops production for locally made beer is somewhat limited at this point. Table 6 shows the current estimated values, where the contributions are mostly dominated by hops production. In this, Michigan hops production has a head start on barley as a source for locally produced beer, as Michigan has become an increasingly important source of hops for the nation. In total and from a high-brushed assessment, agricultural production for Michigan local craft beer supports 21 jobs directly in the agricultural production. Another 13 jobs are created through secondary transactions. In total, the agricultural component of the current local craft beer sector generates about 34 Michigan jobs with annual labor income of \$1.15 million.³ This contributes about \$1.78 million to annual gross domestic product (value-added) and generates about \$3.71 million in transactions.

³ Labor income excludes proprietors' incomes (profit), which is captured in contributions to gross state product (Value Added).

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	21	\$626,798	\$880,189	\$2,034,251
Indirect Effect	7	\$276,712	\$461,201	\$898,437
Induced Effect	6	\$246,263	\$442,662	\$776,550
Total Effect	34	\$1,149,773	\$1,784,052	\$3,709,238

Table 6: Current Contributions of Barley and Hops Farm Production for Local Craft Beer

Malting Contributions

Malting contributions arise from malting operations and the direct expenditures made to suppliers. Here all barley inputs are considered local for measuring the contributions of local craft beer production. However, some malting operations may exist through purchases of malting barley from out of state. Such contributions are not recognized in these estimates. Non-barley inputs may or may not be sourced locally, such as energy inputs, equipment, packaging, etc. Of these, the model determines the share that come from local sources. Table 7 shows the estimated contributions of malt production for local craft beer. Specifically, we assume that all malt produced in Michigan goes to Michigan breweries, and no malt is exported. As the sector builds over time, this may change.

Effect	Employment	Labor Income	Value Added	Output
Direct Effect	20	\$748,953	\$910,844	\$2,406,583
Indirect Effect	11	\$363,000	\$558,202	\$1,857,354
Induced Effect	7	\$303,527	\$545,605	\$955,021
Total Effect	38	\$1,415,479	\$2,014,651	\$5,218,958

Table 7: Current Contributions of Malt Production for Local Craft Beer

Accordingly, current malt production (includes those just now starting operations) creates an estimate of 20 direct jobs. Direct jobs may also entail the owner. Indirect effects include all the direct and indirect effects of barley production plus other secondary transactions and gives rise to some 11 additional jobs. It does not include farm production of hops. Induced effects of spending from household incomes give rise to an additional seven jobs, for a total of 38 jobs with annual income of \$1.42 million. This contributes \$2.01 million to annual gross domestic product and generates \$5.22 million in annual transactions, once accounting for all secondary transactions.

Local Beer Sales and Total Contributions

The final contribution estimates of the value of local craft beer sales currently produced also provides an overall contribution of the Michigan local craft beer sector. In that, the value of barley, malting, hops and of beer production for on premise and off-premise consumption is included in the assessment. The accompanying contribution estimates in Table 8 only consider that produced in Michigan using Michigan malt from Michigan-grown barley, Michigan hops and brewed in Michigan for Michigan consumption.

As shown in Table 8, once accounting for the full value chain through to sales of the brewery, the estimated actual economic contributions are more notable. In total, breweries directly generate an estimated 571 jobs in Michigan. This includes those engaged in brewing, as well as those engaged in service aspects of on premise consumption like wait staff and kitchen crews tied to restaurant-breweries. Other administrative jobs, like those of sales representatives and buyers may be included. Indirect effects that count for 60 estimated jobs include those considered thus far and other effects from purchases of other in-state inputs. Finally, induced effects arise from estimated expenditures from wages and

proprietary income.⁴ Here, induced employment effects of 93 jobs are greater than indirect employment effects. This is rare, but possibly reflects a high degree of non-wage income to proprietors. In total, we anticipate that with the current estimated level of production, local craft beer production generates about 723 total jobs in the Michigan economy with \$18.26 million in labor income. This is expected to contribute about \$26.09 million to gross state product and support annual in-state transactions of just under \$50 million.

Effect	Employment	Labor Income	Value Added	Output
Direct Effect	571	\$11,224,914	\$13,367,374	\$26,765,130
Indirect Effect	60	\$3,113,149	\$5,676,487	\$10,274,102
Induced Effect	93	\$3,918,747	\$7,046,060	\$12,340,365
Total Effect	723	\$18,256,810	\$26,089,921	\$49,379,597

Table 8: Current Contributions of Local Craft Beer Production

Potential Contributions

We next estimate the potential contribution should Michigan producers fully self-supply craft beer production with Michigan agricultural inputs. The short answer to this proposition is that the contributions would be about 14 times larger than that of current levels. That is, current contributions are approximately 7 percent of the potential contributions. Below we show the expected contributions along the value chain.

Barley and Hops Production Contributions

Should Michigan’s craft beer production be fully locally-sourced, Michigan barley and hops demand would be much greater than estimated for meeting current sales. In total, we estimate that farm production of barley and hops would generate some 295 direct jobs that together with secondary effects would generate an estimated 477 jobs (Table 9). These jobs would generate about \$15.15 million in labor income and contribute some \$25.07 million to annual gross state product.

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	295	\$8,920,801	\$12,575,003	\$28,237,414
Indirect Effect	101	\$3,772,441	\$6,275,662	\$12,216,435
Induced Effect	80	\$3,459,017	\$6,217,294	\$10,905,120
Total Effect	477	\$16,152,260	\$25,067,959	\$51,358,969

Table 9: Potential Contributions of Barley and Hops Farm Production for Local Craft Beer

Malting Contributions

Assuming self-supply all of Michigan’s craft beer malt use, maltsters would employ some 290 workers directly (Table 10). Including the jobs associated with malting barley production, indirect jobs would total 154. Combined with induced effects, we estimate that total jobs up through malting, but excluding hops production, would total about 546, with annual contribution to state labor income of \$20.22 million. This would also give rise to \$28.78 million annual contribution to gross state product and generate some \$74.56 million in annual in-state transactions.

⁴ Induced effects also include government expenditures from tax revenues and other institutional expenditures.

Effect	Employment	Labor Income	Value Added	Output
Direct Effect	290	10,699,324	13,012,054	34,379,752
Indirect Effect	154	5,185,711	7,974,309	26,533,629
Induced Effect	103	4,336,098	7,794,361	13,643,163
Total Effect	546	20,221,134	28,780,724	74,556,544

Table 10: Potential Contributions of Malt Production for Local Craft Beer

Local Beer Sales and Total Contributions

As discussed above, the estimated contributions of local beer sales entails the expected contributions along the whole of the value chain. In this, the estimates provided in Table 11 represent the total expected contribution should Michigan self-supply inputs 100 percent of the craft beer agricultural inputs of malt, barley and hops. Other inputs, like packaging, energy, etc., may be sourced within or outside of Michigan. In total, the local Michigan craft beer industry has the potential to generate 10,332, where just over 9,000 of those would be directly linked to the production of beer, as either employed in the brewing sector or in sectors supplying brewers. Such potential employment will likely contribute about \$260.81 million in labor income and contribute about \$372.71 million to gross state product.

Effect	Employment	Labor Income	Value Added	Output
Direct Effect	8,159	160,355,916	190,962,489	382,358,993
Indirect Effect	850	44,473,550	81,092,678	146,772,886
Induced Effect	1,323	55,982,099	100,657,998	176,290,925
Total Effect	10,332	260,811,565	372,713,165	705,422,803

Table 11: Potential Contributions of Local Craft Beer Production

Impact Estimates

Contributions to economic activities only tell part of the story. If we ended the analysis here, we would implicitly assume that all agricultural production of barley and hops occurred on land not used for any other agricultural activity, and that all local craft beer sales were new and does not displace other beer sales. For the purpose of this analysis, we may assume that malting activity is not displacing other economic endeavors, but this is subject to critique. As interviews indicated, some maltsters chose this as a venture while in search of opportunities to build their own business. This begs the question, what other venture or employment would they pursue if malting were not an option? Others noted that malting is an extension of the farm production activity they currently pursue. As such, malting could be considered a new venture that would not be viable in the absence of a market. Even here, though, malting activity comes at the potential cost of other value-added activities one can pursue. The net effect of final sales can also be questionable. Here, the next best option to locally-sourced craft beer cannot be well defined. In the absence of a local craft beer industry, consumers may opt to purchase premium import brands like Heineken or Grolsh. They may opt for premium domestic craft beers like Bell's or New Belgium. Alternatively, they may stick with well-known national brands like Budweiser or Miller. The choice of alternatives for modeling impacts in a world not observed has real implications for measuring net economic impacts.

In this section, we estimate the net economic impact taking into account best-estimated opportunity costs incurred by participating the local craft industry. The first task is to specify the opportunities foregone. That is, if not growing malting barley, what else would have been grown? Similarly, we will conjecture what consumer purchases will be in the absence of a local craft beer industry. Estimates are provided in

aggregate for both potential and actual level of local craft beer consumption in the state. The potential net impact represents that which would be expected should Michigan's fully self-supply the agricultural ingredients in its craft beer industry. Actual net impacts represent the estimated net impacts expected, based on current estimated level of Michigan craft beer consumption.

As barley is a good substitute for wheat in common Michigan crop rotations, we assume that wheat would be grown on malting barley acres. Michigan wheat currently yields around 90 bushels an acre and sells for \$3.35 a bushel. Barley for malting has a rejection rate of about 30 percent, implying that reaching potential levels of Michigan craft beer sales will require 30,000 acres, while meeting current levels requires 2,100 acres. This anticipates the loss of \$9,033 thousand and \$632 thousand in wheat sales at potential and actual levels of production, respectively.

Since hops production is likely to exist with or without a local craft beer sector, we anticipate this sector largely nets out to zero impact. This may be overly restrictive, as some shrinkage in price and net revenues due to lower local demand and higher transportation costs as an export sets in. Alternatively, recognizing the marketing to other states requires greater investment in marketing and logistics, the net impact of servicing local beer production could be negative. Either way, the net effect will likely be small.

For final beer sales, we retain the same 50/50 breakout of on premise and off premise consumption. Prices consumers pay are also adjusted, where off-premise 16 beers are assumed to be of national brand origin and set to \$5.90 for a six-pack, while on premise beers are set at \$3.50 per pint. Like before, margins are applied to off-premise sales.

Finally, as the model used to estimate contributions of local beer production entailed significant modification to account for purchases of local inputs, a fresh model is generated with no modifications in transactions. Opportunities foregone are then modeled for their relative contributions to economy-wide outcomes. The net effects, subtracting out opportunities foregone from local craft beer contributions are then generated.

Table 12 shows the actual, estimated net economic impact estimates from Michigan's current estimated local craft beer sector. In this, the loss of wheat acres harvested, the full value of hops production and the lost revenues of conventional beer purchases are netted out of the estimate. In total, the estimates are positive, driven mostly by the value added activities from brewing to consumer purchase and a higher degree of in-state transactions associated with the local craft beer sector. However, barley net effects are largely negative, once accounting for lost wheat harvest revenues. This is mostly associated with the assumption that only 50 percent of the malting barley will meet specs. Since the current price growers can receive for barley as feed is about 25 percent of the price received for malting, this high percentage greatly reduces the expected returns to malting barley growers. If the rejection rate were to decrease to 30 percent, the net impact of barley acres would be positive. Additionally, hops total net impact is zero by assumption, as hops demand will probably persist in the absence of a flourishing local craft beer industry. This leaves the differences in brewing and retail activity as the primary source of economic impact. Here, local craft beer is assumed to compete with national, regional and international brands. These do not generate the secondary transactions in the state as does locally-sourced beers, hence, exhibit lower multiplier effects. To be sure, they also exhibit lower selling prices, contributing to the lower opportunity costs, and a positive net economic impact.

In total, current production of Michigan craft beers generates about 96 Michigan jobs with labor income of about \$1.6 million per year. It also contributes about \$2.4 million in annual gross state product and creates about \$4.3 million in annual transactions across the state.

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	81	1,002,431	1,346,717	2,307,856
Indirect Effect	6	220,590	471,895	902,376
Induced Effect	10	335,762	605,462	1,053,288
Total Effect	96	1,558,784	2,424,074	4,263,518

Table 12: Actual Net Economic Impact Estimates

Table 13 shows the potential estimated net economic impacts of Michigan’s craft beer sector if all Michigan craft beer was Michigan-sourced. As evident, impacts are smaller than the estimated contribution shown in Table 11, where total employment contributions were 10,332. This reflects the netting effect of lost wheat acres, other uses of hops and displaced retail and food service sales of beer. That is the potential net impacts of Michigan’s locally-sourced craft beer industry could contribute some 1,367 jobs to the state economy, with annual earnings of about \$22.3 million. This would also likely contribute about \$34.6 million to Michigan’s gross state product and generate some \$60.9 million in annual transactions.

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effect	1,150	14,320,447	19,238,819	32,969,376
Indirect Effect	81	3,151,284	6,741,367	12,891,084
Induced Effect	137	4,796,602	8,649,458	15,046,965
Total Effect	1,367	22,268,333	34,629,644	60,907,424

Table 13: Potential Net Economic Impact Estimates

Summary and Conclusions

This assessment of the current and potential impacts of Michigan budding local craft beer industry is multifaceted, reviewing a range of issues and conditions and applying those to value-chain models of economic contributions. While Michigan agriculture and consumer base has innate attributes that make such self-reliant industry possible, many uncertainties exist. Michigan’s microclimates afford environmental conditions for growing barley and hops – the two main ingredients in producing beer. Michigan also has the manufacturing and food-processing expertise to make this successful. However, the notion of locally sourced beer is new and untested in this generation. There are plenty of market examples where locally sourced beer has made inroads to local markets, including San Francisco, attributed to the revival of craft beer, and in Colorado, where many communities are embracing craft beer. However, the draw of “local” in craft beer may not be as strong as the draw of local foods and the sustainability of local appeal, even at home, may be questionable.

While Michigan’s climate affords agricultural production of malting barley and hops, it may not be ideal. In this, Michigan’s relatively wet climate may expose barley to greater disease pressures than other barley-producing states. This may impact the price and quality competitiveness of Michigan malting barley. Alternatively, Michigan hops may provide terroir attributes that identifies Michigan-brewed beer. That is, hops varieties grown in Michigan could have different flavor profiles than the same in popular hops growing states like Washington. Whether this local attribute makes Michigan-grown hops competitive with other hops over time remains to be seen. So far, hops producers appear to be doing well

in and outside of Michigan. Furthermore, hops may be the most important ingredient for setting beer in place.

Malt is the primary barrier to a full value chain for Michigan local craft beer where, in this analysis, it is defined as that which is brewed here and uses Michigan-sourced agricultural inputs. As evident by growers' willingness to engage in barley production for malting houses, the constraint is on the side of not having enough malt houses for which to contract. Many Michigan malt houses are in development stage with a sizeable number planning their first commercial batches for early 2017. Many of these have high expectations for the selling price they can command based on brewers' stated interests in buying from local suppliers. Few Michigan malt houses are operational, and they indicate that competition from national and global suppliers is intense. They posit that the appeal of local, while commanding a comparative advantage over nationally sourced malt, may not be enough to make small malting houses profitable. At best, margins at the malt house will be thin, echoing the MSU malt house feasibility study (Knudson 2014). However, if consumers show a sustained preference for local beers, these ventures may pay out. At present, small brewers tend to favor price over attributes like local when purchasing malt. Malt houses may also be locked out of larger, regional brew houses, in that consistency of the beer is a core requirement for generating a regional following. Such consistency is best reached through large batch sizes and through malt houses that can facilitate quality assurance and blending to meet brewers' specks.

We used representative operation budgets of malting houses as inputs to modeling the economic value of the local beer value chains in terms of the value of transactions and how those transactions are expected to contribute to employment and gross state product. Malt houses represent a lynchpin in the local value chain. Similar budgets were used for estimating the transactions of hops production, while barley production relied on standard expenditure profiles. The estimated impacts show that the greatest share of economic contribution arises through the brewing and selling process of brewers. This entails both sales for on and off-premise consumption, where much of the sales for on premise consumption are often coupled with food sales. However, we only measure the economic value of the local craft beer value chain. In this, our estimates suggest that current local beer production through local sales contributes to about 546 Michigan jobs and about \$28.78 million to annual gross state product. As this sector is changing significantly, this will likely increase over the next few years. These estimates are gross contributions and do not account for displaced economic activities. We further estimated what the gross contribution would be if Michigan craft beer production was wholly satisfied by Michigan-sourced inputs. Under this scenario, employment contributions would be around 10,332 jobs and \$372.71 million annual contributions to gross state product. While reaching this degree of penetration is not realistic, it serves as an upper bound of the potential contribution this industry can make. Once netting out displacement effects, the actual and potential economic impacts are more modest. Assuming all malting activities are new and create no displacement; that hops for local beer use completely displaces other hops use; that barley production displaces equal acres in wheat and that Michigan craft beer displaces conventional beer sales, the net actual impacts include a positive gain of 96 jobs. This contrasts with a gain of 1,367 jobs should Michigan craft beer consumption be met fully with locally brewed beer.

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