The Paycheck Protection Program & Small Business Performance: Evidence from Craft Breweries

Aaron J. Staples, Michigan State University, staple71@msu.edu
Thomas P. Krumel, North Dakota State University, thomas.krumel@ndsu.edu

Selected Paper prepared for presentation at the 2022 Agricultural & Applied Economics Association Annual Meeting, Anaheim, CA; July 31-August 2

The Paycheck Protection Program & Small Business Performance: Evidence from Craft Breweries

Aaron J. Staples*,[1] and Thomas Krumel[2]

Abstract: The Paycheck Protection Program (PPP) provided approximately $790 billion in relief funds to nearly 12 million small businesses experiencing economic damages from the COVID-19 pandemic. We use data from the craft beer industry to explore the role of PPP funding on small business performance. The craft beer industry makes for an ideal case study because it is comprised of thousands of small, independently-owned producers that rely tremendously on on-premise sales. By merging an industry dataset of producers with data from the Small Business Administration on PPP loan recipients, we examine the relationship between PPP funding and remaining in operation and assess the role of such funding on year-over-year production volume changes. Results suggest that firms that received a PPP loan were more likely to be in operation as of July 2021 and were more likely to experience a smaller decline in annual production than firms that did not receive funding. Further, through the development of a quasi-experiment that exploits a natural break in the loan program, we demonstrate that the average decrease in YoY production was the smallest for breweries that received the earliest PPP funding, suggesting the timing of loan approval played a role in performance outcomes. These results provide preliminary evidence that the PPP achieved its desired objective, but questions remain about its distribution and causal effects.

Keywords: breweries, COVID-19, closures, Paycheck Protection Program, small business

JEL codes: H12, L66, M20

Acknowledgments: The authors would like to thank the Brewers Association for their willingness to support this study. Special thanks go to Bart Watson, Ph.D. for his collaboration on this project. Bart's comments, feedback, and suggestions during our meetings and other correspondence significantly improved the direction of this study. Achieving our objectives would not have been possible without Bart's support, and we are grateful for his efforts and those of the entire Brewers Association.

* Corresponding author
[1] Department of Agricultural, Food, and Resource Economics at Michigan State University, staple71@msu.edu
[2] Department of Agricultural Economics at North Dakota State University, thomas.krumel@ndsu.edu

1. Introduction

Analysis suggests that the number of business owners in the United States fell by 22% from February to April 2020 (Fairlie, 2020). Further, business closure rates were 25-33% higher in 2020 than their pre-COVID trends over the past several decades (Crane et al., 2020). While these estimates are grim, they likely would have been worse if not for federal policies providing financial support to small businesses.

On March 27, 2020, the federal government passed the Coronavirus Aid, Relief, and Economic Security (CARES) Act (Public Law 116-136). As part of the $2.2 trillion stimulus package, $349 billion was appropriated to the Small Business Administration (SBA) for the establishment of the Paycheck Protection Program (PPP). The PPP would provide (forgivable) loans to small businesses to alleviate economic damages from COVID-19 and incentivize businesses to retain employees on payroll. As the pandemic wore on, and small businesses continued to face tremulous economic conditions, PPP funding increased, and $790 billion in PPP funds were eventually allocated to nearly 12 million borrowers (Office of Capital Access, 2021; SBA, 2021b). Despite the vast funding and extensive coverage of the federal economic packages that sought to limit the impact of COVID-19, little is known about the overall effectiveness of the program for small businesses.

We use data on U.S. craft breweries and craft brewery closures to examine the relationship between receiving a PPP loan and small business performance. Specifically, our study is the first to our knowledge to align an industry dataset of producers with a governmental dataset on PPP loan recipients to explore the role of PPP loans on business survival and annual production. The craft beer industry makes for an ideal case study as it is comprised of small, independently-owned producers who rely heavily on on-premise

consumption, a revenue stream significantly disrupted by decreased foot traffic and COVID-19 health policies. As such, the objective of this article is to explore the role that receiving PPP funding had on the probability of remaining in business as well as its impact on year-over-year (YoY) production volume.

There is a small but growing body of literature on the economic impact of the PPP on small businesses. Our study most closely resembles Bartik, Cullen, et al. (2020), who use survey data to analyze PPP loan recipient sentiment on their probability of remaining in businesses, and Li (2021), who demonstrates that firms that received PPP funding were less likely to report revenue decreases and reduction in employee hours in the weeks following loan approval. We also draw on the work of Fairlie and Fossen (2021b), who use California administrative sales tax data to examine YoY business losses during the height of COVID-19. Their results suggest sales decreased by 17%, on average, during the second quarter of 2020. Losses were most significant for the accommodation and hospitality industries, further motivating and supporting our use of the craft beer industry to examine the role of PPP funding on small business performance.

Other considerations that have been evaluated in the literature include equality concerns related to PPP loan dispersal and the role of banks in distributing the funding (Atkins, Cook, and Seamans, 2021; Fairlie and Fossen, 2021a; Granja et al., 2020; Humphries, Neilson, and Ulyssea, 2020). These studies suggest that the PPP was fundamentally untargeted, and the first-come, first-served approach negatively impacted smaller and minority-owned businesses that did not have pre-existing relationships with banks. Also, Autor et al. (2022) explore the distribution of PPP funding across all industries, suggesting

46 that the program was highly regressive and just 23-34% of loan funds sustained employees
47 that otherwise would have lost their jobs.

48 Our contribution is threefold. First, by aligning an industry dataset of craft brewers
49 with PPP loan data, we provide an exploratory and descriptive analysis of the relationship
50 between PPP funding and two metrics of small business performance: operational status and
51 YoY production changes from 2019-2020. First, we show that firms that received a PPP loan
52 were more likely to remain in operation through mid-July than firms that did not. Then, using
53 annual production data, our results suggest breweries that received PPP funding
54 experienced, on average, a smaller decrease in YoY production. The timing of loan approval
55 also likely played a role in production changes, with breweries receiving the earliest funding
56 performing better relative to others that received funding just two weeks later. While we
57 cannot make causal claims about our estimates, our results provide preliminary, supporting
58 evidence that the PPP mitigated some of the damage from COVID-19. However, questions
59 and concerns remain regarding the loan program's equality, efficiency, and causal impact.

60 Secondly, we demonstrate that COVID-19 appears to have disproportionately
61 impacted certain segments of the beer industry more than others. Using the industry's
62 market segmentation, results suggest that brewpubs (i.e., breweries that operate in
63 significant food service operations) closed at higher rates and experienced sharper declines
64 in production relative to other segments. The effect on brewpubs likely stems from their
65 reliance on food sales and an inability to pivot towards alternative beer distribution streams.

66 Lastly, through our merging procedures of two unique datasets, we offer a
67 methodological advancement, highlighting the shortcomings of the publicly available SBA

68 data and speaking to the procedures necessary for future studies wishing to achieve similar
69 objectives.

70 The remainder of this article is structured as follows. Section 2 provides background
71 on the PPP and explains the impact of the pandemic on the craft brewing industry. Section 3
72 describes our methodology and the data used in analysis. Section 4 presents the results while
73 Section 5 discusses the study's two central limitations. Section 6 discusses the significance
74 and policy implications of our results, and Section 7 concludes.

75

76 **2. Background**

77 ***2.1 Paycheck Protection Program***

78 The economic damages from COVID-19 were fundamentally different than those from
79 previous recessions, and so too were the corresponding policy responses. While previous
80 recessions have been fueled by fluctuations in business cycles, stock market crashes, and
81 declines in economic confidence, the most recent economic slowdown was caused by a
82 contagious virus. Understanding the catalyst for the slowdown is important to assess the
83 long-term economic consequences of the crisis and the available policy options during the
84 crisis.

85 For example, the Great Recession (2007-2009) was fueled by the collapse of the U.S.
86 housing market and the global financial crisis (Diamond and Rajan, 2009; Fairlie, 2013). In
87 December 2007, before the housing bubble burst, the national unemployment was
88 approximately 5%. Unemployment during the recession at 10% (BLS, 2012). But while the
89 recession began in December 2007, unemployment did not peak until October 2009,
90 implying that the economic damages were slow-developing and long-lasting. In response to

the recession, the government employed traditional anti-recessionary policies including tax cuts, increases in funding for unemployment benefits and poverty assistance programs, and bank bailouts (Adebowale, 2019).

COVID-19, however, caused unemployment to increase from 3.5% in February 2020 to 14.5% in April 2020 (BLS, 2022; Couch, Fairlie, and Xu, 2020). Despite the initial spike, the unemployment rate declined to 6.7% by November 2020 and has reached pre-pandemic levels as of March 2022 (BLS, 2022). These statistics suggest that the effects of COVID-19 on employment were more severe than the Great Recession in a shorter time frame. Indeed, job loss from March to April 2020 more than doubled job loss over the entire Great Recession (Handwerker et al., 2020). Thus, while some of the aforementioned antirecessionary policies were used to fight the economic slowdown (e.g., expanded unemployment benefits), the government needed new tools that would provide support to businesses in jeopardy of closing.

To combat the economic turmoil felt at the onset of COVID-19, the federal government signed the CARES Act (Public Law 116-136) into law on March 27, 2020. Included in the $2.2 trillion economic stimulus package was $349 billion to establish the Paycheck Protection Program (PPP), a program administered by the Small Business Administration (SBA) to provide uncollateralized, low-interest loans to small businesses. The primary stated objective of this program was to provide small businesses with an incentive to retain employees on payroll. However, businesses could also use the proceeds to pay: (i) worker benefits and protection costs, (ii) mortgage interest payments and rent, (iii) damages from looting or vandalism, and (iv) utilities (SBA, 2021a).

Maximum loan amounts were calculated based on 2.5 times a company's average monthly payroll costs up to $10 million (Coronavirus Aid, Relief, and Economic Security Act, 2020; SBA, 2021a). To qualify for a PPP loan, producers must have met pre-determined criteria set forth by the SBA (e.g., having fewer than 500 employees on payroll in a single location; SBA, 2021a).[1] Critically, borrowers were eligible for loan forgiveness if, during the covered period of eight to 24 weeks, they: (i) maintained employment and compensation levels; (ii) allocated loan proceeds to eligible costs and expenses; and (iii) spent 60% or more of the loan proceeds on payroll costs (SBA, 2021d). That is, if producers met each of these criteria, they would not have to repay the loan. Partial loan forgiveness was also possible for businesses that failed to meet all forgiveness criteria (Autor, 2022), and businesses that received the uncollateralized funding but permanently closed thereafter could have the loan discharged (Iacurci, 2020).

Figure 1 provides a timeline of PPP. The SBA began distributing the first tranche of PPP loans on April 3, 2020. Given the rush of applications and the first-come, first-served nature of the program, concerns about the equity of the loan distribution mechanism and the role of the banks in PPP loan approval quickly emerged (Bartik, Cullen, et al., 2020; Fairlie and Fossen, 2021a; Humphries et al., 2020). Banks were utilized to approve borrowers, and the majority of PPP lending came from small relationship banks (Li and Strahan, 2020). The use of relationship banks allowed for rapid, decentralized loan dispersal. However, the

[1] According to the SBA (2021a), the following businesses were eligible to apply for a first-round PPP loan: "(i) sole proprietors, independent contractors, and self-employed persons; (ii) Any small business concern that meets SBA's size standards (either the industry size standard or the alternative size standard); (iii) Any business, 501(c)(3) non-profit organization, 501(c)(19) veterans organization, or tribal business concern (sec. 31(b)(2)(C) of the Small Business Act) with the greater of: 500 employees, or that meets the SBA industry size standard if more than 500; (iv) Any business with a NAICS code that begins with 72 (Accommodations and Food Services) that has more than one physical location and employs less than 500 per location."

program sacrificed targeting for timeliness (Autor et al., 2022), providing firms with a pre-existing relationship with the banks easier access to first tranche PPP funding (Granja et al., 2020). This design has been shown to negatively impact the smallest businesses, as they had lower awareness of the program and were less likely to have their loans approved (Humphries et al., 2020). Sacrificing targeting for timeliness also appears to have negatively impacted minority-owned businesses (Atkins et al., 2021; Fairlie and Fossen, 2021a). Further, the use of banks to distribute funding may have created a wedge between public interests of the government (i.e., maintaining lower unemployment levels and keeping small businesses in operation) and the private interests of the banks (i.e., profitability and the longevity of their consumers) (Bartik, Cullen, et al., 2020).

[FIGURE 1 HERE]

The demand for PPP loans far exceeded the available supply, and the initial $349 billion was exhausted by April 16, 2020—just two weeks after the first loans were approved. COVID-19 cases continued to surge, and states implemented new, or extended old, stay-at-home orders and other public health policies to slow the spread of the virus. The Paycheck Protection Program and Health Care Enhancement Act (Public Law 116-139) was then signed into law on April 24, 2020, increasing allotted PPP funding to $659 billion. The additional $310 billion would be provided to businesses that had not yet received a PPP loan, and the SBA began distributing this second tranche of loans on April 27, 2020.

Additional legislation was passed to modify the program and its deadlines. The Paycheck Protection Program Flexibility Act of 2020 (Public Law 116-142) was signed into law on June 5, 2020, modifying key deferral and forgiveness criteria as well as providing additional guidance on PPP loan maturity dates. On July 4, 2020, the Paycheck Protection

Program Extension of 2020 (Public Law 116-147) was signed into law, extending the deadline of the program to August 8, 2020. Then, on August 8, 2020, the SBA announced the closure of the program, with $130 billion of second-tranche funds left unclaimed. The first and second tranches of PPP funding spanning April 3, 2020, to August 8, 2020, are referred to as the first round of PPP funding.

On December 27, 2020, the Economic Aid to Hard-Hit Businesses, Nonprofits, and Venues Act (Public Law 116-260)—also known as the Economic Aid Act—was signed into law. In addition to allocating an additional $284.5 billion to the SBA to administer PPP loans, the law modified key provisions of the program, extended the deadline of the PPP through March 31, 2021, and authorized a second round of PPP funding to businesses that had previously received it.

On January 8, 2021, the SBA announced they would begin accepting applications for this third tranche of PPP funding. Community financial institutions were eligible to apply as early as January 11, and the application process opened to all lenders soon thereafter (SBA, 2021b; U.S. Department of the Treasury, 2021). Similar, though not identical, eligibility and forgiveness criteria were used for the third tranche of PPP funding. The third tranche targeted smaller businesses that had experienced considerable revenue decreases due to the COVID-19 pandemic, and the maximum loan amount was based on 3.5 times the average monthly payroll of the firm up to $2 million (up from 2.5-times the average monthly payroll in the first round but down from maximum loan amount of $10 million). Eligible firms could have no more than 300 employees in a single location (down from 500 in the first round of the program), and borrowers had to demonstrate a reduction in gross recipients YoY of 25% or more (SBA, 2021i). With an initial deadline of March 31, 2021, the Paycheck Protection

Program Extension Act of 2021 (Public Law 117–6) then extended the life of the program through May 31, 2021. This third tranche from January 11, 2021, to May 31, 2021, is commonly referred to as the second round of PPP funding.

The PPP is now closed, but in the program's lifetime, the SBA approved nearly 12 million loans totaling approximately $790 billion (Office of Capital Access, 2021). Given the impact of COVID-19 on bars, restaurants, and other small businesses as well as the substantial injection of money into the economy throughout the pandemic, considerable media coverage surrounded PPP legislation and distribution. This included allegations of PPP fraud (Department of Justice, 2020) and larger companies returning their approved loans in good faith (Chappell, 2020). Ultimately, this media coverage led to a Freedom of Information Act (FOIA) request by the Washington Post asking for the names of recipients of PPP loans. A District Court ruling granted the request, and the recipients of PPP loans throughout the lifespan of the program were made available on the SBA website (*The Washington Post v. U.S. Small Business Administration,* 2020).

With the PPP now closed and the data on loan recipients now publicly available, we can descriptively monitor and evaluate the success of the program. We do so using the craft beer industry as a case study given COVID-19's substantial impact on the industry.

2.2 COVID-19's Impact on the U.S. Craft Beer Industry

Over the past two decades, the number of breweries in the United States has increased by approximately 500% (Brewers Association, 2021d). Much of this growth has come from the

craft beer industry, a segment comprised of small, independent brewers.[2] In 2005, there were 1,394 craft breweries in the United States. By 2019, there were 8,391, representing 99% of all U.S. beer producers. Further, craft beer's market share, measured in total dollars, increased from 5% to 25% over the same time frame (Brewers Association, 2021a).

Despite this considerable growth in market share, craft beer only accounts for 12-13% of beer by volume, measured in barrels (bbls) of production. In other words, 99% of the breweries in the United States account for just 12% of domestic beer production (Brewers Association, 2021d). The critical distinction between market share by sales dollars and market share by volume stems from the difference in business models and marketing strategies employed by craft brewers compared to large, non-craft breweries. Whereas large brewers sell high quantities of standardized products at a low price point, craft breweries brew smaller quantities of high-quality, differentiated products at a price premium to a niche group of consumers. Further, craft brewers rely more heavily on on-premise sales. Revenue from beer sales is generated through a variety of outlets (e.g., local liquor stores, grocery outlets, and restaurants), but craft brewers rely predominantly on taproom sales, whether from on-premise consumption or to-go sales (e.g., growler fills and six-packs to-go). Indeed, it is typical for 80-100% of a brewery's revenue to come from on-premise sales, and this is especially true for the smallest craft breweries (Staples, Malone, and Sirrine, 2021). With the emphasis on taproom sales in a local community—as opposed to a wide distribution network of retail outlets—craft brewers were more vulnerable to COVID-19 than large, non-craft producers.

[2] The Brewers Association (2021c) defines "small" as producing less than six million barrels of beer per year, and they define "independent" as having less than 25% ownership from a business that is not itself a craft brewer.

In response to COVID-19, states and local municipalities throughout the U.S. implemented public health policies that directly affected the traditional craft brewer business model. These policies included stay-at-home orders and gathering/capacity restrictions. For breweries, bars, and restaurants, COVID-19 restrictions often limited or shut down indoor dining. Social institutions and consumer perceptions about the prevalence of COVID-19 in their community also played a role in the decreased foot traffic to small businesses (Fairlie and Fossen, 2021b; Goolsbee and Syverson, 2021). Indeed, Goolsbee and Syverson suggest that individual decision-making contributed to the decrease in consumer foot traffic at the onset of COVID-19 more than governmental policy did. Irrespective of the reason for the decreased visits, breweries that rely heavily on revenue from on-premise sales needed to reconsider their business model, including their production schedule, employment levels, and alternative revenue streams (Morris, 2020; Romano, 2021).

In late March, the Brewers Association, a 501(c)(6) not-for-profit organization aimed at promoting and protecting the interests of U.S. craft brewers (Brewers Association, 2021c), surveyed approximately 900 craft breweries, asking them about their concerns and perceptions in response to COVID-19 and related policies. Their results showed widespread distress: 90% of respondents had already altered beer production schedules; 61% expected layoffs; and 60% believed their business would fail in three months or less if social distancing guidelines, state and federal assistance, and costs and revenue streams remained at their mid-March levels (Watson, 2020a, 2020b). While this sentiment is not unique to the craft brewing industry (Bartik, Bertrand, et al., 2020), the heavy dependence on on-premise sales and consumption makes craft brewers particularly vulnerable. Indeed, aggregate craft beer

production fell 9% in 2020; sales decreased by 22%; and craft beer market share fell 1.7 percentage points compared to 2019 (Brewers Association, 2021d; Watson, 2021).

In summary, the craft beer industry makes an ideal case study for analyzing the relationship between PPP funding and small business performance for three primary reasons. First, the total number of small and independently-owned breweries in the United States has increased substantially over the past two decades, and nearly all of these breweries were eligible for PPP funding. Second, the primary source of revenue for most of these small businesses is on-premise sales. Thus, while these businesses were experiencing growth before COVID-19, policies limiting indoor dining capacity and consumer perceptions about the risk of contracting COVID-19 disproportionately impacted these businesses. Finally, early survey work suggested large-scale shifts in production, layoffs, and closures if economic conditions or state/federal support did not improve (Watson 2020a; 2020b).

3. Methodology and Data

3.1 Methodology

We are interested in exploring the role of PPP funding on small business performance. To do so, we use two correlated measures of how businesses were impacted by COVID 19 and/or related policies, then describe each in turn. First, we discuss the probability of a brewery remaining in operation as a function of whether it received PPP funding. Utilizing Brewers Association records and internet searches from July 2021, we grouped breweries into three categories: (i) those that have permanently closed since the start of the PPP (April 3, 2020); (ii) those that are temporarily closed as of July 2021; and (iii) those that are in operation as

of July 2021.[3] July 2021 serves as an adequate date to examine operational status because it eclipses the end date of the PPP, coincides with most states lifting COVID-19 restrictions, and aligns with when nearly half of the U.S. population was fully vaccinated against COVID-19 (CDC, 2021). However, one shortcoming to using July 2021 is that this comes immediately after the distribution of Restaurant Revitalization Funds (RRF), a federal government program that provided restaurants, bars, etc. with funding that was equivalent to their revenue losses induced by the pandemic (SBA, 2021e; 2021j). The RRF ran from May 3, 2021, to July 2, 2021 (SBA, 2021f), and so it is possible that some breweries closed shortly after receiving RRF funding but opened in July 2021. Our data collection would not capture this shift in operational status.

The second measure of small business performance uses Brewers Association data on brewery production volume to assess the impact of a PPP loan upon YoY production changes.

3.1.1 Probability of remaining in business

To understand the relationship between receiving a PPP loan and remaining in operation, we utilize a linear probability model (LPM) that estimates the likelihood of a firm being open in July 2021 as a function of whether it received PPP funding. While the LPM can produce

[3] Breweries were identified as permanently or temporarily closed in one of two ways. First, breweries could be identified as permanently closed by the Brewers Association, which was captured in the initial dataset the association provided. Then, to identify permanently closed breweries that did not report their operational status to the Brewers Association as well as temporarily closed breweries that were not identified in the initial dataset, we used Google searches. Specifically, for each brewery included in the dataset, we searched the brewery name and identified breweries that Google listed as temporarily or permanently closed. The internet searches and data collection were conducted in July 2021. Breweries that were identified as temporarily or permanently closed based on the Google searches were then sent back to the Brewers Association for confirmation. The Brewers Association then analyzed the list and sent us an updated copy of the closures. Their revised set of closures was used in the analysis.

estimates that fall outside the necessary zero-one range implied by the binary response and may be inappropriate when evaluating marginal effects on the tails of the distribution, it is computationally convenient and provides us with a useful approximation of the marginal effect for the average observation (Wooldridge, 2010). Our left-hand side variable ($Open_i$) is a binary variable equal to one if the brewery was in operation in July 2021; zero otherwise (i.e., listed as temporarily or permanently closed).

We specify the following functional form to explore the relationship between PPP funding and remaining in operation:

$$(1)\quad Open_i = \alpha + \beta_1 FirstRoundPPP_i + \beta_2 SecondRoundPPP_i + \beta_3 BothRoundsPPP_i + \boldsymbol{\gamma}_j \mathbf{Segment}_{ij} + \boldsymbol{\zeta}_k \mathbf{x}_{ik} + \epsilon_i.$$

The primary right-hand side variables of interest are $FirstRoundPPP_i$, $SecondRoundPPP_i$, and $BothRoundsPPP_i$. $FirstRoundPPP_i$ equals one if a brewery received first-round PPP funding (either first tranche or second tranche funding) and zero otherwise; similarly, for second-round PPP funding (third tranche funding). Variable $BothRoundsPPP_i$ is an interaction term that equals one if a brewery received both rounds of PPP funding; zero otherwise. The vector $\mathbf{Segment_{ij}}$ indicates which segment of the craft beer industry brewery i belongs to, where $j = \{Brewpub, Microbrewery, Regional\}$ and taprooms serve as our baseline. The craft beer industry is divided into four segments based on annual production, revenue streams, and their reliance on food sales. We resort to the Brewers Association's classification for our industry segmentation (Brewers Association, 2021b), where brewpubs are breweries that engage in significant food services with at least 25% of annual beer production sold on-premise. Microbreweries are breweries that produce less than 15,000 barrels (bbls) of beer per year with 75% of production sold off-premise. Regional breweries

are producers brewing between 15,000 and 6,000,000 bbls of beer per year; there is no restriction placed on their revenue streams or food services. Lastly, taprooms are breweries selling 25% or more of beer on-premise with limited or no food services. We hypothesize that the impact of COVID-19 and/or associated policies would be most significant in the segment of brewpubs. Their reliance on food and draught beer sales may have made them more vulnerable to COVID-19 restrictions relative to other segments that were able to pivot to alternative production and distribution channels (i.e., canning their beer for off-premise consumption). The vector $\mathbf{x_{ik}}$ includes a series of brewery-specific and county-level control variables; ϵ_i is a normally distributed error term; and $\alpha, \boldsymbol{\beta} = [\beta_1\ \beta_2\ \beta_3]$, $\boldsymbol{\gamma}_j$, and $\boldsymbol{\zeta}_k$ are parameters to be estimated.

Brewery-specific variables include the logarithm of 2019 brewery production; whether the brewery location was a primary or secondary location; and whether the brewery received funds from the RRF program.[4] County-level fixed effects are created using the five-digit federal information processing standards (FIPS) codes, allowing us to capture county-level unobserved heterogeneity.

We hypothesize that firms that received a PPP loan will have a higher probability of remaining in operation. That is, we expect our coefficient estimates for first- and second-round funding (β_1 and β_2) to be positive and statistically significant, indicative of a positive

[4] We may expect breweries that produce a higher volume of beer per year to benefit from economies of scale and have access to more technologically advanced equipment requiring less labor. Additionally, companies may have multiple locations, with one serving as their headquarters (i.e., primary location) and the other(s) as (a) secondary location(s). Finally, we control for whether a brewery received an RRF loan. Note that the distribution of RRF loans comes immediately before our data collection on open/closed status. This is important because it is possible that some breweries were temporarily closed in, for example, early-May 2021, and then opened when they received RRF funding in late-May 2021. With our data on temporary and permanently closed breweries in July 2021, we would only observe that these breweries were open in July 2021, not seeing that they were temporarily closed weeks before. We attempt to overcome this shortcoming through the inclusion of a control variable for breweries that received an RRF loan in regression analysis.

correlation between receiving PPP funding and remaining in operation. The point estimate for the interaction term (β_3) is hypothesized to be negative and statistically significant. A negative point estimate would suggest that receiving both rounds of funding is associated with a great probability of remaining in business but at a diminishing rate. In other words, a negative point estimate would suggest that while the second round of funding was beneficial, the initial support guides much of the relationship between receiving PPP funding and remaining in operation.

There are two primary limitations to this empirical specification. First, there is likely an issue of self-selection into the treatment, where breweries that were more likely to remain in operation through the pandemic could have been more likely to apply for PPP funding. Breweries that were performing poorly before the pandemic may have ignored calls for PPP applications knowing their business was set to close. Relatedly, the literature suggests there were selection issues related to the size of the firm and whether the firm had a pre-existing relationship with a bank (Granja et al., 2020). Secondly, our reliance on a cross-sectional analysis fails to capture the temporal dimension of loan dispersion and brewery closures. For example, breweries that received second-round funding (starting in January 2021) were more likely to be in operation in July 2021 than even the breweries that received first-round funding (starting in April 2020) given that receiving second-round funding implied the brewery was open in January 2021. We lack the necessary data to assess closure dates of each of the breweries, and we acknowledge this limitation. The implications of these limitations are discussed in greater detail in Section 5 of the manuscript.

3.1.2 Change in annual production

As the craft beer industry relies tremendously on on-premise consumption via draught beer, we anticipate that most breweries would experience a decrease in annual production from 2019 to 2020 (Scott, 2021). However, given that the stated objective of the PPP was to "provide a direct incentive for small businesses to keep their workers on payroll" (SBA, 2021a), we may expect breweries that received a first-round PPP loan to continue production following loan approval whereas breweries that did not receive PPP may choose to halt production entirely. If a brewery received a PPP loan and wanted to qualify for loan forgiveness, it had to retain employment and compensation levels. Given the finite number of jobs in a brewery—most of which are directly involved in beer production and packaging—breweries would struggle to reallocate labor if production stopped entirely. As craft beer can maintain quality in cold storage for up to five months (Sierra Nevada Brewing Company, 2022), brewers that received a PPP loan could slow production to account for the decreased consumer foot traffic while retaining their staff to qualify for loan forgiveness. For a brewery that did not receive PPP funding, however, there was no incentive to maintain employees, and we may expect these breweries to delay production until brewery foot traffic recovers. Therefore, with an incentive to keep employees on payroll, we hypothesize that a brewery that received a first-round PPP, on average, experienced a smaller average decrease in production compared to those that did not receive the first-round loan.[5]

We examine the YoY change in production volume for breweries from 2019 to 2020. Our left-hand side variable of interest is the proportional change in production volume from

[5] Given what is known about the shortcomings of the first-come, first served style of the PPP program, it is also possible that firms that received a first-round loan were likely to perform better YoY than those that did not receive a first-round loan irrespective of federal assistance. We seek to overcome this issue through a quasi-experiment that focuses on a subset of the observations (Section 4.3.2).

2019 to 2020 ($YoY\ \Delta\ Production_i$).[6] Using ordinary least squares to assess the role of first-round PPP funding on YoY production volume, we estimate:

(2) $$YoY\ \Delta\ Production_i = \alpha + \beta FirstRoundPPP_i + \boldsymbol{\gamma}_j \mathbf{Segment_{ij}} + \boldsymbol{\zeta}_k \mathbf{x}_{ik} + \epsilon_i.$$

Our key independent variable of interest is $FirstRoundPPP_i$, which is a binary variable equal to one if brewery *i* received first-round PPP funding (first or second tranche); zero otherwise. Attention is only given to the first-round loan because these funds were available as early as April 2020 while second-round funds were not available until January 2021. Thus, second-round funds have no bearing on 2020 production levels. As in model (1), we include a vector of binary variables for $\mathbf{Segment_{ij}}$ that equals one if brewery *i* is in industry segment *j* and zero otherwise, where $j = \{Brewpub, Microbrewery, Regional\}$ and taprooms serve as our baseline. We also include firm- and county-specific controls; $\alpha, \beta, \boldsymbol{\gamma}, and\ \boldsymbol{\zeta}$ are estimated parameters, and ϵ_i is our error term.

3.2 Data Sources

We use data from two sources to conduct our analysis. First, in partnership with the Brewers Association, we identify our universe of U.S. craft breweries, which includes active breweries and those that have temporarily or permanently closed during the COVID-19 pandemic. Second, we use data on all PPP loan recipients from the SBA website. We discuss the structure of each of these datasets in the following two sub-sections before merging them. The merged dataset uniquely maps PPP loan recipients to a given brewery. This mapping allows us to achieve two primary objectives: (i) to explore the relationship between

[6] The 2021 production volume for breweries was not available at the time of this writing.

receiving a PPP loan and the likelihood of remaining in operation; and (ii) to determine the impact of receiving PPP funding on YoY production volume changes.

3.2.1 Brewers Association

We collaborate with the Brewers Association to identify all active breweries as well as ones that temporarily or permanently closed during the COVID-19 pandemic. We limit our analysis to the 50 states and the District of Columbia and restrict closures to those that occurred after the April 3, 2020 start date of PPP funding.

Our sample consists of 8,946 breweries. As of July 2021, 8,506 of these locations were active, 141 (1.6%) were listed as temporarily closed, and 299 (3.3%) were identified as permanently closed. Importantly, the Brewers Association classifies producers into market segments based on annual production, revenue streams, and whether the brewery engages in significant food operations. We use the Brewers Association terminology to reflect the four market segments: (i) brewpub; (ii) microbrewery; (iii) regional; and (iv) taproom (Brewers Association, 2021b). This classification enables a better understanding of whether certain segments of the industry were more negatively impacted by the pandemic than others. Table 1 presents the active and closed breweries by industry segment.

[TABLE 1 HERE]

Approximately 36% of our sample are brewpubs, 21% microbreweries, 3% regional breweries, and 40% taprooms. The final column of Table 1 presents suggestive evidence that brewpubs were disproportionately harmed by the pandemic relative to other brewing categories. As early-pandemic public health policies restricted indoor bar and restaurant capacity (or shut it down entirely), and consumers scaled back food-away-from-home

purchases during the pandemic (Ellison et al., 2020), breweries that relied heavily on food sales may have been more heavily impacted by these outcomes. Relative to the other craft beer market segments, brewpubs exhibited less capability to pivot production away from on-premise, draught consumption towards canning or other off-premise channels.

Additionally, we obtain brewery production volume data from the Brewers Association and link these estimates to the universe of 8,946 breweries where available. Annual production volume is measured in bbls of beer per year and serves as a proxy for annual revenue. Specifically, we are interested in examining the annual production in 2019 and 2020, allowing us to control for the scale of production in model (1) and generate our left-hand side variable for model (2).

In linking the production volume to the universe of breweries, data are available for 6,304 (70%) of 8,988 breweries for 2019, and 6,892 (77%) for 2020; for observations without production data, yearly production volume is treated as missing data. We then calculate the year-over-year (YoY) production volume change from 2019 to 2020, allowing us to assess how production was affected by the COVID-19 pandemic. We detect several outliers when examining brewery YoY proportion changes, driven largely by breweries that were in the process of expanding production in the time of interest or opened later in 2019 (and so their estimate does not reflect a full year of production). For example, our median YoY change in production from 2019 to 2020 is a 12.5% decline, while the mean YoY change is a positive 26.3% change in production. A 0% change in production from 2019 to 2020 is at the 75th percentile, suggesting the distribution is skewed to the left with a long tail to the right. Therefore, in the analysis that follows, we restrict attention to breweries that saw a

negative 100% to positive 100% change in YoY production.[7] In doing so, our sample is confined to 5,911 (94%) of the initial 6,304 observations with available production data.[8]

3.2.2 Paycheck Protection Program

Data used in our analysis were pulled from the SBA website on June 23, 2021, and contain PPP loan recipients in the 50 states and the District of Columbia through May 31, 2021, the end of the PPP (SBA, 2021b).[9] The SBA approved nearly 12 million PPP loans; we, therefore, use six-digit North American Industry Classification System (NAICS) codes to identify our observations of interest. The six-digit NAICS code for breweries is 312120. However, a significant number of breweries operate in substantial food operations (i.e., brewpubs) and may be coded with full-service restaurants: NAICS code 722511. Also, while the NAICS code for drinking places (722410) is reserved for bars, taverns, and nightclubs, it is likely that some breweries were also coded within NAICS code 722410. To ensure we capture all observations of interest, we analyze each NAICS code of interest: breweries (312120); full-service restaurants (722511); and drinking places (722410).

[7] By construction, there is a necessary lower bound of -100% change in YoY production (i.e., shutdown with zero production in 2020). We impose an upper bound of +100% change in YoY production as to remove significant outliers. For example, a brewery could have opened in November of 2019, had two months of production, and this figure reflects their 2019 annual production. Suppose that the brewery remains open for all 12 months of 2020 and reports their 2020 annual production. Then it is reasonable to expect a 500% increase in YoY production from 2019 to 2020. For this reason, we place the upper bound limit of +100% on our YoY production volume changes.

[8] We also partner with the Brewers Association to collect information on which breweries received funding from the Restaurant Revitalization Fund (RRF). Part of the American Rescue Plan Act of 2021 (Public Law 117-2), passed into law on March 11, 2021, the RRF was an additional government aid program run through the U.S. SBA to support restaurants, bars, and other businesses that provide food or drink services (SBA, 2021e). The program, which ran from May 3, 2021 to July 2, 2021, supported more than 100,000 approved applicants and totaled $28.6 billion (SBA, 2021j). The Brewers Association identified 1,539 breweries that received RRF funds. By segment, the data suggests that 633 brewpubs, 257 microbreweries, 15 regional breweries, and 634 taprooms received RRFs from the SBA.

[9] Data on PPP loan recipients were made available through a Freedom of Information Act request and can be accessed, here: https://data.sba.gov/dataset/ppp-foia

We first import all available PPP loan data and create a subset of loan recipients using the six-digit NAICS code for breweries (312120). The initial scrape yields 5,405 observations coded into the brewery sector. Next, we generate a dataset containing all PPP loan recipients coded as full-service restaurants (722511) to capture brewpubs coded with full-service restaurants. We create a dataset of all full-service restaurants and then use brewery location to fuzzy match brewpub addresses with addresses listed on the PPP loans. One shortcoming with fuzzy matching is that breweries located in large plazas, malls, etc. may share a street address with another full-service restaurant but have different suite numbers. Loan recipients oftentimes failed to list their suite number on their application, and thus we manually corrected for improperly matched locations using Google Maps. Our fuzzy matching procedures result in a dataset of 1,481 brewpubs coded as full-service restaurants. Lastly, we identify businesses coded as drinking places (722410). Similar procedures to those described above are used to identify potential breweries coded into the drinking places sector, resulting in an additional 1,466 observations. We then merge observations across the three NAICS industries to create an initial dataset of 8,352 observations.

Importantly, as firms could receive two rounds of funding, a single brewery that receives both rounds would have two observations in the initial dataset. To subsequently merge the data such that there is only one observation per brewery, we then reshape the data from long to wide form yielding 5,809 unique observations.[10]

[10] We use the *reshape wide* command in Stata to compete these procedures. However, the reshape command only works if the borrower's name is identical for both listings (including punctuation, case sensitivity, etc.). Oftentimes, small discrepancies existed between two observations for the same brewery. For instance, a brewery may list "Company Name, LLC" in round one but "Company Name LLC" in round two. With the missing comma, Stata cannot match across these two observations. Thus, manual corrections were necessary to complete the reshape procedures.

3.3 Merging

To merge the breweries' dataset with our PPP dataset from the SBA, we first separate both datasets by jurisdiction, resulting in 51 different datasets (representing 50 states and the District of Columbia) for each data source. For each jurisdiction, we then combine the breweries and PPP data to initiate matching.

Next, we use a manual identification process to align the PPP data points to the breweries. As we assume that the Brewers Association dataset is our entire universe of breweries, PPP borrowers either sufficiently match to one of the breweries or are excluded from the analysis. The manual procedure was done in three steps. First, we attempt to match the brewery name to the borrower's name listed on the PPP loan application. While a significant proportion of the observations match brewery name to borrower name, several shortcomings in the SBA data prevent some matches. For example, loan recipients would often list their official company name rather than their company's trading name (i.e., their *doing business as* name), while other applicants would list their name as opposed to the name of the brewery. To overcome this shortcoming, our second step matches based on street address. Here, we match the address listed on the PPP loan application to a brewery's address and cross-reference available online resources to ensure the match was indeed correct. For the remaining unmatched observations, step three involves using the borrower's name listed on the PPP application to identify trademarks, alternative trading names, etc. of the loan applicant. To complete this matching procedure, we utilize online resources such as OpenCorporates (OpenCorporates, 2021) to identify whether a company has trademarks or alternative business names.

On aggregate, we match a total of 7,405 (89%) of 8,276 approved and distributed PPP loans across 5,002 unique breweries in 1,210 distinct counties. Observations that are not matched using these procedures are excluded from our analysis.[11]

4. Results

4.1 Summary Statistics

Approximately $1.06 billion in PPP funding has been allocated to the craft brewing industry, including $576 million in the first-round of funding and $482 million in the second-round. These dollars have gone to support nearly 98,000 jobs in the first-round, and over 64,000 in the second-round.[12]

Figure 2 provides a timeline of PPP loan funding to craft breweries. Panel A reflects the structural break that occurred between the two tranches of PPP funding. Approximately 63% of first-round loans were distributed between April 3 – April 16, 2020, with the remaining ones paid out from April 27 onward.

[FIGURE 2 HERE]

[11] Most observations that remained unmatched consisted of cideries, wineries, and distilleries that were incorrectly coded into NAICS 312120 as well as pubs or restaurants that do not qualify as breweries. Several observations that were coded into NAICS code 312120 do not fit the Brewers Association's definition of a brewery. Most notably, kombucha brewers are coded in NAICS code 312120 as their products are fermented like beer but are generally non-alcoholic. Even when they do contain alcohol, the kombucha producer would not be listed in our universe of breweries unless the producer is registered with the Brewers Association. Also, several observations were for beer retailer stores, bottle shops, or growler houses, which are not in and of themselves breweries. A large percentage of the unmatched observations were for borrowers that were incorrectly coded into NAICS code 312120. For example, several wineries, cideries, and meaderies were coded into the breweries' NAICS code, when they should be coded in NAICS code 312130 (wineries). Likewise, several distilleries were coded in NAICS code 312120 when they should be coded in NAICS code 312140 (distilleries). Additionally, several borrowers coded in NAICS 312120 do not engage in alcohol production. The most notable group that is excluded from analysis are breweries in planning or proprietor brewers. These groups were not included in our universe of breweries from the Brewers Association, and so they are excluded from analysis. While this may be seen as a limitation, these observations accounted for less than 20% of the unmatched observations, or less than 3% of total PPP observations.

[12] The statistics on the number of jobs supported by the PPP come directly from the PPP application, where applicants had to list the number of workers employed at the business.

Table 2 provides a breakdown of summary statistics based on whether the brewery received (i) first-round funding only, (ii) second-round funding only, (iii) both rounds of funding, or (iv) no funding. Of the 8,946 observations in our dataset, over half of the breweries in our sample received some form of PPP funding. We find that 2,086 (23% of our sample) received first-round funding only, 513 (6%) received second-round funding only, and 2,403 (27%) received both rounds of funding; the remaining 3,944 (44%) breweries received no PPP funding.

[TABLE 2 HERE]

Examining key outcome variables (Panel A in Table 2), we see differences in operation status and YoY production volume changes depending on whether a business received PPP funding. Businesses that received both rounds of funding were most likely to be open as of July 2021 (98%), while breweries that had received no PPP funding had the lowest probability of remaining in business (92%).

Shifting to changes in YoY production volume from 2019 to 2020, we are primarily interested in how breweries that received first-round funding compared to those that did not (i.e., breweries that received only second-round funding or no funding). The average brewery sees a 12.5% decline in production from 2019 to 2020 (n = 5,911). However, breweries that received first-round PPP funding see a smaller decrease (roughly -10% YoY) compared with those that did not (15% decrease).

We also see variation in county-level variables. Breweries that received first-round PPP funding had a below-average number of confirmed COVID-19 cases on April 3, 2020 (the first day of the PPP funding); similarly for December 31, 2020. This finding is in line with Granja et al. (2020), who suggest that the banks involved in distributing PPP loans were more

likely to do so in areas that were not as adversely impacted by COVID as others. We also see variation across groups concerning the ERS Amenities Score index (ERS, 2019), a proxy for county-level tourism. These differences across counties and groups support the use of county-level fixed effects.

To further determine existing differences across our comparison groups, we plot the historic production levels to observe differences in the pretends. Figure 3 shows the average annual production by group from 2018 to 2020. The sample is limited by data availability to 4,257 of our original 5,911 production-level observations. Specifically, we remove (i) observations that are missing data in 2018, 2019, and/or 2020; (ii) breweries that experienced greater than a 100% increase in YoY production from 2018-2019 and/or 2019-2020; and (iii) outliers that significantly skew the average.[13] Additionally, we limit our analysis to breweries that were open in July 2021, implying that the remainder of this section should be interpreted as YoY production volume changes conditional upon remaining in operation.

[FIGURE 3 HERE]

Figure 3 suggests that breweries across each treatment group demonstrate, on average, increasing production from 2018 to 2019, ranging from a 1% to 8% increase in YoY production. Results align with previous studies suggesting that the smallest businesses were less likely to receive PPP funding, while larger (eligible) operations were more likely to

[13] We remove breweries that were listed as producing 1 bbl of beer per year, as this may be evident of an error in the industry production dataset where "1" signals an indicator of having produced in the corresponding year. Additionally, we remove breweries producing above the 99th percentile of annual production in 2018. The 99th percentile was chosen based on the distribution of the 2018 production data. Specifically, 99% of our sample produces at or below 66,669 barrels of beer per year, while the remaining 1% of observations ranges from 66,784 to 2,175,784 barrels per year. Similar statistics held for the 2019 and 2020 data, with 99th percentiles of 55,660 and 50,084 bbls per year, respectively. As such, we use the 2018 data as our production cutoff point.

546 receive the first-round funds. Breweries that received first-round funding, on average,
547 produce higher quantities of beer from 2018-2020 than those that did not.

548 The graph also reflects the change in loan eligibility for second-round funding, which
549 was targeted toward smaller firms that experienced substantial revenue decreases in 2020.
550 Lastly, we see that the group with the smallest average production received no PPP funding,
551 further raising questions about the distribution of the funding as well as small business
552 knowledge of the loans.

553

554 **4.2 Probability of remaining in business**

555 Table 3 presents results from the LPM that predicts the probability a brewery will be open
556 in July 2021 as a function of whether they have received PPP funding. Across specifications
557 that control for firm- and county-level effects, we see that receiving PPP funding had a
558 positive and statistically significant relationship with the probability of remaining in
559 operation as of July 2021.[14] Interpreting the output from our naïve regression (specification
560 (1) in Table 3), we see that firms that received no funding had a 92.4% chance of survival.
561 Breweries that received a first-round PPP loan only were predicted to have a 95.9% chance
562 of survival, and those that only received a second-round loan had a 97.5% chance of survival.

[14] We also consider the inclusion of state-level control variables, including the political party of the governor; the proportion of 2020 presidential election votes for Trump; the proportion of the state's beer packaged for draught in 2017 (Ulrich, 2018); and the proportion of 2018 GDP from tourism. The political party of the governor and the proportion of votes for Trump in the 2020 election could serve as a proxy for the political and social institutions shaping state-level COVID response. The proportion of the state's beer packaged for draught controls for the state's beer industry reliance on on-premise consumption. The 2017 data is the latest data available. Lastly, while the craft beer industry is largely dependent on neo-localism, breweries are also a common tourism venue for travelers (Pezzi, Faggian, and Reid, 2020), and so we consider the proportion of GDP from tourism. Our results are robust to the inclusion of these state-level control variables. However, the inclusion of these state-level controls does not improve our explanatory power, and their inclusion may be inappropriate given the inclusion of county-level fixed effects inherently capturing the unobserved heterogeneity. Therefore, specification (3) is Table 3 is our preferred specification.

Breweries that received both rounds of funding were predicted to have a 98.3% probability of survival. The negative sign attached to the interaction term is indicative of diminishing marginal returns to receiving the second round of PPP funding.

[TABLE 3 HERE]

We also see suggestive evidence that brewpubs and microbreweries were affected by the pandemic more than taprooms, with brewpubs appearing to be hit the hardest (specification (3) of Table 3). This reinforces industry expectations that brewpubs were less capable of pivoting away from their initial business model compared to taprooms. That is, their reliance on food services may have contributed to higher closure rates.

4.3 Changes in production

4.3.1 Aggregate

We analyze how YoY brewery production was influenced by the COVID-19 pandemic, focusing our attention on breweries that remained in operation as of July 2021. Using available data on 2019 and 2020 production levels, our largest sample for analyzing production data consists of 5,555 breweries; 5,911 breweries had available production data for these years, but 356 of these observations were identified as temporarily or permanently closed. These 356 temporarily or permanently closed breweries are excluded from this analysis, and therefore our results can be interpreted as the impact of receiving PPP on production conditional upon remaining in operation.[15] Table 4 presents these results.

[15] We also ran the described specification including breweries that were closed as of July 2021. Unsurprisingly, results were more pronounced when we include breweries that closed since these breweries saw drastic declines in YoY production. As a result, we believe our approach to be the conservative empirical decision and dampens our estimated results.

[TABLE 4 HERE]

The positive point estimate on the treatment indicator suggests that, on average, breweries that received a first-round PPP loan between April 3, 2020 – August 8, 2020, saw a smaller decrease in YoY production than breweries that did not receive a first-round PPP loan. In our naïve regression analysis, receiving a PPP loan is associated with a 3.5 percentage point increase in YoY production relative to those brewers that did not receive a PPP loan. That is, breweries that received a PPP loan in 2020 saw, on average, a decrease in production of approximately 9.4% YoY compared to a 12.9% YoY decrease for those that did not. Specification (2) includes the county-level fixed effects, while specification (3) includes both county-level fixed effects and brewery control variables. Results are largely robust across specifications, suggesting a positive relationship between receiving a first-round PPP loan and smaller decreases in YoY production. After controlling for county- and firm-specific controls, the magnitude of the point estimate increases from 3.5 to 4.3 percentage points. That is, after the inclusion of important control variables, the relationship between receiving PPP funding and changes in YoY production levels becomes more pronounced.

These results lack a causal interpretation. Self-selection into the treatment group and other unobservable factors likely confound these point estimates. We discuss these limitations further in Section 5. Nonetheless, these results are appealing, as they suggest that receiving PPP funding relates to improved relative performance.

4.3.2 Quasi-experiment: Timing of first-round loan

It is also worth examining how timing could have impacted YoY production changes. That is, conditional upon receiving a first-round loan, we examine whether the timing of the loan

606 approval relates to performance. The first-round of PPP funding consisted of two tranches.
607 The SBA began distributing first-tranche PPP loans on April 3, 2020, but these funds were
608 exhausted by April 16, 2020. The Paycheck Protection Program and Health Care
609 Enhancement Act (Public Law 116-139) was then signed into law on April 24, 2020,
610 increasing allotted PPP funding by an additional $310 billion. Then, on April 27, 2020, the
611 SBA began distributing the second tranche of PPP funding.

612 To develop a quasi-experimental framework examining the role that timing of loan
613 approval played in small business performance YoY, we exploit the natural break in the PPP
614 that occurred between the first and second tranches (Figure 1). By limiting attention to
615 breweries that received funding in either the last seven days of the first tranche (April 10 –
616 16, 2020) or the first seven days of the second tranche (April 27 - May 3, 2020), we create a
617 quasi-experiment to analyze the impact of the timing of PPP loan approval.

618 While we lack the data on loan *submission* dates, it is well established that the demand
619 for PPP in early April far exceeded supply (Autor, 2022; Granja et al., 2020), creating a
620 backlog of loan applications. Indeed, drawing on insights from Bartik, Cullen et al (2020), we
621 can reasonably expect that the majority of loan recipients that received early second tranche
622 funding submitted their PPP loan application when first tranche funding was still available.
623 Bartik, Cullen et al. survey small businesses between April 25 and April 27, 2020—after the
624 Paycheck Protection Program and Health Care Enhancement Act (Public Law 116-139) was
625 signed into law but before the second tranche of PPP funding was distributed—to examine
626 their decision to apply for PPP funding and whether they received PPP. Of the nearly 4,000
627 small businesses that applied for first tranche funding in their sample, just 25% were
628 approved, 24% were denied, and the remaining 51% of applications were still pending. In

other words, while these businesses submitted their loan application before the first tranche funding expired, their application was not approved (nor denied) until after the second tranche funding was available.

Further, Figure 2 shows that 78% of the approved second tranche loans came within the first seven days of SBA resuming loan approvals, demonstrating a backlog of loan applications followed by a drop in demand. Thus, while we cannot say with certainty that all early second tranche approvals (April 27 – May 3, 2020) involved businesses that submitted their application before the exhaustion of first tranche funding, it is reasonable to expect that most of them had already submitted their application before the structural break, allowing us to employ a regression discontinuity framework.

We begin with our sample of 5,555 breweries that were in operation as of July 2021 and had 2019-2020 YoY production volume changes within the bounds of -100% to +100% (analysis shown in Table 4). We then restrict attention to breweries that received PPP funding in our periods of interest (April 10-April 16, 2020, and April 27 – May 3, 2020). To determine whether there are systematic differences between the two groups, we also restrict attention to breweries that reported 2018 production volume, which allows us to examine pretends. We also impose an upper-bound restriction on YoY production from 2018-2019 to mirror the restriction imposed on 2019-2020 YoY production changes. Lastly, we remove outliers that significantly skew our sample means by excluding breweries that produced below the 5^{th} percentile (≤ 100 bbls) and above the 95^{th} percentile (≥ 7,757 bbls) in 2018. These procedures lead to a subsample of 1,346 observations: 720 observations from the last seven days of the first tranche and 626 observations from the first seven days of the

651 second tranche. Figure 4 shows the average production levels from 2018-2020 for our two
652 groups.

653 [FIGURE 4 HERE]

654 Even amongst this group (n = 1,346), breweries that received funding in the last seven
655 days of the first tranche are larger than those that received funding in the first seven days of
656 the second tranche of PPP funding. Both groups, on average, experienced growth from 2018
657 to 2019. The group that received first tranche funding experienced an 8.1% increase in
658 production from 2018 to 2019 while the group that received second tranche funding
659 experienced a 6.1% growth rate over the same time frame, on average. The difference
660 between groups is exacerbated when comparing the recipients of first tranche loans (April
661 3 – August 17, 2020) against recipients of second tranche loans (April 27 – August 8, 2020).
662 Thus, while there appears to be inherent, unobservable differences between the two groups,
663 analyzing this shorter window around the structural break in the program provides
664 preliminary insight into the role of loan approval timing on performance. Table 5 presents
665 the results of our OLS regression estimating the role of timing on YoY production amongst
666 the subsample of interest. Here, given that all breweries in the quasi-experimental group
667 received PPP funding, we now control for the log of the approval amount (i.e., the total funds
668 allocated to the brewery).

669 [TABLE 5 HERE]

670 We find that the breweries that received PPP funding in the last seven days of the first
671 tranche saw, on average, a two- to three-percentage point increase in YoY production
672 relative to those breweries that received their funding in the first seven days of the second
673 tranche. Put differently, breweries that received funding in the last seven days of the first

tranche saw, on average, an 11-12 percentage point decrease in YoY production versus a 14-percentage point drop for those that received funding in the first seven days of the second tranche. Interestingly, we see a negative marginal coefficient attached to the log of total dollars approved in the loan, suggesting that the breweries that requested larger sums of money may have been in more troublesome circumstances. Our results are robust to the inclusion of county- and brewery-specific control variables.[16]

Intuitively, these results are appealing as we can consider a brewery's objective function and its decision to delay beer production at the onset of the pandemic. Watson (2020a; 2020b) suggests that breweries were planning on shifting their production schedules at the onset of COVID-19—i.e., delaying production knowing that taproom sales would slow. Thus, if breweries were going to shift production, it likely would have been in late March through April, coinciding with the implementation of stay-at-home orders and decreased consumer foot traffic (Goolsbee and Syverson, 2021). The decision to delay production appeared to be particularly attractive to breweries that did not receive first-tranche PPP funding. Given that the objective of the PPP was to keep people on payroll, and breweries could qualify for loan forgiveness if they retained employment levels, breweries that received first-tranche PPP funding could pay staff to continue production despite the short-term revenue decrease. However, breweries that did not receive first-tranche funding may have decided to halt production and/or temporarily shut down given the cost of labor. Ultimately, this framework would translate to mid-April 2020—the period between the first

[16] County-level fixed effects are excluded given the sample size and diminished explanatory power. We also run the model presented in Table 5 with county-level fixed effects, and the magnitude of the point estimate is similar (0.025), though it loses statistical significance. By including the county-level FIPS codes in our regression, we are significantly reducing our explanatory power and increasing our standard errors, leading to lower t-statistics. The inclusion of county-level fixed effects here may also not be appropriate given that of the 1,346 observations across 577 counties, 321 counties (56%) are represented by a single observation.

694 and second tranches of PPP funding—being the time when breweries would have
695 experienced the most significant decline in their annual production.
696
697 **5. Limitations**
698 We identify two central limitations to our study. First, our analysis is limited by data
699 availability. Specifically, we rely on a cross-sectional dataset, whereas a panel structure that
700 accounts for temporal variation in closure dates would enable a more compelling causal
701 interpretation. Unfortunately, we lack these dates for all breweries classified as temporarily
702 or permanently closed in our dataset. It is also probable that breweries that are open in July
703 2021 were temporarily closed at some point during the pandemic (Cajner et al., 2020). Other
704 breweries may have adjusted their hours of operation to account for decreased consumer
705 foot traffic, for example, closing their brewery to the public on Monday and Tuesday
706 (Watson, 2020). Future research accounting for the time of business closures across the life
707 span of the PPP could better isolate the effect of receiving a PPP loan. Also, within the SBA
708 dataset on PPP loan recipients, we observe only the loan approval date and not the date when
709 the loan application was submitted. It is reasonable to suggest that all loan applicants would
710 have preferred earlier to later funding, and it is well established that demand for first-
711 tranche PPP funding far exceeded available supply. Yet, without knowing the date of loan
712 application submission, we cannot say that all loans approved in the first seven days of the
713 second tranche were applied for at the same time as those received within the last seven
714 days of the first tranche. If data on PPP loan application submission dates are made available,
715 researchers could use that information to further address the pitfalls and unintended
716 consequences stemming from the first-come, first-served design of the loan program.

The second core limitation is we cannot isolate issues that arise from self-selection into the treatment. That is, we cannot state with certainty that breweries that received PPP funding had the same probability of survival as firms that did not receive PPP funding. For example, a brewery that had a pre-existing relationship with a bank and had more financial resources on-hand at the onset of COVID-19 may have been in a better position to remain in operation than one that did not have such resources available. It is also plausible that the firms most likely not to apply for PPP funding could have been performing the worst at the beginning of the pandemic. However, outside of total production, we cannot observe the firms' economic conditions before the pandemic, and any further discussion would be speculation.

With these limitations, we cannot provide a causal interpretation of our findings limiting the external validity and implications of the results. In other words, without a causal link and the known shortcomings of the loan distribution mechanism, it is plausible to question whether the breweries that received PPP funding would have survived without PPP. Further, given the different sizes (bbls/year) and growth rates between those that receive PPP funding and those that did not, it is possible that the breweries that experienced smaller declines in production were in a better position to adapt to production shocks from COVID-19 irrespective of PPP funding. Thus, while the results suggest a positive relationship between PPP funding and small business performance, questions remain about the efficiency and equality of the loan distribution mechanism as well as the program's causal impacts.

6. Discussion and implications

The *I Can't Go Anywhere But Here IPA* by Proclamation Ale Company and *Zoom Casual IPA* by Denver Beer Company are just two of the COVID-19-inspired beverages created by small, independent breweries that have thus far survived the pandemic. However, not all small businesses were fortunate enough to outlast the economic turmoil generated by the pandemic. With the number of total small businesses falling 22% from February to April 2020 (Fairlie, 2020), it is critical to explore whether the federal policies that provided economic relief to small businesses hit their mark.

While unable to provide a causal interpretation to our results, receiving a PPP loan is associated with a higher probability of business survival and smaller declines in YoY production volume than those that did not receive funding. First, breweries that received PPP funding were more likely to be in operation as of July 2021 than those that had not received PPP funding. Our results suggest that receiving a single PPP loan increased the probability of remaining in business by approximately three percentage points; the likelihood of remaining in business increased at a decreasing rate for breweries that received both rounds of funding. Our results are in line with previous findings on the PPP. Bartik, Cullen, et al. (2020) use survey data to show that small businesses that received PPP funding were more likely to report higher confidence in the probability of remaining in business throughout the pandemic. Additionally, Li (2021) shows that firms that received a PPP loan in early-April 2020 were less likely to report revenue decreases and reductions in employee hours in the following weeks. As such, while our regression analysis is exploratory, the findings are intuitively appealing and provide preliminary and supporting evidence that receiving PPP funding increases the likelihood of remaining in operation.

Interestingly, we see that firms that received first-round PPP loans were larger on average (in terms of annual production volume) and were in counties that had below-average COVID-19 cases at the start of the program. This illustrates the potential pitfalls associated with the first-come, first-served style of the PPP (Humphries et al., 2020), creating a tradeoff between the targeting of loan dispersal and its timeliness (Autor et al., 2022). This mechanism has been linked to disproportionately assisting businesses that had preexisting relationships with a bank (Bartik, Cullen, et al., 2020; Granja et al., 2020); supporting larger firms over small businesses (Humphries et al., 2020); and contributing to equality issues (Atkins et al., 2021; Autor et al., 2022; Fairlie and Fossen, 2021a).

Ex post, we can observe the impact of COVID-19 on the craft beer industry. Industry reports suggest a 9.3% decrease in volume from 2019 to 2020 as well as a 22% loss in dollar sales (Brewers Association, 2021d). Craft beer's market share, in terms of total sales dollars, also fell from 25.2% in 2019 to 23.6% in 2020 (Scott, 2020; 2021). Given their reliance on taproom sales to generate revenue, both social and political institutions slowed on-premise consumption and drastically reduced most craft brewers' primary revenue stream. These results also align with a more general finding that sales for the hospitality and accommodation industries decreased during the COVID-19 pandemic (Fairlie and Fossen, 2021b). Yet, breweries that received PPP funding—first-tranche funding in particular— saw smaller decreases in their YoY production (2019-2020) compared with those that did not. In other words, these results suggest that receiving a PPP loan is associated with smaller production falloffs, and the timing of the funding likely influenced the observed outcome.

Additionally, we show that some craft beer market segments may have been hit harder than others. Brewpubs, or breweries that engage in significant food services

(Brewers Association, 2021b), closed at higher rates and experienced a steeper falloff in YoY production volume from 2019 to 2020, indicative of their inability to pivot to alternative production methods due to either financial, technological, or social constraints. Each market segment has its unique business model, indicative of different production levels, packaging decisions, revenue streams, etc. For brewpubs, food sales constitute a large portion of their revenue relative to the other market segments, and the food sales are largely driven by on-premise dining. When public health policies limited or shut down indoor dining, and consumer foot traffic fell due to the perceived risk of contracting COVID-19 (Goolsbee and Syverson, 2021), brewpubs saw a large decline in a primary revenue channel. Further, a reliance on sales from indoor dining meant that brewpubs were also primarily selling their beer on-premise.

While true that microbreweries and taprooms also rely heavily on on-premise consumption, brewpubs oftentimes have a less diverse portfolio of revenue streams. In other words, it is more common for the other market segments to have canning equipment, relationships with aluminum suppliers (upstream of the supply chain), and relationships with beer distributors and retailers (downstream), making the response to a shift in consumer behavior more likely. Without the necessary equipment and the relationships across the supply chain, brewpubs were particularly vulnerable. Thus, while state governments implemented policies alleviating some of the revenue declines—for example, allowing for to-go beer and brewery delivery—other barriers hindered a brewpub's ability to pivot away from their original business model.

Of course, the COVID-19 pandemic was a once-in-a-century outbreak with economic consequences that differ from past recessions. For example, the unemployment rate

increased from 3.5% in February 2020 to 14.5% in April 2020 with job losses over this two-month timeframe more than doubling that of the entire Great Recession (BLS, 2022; Couch, Fairlie, and Xu, 2020; Handwerker et al., 2020). The speed at which the economic damages were felt made planning and preparation for this crisis particularly difficult. Most businesses were forced to adapt to a sudden, unpredictable shock to their business model that they were not prepared for. Yet, through innovation and entrepreneurship coupled with government support, closures across the industry have been much lower than expected (Brewers Association, 2022; Watson, 2022).

To our knowledge, we are the first to merge an industry dataset with the SBA information on PPP loan recipients. As such, we provide a methodological overview and speak to the challenges associated with achieving our objectives. COVID-19 was declared a national emergency on March 13, 2020, the CARES Act (Public Law 116-136) was passed on March 27, 2020, and the first-PPP loan recipients were approved on April 3, 2020. The quick turnaround was imperative to the survival of small businesses, but bureaucratic shortcomings make it challenging to analyze the effectiveness of the program. For instance, each loan applicant had to list their "Borrower Name" on the PPP loan application. Yet, in some instances, the borrower would list their name or their official company name rather than their trading name (i.e., *doing-business-as* name). This structural inconsistency meant imperfect information in the merging process, which then required the manual merging of data sources based on the analysis of a company's trademarks. While this manual matching was viable for the craft brewing industry, it would likely not be feasible for a much larger industry of producers such as all full-service restaurants. A program like the Economic Injury Disaster Loan (EIDL) program, however, requires the applicant to specify both the legal

name of the business and the trading name (if different from the legal name). This would have enabled a much cleaner merging procedure. Clarification, consistency, and the collection of all pertinent information across loan applications are critical for future loan programs to improve the functionality of governmental data.

Relatedly, researchers analyzing the economic impact of the PPP for a specific industry must be cognizant of the delicacies of the NAICS code classification system. While our attention was on the craft beer industry, we analyzed observations across three different NAICS codes to ensure we captured relevant observations. If we limited attention to the six-digit NAICS code for breweries (312120), we would have captured just 63% of our total matched PPP loan observations—severally underestimating the number of loan recipients. There were also several instances where breweries applied for both rounds of funding through the same bank yet were coded in different NAICS codes across the two applications (i.e., coded in NAICS 312120: Breweries in the first round and coded with 722410: Drinking Places in the second round). These shortcomings highlight the structural shortcomings of the publicly available PPP data and emphasize the need for extensive data cleaning before analysis of the effectiveness of the federal program on a specific industry.

7. Conclusion

The PPP was established to incentivize small businesses to keep employees on payroll and to provide them some relief from economic damages from the COVID-19 pandemic. Using data from the Brewers Association and SBA, we explore the role of PPP funding on brewery closures and YoY production volume changes. We find that breweries that received PPP funding were more likely to remain in operation and experience a smaller decrease in YoY

production compared with those that did not. Further, using a quasi-experimental framework, we demonstrate that the timing of loan approval likely affected YoY performance with breweries receiving the earliest funding experiencing smaller declines in YoY production. While we lack the data for a causal interpretation, our exploratory and descriptive analysis provides preliminary support of a positive correlation between PPP funding and small business performance.

Several avenues for future research remain. While several studies have explored equality concerns over the distribution of PPP funding, many questions remain in this realm. For example, researchers could examine network effects in the PPP loan program across time. That is, given what is known about the role of relationship banks in the loan program (Granja et al., 2020; Li and Strahan, 2021), studies could explore clustering of PPP loans to a specific industry and address the role of social networks in the loan distribution mechanism. Future work should also examine the impact of COVID-19 and the PPP upon new businesses or businesses in planning. We may expect that new businesses or businesses in planning were more vulnerable to the economic turmoil created by COVID-19 than established businesses given their limited financial resources. However, new businesses or businesses in planning could have been more likely to have an active relationship with a bank which could make them more likely to secure a PPP loan. Surveying new small businesses (i.e., in operation for less than two years or businesses in planning at the time of the pandemic) would provide critical insights into the role of economic circumstances on small businesses. Additionally, future research may also consider linking small business closure dates with the timing of PPP funding for a given industry. While data availability remains the primary

concern, linking these two would provide a much clearer insight into the impact of the PPP on small businesses.

References

Adebowale, B. (November 2019). The Great Recession: In What Ways Did Policymakers Succeed and Fail. *Monthly Labor Review*, *142*, 1. Available at: https://www.bls.gov/opub/mlr/2019/book-review/the-great-recession.htm [last accessed May 2, 2022].

Atkins, R., Cook, L., & Seamans, R. (2021). Discrimination in lending? Evidence from the Paycheck Protection Program. *Small Business Economics.* doi.org/10.1007/s11187-021-00533-1

Autor, D., Cho, D., Crane, L. D., Goldar, M., Lutz, B., Montes, J. K., ... & Yildirmaz, A. (2022). *The $800 Billion Paycheck Protection Program: Where Did the Money Go and Why Did it Go There?* (No. w29669). National Bureau of Economic Research. doi.org/10.3386/w29669

Bartik, A. W., Bertrand, M., Cullen, Z. B., Glaeser, E. L., Luca, M., & Stanton, C. T. (2020). *How are small businesses adjusting to COVID-19? Early evidence from a survey* (No. w26989). National Bureau of Economic Research. doi.org/10.3386/w26989

Bartik, A. W., Cullen, Z. B., Glaeser, E. L., Luca, M., Stanton, C. T., & Sunderam, A. (2020). *The targeting and impact of Paycheck Protection Program loans to small businesses* (No. w27623). National Bureau of Economic Research. doi.org/10.3386/w27623

BLS (February 2012). The recession of 2007 – 2009. Available at *Bureau of Labor Statistics* website: https://www.bls.gov/spotlight/2012/recession/pdf/recession_bls_spotlight.pdf [last accessed May 2, 2022].

BLS. (2022). Civilian unemployment rate. Available at *Bureau of Labor Statistics* website: https://www.bls.gov/charts/employment-situation/civilian-unemployment-rate.htm [last accessed May 2, 2022].

Brewers Association (2021a). Brewery production: Brewery data (xls). Available at *Brewers Association* website: www.brewersassociation.org/statistics-and-data/brewery-production-data/ [last accessed August 16, 2021].

Brewers Association (2021b). Craft beer industry market segments. Available at *Brewers Association* website: www.brewersassociation.org/statistics-and-data/craft-beer-industry-market-segments/ [last accessed July 12, 2021].

Brewers Association (2021c). Craft brewer definition. Available at *Brewers Association* website: www.brewersassociation.org/statistics-and-data/craft-brewer-definition/ [last accessed August 18, 2021].

Brewers Association (2021d). National beer sales & production data. Available at *Brewers Association* website: www.brewersassociation.org/statistics-and-data/national-beer-stats/ [last accessed July 12, 2021].

Brewers Association (2021e). Who we are. Available at *Brewers Association* website: www.brewersassociation.org/who-we-are/ [last accessed July 12, 2021].

Brewers Association (2022). 2021 annual report. Available at *Brewers Association* website: https://www.brewersassociation.org/annual-report-2021/ [last accessed May 3, 2022].

Cajner, T., Crane, L. D., Decker, R. A., Grigsby, J., Hamins-Puertolas, A., Hurst, E., ... & Yildirmaz, A. (2020). *The US labor market during the beginning of the pandemic recession* (No. w27159). National Bureau of Economic Research. doi.org/10.3386/w27159

CDC (2021). Trends in number of COVID-19 vaccinations in the US. Available at *Centers for Disease Control and Prevention's COVID Data Tracker* website: covid.cdc.gov/covid-data-tracker/#vaccination-trends_vacctrends-fully-cum [last accessed December 1, 2021].

Chappell, B. (April 20, 2020). Shake Shack returns $10 million loan to U.S. program for small businesses. Available at *NPR* website: www.npr.org/sections/coronavirus-live-updates/2020/04/20/838439215/shake-shack-returns-10-million-loan-to-u-s-program-for-small-businesses [last accessed December 23, 2021].

Coronavirus Aid, Relief, and Economic Security Act. 2020. Public Law 116-136. www.congress.gov/116/plaws/publ136/PLAW-116publ136.pdf

Couch, K. A., Fairlie, R. W., & Xu, H. (2020). Early evidence of the impacts of COVID-19 on minority unemployment. *Journal of Public Economics*, *192*, 104287. doi.org/10.1016/j.jpubeco.2020.104287

Crane, L. D., Decker, R. A., Flaaen, A., Hamins-Puertolas, A., & Kurz, C. (2020). Business exit during the COVID-19 pandemic: Non-traditional measures in historical context. *Finance and Economics Discussion Series 2020-089r1. Washington: Board of Governors of the Federal Reserve System*. doi.org/10.17016/FEDS.2020.089r1

Department of Justice. (September 15, 2020). Attorney General Announces Results of Paycheck Protection Plan Criminal Fraud Enforcement Action - A Nationwide Strategic Plan to Combat PPP Program Fraud. Available at *U.S. Attorney's Office Middle District of Louisiana* website: www.justice.gov/usao-mdla/pr/attorney-general-announces-results-paycheck-protection-plan-criminal-fraud-enforcement [last accessed December 23, 2021].

Diamond, D. W., & Rajan, R. G. (2009). The credit crisis: Conjectures about causes and remedies. *American Economic Review*, *99*(2), 606-610. doi.org/10.1257/aer.99.2.606

Distilled Spirits Council (2021). State issues & market modernizations. Available at *Distilled Spirits Council of the United States* website: www.distilledspirits.org/state-issues-market-modernizations/ [last accessed August 16, 2021].

Drew, J. (July 6, 2021). SBA officially closes Restaurant Revitalization Fund. Available at *Journal of Accountancy* website: www.journalofaccountancy.com/news/2021/jul/sba-closes-restaurant-revitalization-fund.html [last accessed November 9, 2021].

Ellison, B., McFadden, B., Rickard, B. J., & Wilson, N. L. (2021). Examining food purchase behavior and food values during the COVID-19 pandemic. *Applied Economic Perspectives and Policy*, *43*(1), 58-72. doi.org/10.1002/aepp.13118

ERS (August 20, 2019). Natural amenities scale. Available at *Economic Research Service* website: https://www.ers.usda.gov/data-products/natural-amenities-scale/ [last accessed November 30, 2021].

Executive Order No. 2020-9. "Temporary restrictions on the use of place of public accommodation." Available at: https://www.michigan.gov/whitmer/0,9309,7-387-90499_90705-521789--,00.html [last accessed July 28, 2021].

Fairlie, R. W. (2013). Entrepreneurship, economic conditions, and the great recession. *Journal of Economics & Management Strategy*, *22*(2), 207-231. doi.org/10.1111/jems.12017

Fairlie, R. (2020). The impact of COVID-19 on small business owners: Evidence from the first three months after widespread social-distancing restrictions. *Journal of Economics & Management Strategy*, *29*(4), 727-740. doi.org/10.1111/jems.12400

Fairlie, R., & Fossen, F. M. (2021a). Did the Paycheck Protection Program and Economic Injury Disaster Loan Program get disbursed to minority communities in the early stages of COVID-19?. *Small Business Economics*, 1-14. doi.org/10.1007/s11187-021-00501-9

Fairlie, R., & Fossen, F. M. (2021b). The early impacts of the COVID-19 pandemic on business sales. *Small Business Economics*, 1-12. doi.org/10.1007/s11187-021-00479-4

Goolsbee, A., & Syverson, C. (2021). Fear, lockdown, and diversion: Comparing drivers of pandemic economic decline 2020. *Journal of Public Economics*, *193*, 104311. doi.org/10.1016/j.jpubeco.2020.104311

Giri, A.K., Subedi, D., Peterson, W.F., & McDonald, T.M. (2021). Impact of the Paycheck Protection Program on U.S. producers. *Choices,* 36(3), 1-7. Available at: www.choicesmagazine.org/choices-magazine/theme-articles/rural-development-implications-one-year-after-covid-19/impact-of-the-paycheck-protection-program-on-us--producers [last accessed July 28, 2021].

Granja, J., Makridis, C., Yannelis, C., & Zwick, E. (2020). *Did the Paycheck Protection Program hit the target?* (No. w27095). National Bureau of Economic Research. doi.org/10.3386/w27095

Handwerker, E. W., Meyer, P. B., & Piacentini, J. (December 2020). Employment recovery in the wake of the COVID-19 pandemic. *Monthly Labor Review*, *143*, 1. Available at: https://www.bls.gov/opub/mlr/2020/article/employment-recovery.htm

Humphries, J. E., Neilson, C. A., & Ulyssea, G. (2020). Information frictions and access to the Paycheck Protection Program. *Journal of Public Economics*, *190*, 104244. doi.org/10.1016/j.jpubeco.2020.104244

Hungerford, A., Effland, A., & Johansson, R. (2021). Agricultural and food policy response to COVID-19. *Choices*, 36(3), 1-7. Available at: www.choicesmagazine.org/choices-magazine/theme-articles/agricultural-market-response-to-covid-19/agricultural-and-food-policy-response-to-covid-19 [last accessed June 30, 2021].

Iacurci, G. (June 24, 2020). Small businesses expect to fail. Here's what will happen to their PPP loans. Available at *CNBC* website: https://www.cnbc.com/2020/06/24/heres-what-happens-if-a-business-closes-after-receiving-a-ppp-loan.html [last accessed May 2, 2022].

Jensen, K. L., Yenerall, J., Chen, X., & Yu, T. E. (2021). US Consumers' Online Shopping Behaviors and Intentions During and After the COVID-19 Pandemic. *Journal of Agricultural and Applied Economics*, 1-19. doi.org/10.1017/aae.2021.15

John Hopkins CSSE (2021). How to use our data. Available at *John Hopkins University & Medicine's Coronavirus Resource Center* website: www.coronavirus.jhu.edu/about/how-to-use-our-data [last accessed November 30, 2021].

Li, L., & Strahan, P. E. (2021). Who supplies PPP loans (and does it matter)? Banks, relationships, and the COVID crisis. *Journal of Financial and Quantitative Analysis*, *56*(7), 2411-2438. doi.org/10.1017/S0022109021000405

Li, M. (2021). Did the small business administration's COVID-19 assistance go to the hard hit firms and bring the desired relief?. *Journal of Economics and Business*, *115*, 105969. doi.org/10.1016/j.jeconbus.2020.105969

Morris, C. (October 14, 2020). Craft brewers upend their business models in fight to stay alive. Available at *Fortune* website: fortune.com/2020/10/14/craft-beer-brewery-covid-businesss/ [last accessed December 21, 2021].

New York Times (2021). NY Times COVID-19 data. Available at *Github* website: github.com/nytimes/covid-19-data [last accessed November 30, 2021].

Office of Capital Access (May 31, 2021). Paycheck Protection Program (PPP) report: Approvals through 05/31/2021. Available at *SBA* website: www.sba.gov/document/report-paycheck-protection-program-weekly-reports-2021 [last accessed September 15, 2021].

Pezzi, M. G., Faggian, A., & Reid, N. (Eds.). (2020). *Agritourism, wine tourism, and craft beer tourism: Local responses to peripherality through tourism niches*. Routledge. doi.org/10.4324/9780429464102

Romano, M. (July 14, 2021). Lifting restrictions and moving forward from COVID-19. Available at *Brewers Association* website: www.brewersassociation.org/brewing-industry-updates/lifting-restrictions-and-moving-forward-from-covid-19/ [last accessed December 21, 2021].

SBA (2021a). First draw PPP loan. Available at *SBA* website: www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program/first-draw-ppp-loan [last accessed July 28, 2021].

SBA (2021b). PPP data. Available at *SBA* website: www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program/ppp-data [last accessed December 21, 2021].

SBA (2021c). PPP FOIA. Available at *SBA* website: data.sba.gov/dataset/ppp-foia [last accessed July 12, 2021].

SBA (2021d). PPP loan forgiveness. Available at *SBA* website: www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program/ppp-loan-forgiveness [last accessed July 28, 2021].

SBA (2021e). Restaurant Revitalization Fund. Available at *SBA* website: www.sba.gov/funding-programs/loans/covid-19-relief-options/restaurant-revitalization-fund [last accessed November 9, 2021].

SBA (July 2, 2021f). SBA administrator announces closure of Restaurant Revitalization Fund program. Available at *SBA* website: www.sba.gov/article/2021/jul/02/sba-administrator-announces-closure-restaurant-revitalization-fund-program [last accessed December 21, 2021].

SBA (January 8, 2021g). SBA and Treasury announce PPP re-opening; issue new guidance. Available at *SBA* website: www.sba.gov/article/2021/jan/08/sba-treasury-announce-ppp-re-opening-issue-new-guidance [last accessed December 21, 2021].

SBA (January 13, 2021h). SBA re-opening Paycheck Protection Program to small lenders on Friday, January 15 and all lenders on Tuesday, January 19. Available at *SBA* website: www.sba.gov/article/2021/jan/13/sba-re-opening-paycheck-protection-program-small-lenders-friday-january-15-all-lenders-tuesday [last accessed December 21, 2021].

SBA (2021i). Second draw PPP loan. Available at *SBA* website: www.sba.gov/funding-programs/loans/covid-19-relief-options/paycheck-protection-program/second-draw-ppp-loan [last accessed December 21, 2021].

SBA (May 10, 2021j). The SBA funds 16,000 Restaurant Revitalization Fund awards. Available at *SBA* website: www.sba.gov/article/2021/may/10/sba-funds-16000-restaurant-revitalization-fund-awards [last accessed December 21, 2021].

Scott, J. (April 14, 2020). Brewers Association releases annual growth report for 2019. Available at *Brewers Association* website: https://www.brewersassociation.org/press-releases/brewers-association-releases-annual-growth-report-for-2019/ [last accessed December 23, 2021].

Scott, J. (April 6, 2021). Numbers reveal all-time high of operating breweries, first production decline in modern craft era. Available at *Brewers Association* website: www.brewersassociation.org/press-releases/2020-craft-brewing-industry-production-report/ [last accessed December 1, 2021].

Sierra Nevada Brewing Company (2022). Does beer expire?. Available at *Sierra Nevada Brewing Company* website: https://sierranevada.com/blog/does-beer-expire/ [last accessed April 22, 2022].

Staples, A. J., Malone, T., & Sirrine, J. R. (2021). Hopping on the localness craze: What brewers want from state-grown hops. *Managerial and Decision Economics*, *42*(2), 463-473. doi.org/10.1002/mde.3246

The Washington Post v. U.S. Small Business Administration (2020). Available at: www.napa-net.org/sites/napa-net.org/files/PPP_DC%20ruling%20on%20disclosure_110520.pdf [last accessed December 21, 2021].

U.S. Department of the Treasury (January 8, 2021). SBA and Treasury announce PPP re-opening; issue new guidance. Available at *U.S. Department of the Treasury* website: https://home.treasury.gov/news/press-releases/sm1230 [last accessed January 20, 2022].

Watson, B. (September 16, 2014). The rise of the microbrewery tap room. Available at *Brewers Association* website: www.brewersassociation.org/insights/microbrewery-tap-room/ [last accessed December 21, 2021].

Watson, B. (March 18, 2020a). Impact survey shows extreme challenges. Available at *Brewers Association* website: www.brewersassociation.org/insights/impact-survey-shows-extreme-challenges/ [last accessed September 15, 2021].

Watson, B. (April 7, 2020b). Brewery sales dropping sharply, many set to close. Available at *Brewers Association* website: www.brewersassociation.org/insights/brewery-sales-dropping-sharply-many-set-to-close/ [last accessed September 15, 2021].

Watson, B. (August 12, 2020c). Data on Brewery Closing Times During Reopening. Available at *Brewers Association* website: www.brewersassociation.org/insights/data-on-brewery-closing-times-during-reopening/ [last accessed April 5, 2022].

Watson, B. (2021). State of the industry. Presentation at the *Beeronomics Society* on June 25. Available at: www.brewersassociation.org/collab-hour/2020-craft-brewer-numbers-a-closer-look-at-the-brewers-associations-annual-production-report/ [last accessed July 28, 2021].

Watson, B. (January 25, 2022). How did breweries pivot during the pandemic and how have they recovered?. Available at *Brewers Association* website: https://www.brewersassociation.org/insights/how-did-breweries-pivot-during-the-pandemic-and-how-have-they-recovered/ [last accessed May 3, 2022].

Wooldridge, J.M. (ed.) (2010). Binary response models in *Econometric Analysis of Cross Section and Panel Data , 2nd Edition* (pp. 561-642). Massachusetts Institute of Technology.

Tables and Figures

Table 1. Active brewery locations and temporary and permanent closures as of July 2021 by market segment (n=8946)

			Closures (% closed)		
Brewery segment	**# of breweries**	**Active**	**Temporary**	**Permanent**	**Total**
Brewpub	3,238	3,046	70 (2.2%)	122 (3.8%)	192 (5.9%)
Microbrewery	1,889	1,791	32 (1.7%)	66 (3.5%)	98 (5.2%)
Regional	228	221	3 (1.3%)	4 (1.8%)	7 (3.1%)
Taproom	3,591	3,448	36 (1.0%)	107 (2.98%)	143 (4.0%)
Total	**8,946**	**8,506**	**141 (1.6%)**	**299 (3.3%)**	**440 (4.9%)**

Table 2. Summary statistics disaggregated by PPP funding

		PPP funding				
Variable	**Population**	**1st round only**	**2nd round only**	**Both rounds**	**None**	**p-value [a]**
Number of breweries	**8,946**	**2,086**	**513**	**2,403**	**3,944**	**---**
Panel A. Outcome variables						
Open, July 2021	0.951	0.959	0.975	0.983	0.924	0.000
Prop. production change, 2019-2020[b]	-0.124	-0.056	-0.170	-0.139	-0.151	0.000
Avg. production (bbls/year), 2019	3,842.9	3,457.2	2,227.6	2,388.5	5,747.0	0.103
Avg. production (bbls/year), 2020	3,463.6	3,269.2	1,911.3	2,028.9	5,197.6	0.081
Panel B. Firm characteristics						
Proportion of obs. for each segment						
Brewpub	0.362	0.300	0.517	0.409	0.346	0.000
Microbrewery	0.211	0.215	0.189	0.206	0.215	0.505
Regional	0.025	0.033	0.014	0.021	0.026	0.030
Taproom	0.401	0.453	0.281	0.364	0.413	0.000
Prop. of primary locations	0.882	0.954	0.929	0.958	0.791	0.000
Prop. received RRF loan	0.172	0.160	0.236	0.294	0.096	0.000
Panel C. County variables						
Number of counties represented	1,547	834	316	838	1,139	---
Avg. number of COVID-19 cases						
April 3, 2020	590.2	553.3	793.0	610.6	570.9	0.048
December 31, 2020	49,420.5	42,848.9	63,926	55,614	47,376.5	0.000
Avg. ERS Amenities Score [c]	1.6	1.3	2.1	1.6	1.6	0.000

[a] The p-value denotes the results of the ANOVA procedures F-test to detect differences across the four groups.

[b] The number of observations for year-over-year (YoY) change in production varies due to limitations in data availability. Additionally, we restrict attention to observations that saw between a -100% and +100% change in YoY production from 2019 to 2020 to exclude outliers. In total, we analyze data from 5,877 observations, and the number of observations by group as are follows: 1st round only (1,526), 2nd round only (387), both rounds (1,886), and none (2,078).

[c] The number of observations for the ERS Amenities Score varies due to limitations in data availability. For example, data were not available for Alaska and Hawaii. Data were available for 8,842 observations, and the number of observations by group as are follows: 1st round only (2,059), 2nd round only (507), both rounds (2,369), and none (3,907).

Table 3. Linear probability model predicting brewery operational status (open or closed) as a function of PPP funding

Variable	(1)	(2)	(3)
PPP Funding			
FirstRoundPPP	0.035***	0.035***	0.050***
	(0.006)	(0.007)	(0.011)
SecondRoundPPP	0.051***	0.053***	0.074***
	(0.008)	(0.010)	(0.014)
BothRoundsPPP	-0.027***	-0.030**	-0.052***
	(0.010)	(0.012)	(0.016)
Segment			
Brewpub	---	---	-0.025***
			(0.009)
Microbrewery	---	---	-0.021**
			(0.010)
Regional	---	---	-0.024
			(0.020)
Constant	0.924***	0.957***	0.870***
	(0.004)	(0.009)	(0.037)
N	**8,946**	**8,946**	**5,877**
County-level FIPS controls	No	Yes	Yes
Firm-level controls	No	No	Yes
R^2	0.01	0.17	0.23

[a] Superscript ***, **, and * denote statistical significance at the one, five, and ten percent level, respectively.

Observations in specification (3) decrease from 8,946 to 5,877 due to data limitations and data outliers in the brewery production data.

We also consider the inclusion of state-level control variables. When controlling for the political party of the state's governor, the proportion of the state's 2020 presidential election votes for Trump, the proportion of the state's beer packaged for draught in 2017, and the proportion of the state's 2018 GDP from tourism, the magnitude and statistical significance of our point estimates are identical to specification (3). However, the inclusion of these state-level controls does not improve our explanatory power, and their inclusion may be inappropriate given the inclusion of county-level fixed effects inherently capturing the unobserved heterogeneity. Therefore, specification (3) is our preferred specification.

Table 4. Change in brewery annual production from 2019 to 2020 as a function of whether the brewery received PPP funding

Variable	(1)	(2)	(3)
FirstRoundPPP	0.035***	0.037***	0.043***
	(0.008)	(0.009)	(0.009)
Segment			
Brewpub	---	---	-0.102***
			(0.011)
Microbrewery	---	---	-0.020
			(0.013)
Regional	---	---	0.077***
			(0.029)
Constant	-0.129***	-0.157***	-0.072**
	(0.006)	(0.019)	(0.036)
N		**5,555**	
County-level FIPS controls	No	Yes	Yes
Firm-level controls	No	No	Yes
R^2	0.00	0.29	0.33

[a] Superscript ***, **, and * denote statistical significance at the one, five, and ten percent level, respectively.

We also consider the inclusion of state-level control variables. When controlling for the political party of the state's governor, the proportion of the state's 2020 presidential election votes for Trump, the proportion of the state's beer packaged for draught in 2017, and the proportion of the state's 2018 GDP from tourism, the magnitude and statistical significance of our point estimates are identical to specification (3). However, the inclusion of these state-level controls does not improve our explanatory power, and their inclusion may be inappropriate given the inclusion of county-level fixed effects inherently capturing the unobserved heterogeneity. Therefore, specification (3) is our preferred specification.

Table 5. Change in brewery annual production from 2019 to 2020 as a function of whether the brewery received *late* first-tranche funding (April 10 – April 16, 2020) or *early* second-tranche funding (April 27 – May 3, 2020).

Variable	(1)	(2)	(3)	(4)
FirstTranche	0.027**	0.036***	0.034***	0.030**
	(0.012)	(0.012)	(0.012)	(0.012)
log(PPPFunds)	---	-0.029***	-0.029***	-0.022***
		(0.006)	(0.006)	(0.008)
Constant	-0.145***	0.173***	0.172***	0.006
	(0.009)	(0.065)	(0.065)	(0.079)
N		**1,346**		
County-level controls	No	No	Yes	Yes
Firm-level controls	No	No	No	Yes
R^2	0.00	0.02	0.02	0.09

[a] Superscript ***, **, and * denote statistical significance at the one, five, and ten percent level, respectively.

We also consider the inclusion of state-level control variables. When controlling for the political party of the state's governor, the proportion of the state's 2020 presidential election votes for Trump, the proportion of the state's beer packaged for draught in 2017, and the proportion of the state's 2018 GDP from tourism, the magnitude and statistical significance of our point estimates are nearly identical to specification (4). However, the inclusion of these state-level controls does not improve our explanatory power, and so specification (4) is our preferred specification.

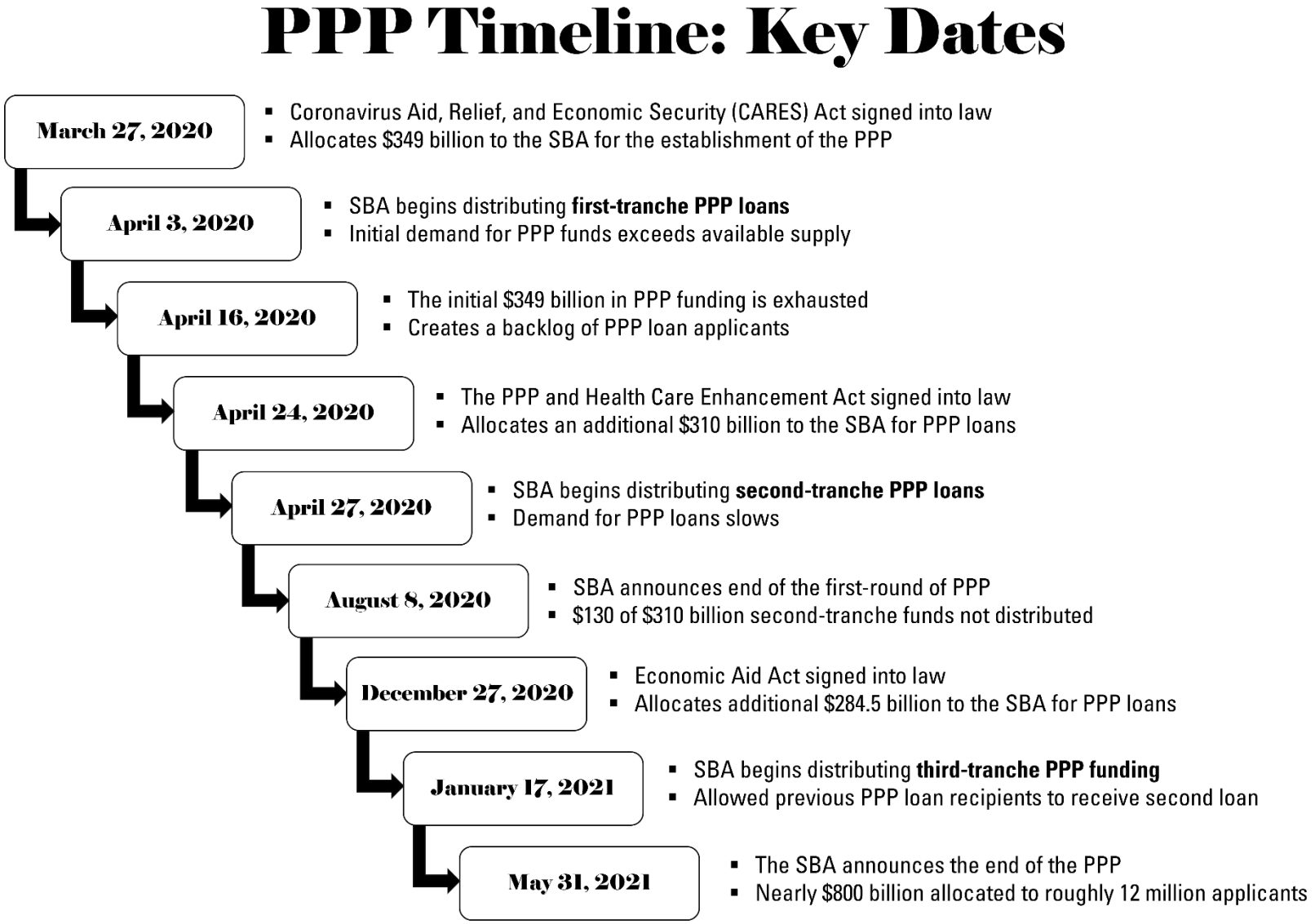
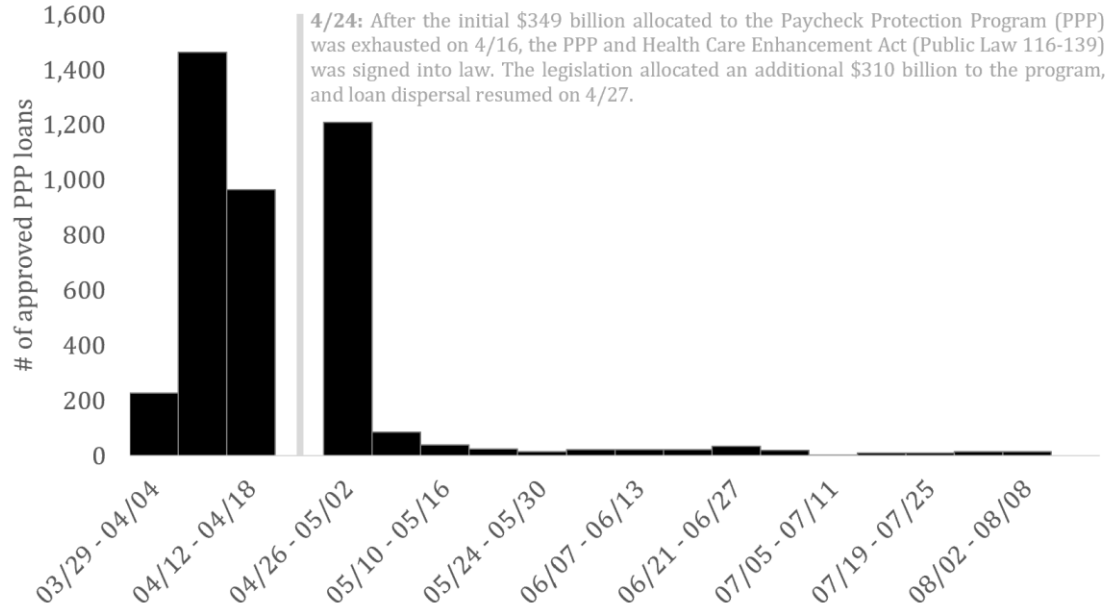


Figure 1. Timeline of key dates in the Paycheck Protection Program (PPP)

Panel A. PPP approved and distributed loans: April 3, 2020, to August 8, 2020



Panel B. PPP approved and distributed loans: January 15, 2021, to May 31, 2021

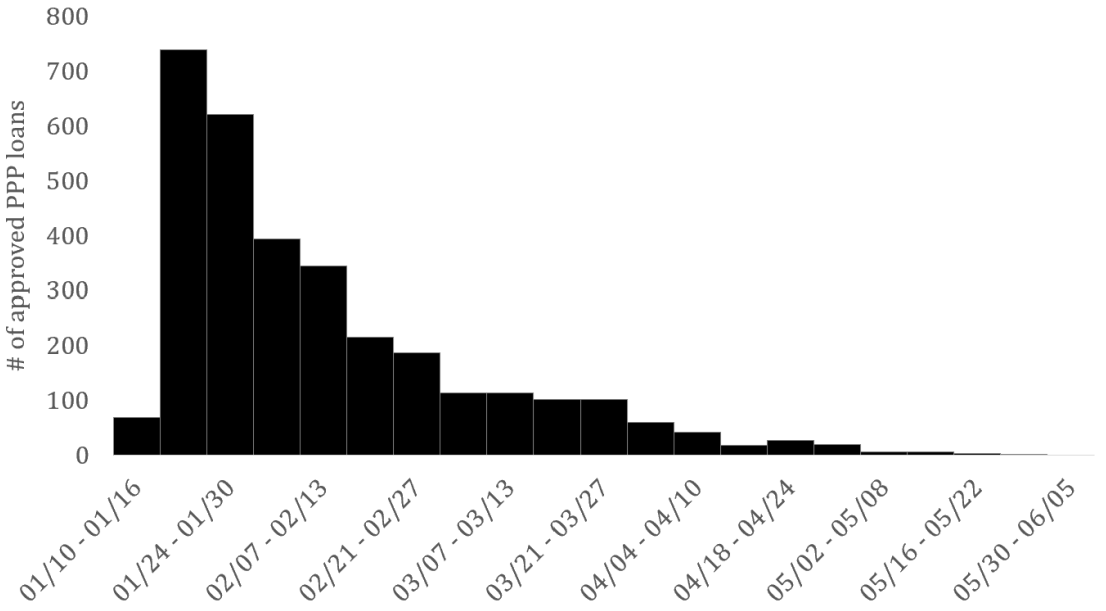


Figure 2. Timing and frequency of PPP loans to breweries, by week

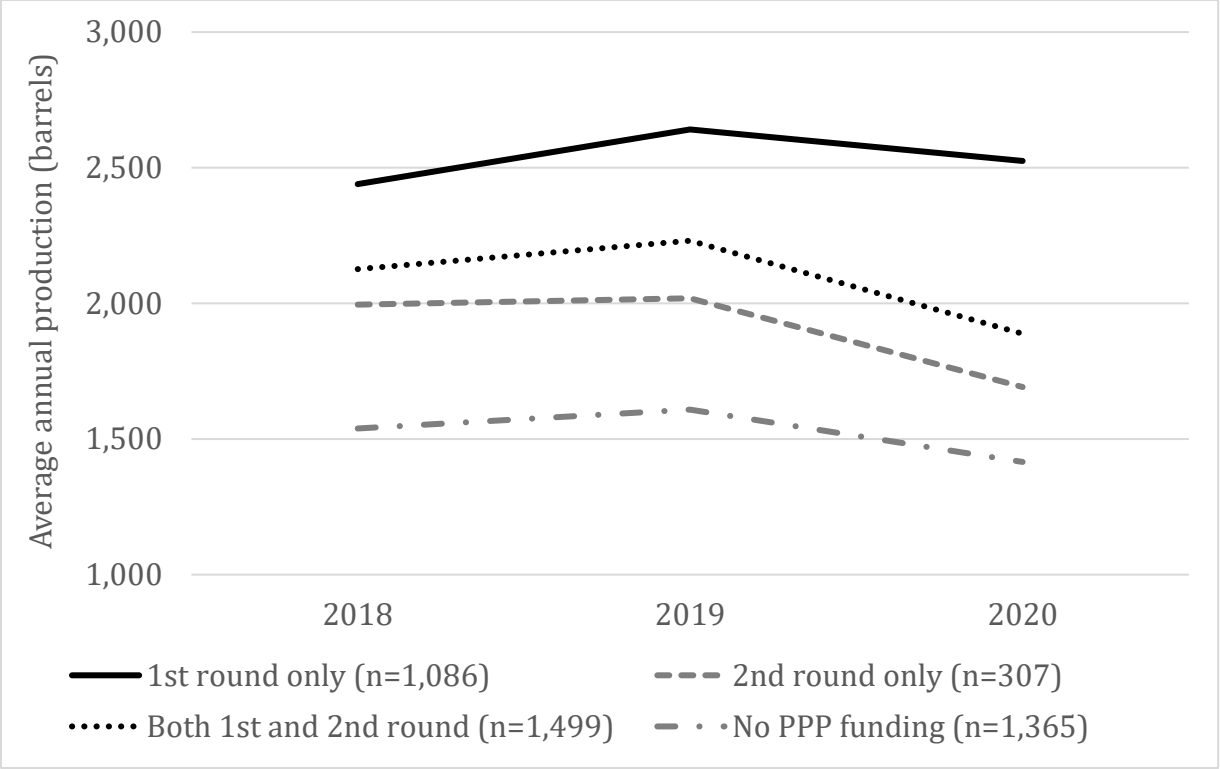


Figure 3. Average annual production (barrels/year) by PPP funding, 2018-2020 (n = 4,257)

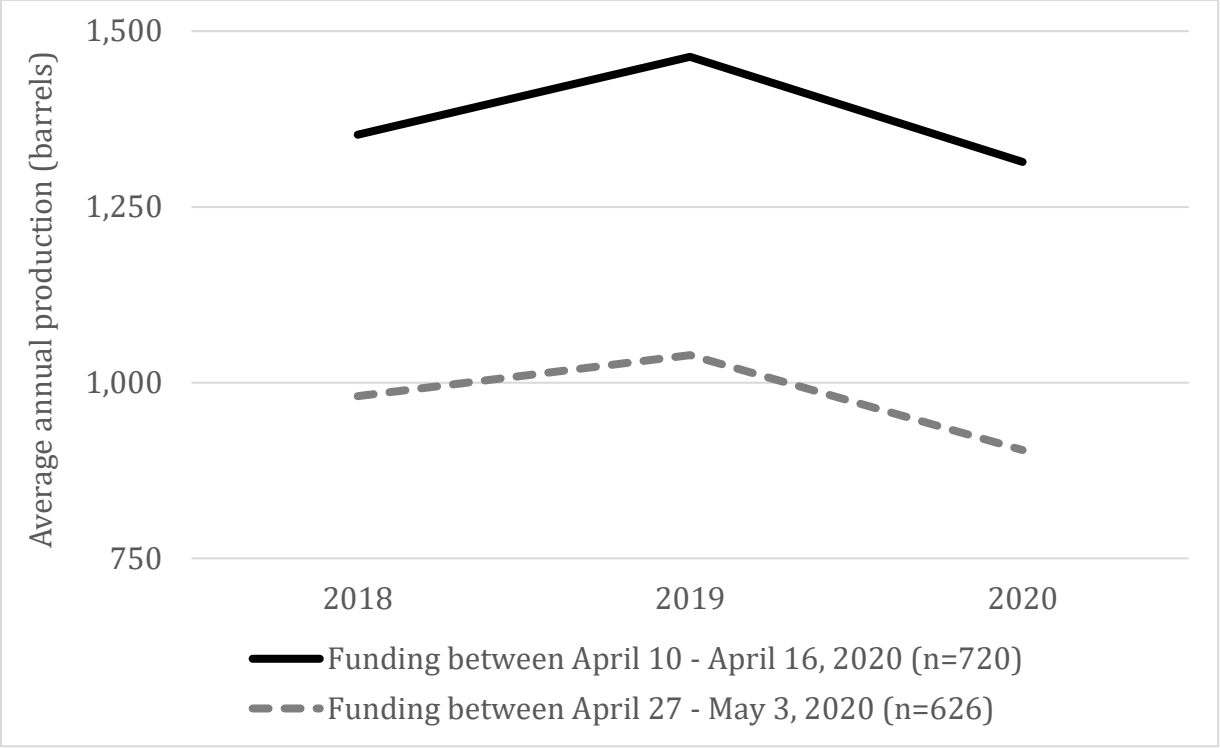


Figure 4. Production levels of breweries that received PPP funding between April 10 – 16, 2020, and April 27 – May 3, 2020 (n = 1,346)