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COUNTY-LEVEL UNEMPLOYMENT DYNAMICS FOLLOWING THE COVID
RECESSION: THE EFFECTS OF PPP LOAN TAKE UP

By

Preston Antes

A thesis submitted to the faculty of The University of Mississippi in partial fulfillment of
the requirements of the Sally McDonnell Barksdale Honors College.

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ABSTRACT

The COVID-19 pandemic caused a nationwide shutdown, dragging the US into a recession. To combat the effects of the pandemic on the economy, Congress created the Paycheck Protection Program (PPP) with the focus of preserving jobs and providing liquidity to small businesses. PPP created low-interest, forgivable business loans with forgiveness tied to a few benchmarks, providing a de facto cash transfer to small businesses. Did PPP preserve jobs? When examining Mississippi, this paper shows that counties with high cyclical unemployment participated more intensely in the program. Furthermore, the research shows that as loan totals grew within a county, local labor markets recovered. As such, this paper concludes that PPP did help preserve jobs.

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INTRODUCTION

The emergence of COVID-19 in the United States led to an unprecedented nationwide shutdown. While the primary focus of government policy shifted to healthcare, the nation's economy was at risk of a major recession. Firms and owners faced significant consequences between credit markets drying up and mass closures. However, owners were not the only individuals affected by the closures of small businesses. Small businesses employed over 47% of the US workforce before the COVID-19 pandemic (US Census Bureau , 2014). Thus, closures posed a massive threat to unemployment levels in the United States, with the risk of destroying the economic growth of the previous decade.

To assist these businesses and attempt to maintain employment levels, Congress created the Paycheck Protection Program (PPP) as part of the more encompassing *CARES Act*. H.R. 748, the *CARES Act*, was enacted on March 27, 2020. Authorizing around \$2.2 trillion in spending, it became the largest financial rescue package in US history. Congress allocated \$350 billion to PPP via the *CARES Act* (*CARES Act*, 2020). Later pieces of legislation brought the total funding for the program to around \$800 billion. To place the program in perspective, PPP alone nearly matched the total expenditures outlined in the American Recovery and Reinvestment Act of 2009¹.

¹ The American Recovery and Reinvestment Act of 2009 (ARRA) signed by President Obama on February 17, 2009, was a stimulus bill intended to deal with the effects of the Great Recession. At the time, the bill was estimated to be nearly \$787 billion in spending.

This program was unprecedented and far-reaching, based on the dollar figure and the number of firms affected. Furthermore, given the urgency of the situation, the rollout of PPP was immediate. In responding quickly, the program could be considered timely. However, while timely, PPP had relatively loose requirements for eligibility and loan forgiveness. Autor et al. (2022) claim this timeliness led to a lack of targeting due to vagueness. The lack of targeting within the program led to concerns about PPP. Firms that did not appear to need loans or those that committed fraud validated this concern in targeting. Research into the program, its effect, and its impacts has already begun and will be long-lasting.

In this thesis, I investigate the effects of PPP loan take-up on local labor markets in Mississippi. Lawmakers created PPP for two primary purposes: preserving jobs and providing liquidity. While both are essential to the program, this paper examines the program's effect on preserving jobs. In doing so it answers two questions. First, what types of counties participated most intensely in the PPP? Second, did a county's level of participation in PPP lead to a labor market recovery? The answers are counties with larger labor market contractions due to the pandemic and yes, respectively.

To reach these conclusions, I construct local cyclical unemployment time series data for each of the 82 counties within Mississippi. I then construct PPP loan participation measures for each county, given publicly available loan data from the Small Business Administration (SBA). Doing so allows me to regress cyclical unemployment measures on multiple variables, including running cumulative loan totals. These regressions provide evidence that counties with high cyclical unemployment participated more intensely in the program and as a county's PPP total grew, they experienced a labor market recovery. The

paper that is closest to this research is Autor et al.'s 2022 paper titled, "The \$800 Billion Paycheck Protection Program: Where Did the Money Go and Why Did It Go There?". Their research utilizes HR data to examine the effects of PPP loans on labor markets, reaching a similar conclusion that the program helped labor markets recover.

The rest of this thesis is organized as follows. The overview describes PPP while acknowledging past research conducted on the program. Section three describes the data sources used and the summary results generated. The fourth section discusses the empirical methodology used in this research, including spatial data and the Hamilton filter to calculate cyclical unemployment. Finally, the fifth section explores the results of the analysis, and section six concludes the thesis.

OVERVIEW OF PPP

The *CARES Act* created the Paycheck Protection Program (PPP) as part of a broader stimulus bill to keep the economy afloat during the COVID-19 pandemic. The legislation moved quickly through both chambers of Congress before being signed by President Trump in late March 2020. The *CARES Act* was the first of three pieces of legislation funding the program, allocating nearly \$350 billion to PPP (*CARES Act*, 2020). The second and third funding allocations were in the *Paycheck Protection Program and Health Care Enhancement Act* and *Consolidated Appropriations Act of 2021*, respectively, and helped PPP reach \$800 billion in funding.

Congress designated the \$800 billion as uncollateralized, low-interest loans up to \$10 million for small businesses. A small business, in this case, is generally defined as a firm with less than 500 employees (*CARES Act*, 2020). However, some exceptions in specific industries extended the limit above 500. The few other eligibility requirements to qualify for a loan included the firm being in operation before February 15, 2020, and the firm having employees for whom they paid salaries and payroll taxes (*CARES Act*, 2020). Eligible firms could apply for up to 2.5 times a monthly payroll expense up to the \$10 million limit (*CARES Act*, 2020).

The regulations for PPP designated loans to be spent on retaining workers and maintaining payrolls, just as the name implies. In addition, firms could use funds on mortgage, lease, and utility payments. While Congress designed the loans to have low-interest rates, the program also included a pathway for loan forgiveness. The pathway only

included three requirements. First, employee and compensation levels are maintained. Second, firms must spend loans on payroll costs and other eligible expenses (CARES Act, 2020). Finally, firms spend at least 60 percent of total funds on payroll costs. The original requirements, however, were more stringent, requiring 75 percent of a firm's loan to be spent on payroll costs. Whether or not the rule change influenced forgiveness rates, by the end of PPP, over 90 percent of loans were forgiven (Autor, et al., 2022). In essence, PPP appears to evolve from a nationwide loan program to a de facto cash transfer from the government to small businesses. It pumped billions of dollars directly into the economy. A broad response, as seen in the program, can be beneficial given the grim financial outlook facing firms at the onset of COVID-19, but this does lead to concerns about the lack of targeting in PPP.

Due to the significant uncertainty and urgency to assist constituents at the beginning of the pandemic, the federal government wrote, passed, and signed the *CARES ACT* within days. For PPP, this allowed the first funds to reach businesses by the middle of April—an unprecedented timeline for the transfer of over \$350 billion. Based on the rapid timeline, the program was timely. However, the legislation contained a distinct tradeoff in targeting to be that timely. PPP loans could be obtained by almost any small business, regardless of industry or region, despite certain firms facing higher financial risks based on their industry or location. Businesses in states such as New York or California faced more stringent lockdowns at the onset of the pandemic and for a more extended period. However, Autor et al. (2022) calculated the take-up rate of eligible firms nationwide at levels over 90 percent. In addition, some firms receiving loans were in relatively open regions compared to states plagued by COVID-19 from March to April.

Furthermore, firms deemed "essential" by state and local governments could still have loans forgiven. The untargeted approach of PPP led to a wide disbursement of funds throughout the United States. It also led to immense strain on the SBA and partnering banks.

To administer funds quickly, the SBA utilized private banks to facilitate the loans. Despite partnering with the private sector, quickly obtaining funds took much work. As João et al. (2022) acknowledge, different firms had varying levels of success in obtaining funds quickly, which can, in part, be attributed to the bank that processed the loans. In the same paper, the authors found that smaller banks were more successful in processing loans quickly for their clients. Some of the leading theories as to why include their preexisting relationships with clients and their utilization of humans over technological processing.

While the ability of the SBA, Treasury, and private banks to disperse funding should be commended, the rollout had multiple issues. First, a lack of communication between the SBA and partnering banks led to mass confusion. Even more troubling was that by April 16, less than two weeks after going live, PPP ran through all \$350 billion in allocated funds. In a joint statement, Treasury Secretary Steven Mnuchin and SBA Administrator Jovita Carranza stated the disbursement was "more than 14 years' of loans in less than 14 days" (Treasury, 2020). Furthermore, the agency lent around \$750 million in loans to over 200 publicly traded companies within the first two weeks (Sradars, 2020). While there were no rules against making these loans, it ran against the spirit of assisting small businesses. Major brands such as Ruth's Chris and the Los Angeles Lakers received loans while some small businesses worried if they would ever see funds (Zarrolì, 2020).

Despite the flashy headlines of favoritism to these publicly traded companies, around 1.6 million businesses were granted loans within the first two weeks (Sraders, 2020).

By April 27, PPP was running again with a second tranche of funding. This time the program had \$310 billion available to loan to eligible small businesses. This renewal made that Monday a busier day for loan requests than any day during the first tranche of funding. More importantly, it allowed researchers to compare loan differences between the first tranche of funding and the second.

Despite the flaws in the program, the SBA proved resilient under challenging circumstances. The program went live eight days after the passage of the *CARES Act*. This required around-the-clock collaboration between the Treasury, SBA, and private partners. As a result, the SBA oversaw nearly \$800 billion in loans in less than two weeks. In the fiscal year 2019, the SBA oversaw only around \$28 billion in loans (Small Business Administration, 2019).

Estimating the effects of the program can prove challenging. This is even more difficult since researching PPP is observational. Autor et al. (2022) and João et al. (2022) utilize microdata from the SBA and employment data from various payroll firms. Their methods allowed them to analyze the data with a difference-in-difference framework. With this framework in place, their research focused on firms near the upper tier of eligibility (approaching 500 employees) while using firms just above as a control group.

While the aims of the papers differed slightly, they all came to similar conclusions regarding PPP and its effects on employment. Autor et al. (2022) conclude that the \$525 billion in forgivable PPP loans during 2020 increased employment at participating firms by an estimated 2 to 5 percent. This number peaked in May and decreased as the year

progressed, with inconclusive evidence of an effect by year-end. A similar study estimated that the effect of PPP at year-end of 2020 is between 0 to 6 percent (Autor, et al., 2022). The same paper estimates the cost per worker retained is near \$258,000 (Autor, et al., 2022).

The acknowledged weakness, however, is that their regressions have difficulty accounting for smaller firms. That is because their calculations only considered those firms on the immediate side of the eligibility divide. Attempts to detect a causal effect among smaller firms utilized event-study estimates, with the results estimating higher employment upon receiving PPP loans (Autor, et al., 2022). This helps provide insight into the effects of PPP on small firms, a group with over a 90% take-up rate, without using a control group.

Focusing on firms with less than 250 employees is integral to understanding PPP effects in Mississippi. Small businesses are vital to the state's economy, comprising over 99 percent of all businesses and employing over 46 percent of Mississippi employees (SBA Office of Advocacy, 2017). Furthermore, over half of Mississippi small businesses contain less than 100 employees (SBA Office of Advocacy, 2017). With this data, it seems pertinent to focus on the effects of utilizing all small businesses.

This thesis utilizes the same loan data from the SBA. This public information gives the loan amount, borrower and project location, and processing date, among other data points. However, unlike past research into PPP, this paper will look for effects on a county level. The county-level employment data is available from the St. Louis Federal Reserve's "Federal Reserve Economic Data" (FRED) site. This pulls monthly, non-seasonally adjusted unemployment data from each US county. Since PPP focuses on small businesses, one way to measure its outcome is its effect on unemployment within a given county. This

paper also conducts a spatial regression to see if geographical differences influenced PPP outcomes. In doing so, the results can help policymakers evaluate whether PPP was effective in Mississippi.

THE DATA

As previously stated, I obtained most data for this analysis from the SBA's PPP loan data. The SBA made information for every PPP loan public. Their database includes loan amounts, the recipient, approval dates, the borrower and project county, and the forgiveness status. While this is available for the entire country, this research focuses solely on Mississippi. This paper pulled data from the SBA after PPP ended, ensuring the "current approval amounts" are the final approval amounts for a given county.

The SBA approved over 180,000 loans for small businesses within Mississippi (Small Business Administration, 2022a; 2022b). Loans totaled over \$5.4 billion throughout the state (Small Business Administration, 2022a; 2022b). The total loans approved for Mississippi were around .7 percent of the total loans approved in the US. That number is unsurprising given that Mississippi contains around .7 percent of US small business employment (U.S. Census Bureau, 2023). The two industries receiving the highest approved loan totals were "Health Care and Social Assistance" and "Construction" at \$738,628,041 and \$632,661,398, respectively. While construction mirrors nationwide approval rates for the industry, the percentage of health care and social assistance relative to other industries was much higher. Below is a table containing the percentage of loans within a given North American Industry Classification System (NAICS) code. Five different industries comprised nearly 50 percent of the state's loans. Below is a table outlining the share of a given industry within Mississippi.

Code	Industry	Share
1x	Agriculture	4
2x	Mining, Utilities, & Construction	13
	<i>Mining</i>	<i>1</i>
	<i>Utilities</i>	<i>1</i>
	<i>Construction</i>	<i>12</i>
3x	Manufacturing	8
4x	Trade	20
	<i>Wholesale Trade</i>	<i>4</i>
	<i>Retail Trade</i>	<i>9</i>
	<i>Transportation & Warehousing</i>	<i>6</i>
5x	Business Services	18
	<i>Information</i>	<i>1</i>
	<i>Finance & Insurance</i>	<i>2</i>
	<i>Real Estate</i>	<i>2</i>
	<i>Professional, Scientific, & Technical</i>	<i>8</i>
	<i>Management</i>	<i>0</i>
	<i>Miscellaneous Business Services</i>	<i>5</i>
6x	Healthcare & Education	15
	<i>Educational</i>	<i>2</i>
	<i>Healthcare & Social Assistance</i>	<i>14</i>
7x	Hospitality & Food	11
	<i>Arts, Entertainment, & Recreation</i>	<i>1</i>
	<i>Food Services</i>	<i>9</i>
8x	Other Services	9
9x	Public Administration	1
TOTAL		100

Table 1

Another major component of understanding PPP data in Mississippi is the geographic component. Figure 1 (below) shows current approval amounts for each county in the state. Generally, gross loan totals are highest near population centers and economic hubs. The highest totals are located around the capital (Hinds, Madison, Rankin) and on the gulf coast (Harrison). The top six counties in current approval totals accounted for 40

percent of Mississippi PPP loan approvals. While this is helpful, this data is not surprising. Values in both figures are in the thousands and spaced in five brackets.

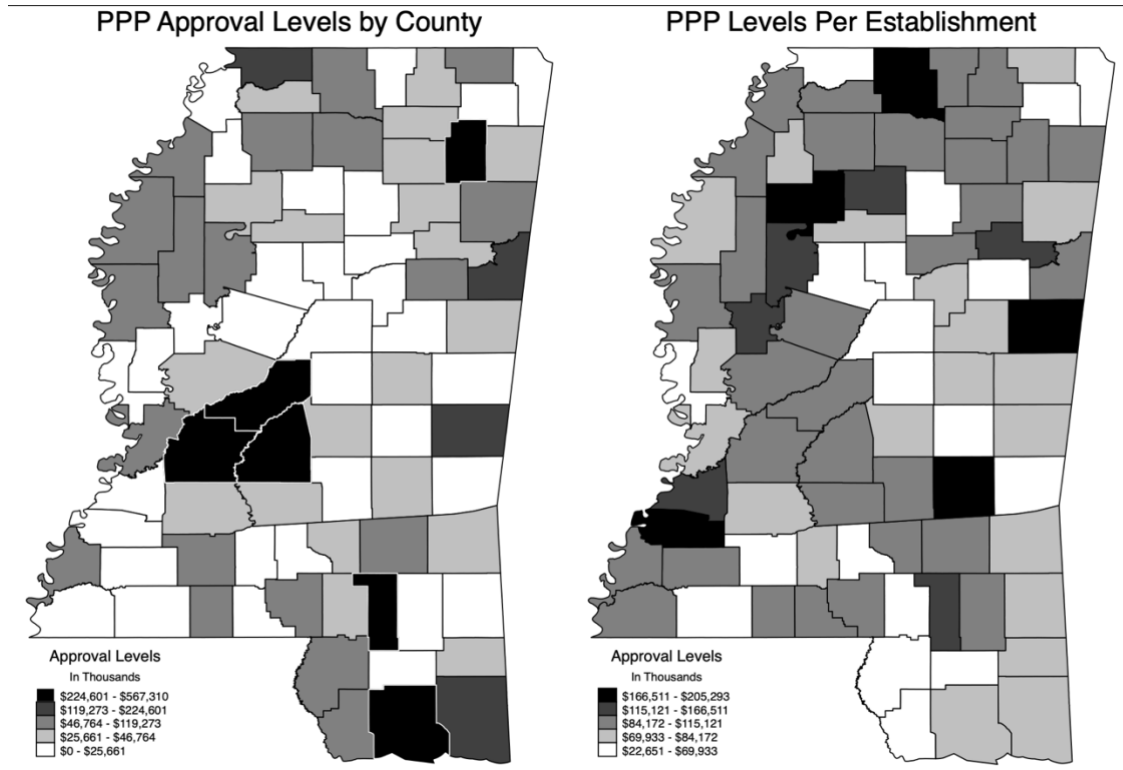


Figure 1

Figure 2

To get a better understanding of the disbursement of PPP loans within Mississippi, I normalized current approval amounts by the number of private establishments in each county. I sourced data for the number of private establishments in a county from FRED. While FRED has quarterly data spanning decades, I used the private establishment figures from quarter four of 2019. These are good figures to normalize current approvals as it is the last full quarter before the COVID-19 pandemic. Figure 2 displays the results of normalization. Upon examination, normalization shows a clear shift from urban centers to more rural areas. Now, instead of the highest counties surrounding the city of Jackson, the largest five are dispersed across the state. The largest county per establishment is Jasper County in Southeast Mississippi.

The cause of this distinct shift is unknown. It could be that the more rural counties contained bigger firms but smaller quantities of private establishments. Another theory could be that a level of PPP fraud occurred, leading these counties to be higher. Both are valid theories for a shift. This paper, however, examines if this shift is at all correlated with a higher cyclical component unemployment, meaning counties with higher levels of unemployment due to COVID-19 received higher loan total per establishment.

METHODOLOGY

As previously stated, this research aimed to examine the correlation and effects, if any, PPP loan approvals had on county-level unemployment. The two goals of PPP were preserving jobs and maintaining liquidity among small businesses. This paper measures PPP effects on the former. To accomplish this, I ran several regressions to measure both correlation and causality.

However, since my research centers around unemployment levels, I first needed to utilize a theory to examine the effect of COVID-19 on unemployment. The data sourced from FRED is observational. That means the unemployment figures available have already built-in effects from variables such as PPP but also a spike of some level due to the COVID-19 pandemic. Therefore, to properly examine unemployment, I needed a baseline forecast of what unemployment should have been and the subsequent difference between the forecasted and realized outcomes, termed the "cyclical component of unemployment." To construct a model of cyclical unemployment during the pandemic period, this research relied upon the Hamilton Filter.

The Hamilton filter regresses current data on past data at a business cycle horizon of two years (Hamilton, 2018). The controls include past year measures of the outcome variable at a two-year lag. That is, given a time series variable, y_t , I perform the following regression:

$$y_t = \alpha + \sum_{h=24}^{35} \beta_h y_{t-h} + \varepsilon_t$$

(1)

Given the model estimates, I obtain a predicted series \hat{y}_t . The difference between the actual, y_t , and predicted values provides an estimate of the cyclical variability of the outcome variable of interest. That is, this measure compares what I would have forecasted the variable two years ahead to be to realized outcomes providing an estimate of the business cycle effect on the variable. An example is 8-quarter ahead data regressed on current data along with one to 3-quarter lags. Fitted values of the underlying data from this regression forecast the variable in 2 years based on the current information.

The difference between the estimate and actual unemployment figures, yielded the cyclical component of unemployment. The following figure provides an example of how this model works. It shows two Mississippi counties' cyclical components of unemployment, Lafayette and Jackson. Lafayette is the dashed line, while Jackson is a solid line. While the two mirror each other closely, the cyclical component has two noticeable spikes. In 2005, the cyclical component of Jackson County, a coastal county, spiked due to Hurricane Katrina. Lafayette, being in north Mississippi, did not observe a spike. However, because of this spike in realized unemployment, the Hamilton filter underpredicts two years into the future because of its forecast based on business cycle theory. This is why, in future

regressions in this research are normalized by unemployment 24 months previously. Using

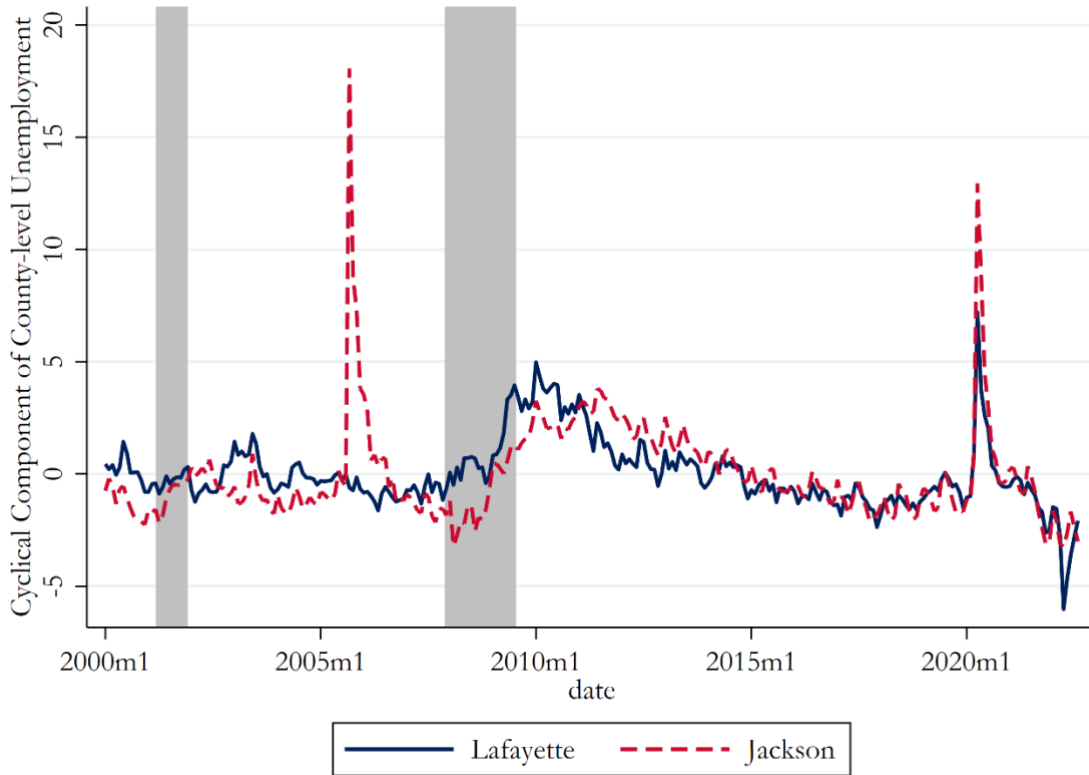


Figure 3

the independent variable of a 24-month unemployment lag, I remove any differences across counties after PPP expired.

Given the cyclical unemployment rate estimates for each county, I first estimate the following regression to quantify the cumulative PPP loan take-up correlation with cyclical unemployment across counties. I conduct the following least-squares regression:

$$\text{cyc. unemp. rate}_i = \gamma + \delta_t(\text{cumulative PPP loan take up}_i) + \delta_2(\text{unemp. rate}_{i,t-24}) + \varepsilon_i \quad (2)$$

at each time horizon t providing a sequence of $\hat{\delta}_t$ estimates from January 2018 to August 2021. I control for the unemployment rate two years ago as abnormally high unemployment

rates within a county at the start of the Covid induce high cyclical estimates in March/April 2020 with very low cyclical estimates in March/April 2021.

This regresses the 24-month lag of unemployment and the log of PPP current approval levels normalized per establishment. While this is beneficial, there is a concern that this does not factor in unobserved heterogeneity. In the context of PPP loans during the COVID-19 pandemic, time-invariant factors affected the results in the previous regression. These include local policies or the large portion of Mississippians that commute across counties for work. To better examine the correlation between PPP funds and unemployment, I run a panel regression as follows:

$$cyc.unemp.rate_{i,t} = \gamma + \delta_{i,t}(cumulative\ PPP\ loan\ take\ up) + \delta_2(unemp.rate_{i,t-24}) + \varepsilon_{i,t} + \eta$$

(3)

The previous equation considers fixed effects across counties and provides a better-fitting model to understand the question at hand. The model includes the same independent variables as the previous but with the inclusion of fixed effects. In adding fixed effects, this model should obtain more accurate and reliable estimates among the variables.

While these provide insight into correlation between counties with a high cyclical component of unemployment and cumulative loans received, they cannot explain any element of causality. As such, I create four more specifications, only regressing months in which the growth rate of the running cumulative unemployment is not equal to 0. This is important in setting up the regressions because PPP was a one-time loan to a business, at least for most of the program. This means that once a small business received PPP funds, it could not consistently draw more funds over time. By August, some counties

had completely expended their “allotment” of PPP loans. Measuring a log of running cumulative PPP totals would paint an incorrect picture.

In addition to accounting for months with a growth rate of 0, I added lags and leads into two specifications. Doing so allows for an examination into whether PPP loans in previous months or the expectation of funds in the future impacted cyclical unemployment in a county.

In conclusion, this research utilized several methodologies to examine the effects of PPP loans on county-level unemployment, specifically the targeting of PPP and whether it preserved jobs. The first step was to establish a baseline forecast of what unemployment should have been during the pandemic period, which was achieved through the Hamilton filter. The difference between the forecasted and realized unemployment figures yielded the cyclical component of unemployment. Regression analysis was then conducted to determine if an increased cyclical component correlated with PPP levels in each county and whether funds effected unemployment while accounting for months with zero growth rates. While this analysis was beneficial, it did not factor in unobserved heterogeneity, leading to the implementation of a panel regression with fixed effects. The results of both regressions are discussed in the next section.

RESULTS

The original OLS regression yields the data depicted in figure 4. The graph runs from 2018 through 2022 to fully encapsulate the period in question while giving adequate background. The dashed vertical line marks the beginning of the recession in the US and a de facto beginning of the pandemic. From 2018 until the pandemic, there was little to no correlation between counties with high PPP loan take-up and cyclical unemployment. That should be the case, given that no counties have PPP loans. However, once the pandemic begins, counties with higher loan take-up are correlated with a higher cyclical level of unemployment.

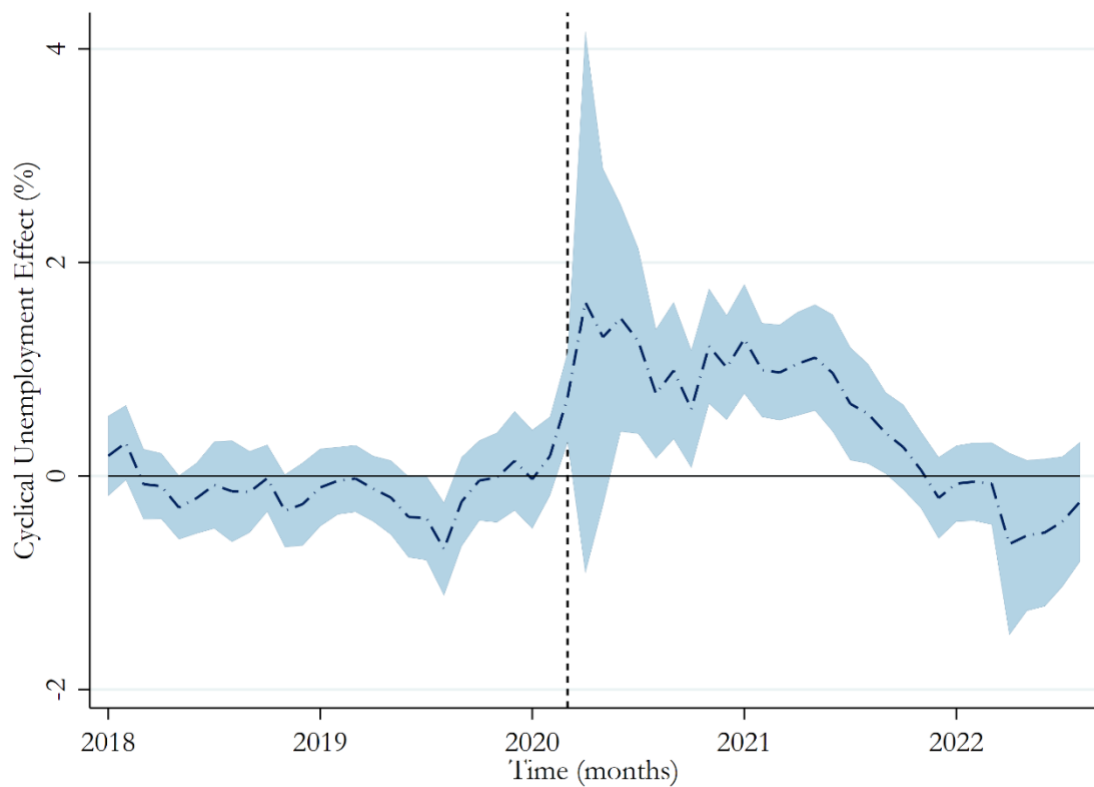


Figure 4

These results merely show a correlation between the take-up levels of counties in Mississippi and those with higher cyclical unemployment levels. The results do not imply causation. However, the table 2 records the results of the six specifications used in this research.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
% Δ RunCum	.1101 (.0082)	.1150 (.0081)	.0724 (.0067)	-.0595 (.0083)	-.0681 (.0080)	-.0770 (.0084)	-.0556 (.0069)	-.0378 (.0082)
L.							-.0241 (.0063)	-.0279 (.0063)
F.								-.0286 (.0074)
Unemp _{t-24}			-.5854 (.0171)			-.3118 (.0919)	.2996 (.0724)	.2934 (.0715)
Dropped 0s	No	No	No	Yes	Yes	Yes	Yes	Yes
FE	No	Yes	Yes	No	Yes	Yes	Yes	Yes
#OBS	2,296	2,296	2,296	765	765	765	683	683

Table 2

The first three specifications do not account for removing months when the growth rate of the running cumulative unemployment is 0. This allows for over 2,000 observations yet it fails to correctly account for how PPP works as previously mentioned. Running take-up controlling for the fact that once a firm takes PPP, it cannot take up again, shows significant negative correlation between growth in PPP loan and cyclical unemployment levels. Meaning in specification six, as 10 percent increase in take-up results in a .7 percent decrease in the cyclical component of unemployment. These are robust figures that are also evidenced in specifications 7 and 8. In both the coefficients are simply spread out between the percent change in running cumulative loans and any lags or leads. Evidence shows that it appears counties with a higher need participated more intensely, controlling for increased participation, growth is correlated with lower cyclical unemployment rates.

CONCLUSION

The COVID-19 pandemic risked plunging the US economy into a major recession. Small businesses faced potentially dire consequences between credit access drying up and government-mandated shutdowns. As such, the federal government instituted the Paycheck Protection Program to preserve jobs and maintain liquidity among small businesses.

PPP administered through the SBA, and partnering banks accomplished the task of distributing millions of loans to small businesses across the country in just weeks. However, the timeliness of the program led to a deep concern among policymakers and economists that PPP was not targeted. While the language-creating eligibility standards may have seemed vague, the research of this paper shows there is a distinct correlation between counties with higher cyclical unemployment during the pandemic and those counties with a higher take-up of loans. This suggests that while not explicitly targeting PPP may have been effectively distributed to areas that needed funds most.

Furthermore, PPP was designated to stabilize labor markets as well. Loans required a firm to cover payroll costs with the incentive of loan forgiveness. Previous research concluded that PPP saved jobs and this research continues to show a strong correlation between increased participation growth within a county and a decreasing cyclical unemployment rate. While this is a promising conclusion more research is needed to assess the impacts of PPP on local labor markets.

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