Data Engineering Final Exam

Analysis of US Business Loans for Covid-19 Relief

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Introduction

The Covid-19 pandemic had a severe impact on the economies of countries worldwide. In the United States, businesses were offered government loan programs to aid employers and employees financially and provide overall economic stability.. This report focuses on two such programs: the Paycheck Protection Program (PPP) and the Economic Injury Disaster Loan (EIDL). The PPP, created specifically to mitigate the Covid-19 impact, provides forgivable loans to small businesses to maintain their payroll and cover eligible expenses. Unlike the PPP, the EIDL program has existed for years, offering low-interest loans to assist businesses suffering economic injury due to declared disasters. Our goal is to understand the distribution of these loans across the states. We analyzed the total number and amount of loans provided by both the PPP and EIDL programs. Furthermore, we normalized these figures based on the number of firms in each state and the total annual payroll, using data from the US Census's Annual Business Survey. Our conclusions indicate significant disparities in loan distribution across states and industries, with arts, entertainment, and non-traditional businesses receiving more targeted support, effectively stabilizing payroll expenses and boosting consumer confidence and spending.

In the following sections, we present our analysis of the loan distributions, identify which states and industries were most and least supported, and examine the impact on consumer spending.

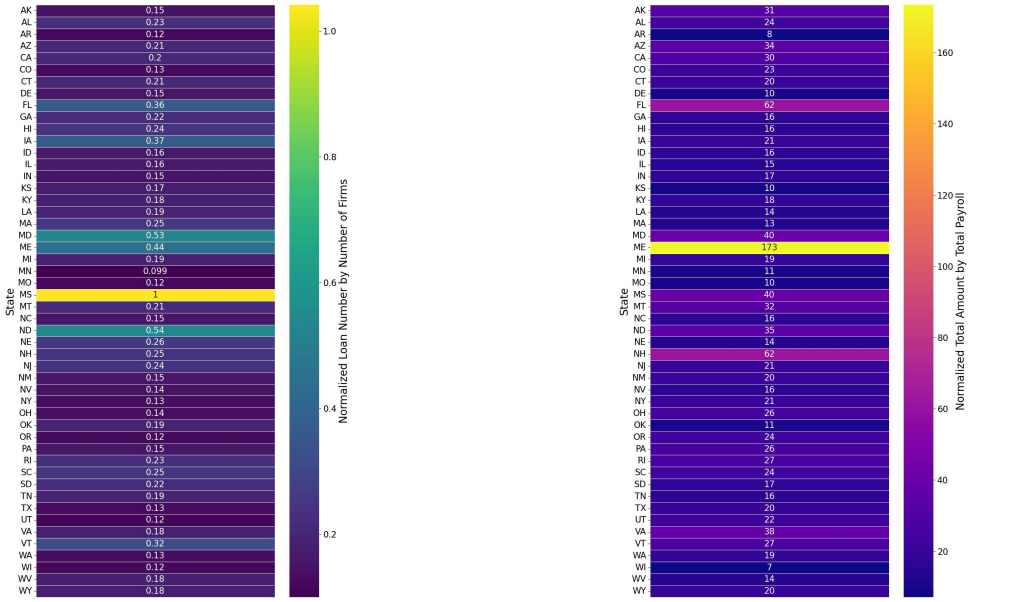
Data Processing

The data for this report were analyzed using Python software.

Initially, we loaded the PPP dataset in the memory and cleaned it by focusing on key variables such as the loan amounts, the states of the borrowers, approval dates, and industry codes. Next we loaded the EIDL data in the memory and utilized variables aligning with the PPP data, despite the absence of industry codes in the EIDL dataset. The datasets were then concatenated to create a comprehensive data frame containing all relevant information. With the combined data, we calculated the total number and amount of loans for each state. To account for the difference in business and state sizes, we need to normalize the calculated numbers. For this purpose, we used the data from the US Census's Annual Business Survey. To normalize the number of loans we used the information of total number of firms per state. The total loan amount was normalized using the annual payroll of employees.

Loan Distribution

Analysis per State



(a) Normalized Number of Loans by State

(b) Normalized Total Amount of Loans by State

Figure 1: Comparison of Loan Data by State

Figure 1a highlights which states received the most support relative to their business population. States like Mississippi (MS), Maryland (MD), and North Dakota (ND) received the highest number of loans per business, indicating robust support. Conversely, Minnesota (MN) had the lowest normalized number of loans, reflecting less support per business.

Figure 1b displays the normalized total amount of loans by state. Florida (FL), Maryland (MD), and New Hampshire (NH) received the highest per business, while Wisconsin (WI) and Arkansas (AR) received the lowest. Mississippi's highest normalized number of loans (1.0) and Maine's substantial loan distribution (0.44) suggest effective outreach and high demand. States like Maine, Mississippi, Virginia (VA), and Vermont (VT) benefited significantly, aiding payroll stabilization and employee retention. Conversely, Minnesota and Wisconsin's low support levels indicate potential access challenges, such as ineffective outreach or bureaucratic hurdles.

Analysis per Industry

After analyzing the data based on the different industries, we highlight the two most and two least helped business sectors.

Industry	Value
Nonclassifiable Establishments	10743,93
Arts, Entertainment, Recreation	2204,71

Table 1: Most helped industries

Industry	Value
Utilities	121.53
Management of Companies and Enterprises	115.43

Table 2: Least helped industries

Table 1 displays that the most supported industries through the loan programs were Nonclassifiable Establishments and the Arts, Entertainment, and Recreation sector. Nonclassifiable Establishments, covering businesses with unique or diverse activities, received the highest total amount per payroll. The Arts, Entertainment, and Recreation sector, significantly affected by pandemic restrictions, also saw substantial support.

Conversely, table 2 indicates that the Utilities sector, providing essential services like electricity and water, and the Management of Companies and Enterprises received less support per payroll. This shows a focus on stabilizing sectors most impacted by the pandemic, while essential services and administrative sectors received comparatively less assistance.

Impact on consumer spending

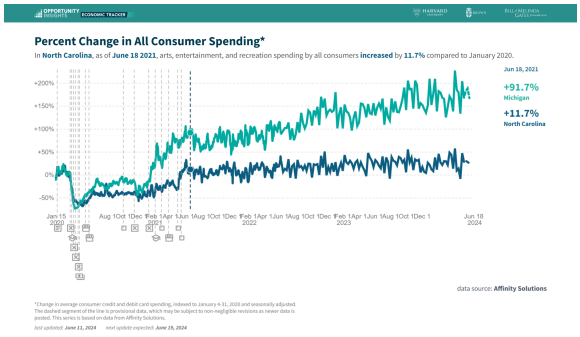


Figure 2: Consumer spending differences between Michigan and North Carolina

Attributes	Michigan	North Carolina
Loan Count	8006	7508
Total Loan Amount	196.678.048	165.882.800
Firms	45575.0	59317.0
Annual Payroll	**8.168.533**	**22.246.809**
Total Employees	250.132	447.169
Loan Amount/Employees	**786,29**	**370,96**
Loan Amount/Payroll	**24,07**	**7,45**

Table 3: Arts, Entertainment and Recreation attributes for Michigan and North Carolina

Figure 2 shows a significant increase in consumer spending in Michigan compared to North Carolina. According to table 3, the number of loans, total loan amount, and number of firms are similar in both states for the Arts, Entertainment, and Recreation sector. However, Michigan, a less wealthy state, received a higher loan amount per payroll and per employee, providing extra help. This higher financial support per unit contributed significantly to stabilizing payroll and retaining employees, leading to a more notable improvement in consumer spending compared to North Carolina.

Conclusions

The analysis reveals significant disparities in the distribution of PPP and EIDL loans across different states and industries. Some states received substantial financial support relative to their business populations, indicating effective outreach and high demand. Conversely, other states experienced lower levels of support, suggesting potential access challenges. Industries such as arts, entertainment, and recreation, along with diverse nonclassifiable establishments, benefited significantly from the loan programs. In contrast, essential services like utilities and administrative sectors received comparatively less assistance. This underscores the importance of tailored financial assistance to address the varied impacts of the pandemic across different regions and sectors.