A CRITICAL NEED FOR MARKET MATCH

A quantitative study of L.A. County farmers' market food assistance program usage during the COVID-19 pandemic

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ABSTRACT

Farmers' markets are highly social marketplaces that provide accessibility to healthy food for local communities. Many markets are authorized to accept food assistance program benefits, such as those from Supplemental Nutrition Assistance Program (SNAP), and nutrition incentive programs, such as Market Match in California, which highly benefit populations who are eligible to receive food assistance benefits. Yet, a new culture of caution and social distancing due to the COVID-19 pandemic has challenged the ways farmers' markets provide food security for local communities. Meanwhile, food insecurity arises due to the effects of the pandemic and many consumers become newly eligible to receive benefits from food assistance programs. This study aims to explore the following: **how has the COVID-19 pandemic impacted food assistance program usage at farmers' markets in Los Angeles County? How can we expand the policies of food assistance programs, given the operational setbacks from the pandemic?** This study utilized Market Match as a proxy for food assistance program usage at 33 out of approximately 40 farmers' markets in Los Angeles County that participate in Market Match. It takes on a quantitative approach, using bivariate Pearson correlations and panel regression analysis via SPSS, to analyze the relationship between COVID-19 cases in Los Angeles County and Market Match sales and customer count for the studied farmers' markets. Results revealed that Market Match usage increased as COVID-19 cases increased. Additionally, COVID-19 cases were able to reliably predict changes in Market Match usage. Because more customers utilized Market Match in spite of the challenges of the COVID-19 pandemic, an increase in Market Match budget and accessibility in Los Angeles County may be appropriate to supply an increasing demand for this program. Future research may also justify an increase in Market Match budget through a study on other Market Match- participating farmers' markets in other counties in California.

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DEFINITIONS

Food assistance programs: Federal Nutrition Assistance Programs by the United States Department of Agriculture aimed to increase food security and reduce hunger by working with state and local governments (USDA Food and Nutrition Service). Common federal food assistance programs at the farmers market include the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Calfresh: The SNAP program in the State of California. It provides monthly food benefits to individuals and families with low income. It is federally mandated, state-supervised, county-operated, and distributed by the Department of Social Services.

Market Match: California's healthy food incentive program, which provides monetary incentives to customers who use their CalFresh EBT benefits at the farmers market. When customers obtain tokens or vouchers by spending their CalFresh EBT, Market Match provides additional funds to be used only on fresh fruits and vegetables ("Market Match Impact Report," 2018).

COVID-19 pandemic: A global outbreak of a novel strain of coronavirus that first appeared in December 2019 but was declared a global emergency in January 2020 by the World Health Organization. It is transmitted primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, and so, practicing social distancing is recommended to slow transmission (World Health Organization, 2020).

INTRODUCTION

Farmers' markets provide convenience and accessibility for the public to obtain locally-sourced food. According to a study by Project for Public Spaces (2013), 60 percent of farmers' market shoppers in the U.S. felt that their local farmer's markets offer better prices than supermarkets, and only 17 percent of shoppers cited "high prices" as a deterrent to shop locally. The 2016 National Consumer Survey study on consumer shopping patterns reported that 12% of all adults in the U.S. frequently shop for their groceries at farmers' markets. (Natural and Organic Foods and Beverages in the U.S., Fifth Edition, 2016). Thus, many rely on farmers' markets to provide their daily source of food rather than at supermarkets and big-box retail stores. These markets also expand food accessibility for food insecure individuals through the use of federal food assistance programs. The U.S. Department of Agriculture (USDA) found that benefits from food assistance program usage include the alleviation of poverty and an increase in food expenditures (Winicki et. al, 2002).

However, the magnitude of the COVID-19 pandemic has revealed a challenge in continuing previous farmers' market operations. Significant and long-term repercussions of the pandemic were felt on all aspects of urban life, including local and small businesses. Although farmers' markets were previously community centerpieces for everyone to obtain access to local and fresh food, social distancing guidelines challenge markets to adjust how they deliver food accessibility while adhering to public health standards.

As food insecurity rates drastically increase due to the restrictive nature of the pandemic, it is essential to adjust previous farmers' market food assistance policies so that they can accommodate a larger population of food insecure individuals. In my research, I analyze

what, if any, effects the COVID-19 pandemic has on food assistance sales at L.A. farmers' markets. **How has the COVID-19 pandemic impacted food assistance program usage at LA farmers markets? How can we expand the policies of food assistance programs, given the operational setbacks from the pandemic?**

Using Statistical Practices for the Social Sciences (SPSS), this research statistically analyzes farmers' market food assistance data and COVID-19 cases data to identify relationships between food assistance program usage and the severity of the pandemic. Data for food assistance programs comes from Market Match, a California nutrition incentive program. Although there may be other variables that impact food assistance data during the COVID-19 pandemic, identifying how the pandemic impacts food assistance usage is essential to provide recommendations for additional funding for food assistance programs.

BACKGROUND

Farmers' markets and food assistance programs

Farmers' markets highly benefit low-income populations by offering food assistance programs such as SNAP (or the CalFresh program in California), WIC, and Market Match. In 2016, the City of Los Angeles adopted a law mandating all farmers markets operating on City property to accept CalFresh (Ferguson, 2016). Consumers can spend their CalFresh payments using the EBT (Electronic Benefit Transfer) system at the farmers market by swiping their EBT card at the market info booth and then obtaining tokens or vouchers to be used at individual vendors. WIC checks, recently replaced by WIC Cards by the California Department of Public Health, can also be used by exchanging them for tokens or vouchers at the market info booth. Markets that participate in Market Match are able to incentivize the use of food assistance programs by doubling the amount of funds provided by CalFresh and other food assistance programs to use towards fresh produce.[7]

Market Match

The California Market Match program was founded in 2009 by Roots of Change and started out as just a handful of market operators and community-based organizations. In 2012, Roots of Change partnered with Ecology Center, a nonprofit organization focused on improving the health and well-being of urban residents, to expand the Market Match program. Market Match then expanded even further when, in 2015, the U.S. Department of Agriculture awarded a $3.7 million federal Food Insecurity Nutrition Incentive (FINI) grant to "improve the health

[7] Market Match can only be used towards fruits and vegetables.

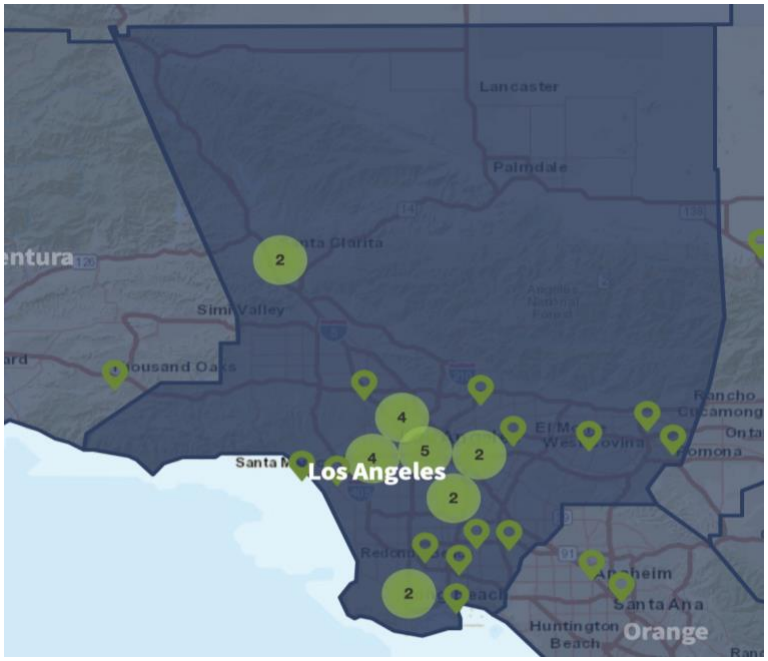
and vitality of low-income Californians and increase the financial sustainability of small and medium family farms and their employees" (University of Southern California, Ecology Center, 2018, pg. 2). The FINI grant has fueled an enormous upwards economic impact leveraged from Market Match dollars. Based on 2018 Market Match findings, the program has created a 107% increase from Market Match sites and a 453% jump in Market Match transactions from 2013 to 2017. Market Match has also created a total of $9.7 million in economic impact from the $2.5 million of Market Match redemption during the FINI grant period (University of Southern California, Ecology Center, 2018).

Using a network model, Market Match uses Ecology Center as a central hub to provide grant administration and training to subcontracting lead partners. Lead partners then have community partners of their own, allowing multiple stakeholders to receive benefits and expand community outreach as much as possible.

As of July 1, 2020, there are 134 certified farmers markets in Los Angeles County (California Department of Food and Agriculture). According to Ecology Center's Farmers' Market Finder, only 40 of these markets utilize Market Match alongside CalFresh. **Figure 1** is taken from Ecology Center's online Farmers' Market Finder and geographically illustrates L.A. County's 40 Market Match-approved farmers markets.[9]

[9] 40 is an approximate figure for the number of L.A. County farmers' markets participating in Market Match, due to the lack of data record for other markets not funded by Ecology Center. There is no publicly available centralized data source for all Market Match farmers' markets.

Figure 1



Source: Farmers' Market Finder by the Ecology Center. https://ecologycenter.org/fmfinder/.

COVID-19 pandemic and farmers' markets

After the COVID-19 pandemic forced the U.S. into lockdown since March 2020, cities began slowly lifting restrictions on reopening as they responded to a crippling economy. Most farmers' markets, which are deemed an essential service alongside grocery stores, were able to reopen in early March- April 2020 in Los Angeles County. Although reopening dates for farmers' markets were on the earlier side, significant and long-term repercussions of the pandemic will be felt for an undetermined amount of time before businesses transition back into previous operational statuses. Temporary market closures and a need for social distancing may have caused some challenges for food accessibility among local communities.

LITERATURE REVIEW

Introduction

The novelty of the current COVID-19 pandemic creates a challenge in gathering concrete information that analyzes how the pandemic affects farmers' market operations, or more specifically, farmers' market food assistance usage. There are currently observational sources highlighting the difficulties the pandemic has placed upon farmers' markets. Yet, there lacks objectively analytical sources that provide evidence of how the pandemic shifts market sales data. It is essential to review previous literature that discusses the benefits of food assistance programs on food security and draw connections to food insecurity during the pandemic.

In my literature review, I discuss the impacts of the pandemic on farmers' markets. I then consider food insecurity during the pandemic and the U.S.'s current policy response. Finally, I conclude with the impacts of food assistance programs on food insecurity and follow with a discussion of monetary incentives to support food assistance programs. By comparing previous studies about food insecurity and food assistance programs, I draw connections between rising food insecurity levels-- an effect of the COVID-19 pandemic-- and how food assistance programs and supporting monetary incentives can help alleviate this social issue.

Farmers' markets during COVID-19

As the COVID-19 pandemic forced countries into lockdown and urged implementation of strict social distancing guidelines, public hoarding of food supplies and disruptions in the food supply chain challenge food security. Amid the pandemic, current articles argue that farmers' markets are "crisis lifelines" to growers and shoppers as well as "vital during COVID-

19" (Storring et. al, 2020, pg.1). Farmers' markets, deemed essential businesses by California Governor Gavin Newsom, fulfill "essential health and economic needs" through the markets' open-air nature and "a uniquely local supply chain that directly benefits local economies," as claimed by a Brookings article (Storring et. al, 2020, pg. 1). Similarly, a Bloomberg article (2020) notes that there has been an uptick of new customers at farmers' markets because of their capability to easily adapt to social distancing guidelines.

Not only are farmers' markets essential businesses during the COVID-19 pandemic, but they are also critical to provide fresh, affordable food-- especially for low-income communities-- during normal times, as noted by a study done by Project for Public Spaces (2013). Based on data from case studies of eight farmers' markets in the U.S. in primarily low-income communities, market shoppers were attracted to the farmers market due to good prices, high quality of products/ produce, convenience, and increased level of socialization. Additionally, farmers' markets provide food accessibility in low-income areas by providing fresh, local produce that supermarkets may not necessarily be able to provide (Project for Public Spaces, 2013).

Food insecurity during COVID-19

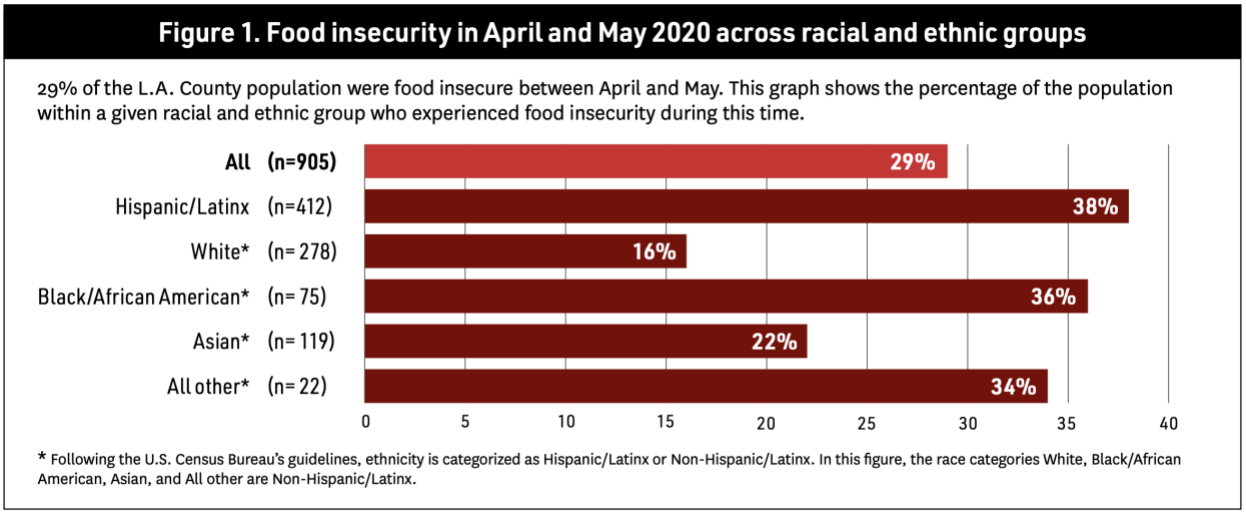
The urgent need for farmers' markets and other essential sources of food became exposed as research revealed high rates of food insecurity correlated to the pandemic. B. Shanks et al. (2020) urge further development of food policies to mitigate the pressing crisis of food insecurity that to which low-income populations are particularly exposed. Nagata et. al (2020) argue that food insecurity in the United States and COVID-19 are intertwined processes

that exacerbate one another and disproportionately affect marginalized populations. Those with COVID-19 symptoms, or in fear of catching the virus, may not be able to work for income or rely on regular support networks which may exacerbate food insecurity. Significant health care costs related to treatment and testing for the virus may also displace budgets for food. On the other hand, food insecurity may lead to susceptibility to COVID-19 through nutritional deficiencies that expose a decline in immune system responses. Because this cycle hits vulnerable and marginalized populations the hardest, health care professionals are recommended to provide patient referrals to food assistance programs.

Nagata et. al further recommended policymakers to expand legislation to address food insecurity as part of their efforts to halt the spread of the pandemic. The U.S. Department of Agriculture (USDA) has implemented more funding for food assistance programs in response to the pandemic, including emergency allotments for SNAP, Pandemic-SNAP (P-SNAP), Pandemic EBT (P-EBT), and extensions of WIC. Although these programs have lessened some of the burdens of food insecurity during the pandemic, B. Shanks et. al and Nagata et. al both claim that further flexibility and expansion of these programs will address the increases in the depth of food insecurity. The COVID-19 pandemic is “a watershed moment” to reveal opportunities for public, private, and academic partnerships to tackle social issues (B. Shanks et. al, 2020, pg. 1).

Research by University of Southern California (USC) Public Exchange also supports the idea that the pandemic is correlated with higher levels of food insecurity in Los Angeles. Using USC’s Understanding Coronavirus in America tracking survey, they found that rates of food insecurity in L.A. County during COVID-19 are substantially higher than before the pandemic--

39.5% of low-income households experienced food insecurity at some point between April and May 2020 compared to the 29.2% figure in 2017 (Haye et. al, 2020). Data also show that there were notable racial and ethnic disparities in food insecurity. The graph below illustrates disproportions in food insecurity levels across racial and ethnic groups[21]:



Source: University of Southern California's Understanding Coronavirus in America tracking survey

This research also found that the majority of people experiencing food insecurity during COVID-19 were not receiving food assistance, although at least 50% of households surveyed were eligible for benefits (Haye et. al, 2020). One possible reason may be poor distribution and flexibility of places accepting food assistance programs, further highlighting the importance of expanding these programs to accommodate the increasing need to tackle food insecurity.

Food assistance programs and food insecurity

Because the pandemic has revealed a large increase in food-insecure individuals and households, food assistance programs are now more than ever essential to tackle food

[21] Graph taken from "The Impact of COVID-19 on Food Insecurity in Los Angeles County: April to May 2020."

insecurity. Research shows that food assistance programs are effective in increasing the well-being of low-income families. A study by the Economic Research Service (ERS) published by USDA illustrates the benefits of food assistance programs on various outcomes: these include a decrease in food insecurity, higher nutrient intake, increases in food expenditures, and an alleviation of poverty (Winicki et. al, 2002).

A quantitative research study done by Ratcliffe et. al (2011) utilized an instrumental variable (IV) model to measure the effectiveness of SNAP in reducing food insecurity levels. An IV approach was utilized to control for the endogeneity of SNAP participation which may result from selection bias. Results suggested that SNAP reduces the likelihood of being food insecure by roughly 30% and very food insecure by roughly 20% (pg. 1096). Similar to the other mentioned articles about food insecurity and farmers' markets, Ratcliffe et. al (2011) urge policymakers to "understand the effectiveness of their programs so they can better serve low-income households and those experiencing food-related hardship" (pg. 1096). The authors call for easing of SNAP rules to increase SNAP participation, further enforcing previous arguments to expand food assistance policies.

Both Winicki et. al (2002) and Ratcliffe et. Al (2011) found that controlling for selection is important for debunking the effect of SNAP on food insecurity. Although studies "consistently find that food stamp recipients are more likely to be food insecure than nonrecipients," Winicki et. al. (2002) accounted for selection bias and found that food assistance programs "do not erode a household's food insecurity" (pg. 2). The study found positive outcomes when controlling for self-selection: food assistance programs were found to benefit food security. Ratcliffe et. al (2011) produced results from the naive probit model, which does not control for

endogeneity, in which they found that SNAP receipts are associated with higher food insecurity. However, their bivariate probit model that controls for endogeneity revealed that SNAP receipts are likely to reduce food insecurity. As mentioned by both articles, relatively high rates of food insecurity may result from demographics: food-insecure households are more likely to participate in food assistance programs than food-secure households.

Monetary incentives at the farmers market to supplement food assistance programs

Monetary incentives to fuel food assistance program usage was found to be effective by providing greater food accessibility to food insecure households. The 2017-2018 Market Match Impact Report on California's Market Match program highlighted federal incentive grants, which supplement food assistance programs, at farmers markets to increase the purchase of fruits and vegetables by low-income shoppers. The report claimed that Market Match promoted "greater health, thereby [reducing] costs, for low-income consumers, and increased financial sustainability for small-and medium-scale farmers" (University of Southern California, Ecology Center, 2018, pg. 2). The $3.7 million federal FINI grant for Market Match was found to have a $9.7 million total economic impact, including $4.2 million addition CalFresh benefits redeemed all from June 2015- June 2017 FINI grant period. This report provides evidence on the importance of funding food assistance incentive programs to boost food security.

Similar monetary incentive programs from other states have seen positive results in increasing food assistance sales. Freedman, Mattison-Faye et. al (2014) presented research that examines the influence of Shop N Save (SNS) on revenue trends located at a federally qualified health center (FQHC)- based farmers market in rural South Carolina. SNS was available to

anyone with SNAP, WIC, and/or FMNP vouchers and provided one $5 monetary incentive to customers spending at least $5 in food assistance at the farmers market. They compared revenue trends for 20 weeks before the SNS intervention (2011) and 20 weeks after (2012) and found that “matching intervention was effective not only in increasing food assistance revenue at the farmers’ market but also may have facilitated the farmers’ market’s economic sustainability” (pg. 11). After SNS was implemented, four times more SNAP dollars and 3.5 times more Senior FMNP vouchers were used to purchase produce at the farmers market.

Additionally, the dollar-to-dollar program at farmers’ markets in a Midwestern community has overall provided a positive impact of usage at the farmers market for SNAP recipients (Amaro, Roberts, 2017, pg. 2790-96). This program was also on a self-enrollment basis, and recipients could obtain up to $25 in tokens by using their SNAP cards. Findings from their cross-sectional study reported that customers saw a positive impact on the dollar-to-dollar match program. The program enabled customers to afford to shop at the farmers market using their SNAP card and also to provide enough funds until they had to restock.

Freedman, Ngendahimana et. al (2019) conducted a quantitative regression analysis to evaluate how monetary interventions can maximize the reach of customers who use SNAP. While previous research supported the use of monetary incentives to expand SNAP usage (such as SNS and the dollar-to-dollar match program case studies), this research added to the field by highlighting four key implementation factors to maximize monetary incentives: location (farmers markets in rural vs. urban areas), an increase in SNAP usage with more than once incentive program, paying market managers to operate incentive programs, and increase the number of produce vendors at the market. Findings also showed how these programs can be

further expanded. As with other articles, the authors recommended an expansion of monetary incentive programs on a policy level. They find that there is a benefit in "providing financial support to farmers' markets to cover the costs of hiring staff to operate fruit and vegetable incentive programming," and so enhancing the federal FINI grant program to maximize reach among SNAP recipients is crucial (pg. 1046).

Conclusion

There is no current research regarding the effects of the COVID-19 pandemic on food assistance programs at farmers' markets. Therefore, in my research, I illustrate the prominent shift in food assistance program usage created by the pandemic by analyzing the changes in food assistance usage at farmers' markets. Although previous research has shed light on how food assistance programs and monetary incentives at the farmers market can tackle food insecurity, my research adds to existing findings by objectively analyzing data to illustrate how an additional explanatory variable, the COVID-19 pandemic, can cause changes in food assistance program usage. By discovering changes in usage of food assistance programs and monetary incentives such as Market Match, I provide an evidence-based framework for an expansion of food assistance policies as many people shift their realities to accommodate the unprecedented nature of the pandemic.

METHODOLOGY

Overview and Data

This research paper utilizes statistical analyses to quantitatively examine the relationship between changes in food assistance usage at L.A. farmers markets and COVID-19 cases in various communities in Los Angeles County in order to understand what impact, if any, the COVID-19 pandemic has on food assistance program usage. Using Market Match customer count and sales as a proxy for food assistance program usage at the farmers market and COVID-19 cases as a proxy for the severity of the pandemic in Los Angeles, I measured the correlation and relationship between Market Match usage and COVID-19 cases in L.A. communities. Market Match is a good proxy for food assistance program usage because of its ability to match CalFresh, the food assistance program that most people use at markets. Because Market Match can only be used to match dollars for fruits and vegetables, we are able to observe how food assistance benefits are being used. Additionally, because COVID-19 cases may vary in each L.A. neighborhood, it is effective to compare Market Match and COVID-19 cases data in different communities over time. These statistical tests were all ran on IBM SPSS Statistics, version 26.

Data for COVID-19 cases in L.A. County were taken from the Los Angeles Times' independent tally of COVID-19 cases in California. Both data on a community-level and county-level were found on Github, an open source development platform. L.A. Times datasets were chosen for this research because these datasets were compiled by a continual Times survey that polls 58 county health agencies and three city agencies. Some information gathered were not provided by the state, making these files typically ahead of California's Department of Public Health. Data for Market Match and other food assistance programs were taken from two

non-profit organizations that are partners of Market Match: Hunger Action Los Angeles (HALA) and Sustainable Economic Enterprises of Los Angeles (SEE-LA).[32] Market Match data were available both at the county-level and community-level.

From these findings, I am able to conclude how much the pandemic influences an increase in farmers' market food assistance usage and create recommendations on expanding Market Match and federal funding for all food assistance programs at the farmers market (the most common being SNAP/ CalFresh and WIC).

Null and alternate hypothesis

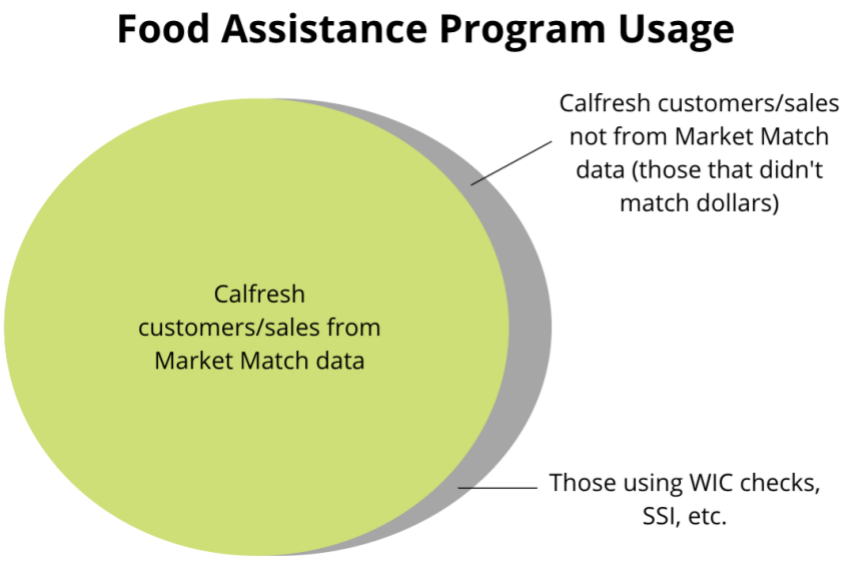
The null hypothesis, H_0, is that there is no statistically significant relationship between COVID-19 pandemic and food assistance program usage. To reject the null hypothesis, I will use statistical tests to test for the alternate hypothesis, H_a, that there is a statistically significant relationship between COVID-19 cases and food assistance program usage. To prove whether there is a relationship between these two variables, I conducted Pearson correlations to test whether there is a statistically significant relationship between the number of COVID-19 cases and Market Match usage and panel regressions to test how the number of COVID-19 cases predict changes in Market Match usage across time.

[32] These two organizations have collected data for the markets that they are responsible for. The Market Match grant is distributed throughout different organizations and, therefore, these markets are not being controlled by just one single organization. I was not able to collect data from other organizations that are responsible for other markets.

The dependent variable

The dependent variable is food assistance usage at L.A. farmers markets. Market Match was used as a proxy for all food assistance program usage because of the availability of data for Market Match compared to other food assistance programs. Additionally, Market Match is a relatively new program specific to the state of California that has the potential to be expanded, therefore creating the capacity for this study's results to provide recommendations for future program expansion. Of the studied farmers' markets for this research, Market Match covers a majority of all food assistance program usage from matching Calfresh dollars. Although those that use WIC checks at the market and those that do not match their Calfresh dollars were not accounted for, they only make up around 5% of the holistic food assistance program usage at the studied farmers' markets. **Figure 2** illustrates the breakdown of food assistance sales.

Figure 2



* The green area is data accounted for. The grey area is data not accounted for.

The independent variable

The independent variable for this research is the number of COVID-19 cases in L.A. communities, which may explain a change in the number of Market Match customers and sales. Using data from Github, I took data from each community in the past six months, starting in March 2020 when L.A. County first created new business operation guidelines. I then used SPSS to conduct a bivariate Pearson correlation that indicated whether there is a statistically significant relationship between Market Match usage and COVID-19 cases. I also conducted a panel regression, with the predictor variable being both the number of Market Match customers and sales and the explanatory variable being the number of COVID-19 cases, to test how the number of COVID-19 cases predict changes in Market Match customer count and sales across time. The place-bearing variable is the communities with farmers' markets that accept Market Match while the time-bearing variable is the past six months.

Other explanatory variables

Changes in monthly unemployment rate may have also influenced changes in food assistance sales. The pandemic has created a statewide shutdown of a majority of businesses and employment sectors, leaving many unemployed and seeking unemployment benefits from the state Employment Development Department (EDD). As the unemployment rate increases, the number of households that qualify for Calfresh also increase, which may have caused an increase in those who use food assistance programs and Market Match. Using unemployment rate and labor force data from the California EDD for the past six months, I conducted a bivariate Pearson correlation to indicate whether there is a statistically significant relationship

between unemployment rate and Market Match customer count and sales. Because there was no statistically significant relationship between these variables, a regression analysis was not applicable.

DATA AND FINDINGS

Data

Data for each L.A. community with corresponding farmers' markets were gathered to filter the markets by community. By identifying each farmers' market by its community, I was able to track COVID-19 cases in each neighborhood with corresponding farmers' markets. **Table 1** shows each farmers' market with complete Market Match data and their corresponding neighborhood.*

Table 1: Farmer's Market Name by Corresponding L.A. Neighborhood (by zip code)

Farmers' Market Name	L.A. Neighborhood (by zip code	Farmers' Market Name	L.A. Neighborhood (by zip code)
Altadena	Altadena	Huntington Park	Huntington Park
Atwater Village Farmers' Market	Atwater Village	Bixby Knolls	Long Beach
Baldwin Hill Crenshaw Farmers' Market	Baldwin Hills	Long Beach DT	Long Beach
Livingwell FM	Boyle Heights	New Monterey Park	Monterey Park
Dominguez Hills FM	Carson	No. Hollywood	North Hollywood
Mar Vista	Culver City	Pasadena	Pasadena
Historic Downtown	Downtown	Pomona	Pomona
E. Hollywood Monday	East Hollywood	Rosemead	Rosemead
E. Hollywood Thursday	East Hollywood	Old Town Newhall	Santa Clarita
East LA	East Los Angeles	Santa Monica	Santa Monica
Echo Park Farmers' Market	Echo Park	South Gate	South Gate
Gardena	Gardena	Central Avenue Farmers' Market	South Park
Kaiser Carson	Gardena	Adams/Vermont	University Park
Kaiser Gardena	Gardena	MLK Campus Farmers' Market	Watts
Harbor City	Harbor City	Wellington Square	West Adams
Hollywood Farmers' Market	Hollywood	West Covina	West Covina
		Wilmington	Wilmington

**Note: this is not a comprehensive list of all L.A. County farmers' markets participating in Market Match. Although the total number of L.A. County markets participating in Market Match is around 40, I was only able to obtain data for these listed 33 markets.*

Descriptive statistics of the independent variable

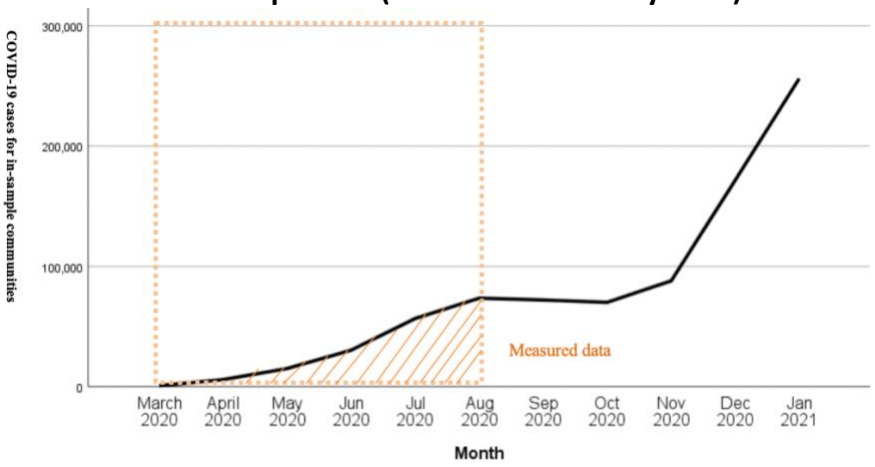
Table 2 presents descriptive statistics of the independent variable, the number of L.A. County COVID-19 cases both by each individual community (n=192) and the monthly total

across communities (n=6). “COVID-19 cases by community” presents the count of cases in each L.A. neighborhood where the studied farmers’ markets are present. “COVID-19 cases by month” presents the total sum of all cases in all L.A. neighborhoods where the studied farmers’ markets are present for each month. The table illustrates that the mean for both COVID-19 cases by community and per month are greater than the median, indicating that the distribution of the data is skewed to the right. This means that several communities (and months) have a much higher case count and are skewing the mean rightwards.

Table 2: Descriptive Statistics of L.A. County COVID-19 cases by community and sum, per month (March 2020- August 2020)

	COVID-19 cases by community	**COVID-19 cases by month**
n=	192 communities	6 months
Mean	912 per community	29,223 per month
Median	354 per community	21,535 per month
Std. Deviation	1,612	28011
Range	10,491	69,327
Minimum	1	789
Maximum	10,492	70,116

Graph 1: Line Graph of total L.A. County COVID-19 cases for in-sample communities per month to present (March 2020-January 2021)



Although COVID-19 cases in L.A. County are still present and have continued to increase through 2021, the relevant months for this project are March 2020-August 2020 for in-sample communities. March 2020 was when COVID-19 cases first became present in L.A. County. Farmers' market data is only available up to August 2020 and, therefore, data for COVID-19 cases was also taken up to August 2020 to account for the time variable. In **Graph 1**, the shaded portion is the relevant measured area. There is a positive slope of COVID-19 cases by month (March 2020-August 2020), showing an upwards trend in COVID-19 cases as the year progresses.

Descriptive statistics of the dependent variable

Descriptive statistics of the dependent variable, Market Match customer count, was compared to Market Match sales in order to record the differences between Market Match customer count (by customer) and sales (by $). **Table 3** presents descriptive statistics for both Market Match customer count and sales both by community and by month. In the table, the

mean is larger than the median for Market Match customer count by community and by month as well as for Market Match sales, indicating that the distribution of data is skewed to the right.

Table 3: Descriptive Statistics of farmers' market Market Match customer count and sales ($) by community and sum, per month (January 2019-August 2020)

	Market Match customer count, per community	Total Market Match customer count, per month	Market Match sales, per community	Total Market Match sales, per month	Sales per customer, per community
n=	460	13	460	13	
Mean	114	3498	$1212	$37,557	$10.6
Median	60	3538	$628	$37,295	$10.5
Std. Deviation	141	1089	1523	9604	$10.8
Range	1114	3734	$11748	$32,036	$10.5
Minimum	0	1633	$0	$19,326	0
Maximum	1114	5367	$11748	$51,362	$10.5

Tables 4 and 5 present descriptive statistics for both farmers' market Market Match customer count and sales both by community and by month when broken down into two phases: the pre-pandemic months (January 2019- February 2020) and the months in which the pandemic is present (March 2020- August 2020). All descriptive statistics for the months during the pandemic are higher than those for the pre-pandemic months, indicating that Market Match customer count and sales are greater in the pandemic months. Yet, sales per customer, per community were higher for the pre-pandemic months than for the months during the

pandemic. This may be a result of a higher sample size for the pre-pandemic months (n=268 for the pre-pandemic months compared to n=192 for the pandemic months).

Table 4: Descriptive Statistics of farmers' market Market Match customer count and sales ($) by community and sum per month, pre- pandemic (January 2019-February 2020)

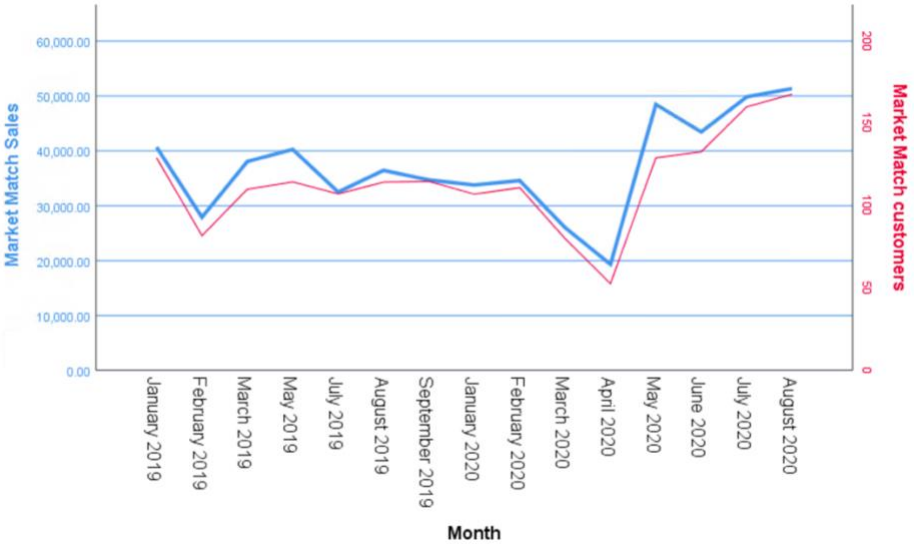
	Market Match customer count, per community	Total Market Match customer count, per month	Market Match sales, per community	Total Market Match sales, per month	Sales per customer, per community
n=	268	7	268	7	
Mean	110 customers	3,189 customers	$1,190	$35,683	$10.8
Median	56 customers	3,229 customers	$633	$36,456	$11.3
Std. Deviation	125	612	1,321	4,488	$10.6
Range	611	1,744	$7,408	$12,778	$12.1
Minimum	0	2,045 customers	$0	$27,903	0
Maximum	611 customers	3,789 customers	$7,408	$40,681	$12.1

Table 5: Descriptive Statistics of farmers' market Market Match customer count and sales ($) by community and sum per month, during COVID-19 pandemic (March 2020-August 2020)

	Market Match customer count, per community	Total Market Match customer count, per month	Market Match sales, per community	Total Market Match sales, per month	Sales per customer, per community
n=	192	6	192	6	
Mean	121 customers	3,857 customers	$1,242	$39,745	$10.3
Median	61 customers	4,190 customers	$619	$45,962	$10.1
Std. Deviation	162	1,452	1,769	13,658	$10.9
Range	1,114	3,734	$11748	$32,036	$10.5
Minimum	0	1,633 customers	$0	$19,326	0
Maximum	1,114 customers	5,367 customers	$11,748	$51,362	$10.5

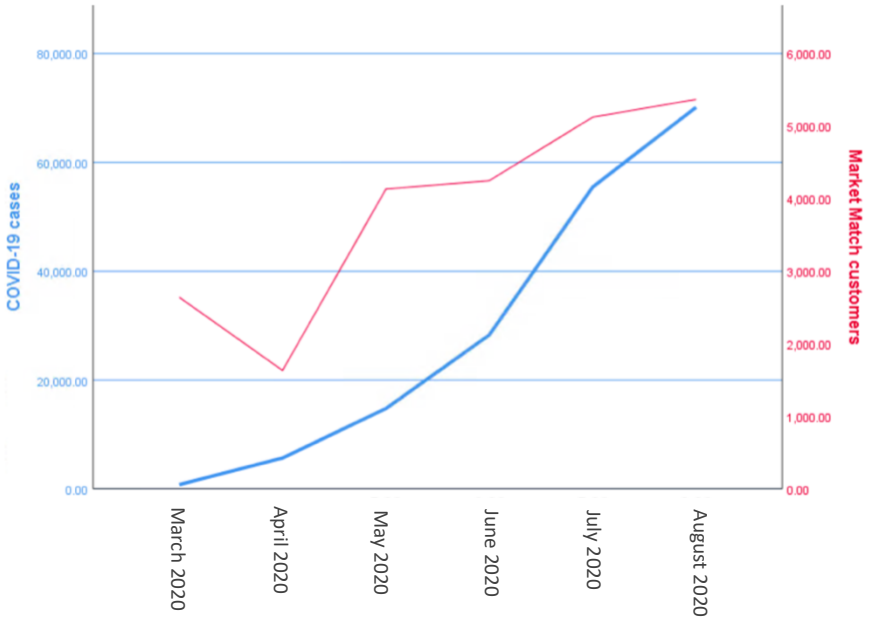
Graph 2 illustrates comparisons between the sum of communities for Market Match customer count and sales from January 2019-August 2020. Although Market Match sales were comparatively higher than Market Match customers, both Market Match sales and customer count reflect each other over time, given that both slopes either increase or decrease in the same direction.

Graph 2: Multiple Line Graph of Farmers' Market Market Match Customer Count and Market Match Sales ($), per month (January 2019- August 2020)



Graph 3 compares Market Match customers to COVID-19 cases to show relationships between the trends in COVID-19 cases and Market Match customers during the pandemic from March 2020-August 2020.

Graph 3: Multiple Line Graph of Farmers' Market Market Match Customer Count and COVID-19 cases, per month (March 2020- August 2020)



Descriptive statistics of the explanatory variable

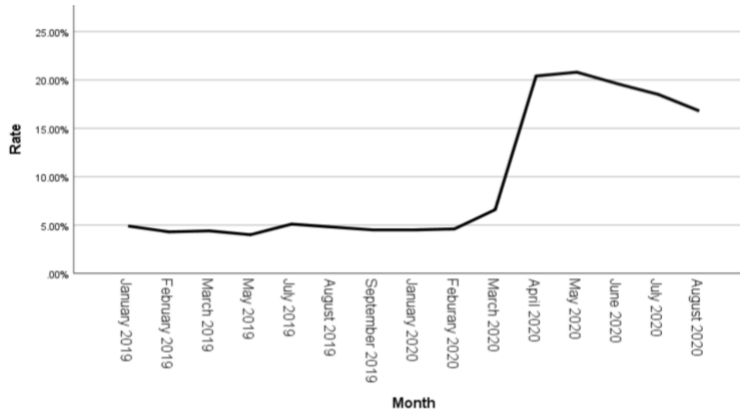
Table 6 presents descriptive statistics of a possible explanatory variable, L.A. County unemployment rate per month. This was not filtered by community due to lack of available data for each L.A. neighborhood. Similar to other variables, the distribution of data may be skewed to the right due the mean being larger than the median for both unemployment count and rate.

Table 6: Descriptive statistics of L.A. County unemployment and unemployment rate, per month (January 2019-August 2020)

	Unemployment Count	**Unemployment Rate**
n=	13	13
Mean	472,780	9.6%
Median	252,400	4.9%
Mode	201,400	4.5%
Std. Deviation	338,925	7.1%
Minimum	201,400	4.0%
Maximum	980,600	20.8%

Graph 4 illustrates how unemployment and unemployment rate changes over time form January 2019-August 2020. A comparison of both slopes show that unemployment and unemployment rate directly reflect each other-- slopes remain relatively constant from January 2019- February 2020 until it drastically increases in March 2020.

Graph 4: Line Graph of L.A. County Unemployment Rate (January 2019-August 2020)

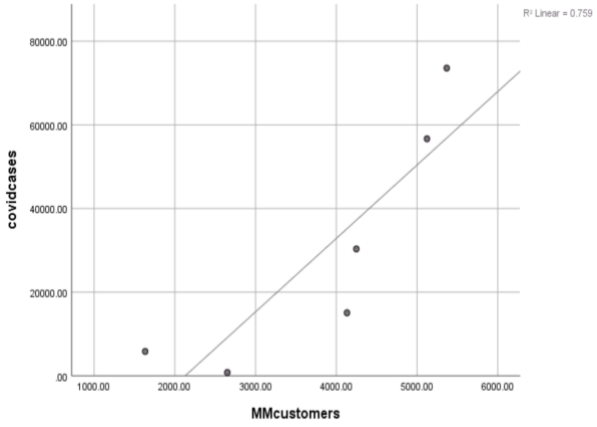


Findings

Correlation

There seems to be a positive linear relationship between the total number of COVID-19 cases and the total number of Market Match customers for all 34 markets and their communities, given the scatterplot below.

Graph 5: Scatterplot with Fit Line of COVID-19 Cases and Market Match Customer count, by sum per month (March 2020-August 2020)



Given the linear relationship of our independent and dependent variable, SPSS was used to conduct a bivariate Pearson correlation to indicate whether there is a statistically significant relationship between food assistance sales and COVID-19 cases. A correlation was first

conducted between COVID-19 cases and Market Match customer count by community and then by month. Additionally, a correlation between COVID-19 cases and Market Match sales ($) was conducted to show comparisons between correlation coefficients for Market Match customer count and sales. **Appendix B** illustrates the correlation SPSS output.

Results show that the correlation coefficient is .08 and the p-value is .30 between COVID-19 cases and Market Match customers by community, indicating that there is no statistically significant correlation between COVID-19 cases and Market Match customers by community. However, when filtered by month, there is a statistically significant positive correlation of .87 at p<.05 (p-value=.02).

The correlation coefficient is -.06 and the p-value is .44 between COVID-19 cases and Market Match sales by community. When filtering by month, the coefficient becomes .77 with a p-value of .07, indicating that there is no statistically significant correlation between COVID-19 cases and Market Match sales by community and by month at a significance level of .05.

Regression

A fixed effects panel regression was conducted to test how the number of COVID-19 cases predict changes in Market Match customer count and sales over time. **Appendix B** illustrates regression SPSS output.

a. *Market Match customer count*

When keeping community as a fixed factor, results show that the F-value for the corrected model is 20.21 and r^2 =0.78 with a significance level of p-value <.01. We can conclude that this

regression model explains 78% of the fitted data. The independent variable, COVID-19 cases, reliably predicts changes in the dependent variable, Market Match customer count, when keeping community as a fixed factor. The unstandardized coefficient (B)= .017 for COVID-19 cases by community. So, for each individual community when the community variable is held constant, each additional COVID-19 case is associated with a .017 increase in Market Match customers.

A regression model between Market Match customer count and COVID-19 cases that keeps both community and time in months as a fixed factor results in an F- value of 86.81 for the corrected model and r^2 =0.998 with a significance level of p<.01. We can conclude that this regression model explains 99.8% of the fitted data. COVID-19 cases also reliably predicts changes in Market Match customer count when keeping community and time as a fixed factor. B= -.006 for COVID-19 cases by community for this regression model. So, for each individual community when community and time is fixed, each additional COVID-19 case is associated with a .006 decrease in Market Match customer count.

Some communities include multiple markets and therefore may influence the results of the panel regression. Thus, when keeping individual markets as a fixed effect, the regression model between Market Match customer count and COVID-19 cases results in an F- value of 17.86 for the corrected model and r^2 =0.789 with a significance level of p<.01. We can conclude that this regression model explains 78.9% of the fitted data. COVID-19 cases also reliably predict changes in Market Match customer count when keeping individual markets as a fixed factor. B=.019 for this regression model. So, for each individual market when markets act as fixed

effects, each additional COVID-19 case is associated with an .019 increase in Market Match customers.

b. Market Match sales

To further test the impacts of the COVID-19 pandemic of food assistance program usage, an additional panel regression between COVID-19 cases and Market Match sales was conducted. When keeping community as a fixed factor, results show that the F-value for the corrected model is 5.43 and r^2 =0.49 with a significance level of p-value <.01. We can conclude that this regression model explains 49% of the fitted data. COVID-19 cases reliably predict changes in Market Match sales when keeping community as a fixed factor. The unstandardized coefficient (B)= 241 for COVID-19 cases by community. So, for each individual community when the community variable is held constant, each additional COVID-19 case is associated with a 241 increase in Market Match sales (in dollars).

A regression model between Market Match sales and COVID-19 cases that keeps both community and time in months as a fixed factor results in an F- value of 6.46 for the corrected model and r^2 =0.98 with a significance level of p<.01. We can conclude that this regression model explains 98% of the fitted data. COVID-19 cases also reliably predicts changes in Market Match sales when keeping community and time as a fixed factor. B= 1292.4 for COVID-19 cases by community for this regression model. So, for each individual community when community and time is fixed, each additional COVID-19 case is associated with a 1292.4 increase in Market Match sales (in dollars).

When keeping the individual markets as a fixed factor, the F-value is 4.8 for the corrected model and r^2 =0.5 with a significance level of p<.01. We can conclude that this regression

model explains 50% of the fitted data. B= 216.1 for COVID-19 cases by community for this regression model. So, for each individual community when community and time is fixed, each additional COVID-19 case is associated with a 216.1 increase in Market Match sales (in dollars).

Statistical tests for other explanatory variables

Multivariable statistical analyses were conducted to examine factors associated with the change in food assistance sales beyond the number of COVID-19 cases. A bivariate Pearson correlation was first conducted to indicate the relationship between unemployment rates and both Market Match customer count and sales.

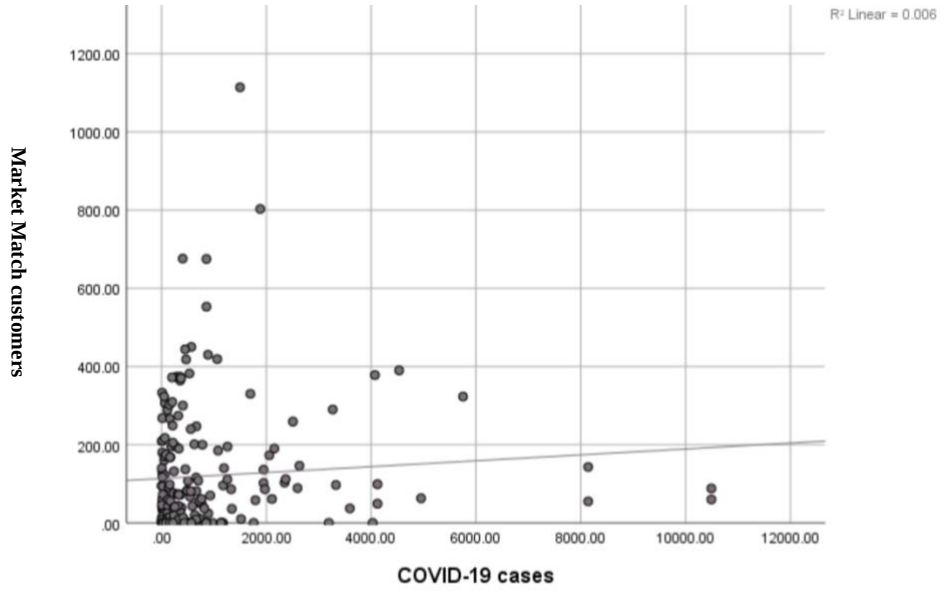
Results show that the correlation coefficient is .27 and the p-value is .60 between unemployment and Market Match customers by month. Therefore, there is no statistically significant relationship between Market Match customer count and unemployment by month. Additionally, the correlation coefficient is .39 and the p-value is .45 between unemployment and Market Match sales by month. Again, there is no statistically significant relationship between unemployment and Market Match sales. Because there is no statistically significant relationship between unemployment and Market Match customer count and between unemployment and Market Match sales, a regression for these variables is not applicable.

ANALYSIS

Market Match customer count versus Market Match sales

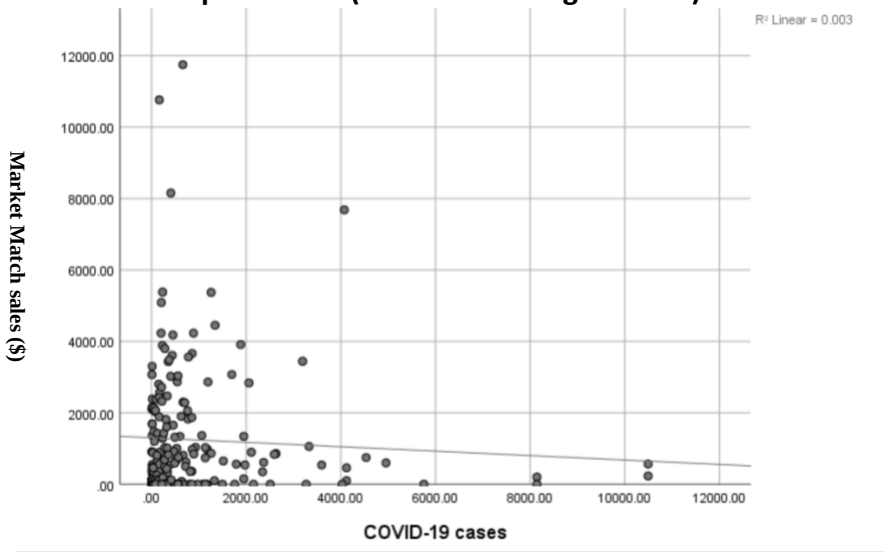
When filtering by each individual community for the studied farmers' markets, there is a relatively weak positive slope between COVID-19 cases and Market Match customer count, as shown in **Graph 6.**

Graph 6: Scatterplot with Fit Line of COVID-19 Cases by Market Match Customer Count, by community per month (March 2020-August 2020)



Just visually based on this graph, this may show that an increase in COVID-19 cases may not have a large relationship with the number of customers utilizing Market Match at the studied farmers' markets. There is also a relatively weak, slightly negative slope between COVID-19 cases and Market Match sales, as shown in **Graph 7.**

Graph 7: Scatterplot with Fit Line of COVID-19 Cases by Market Match Sales, by community per month (March 2020-August 2020)



Just visually based on this graph, there may not be a strong relationship between COVID-19 cases and Market Match sales, and an increase in cases may also slightly decrease sales.

There is also a contrast in growth rate for Market Match customer count and Market Match sales for each individual market. The following formula was used to calculate the growth rate of both Market Match customers and sales for each market during the start of the pandemic (March 2020-August 2020):

Percent growth rate for each market= [(August value-March value)/ March value] x 100

The Market Match customer count seems to have a uniform increase in growth rate for all markets. However, some markets saw a decrease in growth rate for sales.

A possible explanation of Market Match sales slightly decreasing but Market Match customer count slightly increasing, as well as the difference in growth rate of customer count

and sales, is that Market Match customers are spending less Calfresh dollars at the farmers' market. Because Market Match matches the dollar amount of Calfresh spent at the market (up to a maximum amount), less Calfresh dollars spent at the market would decrease total sales even though there may be a higher participation rate among customers who use food assistance programs at the market. This effect may be due to the increase in financial hardship due to the COVID-19 pandemic. As shown in **Graph 4,** unemployment rate in L.A. County dramatically increases from around 6% to over 20% in March 2020 and remains above 15% even in August 2020. This spike in unemployment rate may reveal financial hardships among those in the labor force as more of the general population in L.A. County are losing their jobs, reflecting the decrease in sales at the farmers' market.

Results filtered by community versus by month

Graph 2 shows that there is a general upwards trend of both Market Match customer count and sales by month, resulting in an increase in Market Match usage among farmers' market shoppers as the year progresses, even during the pandemic.

There is a statistically significant correlation of .87 at $p<.05$ (p-value=.02) between COVID-19 cases and Market Match customer count per month, showing that, holistically, there is a relatively strong positive correlation between COVID-19 cases and Market Match customer count for all studied farmers' markets for each month from March 2020-August 2020. Results for the aggregated data may show that more people generally shopped at the studied farmers' markets as the year progressed. Yet, there is no statistically significant correlation when filtering by each individual community for the studied farmers' markets. This may be because

some farmers' markets may have varying customer count for each month and there is no general increase or decrease in the number of customers utilizing Market Match for each individual market. Lack of data for all farmers' markets in L.A. County that utilize Market Match, as well as market closures in some communities due to the COVID-19 pandemic, may also impact results.

Regression

All panel regressions show that COVID-19 cases reliably predict changes in Market Match customer count. When keeping community as a fixed factor, the model explains 78% of the fitted data. However, when keeping both community and month as a fixed factor, the model explains 99.8% of the fitted data. A regression for individual markets was also studied due to the fact that some communities contain multiple markets. When keeping individual markets as a fixed effect, the model explains 78.9% of the fitted data. The community and month variable may contribute to a lot of the variation that is found within the regression models. Therefore, the r^2 value varies and may be higher since it is responsible for fixing most of the variation for these variables.

In addition, the model when keeping time and community as a fixed factor between Market Match sales and COVID-19 cases best explain the fitted data at 98%. The community and month variable may also contribute to a lot of the variation that is found within regression models for Market Match sales and COVID-19 cases. Nonetheless, the COVID-19 pandemic impacts monetary incentive usage, thereby supporting the correlation between food assistance program usage and COVID-19 cases over time.

There is no statistically significant relationship between unemployment and both Market Match customer count and sales as shown in correlation results. Although unemployment has drastically increased in March 2020, which is during the time when the COVID-19 pandemic first began, unemployment does not impact Market Match usage. This may be due to lack of accessibility to the farmers' market or lack of knowledge of food assistance programs among those who are unemployed.

Although a lack of adequate sample size may result in inconclusive data, there is a slight correlation between COVID-19 cases and Market Match usage for all farmers' markets. Because of this, and the fact that the COVID-19 pandemic impacts monetary incentive usage over time, I reject the null hypothesis and conclude that there is a statistically significant relationship between COVID-19 cases and Market Match usage across all farmers' markets over time. Market Match may prove as a successful monetary incentive to support farmers' market food assistance programs. More people are utilizing Market Match at the studied farmers' markets despite the COVID-19 pandemic hindering normal market activity and transactions. The rise of COVID-19 cases may drive an increase in Market Match. Expanding the prevalence of Market Match at other farmers' markets, given the increase in usage at the studied farmers' markets, may provide food security to an increasingly more food insecure population that arose due to the COVID-19 pandemic.

LIMITATIONS

Datasets for this study were based off of data received from outside organizations. Data was acquired by contacting UEPI as a third-party to connect with HALA and SEE-LA, then compiling the datasets that these two organizations have collected. This reliance on outside organizations means that findings for this study were solely based on external data collection outside of my control. Results may have been influenced by other variables that may have not been addressed, such as management policy and method of data collection that may differ for the two organizations.

Another limitation is that there were some missing months for the Market Match customer count and sales data. Because data was acquired from outside organizations, data for these months, such as April 2019, were not available to be included in my data and findings. This may influence the time factor. Elimination of month(s) may influence the relationship between the COVID-19 variable and the Market Match variable as well as time-varying graphs. The given data showed a positive trend in both Market Match sales and customer count, as shown in **Graph 2**, but this may differ when missing months are added. We can only make holistic conclusions based off of the given data.

Additionally, this study contains a small sample size due to lack of data for months beyond August 2020. Data for the Market Match variable is only available from January 2019 to August 2020, thereby affecting the COVID-19 variable as well (data for COVID-19 cases are only recorded from March 2020, which is the start of the pandemic, to August 2020). This may also influence the time factor. A lack of data for months prior to and after the months in this study may influence the relationship between COVID-19 cases and Market Match sales and

customer count. A lack of data may also affect time-varying graphs, showing a possible change in slope for COVID-19 cases and Market Match data.

This study does not contain all L.A. County farmers' markets participating in Market Match. It only contains data for the markets that HALA and SEE-LA are partnered with due to the inability to obtain data from other organizations that are responsible for the rest of the markets. We can only make conclusions based on the given data. This sample may not be a true representation of the population. The conclusions from this study are limited to the studied markets and cannot be generalized to all L.A. County farmers' markets participating in Market Match.

Additionally, there is a lack of data for total customer count and sales for the studied farmers' markets that include data for populations that do not utilize food assistance programs. Without a ratio of farmers' market Market Match customers and sales versus total farmers' market customers and sales, it is difficult to interpret the solvency of the farmers' market for those not benefitting from food assistance subsidies. Yet, it is important to note the change in food assistance program usage over time to make conclusions about how farmers' markets benefit those that utilize food assistance programs. Future research can implement data for total farmers' market customer count and sales to compare how markets benefit those receiving food assistance versus those who do not.

Despite these limitations, this study is still a worthwhile research that provides a foundation for future research regarding how the COVID-19 pandemic has affected farmers' market food assistance usage during and post-pandemic. This research can easily be expanded upon and applicable to other markets nationwide. Although lack of data may prove difficult to

draw generalized conclusions, this study still provides quantitative evidence that favors an increase in the prevalence of Market Match at farmers' markets.

POLICY RECOMMENDATIONS

Expand the budget of Market Match in Los Angeles County

Market Match offers an opportunity to mitigate food insecurity on a policy level. Nagata et. al (2020) concludes that rising COVID-19 cases are intertwined with food insecurity and exacerbate one another. Further development of a monetary incentive during the pandemic at the farmers' market may expand benefits to counteract an increasingly high rate of food insecurity in Los Angeles. Given the findings of this study, the COVID-19 pandemic impacts Market Match usage over time. There is a slight positive correlation between COVID-19 cases and Market Match customer count. Thus, more people are utilizing Market Match at the studied farmers' markets during the COVID-19 pandemic, indicating that an expansion of the Market Match budget would be successful in providing benefits to customers.

There is currently a cap to the dollar amount that customers can match at the farmers' market when utilizing Market Match. According to Hunger Action LA, customers can redeem up to $10 at their participating farmers' market in 2014 (Hunger Action LA). However, markets have offered additional support for shoppers during the COVID-19 crisis -- Highland Park Farmers' Market offered a Market Match special of $30 that can be matched from March 2020 to May 2020 (UEPI, 2020). An increase in the dollar cap will continue to give support to customers at the farmers' market due to the increase of food insecurity caused by the COVID-19 pandemic that extends well beyond the beginning of the pandemic. This would bring more revenue to small farmers as well as provide more means to obtain more healthy fruits and vegetables. Because Market Match utilizes a network model to allow multiple subcontracting partners to receive benefits and provide community outreach, an increase in the holistic

Market Match budget can be directly provided to Market Match's lead partners and their community partners to directly bring support to their corresponding communities. For example, an increase in Hunger Action LA's budget may increase the dollar cap for the markets they are responsible for. The diagram below illustrates the Market Match network model.

Rather than relying on Ecology Center as the main source for a new Market Match grant to trickle down to smaller community partners, funding the communities directly would ensure that all communities would receive adequate funding.

Make Market Match more accessible

Market Match is currently a nutrition incentive program used to supplement Calfresh, a major food assistance program. Market Match has provided tremendous impact to communities by enabling healthy food choices for low-income shoppers as well as increasing the economic vitality of small farms (Market Match Impact Report, 2018). Yet, expanding Market Match to match not only Calfresh dollars but other food assistance programs, such as WIC, can further increase assistance to a larger population of market shoppers. Due to the impact of COVID-19 pandemic on both Market Match customer count and sales, it is essential now more than ever to extend support to those utilizing food assistance programs. The USDA has granted waivers for WIC recipients for food substitutions when supply levels are being challenged as support for the COVID-19 crisis (USDA, 2021). An increase in WIC foods at farmers' markets as well as Market Match redemption for WIC recipients will allow a larger variety of foods to supplement their diet.

Additionally, a COVID-friendly method for Market Match redemption would prove effective to accommodate social distancing requirements while still providing accessibility for customers to shop at the market. Market Match is currently redeemed via the market manager booth at the farmers' market. After swiping a Calfresh EBT card to redeem tokens or vouchers from the market manager, Market Match tokens are also given to be spent at individual market

booths. A mobile-friendly option to redeem Market Match tokens would limit excess interaction at the market for the safety of both the market staff and the public. This also directly aligns with Ecology Center's goal to "develop and test technological innovations that improve benefit redemption systems for use at direct-sales outlets, including farmers' markets…" (Market Match, 2020). The COVID-19 pandemic is an opportunity to improve on existing food incentive redemption systems that will be able to accommodate a changing society.

Increase participation of Market Match at more markets

Ecology Center is currently trying to increase participation of Market Match at more farmers' markets nationwide. One of their listed goals is to "bring Market Match to every region of the state in order to increase the purchase of farm-direct fruits and vegetables by low-income California consumers participating in SNAP" (Market Match).

Given the findings from this study, an increase in Market Match participation rate would specifically benefit L.A. County. **Graph 2** illustrates a general positive trend of Market Match customer count and sales from January 2019 to August 2020. Furthermore, correlation results indicate that there is a positive correlation between Market Match customer count and COVID-19 cases for every month, but there is no statistically significant correlation between Market Match customer count and COVID-19 cases by individual market. This may indicate that some markets differ in customer count without the interference of time and the independent variable, which may be for different reasons such as weather, location, and seasonality of produce. Having Market Match at more farmers' markets in L.A County would further increase

customer count every month and provide benefits at markets that may see a high number of foot traffic.

Additionally, Ecology Center's Market Match Impact Report finds that although there has been in growth in demand for Market Match since the implementation of the FINI grant, "the demand for incentives at farmers' markets far exceed the supply….fewer than half of the 800 certified farmers' market in the state offer incentives" (University of Southern California, Ecology Center, 2018). Implementing Market Match in other locations would expand the supply of nutrition incentives needed to deliver healthy, fresh food to communities.

Improvements in Market Match data collection

Market Match data is currently managed through different lead and community partners. In L.A. County, most of the Market Match data is managed through HALA, SEELA, Model Neighborhood Program. There are also some markets participating in Market Match that independently manage their own data. Additionally, it is difficult to track all markets participating in Market Match at one time because, while Ecology Center tracks most Market Match markets, there are some markets that are not managed by Ecology Center. Rather than having multiple sources for Market Match data collection, a standardized and centralized method of data collection would allow a more reliable way to measure the impact of Market Match. This would improve data management while reducing variability in data collection by multiple partners. Given that this study encountered difficulties in data reliability due to reliance on third-party organizations, a standardized data collection would eliminate this limitation.

CONCLUSION

The magnitude of the effects of the COVID-19 pandemic has exacerbated food insecurity levels in L.A. County. A new culture of social distancing to halt the spread of the COVID-19 virus has presented challenges for farmers' markets which were once highly social gathering spaces. This in turn reveals new challenges for small farmers who utilize farmers' markets as a source of revenue as well as for customers, especially low-income shoppers, who depend on the farmers' market for their daily source of nutrition.

Previous studies have shown that food assistance programs and nutrition incentive programs are successful in providing food security as well as food accessibility for low-income populations (Winicki et. al, 2002 and Ratcliffe et. al, 2011). The Market Match nutrition incentive program in California has also proven to be highly successful in providing healthy food choices for food assistance users and securing revenue for small farmers (Market Match Impact Report, 2018). Both food assistance programs and nutrition incentive programs are present at the farmers' market. Due to these positive results, an expansion of food assistance programs at the farmers' market during the COVID-19 crisis may further help alleviate food insecurity.

This study utilizes quantitative research methods to study what, if any, impact the COVID-19 pandemic has on food assistance program usage in L.A. County farmers' markets. It presents evidence that encourages an expansion of Market Match at L.A. County farmers' markets, especially due to the effects of the COVID-19 pandemic. By analyzing the relationships between COVID-19 cases and Market Match sales and customer count, this study highlighted that COVID-19 cases are able to reliably predict changes in Market Match customer count and sales. Although there seemed to be an increase in both Market Match customer count and sales

that reflect the increase in COVID-19 cases over time, Market Match customer count may be slightly positively correlated with COVID-19 cases while there may be a slightly negative correlation between Market Match sales and COVID-19 cases. This indicates that the difference between Market Match customers and sales may have been due to the financial hardships of the COVID-19 pandemic or some other external factor. Additionally, some markets saw a difference in growth rate without the time-varying variable, indicating that some communities in L.A. may have seen various levels of impact from the COVID-19 pandemic on food security at the farmers' market. The positive relationship of COVID-19 and Market Match encourages further support for food assistance programs.

While this research has given quantitative evidence on the impacts of the COVID-19 pandemic on the studied farmers' markets participating in Market Match in L.A. County, additional research can build on this study by conducting a quantitative analysis of the impacts of the COVID-19 pandemic on Market Match-participating farmers' markets statewide. This would address the relevance of Market Match in other markets and in other California counties during the COVID-19 crisis. As more data on COVID-19 become publicly available, future research should analyze data derived from the past 2 years before the pandemic, during the months where the pandemic is present, and 2 years after the pandemic to create a more holistic overview of how Market Match usage changes during, before, and after the pandemic.

In addition, further research can build upon the impacts of the COVID-19 pandemic on other food assistance programs. Although this study focuses on California's nutrition incentive program, Market Match, research regarding other food assistance programs widely used at farmers' markets, such as Calfresh and WIC, may give insight into changes in usage due to the

pandemic, further providing a base for budget recommendations for these other food assistance programs. Future studies should also include other explanatory variables that may influence a change in food assistance program usage, such as seasonality in markets and a ratio of customers obtaining food assistance programs at the market versus those not obtaining assistance.

APPENDIX A
Correlation and Regression Tables

Correlation

1. Market Match customers and COVID-19 cases

a. by community

Correlations

		Covidcases_community	MMcustomers_community
Covidcases_community	Pearson Correlation	1	.075
	Sig. (2-tailed)		.300
	N	192	192
MMcustomers_community	Pearson Correlation	.075	1
	Sig. (2-tailed)	.300	
	N	192	192

b. per month

Correlations

		covidcases	MMcustomers
covidcases	Pearson Correlation	1	.871*
	Sig. (2-tailed)		.024
	N	6	6
MMcustomers	Pearson Correlation	.871*	1
	Sig. (2-tailed)	.024	
	N	6	6

*. Correlation is significant at the 0.05 level (2-tailed).

2. Market Match sales and COVID-19 cases

a. by community

Correlations

		MMsales	Covidcases_community
MMsales	Pearson Correlation	1	-.057
	Sig. (2-tailed)		.436
	N	192	192
Covidcases_community	Pearson Correlation	-.057	1
	Sig. (2-tailed)	.436	
	N	192	192

b. per month

Correlations

		covidcases	MMsalessum
covidcases	Pearson Correlation	1	.772
	Sig. (2-tailed)		.072
	N	6	6
MMsalessum	Pearson Correlation	.772	1
	Sig. (2-tailed)	.072	
	N	6	6

3. Unemployment
   a. Unemployment and Market Match customers

Correlations

		MMcustomers	unemployment_month
MMcustomers	Pearson Correlation	1	.274
	Sig. (2-tailed)		.600
	N	6	6
unemployment_month	Pearson Correlation	.274	1
	Sig. (2-tailed)	.600	
	N	6	6

b. Unemployment and Market Match sales

Correlations

		unemployment_month	MMsalessum
unemployment_month	Pearson Correlation	1	.389
	Sig. (2-tailed)		.445
	N	6	6
MMsalessum	Pearson Correlation	.389	1
	Sig. (2-tailed)	.445	
	N	6	6

Fixed effects panel regression

1. Market Match customers
   a. Community as a fixed factor

Tests of Between-Subjects Effects

Dependent Variable: MMcustomers_community

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3909307.82[a]	29	134803.718	20.210	.000	.783
Intercept	1527817.401	1	1527817.401	229.057	.000	.586
Covidcases_community	95997.899	1	95997.899	14.392	.000	.082
Community	3881055.425	28	138609.122	20.781	.000	.782
Error	1080543.845	162	6670.024			
Total	7779668.000	192				
Corrected Total	4989851.667	191				

a. R Squared = .783 (Adjusted R Squared = .745)

Parameter Estimates

Dependent Variable: MMcustomers_community

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	7.958	33.643	.237	.813	-58.477	74.394	.000
Covidcases_community	.017	.004	3.794	.000	.008	.025	.082

b. Community and time (in months) as a fixed factor

Tests of Between-Subjects Effects

Dependent Variable: MMcustomers_community

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	4981995.07[a]	168	29654.733	86.814	.000	.998
Intercept	901578.022	1	901578.022	2639.350	.000	.991
Covidcases_community	1793.075	1	1793.075	5.249	.031	.186
Month	190464.311	5	38092.862	111.516	.000	.960
Community	3777126.210	28	134897.365	394.909	.000	.998
Month * Community	853084.944	134	6366.306	18.637	.000	.991
Error	7856.592	23	341.591			
Total	7779668.000	192				
Corrected Total	4989851.667	191				

a. R Squared = .998 (Adjusted R Squared = .987)

Parameter Estimates

Dependent Variable: MMcustomers_community

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	103.849	19.586	5.302	.000	63.333	144.365	.550
Covidcases_community	-.006	.002	-2.291	.031	-.011	-.001	.186

c. Individual markets as a fixed factor

Tests of Between-Subjects Effects

Dependent Variable: MMcustomers_community

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	3934934.60[a]	33	119240.443	17.859	.000	.789
Intercept	1258615.447	1	1258615.447	188.509	.000	.544
Covidcases_community	115995.738	1	115995.738	17.373	.000	.099
Marketindividual	3906682.208	32	122083.819	18.285	.000	.787
Error	1054917.062	158	6676.690			
Total	7779668.000	192				
Corrected Total	4989851.667	191				

a. R Squared = .789 (Adjusted R Squared = .744)

Parameter Estimates

Dependent Variable: MMcustomers_community

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval		Partial Eta Squared
					Lower Bound	Upper Bound	
Intercept	103.849	19.586	5.302	.000	63.333	144.365	.550
Covidcases_community	-.006	.002	-2.291	.031	-.011	-.001	.186

2. Market Match sales
   a. *Community as fixed factor*

Tests of Between-Subjects Effects

Dependent Variable: MMsales

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	294547098[a]	29	10156796.48	5.427	.000
Intercept	198242796.2	1	198242796.2	105.919	.000
Covidcases_community	741339.830	1	741339.830	.396	.530
Community	292633813.8	28	10451207.63	5.584	.000
Error	303207169.1	162	1871649.192		
Total	893934007.0	192			
Corrected Total	597754267.0	191			

a. R Squared = .493 (Adjusted R Squared = .402)

Parameter Estimates

Dependent Variable: MMsales

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	240.976	563.563	.428	.670	-871.902	1353.853
Covidcases_community	.046	.074	.629	.530	-.099	.192

   b. *Community and time (in months) as fixed factors*

Tests of Between-Subjects Effects

Dependent Variable: MMsales

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	585341656[a]	168	3484176.521	6.456	.000
Intercept	107450304.6	1	107450304.6	199.100	.000
Covidcases_community	1701089.723	1	1701089.723	3.152	.089
Month	22445440.96	5	4489088.192	8.318	.000
Community	279113626.1	28	9968343.789	18.471	.000
Month * Community	259410578.8	134	1935899.842	3.587	.000
Error	12412611.44	23	539678.758		
Total	893934007.0	192			
Corrected Total	597754267.0	191			

a. R Squared = .979 (Adjusted R Squared = .828)

Parameter Estimates

Dependent Variable: MMsales

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	1292.366	778.488	1.660	.110	-318.059	2902.790
Covidcases_community	-.176	.099	-1.775	.089	-.382	.029

c. Individual markets as fixed factor

Tests of Between-Subjects Effects

Dependent Variable: MMsales

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	299340708[a]	33	9070930.551	4.803	.000
Intercept	185361208.6	1	185361208.6	98.143	.000
Covidcases_community	1603692.936	1	1603692.936	.849	.358
Marketindividual	297427424.1	32	9294607.002	4.921	.000
Error	298413558.8	158	1888693.410		
Total	893934007.0	192			
Corrected Total	597754267.0	191			

a. R Squared = .501 (Adjusted R Squared = .397)

Parameter Estimates

Dependent Variable: MMsales

Parameter	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Intercept	216.105	566.504	.381	.703	-902.792	1335.002
Covidcases_community	.071	.077	.921	.358	-.081	.222

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