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COVID-19 and the Agriculture Industry: Labor, Supply Chains, and Consumer Behavior

Luis Peña-Lévano, Grace Melo and Shaheer Burney

JEL Classifications: J01, J09, J15, J18, J28, J44, J64, D19, P46, D90, H31, Q13, R49
Keywords: Agricultural production, Covid-19, Supply chains, Labor, Unemployment

Following a period of sustained growth that lasted over a decade, the U.S. economy was plunged into a recession by the onset of the COVID-19 pandemic in the first quarter of 2020. While the pandemic's impact has been felt throughout the economy, the agriculture industry has been particularly affected as a range of COVID-19 related factors have disrupted agricultural supply chains. Despite the U.S. Department of Homeland Security's designation of the food and agriculture sector as "critical infrastructure" during the pandemic, demand and supply-side labor issues have been predicated by state stay-at-home mandates, restaurant and school closures, virus outbreaks at food-processing facilities and farms, precautionary measures implemented by agricultural businesses, immigration policies, and consumers' spending behavior, among other things. As state governments relax shut-down orders in mid-2020 and businesses begin to reopen, uncertainty surrounds the economic outlook for the agriculture industry. Further complicating the situation is fear of another spike in nationwide COVID-19 cases in the coming months.

The articles in this theme discuss many facets of the effect of COVID-19 on agriculture supply chains, with a particular emphasis on labor concerns. In addition to providing a broad perspective on issues affecting the overall agriculture industry, these articles focus on specific challenges facing U.S. agriculture and its subsectors due to the COVID-19 pandemic. Given the rapidity with which the crisis has evolved, the main intent of these articles is to describe the situation in its current form. However, they also provide some insight into the short-term and long-term implications for the agricultural industry.

Peña-Lévano, Burney, and Adams provide a broad overview of how COVID-19 has displaced employment in agriculture and its three subsectors: production, processing, and retail. For comparison, they also report on the employment situation in non-agriculture industries. This article goes on to discuss employment effects by race and ethnicity and highlights differences among Hispanic, black, and white populations. Furthermore, this article includes a section on government response to the economic disruptions caused by the pandemic.

Farnsworth explores the implications of government policies—such as paid leave for workers, required and recommended safety practices, and travel restrictions on immigrant workers—for the supply and demand of agricultural labor. The author concludes that the

Articles in this Theme:

predicted effect of these policies is to decrease the availability, efficiency, and overall productivity of these workers and that these policies will likely lead to higher production costs, particularly for more labor-intensive crops like fresh fruits and vegetables.

Onel, Simnitt, Stacciarini, and Tovar-Aguilar's study COVID-19 risk factors for Florida farmworkers by immigration status, specifically they study H-2A guest workers and unauthorized farmworkers. In addition, they discuss implications of their findings for planning targeted measures for the health and safety of both legal status groups and for keeping crop farms operational amid the battle against the new virus.

Escalante, Luo, and Taylor also focus on the immigration status of farm labor. In particular, they consider how travel bans, strict medical screening at ports of entry, and virus outbreaks at the border have affected the arrival of H-2A workers in the United States. They explain how labor could be a disrupting factor as farms strive to meet sustained demand during the pandemic.

Walters, Wade, and Suttles discuss shocks to the food supply chain, review the regulatory exemptions granted to the transportation sector, and provide insight on emergency relief efforts. The authors conclude that human resources have presented the greatest risk exposure to the U.S. food supply chain but have also been the most significant asset underlying the innovative response to unprecedented shocks.

Finally, Melo explores the demand-side impact of the COVID-19 pandemic. Specifically, she discusses changes in consumer behavior and purchasing patterns. The author determines that as the crisis began, consumers exhibited emotion-driven behavior, characterized by panic buying. After a period of adjustment, consumers switched to rational actions. The author also describes potential new norms in purchasing behavior and food retail in the future, such as technology-driven online shopping and new developments in food safety standards.

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COVID-19: Effects on U.S. Labor, Supply Chains and Consumption Imagery Article

Luis Peña-Lévano, Shaheer Burney, Grace Melo, and Cesar Escalante

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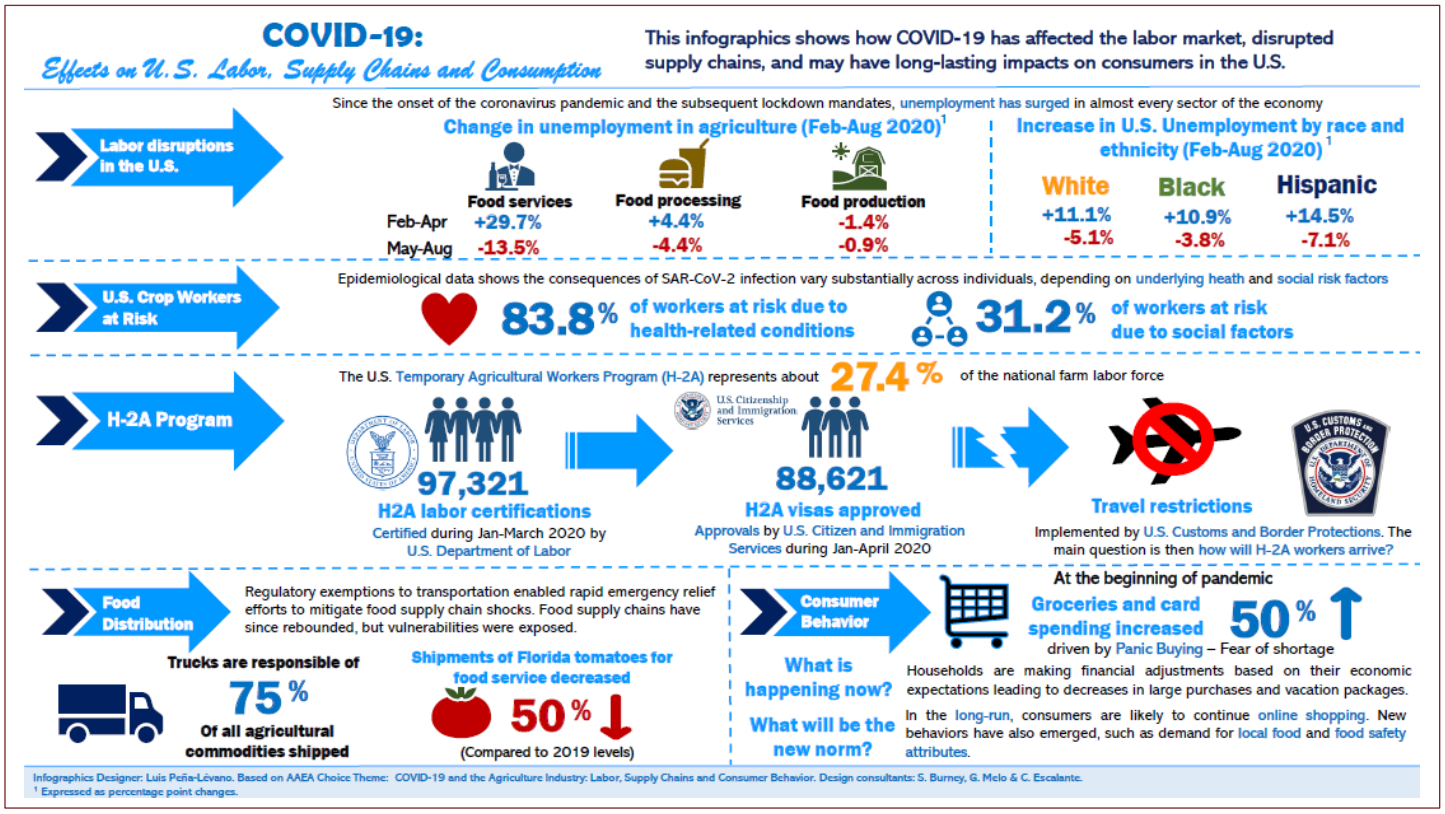
Background

COVID-19 has disrupted labor employment, supply chains and consumer behavior in the U.S. This infographic discusses these effects paying particular attention to labor concerns in agriculture and the unemployment effect by ethnicity and race, as well as the effect on the supply changes and the long-run effects in consumers behavior and how the pandemic has restricted the access of H2A workers into the U.S. which may have effects on crop production. The epidemiological data in this infographic also suggests that crop workers are susceptible to COVID-19 due to underlying health and social risk factors. Given the rapidity with which the crisis induced by the pandemic has evolved, the main intent of this infographic is to describe the situation in its current form. However, it highlights long-term implications for the agricultural industry.



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CHOICES

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Labor Disruptions Caused by COVID-19 in the U.S. Agriculture and Nonfarm Industries

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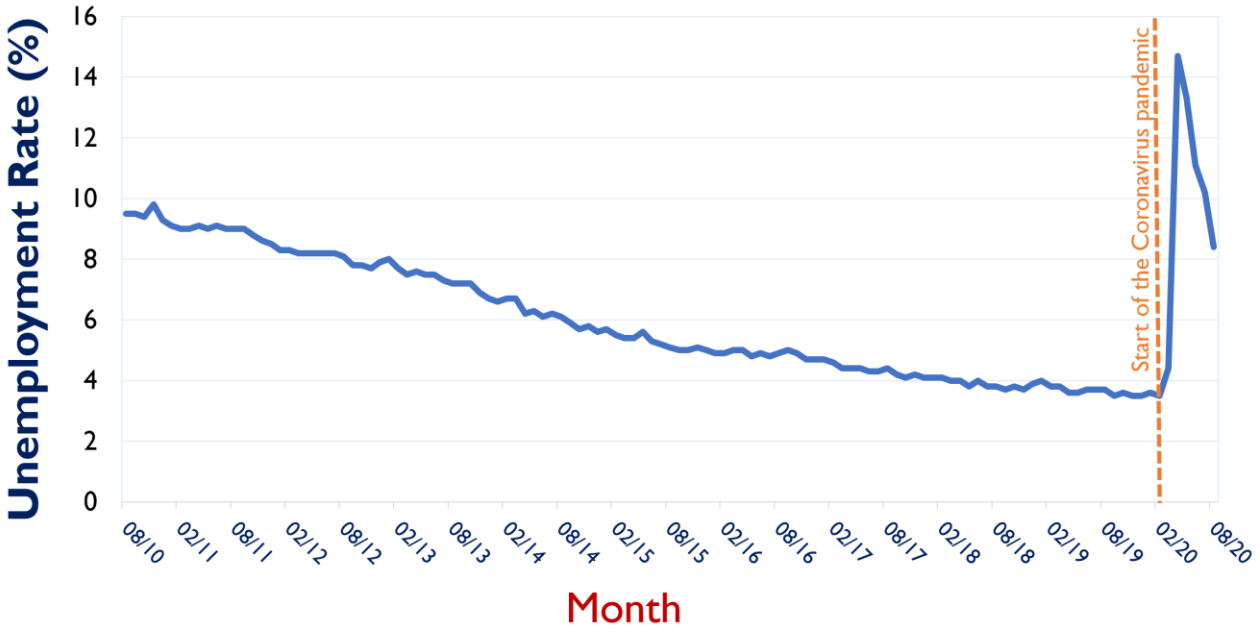
JEL Classifications: J01, J09, J15, J18, J28, J44, J64
Keywords: Agricultural production, Agriculture, Coronavirus, Economic disruption, Government policy, Jobless claims, Labor, Labor policy, Unemployment, Unemployment by race, Unemployment level

Since the onset of the coronavirus pandemic and the subsequent lockdown mandates, unemployment has surged in almost every sector of the economy. The U.S. unemployment rate rose from 3.5% in February 2020 to 14.7% in April 2020 (Figure 1). Consequently, 50 million individuals applied for unemployment benefits in the 16 weeks prior to July 4 (Figure 2). However, as several states began lifting stay-at-home orders and allowed business activities to resume, the number of weekly filings saw a steady decline, leading the unemployment rate to fall to 8.4% by the end of August.

The labor impact of COVID-19 is unique for each major sector of the economy (U.S. Bureau of Labor Statistics, 2020j). Manufacturing and service industries have been severely affected by the lockdown directive due to slumping domestic demand and reduction of exports (Reuters, 2020b). The agriculture industry, however, was declared "essential" to ensure food supply during the pandemic, keeping farm operations under social-distancing guidelines such as requiring workers to keep a distance of at least six feet between one another at work (Jordan, 2020). Figure 3 shows that the unemployment rate in the agriculture industry remained relatively unchanged.

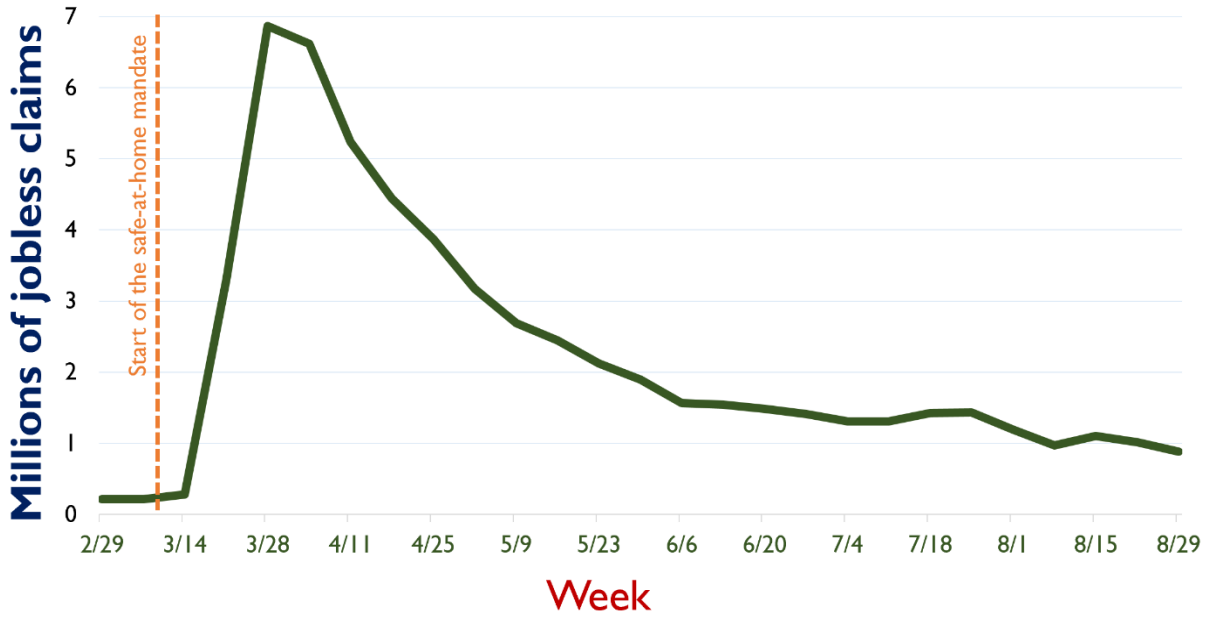
Disaggregating agriculture into three subsectors—food services, processing, and production—shows that the impact varies within this industry. Figure 4 shows the monthly unemployment rate per subsector over a two-year period, indexed to April 2018. Food services suffered the largest loss of employment, as many restaurants closed operations, leading to an increase in the unemployment rate from 5.7% in February to 35.4%

Figure 1. Unemployment Rate in the United States



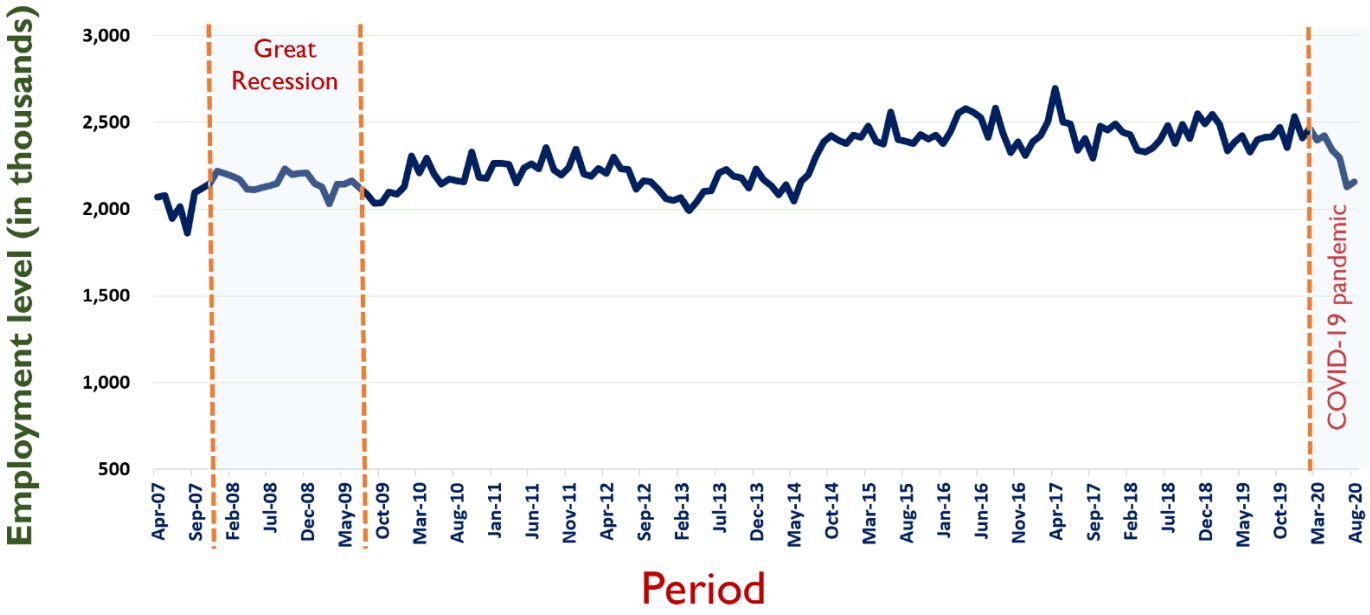
Source: U.S. Bureau of Labor Statistics (2020h).

Figure 2. Weekly Jobless Claims in the United States



Source: U.S. Department of Labor (2020b).

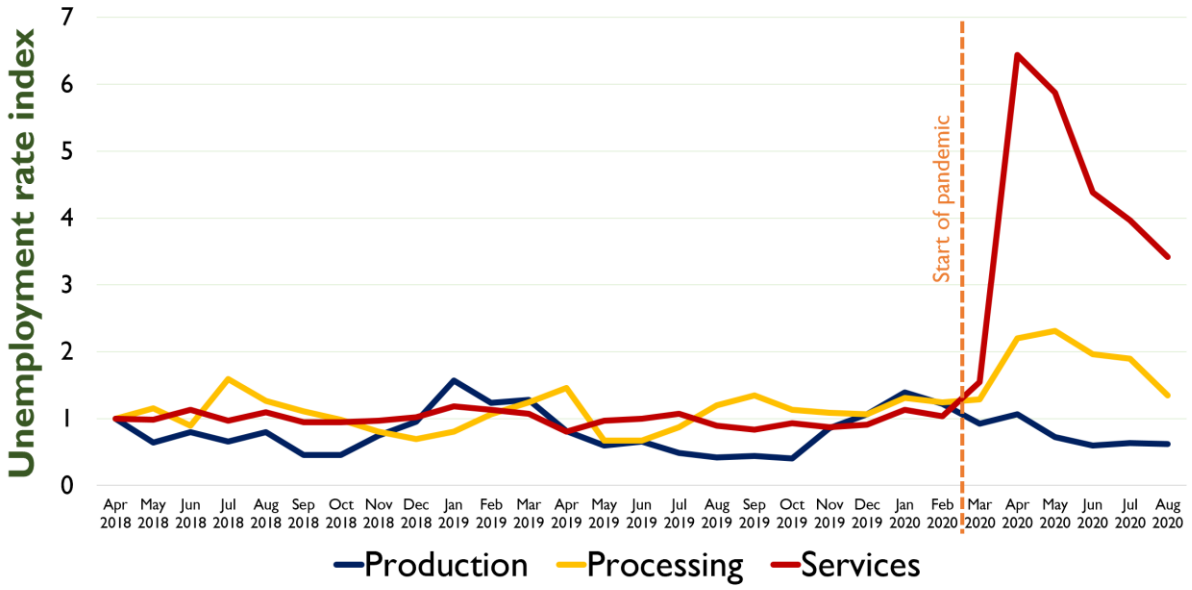
Figure 3. U.S. Employment in Agriculture



Note: The employment in agriculture is seasonally adjusted and includes related private wage and salary workers. Numbers are in thousands of workers.
Source: Federal Reserve Bank (2020).

in April in this subsector. Food processing (including meat processing plants) suffered job losses as COVID-19 infections spread among workers (Plumer, 2020). The effect on unemployment in the food processing sector, while not as large as in food services, was still significant as the unemployment rate increased from 5.7% in February to 10.1% in April. In contrast, food production remained relatively unaffected as demand for seasonal farmworkers and the subsector being declared "essential" by the U.S. Department of Homeland Security partially offset the unemployment effect of COVID-19 (Jordan, 2020). Between February and April, the

Figure 4. U.S. Unemployment Rate Index by Agriculture Subsector



Note: The unemployment rate displayed in this figure uses as reference April 2018.
Source: U.S. Bureau of Labor Statistics (2020e).

unemployment rate for the food production subsector fell from 11% to 9.6%, a 1.4 percentage point decrease. For comparison, the unemployment rate for this subsector decreased by 3.8 percentage points during the same period in 2019. By June, as most states lifted their economic lockdowns, all three subsectors started to show signs of recovery. The unemployment rate reported for August was down to 18.8% in food services, 6.2% in food processing, and 5.6% in food production.

This article reports how COVID-19 and the subsequent economic lockdowns have influenced employment in each of the three subsectors of agriculture. In addition, we describe the employment situation in three of the highest-impacted nonfarm sectors (i.e., healthcare, education, and professional and business services). We also outline the federal government response to the COVID-19-related unemployment issues and the heterogeneous impact on employment by race and ethnicity and discuss implications for the future of the agriculture industry.

Agriculture and Food Supply Chain

Food Services

The food services subsector includes restaurants, catering services, food trucks, and any other industry that offers "meals, snacks, and beverages to customer order for immediate on-premises and off-premises consumption" (U.S. Bureau of Labor Statistics, 2020f). In this sector, about 5.5 million servers, chefs, cashiers and bartenders lost employment due to states' stay-at-home or shelter-in-place regulations (Franck, 2020). This is mainly attributed to labor-force downsizing by restaurants facing lower demand as consumers shifted food expenditure to food cooked at home (Plumer, 2020). The restaurants that did not close their doors began operating at partial capacity, relying on drive-through sales or delivery to survive during the pandemic (Wida, 2020).

Food trucks that typically cater to large-scale events and crowded venues such as festivals, business centers, and college campuses were also driven to change their marketing strategies during the lockdown mandate. Thus, food trucks were driving to residential neighborhoods or turned themselves into mobile grocery stores. In addition, in order to pursue areas of high foot-traffic, many chose to locate near workplaces of essential employees, such as hospitals, and even highway rest stops to market to truck drivers (Dingwall, 2020).

Catering is defined as providing food at places and events such as sports entertainment, hotels, airlines, and cruise ships. Several prominent venues and sports leagues throughout the country temporarily shut down or canceled events due to the pandemic (Mather, 2020). Hotel caterers were severely impacted by disruptions of leisure and work-related travel. The American Hotel and Lodging Association (2020) reported that at the end of July more than half of the rooms were vacant across the U.S., an occupancy rate considered to be worse than that during the Great Depression in the 1930s. Caterers who partnered with airline companies suffered a similar fate, with widescale flight cancellations and seat capacity reduced by 70% compared to previous seasons (Whitley, 2020). The catering industry was also indirectly

affected by the "no sail" government order, which calls for cruise ships to cease admitting new passengers to avoid further COVID-19 outbreaks on cruise ships (Centers for Disease Control and Prevention, 2020).

Food Processing

Food processing was also severely affected by the pandemic, albeit to a lesser extent than food services. Although processing plants were required to continue production under the Defense Production Act (which mandates facilities that are considered essential to continue their operations during the pandemic) the unemployment rate almost doubled, from 5.7% in February to 10.6% in May (U.S. Bureau of Labor Statistics, 2020e). This can be partially attributed to a high risk of COVID-19 infection among workers (Restuccia and Bunge, 2020; Associated Press, 2020).

To prevent the spread of COVID-19 infections, most states have mandated social distancing in the workplace (Johansson, 2020). However, many stages in meat processing, such as separating organs and cutting and packaging meat, require employees to work in close proximity, which makes it difficult to implement social distancing regulations. Further, certain jobs cannot apply safety precautions efficiently due to the nature of the task. For instance, cleaners at a processing plant may inevitably get their masks wet, forcing workers to take them off and put themselves at risk (Bagenstose, Chadde, and Wynn, 2020).

These factors have caused processing plants to represent a large share of the COVID-19 cases in their respective counties, prompting facility closures by several large processors. A prominent example is Smithfield Foods, which temporarily closed its South Dakota meatpacking facility. This location processes 5% of the U.S. pork production (Huber, 2020). They resumed operations in May 2020 after approval by the Centers for Disease Control and Prevention, which helped to avoid pork shortages (Smithfield Foods, 2020). The seafood preparation and packaging industry faced a similar situation, with several seafood processors shutting down operations to avoid further COVID-19 outbreaks (Chase, 2020). Since the reopening of the economy in phases, seafood processors have been allowed to continue their operations as long as precautions are taken, workers are asymptomatic, and no more COVID-19 infections are recorded (Centers for Disease Control and Prevention, 2020).

Munshi (2020) reported dwindling inventory levels at cold-storage facilities that showed existing inventories amounting to only two weeks' worth of the nation's beef, pork, and poultry meat production. Thus, the closure of processing plants spurred fears of a possible meat shortage (Corkery and Yaffe-Bellany, 2020). On April 28, 2020, Restuccia and Bunge announced that meat production had decreased by 24.5% for the week ending April 25 compared to the previous week. To avoid possible shortages, a few large retailers set limits on the quantity of meat products that consumers were allowed to purchase during each visit while some fast food establishments opted not to sell products containing beef (Corkery and Yaffe-Bellany, 2020). However, the situation has received some relief due to the President invoking the Defense Production Act. By early June, various meat processing plants were operating at 95%–98% capacity (USDA, 2020).

Some processing companies have provided cash incentives to motivate employees to keep working. However, labor shortages continue to be substantial (Restuccia and Bunge, 2020). Some states have encouraged plants to reopen operations after a complete disinfection of the facility and to provide infected workers a reasonable time to recover before returning to work (Huber, 2020). Additionally, food manufacturers are incorporating new safety measures for their workforce, such as risk assessment, designating groups of workers (cohorts) for easier identification of an outbreak source, contact tracing, plastic barriers between workers at close range, slower production speeds to enable social distancing on conveyor lines, access to facemasks, education programs, and temperature checks (Bagenstose, Chadde, and Wynn, 2020; Chase, 2020; Huber, 2020). Nevertheless, restoring pre-quarantine production levels will take time.

Farm Production

The pandemic has added unexpected challenges to farmers. State social distancing mandates have decreased efficiency in labor activities (Newman, 2020). Farms hosting foreign guest workers under the H-2A program have faced additional costs as many growers must rent hotel rooms to quarantine workers or family members exposed to the virus (Newman, 2020). Despite these challenges, farm production has been least affected by the COVID-19 pandemic relative to other subsectors (Figure 4). This can be partially attributed to farm production being declared an essential activity needed to ensure food supply (Jordan, 2020).

The impacts on food production are regionally concentrated and commodity specific. Tables 1 and 2 summarize the estimates from the Purdue Food and Agriculture Vulnerability Index (Purdue University Department of Agricultural Economics, 2020). In terms of infection among farmworkers (Table 1), California, Texas, Iowa, and New York exhibited the greatest number of agricultural workers with confirmed cases of coronavirus across most commodities included in the index as of July 2020. It should be noted that these lists have evolved rapidly as the number of cases in New York has declined and the number of cases in Texas has drastically increased. Table 2 highlights production losses provoked by labor disruptions during the pandemic for each selected commodity. At the national level, vegetables show the greatest losses (likely due to the labor-intensiveness of vegetable production),

Table 1. Top Three States with the Highest Expected Number of Agricultural Workers with Confirmed Covid-19 Case by Commodity

Beans	Cattle	Vegetables	Hogs	Chickens	Wheat	Rice
California	Texas	Texas	Texas	Texas	California	California
Washington	California	California	California	California	Texas	Texas
Minnesota	Iowa	New York	Iowa	Iowa	Illinois	Arkansas

Note: Data as of July 4, 2020.
Source: Purdue University Department of Agricultural Economics (2020).

Table 2. National Production Lost due to Labor Impacts of Covid-19 by Commodity

Beans	0.63%
Cattle	0.84%
Vegetables	0.86%
Hogs	0.81%
Chicken	0.86%
Wheat	0.78%
Rice	0.67%

Note: Data as of July 4, 2020.
Source: Purdue University Department of Agricultural Economics (2020).

followed closely by chickens and cattle (including milking cows and calves).

Seasonal farm employment is expected to rise during the harvesting season of many commodities, raising concerns that the influx of farmworkers in rural areas may increase the virus' spread, especially in areas where healthcare facilities tend to be limited in number and capacity. Production of labor-intensive commodities, such as fruits and vegetables, is expected to be the "potential" driver of COVID-19 infections in these areas, especially if the product requires packaging, as short distances between workers on conveyor belt lines resembles the case of meat processing plants (Reuters, 2020a).

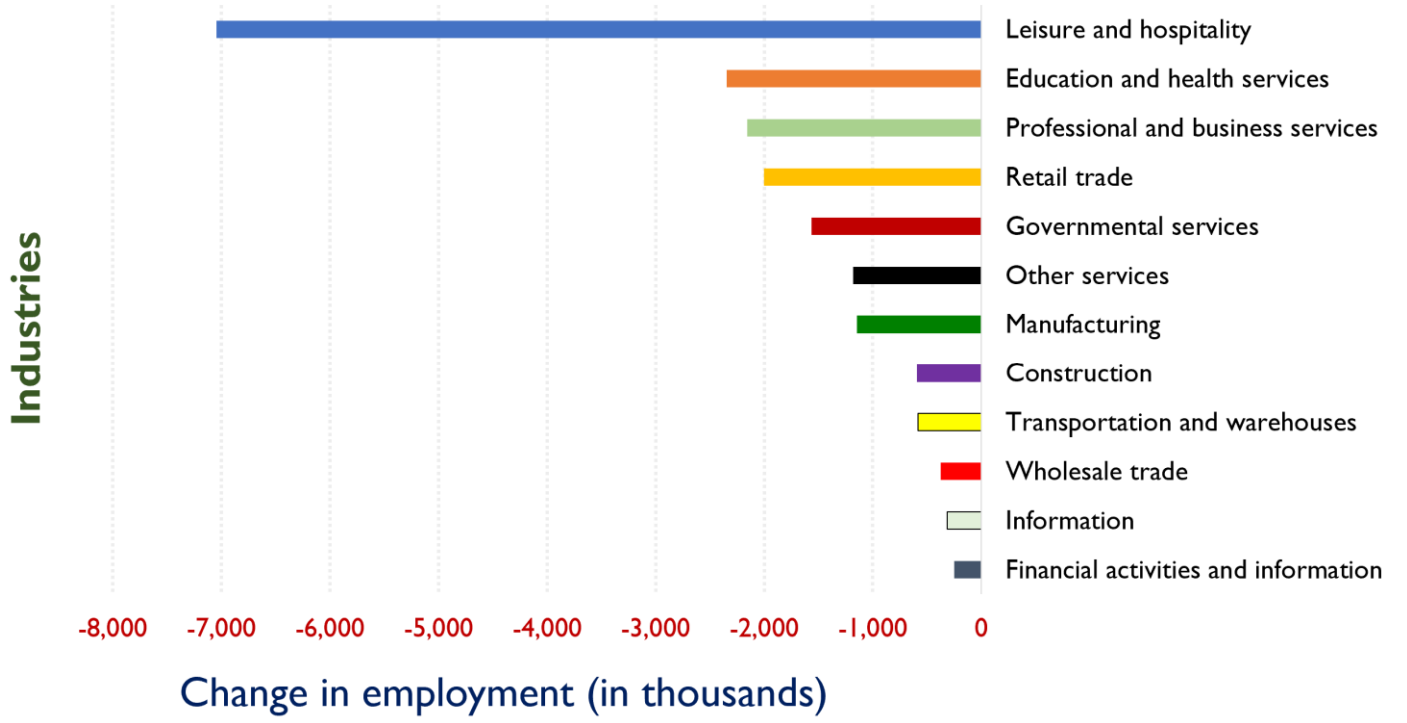
Farm production may also be impacted by market conditions and consumer behavior. Fear of COVID-19 outbreaks at farms can cause "panic buying" at retail stores, which can drive up food prices (Faber, 2020). This is likely to affect specific farm products because at the onset of the pandemic, "panic buying" mostly included storable commodities, not perishable farm products like strawberries, eggs, and milk. In addition, school closures and reduced capacity at restaurants induced a sharp decline in sales of perishable commodities leading to an "oversupply" in the market. This has forced growers to dispose excess production and sell the remaining products at a low price (Kesling, 2020). A similar phenomenon occurred in the dairy industry, which has a supply chain designed to work at a constant flow without disruptions (Mak, 2020). With fewer buyers and constant milk production in the short term, many dairy farmers and cooperatives were forced to dump the excess milk (Huffstutte, 2020).

Farmers are implementing a host of measures to prevent a COVID-19 outbreak among farmworkers. These measures range from investing resources for worker education about safety practices to buying their workers' groceries for them with the aim of encouraging observance of stay-at-home orders (Farm Bureau, 2020). Some farmers are entering temporary contracts with hotels to provide housing to workers in an effort to promote social distancing (Newman, 2020). Many agribusinesses are also offering medical care and paid sick leave for farmworkers who are infected with the virus (Jordan, 2020). However, one crucial uncertainty is the duration of the pandemic. Therefore, farmers are now beginning to formulate plans and procedures to address a COVID-19 outbreak if it occurs within their businesses (Farm Bureau, 2020).

Labor Effects of COVID-19 beyond Agriculture

While the agriculture industry has been deeply affected by the COVID-19 pandemic, other sectors of the economy have also faced large spikes in unemployment. Figure 5 shows the situation for nonfarm sectors. For comparison, we explore the labor situation in three industries outside of agriculture that have been impacted most by COVID-19.

Figure 5. U.S. Employment Change in Nonfarm Industries



Note: The change unemployment level is seasonally adjusted and represents the net three-month change from February to May for every industry.
Source: U.S. Bureau of Labor Statistics (2020a).

The health care and social assistance sector—which comprises hospitals, nursing homes, physician offices, and dentist offices—has seen its unemployment rate go from 2.2% in February 2020 to a peak of 10.4% in April (U.S. Bureau of Labor Statistics, 2020g). Cancelled elective surgeries and nonemergency visits due to the pandemic caused revenue losses for several hospitals and clinics (Karlamangla and Mason, 2020). About 27,000 health workers were furloughed or laid off between March and May 2020 (U.S. Bureau of Labor Statistics, 2020c). The reopening of states has allowed hospitals to perform their usual medical services. However, the number of doctor visits is slow to recover as people are afraid of exposure to COVID-19 (Howard, 2020).

Educational services—which includes K-12 schools and higher education institutions—also faced a rise in unemployment from 4.6% in March 2020 to 12.7% in April 2020 (U.S. Bureau of Labor Statistics, 2020b). Many school nurses and counselors were laid off due to budget reductions in public schools and classes moving online (Strauss, 2020).

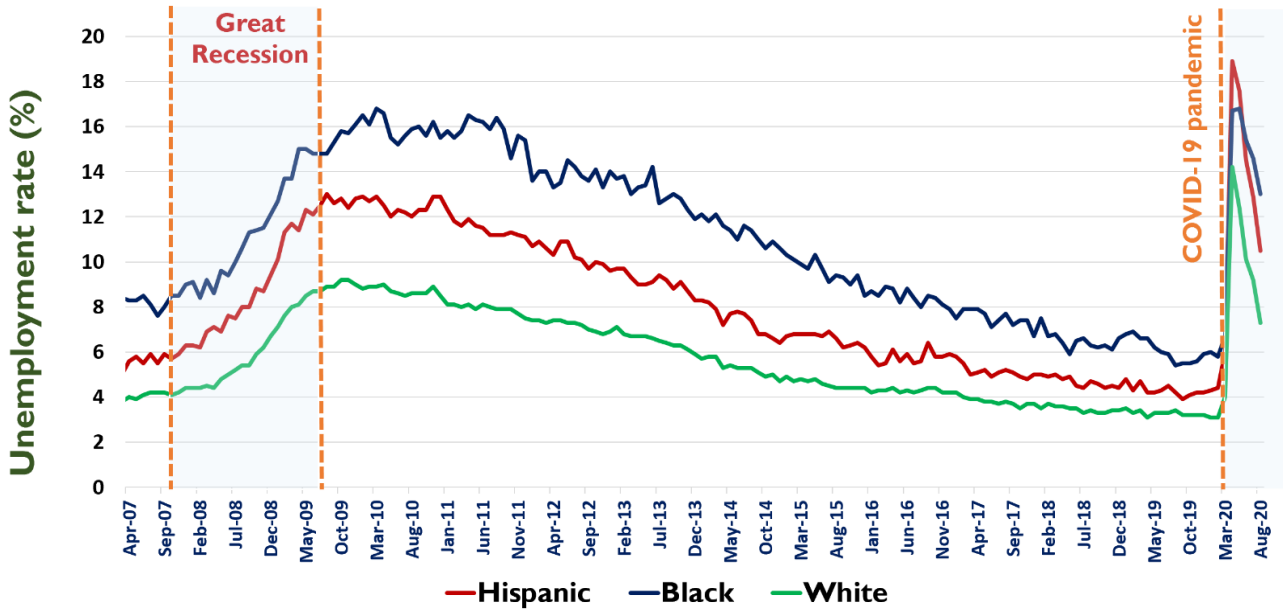
The professional and business services subsector—which contains accountants, lawyers, engineers, and office clerks, among other professions—doubled its unemployment rate between February (4.4%) and May 2020 (9.0%) (U.S. Bureau of Labor Statistics, 2020i). In particular, almost half of these job losses during this period occurred in temporary positions (Franck, 2020).

Unemployment by Race and Ethnicity

COVID-19 has disproportionately affected unemployment among racial and ethnic minorities (Figure 6). Hispanic workers suffered the highest rise in unemployment, at 17.6% in May 2020, relative to other ethnicities (Bureau of Labor Statistics, 2020). This is attributed to the quarantine mandate that forced industries with large shares of Hispanic workers, such as hotels, restaurants and construction, to limit operations (Gogoi, 2020). In particular, Hispanic women faced a 21% drop in employment as leisure and hospitality services (food services, accommodation, arts and recreation) either closed or started operating at partial capacity (Kocchar, 2020). African Americans also faced a spike in unemployment (16.7% in April, relative to the national average of 14.7%), mainly attributed to the economic shutdown. Smialek and Tankersley (2020) reported that less than half of African American adults had jobs in April 2020.

The reopening of states is expected to reopen job positions across the nation. However, the U.S. Bureau of Labor Statistics (2020d) shows that changes in employment have not been uniform across races and ethnicities. The job situation for white Americans has

Figure 6. Unemployment Rate by Race and Ethnicity



Note: The unemployment rate is seasonally adjusted for each race and ethnicity.
Source: Federal Reserve Bank (2020).

started to improve, with unemployment rate decreasing from 14.2% in April to 12.4% in May 2020. In contrast, African Americans suffered a slight increase in the jobless rate, from 16.7% in April to 16.8% in May. Asian Americans also faced a rise in unemployment (+0.5%) for the same period. In August, unemployment rate for White, Black and Hispanic were reported to be 7.3%, 13.0% and 10.5%, respectively (U.S. Bureau of Labor Statistics, 2020d).

Government Response

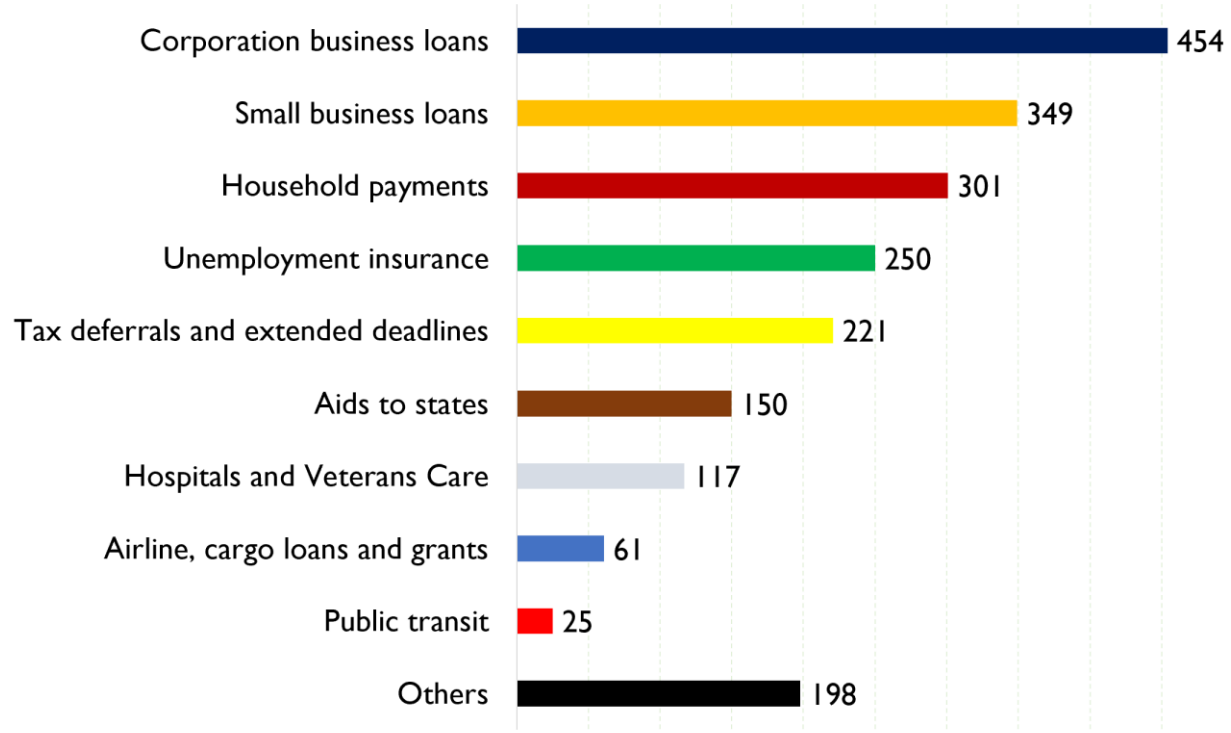
To address the economic crisis created by the pandemic, the federal government passed the Coronavirus Aid, Relief and Economic Security (CARES) Act, a $2 trillion-dollar stimulus package aimed at supporting small businesses, workers, and families (U.S. Department of the Treasury, 2020). Specifically, the CARES Act has provisions for corporate and small business loans, household payments, hospitals and veterans care, and unemployment insurance among others (Figure 7).

Funds totaling $349 billion are given to small businesses (with 500 or fewer employees) through the Paycheck Protection Program (PPP). These forgivable loans are used to support employment and payroll (Forde, 2020). A second version that was issued on June 4, titled the Paycheck Protection Program Flexibility Act (PPPFA), increased the funds of the program by $349 million. The PPPFA requires small business owners to use 60% of the loan to cover payroll costs while also extending the deadline for these expenses to be paid, giving employers more time to rehire employees (Hare, 2020). Larger businesses have access to the $500 billion fund granted through the Economic Stabilization Fund (ESF). Only U.S.-based corporations with revenues of less than $2.5 million or fewer than 10,000 employees are eligible (Forde, 2020).

The government also set up the Coronavirus Food Assistance Program, which provides $16 billion of direct payments to farmers and $3 billion to buy surplus harvests to stock food banks (Kesling, 2020). The maximum allowance is $250,000 per legal entity or person with an average annual gross income less than $900,000 in the years 2016–2018 (U.S. Department of Agriculture, 2020).

A number of relief efforts have been undertaken by the federal government to support workers affected by the COVID-19-related economic shutdown. One of the most notable provisions of the CARES Act was the “economic impact payments,” better known as stimulus checks, which provide tax credits to families depending on household income and number of household members. This program provides stimulus payments of $1,200 for a single person, $2,400 to a married couple, with an additional $500 for each dependent person younger than 17 years old as of December 31, 2020 (Consumer Financial Protection Bureau, 2020). The payment decreases incrementally for single people and married couples receiving income greater than $75,000 and $150,000 per year, respectively (Consumer Financial Protection Bureau, 2020).

Figure 7. Relief Amounts of the CARES Act by Provision Category (in $billions)



Source: Davidson and Mitchell (2020).

The CARES Act also created the Federal Pandemic Unemployment Compensation program (FPUC), which gives an additional $600 per week in benefits for a maximum of 13 weeks to workers suffering from COVID-19-related job losses (U.S. Department of Labor, 2020a). Likewise, the Families First Coronavirus Response Act (FFCRA), broadens the coverage of the Family Medical Leave Act, adding a new paid sick leave law, and mandates private health insurers to cover COVID-19 testing (Parker and Ryan, 2020). None of these benefits are available for undocumented workers (Jordan, 2020).

A second program that was discussed in Congress is the Health and Economic Recovery Omnibus Emergency Solutions (HEROES) Act (U.S. Congress, 2020). With ongoing talks in Congress, the possibility and specific details of the next round of stimulus is currently uncertain.

Conclusion and Discussion

Overall, our analysis has shown that employment in the food services subsector was most vulnerable to the economic fallout from the COVID-19 pandemic. Food processing was also impacted, although to a lesser extent than food services, driven primarily by closures at large processing plants. Farm production has so far been relatively successful at avoiding wide-scale layoffs of agricultural workers. This variation can be attributed to the nature of business at the three stages of the agricultural supply chain. While unemployment in food services is largely the product of demand-side shocks, such as restaurant and school closures, unemployment in food processing and production is related to supply-side factors such as issues of worker safety. Among nonagricultural industries, healthcare, education, and professional services were found to be the most affected. While unemployment has risen nationwide, racial and ethnic minorities were especially vulnerable to COVID-19 related layoffs, with Hispanic Americans experiencing the highest unemployment rate.

Despite the aggressive measures implemented by policy makers to combat the spread of the virus and the consequent economic fallout, a second wave of COVID-19 infections is not only possible, but it may have already begun. This is indicated by the recent uptick in the number of new daily COVID-19 cases reported by Florida, Texas, Arizona, and Oregon, among others. A second wave of infections may prolong the duration of the current economic crisis and lead to new disruptions in agricultural supply chains. While the probability and magnitude of a second wave is uncertain, the impact on employment may not be as severe as the first wave. Preventive measures taken by food processors, retailers, and producers in response to the first wave may avert large scale infections among agricultural workers. In addition, as new information about the coronavirus comes to light, proactive measures can be implemented across the supply chain to prevent, or at least slow, the spread of new COVID-19 cases in the agriculture industry.

This unprecedented crisis may have long-term implications for agriculture. For example, if higher costs of labor due to COVID-19 safety measures becomes the "new normal," it may ultimately lead to higher food prices for consumers. Further, it may induce agribusinesses (including farms) to favor automation of production processes over manual labor, which may expedite the decades-long trend of farm and agribusiness consolidation, as smaller businesses may not be able to afford large capital investments to replace labor. Potential restrictions on temporary foreign agricultural workers may also contribute to increasing labor costs.

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U.S. COVID-19 Policy Affecting Agricultural Labor

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Introduction

Businesses around the world have been affected by the COVID-19 pandemic. In the United States, stay-at-home orders, voluntary safety practices, and other public health regulations in response to the spread of COVID-19 have corresponded to disruptions to normal business operations. Businesses deemed essential, such as those in the food supply chain, have adapted to continue operations during the pandemic.

This article discusses the major policies affecting the supply and demand of labor in agricultural production during the pandemic. There has been significant concern in recent months about the availability of staple products, particularly food products. Shortages of some food products have drawn media attention to disruptions in the food supply chain; simultaneously, agricultural producers face excess production and low prices for some commodities (Jeffery and Newburger, 2020; Yaffe-Bellany and Corkery, 2020). The pandemic and these associated disruptions have drawn attention to the safety, availability, and productivity of essential workers, especially those in agriculture.

This attention is not unwarranted. Recent data from the Washington State Department of Health found that "agriculture, forestry, fishing, and hunting" employees tested positive for COVID-19 at higher rates than any other employment category after "health care and social assistance" (Washington State Department of Health, 2020). It is frequently the case that essential workers in the agricultural supply chain cannot expediently or effectively adhere to safety recommendations. Thus there have been numerous significant COVID-19 outbreaks on farms and at processing facilities (Dorning and Skerritt, 2020; Gallagher and Kirkland, 2020; Garcia, 2020; Shoichet, 2020; de la Rosa, 2020). Undocumented agricultural workers are likely the most at risk given their higher rates of communal housing, shared transportation, and lack of access to healthcare.

State and federal government policy has affected agricultural workers' leave, safety practices, and even the ability to recruit agricultural workers from other countries. Further, compliance with additional worker safety recommendations from the Centers for Disease Control and Prevention (CDC) and the U.S. Department of Agriculture (USDA) may have significant effects on agricultural employers that are already competing for a limited supply of laborers. These topics and their potential implications are discussed sequentially below.

Essential Workers

On March 19, workers in 14 necessary sectors of the economy were classified as "essential critical infrastructure workers" in guidance from the U.S. Department of Homeland Security's (DHS) Cybersecurity and Infrastructure Security Agency. By May 19, these 14 categories had been revised to 17 (DHS, 2020b):

- Healthcare/public health;
- Law enforcement, public safety, and other first responders;
- Food and agriculture;
- Energy;
- Water and wastewater;
- Transportation and logistics;
- Public works and infrastructure support services;
- Communications and information technology;
- Other community- or government-based operations and essential functions;
- Critical manufacturing;
- Hazardous materials;
- Financial services;
- Chemical;
- Defense industrial base;
- Commercial facilities;
- Residential/shelter facilities, housing and real estate, and related services;
- Hygiene products and services.

While there are some nuanced differences in state-level implementation of this guidance, most states mirrored the original 14 categories of essential employees in the directive when constructing their own stay-at-home

orders (National Conference of State Legislatures, 2020).

Food and agriculture essential workers span the entire food supply chain, from farmworkers to restaurant and grocery store employees. The pandemic has highlighted the necessity of these workers to provide food for consumers as COVID-19 outbreaks impacting the food supply chain have caused shortages for some consumer goods. For example, outbreaks in the meatpacking industry due to working conditions conducive to the spread of the virus caused several major meatpacking plants to temporarily close (CDC, 2020; Gallagher and Kirkland, 2020). In response, on April 28, President Trump invoked the Defense Production Act of 1950 via executive order to support meat production during the crisis (President of the United States of America, 2020).

As the pandemic continues, there are growing concerns that disruptions to the food supply chain will continue in other at-risk industries. Peak harvest season for the most labor-intensive crops in the United States is during the summer, and growers of these crops have already been experiencing agricultural labor shortages for years. In fact, the rapid growth of the H-2A Temporary Agricultural Worker Program in the fruit and vegetable industry over the last decade has been attributed to a lack of domestic agricultural workers (Bampasidou and Salassi, 2019; Costa and Martin, 2020; Luckstead and Devadoss, 2019; USDA, 2020b). Already, numerous workforce representatives and news agencies report major COVID-19 outbreaks on farms (Dorning and Skerritt, 2020; Farmworker Justice, 2020; Garcia, 2020; Newman, 2020; Shoichet, 2020; de la Rosa, 2020).

Paid Medical Leave

Safety recommendations from the CDC and U.S. Department of Labor (DOL) state that workers who exhibit COVID-19 symptoms should immediately be separated from others at the workplace to prevent further spreading the disease (CDC, 2020a; CDC, 2020b; DOL, 2020b). The U.S. government is supporting these guidelines by enacting significant legislation supporting public safety. In particular, new paid medical and family leave provisions in the Families First Coronavirus Response Act (FFCRA) may significantly affect the workplace.

The FFCRA was signed into law on March 18, 2020, and became effective April 1 (U.S. Congress, 2020). The Congressional Budget Office (CBO) estimates that the FFCRA will cost approximately $192 billion (CBO, 2020). The FFCRA responds to the pandemic "by providing paid sick leave, tax credits, and free COVID-19 testing; expanding food assistance and unemployment benefits; and increasing Medicaid funding" (U.S. Congress, 2020).

The paid leave requirements of the FFCRA cover the cost of employees' leave due to COVID-19 for employers of businesses with 500 or fewer employees. These two weeks of paid leave cover sick leave for COVID-19 related reasons with a maximum payout of $5,110 per worker. There is also two weeks of medical leave at a rate of two-thirds regular pay, with a maximum payout of $2,000. This medical leave can be expanded an additional ten weeks to care for children with school closings with a maximum payout of $10,000. Employers with fewer than 50 employees may be exempt from the long-term family leave requirement if the loss of workers will cause the business to close (U.S. Congress, 2020; DOL, 2020c).

The reduction in workers taking leave due to illness may significantly affect the availability of agricultural labor. Further, symptomatic workers who do not take leave will likely be less productive and potentially infect other workers. There are already numerous observations of agricultural workers contracting COVID-19 and outbreaks on farms (Dorning and Skerritt, 2020; Garcia, 2020; Newman, 2020; Shoichet, 2020; de la Rosa, 2020). Agricultural workers are an especially at-risk group as essential workers. These workers often work in close proximity, share living accommodations and transportation, travel around the country to find seasonal work, and may lack access to high-quality healthcare.

Workplace Safety Precautions

Recommended and mandated workplace safety precautions may significantly reduce agricultural workers' productivity in order to mitigate the spread of COVID-19. The CDC (2020a; 2020b) and OSHA (DOL, 2020b) recommend social distancing, sanitizing workstations, barriers, and face coverings. These precautions are mandated in some states, counties, cities, and other organizations.[1] Even when these precautions are not required, workers may be hesitant to continue employment with employers that do not follow safety precautions.

These safety precautions can be particularly difficult to implement in agricultural operations. Work crews may not operate as efficiently when workers are separated by a barrier or require a six-foot distance between each other. Face coverings and respirators may impede the efficiency of labor-intensive jobs (Johnson, 2016; Li et al., 2005; Roberge, Kim, and Coca, 2012). Barriers, disinfectants, and face coverings may be expensive to acquire, especially given the surge in demand. Further, there may be additional training, installation, and operational costs. There is ongoing research to fully assess these materials costs and productivity losses, but they are potentially substantial (Vasquez 2020).

[1] *State, county, and city orders related to COVID-19 vary substantially both geographically and over time. Many businesses and organizations have also developed supplemental operational guidelines.*

It is also the case that agricultural workers often share housing and transportation. It is common for employers of seasonal workers to provide housing and transportation that are regulated by the DOL. Data from the National Agricultural Worker Survey (NAWS) indicate that approximately one-third of U.S. farmworkers live in crowded dwellings (Hernandez and Gabbard, 2018). Symptomatic workers are directed to be separated from others, but federal housing standards only require beds to be spaced three feet apart. This means that many employers of agricultural workers who provide housing as part of the contract must rent additional living spaces for infected workers or risk further infection of their workforce (Newman, 2020). Adhering to social distancing guidelines in transportation may require additional trips to and from lodging and workplace, adding to time and fuel costs.

Employer-provided housing and transportation are key facets of the H-2A Temporary Agricultural Worker Program, which accounts for approximately 10% of the national crop workforce (Costa and Martin, 2020). The DOL Employment and Training Administration's Office of Foreign Labor Certification has recognized the disruptive impacts of the pandemic by allowing employers of these workers to relocate workers temporarily without the normal approvals (DOL, 2020a). Nevertheless, concerns remain whether these workers utilizing employer-provided housing and transportation will be able to adhere to recommended safety practices. There have been numerous claims of employers not adhering to recommended workplace safety precautions, particularly in housing and transportation (Dorning and Skerritt, 2020; Farivar, 2020; Garcia, 2020; Newman, 2020; Shoichet, 2020; Vasquez, 2020; de la Rosa, 2020).

Compounding these worker safety issues is the availability and cost of testing. The CDC notes that, "Although supplies of tests are increasing, it may still be difficult to find a place to get tested" (CDC, 2020c). It can be particularly difficult for farmworkers in the United States to get tested when exhibiting symptoms. These workers are often located far away from the nearest testing center or hospital and may not have health insurance (Vasquez, 2020). It can also be more difficult for undocumented agricultural workers to acquire these services. Data from the NAWS estimate that unauthorized workers account for approximately half of the U.S. agricultural workforce; only 47% of all farmworkers reported having some form of health insurance (Hernandez and Gabbard, 2018; USDA, 2020b).

Travel Restrictions

Travel restrictions implemented as a result of the COVID-19 pandemic have raised concerns with U.S. agricultural employers. Over 200,000 temporary agricultural workers each year travel from Mexico to the United States as part of the H-2A Temporary Agricultural Workers Program. These seasonal workers account for approximately 10% of the national crop workforce, and that proportion has grown rapidly in recent years (Costa and Martin, 2020). Further, many other U.S. agricultural workers regularly migrate within and across national borders. Simply put, the agricultural workforce is quite mobile.

The number of temporary visas issued through the H-2A program increased from 60,112 in 2009 to 204,801 in 2019 and is on a trajectory to keep growing (Costa and Martin, 2020, DOL, 2020). See Table 1 for the growth of H-2A visas issued in the last decade. These legal, temporary workers are an essential component of U.S. agricultural production. The program is designed so that these foreign workers are only hired when agricultural employers can provide evidence of a shortage of domestic workers. H-2A workers are most commonly employed in labor-intensive agricultural operations such as fruit and vegetable production (Luckstead and Devadoss, 2019).

Table 1. H-2A Temporary Agricultural Worker Visas Issues by Year (2009-2019)

Year	H-2A Visas
2009	60,112
2010	55,921
2011	55,384
2012	65,345
2013	74,192
2014	89,274
2015	108,144
2016	134,368
2017	161,583
2018	196,409
2019	204,801

Source: Costa and Martin (2020) analysis of U.S. Department of State Nonimmigrant Visa Statistics (2020).

Recent travel restrictions may negatively impact the mobility of the U.S. agricultural workforce, especially H-2A workers. On March 18, the U.S. Embassy in Mexico City and all U.S. consulates in Mexico suspended routine consular and visa services (U.S. Embassy and Consulates in Mexico, 2020). This action prompted immediate concern by agricultural producers in the United States, who require these visa services to hire H-2A workers. On March 26, Secretary of State Mike Pompeo, in consultation with the DHS, responded to these concerns by authorizing consular offices to continue processing H-2A visa applications (U.S. Department of State, 2020). Further, on April 20, the DHS amended certain H-2A requirements to facilitate the hiring of H-2A workers (USDA, 2020; DHS, 2020a). These amendments include interview waivers for certain applicants, allowing H-2A workers to transfer contracts without returning to their home country, and extending

the three-year maximum cumulative stay for H-2A workers.

Despite the combined actions of the U.S. Departments of Homeland Security, Labor, Agriculture, and State, the number of H-2A workers and the broader agricultural workforce may decline this year. Interviews are still required for some H-2A visas and this process remains halted for the time being. Varied other travel restrictions such as travel bans also remain in place, potentially disrupting the arrival of agricultural workers. Even without these restrictions, some agricultural workers may choose not to participate in the industry due to safety concerns.

Discussion

As the COVID-19 pandemic continues, there are growing concerns in the United States about the health, availability, efficiency, and overall productivity of essential agricultural workers. Policies in response to the pandemic have tried to balance the safety of these workers and the ability for agribusinesses to operate efficiently. These policies include classifying agricultural workers as essential, paid medical leave provisions, voluntary and mandatory workplace safety precautions, and travel restrictions. Despite these policies, the U.S. agricultural workforce continues to be a major source of infections.

Continued and potentially increasing COVID-19 outbreaks on U.S. farms could further disrupt the food supply chain, thus increasing costs and causing additional shortages or higher prices for some agricultural products. Further, these disruptions and adjustments to the production process may have significant negative effects on the well-being and continued profitability of U.S. agribusinesses. As we approach peak harvest season in the summer, we will observe more fully the impact of the pandemic on U.S. farms and the broader food supply chain.

Further into the future, there are concerns that workplace safety violations during the pandemic may result in lawsuits against government agencies and employers, particularly those involved in agriculture. Already, the United Farm Workers and other groups sued Washington State this April over the lack of appropriate health precautions in place for agricultural workers. Smithfield Foods was also sued over working conditions in its Missouri facilities (Farivar 2020).

Overall, the pandemic may bring into clearer view the treatment of this essential workforce. Undocumented agricultural workers still account for approximately half of farm employment according to recent estimates (Hernandez and Gabbard, 2018). These at-risk workers may be hesitant to seek medical attention or stop working due to fear of retribution, whether by deportation or firing. The H-2A Temporary Agricultural Workers Program, once relatively unknown to much of the public, is now becoming a focal point in discussions of immigration reform. Employers seeking increasingly scarce agricultural workers may be forced into offering higher wages and more amenities. This global event has caused society to rethink many of its institutions and industries. Agriculture in the United States could be on the precipice of dramatic changes, particularly regarding the employment of farm workers.

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COVID-19 Risk Factors Vary by Legal Status among Florida Crop Workers

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Introduction

COVID-19, the disease caused by the novel coronavirus (SARS-CoV-2), has shaken personal and economic lives across the United States and around the world. Despite the stay-at-home orders, the number of COVID-19 deaths continues to rise at an alarming rate. At the same time, efforts to "re-open the economy" continue after stay-at-home orders have been ended. The ripple effects of COVID-19 in the United States appear to have hit different states, and even counties within a state, at different times and with varying intensity. The Northeastern states of New York and New Jersey, among the hardest hit earlier in spring 2020, have started seeing their rate of infections decrease, as states in the South and Southwest—including Florida, Alabama, Arizona and Texas—are experiencing increasing rates of new COVID-19 cases as summer 2020 progresses (Bosman and Smith, 2020). In Florida, an outbreak among crop workers has contributed to the recent uptick in COVID-19 cases, renewing concerns about the safety of farmworkers as well as the sustainability of the food supply during the pandemic (Mazzei, 2020).

Florida is one of the top crop-producing states in the country, with over 77% of the state's total agricultural cash receipts coming from the crop sector (U.S. Department of Agriculture, 2020a). The share of specialty crops (i.e., fruits and vegetables, tree nuts, dried fruits, horticulture and nursery crops, and floriculture) in Florida's total agricultural cash receipts was 66% in 2017 (U.S. Department of Agriculture, 2020). Labor costs account for over 25% of the total gross cash farm income in specialty crop sectors (U.S. Department of Agriculture, 2020b). The viability of the crop sector, including the specialty crops sector, relies on sustaining a healthy labor force.

As new epidemiological data on COVID-19 continue to flow in, it becomes clear that the consequences of the SAR-CoV-2 infection vary substantially across individuals, depending on underlying risk factors (Jordan, Adab, and Cheng, 2020). While the majority of individuals infected with SAR-CoV-2 exhibit only mild symptoms of the disease, others develop serious complications that can lead to hospitalization or even death. With no vaccine or effective treatment yet in sight, one question of interest for mitigating COVID-19 within the crop sector is whether crop workers vary in their COVID-19 risk factors. We aim to gain insights into this question using available data on the characteristics of Florida crop workers.

Our analysis suggests that COVID-19 risk factors vary across the counties of Florida and between legal status groups—specifically, between H-2A guest workers and unauthorized farmworkers. The federal H-2A guest workers program provides legal, nonimmigrant visa classification to foreign-born workers seeking to perform agricultural work of a temporary nature, typically lasting no longer than one year, for which able, willing, and qualified U.S. workers are not available. Unauthorized workers are foreign-born workers who lack proper, legal documentation to work in the United States. We discuss implications of our findings for planning targeted measures for the health and safety of both legal status groups and for keeping crop farms operational amid the battle against the new virus.

Crop Workers Are at High Risk of Developing COVID-19 Related Complications

Using data synthesized from the National Health Interview Survey (Blewett et al., 2016) and Quarterly Census of Employment (U.S. Bureau of Labor Statistics, 2020), we examine the underlying health and social conditions of Florida and U.S. crop workers that can increase the likelihood of developing COVID-19

Table 1. Estimated Crop Workers at Risk of Developing COVID-19 Complications Given SARS-Cov-2 Infection

	FL Crop Workers at Risk		U.S. Crop Workers at Risk	
By health risk factors	Fraction	Number	Fraction	Number
Any health risk	75.1 %	33,317	83.8 %	439,076
BMI >25.5	59.5 %	26,417	67.7 %	354,500
Hypertension	21.1 %	9,354	45.9 %	83,379
Diabetes	10.5 %	4,673	10.2 %	53,673
Liver disease	6.5 %	2,890	2.3 %	12,112
Heart condition	5.3 %	2,335	4.4 %	23,009
Kidney disease	3.7 %	1,636	2.2 %	11,772
Cancer	2.5 %	1,099	3.0 %	15,680
Asthma	0.0 %	0	3.3 %	17,541
Any health risk, except BMI>25.5	55.4 %	24,581	51.4 %	269,292
Over 60, any health risk	16.0 %	7,088	17.1 %	89,592
By social risk factors:	Fraction	Number	Fraction	Number
History of smoking	29.7 %	13,199	31.2 %	163,700
No insurance	23.5 %	10,426	23.0 %	120,518
Can't afford care	4.8 %	2,130	5.9 %	30,947
Male	81.0 %	35,973	72.0 %	377,171
Age 40 or above	57.1 %	25,354	57.3 %	300,102
Age 60 or above	18.0 %	8,002	17.7 %	92,493

Sources: Compiled from Maher et al. (2020).

complications, given infection with the virus (Maher et al., 2020).

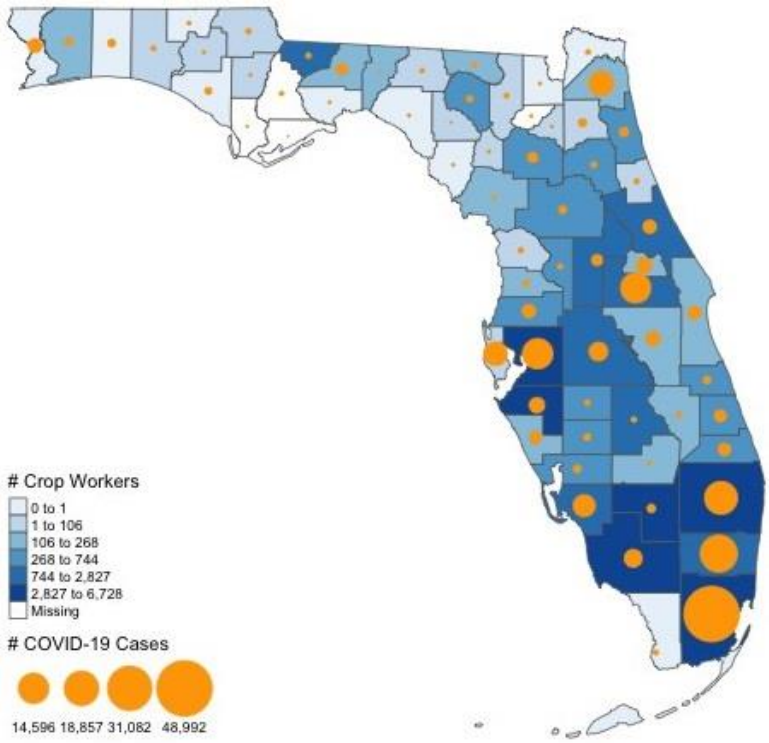
Table 1 suggests that 75.1% of crop workers in Florida (33,317 workers) and 83.8% of U.S. crop workers (439,076 workers) have at least one underlying health condition that puts them at risk of developing COVID-19 complications if they are infected with SAR-CoV-2. A common perception is that a typical crop worker should be in a good state of fitness due to the physical demands of their farm jobs. However, this perception does not appear to hold for either Florida or U.S. crop workers, with 59.5% of Florida crop workers and 67.7% of U.S. crop workers at risk due to a body mass index (BMI) over 25.5 (i.e., overweight). Excluding the high BMI, the fraction of crop production workers at risk of developing COVID-19 complications decreases from 75.1% to 55.4% in Florida, and from 83.3% to 51.4% in the United States. Compared to the U.S. average, Florida crop workers have a higher COVID-19 risk due to diabetes, liver disease, heart condition, and kidney disease but a lower risk due to hypertension, cancer, and asthma.

Table 1 also reports social risk factors of crop production workers for developing COVID-19 complications given infection. Scientists agree that being older and male are among the top risk factors for developing a more serious illness after contracting SARS-CoV-2. According to data in Table 1, higher percentages of crop production workers are male (81%) in Florida than in the United States. The age distribution of crop production workers is comparable in Florida (18% at age 60 or above) and in the United States (17.7% at 60 or above). The fraction of crop production workers who report no access to health care is similar in Florida (28.3%) and in the United States (28.9%). A history of smoking among crop production workers is also comparable between Florida (29.7%) and the United States (31.2%), with slightly fewer smokers among Florida workers. Current scientific knowledge of the virus does not allow predicting exactly who will become seriously ill due to COVID-19. However, the data in Table 1, overall, suggest that crop workers in Florida and the Unites States are at high risk of developing complications due to underlying health and social risk factors.

COVID-19 Spreads across Agricultural Counties of Florida

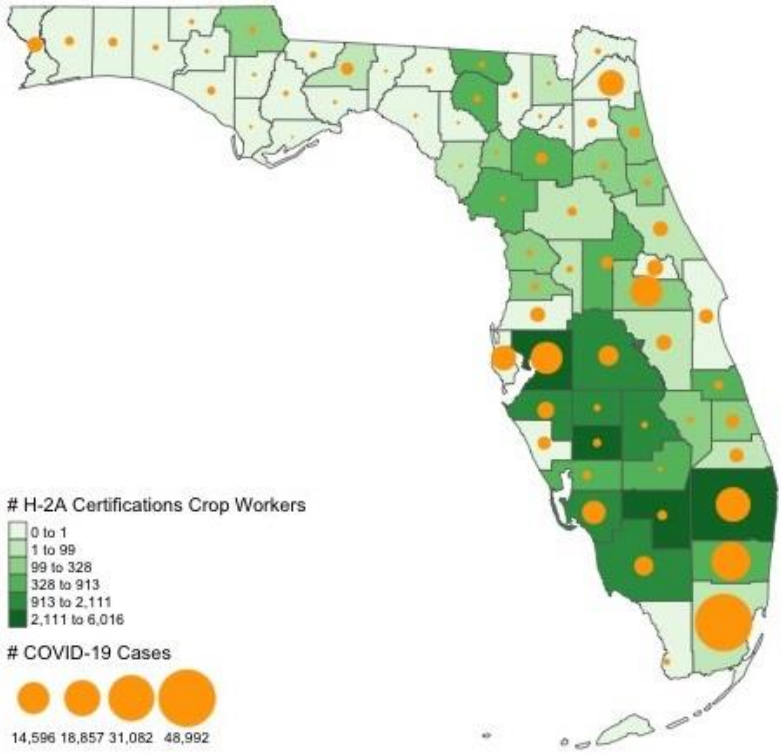
According to the Centers for Disease Control and Prevention (CDC), the SARS-CoV-2 mainly transmits from person to person through respiratory droplets produced by coughing, sneezing, or talking (CDC, 2020). Therefore, one of the most important risk factors for contracting the virus is proximity to locations with a high number of infections. Figure 1 contains mapped data on county-level numbers of crop workers reported in the Quarterly Census of Employment and Wages (QCEW) (U.S. Bureau of Labor Statistics, 2020), along with total COVID-19 cases in each of the counties in Florida (Florida Department of Health, 2020). The QCEW only reports crop workers covered by state unemployment insurance. In Florida, QCEW excludes H-2A guest workers, as employers of H-2A workers are exempt from paying state unemployment insurance (Roka et al.,

Figure 1. Spread of COVID-19 across Florida Counties with Most Crop Workers (excluding H-2A workers)



Sources: Authors' calculations based on U.S. Bureau of Labor Statistics (2020) and Florida Department of Health (2020) data (COVID-19 cases were last updated on 7.6.2020).

Figure 2. Spread of COVID-19 across Florida Counties with Most H-2A Certifications



Source: Authors' calculations based on U.S. Department of Labor (2020b) and Florida Department of Health (2020) data (COVID-19 cases were last updated on 7.6.2020).

2017). As such, QCEW data in Figure 1 can approximate only domestic crop production workers, some of whom are likely unauthorized. To examine the spatial distribution of H-2A crop workers in Florida compared to the intensity of county-level total COVID-19 cases, we use the data on the number of H-2A certifications in Figure 2.

As agricultural employers experience challenges in hiring domestic workers, the H-2A guest worker program gains popularity despite the high costs and administrative complexities involved in utilizing the program (Onel and Farnsworth, 2016; Roka, Simnitt and Farnsworth, 2017; Luckstead and Devadoss, 2019). The number of H-2A visas issued to foreign-born workers has increased every year since 2011. In fiscal year 2019, 204,801 visas were issued by the U.S. Department of State (2020) and 257,667 positions were certified by the U.S. Department of Labor (2020a). In 2019, Florida ranked first among all states requesting H-2A positions, with over 33,000 H-2A positions certified for work in Florida (U.S. Department of Labor, 2020a). The existence of a large specialty crops sector, which is characterized by labor-intensive tasks, is a contributing factor for the quick adoption of the H-2A program in Florida.

The darker shades in Figures 1 and 2 correspond to Florida counties with higher crop worker populations. Accordingly, counties with the highest numbers of domestic crop workers are Miami-Dade, Palm Beach, Collier, Hendry, Hillsborough, and Manatee (Figure 1); four of those six counties also are among the ten counties with the highest number of COVID-19 cases. Counties with the most H-2A crop workers are Palm Beach, Hendry, DeSoto, and Hillsborough (Figure 2); two of those four counties are among the ten counties with the highest number of COVID-19 cases.

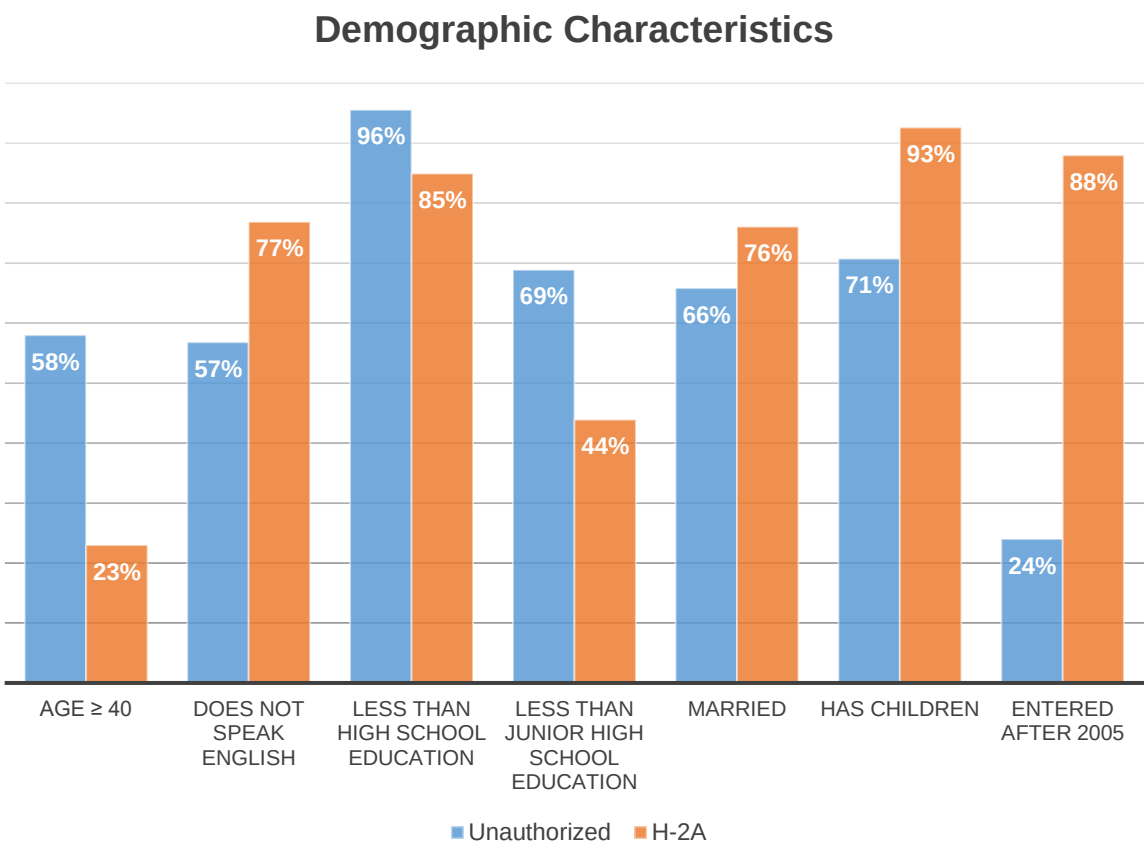
Workers' Legal Status Matters in the Battle to Help Farmworkers Control COVID-19

The National Agricultural Workers Survey (NAWS), which has been the main data source for the socioeconomic characteristics and legal status of farmworkers since the 1990s, excludes information on H-2A guest workers—an emerging legal status group among farmworkers (U.S. Department of Labor, 2018). With H-2A hires growing exponentially in recent years, information provided by the NAWS is becoming increasingly limited. To this end, we utilize a unique dataset, the Florida Citrus Harvesters Survey (FCHS) (Onel, 2016), to compare demographic, housing, commute, and work variables for H-2A and unauthorized workers, to the extent that these variables are relevant for COVID-19 risks. The FCHS was conducted during the 2016 spring harvesting season by a team of researchers and community partners from the University of Florida, Institute of Food and Agricultural Sciences (UF/IFAS), and the Farmworker Association of Florida (FWAF). More than 300 citrus workers were interviewed across seven Florida counties: Collier, DeSoto, Hendry, Highlands, Indian River, Okeechobee, Polk, and Pasco. While the majority of surveyed workers (about 80%) were in the United States on H-2A visas, nearly 15% of the total number of farmworkers surveyed did not have legal authorization to work in the United States (Simnitt, Onel, and Farnsworth, 2017). The FCHS asked citrus harvesters demographic and economic questions similar to those in the NAWS but excluded the NAWS health questions. While the FCHS data are not representative of the entire Florida farmworker population, they provide rare information on a relatively unknown group of workers—the H-2A guest workers.

Figure 3 presents a comparison of the demographic variables for H-2A and unauthorized citrus workers in Florida. Almost all workers in the sample were male. The majority of the workers were married (66% of unauthorized workers and 76% of H-2A workers) and had dependent (minor-aged) children (71% of unauthorized workers and 93% of H-2A workers). Unlike the H-2A workers, the unauthorized workers typically lived with their families in Florida, increasing the likelihood of contracting and spreading the disease within these households. Another implication of COVID-19 for unauthorized workers with young children is that school closures may force them to stay at home with their children during the pandemic, shrinking the available pool of farm workers (Costa and Martin, 2020). There was a significant gap in age between the two legal groups in the survey, where 58% of unauthorized workers were 40 years old or above compared to only 23% of H-2A workers. This is not surprising, as most unauthorized immigrants in the United States are settled migrants, who have been in the country for over 10 years. As such, they are aging (U.S. Department of Agriculture, 2020b). Time of first U.S. entry in the last column of Figure 3 confirms this, showing that only 24% of unauthorized citrus workers entered the United States after 2005 (i.e., within 10 years of the survey year, 2016) compared to 88% of H-2A workers. These two findings have significant implications for relative COVID-19 risks between the two legal groups. Unauthorized workers are at higher risk of serious COVID-19 illness as they are significantly older than H-2A workers. Language skills and education level are among other important social risk factors for COVID-19. Figure 3 illustrates that 57% of unauthorized workers and 77% of H-2A workers did not speak any English. In addition, 69% of unauthorized workers and 44% of H-2A workers had less than a junior high school education. These findings highlight the need for and importance of outreach efforts to educate workers about preventative measures for COVID-19.

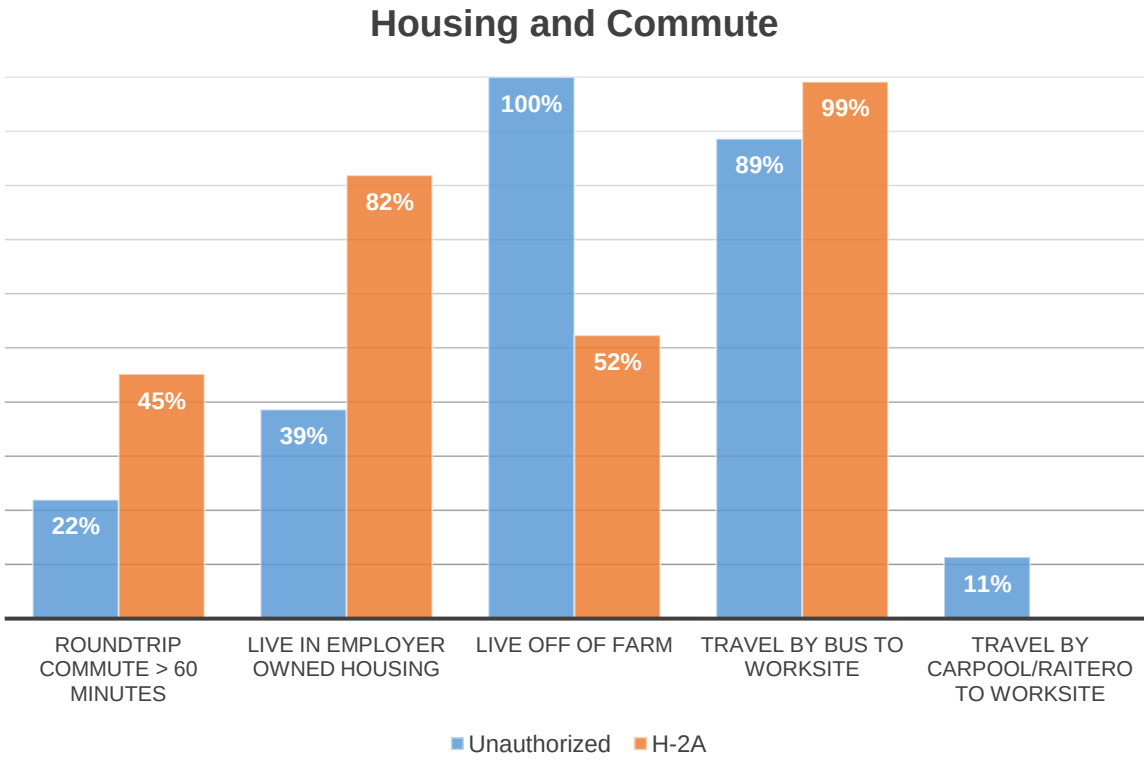
Figure 4 presents housing and commute data that are relevant for mitigating COVID-19 among workers. A significant portion of Florida citrus workers (89% of unauthorized workers and 99% of H-2A workers) commuted daily to their worksite by bus. However, time

Figure 3. Demographic Characteristics of H-2A and Unauthorized Citrus Workers (Florida, 2016)



Source: Onel (2016).

Figure 4. Housing and Commute Status of H-2A and Unauthorized Citrus Workers (Florida, 2016)



Source: Onel (2016).

Table 2. Work Characteristics of H-2A and Unauthorized Citrus Workers (Florida, 2016)

	H-2A		Unauthorized		
	Average	Std. Dev.	Average	Std. Dev.	Difference
Hourly wage	$11.59	4.04	$8.96	5.92	$2.64*
Employed by farm labor contractor (%)	66.23%	7.14	95.45%	1.38	-29.23%*
Paid by piece rate (%)	95.60%	2.77	73.33%	1.71	22.27%*
Years of farm work experience (in U.S. only)	4.96	5.56	13.76	8.79	-8.80*
Years of farm work experience (in U.S. and abroad)	18.53	10.11	25.09	12.41	-6.56*
Monthly remittances sent home	$823.37	372.71	$549.38	265.39	$273.99*

Note: The "*" denotes statistically significant differences between the two legal groups.
Source: Onel (2016).

spent for the roundtrip journey was different between the two groups of workers, with 45% of H-2A workers and 22% of unauthorized workers daily commuting more than an hour roundtrip for work. SARS-CoV-2 infection risk increases in enclosed spaces and directly correlates with time spent indoors (Mittal, Ni, and Seo, 2020). Therefore, relatively long commute times for H-2A workers on buses increase the infection risk for this group of workers. Housing data show that all unauthorized workers and about half of H-2A workers lived off the farm in 2016. Further, 82% of H-2A workers and 39% of unauthorized workers lived in employer-owned housing. The remaining H-2A housing was employer-leased housing. This implies that employers of H-2A workers have relatively more control over implementing social distancing and other preventative measures for COVID-19 at workers' housing quarters. Employer-controlled H-2A housing could make it easier to set up strict COVID-19 testing procedures, limit workers' contact with outsiders, and establish a dedicated space within the housing camp to isolate COVID-19 positive workers who do not need hospitalization. Employer-controlled H-2A housing could also make contact tracing easier if a worker became infected with SARS-CoV-2. On the other hand, further restricting the movement of H-2A workers could draw criticism from farm labor advocates, who already raise concerns for potential exploitation of H-2A workers.

Comparative work data in Table 2 can provide further insights on the safety of workers during the pandemic. First, H-2A citrus workers, on average, were paid higher wages ($11.59 in 2016) compared to unauthorized workers ($8.96 in 2016). This is expected, as the minimum wage for H-2A workers is federally set higher than the state minimum wage through the Adverse Effect Wage Rate. At a glance, this would mean that H-2A workers have higher disposable income compared to unauthorized workers. However, remittances to home country complicate this picture. H-2A workers also sent significantly more money home per month than unauthorized workers did (Table 2). Higher remittances not only imply a reduction in workers' disposable income for use in the United States but also indicate that H-2A workers likely have stronger ties with family in their countries of origin than unauthorized domestic workers. This is important with the recent spikes in COVID-19 cases in Mexico and South America; that is, H-2A workers—who are mostly married, have minor-aged children, and have stronger ties to their country of origin—might be more reluctant to return to U.S. farms amid the COVID-19 pandemic. Field reports from university extension faculty confirm that some H-2A workers left before the end of the harvest season to be with their families in their home countries during the pandemic (E.J. McAvoy, personal communication, March 20, 2020). On the other hand, low earnings coupled with high propensity to remit may encourage existing workers in the fields to continue working even when sick, posing a significant challenge for containing outbreaks.

The channel through which crop workers are hired is changing. For example, in 2016, almost all unauthorized citrus workers (95%) and the majority of H-2A citrus workers (66%) in Florida were hired through Farm Labor Contractors (FLCs) rather than directly by growers (Table 2). However, the proportion of workers hired by FLCs, as opposed to directly by growers, likely differs based on the specific crop and farm operation size. Whether workers are hired directly by growers or through FLCs will have implications for extension and outreach during COVID-19, as university extension agents will likely have more established relationships with growers who manage their own labor crews than with FLCs. As a result, outreach and delivery of vital COVID-19 training to FLCs would likely be more challenging. Finally, the payment scheme data in Table 2 show that H-2A and unauthorized citrus harvesters were paid overwhelmingly by piece rates (i.e., by the number of tubs of citrus fruit they picked). Piece-rate payments pose a challenge during COVID-19, where

employers need workers to be vigilant about hand hygiene and wearing masks. Workers, especially H-2A workers, may be reluctant to follow safety guidelines that would slow them down and yield fewer pieces of fruit.

Challenges and Opportunities for Mitigating COVID-19 among Crop Workers

Reports from University of Florida extension agents indicate that growers quickly implemented several preventative measures for COVID-19. Efforts include installing handwashing stations, distributing face masks and hand sanitizers, regularly disinfecting buses in which workers commute, and providing COVID-19 educational materials to employers for developing safety protocols for workers.

There remain substantial challenges for both preventing the spread of the disease and for mitigating an outbreak once it occurs. Low levels of English language proficiency and formal education among workers emphasize the need for training materials and training sessions in workers' native languages that are culturally appropriate and accessible to workers. Florida farms are diverse, with increasing numbers of workers who speak Haitian Creole and several indigenous languages. While the extension faculty of UF/IFAS, staff of the Florida Department of Health, and members of the Farmworker Association of Florida have developed COVID-19 education materials in English, Spanish, and Haitian Creole, additional opportunities exist to expand outreach through translations in other indigenous languages. Community partnerships with the Farmworker Association of Florida and the Rural Women's Health Project can assist efforts to make educational materials relatable and culturally appropriate for each group of workers.

Federal laws require H-2A employers to provide housing at no cost for H-2A workers and "[U.S.] workers in corresponding employment" (20 CFR § 655.122(d)). Housing regulations establish the maximum occupant density in living quarters and other housing standards. Many H-2A workers share sleeping quarters and live in close proximity, making social distancing difficult. Housing related problems for mitigating the disease include the challenge of isolating infected workers, given limited space. Arranging additional housing for workers who need to be quarantined due to infection may not be feasible for most employers in a rapidly evolving environment. The daily commute to worksite adds further difficulty for containing the virus. Despite frequent disinfecting of buses, an asymptomatic worker can easily carry the virus from housing quarters to daily commute buses, given long transit times to jobs sites and difficulty with social distancing during transport.

Another significant issue during the COVID-19 pandemic relates to immigration rules. During the initial onset of COVID-19, the Department of Homeland Security (DHS, 2020) announced a temporary final rule, 85 FR 21739, relaxing certain H-2A program requirements until August 18, 2020, to help U.S. agricultural employers avoid disruptions in employment during the pandemic. The temporary rule allows certified H-2A employers to offer new contracts to H-2A workers who are already in the United States concluding their existing contracts. In addition, the rule allows H-2A workers to temporarily extend their stay in the United States beyond the three-year maximum allowable period of stay. These efforts to retain existing H-2A workers are expected to preserve up to 20,000 H-2A positions (U.S. Department of Agriculture, 2020c) but are likely not sufficient to meet the employment needs of the U.S. crop sector. As the spread of COVID-19 in Mexico and South America intensifies, new H-2A arrivals for the upcoming harvest season may be further disrupted. Agricultural employers may, therefore, need to redouble their efforts to recruit workers from the U.S. domestic labor market (Costa and Martin, 2020).

Nationally, about half of domestic seasonal farm workers are estimated to be unauthorized (U.S. Department of Labor, 2018). Since these workers lack valid Social Security numbers, they are unable to access most federal safety net programs, including the stimulus checks sent to legal residents through the Coronavirus Aid, Relief, and Economic Security Act (CARES). As discussed above, unauthorized workers are older and thus are more likely to develop COVID-19 complications requiring medical attention. However, most fear deportation in today's immigration environment and typically avoid seeking medical care or other services (Haedicke, 2020). This will hinder COVID-19 testing and contact tracing efforts among farmworkers. Unauthorized crop workers also lack health insurance (U.S. Department of Labor, 2018) and typically visit emergency rooms when clinical care is necessary. This poses a risk of overwhelming hospitals in case of a large COVID-19 outbreak. Additionally, the reluctance to seek social and medical services among immigrant farmworkers is impacted by the new Public Charge Rule, under which immigrants using (or, likely to use) Medicaid, food stamps, and other safety net programs would face greater scrutiny from immigration officials when applying for change of legal status. Paid sick leave provided through the Families First Coronavirus Response Act (HR 6201) is an exception to the Public Charge Rule, requiring private-sector (including agricultural) employers with fewer than 500 employees to provide up to two weeks of fully or partially paid sick leave for COVID-19-related reasons until the end of calendar year 2020 (Beatty et al., 2020). Both H-2A and unauthorized workers are eligible to benefit from the Families First Coronavirus Response Act, although it is not clear what proportion of employees and employers are aware of the temporary paid sick leave benefit. Out of fear of negative immigration consequences, many immigrant farmworkers may continue avoiding public benefits of any kind during the COVID-19 pandemic.

Conclusion

COVID-19 continues spreading across Florida and the United States. Scientists expect a second wave of COVID-19 cases in fall 2020 (Xu and Li, 2020). While the spring harvest seasons for most fruit and vegetable farms in hard-hit counties of Florida have already passed the peak, worker safety concerns for the upcoming harvest season in fall 2020 are growing. With guidance from available data, the article provides insights for targeted prevention and mitigation plans for COVID-19 infections among crop workers. Similar to other sectors of the U.S. economy, COVID-19 has exposed existing weaknesses in food production systems. Disruptions to food supply chains are estimated to result in billions of dollars of revenue loss for Florida growers. While struggles to keep farms afloat financially continue, growers and policy makers are also increasingly wary about keeping the farm workforce healthy during the pandemic, as worker safety is essential for the sustainability and resilience of food supply chains.

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CHOICES

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The Availability of H-2A Guest Farm Workers during the COVID-19 Pandemic

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The COVID-19 pandemic has significantly altered social and economic dynamics in the United States and elsewhere in the world. Mandates establishing social mobility constraints have led to substantially diminished economic production and retrogression as the economy confronts another economic recession.

This article analyzes the effect of the current economic situation on the farm sector's labor sourcing predicament. The COVID-19 pandemic imposed additional restraints and challenges on farm labor availability on an industry that has become increasingly dependent on foreign labor. When the COVID-19 pandemic started, the government issued travel bans, border entry restrictions, and suspension orders for consular operations and visa processing. This article clarifies how disruptions in travel and government operations have affected the inflow of foreign farm workers coming into the country under H-2A working visas.

H-2A as Supplier of Replacement Foreign Labor

Even as the farm sector leans toward accelerating the development and adoption of more mechanized operations, certain enterprises (especially specialty crops such as fruits, vegetables, tree nuts, horticulture, and nursery crops) remain dependent on labor inputs for production, harvesting, and processing (Astill, Perez, and Thornsbury, 2020; Calvin and Martin, 2010). The share of labor costs to total operating expenses in these enterprises ranges from 29% to 43% (Bier, 2020).

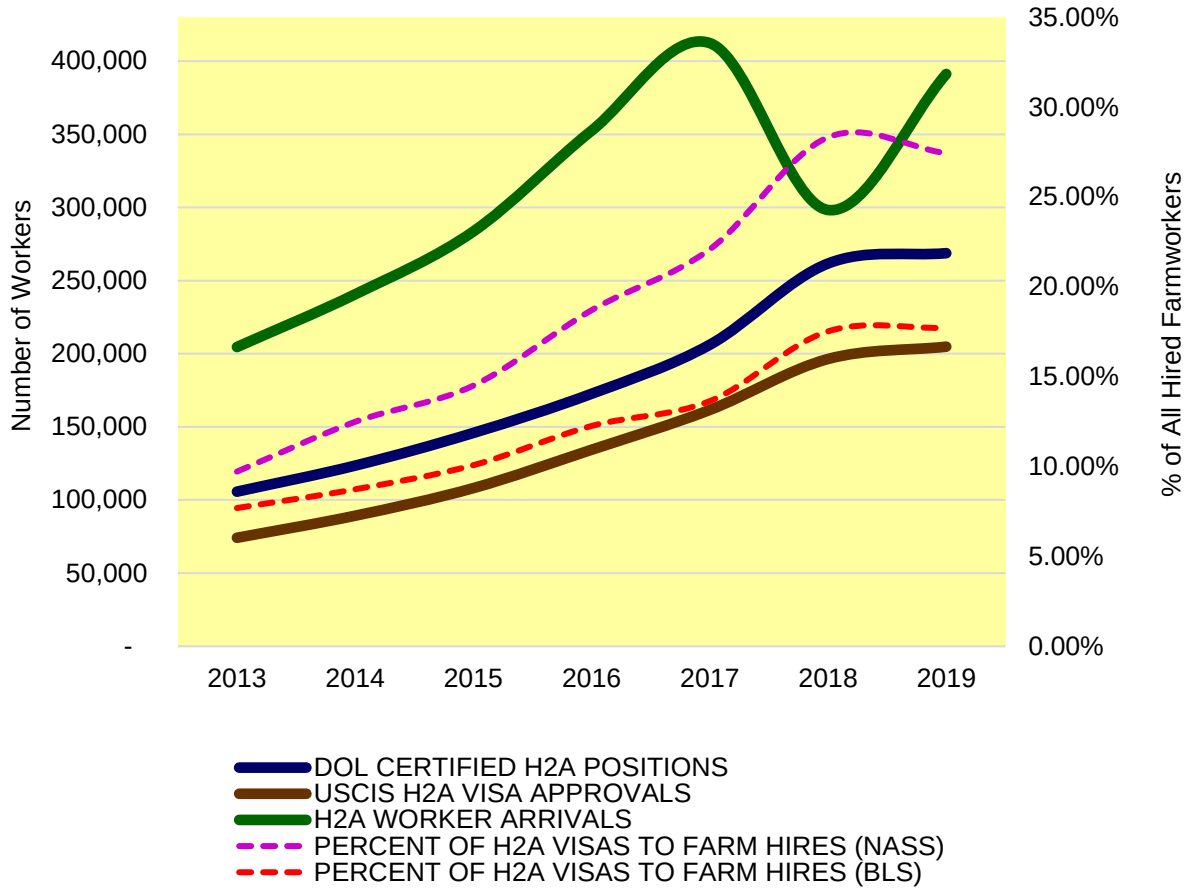
The distribution of farm workers hired in the United States indicates heavy dependence on foreign labor as the share of U.S.-born farm workers dropped from 40% in 1989 to about 25% in 2016 (Bier, 2020). Notably, relative to all new entrants to the U.S. farm labor force, the share of the U.S. pool of workers with legal authority to work dropped from 27% in 1997 to just 4% in 2016 (Bier, 2020). The physically strenuous and highly risky nature of farm work unmatched by the compensation structure usually resulted in domestic residents preferring work in nonfarm industries as opposed to farm employment. (Escalante, Wu, and Li, 2016; Kandel, 2008). The farm sector also lags behind the nonfarm sector in granting employer-provided health benefits that could mitigate the inherent health risks endured by its workers (Luo and Escalante, 2017).

In filling their labor needs, farms in the past desperately resorted to hiring undocumented workers, whose employment reached a peak proportion of about 56% in 2000. Worker deportations during the enforcement of stricter immigration policies since the early 2000s reduced the proportion to about 48% in 2016 (Bier, 2020). Workers hired under the H-2A Guest Farmworker Visa program slowly filled in as replacements for evicted foreign workers.

Farmers' patronage of the H-2A program, however, has been affected by issues they raised on the program's guidelines, requirements, and processing efficiency. To this day, the program continues to deal with farmers' persistent demands for modifications in its guidelines and implementation, especially those that relate to its mandatory costs and infrastructures, in addition to its reliability in promptly supplying labor to avoid disruptions in farm operations (Williams and Escalante, 2019; Escalante et al., 2019). Over time, the government has addressed implementation issues through improvements in processing efficiency, but the program's guidelines have been modified only slightly through the years (Zahniser et al., 2018).

The following historical trends in H-2A applications and approvals will trace the farmers' patronage of the program in recent years. The plots (solid lines) in Figure 1 trace the volume of H-2A workers in each step of the visa approval system. The process starts with labor certification at the Department of Labor (DOL), followed by approval of farmers' petitions on behalf of the workers at the U.S. Citizenship and Immigration Services

Figure 1. Annual H-2A Certifications, Visa Approvals, Arrivals, and Share in Total Hired Farmworkers, 2013-2019



Source: Department of Labor, U.S. Citizenship and Immigration Services, National Agricultural Statistics Office, and Bureau of Labor Statistics.

(USCIS), and finally worker arrivals at U.S. ports of entry after their visas were approved by the U.S. consular offices in their home countries. Between 2013 and 2019, H-2A foreign labor certification and visa approvals grew by 154% and 176%, respectively. H-2A arrivals peaked in 2017, when 412,319 workers entered the country, representing a 102% growth from the 2013 volume. In 2019, the DOL certified 268,729 farm positions, the USCIS approved petitions for 204,801 workers, and port authorities recorded 391,208 H-2A worker arrivals.

The growth in H-2A patronage over time reflects farmers' difficult labor hiring predicament, especially after the eviction of previously employed undocumented workers. As farmers have been reporting limited availability of domestic farm labor, the importance of the H-2A program in augmenting farm labor supply has grown over the years (Figure 1). H-2A visa approvals accounted for 7.69% of all employed workers in farming, fisheries, and forestry in 2013 and 17.72% in 2019. Using employment data compiled by the National Agricultural Statistics Service (NASS), the H-2A program's share for farming alone is even larger, at 27.43 % of total hired farm labor in 2019.

Farm Employment during the Pandemic

Before the outbreak of the pandemic, the farm sector had experienced improvements in labor market conditions, reflected in rising farm wage levels. After the late 2000s recession, increasing demand for highly labor-intensive commodities (such as fruits and vegetables) created higher farm employment levels and favorable farm wage levels that grew at rates faster than nonfarm wages (Zahniser et al., 2019).

When the pandemic's social distancing mandates substantially slowed overall economic activity, the farm sector was expected to thrive better than other industries. After all, farming supplies the economy with essential goods that consumers prioritize in their purchase decisions during crises. Farmers selling their products for direct consumer use in local markets benefited from temporary restaurant closings. These farm operations realized unexpected revenues as residents in their communities resorted to buying from trusted local suppliers (Peyton, 2020). Moreover, farmers were pressed to replenish supplies in grocery shelves emptied by the consumers' panic-buying and stockpiling frenzy (Schrotenboer, 2020). Hence, the farm

sector's main concern during the pandemic is not necessarily a decline in the total demand for its goods and services, but rather the price-related shocks and "disruptions to supply chains" that are partially driven by the mobility and availability of the needed labor force to sustain farm operations during the COVID-19 pandemic (Smith and Glauber, 2020).

H-2A Workers' Availability during COVID-19

Demand for farm workers increases when planting season for crops commences (da Silva, 2000). For certain farm enterprises and production regions, this season starts around April. Subsequently, more workers are needed when the harvest season arrives. In a typical year, these impending conditions in U.S. farms would be synchronized with the social environment in Monterrey, one of Mexico's H-2A visa-processing centers (Echavarri, 2020). In mid-March, aspiring H-2A Mexican workers would usually flock to the city to finalize their departure plans to travel to the United States just in time for the start of the planting season.

Figure 2 traces the trends in filing and approval of H-2A foreign labor certification applications at the DOL. The quarterly figures indicate that most U.S. farms usually file their H-2A labor certification applications from January to June of each year (the second and third quarters of each fiscal year). Strategically, this trend reflects the farmers' anticipation of the entire processing period to last around six months. In the second quarter of 2020, the DOL certified 97,321 H-2A positions, the highest quarterly figure ever registered by the program. This represents a 175% increase over last fiscal year's corresponding period (second quarter of 2019) and 138% growth over the previous quarter's level.

Figure 3 presents the monthly frequency of H-2A visa approvals from October 2018 through April 2020. In each year, H-2A approvals start rising in January, reaching their highest levels in April. This pattern draws from the high inflow of DOL certification approvals from the previous quarters (Figure 2). This pattern coincides with farmers' needs and expectations of foreign guest workers being available to work when planting season begins around April for certain farms and regions. In April 2019, 35,215 H-2A visas were approved, with 91.31% of them coming from Mexico. This April, Mexican workers account for 96.34 % of visas approved (for 30,157 workers).

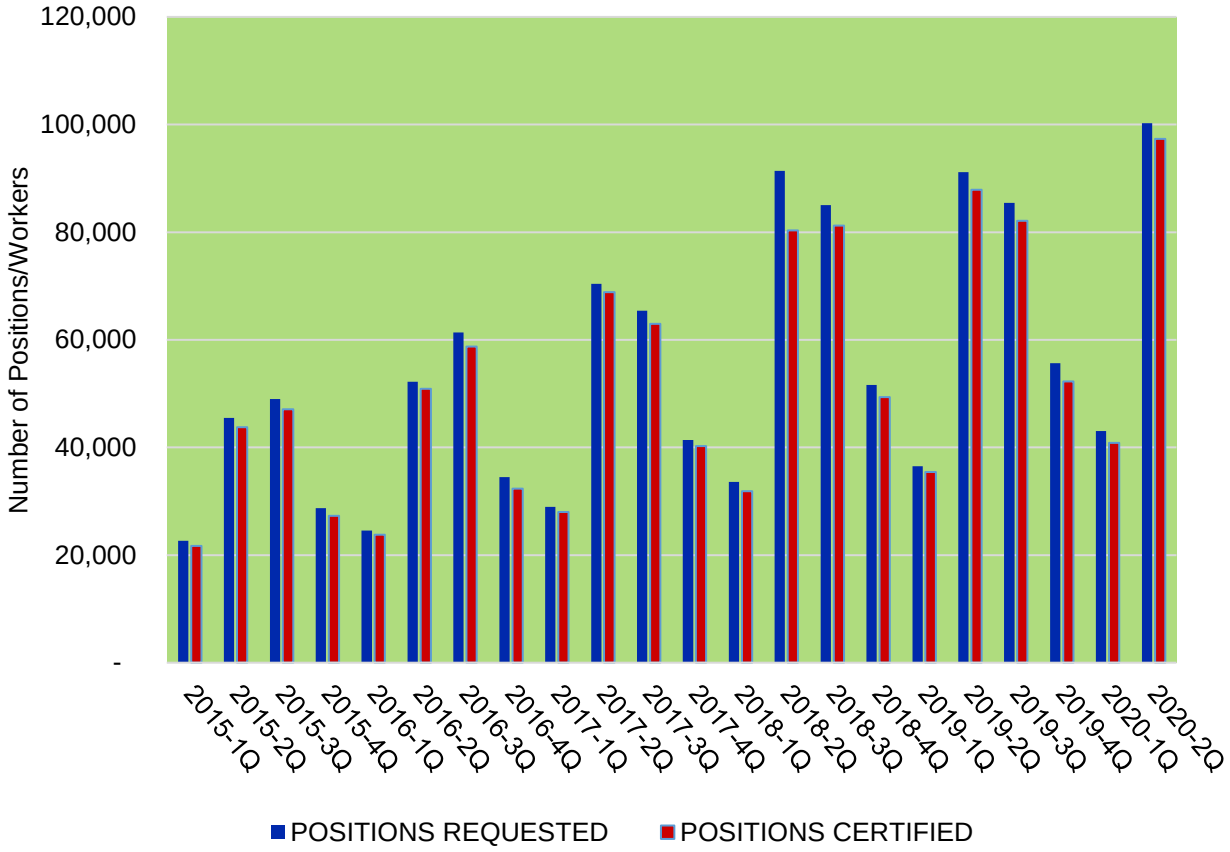
Based on the March 2020 and April 2020 figures, the normal visa application trend has not been disrupted, even under pandemic conditions. The government issued a directive on March 20 suspending temporarily regular visa processing services at all U.S. consular offices and embassies (Department of State, 2020). Exceptions, however, were made for H-2A (agricultural) and H-2B (non-agricultural) temporary guest worker visas. Interview waivers were granted to two categories of workers: (i) returning and first-time applicants with no apparent or potential indicators of ineligibility and (ii) reapplicants for another visa after their previous approval expired during the last two years and did not require a waiver of ineligibility during their last visa application (Department of State, 2020).

On April 20, 2020, the federal government issued a temporary final rule to alleviate potential shortages in farm labor during the pandemic (U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, 2020). The rule allows farm businesses with approved DOL labor certifications to immediately employ their petitioned workers who are already in the country under a valid H-2A status. The employment date should not be earlier than the USCIS's receipt date of the approved petition (U.S. Department of Homeland Security, U.S. Citizenship and Immigration Services, 2020). Moreover, the U.S. Department of Agriculture (USDA) and the DOL forged an information-sharing partnership in which the DOL will provide information on H-2A workers with contracts that are currently about to expire (Nosowitz, 2020).

Even with temporary federal provisions to help alleviate H-2A worker shortages, the transport of incoming new foreign guest workers could still be affected by other prevailing immigration restrictions. The federal government issued a presidential proclamation on March 11, 2020, suspending entry of foreigners from most European countries, in addition to earlier bans on entries from China and Iran (U.S. Department of Homeland Security, 2020a). On March 20, 2020, a joint initiative between the U.S. and Mexico was forged to suspend nonessential travel between these countries (U.S. Department of Homeland Security, 2020b). While travel of H-2A-workers is considered essential, all incoming migrants are still subject to strict medical screenings at ports of entry and 14-day self-quarantine upon entry (Cheung, Donnelly, and Lewis, 2020). At the Mexican border, heightened anxiety and paranoia arose when new outbreaks of COVID-19 cases were validated among those crossing the border (Fearnow, 2020).

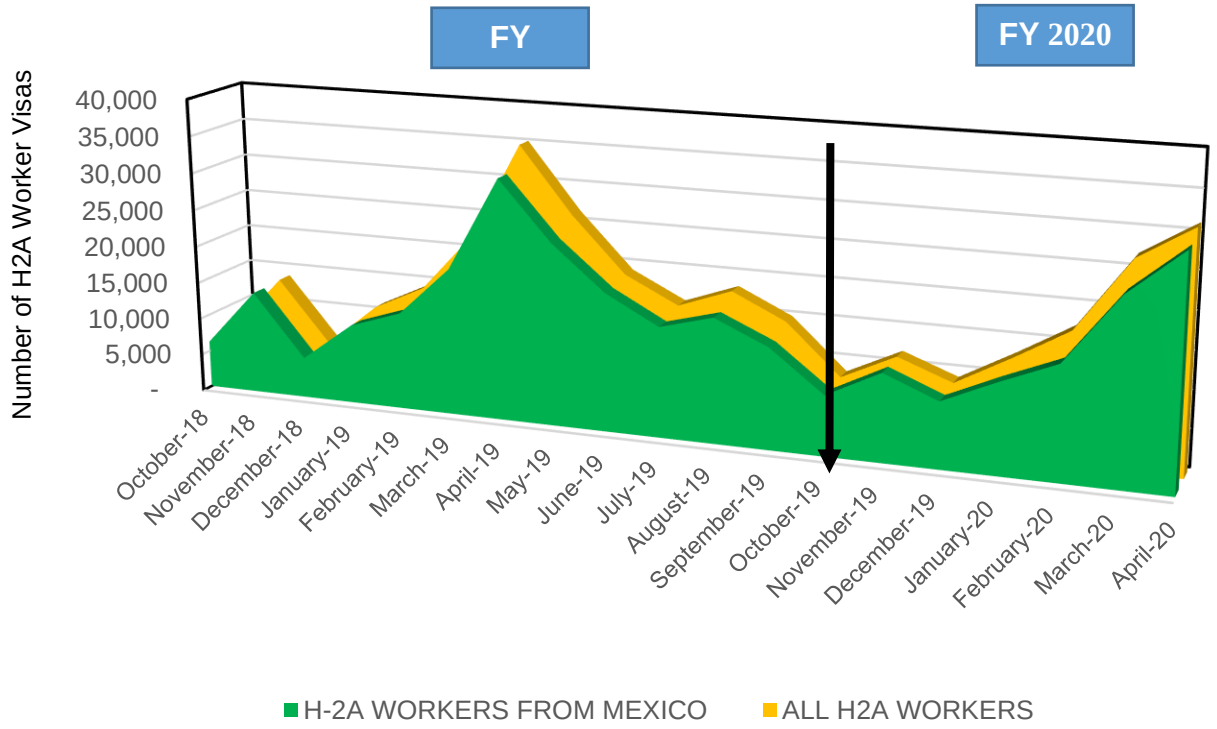
Based on the I-94 arrival records obtained from the National Travel and Tourism Office, admissions in March 2020 at all U.S. ports of entry dropped by 49.5% compared to March 2019 arrivals. The rate of decline was 96.4% between April 2019 and April 2020. Arrivals from Mexico, including border crossings, decreased by 30.1% between March 2019 and March 2020. The rate of decline between April 2019 and April 2020 was 87.9%. Given these trends, it is possible that even when government regulations are modified to avoid disruptions to the flow of authorized migrant workers, other travel-related restrictions and fears could limit the realized availability of guest workers amid the COVID-19 pandemic.

Figure 2. Quarterly H-2A Foreign Labor Certification Data, 2015-2020 (2nd quarter)



Source: Department of Labor

Figure 3. Monthly H-2A Visa Approvals, All and Mexican Workers, October 2018–April 2020



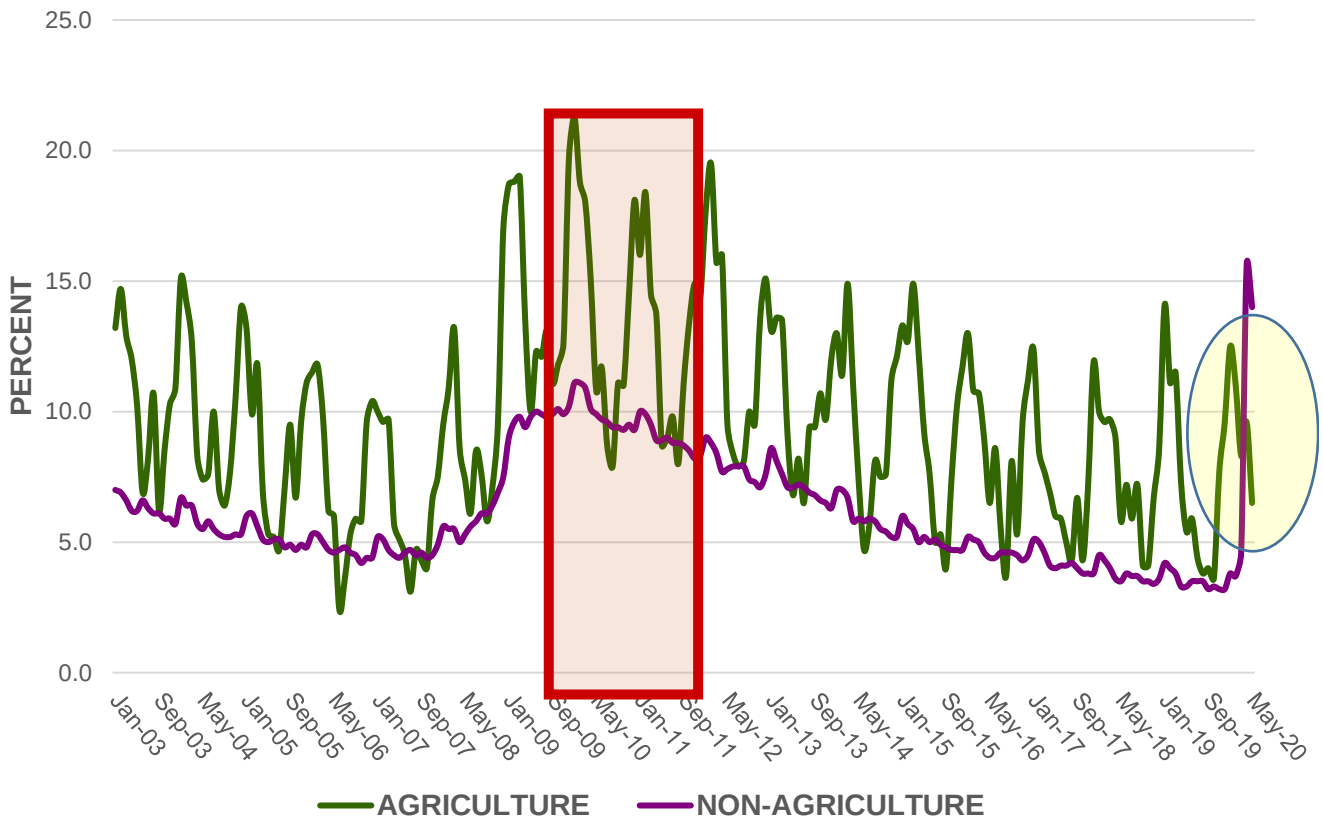
Source: U.S. State Department - Bureau of Consular Affairs.

Economic recession and unemployment are linked with each other. During the last recession, farm unemployment rates—which had been higher than nonfarm unemployment rates in most months in each year—reached a peak of 21.4% between the end of 2007 and January 2010 (pink-shaded area of Figure 4). In contrast, the highest unemployment rate in the nonfarm sector during the same period was 11.1%. As the COVID-19 pandemic increases recessionary pressure, the unemployment trend reversed in April and May 2020, with the nonfarm sector registering 15.6% and 14.0% unemployment compared to the farm sector's rate of 9.6% and 6.5%, respectively (yellow-shaded area in Figure 4).

Would the recent trend translate to an interindustry migration of unemployed workers from nonfarm to farm businesses? The empirical evidence indicates a normal reverse flow due to inherent disparities in compensation structure and the incongruence of work expectations and physical work demands in the farm sector (Luo and Escalante, 2017; Escalante, Wu, and Li, 2016; Kandel, 2008). The reluctance of native-born and legally authorized workers to assume farm positions has been well documented by reports (Preston, 2007; Seid, 2006), testimonies of individual farmers (Martin, 2014; Burke, 2010; Santos and Escalante, 2010), and declarations by industry representatives (Carter, 2011; Rivoli, 2011; Escalante, Perkins, and Santos, 2011). Even when U.S. workers are lured into farm work through higher wage and nonwage offers, they typically lack the productivity and motivation that foreign-born workers exhibit; as a result, domestic workers usually "work for a few days and quit, or perform work in an unsatisfactory manner" (Cockerham, 2012). Matthews (2013) discloses that when 6,500 farm workers were needed in North Carolina in 2011, only 163 of the 245 hired workers showed up. Of these, only 7 workers fulfilled their contracts to work until the end of the growing season. Interestingly, this was the farm sector's experience at a time when 489,095 U.S. residents were unemployed.

Luo and Escalante (2017) argue that external shocks pushing the economy toward recession would actually induce the country's permanent residents and citizens to abandon farm employment and transfer to nonfarm employment. Notably, undocumented workers remain in their farm positions to see their employers through the challenging times. Other countries with high levels of undocumented populations, such as Spain, acknowledge these workers' value in the face of a looming farm labor shortage under COVID-19

Figure 4. Monthly Agricultural and Nonagricultural Unemployment Rates, January 2003—May 2020



Source: U.S. Bureau of Labor Statistic.

conditions. The Spanish government, for example, issued a royal decree allowing undocumented immigrants to assist in harvesting operations as legal migrants became difficult to employ during the pandemic (Purdy, 2020). However, it is not clear how a similar measure would be taken in the United States, given the country's current immigration policy environment.

Based on the farm sector's previous experiences, the inability to hire reliable farm workers when they are needed could result in business losses (Zahniser et al., 2012). For instance, McKissick and Kane (2011) estimated millions of dollars in crop losses in Georgia attributed to unfilled positions. Nowadays, the same fears pervade in the industry, with estimates of over a billion dollars of crop revenues that could be lost if only 50% of planted specialty crops are harvested due to inadequate labor supply (Dowdy, 2020).

Closing the Labor Gap

The U.S. government's prompt adjustment of existing policies affecting H-2A working visa processing has partially curbed the depletion of the number of visas approved for foreign workers. However, two issues could further complicate the farm labor availability during COVID-19. First, even if modified regulations now allow flexibility in moving H-2A workers already present in the country from one farm position to another, such a transition may be difficult among skill-specific farm positions. The workers' adaptability in quickly developing certain new skills requirements will determine whether this will be a significant issue in the near future.

The other issue pertains to incoming workers still based in their home countries. Even with approved visas, these workers still need to hurdle the medical and other required screenings at ports of entry. H-2A workers' travel plans may be delayed or postponed during these difficult times. Coinciding the timing of worker arrivals with farm operation plans could pose a serious challenge during COVID-19.

If a sufficient number of H-2A workers cannot arrive at the right time, could farms rely on available domestic residents to fill open positions? Compared to the last recession, when many farm jobs were left unfilled by unemployed residents without any legal impediments to seek employment, the current situation offers opportunities for farm employers to tap into a significantly larger pool of unemployed domestic workers in the nonfarm sector during the pandemic.

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Food and Agricultural Transportation Challenges Amid the COVID-19 Pandemic

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Introduction

As a human pandemic, COVID-19 affects the behavior and movement of people, with impacts on the food supply chain as displayed by consumer psychology and behaviors and workplace absenteeism (Mussell, Bilyea, and Hedley, 2020; Cranfield, 2020). In mid-March, statewide closures of nonessential businesses and institutions across the United States, coupled with stay-at-home advisories/orders, caused a sharp and sudden shift in food consumption away from commercial and institutional food service establishments primarily to home use. Food service sales plummeted while demand surged at grocery stores (Lusk, 2020; Karoub, 2020). Some consumers engaged panic buying and stockpiling in anticipation of possible shortages and movement restrictions (Hobbs, 2020). Across the nation, news reports of stockouts, numerous public health directives from state and federal authorities and conflicting political views heightened consumer anxieties about food availability and access. Labor supply concerns soon followed as workers were affected.

On March 19, 2020, the U.S. Department of Homeland Security identified the food, agriculture, and transportation systems sectors as "critical infrastructure" industries during the COVID-19 pandemic. This allowed for continuity of normal business operations and services with appropriate modifications per Centers for Disease Control and Prevention (CDC) workforce and customer protection guidance. Consequently, this identified some employees as "essential critical infrastructure workers" in that they conduct a range of operations and services that are deemed essential to continued critical infrastructure viability, and support crucial supply chains and enable functions for critical infrastructure (U.S. Department of Homeland Security, 2020). In this article, we discuss the logistical challenges posed by the COVID-19 pandemic for the U.S. food supply chain and review emergency support provided through the transportation sector given specific regulatory exemptions. We conclude that human resources have presented the greatest risk exposure to the U.S. food supply chain but have also been the greatest asset underlying the innovative response to unprecedented shocks.

Pandemic-Related Food Supply Chain Shocks

Simultaneous demand and supply shocks have roiled food markets since the onset of COVID-19, at once revealing underlying vulnerabilities of food supply chains and raising concerns about resiliency. Modern food supply chains are complex networks of nodes and links: The nodes are the intermediaries where products are received, stored, and dispatched—such as factories, distribution centers, and meatpacking plants—and the links are the transportation corridors on which products move between the nodes, whether by roads, rail, air, or waterways (Hale, 1999). Much of the disruption to the supply chain appears to occur at the nodes, such as meatpacking plants and factories (Northwestern University Transportation Center, 2020). For a food distribution system based on just-in-time (JIT) manufacturing, delivery, and inventory management strategies, the shock to grocery supply chains was inevitable and resulted in empty store shelves. Under normal circumstances, the JIT system efficiently smooths production flows and relies on the transportation industry to move products quickly between nodes in supply chains. This system, however, was shown to be vulnerable in pandemic conditions (Johnson, 2020; Mussell, Bilyea, and Hedley, 2020; Hobbs, 2020).

As stated earlier, the sharp drop in food consumption at restaurants and other food service establishments and the surge in grocery store sales from panic buying were major factors that pressured the food system from the demand side (Hobbs, 2020; Lusk, 2020). To recoup losses incurred from the sharp drop in food consumption by the food service sector, some distributors—such as Sysco and U.S. Foods—pivoted to doing business within

the food retail sector, which they do not typically serve (Lucas, 2020). However, most products were sold at a loss and discarded as suitable markets could not be secured in the short term. Although products sold to food service and food retail sectors are similar in terms of ingredients, they differ with respect to volume, packaging, labeling requirements, and value (Lusk, 2020). Products may also differ with respect to value—for example, truffles, caviar, and other exotic seafood are used by high-end restaurants and hotels but not typically consumed by households (Lucas, 2020).

On the supply side, labor shortages caused by workplace absenteeism due to illness (or fear of contracting COVID-19) significantly slowed operations and created bottlenecks, particularly in highly concentrated industries such as meatpacking (Mussell, Bilyea, and Hedley, 2020; Lusk, 2020; Funk and Groves, 2020). Roughly 45,000 workers at 30 meat-processing plants were affected by closures between April and June, when over 3,000 workers tested positive for COVID-19, with at least 44 deaths (Crampton, 2020a). While some workers were quarantined, others refused to work, citing unsafe conditions. This directly affected meat-processing volumes, which fell to 40% below 2019 levels (Curtis, 2020; Lusk, 2020). Although processing has since rebounded as working conditions have improved, there is some concern that safety measures and movement restrictions are lowering productivity and increasing production costs (Funk and Groves, 2020).

As the fruit and vegetable harvests have progressed, COVID-19 infection rates have also sharply increased among farm worker populations in Washington, New Jersey, and Tennessee (Doring and Skerritt, 2020) and in South Florida farmworker communities such as Immokalee, Belle Glade, and Homestead (Crampton, 2020b). With a population of 24,145, Immokalee has had one of the sharpest rates of increase, with confirmed cases increasing from 44 in May to over 1,100 by mid-June (Crampton, 2020b; Winchester, 2020). Workers typically live, travel, and work closely together, which makes physical distancing difficult. The CDC and U.S. Department of Labor issued interim guidance for agricultural workers and employers, which may be adapted for specific work operations and sites (CDC, 2020). Concerns with illness related absenteeism aside, travel/movement restrictions may be an issue for some farmworkers. Although farmworkers were declared essential, the crop farm workforce is predominantly immigrant and roughly half undocumented. Movement restrictions may be less of a concern to those who are lawfully employed on H-2A visas since the U.S. Citizenship and Immigration Services (2020) temporarily amended employment requirements during the pandemic. Undocumented workers, however, may still be apprehended and deported by immigration authorities despite being designated essential, and such fears may affect their willingness to travel with agricultural jobs that follow seasonal harvests.

Industry-level produce shipment data may offer some insight, so we examine data for Florida tomatoes. Figure 1 shows the total volume of conventionally grown tomatoes that were shipped via truck from Florida for March through April 2020. This coincides with the time frame for nonessential business closures and stay-at-home orders/advisories. Volumes for previous years (2017–2019) are included for comparison. There are annual reductions in supply—largely attributed to competition from Mexican producers (Guan, Biswas, and Wu, 2017)—but there are also larger than expected reductions in the same months for 2020. Almost all Florida cherry tomatoes and 80% of grape tomatoes are grown for the food service industry. Likewise, up to 80% of round and plum tomato varieties are marketed to the food service industry, but these varieties were more easily diverted to grocery stores than cherry and grape tomatoes (M. Schadler, personal communication, June 10, 2020). Cherry and grape tomato shipments declined 50% and 47%, respectively, from 2019 levels, whereas shipment volumes for round and plum varieties were not as severely affected. While some of these losses could be attributed to yield reductions from an unusually dry and hot 2019 winter, Figure 1 also likely captures disruptions to the supply chain from COVID-19. Tens of millions of pounds were discarded or donated, and some growers lost as much as 30% of their winter crop. Winter crops are harvested from January to mid-April in South Florida. Some growers in South Florida do not have fields in Central Florida, where spring crops are grown, so the timing of the COVID-19 related closures was especially devastating for those producers (M. Schadler, personal communication, June 10, 2020). However, when considering the effect of the pandemic on this industry, we should note that the Florida tomato season begins in October and ends in June; therefore, the industry-wide impact is limited to those growers who harvested during March and April.

Transportation Regulatory Exemptions under COVID-19

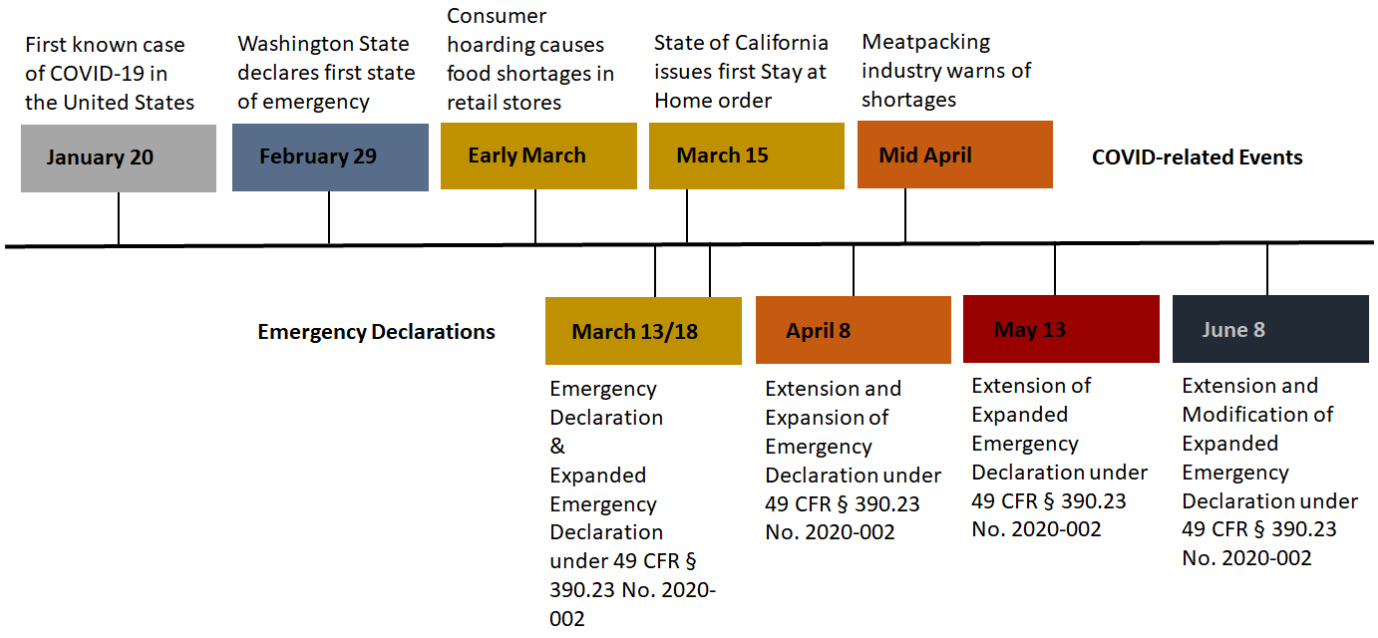
The transportation sector provides crucial support for commodity and food distribution to the food and agriculture sector. As a highly flexible means of transportation, trucking is responsible for roughly 75% of all agricultural commodities and food products shipped (Blanton, 2017). This flexibility was a key factor in shaping the emergency relief response and delivery of essential supplies. Figure 2 illustrates the timeline of federal emergency declarations that permitted exemptions to transportation safety regulations for commercial motor vehicle (CMV) carriers and drivers involved in emergency relief efforts during the COVID-19 pandemic.

The original emergency declaration on March 13, 2020, stated that CMV carriers and drivers providing direct assistance in support of emergency relief efforts related to the COVID-19 pandemic were granted emergency

Figure 1. Florida Tomatoes Shipped by Truck, 2017–2020

Note: Horizontal scale varies by graph
Source: USDA, Agricultural Marketing Service, 2020

Figure 2. Timeline of Emergency Declarations under CFR § 309.23 No. 200-002 with Updates



Source: FMCSA (2020a,d,e,f,g).

Box 1. The Federal Motor Carrier Safety Administration (FMCSA)

The primary mission of the U.S. Department of Transportation's Federal Motor Carrier Safety Administration (FMCSA) is to prevent commercial motor vehicle–related fatalities and injuries. The FMCSA oversees transportation safety regulations, including general motor carrier regulations, hours of service regulations, and employee safety and health standards regulations. For five days, between March 13 and 17, none of these existing transportation safety rules applied to drivers providing emergency relief through direct assistance under the original emergency declaration. CMV carriers and drivers were also not required to record drivers' on-duty drive times while providing direct assistance, nor was specific documentation required to verify participation in direct assistance during the emergency period. This was promptly updated on March 18 to require transportation safety by drivers who were providing emergency relief.

Sources: FMCSA, 2020a,d,e

relief from parts 390 through 399 of Title 49 Code of Federal Regulations (Federal Motor Carrier Safety Administration, 2020a, 2020b, 2020c). "Direct assistance" was defined as transportation and other relief services provided by carriers or drivers to support the immediate restoration of essential services supplies related to COVID-19 pandemic. This included transportation to meet immediate food needs, such as the emergency restocking of retail food outlets. Transportation of agricultural products and livestock were included given that the emergency declaration covered "immediate precursor raw materials… that are required and to be used for the manufacture of items" (Federal Motor Carrier Safety Administration, 2020d). On March 18, the emergency declaration was expanded to explicitly require that CMV drivers maintain transportation safety by complying with local traffic laws and observing rest periods as required by law (Federal Motor Carrier Safety Administration, 2020e).

Another expansion on April 8 clarified that direct assistance excluded routine commercial deliveries, including mixed loads with nominal quantities of qualifying emergency relief added to obtain the benefits of the emergency declaration's exemptions. Essential food and agricultural items qualifying as emergency relief were explicitly updated to include "food, paper products, and other groceries for emergency restocking of distribution centers or stores" (Federal Motor Carrier Safety Administration, 2020e). On June 8, essential status for agricultural goods and food products was removed, except for livestock and animal feed, as emergency relief was no longer deemed necessary for those categories (Federal Motor Carrier Safety Administration, 2020g). That the emergency declaration was expanded and updated several times reflects the fluidity and uncertainty associated with the COVID-19 pandemic. Further, federal and state authorities were required to consider speed and efficiency of response within the context of existing transportation safety regulations and laws. Transportation safety for commercial motor carriers and motor vehicle operators is overseen by the Federal Motor Carrier Safety Administration (Box 1).

Trucking Industry Emergency Relief Response

In an effort to understand the real-world implications of shocks to the food supply chain for the transportation sector and the resulting transportation safety waivers, we interviewed an East Coast mix-load driver, a West Coast fresh produce driver, and a Midwest wholesale transportation director under conditions of anonymity afforded by IRB protocol (authors' interviews, 2020). As seen in Box 2, these industry experts suggest that because the shocks to the food supply chain were so varied, it is difficult to determine long-term implications of the pandemic to the transportation sector. The transportation director, however, remains optimistic about the future opportunities. We also learned that, despite the regulatory exemptions, CMV drivers were careful to observe Federal Motor Carrier Safety Administration hours of service rules to avoid jeopardizing their commercial driver's licenses and livelihoods.

There have not been widespread reports of labor shortages in trucking owing to illness from COVID-19. From the onset of the pandemic, companies have emphasized safety measures, including the use of personal protective equipment (PPE) and intensive cleaning of trucks between and during shifts. Some carriers shifted to contactless transactions with digital processing of paperwork, and the flow of drivers and trucks through customer facilities is now more strictly controlled to enforce physical distancing (Smith, 2020).

As essential workers, state stay-at-home orders do not apply to truck drivers, who also do not have to self-quarantine for the recommended 14 days if they are working. Drivers are not subject to movement restrictions when working and can freely cross the U.S. borders with Canada and Mexico, which have been closed to nonessential travel since late March. During the initial weeks of the pandemic, availability of rest areas and full-service travel amenities was a major concern. CMV drivers had limited options as several states closed their rest areas and commercial travel centers amid fears of disease transmission. By late March, the Federal Highway Administration encouraged state transportation

Box 2. Voices from the Trucking Industry

Long-Haul Driver

We interviewed a long-haul driver employed with a West Coast trucking company. The driver transports fresh produce grown on the West Coast to wholesale markets on the East Coast, which means he often backhauls prepared foods. During the height of the COVID pandemic, the driver felt travel between destinations was easier and safer because there were fewer private vehicles on the road. His company notified its staff that their accident rate was down during the pandemic while the demand for produce transportation remained stable. The driver mentioned that despite the price of transportation increasing during the pandemic, drivers' wages have not increased accordingly. As for the driver's health and wellness, he cleans his cab with sanitizing products daily and has not had an issue with finding a rest stop while traveling to maintain personal hygiene.

Wholesale Transportation Director

We interviewed a transportation director employed with a wholesale produce company in the Midwest. The company has two sales channels: retail and food service. Prior to the COVID pandemic, the company kept transportation separate for each sales channel, but with reduced demand from its food service customers during the pandemic, the company is doing mixed loads.

The company laid off nearly one-third of its drivers given that many of its food service customers (e.g., school cafeterias) were forced to close at the start of the pandemic. Rerouting deliveries to both high-demand retail grocery customers and low-demand food service customers has been a challenge. Its drivers are working longer shifts because, despite less business, there are fewer drivers. As to not jeopardize their commercial driver's licenses and livelihoods, drivers will not violate FMCSA hours of service rules to extend shifts beyond what is allowable. Additionally, all deliveries take longer during the pandemic because drivers must follow health and safety protocols throughout the workday. Drivers have their temperature taken and answer a survey on COVID-19 symptoms before being allowed on each customer's premises. As more food service clients open for business, however, the company has been calling its drivers back to work. The transportation director remains optimistic. He believes that although there is no blueprint for a pandemic, wholesale businesses and drivers will come out of the crisis better for having dealt with the panic of rerouting inbound shipments and outbound deliveries in a complex food system.

Sources: Authors' interviews, 2020

agencies to keep rest areas open as a resource for drivers to ensure safe and timely delivery of essential goods (Fisher, 2020). Since then, rest areas and travel centers have reopened with safety measures and protocols in place.

In certain instances, ingenuity and resiliency in the transportation sector were not able to overcome the disruption in the food supply chain. As an example, meatpacking plant closures impacted other activities along meat supply chain, subsequently affecting demand for livestock transportation. As a result, cattle freight volumes have reportedly been flat as producers either kept cattle for longer periods or delayed and canceled transportation services outright. In some cases, the animals were redirected to other processing plants (Hawes, 2020; Smith, 2020). Drivers who transport livestock and processed meats reported fewer high-paying loads and backhaul opportunities (Hawes, 2020). Some companies have incentivized drivers with bonuses and guaranteed pay to discourage absenteeism—for example, Tyson Foods Inc. paid its drivers up to $1,000 in bonuses (Premack, 2020). In the produce sector, the sharp drop in food service demand led to crop losses at the farm level, but issues with transportation have not been reported.

Prior to the pandemic, there were widespread reports of driver shortages, but these appear to have disappeared with increased demand for trucking in some sectors, particularly the transportation of goods deemed essential (Costello, 2020; Ronan, 2020). However, normal trucking routes have been disrupted and trucking capacity has reduced (Fisher, 2020; ABI Research, 2020), so the medium- to long-term challenges and opportunities are unclear.

Concluding Remarks

The COVID-19 pandemic has created many challenges globally as countries have struggled to coordinate public health and economic responses across multiple systems. Social distancing and isolation measures to control transmission have had significant adverse impacts on personal routines and economic and commercial activities.

Regulatory exemptions granted to critical infrastructure industries such transportation enabled rapid emergency relief efforts to mitigate food supply chain shocks. Food supply chains have since rebounded, but vulnerabilities were exposed. Closures of some food service establishments revealed problems where adaptations could not be easily made to allow repurposing of food

products for the food retail sector. While much emphasis has been placed on specialization, it has also created a rigidity that inhibits response in times of crisis. With over 5.6 million confirmed cases of COVID-19 disease in the United States and no consistent downward trend presently, the long-term implications for the food service sector are uncertain. For pandemic crises however, it appears that human resources are *the* crucial component, as they pose the greatest risk to business operations and yet are critical to effective emergency response.

For More Information

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The Path Forward: U.S. Consumer and Food Retail Responses to COVID-19

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"Judgment under uncertainty systematically departs from the conventional definition of rationality" (Kahneman and Smith, 2002).

The recovery from the global pandemic and economic crisis will be prolonged and erratic (Lahart, 2020). Six months into the COVID-19 crisis, countries around the world are experiencing the symptoms of a social and political economic recession, characterized by heightened economic uncertainty. To make sense of market outcomes, it is critical to understand consumer behavior in times of significant shocks to the financial system. This article provides insights into the effect of COVID-19 on consumer behavior by exploring essential questions, with implications for the food retailing sector, such as whether consumers under a pandemic are "rational" and what the "new normalcy" in post-pandemic consumer behavior and retail will look like. I employ market and media reports that present the timeliest information, along with evidence from behavioral economics and the emerging economic literature, to addresses these questions. We hope to serve as a jumping-off point for debate and future research into the impact of COVID-19 on consumer behavior.

What Will the "New Normalcy" Look like?

At the end of April 2020, the U.S. economy recorded its worst first quarter since the 2008 recession (Casselman, 2020). As the pandemic unfolded, businesses closed or operated at lower capacity, jobs disappeared, and workers took time off or quit. The economic downturn spawned by a health crisis will be the deepest on record for the global economy for over 100 years (Goodman, 2020), with recovery limited by continued anxiety under uncertainty.

Shopping behavior has been influenced through two mechanisms: internal influences (e.g., fear of contagion or scarcity) and external influences (e.g., shelter-in-place orders, market conditions) (Hawkins and Mothersbaugh, 2010). Behavior shifts will remain as long as uncertainty about the pandemic remains. Without a definite pandemic end, new behaviors could potentially turn into habits. Part of these shifts appeared before the pandemic (e.g., online shopping), with the outbreak simply amplifying existing trends. The transition to this new equilibrium can be described by three stages: impact, adjustment, and "new norm."

First Stage: Impact of a Shock (Coronavirus Pandemic—Lockdown Period)

Lockdown Restrictions and Consumer Spending

Market reactions. Stock price reactions appeared even before COVID-19 was declared a global pandemic on March 11. As the COVID-19 impact dispersed worldwide by collapsing financial markets, changes in shopping behavior were more notorious, especially following the shutdown. Grocery and credit card spending sharply increased (+50%) for the period from February 26 to March 11, followed by a decrease in overall spending after March. Nonetheless, grocery spending remained higher relative to earlier in 2020 (+7.5%) (Baker et al., 2020). Spending increase was associated with an increase in perceived uncertainty and stockpiling medical and food supplies during the fever period (Dietrich et al., 2020). As a result, returns of food and staple retailing performed well relative to other sectors, such as consumer services, that had poor performance during these months (Ramelli and Wagner, 2020).

What triggered shocks to the market? Some highlight that the shutdown was, in essence, a supply shock with possible spillovers to the demand side (Guerrieri et al., 2020). This is supported by the fact that the change in spending on restaurants and retail was more substantial in states with shelter-in-place orders. (Baker et al., 2020). Others stress that the pandemic also affected demand directly because of the health risk of going to public spaces (Eichenbaum, Rebelo, and Trabandt, 2020). This is supported by survey evidence indicating that the majority of consumers opposed the reopening of restaurants and nonessential businesses as they have concerns about future contagion (Newmyer, 2020).

Shopping Behavior

Consumer concerns shifted (from health to finances and relationships) when shelter-in-place orders, travel restrictions, and curfews were put into effect (Petersen, 2020). As consumer concerns shifted, priorities and behavior also changed.

Purchase deferral. Consumers delayed purchases of nonessential goods and services such as traveling, eating out, and recreation. Fewer purchases of big-ticket items (e.g., electronics, home appliances, furniture, vehicles, house, vacations) were made this year compared to the previous year by all consumers but especially by high-income and younger (below 40) consumers (Koşar, Smith, and Klaauw, 2020).

Self-efficiency (producing). Due to social distancing and the economic downturn, more time was spent at home, decreasing the opportunity cost of cooking and cleaning. This resulted in a surge in demand for cleaning products and basic food product forms, such as flour, to prepare staple foods (Deas, 2020).

Spending, savings, and uncertainty. The majority of households do not expect to make large purchases, especially vacations, in the near future (Dietrich et al., 2020; Koşar, Smith, and Klaauw, 2020). Consistently, higher projected savings were correlated with greater perceived uncertainty during this period (Dietrich et al., 2020).

Panic buying and stockpiling. Panic spending distorted usual consumption patterns and created market distortions. At the beginning of quarantine, stockpiling behavior was observed through excess demand for toilet paper, shelf-stable food items (frozen, canned, and dried foods; snacks; and beverages) and cleaning products, which translated into stock out at the grocery store (Terlep, 2020). During a black swan event such as an earthquake, large households and households with a middle-aged or older household wife are likely to engage in panic buying (Hori and Iwamoto, 2014).

Reasoning. Stockpiling behavior can be explained by a dual-process theory of thought (Kahneman, 2011). Purchasing excess in-home food inventory can be used as a self-insurance mechanism to guarantee future consumption during uncertainty (i.e., rational and logical, or *slow*, thinking). Stockpiling can also be a consequence of irrational panic buying (i.e., emotion-driven and intuitive, or *fast*, thinking). Panic shopping was essentially triggered by people imitating what others do in anticipation of shortages (i.e., herd mentality), perceived scarcity, loss aversion, and mistrusts in market institutions (Hauser, 2020; Lufkin, 2020; Whitehead, 2020; Gupta and Gentry, 2019).

***Consequences*.** Inventory accumulations resulted in limited stock availability of popular items at the store. Demand-side scarcity could have affected food prices and brand loyalty, especially during lockdown, when bars and restaurants were shuttered.

Food Retailing and Demand

Online retailing. Social distance measures, including limited operation hours for stores, have influenced where and how people shop during the pandemic. This has expanded the e-commerce industry (e.g., online food retailing and food delivery services). The shift from in-store to online shopping might be a reason why credit card spending did not decrease during the economic downturn (Baker et al., 2020).

Second Stage: Adaptation (reopening and recession period)

Monetary and fiscal policy. To reduce borrowing costs, the Federal Reserve lowered interest rates; however, corporate debt and cash holding continued to be essential factors explaining stock returns (Ramelli, and Wagner, 2020). This is expected given that fiscal policies are far from effective in the presence of uncertainty around the pandemic (Guerrieri et al., 2020). To save jobs and bail out some companies, the U.S. Senate approved a substantial relief package at the end of March, which included loans for small businesses with the condition that they maintain employment levels.

Is a recession next? Beginning in May, the reopening was announced, but not all states began reopening their economies, wary of a surge in new cases. Based on estimates cited in press reports at the time of writing, it might take more than a year for a vaccine to be available (Gallagher, 2020). As the lockdown restrictions relax, the recovery of the market is limited by the fear of more outbreaks and, and despite policy efforts, a recession seems unavoidable.

Economic Downturn and Spending

Economic projections. GDP is projected to decline by 6%–60% (Bachman, 2020; Barro, Ursúa, and Weng, 2020; Mulligan, 2020). Likewise, real consumer total spending is expected to decrease by 4.7% in 2020 (Bachman, 2020) and the unemployment rate to reach 32%, surpassing the Great Recession peak of 25% (Faria-e-Castro, 2020). Because part of the shock to consumption originates in disruption to consumption itself, spending is expected to fall even more than income, with a drop of 15%–19% in the second quarter of 2020 (Muellbauer, 2020).

Consumer spending and economic uncertainty. Generally, an increase in employment uncertainty would affect mainly low-income households who would decrease spending. An increase in income uncertainty would affect mostly high-income households (e.g., nonessential business owners and smaller landlords), who would increase rather than decrease consumption

due to market uncertainty (Deaton and Muellbauer, 1980).

Shopping Behavior

The financial distress associated with unemployment might have a detrimental effect on consumers' mental and physical health (French and Davalos, 2011). Consumers' perceptions and decisions would not only be affected by economic stability but also the potential pandemic effects on wellbeing and mental health due to the lockdown (Hamermesh, 2020; Petersen, 2020). Therefore, a belief in the rationality of humans and organizations *amid economic* crisis is unrealistic (Ariely, 2009).

Consumer expectations. Widespread pessimism about the economy in light of the outbreak was reflected in consumers' expectations for declining economic activity and rising inflation (Knotek et al., 2020). How optimistic or pessimistic consumers feel regarding the recovery of the economy can affect future decisions:

Spending. According to a survey conducted in April 2020, households expecting more considerable income losses (lower-income and younger families) were more likely to report a decrease in total expenditure in the future. Interestingly, households expecting large shocks to financial wealth (wealthy and middle-age households) were neither more nor less likely to report future spending changes.

Plans. Expecting greater income and wealth shocks were, in general, associated with a higher likelihood of upward adjustments of projected household debt outstanding by the end of 2020, retirement age, and desired working hours (Hanspal, Weber, and Wohlfart, 2020).

Self-efficiency (producing). High unemployment rates during recessions could maintain or further promote food preparation (Aguiar and Hurst, 2005; Beatty and Senauer, 2013; Birkeland, 2014), which could be used as a self-efficiency tactic to lessen the recession effects. Cooking at home could affect the diet quality of a family during an economic contraction through food budget planning and more time at home due to unemployment (Ásgeirsdóttir et al., 2016).

Will consumers become less loyal? Brand loyalty could have been affected by external cues, such as empty grocery shelves for popular items and social distancing restrictions that prevented some purchases (e.g., traveling, dining out) during quarantine as well as company exits from the market due to recession. Likewise, it could have been influenced by internal cues such as alterations of consumer needs and motivations due to the outbreak (e.g., anti-bacterial soap) and deliberate delay of purchases (e.g., big-ticket items).

Food Retailing and Demand

Local retailers. While online grocery shopping will supply the basics, local shopping will provide fresh and local goods, especially to those consumers who value convenience (more than low prices at major retailers), want to support the local economy (smaller and local stores and restaurants within communities), and consumers who prefer to avoid hot spot areas for the virus.

Online retailing. Thousands of stores affected by the recession will permanently close as the e-commerce shift dominates the market and expands delivery services. Firms will need to rethink their marketing to remain viable (Ariely, 2009; Piercy, Cravens, and Lane, 2010). Retail firms will start implementing and promoting alternative shopping channels, including online shopping, as well as innovating their marketing in order to influence the new wave of consumers.

Third Stage: New Normal (post-COVID economic recovery)

Previous pandemics were followed by several decades with depressed investment opportunities, possibly due to heightened desires to save or rebuilding of depleted wealth (Jordà, Singh, and Taylor, 2020). The economic recovery will slowly increase investment and spending and will welcome the new normalcy.

Shopping Behavior

While some shopping patterns emerged before the pandemic, such as online shopping, others emerged because of it, such as online services (e.g., health and wellness-related services) (Petersen, 2020). Whether they persist in the long term will depend on several factors, including the continued presence of the contextual cues, how much the context reverts, and how fast consumers emerge—economically and emotionally—from the outbreak crisis. The following are some new food shopping trends that arose due to the pandemic:

Consumer concerns about food safety. About half of consumers reported avoiding products from China due to the pandemic (Dietrich et al., 2020). Consumers will seek "risk-free" products, especially those shoppers who unconsciously have carried out the negative association, particularly with respect to cleaning products, antiseptics, and imported products.

Emphasis on the supply chain. Future shoppers will be more interested in understanding the supply chain—from farm to factory to distribution—and will be willing to pay more for products with high-quality assurances and verifiable safety standards (Leggett, 2020).

Local food. Promoting the local origin of products and informing consumers about food safety measures, for instance, in food delivery (CPG FMCG & Retail, 2020;

Leichenko, 2020) are some directions retail companies can take to assuage consumer concerns about safety standards.

Food Retailing and Demand

After the Great Recession, companies implemented more analytics, metrics, and online marketing, including social media in business-to-business marketing (Rollins, Nickell, and Ennis, 2014). Larger retailers would play a significant role in meeting new market trends during the economic recovery.

Online shopping and grocery automation. To respond to the switch from in-store to a pick-up and delivery model, major grocers will improve online grocery with technology, including the use of robots and artificial intelligence to improve store operations, offer fast home delivery, and expand store pick up. Big-box retailers (e.g., Walmart) are currently playing a significant role and enabling technologies that create high convenience in retailing (Meyersohn, 2020).

Building brand loyalty. Firms that adopted proactive marketing during the recession will have an advantage over competitors during this period (Srinivasan, Rangaswamy, and Lilien, 2005). As online advertising (e.g., food delivery advertising) and data analytics grows (Leichenko, 2020), building and maintaining brand loyalty will be a challenge, especially for food companies that rely on large distributors to sell their products (e.g., Amazon).

New consumer segment. As more people work from home, convenience meals (easy to cook or ready to eat meals) and food delivery services might increase popularity. Foodservice establishments with sanitary environments will also become popular (Richtel, 2020), as this group seeks work and meeting spaces.

Summary

The coronavirus pandemic has modified individuals' behavior in many ways influencing the marketplace and challenging the retail food sector. This article provides insights into the effect of COVID-19 on consumer behavior by exploring essential questions, with implications for the food retail, that current research has not yet discussed.

Are consumers rational under an unprecedented health crisis? During COVID-19, consumer behavior was not singularly the result of rational (slow) thinking nor emotion-driven (fast) thinking. At the beginning of the pandemic, fast thinking was dominant, resulting in impulsive shopping behavior such as panic buying and hoarding. As the crisis unfolded, slow thinking was more evident, inducing more conscious decisions, as such households started to make financial adjustments based on their economic expectations.

What will post-COVID-19 consumer behavior and retail look like? The new norm in consumer behavior will likely be characterized by more considerable popularity of trends that existed pre-COVID-19, such as online shopping, as well as the adoption of new behaviors that emerged due to the pandemic, such as demand for local food and food safety attributes. As a result, there will be a growth of technology-driven online retailing and developments in the food value chain regarding safety standards.

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