Local Food Supply Chain Dynamics and Resilience During COVID-19

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Abstract
Local and regional food systems (LRFS) innovated during COVID-19 to respond to market demand and policy changes. Given their unique characteristics, we identify drivers that explain why local responses to COVID-19 vary when compared with the national dialogue on food supply chain disruptions. We suggest LFRS enterprises are nimble and connected to supply chain partners, allowing them to innovate quickly with a targeted approach. Considering the shorter supply chains and smaller operations typical of LRFS, we assert the current regulatory environment's fairness and relevance may be scrutinized. In conclusion, we articulate an updated research and technical assistance agenda for LRFS.

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Introduction

Local food systems have garnered increasing attention from the marketplace, policymakers, and the public during the past two decades. The COVID-19 pandemic accentuated this visibility as many recent public policy discussions centered on U.S. food access, affordability, and supply chains. Arguably, at no time since the Great Depression and Dust Bowl of the early 20th century has the American public focused so much attention on the "invisible hand and infrastructure" that assures an ample and affordable food supply. As local food systems are often more visible and accessible, some food buyers and policymakers are re-examining and re-committing themselves to find ways to support and sustain such food systems in their communities.

Because of the proximate, short supply chains underlying local markets, local and regional food systems (LRFS) can be characterized as nimble and connected. Chenarides et al. (2020) argue managerial rigidities underlie a critical weakness in the broader U.S. food supply system, and that resiliency in an era of persistent uncertainty surrounding both retail and food service supply chains will require flexible strategies. Among the early market forces that drove demand for artisan, craft, and local brands was the ability of enterprises offering such brands to nimbly respond to changes in consumer demand for unique food and beverage attributes and varieties (Faison and Leverette, 2018; Low et al., 2020).

The nature of the connections among stakeholders is also an important and novel feature of LFRS. LRFS have the potential to generate both bridging and linking social capital through facilitating connections between producers, consumers, and small food businesses, as well as public health stakeholders such as University Extension, government agencies, and non-

government organizations (NGOs).[1] While difficult to quantify (Deller et al., 2017), with linkages to markets that are not well understood (Hughes and Boys, 2015), evidence is increasingly emerging that social capital contributes to the development and strengthening of LRFS (Glowacki-Dudka et al., 2012; Bauermeister, 2016; Papaoikonomou and Ginieis, 2017). Finally, a large and diverse coalition of stakeholders have coalesced to support LRFS (CSA Innovation Network, 2020; Local Catch Network, 2020). Far beyond simply backing LFRS with their food purchasing dollars, many in this community have become advocates for policy changes to address the barriers and vulnerabilities facing the smaller and family-owned farms, ranches, fishers, and food businesses they see as vital elements of their local food system.

During COVID-19, LRFS enterprises made agile pivots to new market channels and buyers by leveraging relationships in local food supply chains. Shorter supply chains allow producers to develop direct, personal relationships with their supply chain partners and buyers (Hardesty et al., 2014). When markets are disrupted, these relationships enable local farm and food managers to leverage community networks to find necessary inputs including labor, secure new buyers, and escalate word-of-mouth and social media promotion. Arguably, the rigidity of the current regulatory and policy environment constrains the flexibility of potential marketing and strategic responsiveness for LRFS farms and food businesses. This is readily apparent to consumers and larger buyers in the market that are gaining firsthand insights into regulatory and food supply chain organizational limitations (Chenarides et al., 2020) and are now calling for policy action to address some regulatory "rigidities" (Thilmany and Malone, 2020).

[1] Social capital has been described as "the sum of the resources, actual or virtual, that accrue to an individual or group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu and Wacquant, 1992, p. 119). "Bridging social capital" connects sectors of society that would otherwise not have contact, while "linking social capital" allows citizens to interact with institutions to carry out advocacy through collective action (Sabatini, 2008).

Given the unique characteristics of local food systems, we have identified a few of the drivers that may offer insight into why local responses to COVID-19 vary when compared with the broader national response to food supply chain disruptions. Previous work has found that local and regional food enterprises allow producers to more fully integrate into downstream supply chain decisions through intermediated sales via food hubs, new age cooperatives, and collaborative food distributors and brokers (Hardesty et al., 2014). These enterprises are more likely to operate in areas with high social capital using more localized procurement strategies (Cleary et al., 2019; Angelo et al., 2016).

We posit that because local food systems are relatively nimble and proximately connected to their supply chain partners, local food enterprises can innovate quickly and with a more targeted approach, i.e., they are dynamic. We review examples that illustrate how local and direct-to-consumer (DTC) businesses have innovated during the pandemic to respond to market demand changes. Given the shorter supply chains and relatively smaller operations typical of LRFS, the impact of constraints imposed by the current regulatory environment have become even more apparent and scrutinized. Finally, using examples of current and proposed policy changes, we consider the role of resilient food system innovators and networks in the LRFS response to COVID-19 market disruptions, and consider potential market and policy reforms and refinements that may be beneficial to moving forward.

Local Foods Pre-COVID-19

For decades prior to COVID-19, consumers purchased local foods directly from farmers (e.g., farmers markets, pick-your-own farms, and farm stands) and through intermediaries such as restaurants, grocery stores, and institutional foodservice operations including schools and universities. COVID-19 instantly and severely shocked LRFS supply chains by forcing the

closure of schools, restaurants and, initially, many farmers' markets (NFSN, 2020a). In this section, we describe the local foods landscape prior to the COVID-19 pandemic and provide data and background information to support our hypothesis that LRFS functioned with dynamism (nimbleness) and connectedness through increasingly partnering with other LRFS enterprises and allied organizations.

DTC sales of food for human consumption is the quintessential short supply chain marketing channel as sellers have direct relationships with their customers and are able to quickly respond to their feedback. Since 1992, the Census of Agriculture has collected DTC sales (dollars) and the number of DTC operations every five years (Figure 1).

Between 2002 and 2007 the number of DTC operations increased by 17%, and sales increased by 32%. Sales growth through the most direct to consumer channels, however, has plateaued since 2007. This stagnation has been attributed to several factors including the Great Recession (O'Hara and Low, 2016), local foods market saturation, and the new data disaggregation which reveal that a tremendous share of sales are generated through intermediated sales channels such as institutions, retailers, and locally oriented distributors known as food hubs (Low et al., 2015; Cleary et al., 2019) – marketing channels not included in the Census of Agriculture's earliest DTC metric. Note that 2017 DTC sales growth observed in Figure 1 is due, in part, to a definitional change. Processed foods sold directly from the farm to the consumer were counted as DTC for the first time in the 2017 Ag Census.[2] Given this change, 2017 sales are not directly comparable with those of earlier periods.[3]

[2] The Census of Agriculture prior to 2017 defined DTC sales as sales of unprocessed food for human consumption; thus, products such as butchered meat, homemade bread, and canned salsa were excluded. Processed, or value-added, goods were captured separately, but lacking marketing channel info, sales were not designated as local.
[3] See O'Hara and Benson, 2019 for a detailed explanation.

Low and Vogel (2011) provided the first evidence that DTC inadequately measures local food sales at the farm gate and offered two explanations as to why non-DTC sales of local food were gaining momentum. First, from the producers' perspective, non-DTC marketing outlets ensure farmers don't spend their limited time and labor marketing food. For producers who view their comparative advantage as production, they could partner with others who are savvier at aggregating, distributing, and managing buyer accounts.[4] Second, many consumers seek to buy local foods through more convenient retailer options such as at a grocery store or even online (O'Hara and Low, 2020; Richards et al., 2017).

LRFS constitutes a tiny portion of agricultural production and food sales. The 2017 Census of Agriculture was the first to report a dollar value for total sales of local and regional foods (DTC and non-DTC sales).[5] It has been reported that local and regional food sales totaled $11.84B (3% of total food sales) from 7.8% of U.S. farms (Johnson, 2019).[6] As illustrated in Figure 2, the sum of DTC and non-DTC sales as a share of total agricultural sales are concentrated on the coasts and near major urban markets.

Consumer interest in buying from local farm and ranch operators parallels another trend—farmer entrepreneurs adopting food processing and other value-added activities as diversification strategies (Low et al., 2020). Like LRFS farms, many food and beverage manufacturing start-ups are small (U.S. Census Bureau, 2017).[7] Research shows local food

[4] For example, instead of driving to a farmers market, setting up a stall, and then packing up and driving home, farmers can sell the same goods to the same consumers and save many person-hours.
[5] The U.S. Department of Agriculture conducted the first Local Food Marketing Practices Survey (LFMPS) in 2016, drawing on 2015 data, with a goal of better enumerating local food activity. The 2015 LFMPS was part of the impetus to revise the 2017 Census of Agriculture to better reflect measures of "local food."
[6] Publicly available data do not allow us to parse out the overlap between these two groups' operations with DTC sales and non-DTC sales; doing so would require access to confidential census microdata.
[7] Data in this paragraph are from authors' analysis of County Business Patterns data from the U.S. Census Bureau; these data give the number of establishments, by size and industry, in each county on an annual basis; these data exclude production agriculture firms (i.e., farms).

marketing activity is positively associated with food and beverage manufacturing start-ups across the continental U.S. (Low et al., 2020). That is, where LRFS activity is relatively high, small food and beverage manufacturing is growing—at least pre-COVID.[8] While some types of food and beverage manufacturers grew over the past 15 years, others declined, including small *animal slaughtering and processing* plants (7% fewer).[9] Losing small processors in the run-up to COVID-19 is a supply chain "bottleneck" we will consider in detail below.

COVID-Driven Disruptions and Innovation in Local and Regional Food Systems

Local food producers and food manufacturers with local and regional brands that focused on sales to foodservice operations faced a significant market disruption under COVID-19 due to school closures and the partial closure of restaurants (NFSN, 2020a). In addition, social distancing affected the protocols for farmers markets and farm stands, though anecdotes are mixed as to the extent consumers have continued to purchase through these outlets despite altered operations.

Thilmany et al. (2020) estimated that across local and regional markets during March through May 2020, COVID-19 sales and payroll reductions may have led to a national loss of $1.32B loss (10% to 25%) to LRFS. Earlier, O'Hara and Low (2016) found that local food sales are procyclical with income elasticities of demand far above those for nonlocal foods—suggesting that the current recession may impact local food sales disproportionately. Also, Richards and Rickard (2020) report anecdotal evidence that consumers stockpiled frozen fruits and vegetables in early periods of the pandemic, potentially reducing future fresh produce sales.

[8] It will be years before data are available to evaluate trends during the pandemic.
[9] Food and beverage manufacturing plants grew 7% between 2002 and 2017 according to U.S. Census Bureau County Business Patterns. For example, *snack/other food* manufacturing had 35% more plants and 38% more employment in 2017 than in 2002, and the same period featured more than 600% growth in *breweries*, 770% growth in *distilleries*, and 200% growth in *wineries*.

Online Sales as an Alternative to DTC

To highlight some innovations and rapid strategic responses motivated by the pandemic, we begin with the results of semi-structured interviews with 10 e-commerce platforms operating at different scales that serve LRFS.[10] Overall retail food sales increased significantly, and in mid-March 2020 peaked at 73% higher than January 2020 sales (Opportunity Insights, 2020). To provide some context on the importance of e-commerce platforms, online food sales were particularly impacted as 33% of U.S. households shopped for groceries online in May 2020 compared with 13% in 2019 (Brick Meets Click, 2020). Instacart, one of the largest online grocery ordering and delivery services, experienced a volume order increase of 500% year-over-year in April 2020 (Wiggers, 2020).

E-commerce growth was not limited to grocery store sales; local and regional food operations have also pivoted to e-commerce. In 2015, only 8% of farmers with DTC food sales had online marketplaces (O'Hara and Low, 2020). The pandemic, however, induced many LRFS producers and businesses to quickly pivot into online marketing and sales (NMPAN, 2020). Aligning with the broader online grocery trend (Figure 3), online sales by LRFS operations bloomed during the early months of COVID-19. Between April and May 2020, online local foods sales increased by 360% due both to increases in the number of orders (+189%) and dollars spent per order (+71%). As indicated by one respondent, a consumer may have only spent $10 to $20 per transaction at a farmers' market, but he or she now spends $75 to $100 in online transactions—a marked increase in basket size. E-commerce platforms also experienced a significant increase in web traffic (+247%). Although traffic may not always convert to sales, it

[10] This information was obtained through a series of 10 interviews conducted with e-commerce platforms used by LRFS firms in May 2020. The sample of platforms was drawn from the Farmers' Guide to Direct Sales Software Platforms (National Young Farmers Coalition, 2020). Those interviewed represented farms and food businesses and were asked to assess the role of speed and innovation as drivers of their new marketing strategies.

likely demonstrates an increased interest in online local food options (since the more visible platforms of mainstream food retailers are easier to find and use for a customer). MarketMaker, an online database that connects producers and buyers, experienced a 100% increase in profile views in May 2020 compared to the same period in 2019 (Posadas, 2020).

The availability of resources such as access to broadband internet, e-commerce Extension education, technical assistance from community organizations and commercial e-commerce platforms have helped producers adapt and respond to changes in food marketing. While 73% of farmers have computer access and 75% have internet access, only 19% previously used these electronic devices to conduct marketing activities such as DTC sales, online auctions, or to track prices online (USDA-NASS, 2019).

During this period, it was reported that there both an increase in the number of producers who were first-time e-commerce users (63% increase compared to 2019) and a rekindled use of existing, but slightly or sometimes unused, e-commerce platform accounts. For example, LocalHarvest, a large online directory of DTC farms, saw a sudden surge in updates to existing profiles.[11] Previous use of e-commerce—even if limited—enabled these producers to be nimble as they revamped online sales portals relatively quickly, improved the features offered in their online stores, and expanded the mix of products they sold through this channel (e.g., many Community Supported Agriculture (CSAs) now offer add-on products). LRFS producers identified a need and adopted demand-driven innovations that offer convenience for consumers via online pre-ordering (for farmers' markets), online payment, new formats of online food subscriptions, and expanded pickup, home delivery, and shipping options (CSA Innovation Network, 2020).

[11] Guillermo Payet, personal communication, May 18, 2020.

Producers have also forged new collaborations to increase product variety in their online marketplaces as well as to renew or improve access. For example, Pig and the Plow, a locally-focused baked goods producer in Northern Colorado partnered with producers who offer fresh produce, meat, eggs, and value-added goods in a diverse online marketplace. This platform now offers home delivery and multiple pickup locations that extend to areas and deliver on days not currently served by the region's farmers markets.

E-commerce platforms serving LRFS have also actively responded to new market opportunities. Despite e-commerce potentially competing with physical markets that do remain open (Etumnu and Widmar, 2020; Zapata et al., 2016), pandemic-era measures to limit vendor occupancy and customer foot traffic led many U.S. farmers' markets to adopt e-commerce tools to offer pre-ordering and a storefront available to customers for ordering throughout the week. Numerous farmers' markets have maintained business by serving as a pickup location or offering delivery. Farmers market participation in online directories such as MarketMaker has already proven beneficial (Zapata et al., 2016). It is unclear, however, whether online farmers' markets can sustain or continue to grow through online activities.

Flexibilities Facilitating Local and Regional Food Enterprise Resiliency During COVID

COVID-19 has also impacted the ability of certification systems to provide food safety and other forms of food system oversight. Most relevant to local foods markets, the USDA Agricultural Marketing Services (AMS) temporarily extended the expiration date of audit certifications for Good Agricultural Practices (GAP) and relaxed some of the requirements of the Food Safety Modernization Act's (FSMA) Produce Rule by committing not to enforce some criteria for qualified exemptions (USDA-AMS, 2020). In addition, travel restrictions and site biosecurity measures reduced (or, in some cases, eliminated) the ability of auditors to make site

visits. For example, in the case of organic certifications, the Accredited Certifiers Association and International Organic Inspectors Association developed contingency plans wherein new applications for certification cannot be issued without an onsite inspection, but certified businesses seeking to maintain or add new products, land or facilities, can complete audits using remote inspection and/or a records audit.

Beyond farms, local and regionally-branded food processors also faced significant supply and market disruptions at the beginning of COVID-19. Sales evaporated when public health concerns forced partial closures of restaurants, schools, and other institutions (Colpaart, 2020). On the supply-side, many processors faced worker shortages as pandemic protocols changed the nature and extent of risk of normal operations. The meat processing industry was particularly hard hit by supply chain bottlenecks. During the first few months of the pandemic, as large plants halted output, small processors were dynamic and quickly pivoted, increasing processing output in April and May (Lusk, 2020b). *Animal slaughtering and processing* plants represent approximately 15% of all food manufacturers. Within this sector, the smallest plants, those with fewer than 20 employees, represent nearly 60% of all plants. These small plants are often custom-exempt and serve a truly local market. Yet these smallest processors have dwindled in number, with 257 (7.3%) fewer in 2017 compared to 2002.[12] The remaining local meat processors quickly hit capacity and scheduled out as far as 18 months into the future to meet demand spikes. In lieu of few alternatives, some consumers chose to buy larger shares of beef (1/2 or full animals) and retail stores returned to doing their own butchery (NMPAN, 2020).

What might happen if food safety requirements in in the production and processing of foods sold within local markets were loosened? As one pre-COVID example, relaxing state cottage food laws, which allow small food entrepreneurs to produce low-risk foods in home

[12] Authors' analysis of County Business Patterns data, 2002 and 2017, from the U.S. Census Bureau.

kitchens and market them via DTC outlets, is a valued food manufacturing regulatory flexibility among those in the LRFS community. Cottage food laws vary tremendously by state and eased over the previous 10 years (O'Hara et al, 2020), with significantly more baked good establishment start-ups (especially small firms without employees) where and when cottage food laws were in place.[13]

Cottage foods laws illustrate that sensible relaxation of food regulation can led to more businesses - but, are there other regulatory flexibilities that would be appropriate in light of COVID-19? Currently, there is no evidence indicating that transmission of COVID-19 is associated with food or that COVID-19 is a source of potential food borne illness (CDC, 2020), and the risk of transmission through food products or packaging is low (CDC, 2020). Due to this and the inherent challenges of maintaining standard food manufacturing and market inspection schedules due to COVID-19, some of these requirements were have been temporarily relaxed. In North Carolina, for example, some counties allowed in-person health inspections to stop or be cut-back, or inspection frequencies were waived to allow staff to focus on COVID prevention. Recognizing the relatively higher cost burden on smaller scale businesses in instances where revised business practices were required by legislation or regulation, past exemptions and differential treatment of small-scale farms and food processing and manufacturing businesses have been permitted.[14]

The implications of more flexible food safety and certification oversights for local meat processors and other LRFS suppliers are unclear. If certified firms continue to adhere to the

[13]Kacher and Weiler (2017) estimated that 10-20% of non-employer establishments eventually become employer establishments. To the best of our knowledge, no estimates specific to bread and bakery manufacturing exist.

[14] For example, it was recognized during the implementation of the Food Safety Modernization Act (FSMA) that the fixed cost expense of compliance would be high and unduly burdensome to small-scale producers (Boys et al., 2015). As small-scale firms selling into local markets have short supply chains and reach a small number of customers, their food safety risk was deemed to be relatively small. Thus, FSMA exemptions and additional time to comply were allowed for 'micro' businesses (<25K in annual average revenue) and small farms.

production practices that were in place prior to COVID-19, the direct risks to food safety and quality are likely to be minimal. At the same time, indirect risks due to the impacts of COVID-19 may be increased (Bayham and Hill, 2020). In the short-run, there is a real threat that firms are likely to experience labor attrition or shortages due to illness of workers, or other circumstances affecting worker availability (e.g., childcare or eldercare challenges). Employees who are hired to fill staffing gaps may not receive the usual level of training, and management oversight may be weakened due to their own health considerations and required changes in operating procedures. While these challenges are not unique to local markets, due to the lack of infrastructure and access to resources, smaller-scale farm and food operations may be disproportionately affected. This may be particularly true of those operated by socially disadvantage and underserved populations (CEFS, 2020).[15]

Will COVID-19 Catalyze Permanent Changes in the Food Policy Environment?

COVID-19 has highlighted supply-chain resilience and flexibility, and as a result food supply chains have "turned on a dime" (Bellemare and Dusoruth, 2020). In light of the challenges and innovations exhibited by the food system in response to COVID-19, a national dialogue has been reinvigorated concerning how we can best frame our policy and regulatory environment to create more diversified and resilient food supply chains. Out of necessity, this pandemic has already spurred LRFS policy innovation at the federal, state, and regional levels. For example, federal and state governments readily "flexed" a number of regulations to respond to the most visible "pain points" across all producers of all sizes and market orientation, such as retail label requirements for foods destined for wholesale outlet. On the consumer side, there were a waive and continuance of waivers to allow for online food assistance benefits. Following

[15] By way of example, an *E.coli* contamination in beef processed at a custom-exempt processing establishment in Illinois was announced in June (Food Safety News, 2020).

this crisis, one could imagine that policymakers may revisit and reform a broader set of food regulations rather than simply reversing current exemptions. LRFS advocates are already weighing in on this with suggestions of how to address potential scale and market channel bias. In addition to revisiting the regulatory landscape, concerns about food market structure and performance under the challenges brought by COVID-19 are likely to catalyze broader discussions at local, state, and federal levels (Faison and Leverette, 2018).

Justified by the significant market impacts of COVID-19, a number of long-running policy and programming priorities identified by food system advocates are getting heightened attention and rapid responses. Traceability and third-party certifications, for example, are strongly preferred for products distributed through longer supply chains where they mitigate risk due to factors such as distance traveled, need for greater shelf life, and reducing costly waste and redundant inspections when numerous enterprises are involved. Due to the connected and proximate nature of LRFS systems, however, some argue there is bias within traceability and certification requirements if they are overly burdensome for smaller farmers and agribusinesses (Boys et al., 2015). A few examples of additional time-sensitive policy actions provide interesting context for how broad agriculture and food issues may change in ways that have longstanding implications. In the longer run, COVID-19 may lead policymakers to evaluate and refine the incentives and barriers current policies and regulations represent to LRFS.

Meat Processing Regulation

In the context of COVID-19, the oligopolistic market structure of meat slaughter and processing activities has signaled significant vulnerability. High-throughput facilities had to slow or shutdown production due to worker illnesses and to enable some distancing between workers. Processors must comply with either federal regulations, or those of a designated state agency

whose requirements are at least equal to the federal requirements.[16] Importantly, only meat from federally inspected processors can be sold across state lines.[17] The consequences of this have been significant – bottlenecks developed in animal production systems and short-term price spikes faced by consumers (Johansson, 2020; Ruane, 2020).

In response, federal policymakers have witnessed renewed interest in promoting a more diversified supply chain.[18] Due to the impacts of COVID-19, a bi-partisan group of house members and Senators requested that the USDA: (1) clarify and streamline the approval process for meat labels; (2) give smaller meat processors more flexibility to comply with HACCP regulations; (3) allow smaller meat processors to sell across state lines; and (4) reduce the expense of inspections on meat processors if an inspector works overtime (Jordan et al., 2020; Cramer et al., 2020). Moreover, a bill has been introduced to the House Committee on Agriculture to allow state-inspected meat to be sold across state lines (H.R. 7162). In addition, there has been renewed and bipartisan interest in passing the Processing Revival and Intrastate Meat Exemption (PRIME) Act, which would allow states to modify their laws for the sale of meat products.[19] In July 2020, Requiring Assistance to Meat Processors for Upgrading Plants (RAMP-UP) was introduced to provide financial assistance to existing meat and poultry processor to make the investments necessary to secure and maintain Federal inspection.

[16]State inspection programs operate under cooperative agreements with the USDA Food Safety Inspection Service (FSIS). In states with state inspection, meat processing facilities can choose between FSIS or state inspection. Currently 27 states have opted to implement their own meat inspection program (Rumley and Wilkerson, 2020).
[17] Through the Talmadge-Aiken Act, the Cooperative Interstate Shipment of State Inspected Meats Program permits state employees to conduct federal inspections which thus qualify for interstate commerce. Approximately 360 establishments in nine states are covered under this agreement (NASDA, 2017).
[18] For example, The Corner Newsletter (May 14, 2020) compiled anti-monopoly actions and/or efforts to remove barriers perceived to impede the formation and sustainability of small and medium-sized meat processors. In addition, 11 state Attorney Generals formally wrote to U.S. Attorney General Barr to express concerns regarding market concentration and anticompetitive practices by meat packers (Stenehjem, May 5, 2020).
[19] It is worth noting that major industry groups such as the National Pork Producers Council, oppose the PRMIE Act due to concern that it would potentially compromise consumer confidence in the safety and quality of meat products.

In the absence of federal action, several states that that manage their own inspection programs lobbied for federal regulations to be relaxed and proposed or enacted adjustments to their own regulatory policies. Wyoming revised their Food Freedom Act to incorporate an animal share amendment which allows consumers to buy a share of an animal and arrange the slaughtering and butchering through custom slaughter facilities (Linnekin, 2020). Oklahoma, Nebraska, Oregon, and Maine are also pursuing more flexible state inspection options (Morgan, 2020; Balin, 2020; MDACF, 2020; Borrud, 2020), and Kentucky and Montana have initiated new grant programs to increase in-state slaughter capacity (Grebner, 2020; Kentucky Interim Joint Committee on Agriculture, 2020; MDA, 2020; MDC, 2020).

Programs and Innovations to Jointly Support Markets and Food Security

The far-reaching health and economic effects of COVID-19 have also increased concerns about food security, and these discussions commonly overlap with LFRS because of increased programming to capture and leverage food assistance dollars in DTC markets (e.g., Farmers Market Nutrition Program), or through alternative retail channels that "incentivize" local produce purchases (NFSN, 2020a). For example, various state-level COVID-19 assistance initiatives sought to increase access to local and fresh foods among the food insecure while creating marketing opportunities for LRFS.[20] At the federal level, the USDA partnered with regional and local distributors to supply agricultural products to food banks and other organizations as part of the Farmers to Families Food Box Program (USDA, 2020). We evaluated the websites of approved contractors from the first and second round of this program to assess their connection

[20] Some examples include the Fresh Food Financing Initiative COVID-19 in Pennsylvania (Pennsylvania Department of Agriculture, 2020) and Massachusetts's Food Security Infrastructure Grant Program (Government of Massachusetts, 2020).

to LRFS[21] and found that around 18% (39 out of 214) of the program's distributors participate in LRFS, although contracts to LRFS suppliers only represent a small share of the overall program spending. For many food hubs, this program provided an alternative revenue stream to offset losses in sales to foodservice channels, allowing them to stay in business (Wallace Center, 2020).

In response to COVID-19, the federal government also relaxed rules to expedite emergency food provision efforts (Jablonski et al., 2020). The USDA gave states temporary administrative flexibility in their SNAP program including some measures that may allow more local food markets to accept food assistance dollars (USDA-FNS, 2020). Many school districts and farm to school networks also heightened efforts to incorporate local foods into emergency feeding programs during COVID-19 school closures (NFSN, 2020a, 2020b). This increased flexibility and support within governmental food assistance programs has resulted in new partnerships between LRFS and the emergency food system (Wallace Center, 2020), and may allow more LFRS enterprises to participate in nutrition programs post-pandemic. Given that cross-sector collaboration and adaptable supply chains have been key to the effectiveness of these emergency feeding programs (Jablonski et al., 2020), LRFS may play a role in filling some gaps at the local level.

To further illustrate the contribution of the LRFS to addressing food insecurity during the COVID-19 pandemic, we conducted an analysis of news coverage of LRFS suppliers—including food hubs, farmers' markets, local producers, or CSAs—collaborating with local Emergency Food Programs, food banks, and other community organizations. Our analysis using LexisNexus

[21] The criteria used to identify the LRFS status of a distributor included whether they are listed as a food hub, participate in farmstands, farmers markets, or CSAs, distribute food within a state and/or advertises products as local.

(Nexis Uni®)[22] resulted in 40 unique news stories generally showcasing city- or state-level partnerships between LRFS stakeholders and emergency food programs and other local organizations during the February–September 2020 period. We identified various formats of collaboration, including donations of surplus products by LRFS vendors, fundraising at farmers markets (e.g., donations of cash or gift tokens), and consumers' purchase and donation of produce boxes or CSA shares. In many instances, these partnerships allowed consumers to patronize LRFS while also supporting efforts to supply local food banks.

Setting a Research and Technical Assistance Agenda for LRFS Post-COVID

We argue that some characteristics inherent to local and regional food systems have permitted LRFS to be resilient and nimbly respond to the COVID pandemic—and perhaps—better connect with consumers as some segments of the agri-food system struggled with disruptions. In the course of this pandemic, regulations affecting several dimensions of the agri-food system, including those governing food labelling, approaches to access benefits of federal nutrition programs, and some food farm and manufacturing site inspections have been relaxed. In the case of agri-food products produced by operations and marketed within a LRFS, it has argued that - due to both their smaller volume of production and shorter supply chains with smaller geographic reach and can offer improved product traceability - the risks of a large public health of a food safety event are considered lower than for the conventional food system. Indeed, this is a large part of the motivation for the Tester-Hagan amendment incorporated into FSMA which permits exemptions for and differential treatment of small farms (Boys et al.,

[22] Search terms included COVID-19 AND Food bank OR Food security AND Donation OR Supply OR "Food assistance" AND "food hub" OR "local farmers" OR "local producers" OR "local gardeners" or "Community supported agriculture" OR "farmers market". We evaluated each of the results and selected only news covering stories of programs and partnerships involving LRFS.

2015) which are such a key component of LRFS. Given this, an argument might be made for permanently reforming regulations applied to LRFS participants.

Still, it is important to balance the emboldened call from advocates to overhaul the food system with a realistic look at the limitations and vulnerabilities of an over-reactionary response. For example, due to scale inefficiencies and potentially higher production costs, caution should be exercised when advocating for shorter, less centralized or involuntary differentiation within supply chains (for example, mandatory standards for cage-free eggs). As shown by Mullally and Lusk (2017), the impact of animal welfare laws in California, enforcing differentiated production systems through regulation can result in higher prices for consumers and welfare losses.

Given concerns about how to inform and assess tradeoffs moving forward, we articulate a research and technical assistance agenda for LRFS that integrates much of what has been documented and informs how the applied economics field can contribute to the public discussions surrounding current food system challenges. First, a key role for economists will be to analyze and share market briefs on how different marketing channels in the agriculture and food sector responded and performed under COVID-19 disruptions. To this end, the USDA Ag Marketing Service gathered a new LRFS Community of Practice, coordinated by Land Grant partners from the University of Kentucky, Colorado State University and Pennsylvania State University, to document the impacts, innovations and case studies of these supply chains in response to COVID (https://lfscovid.localfoodeconomics.com/). Through this project and other initiatives, it will be important to assess how key market, financial, labor, and organizational metrics for LFRS suppliers, processors, and distributors varied from other firms through comparative case studies and documenting innovations the sector used to respond to COVID-19.

Second, there is a need to conduct applied research and update business planning using market analytics. The 2015 Local Foods Marketing Practices Survey was part of the impetus to revise the 2017 Census of Agriculture to better reflect measures of "local food." The survey's continuation in 2020 will help provide detailed and longitudinal data on local foods production and marketing practices. In addition, as many existing e-commerce platforms share data analytics, integrate inventory and supplier management, and facilitate integration with other software (e.g., QuickBooks) commonly used by farmers and small-scale manufacturers, decision tools can be developed for a new era of recordkeeping. A wide adoption of these tools could improve the efficiency of LRFS. For example, the integration of production, supplier (e.g., for food hubs, multi-farm CSAs), and inventory management tools could also be a step towards better food safety verification and traceability in LRFS. As e-commerce tools are more widely adopted, there is an opportunity to harness e-commerce data analytics to create benchmarks to help entrepreneurs become more knowledgeable about consumer trends. Extension education could play an important role in helping producers capitalize on this buyer information.

Third, as policy initiatives to address the vulnerabilities of the food supply chain are considered, there will be a need for economists to revisit cost-benefit analyses of regulations with an eye toward the tradeoffs across scale, market channels, and sector-specific risks. What policy changes are necessary and sensible to reduce the regulatory burden small-scale processors face? In the case of animal processing, for example, it is really an empirical question to explore the price, resiliency, and distributional outcomes of investing in the 100 small plants needed to make-up for reduced capacity in one large processing plant (Lusk, 2020a). Such analysis would provide the foundation for revisiting the need for a restructured regulatory environment.

In terms of regional economic development, research might assess whether regionally distributed plants increase resilience and reduce supply risk to agriculture, which is a key economic sector for many rural areas. If there is a decision to make food supply chains as core to planning as other key systems (e.g., transportation, health), then we must assess whether these characteristics are worth the sacrifice in economic efficiency. Supply-side bottlenecks have challenged local and regional-facing food manufacturers, particularly for animal production systems (NMPAN, 2020). In response, Extension specialists and educators can work with local and state food policy councils to frame and technically support new and innovative models for expanding local processing and market access models (for both the animal industry, but also for a broader and more diverse set of agriculture and food sectors).

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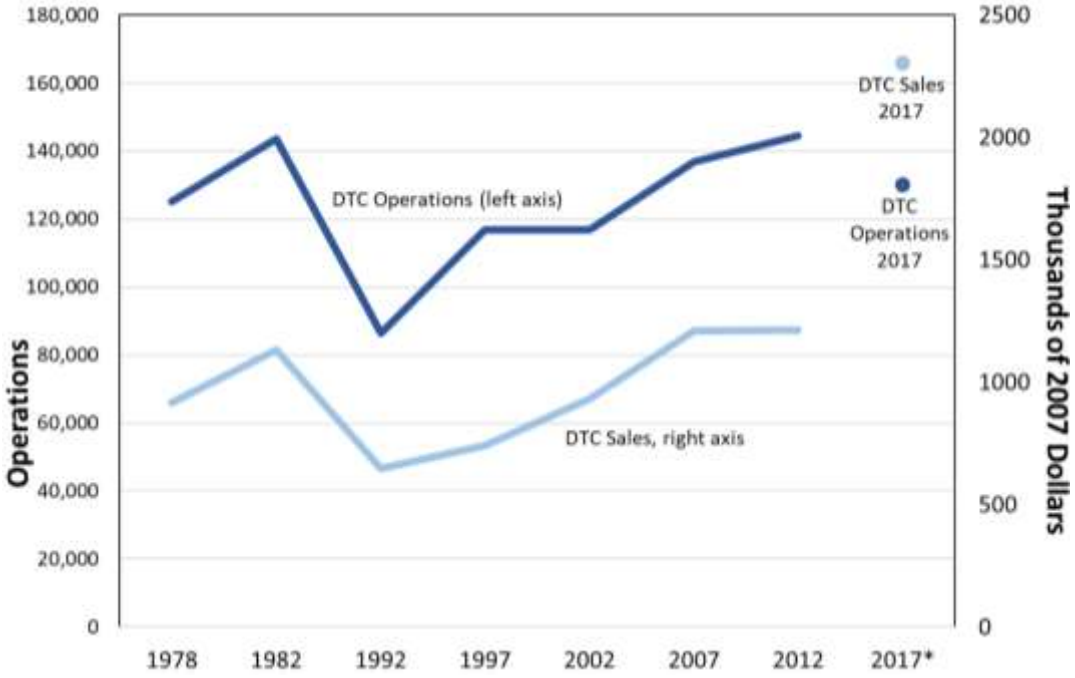
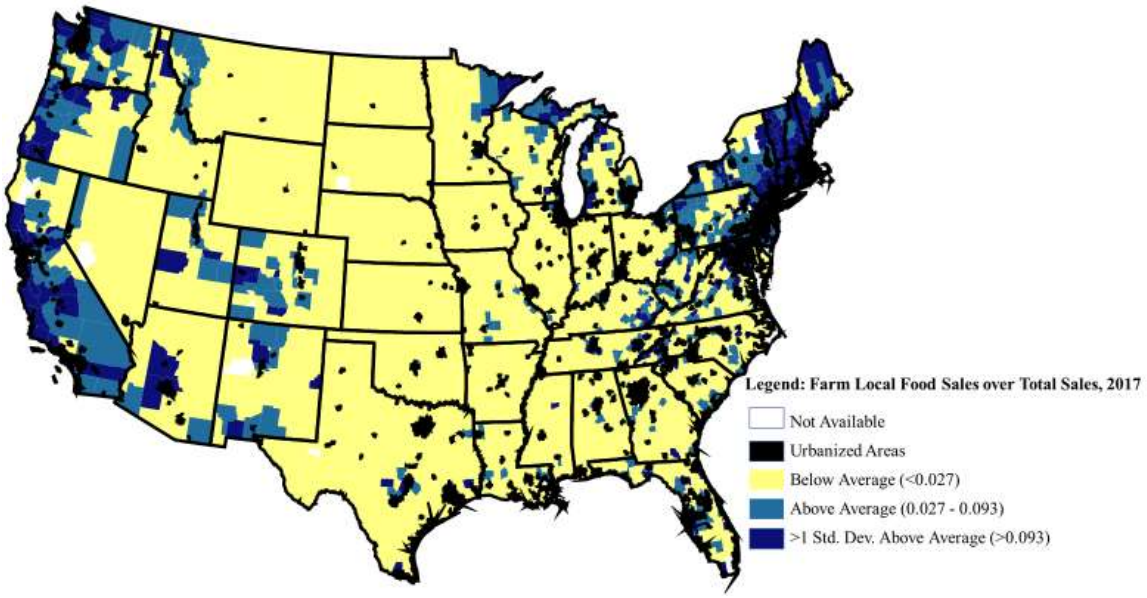
Figure 1. Direct-to-Consumer Sales and Number of Participating Operations



*Note: 2017 DTC data not comparable to earlier data, see text for details
Source: Low and Vogel, 2011; 2012 and 2017 Census of Agriculture.

Figure 2. DTC and Non-DTC Local and Regional Food Sales as a Share of Total Sales by Farms and Ranches.



Data Source: 2017 Census of Agriculture. National average of food sales to total sales in 2017 was 0.03.

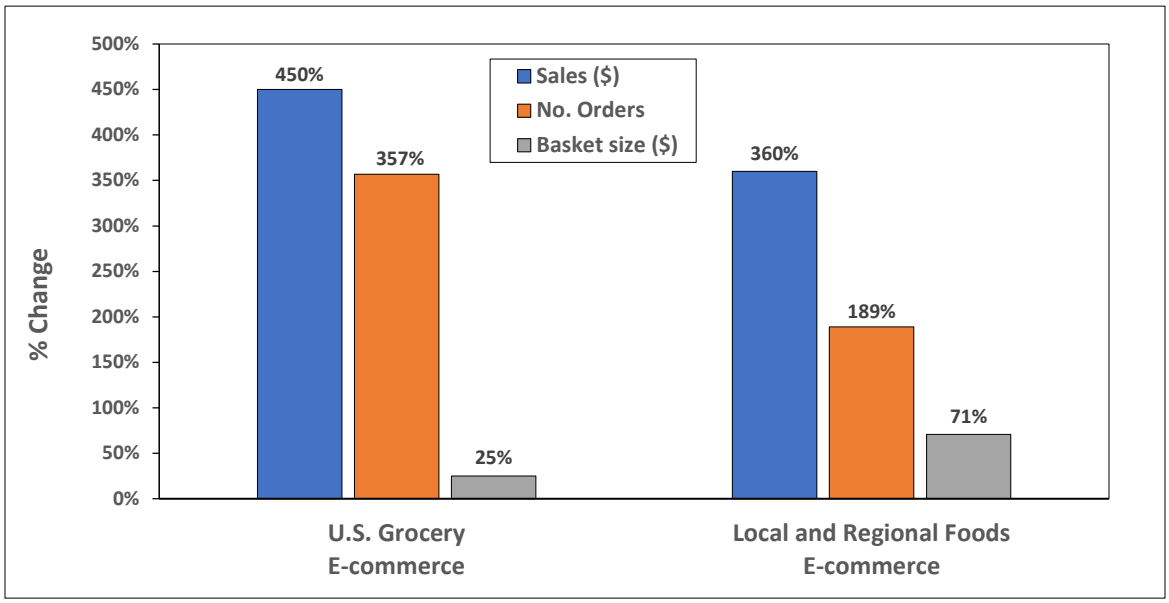


Figure 3. Changes in online food shopping amid the COVID-19 pandemic, 2019–2020.

Note: U.S. grocery e-commerce data are from Brick Meets Click (2020), and changes represent growth from August 2019 to May 2020. Local and regional foods e-commerce numbers are based on authors' calculations from survey of e-commerce platforms. The percent change represents year-over-year growth for same period (May) weighted by estimated size of the e-commerce platform.