Why are Indian Farmers Protesting the Liberalization of Indian Agriculture?

Shoumitro Chatterjee and Aprajit Mahajan

Farmers in India fear that new laws will enable corporations to exploit them. The most vocal protests have been in the states of Punjab and Haryana. The roots lie in the Green Revolution of the 1960s.

As the second wave of the Covid-19 pandemic ravages India, thousands of farmers continue to protest the new farm laws that seek to liberalize Indian agriculture. While various groups of farmers have expressed discontent with these laws, those most visible have been farmers from the states of Punjab and Haryana. They have been protesting at the gates of New Delhi for over six months. In the 1960s, these two states were the primary sites of India’s Green Revolution which turned India from a nation having a chronic food deficit to one that has a food surplus.

Supporters of the new farm laws argue that these reforms are necessary to transform Indian agriculture. Like the economic liberalization of 1991, these reforms will supposedly open-up agricultural markets to private competition and investment and thus increase farmer incomes.

Two questions arise. First, why are farmers protesting the very reforms that would presumably increase their incomes? Second, is the geographical variation in the extent of the protests informative about underlying heterogeneity in the effects or scope of the new laws?

India’s agricultural markets are not well understood, and thus neither are the scope and reach of these laws. Several scholars, including one of us, have already written in depth about the laws, so we will not rehash those arguments here.

Instead, we will start by summarizing the new laws within the context of the history of agricultural market regulation in India. Subsequently, we will draw a relationship between the laws, India’s agricultural history, and the geographic concentration of the protests.

Agricultural Marketing Regulation in India: A Brief History

The genesis of the current system of agricultural markets can be traced back to the report of the Royal Commission on Agriculture (1928) in colonial-era India. At its heart was the principle that a network of well-regulated local, physical markets is the best way to discipline the first transaction between farmers and buyers of agricultural produce. The commission’s thinking was a direct transplantation of the ideas to bring order to the unruly wheat and meat markets of early 20th century Britain.

The goal of market integration was to protect farmers from the exploitative practices of traders such as collusive price setting, adulteration, fraudulent weighing and quality assessment, delayed payments, and more. In order
to address these malpractices, regulated markets were supposed to hold open auctions, disseminate information, use standardized weights, and take punitive actions against dishonest traders.

In independent India, each state adopted versions of the committee’s recommendations to design its own Agriculture Produce and Marketing Committee (APMC) act to regulate the marketing of agricultural produce, particularly the first transaction. Central to implementing the regulations was the creation of local, physical market sites (known as mandi), intended to function as primary spot markets enabling competitive price discovery.

Elected committees, with representatives from farmers and traders, were tasked with dispute resolution and ensuring fair trade practices. The states invested, to varying degrees, in constructing marketing infrastructure and regulating trade. Starting from 286 regulated markets in 1950, there are now about 6,746 regulated market sites operating nationwide under different state APMC acts.

However, there is much regional variation within this aggregate story. First, many states like Kerala and Manipur never legislated an APMC act. Second, in other states, depending on commodity and region, many market sites continue to be unregulated. Third, many market sites exist only on paper, with no sign of a functioning market.

Finally, while in many states (e.g., Punjab, Haryana, Karnataka, Madhya Pradesh, and Uttar Pradesh) APMC markets are the dominant sites of exchange, this is not the case in many others (e.g., Bihar and Odisha) where physical APMC markets largely never developed. In these regions, the first transaction is farm-gate sale to itinerant traders (see Figure 1). Even in states with well-established APMC markets, small farmers commonly sell at the farm gate to traders who then sell in regulated markets.

**Post-Independence Reforms**

While the establishment of market sites and regulations initially improved price discovery, challenges remained. The old APMC acts restricted sales to licensed traders operating inside the regulated markets. Obtaining new licenses was a bureaucratic nightmare. Incumbent traders formed cartels and more generally exerted market power.

The states enacted several reforms in response to these challenges, including creating alternative marketing channels (outside of the regulated markets) and enabling direct purchases from farmers. By the summer of 2020, most farmers had legal access to multiple buyers inside and outside of regulated markets because the states either 1) never enacted APMC acts; 2) they had repealed these acts completely; or 3) they reformed existing acts.

However, there was a widespread view that the reforms were incomplete and slow. Many reforms remained on paper and lacked implementation on the ground. For instance, states were slow and corrupt in awarding licenses for direct procurement, and new licenses for trading across markets had higher fees. Moreover, many states were not investing enough in agricultural marketing. In this context, the central government took the view that agricultural marketing needed to be further deregulated to facilitate the entry of private corporations, as this would increase farmer incomes because of increased competition and investment.

**The 2020 Farm Laws**

In the summer of 2020, the central government introduced three pieces of legislation that were formalized as laws in September 2020. The first law allows trade to occur in any place outside APMC regulated markets and free movement of goods across state lines. Importantly, states are prohibited from regulating and taxing transactions outside of the APMC markets. The second law is a contract farming law that provides a legal framework for farmers to enter into pre-arranged contracts with buyers.

Under both laws, dispute resolution is to be handled by a government-appointed bureaucrat, and the laws specifically prohibit farmers from going to court. The third law removes all legal stocking limits on food.

**Farmer Protests**

At a broad level, farmers and farmer organizations have expressed concerns about a potential loss of the existing systems of livelihood and trade. Their
concerns are rooted in their experience of successive governments reneging on earlier promises. For instance, every year the government announces a minimum floor price for 23 crops, though in reality, an overwhelming majority of farmers do not obtain it because the government does not establish procurement infrastructure in most regions and for most crops.

Farmers also worry that regulated market sites will become defunct because private actors would prefer to buy outside of these markets (where they are not subject to any taxes or regulation). Farmers would thus lose the public goods provided by the regulated markets, such as dispute resolution, use of proper weights, and timely payments. In that scenario, both small intermediaries and corporations would exert even greater market power. That being said, there is a great deal of regional heterogeneity both in the intensity of, and the reasons behind, the protests.

Why Are the Protests Geographically Concentrated in Punjab and Haryana?

The reasons why farmers from Punjab and Haryana are the most vocal are rooted in the extant agricultural systems and their evolution since the “Green Revolution” of the 1960s.

Two aspects are worth highlighting. First, the Green Revolution greatly increased the demand for credit to cover input costs (fertilizers, pesticides, and mechanization). While access to institutional credit has increased since then, nearly all farmers still rely on informal credit. Commission agents (locally known as arhatiyas) are the single largest source of informal credit for farmers in these states. While under the APMC Act, the commission agents are licensed intermediaries who facilitate the sale of farmers’ produce; it is their informal lending activity that makes them crucial. They are also dependable sources of finance during emergencies, and for social expenditures (for which it is impossible to obtain formal credit). Often farmers borrow from them to repay formal loans with rigid repayment schedules.

The second aspect is related to public procurement. To incentivize the adoption of Green Revolution technology, the government instituted a policy of procurement at a floor price (the minimum support price or the MSP) to reduce price risk. The key lies in the mechanism of procurement. In these states, government agencies procure paddy (rice still in the hull) and wheat at the regulated markets through the commission agents. The government then pays these agents the MSP plus a percentage commission, and they, in turn, pay the farmers. Farmers are thus solely dependent on these agents for selling and receiving payments.

Given the incentive structure, agents ensure that all farmers—including sharecroppers—can access the procurement apparatus. Consequently, public procurement of paddy and wheat in these two states is nearly universal, and farmers receive the MSP.

For nearly half a century, this is the only system these farmers have seen and trusted. All these years, farmers have followed a monocropping cycle of growing paddy and wheat and this has had disastrous consequences on the agroecology, especially groundwater levels. Yet, in the short-run, it is rational for individual farmers to continue business-as-usual. The current system guarantees a fixed price, reliable credit, and timely payments through the commission agents.

This is not the case in the rest of the country, where procurement is limited, is conducted outside of regulated markets, (without commission agents), and payment is made directly to the farmers, often with delays. Importantly, farmers are aware that in much of the rest of the country—with less developed markets and limited procurement—farmers face substantially more uncertainty and worse conditions.

The new laws threaten the existence of these regulated markets if (as is likely) state procurement agencies, in order to reduce procurement costs, prefer to trade outside these markets. Farmers have concluded that this will eventually lead to the closure of the regulated markets and the disappearance of the commission agents. Once that happens, they fear they will lose the protection of guaranteed public procurement and access to credit. Even if the state continues to procure outside the markets, they may become more selective—rejecting poor quality produce or undocumented farmers—as is the case in other states.

Hence, farmers in Punjab and Haryana have much to lose. The MSP is 30–40% higher in Punjab and Haryana than the market price in other states like Bihar that have negligible procurement. The lack of clear alternatives and years of mistrust has led to understandable anxiety among farmers, explaining why we see them protesting with such force.

Rest of India

There has been opposition to, and protests against, the reform laws in most parts of the country. Primarily, farmers view the laws as providing large corporations unregulated access to agricultural markets and severely reducing their bargaining power. Large corporations are viewed with considerable skepticism as they have contributed to reducing farmers’ incomes in several countries, including the United States.

Furthermore, there have been well-publicized instances in India where private firms reneged on contracts. The fact that the laws explicitly restrict farmers from approaching the courts has considerably increased farmers’ anxieties. Yet, these protests are limited (when compared to those by the farmers of Punjab and Haryana) for a number of reasons.

First, unlike Punjab and Haryana, where almost every farmer cultivates...
to sell, many farmers in the rest of the country are subsistence farmers. Estimates suggest that out of approximately 150 million cultivators nationwide, only about one-third obtain a major source of their income through agriculture. This is worse in the eastern states, where few farmers have any marketable surplus. Second, in the many states without regulated markets like Bihar and Odisha, the new laws bring little change and, unsurprisingly, do not evoke much of a reaction.

The third reason for the limited protests outside Punjab and Haryana is the differences across states in public procurement. Farmers in Punjab and Haryana have been the longest beneficiaries of the procurement program. In recent years, the scope of procurement has increased in other states, yet many farmers remain untouched. Procurement has mainly been limited to paddy and wheat, with some procurement of cotton and pulses in a few states. In Odisha, where about 60% of paddy produced is procured, operational problems such as delayed procurement or a preference for large farmers, exclude a majority of farmers. In the rice-producing states of Bihar, West Bengal, and Assam, less than 10% of the production is procured. In Maharashtra, a key cotton-producing state, less than 30% of the cotton is procured at MSP. In other states like Madhya Pradesh, regulated markets are not the site of procurement.

Fourth, in other parts of the country farmers rely much less on intermediaries for credit (Figure 2). In Bihar and Odisha, for example, the main source of credit is cooperative agencies.

In summary, the new laws do not immediately impact the largest group of farmers, for whom the regulated market is either not a site for public procurement or sales. Those who have realized the benefits of regulated markets are acutely aware of the potential losses they face. However, no group has benefited as much as the farmers from Punjab and Haryana, due to assured procurement. Thus, despite the fears of a corporate takeover, protests in other parts of the country are relatively muted but not absent. A sizable number of farmers have also used the opportunity to voice their demand for a legally guaranteed MSP for all crops in all regions by incorporating this into the new farm laws.

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How Has Residential Per Capita Water Consumption in California Changed Between 1994–2019?

Juhee Lee, Mehdi Nemati, and Ariel Dinar

Residential water consumption (gallons per capita per day) in California fell dramatically in the past three decades. These reductions are the result of various water-conservation policies and other efforts by state and local water managers. In this article, we describe California’s major droughts and conservation policies between 1976 and 2020. We then estimate the reductions in residential water consumption from 1994 to 2019 and show how they vary by time, location, and water agency characteristics.

Conservation efforts and policies have substantially reduced residential water use in California.

Photo Credit: Jaycek Dylag

California has one of the most proactive urban water management systems of the many states and countries facing water scarcity. The need for urban water management has increased in California mainly because of two conditions: 1) The state’s urban population has steadily increased over time, and 2) California is affected by severe and long-lasting droughts. These situations have emphasized the need for water conservation in California’s urban landscape.

The state continues to invest in and encourage conservation by introducing new technologies and various policy interventions to reduce water use. To combat the chronic threat of drought, the state enacted a series of regulations during the past three decades. However, little evidence exists that documents how residential water use and its distribution has changed over time due to these efforts.

This article examines: 1) how California’s urban water systems (agencies) are structured and how residential water use has changed over time; 2) how California’s existing water-conservation policies have reduced residential water use over the recent decades; and 3) how conservation practices have differed among the various agencies and regions.

We collected a comprehensive dataset from different sources, including monthly residential water use (measured as residential gallons per capita per day, or R-GPCD) from 1994 to 2019, water agencies’ boundaries and characteristics, weather information, and demographic data. We then conducted an in-depth analysis to improve our understanding of regional differences in conservation results, consumer characteristics and behaviors, and policy effects.

Public Water Systems

While California has more than 7,500 water agencies, nearly 50% of these agencies serve fewer than 100 customers, and about 80% serve fewer than 500. Agencies serving more than 3,300 customers constitute roughly 9% of all agencies. The majority (86%) rely on groundwater, while 14% have surface water as their primary water source. Approximately 33% of the agencies primarily serve residential areas, followed by recreation areas (18%), and industrial/ agricultural areas (10%). The rest serve mobile home parks, restaurants, schools, hotels, institutions, highway rest areas, and medical facilities.

Most of California’s small and medium-sized water agencies are privately owned. The majority of the larger agencies are public (owned by local governments). Figure 1 (on page 6) shows the distribution and number of water agencies in California by county. Water agencies in California are not distributed evenly across counties. Counties with a high population or high agricultural intensity tend to have more water agencies.

From the 7,500 water agencies, we obtained data on 409 urban water agencies throughout California to analyze water-use changes over time. Each of these 409 agencies serve more than 3,000 customers, or annually deliver over 3,000 acre-feet of water, making them subject to regulations by the State Water Resources Control Board (SWRCB). These agencies are required to report monthly water use to the Department of Water Resources (DWR) and recently also to the SWRCB. These 409 agencies serve 97% of California’s population, and local governments own the majority (81%). We observed that 69% of these agencies mainly use surface water (which is less reliable) as a primary water source. Among the
agencies that use surface water, only 25% own their water source. The rest rely on purchased surface water. Most of the agencies that purchase surface water are solely retailers; only 14 (3.4%) are also water wholesalers.

Figure 2 illustrates the average R-GPCD by hydrologic region from 1994 to 2019. Our analysis is based on average monthly R-GPCD. From 1994 to 2019, R-GPCD follows a downward trend across all of the regions. The dashed line in Figure 2 indicates the average across all the regions in California. The minimum, average, and maximum R-GPCD in California in 1994 was 106, 147, and 232, respectively. These numbers decreased in 2019 to 73, 101, and 129, respectively. These findings verify that regional variation in R-GPCD fell between 1994 and 2019 (regions have become more similar over time in terms of their water consumption). This figure also indicates the regional differences in per capita residential water use. For example, although R-GPCD decreased over time, the Colorado River region has one of the highest R-GPCD levels compared to the others. These differences between the regions could be due to multiple factors such as climate conditions (e.g., the Colorado River Region has higher temperatures and less precipitation than other regions), population density and house size, regional and agency-level regulations, and water management strategies, among other things.

Urban Water Conservation Policies

California’s population grew due to rapid urbanization in the early 20th century. Frequent and long-lasting droughts led to significant water scarcity levels and challenges for water resource management. From 1976 through 2019, California experienced drought periods that significantly influenced the state’s water conservation policies during the past half-century (Figure 3).

The first drought period (1976–1977) triggered the Urban Water Management Planning (UWMP) Act, passed in 1983. This act imposed mandates on state agencies requiring every urban water supplier with more than 3,000 customers, or annually delivering over 3,000 acre-feet of water, to provide water management planning at least once every five years.

The second drought period (1987–1992), which resulted in significant water scarcity, expanded the existing urban water management measures. Correspondingly, the UWMP Act of 1983 was amended in 1991 to allow more comprehensive and preventive measures against short- and long-term droughts. These efforts led to initiatives to reduce short- and long-term urban water use through the 1993 Memorandum of Understanding Regarding Urban Water Conservation.

The third major drought (2007–2009) induced the Water Conservation Act in 2009 to ensure sufficient water supply. This act mandated that all water suppliers increase their water-use efficiency, targeting a 20% reduction in R-GPCD consumption by 2020 (called 20×2020).

The fourth drought (2012–2016) was the second prolonged drought period, following the previous one in 1987–1992. The continued water scarcity led to the governor’s proclamation of an emergency decree in 2014 that ordered state agencies to take more aggressive water-saving actions. The order called on urban water suppliers to immediately implement their water shortage contingency plans, including the state
drinking water programs, to identify communities in danger of running out of water by extending water loss reporting requirements in 2015 to urban wholesale water suppliers.

This four-year, prolonged drought, triggered changes in public perception and increased water policy interventions with the enactment of the Water Conservation and Drought Planning legislation in 2018. This legislation required the state to have ongoing efforts to make water conservation a way of life in California through four goals: 1) use water more wisely; 2) eliminate water waste; 3) strengthen local drought resilience; and 4) improve agricultural water-use efficiency and drought planning. In addition, water suppliers must enact provisions for efficient water use by 2022.

**Methods and Results**

Based on our sample of 409 water agencies, we examined the changes in R-GPCD from 1994 to 2019 using statistical models where we controlled for variation in weather (precipitation and temperature) and demographics (average income and household size), along with agency-specific and calendar month-specific effects. Note that estimated effects in this article provide descriptive differences and should not be interpreted as causal effects of specific programs.

Figure 4 (on page 8) shows our statistical model results. Each point is the estimated change in R-GPCD, compared to the 1994 levels. As shown in the figure, considerable reductions in R-GPCD are realized after the 2007–2009 drought, and, later, after the 2012–2016 drought. Notably, between 1994 and 2019, residential R-GPCD decreased by 34% (47 R-GPCD). We also found that Southern and Northern California agencies reduced their R-GPCD by 39% (58 R-GPCD) and 19% (23 R-GPCD), respectively, in 2019 compared with 1994 levels.


Our results show that water consumption decreased by 3.2% during 2007–2009, compared to the base period 1994–2000. After that drought, water consumption was further reduced during the 2010–2011 period that
followed (up to 22.6%), mainly due to the state and local agencies' conservation policies and efforts. An extended drought occurred in Period 6 (2012–2016), leading to a 28.5% decrease in water consumption relative to the base period. For the last period, 2017–2019, water use fell by 34.8%, compared to 1994–2000. Overall, the effects are cumulative as we move from the first to the last period (i.e., 0.6% in the second period to 34.8% in the last period), indicating the continuous collective conservation efforts since 2001.

Finally, we estimated the residential water-use trends by periods, considering heterogeneity based on agency and regional characteristics. Relative to the base period, we observed a more substantial reduction in R-GPCD by local, government-owned agencies than by those owned by the private sector. In addition, we found that agencies relying primarily on surface water have a significantly higher rate of reduction than those relying primarily on groundwater. Our findings also indicated that those who rely on purchased water reduced usage by higher rates than those relying on local sources, especially in the last ten years. Reduction rates in the 2017–2019 period, compared with 1994–2000 levels, are 34.9% (48 R-GPCD) and 24.6% (36 R-GPCD), respectively, for agencies relying on purchased water versus those relying on local sources.

Regarding climatic characteristics, we found that the percent reduction in R-GPCD in summer months is similar to that in non-summer months. However, given that these are in percentage terms, the absolute values imply that the water conservation in summer is greater, since water use is relatively high due to outdoor activities, allowing greater opportunities to reduce use.

Lastly, we also found regional variation in water-use reductions. Specifically, during the 2017–2019 period, agencies in Southern California reduced usage by 33.9% (52 R-GPCD), and those in Northern California reduced usage by 20.3% (26 R-GPCD), compared with 1994–2000 levels. We also found evidence that agencies in Northern California started conservation in earlier periods (starting around 2003) than those in Southern California (starting around 2010).

**Conclusions**

We found that California’s water use was reduced incrementally after major droughts, potentially due to state and local conservation policies, which resulted in improvements in urban water-use efficiency. We also found that these reductions vary based on the year, season, region, and agency characteristics. These findings have important implications for local and statewide water managers and policymakers to consider future conservation planning, legislation, policies, and investment strategies.

**Suggested Citation:**


**Authors' Bios**

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COVID-19 Transmission in Meatpacking Plants in the United States

Tina L. Saitone, K. Aleks Schaefer, and Daniel P. Scheitrum

The meatpacking industry has been at the center of employee-related COVID infection concerns. However, there is limited information on the scope of the issue. We investigate the extent to which the presence of a large meatpacking (i.e., beef, pork, and broiler chicken) plant has affected county-level COVID-19 transmission dynamics. We find that meatpacking operations significantly increased transmission of COVID, resulting in 334,000 cases and 18,000 deaths from January through October 2020.

A variety of environmental and infrastructure-related factors likely contribute to increased transmission rates observed within meatpacking plants including: 1) low temperature and low humidity conditions coupled with metallic surfaces where the virus can persist; 2) substantial water use that facilitates the transport of pathogens across surfaces; and 3) constantly re-circulated air that promotes viral transport. Work-related conditions and socio-political factors are also likely contributors to elevated levels of transmission within and outside meatpacking facilities. Shared work and break areas limit the ability to maintain adequate distance, and the pace and physically demanding nature of work make adherence to face coverage mandates challenging. Many meatpacking workers live in multi-generational housing and often share transportation to and from work, increasing transmission risks both inside and outside of the workplace. Undocumented immigrant workers, who comprise a significant portion of meat-processing workforces, are more likely to keep working despite illness, given their inability to access unemployment benefits and fear of job loss or deportation.

COVID-19 Transmission

More than half a million meatpacking workers are concentrated in large processing facilities throughout the United States: 39 beef packing facilities, 31 pork processing facilities, and 139 broiler chicken processing facilities (Figure 1). To determine if these facilities affected COVID-19 transmission dynamics, we utilize daily, county-level confirmed COVID cases. In order to compare per capita infection growth rates across counties, we harmonize disease transmission start dates (i.e., the date the first documented COVID infection that occurred in the county) to ensure we...
are considering counties at the same evolutionary stage.

When attempting to isolate the impact of large meatpacking facilities, it is necessary to control for those factors that are known or are suspected to influence county-level transmission rates. First, in all of the models we estimate, we control for policy and location-specific factors, including emergency declarations, stay-at-home orders, county business closure declarations, state, and climate. The county-specific factors suspected to influence COVID spread are numerous and can be categorized into five areas: 1) structural characteristics (e.g., metropolitan, nursing home or correctional facility in the county); 2) demographic characteristics (e.g., population density, average international migration rate, share of population that is foreign born); 3) economic characteristics (e.g., unemployment rate, median household income); 4) educational characteristics (e.g., share of adults with a high school degree, share with a college degree); and 5) health characteristics (e.g., share of population in poor health, share of smokers, share of obese).

Given the sheer number of control variables, we use an iterated regression approach to estimate a series of models for each type of plant (i.e., beef, pork, chicken). We sequentially select a specific control variable from each of the five categories and iterate variable selection until we estimate a model for every combination of controls across the five categories for each day since the first confirmed COVID case. This process results in 62,400 model specifications run each day for 150 days following the first confirmed case across 3,405 counties in the United States—a total of 9.36 million models. Estimating millions of models allows us to obtain robust estimates of meatpacking plant-related increases in COVID transmission, while the epidemiological literature has yet to determine the factors that have the largest influence on county-level spread.

**Meatpacking Plant Transmission Results**

Figure 2 summarizes the estimated impact that large beef, pork, and chicken processing plants have had on county-level COVID disease dynamics. The effect that the presence of a meatpacking plant has on transmission changes over time. For example, the day 1 estimates for beef, pork, and chicken plants did not have a detectable impact on county-level COVID case rates. County-level impacts of beef and pork processing facilities then increase up to day 60 before leveling off. By day 150, infection rates in beef- and pork-packing counties are 0.0107 and 0.0154 cases per capita respectively, which are statistically different from counties without meatpacking facilities. For context, at the same point in the outbreak (i.e., day 150), the median no-packing-plant county had an observed per capita case rate of 0.0097. This equates to approximately 650 additional infections in the median-population beef-packing county and an additional 563 cases in the median-population pork-packing county. Thus, the estimated beef- and pork-packing impacts equate to 110% and 160% increases, relative to the infection rate in counties without processing plants. Infection rates in counties with broiler chicken processing facilities had an increase in COVID cases per capita of 0.0019 at the 150-day mark. For the median-population chicken-processing county, this equates to an additional 103 cases, and represents a 20% increase in case rates relative to the median-population no-plant county.

**Mortality and Morbidity Costs**

Overall, our per capita estimates suggest that large meatpacking plants in the United States generated 333,670 COVID cases from January 22, 2020 to October 3, 2020. Of these cases, 33% were sourced from beef packing facilities, 60% from pork processing facilities, and 7% from broiler chicken processing facilities. We account for the economic consequences of increased infection rates in terms of losses in productivity (i.e., lost wages) and morbidity costs. For each infection attributable to a meatpacking plant, we account for lost wages from the
perspective of the infected individual, using the median wage rate ($14.05/hour) of employees in meatpacking plants reported by the Bureau of Labor Statistics and assuming that they were unable to work for three weeks.

When quantifying the mortality costs, we recognize that the medical system has improved COVID-treatment outcomes as the pandemic has evolved by using the contemporaneous 7-day-moving-average case fatality rate (CFR) in the United States. Mortality associated with meatpacking operations is estimated by multiplying cases caused by meatpacking facilities and the CFR. The economic costs of mortality are then calculated by multiplying the wage rate by an 8-hour work day, a 5-day work week, 52 weeks worked a year, and a 20-year work life remaining. Table 1 summarizes the cases, deaths, and the costs associated with forgone wages and mortality.

Our estimates suggest that nearly 334,000 cases and nearly 18,000 deaths were associated with large meatpacking plants in the United States. Taken together, the mortality and morbidity costs total almost $11.2 billion. These cost estimates are likely to dramatically understate the true economic losses and can be considered a lower-bound estimate. For infected people who do not die, we do not account for the potential long-term costs associated with COVID-19-related illnesses, including chronic health issues and quality-of-life reductions. Further, we do not account for the costs associated with medical treatment or the investments made by processors to augment the work environment in an attempt to safeguard worker health.

### Table 1. Economic Costs of Morbidity and Mortality

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<th>Deaths 1,000</th>
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<td>199.5</td>
<td>10.6</td>
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<tr>
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**Discussion**

The increased COVID-19 transmission rates—coupled with longstanding concerns over the horizontally concentrated and vertically integrated structure of the industry—have prompted critics to question the fundamental resiliency of the industrial meatpacking system. Many of those who are critical of this system have advocated for a smaller and more geographically dispersed industry, suggesting that this would make the meatpacking industry less susceptible to shutdowns and massive disruptions like those experienced during the early parts of the pandemic in 2020. While the infection rates and COVID-19 mortality costs associated with the meatpacking industry are substantial, those critical of the industry’s structure must recognize that sacrificing the scale, concentration, and efficiency of the industry we know today, in the name of disease-transmission resiliency, would come at a significant cost.

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