MERCATUS SPECIAL STUDY

PANDEMIC PROBLEM SOLVERS
PRIVATE MARKETS AND THE PUBLIC SECTOR

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ABSTRACT

Although the COVID-19 pandemic was a seismic shock to economic activity in the United States, individuals, businesses, and governments responded with creative energy and innovation. This paper explains the core economic challenges of the pandemic and connects them to the successes and failures of private-market and public-sector responses for three pandemic goals: (1) Reduce the spread of infection while maintaining economic activity. (2) Help those facing economic pain due to unemployment and demand shifts. (3) Monitor ongoing infection through testing. We illuminate the myriad of helpful responses from both businesses and governments and evaluate which actions were most effective in solving these core economic problems. What we learn can inform more resilient future responses and provide a counterbalance of optimism to the turbulence of pandemic disruption.

JEL codes: A1, H1, H12, H3, L1, 03

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INTRODUCTION

The COVID-19 pandemic was a seismic shock to daily activity in the United States, leaving a trail of economic destruction in its wake. However, individuals, businesses, and governments responded with creative energy and innovation. We can learn from these responses to become more resilient as COVID variants continue to cycle through the economy. The ensuing global disruption demonstrates that we should prepare for a range of events, from food-security problems and environmental disasters to threats to national security. This paper explains the economics underpinning the pandemic's challenges and discusses measures with the greatest impact from both private markets and the public sector.

In this paper, we discuss the core economic problems underlying three pressing challenges of the COVID-19 pandemic. We examine the actions taken, the effectiveness of these approaches, and the advantages and disadvantages of each sector's tool kit. We lay out tools to aid economic recovery, analyze how innovation thrives, and then identify the conditions that let innovation roll! Through understanding the economics of the crisis, we can use these lessons to lay the foundation for future responses—responses that balance value to the public with findings of epidemiological effectiveness.

The goal of this paper is to illuminate both private and public pathways to achieve social goals. During a crisis, calls for solutions are often directed solely toward the public sector. However, this neglects the main drivers of the economic engine: private markets. In fact, private markets are constantly engaged in problem-solving. You're hungry? Enter private markets and a food truck. You're bored and want something to do on Friday night? Enter private markets and streaming services, live theater, or maybe this fine paper for debate at your local bar. Do you want to grow your tech start-up and need cloud servers, storage, networking, remote computing, email, mobile development, and security in more than 240 countries? Enter private markets and Amazon Web Services. Private markets exist to solve our mundane and extraordinary daily problems, and the pandemic's new challenges are no different.

In this paper, we evaluate the strengths and weaknesses of public-sector and private-market problem-solving tools in three areas. These areas were important during the pandemic but have parallels to general problem-solving needs in other crises. The goals are as follows:

Goal 1: Reduce the spread of infection while maintaining economic activity
Goal 2: Help those facing economic pain due to unemployment and demand shifts
Goal 3: Monitor ongoing infection through testing

As we work through these goals, we will identify the core economic problem in each of these settings. The core economic problem is our guiding light. The solutions that most directly and effectively address the core economic problem will truly improve economic outcomes in the long term. Within our evaluation framework, we will compare private-market and public-sector solutions in four areas of success: timeliness (speed of implementation), effectiveness (addressing the core economic problem), flexibility (ability to adjust to diverse needs), and scale (the number of individuals impacted and complying).

In this paper, we seek to shed light on the myriad of helpful responses to the pandemic that arose quickly and organically in the face of uncertainty and tragedy. Armed with an understanding of which actions and solutions were most effective, we can use these lessons as a counterbalance, providing optimism in the turbulence of pandemic disruption. Let's get started!

GOAL 1. REDUCE THE SPREAD OF INFECTION WHILE MAINTAINING ECONOMIC ACTIVITY

Core Economic Problem

Reducing the spread of the novel coronavirus strain was of particular concern because it was unusually virulent, spread asymptomatically, and had high mortality rates. For all individuals, daily interaction during the early days of the pandemic came with increased risk of infection. However, this in itself is not the policy-relevant core economic problem. To understand why, consider the following example:

> Imagine that a young gourmand goes out for a restaurant meal. She benefits from an enjoyable experience and a full belly, and the restaurant owner benefits by being able to pay his rent. Now also imagine there is a global pandemic with asymptomatic spread. If the gourmand happens to live with her grandma or works in a busy office the next day, she may unknow-

ingly transmit the virus to these third parties. Grandma and the coworkers didn't taste the delicious meal or receive payment for it; they didn't share in the benefits of the transaction, but they did share in the costs.

This additional social cost affecting those beyond the two involved in the economic transaction is called an *externality*.

Note that the crux of the problem is not the transaction itself. The young gourmand must confront the pandemic by weighing her own health-status risk against her stomach's immediate needs. The restaurant owner may choose to close if the infection risk is higher than his economic benefit. The core economic problem is the extra effect on Grandma and work colleagues if the gourmand does not take their additional risk into account. An effective solution to this core economic problem will focus on reducing or eliminating this extra social cost of daily activity while allowing beneficial transactions to still take place.[1]

To slow infection, most jurisdictions and public-health officials sought to restrict movement through stay-at-home orders. However, as we have just outlined, there were compelling individual reasons to continue participating in daily activities—for example, to learn, recreate, and earn a paycheck. We now examine stay-at-home orders as well as solutions that address the relevant social costs while maintaining the beneficial aspects of individual activity as much as possible.

Private-Market Responses

In private markets, we witnessed efforts to mitigate this additional social cost in three distinct settings—within an organization (internally), outside an organization (external relations), and between members of society—with a fourth option of erasing cost entirely through innovation.

For large organizations, the externality problem is not a formless external social cost but quickly becomes an internal problem for their bottom line. The larger the group of employees and the more interactions they have, the more this extra infection risk compounds within the workplace itself. Contagion in the workplace leads to lost productivity, which, when compounded with weeks of quarantine, leads to significant economic loss.

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1. Ponder the phrase, "if the gourmand does not take their additional risk into account." In fact, if the gourmand loves her grandma or cares about her coworkers, it is quite reasonable to think she will indeed take this into account. However, because including externality costs in a decision may be harder the more distant the relationship, in our ensuing discussion, we will consider this extra social cost as missing from an individual's decision for an ordinary transaction. We would submit that this might be an underestimate of how a thoughtful society truly operates. We do hope readers can cite thoughtful examples from their own experience.

Because both the benefits and the costs of activity are contained within one organizational decision structure, the employer gains by taking action to mitigate the effects of infection. In response to COVID-19, large employers were among the first to impose work-from-home policies and in-person mask mandates. The speed of implementation was high because every day of delay meant lost profits and unproductive workers. Facebook, Google, Twitter, and Amazon all implemented remote working policies for many or all their employees by March 12, 2020—more than a week before any state stay-at-home orders. Universities also moved quickly to remote activity. Universities are large organizations, where many individuals reside in congregate living and come together daily in enclosed spaces. During the first few weeks of the pandemic, universities with COVID-exposed students, such as Hofstra, Yeshiva, and Columbia, switched to remote classes, as did universities in areas with high rates of transmission, such as UC Berkeley and the University of Washington. The final category of academic first-movers were elite institutions, such as Ivy League schools.

This last category illustrates how large organizations influence industry standards. Big Tech and elite academic institutions are often decision-making standard-bearers for smaller institutions in those sectors. The reach or scale of these standards depends on the pull of these trendsetters, as smaller firms in the industry may not have the same incentives in their operations.

Many large firms came out with improved employee sick-leave policies to prevent infected individuals from coming to work. Walmart announced a two-week paid sick leave during quarantine, as did Apple and Instacart and restaurant chains such as Olive Garden, LongHorn Steakhouse, and McDonald's, among others.[2]

The core economic problem in play becomes an internal problem for large organizations, so the resulting solutions can be flexible and economically efficient. Organization-level policies are flexible because the business can weigh the benefits of in-person activity with internal spillover of infection risk and prescribe policy accordingly. For example, an office worker may be sent home with her computer, but the plant maintenance staff can remain in person and masked.

The next private-market approach deals with protecting employees from the cost imposed on them via consumers and other external agents. Workplaces with high levels of customer interaction face extra infection risk imposed on them—by the gourmand, for example—and thus also have to confront increased productivity losses from illness and employee quarantines.

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2. Justine Coleman, "Major Companies Updating Sick Leave Policies in Response to Coronavirus," *The Hill*, March 11, 2020.

Businesses responded to the externally imposed risk of infection with policies such as online and curbside transactions, in-store limits, social distancing, and in-store mask mandates. Limiting the number of people in a business and enforcing mask mandates mitigated the infection risk to employees, which reduced lost productivity and profits. This also directly addressed the core economic problem at a social level by reducing the risk of those customers bringing the virus to their next destination.

One caveat to this approach arises from the customer response to these policies. Individual businesses may face new costs if customers dislike this additional inconvenience. If this is the case, imposing masking hurts the business by deterring customers, while not imposing masking increases infection risk for the business's employees. Social distancing or in-store limits make visiting a business less pleasant and increase waiting times. This may be an area in which government policy can improve outcomes, as we discuss later.

The strategies previously outlined are firm actions on a business's own employees and corresponding policies. However, forces are also at work to address this problem between firms and other social organizations. Another driving force in the marketplace is social pressure. Many media outlets spread the message of mask wearing and social distancing to reduce the spread of the virus. Healthcare workers and first responders were praised, and major corporations and celebrities promoted preventive actions. All these actions created strong social norms for health and safety of workers and customers.

How does a social norm translate into changes in business behavior? In nonpandemic times, consumers routinely seek out or pay a premium for "socially responsible" products. We see this in "green" products that use environmentally friendly materials and manufacturing processes, or in products that advertise charitable contributions with each purchase. In lab experiments offering consumers socially responsible coffee choices, researchers have found that some customers are willing to pay a price premium of between 19.2 and 52.5 percent over standard coffee.[3] In studies of online auction sites of goods with a 10 percent charitable contribution, researchers found price premiums of 5 percent compared with other goods.[4] Products and businesses that demonstrate actions to keep employees and customers safe from infection can reap the social rewards

3. Leslie J. Verteramo Chiu, Jura Liaukonyte, Miguel I. Gómez, and Harry M. Kaiser, "Socially Responsible Products: What Motivates Consumers to Pay a Premium?" *Applied Economics* 49, no. 19 (2017): 1833–46.

4. Daniel W. Elfenbein and Brian McManus, "A Greater Price for a Greater Good? Evidence That Consumers Pay More for Charity-Linked Products," *American Economic Journal: Economic Policy* 2, no. 2 (2010): 28–60.

through improved reputation and the ability to charge a premium price. In addition, if workers value a safe workplace, enacting safe policies helps to retain high-quality workers.

Social pressure also cut the other way during the pandemic when social shaming, or the desire to avoid social shaming, motivated businesses to curtail or cancel their activities. Concert promoters and sports leagues canceled large (profitable) events to avoid bad press. Good health and safety protocols made it less likely that a business would make the front page of the local paper as the cause of an outbreak. Social pressure and the desire to avoid negative press brought the social costs of additional infection risk directly into the business-decision framework.

Finally, an inspiring private-market response to the problem of extra societal-level costs was to innovate these costs away. The power of the entrepreneur and the internet created innovations to replace many interactions that used to occur in person. In a short period of time, numerous online platforms such as Zoom, Google Meet, and Microsoft Teams emerged to address this social problem. Instead of shifting the infection costs of in-person interaction between the firm and employees or the firm and customers through masking or reduced operations, these platforms offered a way to continue daily operations while eliminating infection risk. Although some of these products existed before the pandemic, their popularity (and functionality) exploded when they stepped in as a day-to-day substitute (of sorts) for many activities previously conducted in person. These platforms expanded into broader use for social events, such as church meetings, holiday gatherings, and weddings.

Retail and manufacturing sectors have not been left out of the burst of innovation. Elevated infection risk from in-person work and labor shortages presented new challenges for manufacturing facilities to source, produce, and distribute their products. As a result, investment in supply-chain innovations exceeded $24 billion in 2021, more than 60 percent higher than the year before. Examples include Attabotics, a robotic inventory-retrieval system. Attabotics imitates an ant colony by moving both horizontally and vertically to retrieve bins of consumer goods for order fulfillment. This automated technology enables one person to accomplish what four or five would have done previously.[5] Besides a surge in manufacturing automation using robotics and remote-operated forklifts, retailers are restructuring fulfillment to focus on e-commerce using more numerous, but smaller, warehouses or even modifying traditional retail stores

5. Christopher Mims, "The Technology That's Helping Companies Thrive amid the Supply-Chain Chaos," *Wall Street Journal*, February 12, 2022.

as mini–fulfillment centers. This makes inventory monitoring more nimble and gets orders out to customers more quickly. Companies such as Shopify, Radial, and ShipBob emerged as leaders in helping both large and small operations develop their e-commerce operations.

Public-Sector Responses

The public sector's approaches to reducing the spread of infection were threefold: stopping the movement of individuals, implementing mask mandates, and distributing information. We will examine these approaches, weighing the social costs of an externality against other costs of curtailing beneficial interactions.

From mid-March to early April 2020, 40 states and the District of Columbia implemented stay-at-home orders to slow the spread of COVID-19. These executive orders were generally imposed quickly and became effective within a matter of days. They applied to most individuals and introduced complexity by loosening restrictions in certain areas for industries and individuals categorized as "essential." The economic efficiency of these orders depended on the process of classifying and enforcing "essential businesses." The classifications had large variance at the state and local levels and were heavily determined by political forces—that is, connections and industry influence were significant determinants of exceptions to shutdown orders. Additionally, as discussed previously, the balance of costs and benefits was not uniform for all types of workers in an industry. This meant scale and effectiveness varied locally because "essentialness" was not determined by a cost/benefit calculation in response to the core economic problem of additional external social cost.

The largest impact of these orders was in their scale—they were applied immediately to large swaths of the population. Thus, these orders wiped out much of the social cost discussed previously. Individual movement dropped precipitously; the gourmand wasn't bringing home the virus to Grandma because the restaurant was not open for business. However, this simple example also illustrates the decimation of benefits resulting from a stay-at-home order. Perhaps the gourmand could replicate some of her benefits at home through home cooking or grocery purchases. (Grocery services were usually classified as essential.) On the other hand, the restaurant owner and employees would have a tougher time recouping their benefit (i.e., revenue) without customers. We will discuss later some private-market strategies in the face of reduced demand, but the first impact to note here is that universally implemented stay-at-home orders overshoot the cost of the externality by eliminating many of the benefits from daily economic activity.

Decentralized public decision-making helped reduce the inefficiencies of this broad-stroke tool by allowing local knowledge to inform policy. States such as Wyoming, Nebraska, and Utah, with lower population density and thus less virulent spread of infection, never implemented an official statewide stay-at-home order. The costs of shutting down economic activity are large, so this type of economic policy should only be implemented if the accompanying benefits will also be large. Keeping people at home in a population-dense area such as New York City, where people live close together and take public transportation, can significantly slow infection rates. This is not the case in areas where the population is spread out, lives in stand-alone buildings, and uses personal vehicles for travel. Policies will be more efficient if they can be varied for different settings. During COVID, this was sometimes achieved through local ordinances; cities typically would enact more stringent social-distancing policies than suburbs or rural areas did. For example, although Wyoming never issued a statewide stay-at-home order, the popular tourist destination of Jackson Hole did early on. This decentralization of decision-making to local powers allowed the policy costs to better match the benefits.

A public-sector approach to slowing infection with less drastic economic pain was mask mandates. These mandates could apply to indoor spaces where there was an increased chance of infection—that is, places where one expects the external social cost to be high. As discussed in the private-market responses, businesses can request mask wearing, but a public-sector mandate may be an ally in encouraging compliance. If masks are unpopular among consumers, then businesses face the dilemma of either imposing them anyway (potentially losing customers) or not imposing them (hurting their employees and potentially losing productivity and profits). Either way, mask wearing likely takes a hit, accompanied by a higher level of external social cost. This problem can be magnified if the individual business faces intense competition, particularly if competing businesses do not require masks. However, if mask mandates are a universally imposed public-sector policy, this mitigates the competitive problem because all consumer options would require masking, thus masking in any individual business would be easier to enforce.

Mask mandates have a few advantages. The costs are much lower—businesses can still be allowed to operate within these constraints, and the practical implementation of mask wearing can be inexpensive. A good number of consumers and businesses can reengage in benefit-generating transactions with a small hit of inconvenience. Recall that the goal of these policies should be to address the core economic problem of the third-party infection risk. The business owner and the customer already assess their own risk when they choose to interact or not.

The smaller cost of mask mandates is a better match for the smaller cost of third-party infection.

The public-sector policy of highest impact focuses on information. The Centers for Disease Control and Prevention (CDC) have a long-standing role in public-health crises in the United States and provide centralized information on the nature of the virus and effective mitigation methods. In fact, research on changes in individual movement at the start of the pandemic has shown that shutdown orders accounted for only a modest amount of the decrease in activity. Much of the impetus to stay at home resulted from individual actions based on current information on the virus and infection rates. Using mobility data from cell-phone locations, researchers across many studies found dramatic drops in individual travel from home during the second week of March 2020, well ahead of any official state or local shutdown orders. Information, such as the first COVID case in an area, was a larger driver of individual movement than the legal stay-at-home orders. Additionally, we saw marked differences in behavior matched to different levels of individual risk—another way that information helped to influence individual movement in an efficient, targeted way.[6]

One lesson learned from the pandemic on making information as impactful as possible is that information should not be used for dual tasks—that is, it should not also try to influence economic forces. For example, when masks were in short supply early in the pandemic, the CDC tried to influence supply-and-demand forces by discouraging the public from using masks as a preventive measure. However, this later created distrust when supply had sufficiently recovered and the CDC began to encourage mask use. Similarly, because local infection levels and infection risks varied widely, the strict social-distancing recommendations that were appropriate in some locations were not appropriate in others. A lack of local flexibility in recommendations hurt the credibility of the information source.

Private markets provide some benefits over the public sector in implementing solutions to minimize infection. Both private markets and the public sector can enact certain responses quickly, but the public sector is not as flexible and is less able to match cost and benefits precisely because of the associated legislative

6. For further reading on patterns and causes of individual foot traffic, see the following resources: Sumedha Gupta, Kosali Simon, and Coady Wing, "Mandated and Voluntary Social Distancing During the COVID-19 Epidemic," *Brookings Papers on Economic Activity* (2020): 269–315; Christopher J. Cronin and William N. Evans, "Total Shutdowns, Targeted Restrictions, or Individual Responsibility: How to Promote Social Distancing in the COVID-19 Era?," *Journal of Health Economics* 79 (2021): 102497; and Sumedha Gupta et al., "Tracking Public and Private Responses to the COVID-19 Epidemic: Evidence from State and Local Government Actions," *American Journal of Health Economics* 7, no. 4 (2021): 361–404.

process (often complicated by political agendas). The public sector also imposes costs with a broader brush. For example, treating all workers in an essential industry equally creates unnecessary costs. Public-sector solutions do benefit from expansive outreach, however. If compliance is achieved, large-scale recommendations have the power to consistently influence larger groups—greater numbers than the private market can reach.

By balancing the strengths and weaknesses of each sector, we can improve future responses. The public sector has a large reach as a provider of information in an evolving health crisis and can partner with private markets to create multifaceted solutions. Government health organizations can synthesize and widely publicize information on gathering limits and masking, which can then be carried out flexibly and effectively by businesses that can optimize their own implementation of these recommendations.

Comparative Evaluation

GOAL 1: REDUCE THE SPREAD OF INFECTION

Private Markets		Public Sector	
Score	Examples	Score	Examples
Timeliness (speed of implementation)			
High	• Big Tech and universities were fully remote within days, well ahead of first state and local orders	**High**	• Executive orders issued within days
Effectiveness (addressing the core economic problem)			
High	• Costs and benefits were evidenced within big firms (e.g., go remote for your bottom line) • Paid sick leave prevented productivity losses • Social pressures shamed some and encouraged incorporating social-infection costs • Innovation sidestepped problems (e.g., Zoom)	**Low**	• Stay-at-home orders were too broad, quashing some social costs but overshooting others • Mask mandates better matched costs and benefits when enforceable • "Essential" industry decisions were politically fraught and linked to industrial influence, not matched to underlying costs and benefits
Flexibility (ability to adjust to diverse needs)			
High	• Within-firm choices provided flexibility; office workers went remote while plant maintenance remained in person • Service-industry workers were masked but knowledge workers were fully remote	**Low**	• Statewide orders ignored rural-urban differences; cases of decentralized local response were better
Scale (number of individuals impacted and complying)			
Low	• Influence depended on standard-bearers (e.g., Facebook and Walmart) • Charging small, service-based businesses with enforcement was difficult	**High**	• Applied to whole jurisdictions up to state level • Early information dissemination promoted voluntary choices to social distance

GOAL 2. HELP THOSE FACING ECONOMIC PAIN DUE TO UNEMPLOYMENT AND DEMAND SHIFTS

Core Economic Problem

The onset of the pandemic ushered in unparalleled employment shifts for both legal and voluntary reasons: workplaces were shut down, and demand dried up for economic activities linked to infection risk. In the discussion that follows, we will leave others to evaluate how much of the observed economic disruption was due to true demand changes in response to COVID-19 risk rather than due to political influence, essential-business designations, or policy-driven spending distortions. A careful evaluation of these factors will reveal how much disruption was fundamental and inevitable as opposed to policy induced. Here, we focus on the inevitable forces and how to mitigate the economic pain from the income and job losses that resulted.

This core economic problem is always present in a dynamic economy, but it loomed historically large with the sudden arrival of COVID-19. When markets face an abrupt decrease in demand, this lowers employment and wages, and these changes may be transitory or permanent. The problem is essentially one of transition time. Switching businesses and workers from pre-pandemic operations to the "new normal," with different levels of demand and different constraints, takes time. During this transition time, lost wages and employment cause acute economic pain.

In the discussion that follows, we will classify the core economic problem of transition time for industries under fire into three areas of need: information catch-up, problem-solving innovation, and outmoded industry.

In the information catch-up group, we find industries that could operate without much change to their products or services but need information on vaccines or best practices to contain infection. This means that, at the start of the pandemic, these industries were waiting for accurate and implementable information before their operations could resume. We can think of two ways to help this group—either by making the inevitable waiting time less painful or by shortening the waiting period itself.

In the problem-solving innovation group, the industry must make fundamental changes to operate in a pandemic, either because of new restrictions due to infection risk or because of changes in demand for their products. Note that this group may include both industries that innovate by necessity and industries looking to leave the waiting game and innovate proactively.

Finally, if firms in an industry cannot resume pre-pandemic operations or innovate their way out of the demand shock, the firms must permanently exit the market as outmoded industries. This dynamic of newly created industries destroying the old is always at play in growing economies. Just browse through your favorite movies ~~on VHS~~, ~~on DVD~~, ~~at Blockbuster~~, on Netflix to ponder this phenomenon, termed *creative destruction*. We witnessed this in action across the economy as the pandemic swept through daily operations.

Private-Market Responses

In this section, we will walk through how the private market helped those in economic distress in each of the three economic transition groupings.

The first group is workers in industries in which economic pain is caused by the waiting time between pandemic onset and sufficient information (or vaccines) to resume operations. The first way to address this waiting period is to reduce the economic pain during the transition. There are plentiful and heartening examples of the ways society worked together to help those in need. As of May 15, 2020, the Indiana University Lilly Family School of Philanthropy estimated that grassroot community funds in US cities and towns had raised $634 million and distributed at least $376 million to address food insecurity, mental health needs, and emergency financial assistance. Crowdfunding operations also took off, such as the GoFundMe.com campaign for America's Food Fund, which raised $26 million to address food insecurity during the pandemic.[7] A good illustration of communities recognizing the waiting-time concept was the call to purchase gift cards from local businesses. The community recognized that the products and services offered by these businesses were still desirable but that it would be some time before they could be safely enjoyed. The Support Local initiative by *USA Today* connected businesses and customers in 99 cities so customers could buy a meal, make an appointment, or purchase a gift card. Rally for Restaurants sweetened the deal by adding a $1 donation from Toast.org for a gift-card purchase tagged on social media. A gift-card campaign is a creative way to buy time for a business struggling during the transition back to normal operations.

Private-market giving also included nonmonetary help. As struggling businesses were designing new working conditions or adjusting to additional pandemic demands, other businesses and individuals provided free goods or services

7. *Supporting Charitable Giving during the COVID-19 Crisis*, Virtual Hearing, before the Joint Economic Committee, 116th Cong., 2nd Sess. (2020), https://www.govinfo.gov/content/pkg/CHRG-116shrg40895/pdf/CHRG-116shrg40895.pdf.

to help during this transition. These offerings were tailored to the emerging needs of the community, such as free courses from the employment networking website LinkedIn, waived advertising fees on Yelp for bars and restaurants, N95 masks for hospitals from companies such as Facebook and Harbor Freight Tools, and face-mask kits from JoAnn's Fabrics.[8]

Note that this collaborative help doesn't necessarily have to be fueled by an unselfish generosity from businesses. Offering free products helps businesses develop their customer base and embed themselves in the community, which can pay off for their bottom line in the future. This isn't to say that a free pair of Crocs shoes offered to an ICU nurse is going to solve the problem of overwhelmed and overworked healthcare workers, but it is still good news. Private-market incentives do encourage charitable activity.[9]

To reduce economic pain for industries in the information catch-up group, we could also shorten the waiting period. Public-sector initiatives to speed up vaccine development are detailed later, but there were also notable private-market initiatives. Private organizations contributed to vaccine efforts, such as $250 million from the Bill & Melinda Gates Foundation. Additionally, many private-market actors moved swiftly to produce alternative funding channels when they discovered how scientists working on vaccine technology were frustrated by the slow and onerous federal-funding process. For example, from planning to award, it can take as long as two years to obtain a grant from the National Institutes of Health—even longer if the committee requests changes and resubmission. Further, it typically takes between 8 and 20 months after the grant's due date to receive the award.[10] One initiative to fix this problem was Fast Grants, launched in April 2020. It set up a 48-hour decision-making process with funding sent out within a week. The whole system was created in just 10 days and initially secured more than $50 million from donors. By the end of 2020, Fast Grants had issued 260 grants, mostly to labs in the United States but also internationally, which were used to track viral variants, identify misfired immune responses in severe COVID cases, and develop new testing technology using saliva samples, among other things.

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8. David Hessekiel, "Creative Ways Companies Are Giving Back during the COVID-19 Crisis," *Forbes*, March 27, 2020.

9. Since spring 2020, Crocs has distributed more than 910,000 free pairs of shoes to healthcare workers. The smiling nurses on their website, besides looking very fashionable, seem to show they greatly enjoy them. See Crocs, "Happy National Nurses Week," accessed July 12, 2022, https://www.crocs.com/stories/nurse-week.html.

10. "Illustrated Application and Grant Timelines," National Institutes of Allergy and Infectious Diseases, last reviewed December 30, 2019, https://www.niaid.nih.gov/grants-contracts/timelines-illustrated.

An even better solution to the pain of transition would be to sidestep it with better ways of operating. Markets thrived during COVID by using problem-solving innovation to tackle new challenges. These innovations arose flexibly, addressing a range of problems across varied industries, and they were tailored to individual risk levels. Some industries largely maintained existing operations but used innovation to eliminate infection risk; examples are the use of virtual platforms (such as Zoom) for meetings or the move to release films through streaming services like Disney+ or Amazon. Other ideas, such as QR codes for restaurant menus and the expansion of remote ordering, helped to remove infection risk from business operations. Food and grocery delivery services and apps, such as Grubhub, DoorDash, and Instacart, grew and added new features, such as contactless delivery or the "Reopen for Delivery" program that partnered with brick-and-mortar restaurants. There was even the futuristic introduction of delivery robots on college campuses! These innovations highlight the flexibility of private-market responses; grocery stores and restaurants could still be open for in-person business, and individuals could take advantage of contactless services adapted to their own risk levels.

Last, but most compellingly, innovation during this transition produced new technologies that changed the nature of products to fit evolving demand. Virtual concerts are a fascinating example. Live in-person concerts and festivals were among the first casualties of the pandemic, with both legal and social pressures leading to the postponement of events like Coachella, Lollapalooza, and South by Southwest (SXSW). Each of these events typically attract about 250,000 concertgoers. As 2020 wore on, platforms opened for live, virtual, and interactive concert experiences with popular artists who previously had only performed in person. One of the first indications that this was a new kind of entertainment was when the online gaming platform Fortnite partnered with rapper Travis Scott to perform for *12 million* live viewers. The viewers could interact as avatars in a virtual metaverse manipulated by the performer. The rapper's avatar performed previous hits and introduced new music all while leading the audience through stunning visuals from underwater to outer space. Fortnite recently launched its own concert series with global performers from Egypt, Australia, Brazil, and Japan.[11] For artists, virtual platforms offer an opportunity to reach a global audience, unfettered by geographic constraints.

The final category of transition industries includes businesses that can no longer operate successfully in the new normal and are forced to exit the econ-

11. Ethan Millman, "Fortnite Thrived with Its Virtual Concert Stage. Now It's Going Global," *Rolling Stone*, September 7, 2021.

omy. Innovations that helped parts of an industry to adapt (virtual concerts) may also hurt other parts (concert tours). Private-market solutions for this cycle of innovation and creative destruction depend on ever-evolving opportunities. However, the difficulty lies in how adaptable old skills are to new industry needs; accessible ways to retrain individuals with outmoded skills are key. How painful this retraining is for them in practice is a complex problem, one we will discuss further as we examine public-sector solutions.

Public-Sector Responses

The public-sector response shone brightest in its efforts to shorten the waiting time for vaccines. Getting shots into arms has two components: creation and distribution. For creation, the biggest boost the public sector could provide was simply funding the private companies developing the vaccines. Both congressional legislation and Operation Warp Speed channeled billions into the vaccine-development process. The Coronavirus Preparedness and Response Supplemental Appropriations Act in early March 2020 promised $8.3 billion for public-health agencies and vaccine development. Funding to public-health agencies helped with information dissemination on how to safely resume daily business operations, and funding toward vaccine development accelerated vaccine availability.

For both creation and distribution, Operation Warp Speed illustrates several strengths of public-sector tools. First, the public sector was able to accelerate vaccine availability by scaling up funding for two key components of vaccine production. Large-scale trials for pharmaceuticals are the most expensive part of the development and approval process. By funding this component heavily, the government allowed these trials to take place quickly and efficiently. Final vaccine delivery requires increased industrial-production capacity for vaccine compounds as well as for more ordinary components (e.g., needles and vials). Existing firms already had the production knowledge, but early government investment enabled them to expand their production capabilities, with the result that facilities were ready by the time vaccines could roll out. In both cases, private markets had the science and production technology, but government funding enabled markets to scale quickly.

Second, Operation Warp Speed leveraged national-level bargaining power to secure first access to vaccines. Ordinarily, the United States lacks this advantage in negotiations with pharmaceutical and medical producers because of the decentralized nature of the healthcare system. For example, in Canada's national health insurance system, the federal government is the single payer for health

purchases and thus has bargaining power based on the full force of purchasing for 38 million people at once. In contrast, the US system is comprised of federal buyers (Medicare and Medicaid), state buyers (Medicaid), and myriad individual insurance agencies (UnitedHealth, Humana, Blue Cross Blue Shield, etc.). As a result, each individual negotiator has less bargaining power because the US population is split among them. In contrast, Operation Warp Speed started making advance purchase commitments to a portfolio of early stage vaccine candidates as soon as July 2020, with the full force of 329 million individual customers behind it. No one wants to pass up that deal!

A parallel approach to helping individuals in the waiting game is to make the waiting less painful for them. Public-sector actors can make larger overall payments, but public-sector tools are less agile and precise than private markets. Multiple rounds of legislation passed early in the pandemic increased unemployment benefits by $561 billion, sent $909 billion in support to businesses, and made individual stimulus payments of $456 billion.[12] Clearly, legislation can allocate huge sums of money. The disadvantage is that this aid is less nimble—a term that encompasses both how quickly aid is implemented and how well it can be adapted to new circumstances. Initial public-sector payouts took longer to implement than private-market actions, which began literally overnight. The key difference with public-sector actions is that legislation is not flexible. Once enacted, it is difficult to change (or retract). Legislation can easily overreach, as illustrated by subsequent hiring challenges in the labor market and research showing that median household balances, even for low-income individuals, actually rose during the pandemic compared to 2019.[13]

Getting legislative-aid levels wrong hurts society overall because of the *opportunity cost* of those funds (i.e., the next best use of a resource). In this case, resources could have been used to control infection, support overwhelmed health systems, and push forward vaccines, all of which would have improved lives across the economy. Overshooting stimulus payments boosted demand for goods and services while simultaneously removing workers from already strained supply chains; this chain of events left economic disruption in its wake. Additionally, once these mistakes were discovered, it was hard to rectify the situation. Legislative aid lacks the flexibility that is necessary to adjust to changing conditions, partly because of the nature of the legislative

12. Peter G. Peterson Foundation, "Here's Everything the Federal Government Has Done to Respond to the Coronavirus So Far," March 15, 2021, https://www.pgpf.org/blog/2021/03/heres-everything-congress-has-done-to-respond-to-the-coronavirus-so-far.
13. Diana Farrell, Erica Deadman, Fiona Greig, and Pascal Noel, "Household Cash Balances during COVID-19: A Distributional Perspective," JPMorgan Chase & Co., December 2020.

process (i.e., introducing bills and creating compromise) and partly because of the nature of political lobbying. Also, no one wants to give back surplus aid.

A better way for the public sector to help is by aiding the more nimble private-market forces in developing innovative solutions to the problem of transition time. For example, COVID-fueled deregulation opened up outdoor dining in restaurants. An even more compelling example was easing restrictions on telehealth. Prior to the pandemic, telehealth access was limited mostly to rural areas or to areas with physician shortages—and even then, telehealth was permitted only in an authorized clinic or health facility. All states had some Medicaid coverage for telehealth services, yet these services were encumbered by regulation and were not well reimbursed. By March 17, 2020, the Centers for Medicare and Medicaid Services (CMS) had issued waivers of program requirements for telehealth and allowed patients to receive telehealth in their homes. By June 15, 2020, 50 states and the District of Columbia allowed out-of-state physicians to provide care to Medicare enrollees, and 44 states allowed electronic service delivery. CMS also expanded eligible services to specialists, such as psychologists and counselors, occupational therapists, and speech-language pathologists.

The results have been unprecedented. The broadening of telemedicine flexibilities combined with in-home communication has resulted in an unprecedented surge in beneficiaries receiving telehealth services. Before the pandemic, approximately 13,000 beneficiaries in fee-for-service Medicare (the largest Medicare program) received telehealth services; by the end of April 2020, this number had reached nearly 1.7 million.[14] Previously underserved areas of medicine with high telehealth benefits were mental healthcare (beneficiaries may feel stigma or may have trouble keeping appointments) and nursing homes (beneficiaries may be immobile or vulnerable). Initial take-up data revealed that telehealth was an important source of care all across the country, not just in rural areas. It also highlights the agility of the healthcare sector when providers are allowed to structure care as they see fit after removal of regulatory burdens. The speed with which healthcare providers increased telehealth availability to safely take care of their patients may just be the first of many areas where setting innovation free can improve patient care.

Of course, the most impactful public-sector easing of regulations was the emergency-use authorization of vaccines and their trials. Pharmaceutical innovation that ordinarily struggles through at least 10 years' worth of patent approvals and Food and Drug Administration (FDA) processes was accomplished in just

14. Seema Verma, "Early Impact of CMS Expansion of Medicare Telehealth during COVID-19," *Health Affairs Blog*, July 15, 2020.

a year! The FDA's substantial regulatory burden and lengthy approval process has long been a source of debate in public-health research. A notable champion for improved efficiency is Sam Peltzman, who showed that additional regulations, such as the Drug Efficacy Amendment in 1962, slowed the pace of new pharmaceutical innovations and delayed their entry into the market. According to Peltzman, because the public never received the full level of innovation, this slowdown was equivalent to a tax of 5 to 10 percent on all prescriptions sold.[15]

The federal government sped up the delivery of vaccines to the public by allowing companies to submit portions of their applications as they proceeded with testing, rather than waiting for all stages to be fully completed. During Stage 2 trial testing, when the vaccine was tested on smaller groups of people suffering from the disease, the FDA allowed planning and implementation of Stage 3 trials. These trials randomized treatment over large populations and were allowed to proceed once sufficient data had been collected. This saved the process from the typical waiting times and delays, which would have had huge economic and social costs during the pandemic. Bringing an effective vaccine to the public was the best way to turn the tide and allow more businesses to safely resume operations.

The final category of industries seeking economic relief is that of those who cannot make the transition to a changed economy and are thus forced to shut down. Unfortunately, this is not a new phenomenon in a dynamic economy. The United States has been experiencing this kind of growing pains in the last 25 years as it transitions from a manufacturing to a knowledge-based economy. Throwing large amounts of money at the problem, such as providing economy-wide unemployment relief, does not address the underlying factor—that the opportunities and needed skills of tomorrow are different from those of yesterday.

Businesses and individuals need to move into new activities and markets. One role the public sector can play echoes the successes described above (i.e., fostering innovation in the face of shocks to economic activity). The public sector may be most helpful during times of transition by clearing the way for the change and innovation happening in private markets—that is, reducing the regulations that keep individuals from entering new occupations or that keep businesses from developing new models of operation. This should include removing unnecessary occupational licensing requirements. Occupational licensing is a patchwork of state-based licenses requiring specific training or certification to participate in a market. Such licensing is often cited as necessary to protect consumer

15. Sam Peltzman, "An Evaluation of Consumer Protection Legislation: The 1962 Drug Amendments," *Journal of Political Economy* 81 (1973): 1049–91.

safety. However, when a license is required for activities, such as opening a floral shop or becoming a makeup artist, it is merely a hurdle to entering an industry, which protects existing businesses from competition. In cases like these, licensing misallocates people's energies and training. Further, research conducted by the Treasury Department found that workers in heavily licensed occupations are nearly 15 percent less likely to move to other states.[16] This frustrates workers in their efforts to find new jobs and keep their families together.

Comparative Evaluation

GOAL 2: HELP THOSE FACING ECONOMIC PAIN

Private Markets		Public Sector	
Score	Examples	Score	Examples
Timeliness (speed of implementation)			
High	• Charity operations began overnight, with $634 million in community funding by mid-May • Fast Grant program: By April 2020, $50 million was granted in COVID research funding, and decisions were made in 48 hours	**Low**	• Stimulus payments came 2 months after lockdowns, with extra toppings of bureaucracy • Federal research funding: timeline is typically 2 years (i.e., until award funds are received)
Effectiveness (addressing the core economic problem)			
High	• Short-term aid was provided by food pantries and industry-specific foundations during waiting time for vaccines • The private sector developed and produced vaccines with remarkable speed	**High**	• Operation Warp Speed simultaneously funded vaccine development, large-scale trials, and production facilities • Deregulatory aid was effective (e.g., telehealth waivers and emergency use authorization for vaccines)
Flexibility (ability to adjust to diverse needs)			
High	• In-kind goods were provided (e.g., free retraining, virtual products); free products helped others and grew customer base • Services were available for varied risk levels (e.g., food and grocery delivery and apps)	**Low**	• When stimulus payments overheated the economy, they couldn't be scaled back • Opportunity costs of misspent aid were large
Scale (number of individuals impacted and complying)			
High	• Large-scale direct and indirect charitable giving enabled wide reach • Virtual innovations grew market reach (e.g., live virtual concerts, streaming entertainment)	**High**	• Nationwide contracts moved the United States to the front of the line in vaccine purchases • Billions in vaccine funding were made available—$8.3 billion in Coronavirus Preparedness & Response Supplemental Appropriations Act alone

16. Department of the Treasury, Office of Economic Policy, the Council of Economic Advisers, and the Department of Labor, *Occupational Licensing: A Framework for Policymakers*," July 2015, https://obamawhitehouse.archives.gov/sites/default/files/docs/licensing_report_final_nonembargo.pdf.

GOAL 3. MONITOR ONGOING INFECTION THROUGH TESTING

Core Economic Problem

The third goal of pandemic response looks at both the present and the future to monitor ongoing infection. Effective monitoring should include a broad swath of the population because risk and knowledge of exposure will vary. The information resulting from this monitoring should also be widely accessible to influence future behavior. A primary response to this monitoring problem in both private markets and the public sector has been extensive testing. To understand the core economic problem at the heart of this goal, we need to understand the underlying characteristics of its key components: tests versus information.

Information is a special type of "good" to produce. First, unlike common consumer products, such as an apple or shampoo, consuming information does not prevent others from also acquiring the same information. Once the apple is finished or hair shampooed, the product cannot be shared with another person (other than by garnering admiration for your shiny locks). However, information can be shared with others with no risk of losing original access to the information. This characteristic of information is called *nonrival*, and the idea is that the good can be consumed by multiple consumers simultaneously.

Relatedly, it is difficult to prevent others from consuming information. Shampoo has a price tag that must be paid before lathering up. (If you pocket the bottle and try to walk out of the store without paying, the security officer will show you the door.) Information, on the other hand, is often transmitted freely through word of mouth or media, and certainly cannot be taken from the consumers once they have learned it.[17] This quality is called *nonexcludable*. On a societal level during a pandemic, making local infection-rate information nonexcludable can improve corresponding social behavior.

The diagnostic tests that generate information are taken at an individual level, much like the apple or shampoo. That is, after the nasal swab is completed, another individual cannot take the same test (not only would it invalidate the first test, but—*eww*!). Even in pooled testing, the size of an effective pool is limited.

17. This isn't to say that information never has a price tag. Consulting companies function well providing client-specific information for a price, and complex enforcement contracts can be made to prevent information leaks. For example, movie actors have clauses in their contracts mandating that they not reveal plot details. However, a main takeaway here is that excluding consumers from information requires significant costs to the producer and is hard to enforce. Check out the many YouTube videos of Marvel movie actors revealing spoilers!

This means that a test is *rivalrous* in nature: once the product is consumed, it cannot be consumed by another individual.

Individual tests, because of their concrete, physical form, are also an *excludable* good: an individual can be prevented from taking a test through some kind of barrier. The barrier could be as simple as a price or could involve having to travel to a physical clinic to have the test administered. Excludability is the most common characteristic of everyday consumer goods, for a practical reason: a producer prefers to produce a good when it is possible to charge money for it!

The characteristics of information and testing described previously form the core problem in monitoring ongoing infection. *We would like information to be universal and free, but the testing that creates the information is individual and costly.* Let's turn to our two sectors of the economy to examine how this problem might be addressed.

Private-Market Responses

Private-market solutions could address the universal and free component of the core economic problem, just the individual and costly component, or both. One approach that emerged early in the pandemic chipped away at both. When tests were new and costly and personal protective equipment (PPE) was scarce, early innovators such as Massachusetts General Hospital ran mass-testing clinics. Massachusetts General improved the mass-testing environment with new "personal protective booths," in essence little phone booths with gloves for testing personnel to use over many, many patients. This decreased the costs of testing in two ways. First, since PPE was scarce and costly, it reduced the PPE costs from many individuals to a single, reusable booth. This is called *economies of scale*—when the costs of producing something are reduced by using a central resource many times. For example, renting a van for a road trip with friends is much more economical per person than renting a van alone.

Second, mass testing reduced costs by centralizing learning. Initially, personnel needed some time to learn to correctly administer the product. If tests are administered in individual physician offices, this means each physician must learn the specifics of the test, perhaps for only a handful of patients a day. Mass-testing sites maximized learning through doing more tests, termed *learning by doing*.

Both economies of scale in PPE and learning by doing dramatically reduced the costs of testing by honing in on the nonindividual components of the test. The test reagents could still only be used for one patient, but other parts of administering a test, such as time and personnel, could be cut. Economies of scale were also present on the producer side by reducing distribution of tests to multiple

offices and simplifying supply-chain management. Mass-testing sites offered scale while minimizing exposure by setting up all operations in open spaces, often with drive-through capabilities.

The large-scale operations of health systems also improved the information component of the core economic problem. Economies of scale and learning by doing work best with large operations seeing a significant portion of the affected population. This means that the principal information producers should be those performing many, many tests. Even if these health systems just reported within their own vast operations, the local information dissemination is significant and inches closer to the universal dissemination we would desire.

Another private-market approach to solving the information and testing problem involves redefining what "universal and free" means. To influence behavior, we would like information to be universal in the sense that everyone whose choices could increase infections has the information needed to mitigate that behavior. For large private-market operations, particularly for those with high monetary stakes in the event of an outbreak, this means creating and sharing information on infection within the organization—redefining "universal" as the boundaries of the organization. A colorful example is the National Basketball Association (NBA). An outbreak of COVID-19 within the NBA would easily spread across teams because of the close-contact environment of a game. The teams also converge from many different areas of the country, potentially carrying local infection levels from one city to another. Large outbreaks would obviously mean canceled games, which would translate to millions of dollars of lost revenue.

The NBA's strategy famously became known as "The Bubble"—a relocation of all key staff and players to Walt Disney World Resort in Florida. This addressed the issues of free universal access to information and administration of costly individual tests by making all costs and benefits of testing accrue within the same entity. Tests were still costly to the NBA and were consumed at an individual level, but now these costs could be balanced by the enormous benefits of preventing an outbreak and continuing the season. "Universal" was now defined as the sphere of influence of NBA infection risk.[18]

The final private-market approach focuses squarely on reducing the costs of testing. If we lower the individual hurdles to testing, we will increase the testing rate and improve infection information. In run-of-the-mill consumer goods,

18. It is important to note that the NBA "Bubble" also involved many strict rules on staff and player behaviors, which directly affected infection rates. This is separate from the previous argument, which does not address levels of infection but instead purely focuses on how testing translates into usable information. Both information and behaviors combine to influence infection levels.

new expensive products often become cheaper and more available over time as innovation improves product quality and reduces production costs. Consider essentially any kind of computing device—processing power has increased over time, sizes have become more convenient and compact, and prices are drastically lower.[19] Medical tests for COVID-19 are unfortunately not a straightforward consumer good because tests are subject to COVID-19 legislation mandating free coverage and because they are being produced and consumed in the heavily regulated industry of healthcare. This means that the tool of price, an important driver of cost-reducing innovation, is no longer observed by the patient when they choose to consume the test.

However, dollars are not the only way individuals end up "paying" for a good. Every product you consume also requires some payment of time. This is why Amazon is the king of commerce; it ruthlessly slashed almost all the consumer's time cost of purchasing a product. There's no need to run to the grocery store—have that box of Pop-Tarts delivered in time for tomorrow morning! A consumer's full evaluation of a purchase also includes the quality of the product. Particularly in healthcare, where prices are hidden from patients, hospitals specifically advertise quality to attract more patients. Think about those highway billboards touting the latest award-winning cancer care or caring, smiling hospital staff.[20]

The price of tests in terms of time and quality have dropped in multifaceted ways as private markets continue to innovate. Since the first "brain-tickler" tests, which involved a long, uncomfortable nasal swab, COVID-19 tests can now be administered through saliva collection and less intense nasal swabs. One saliva test came from a collaboration with the NBA, which was looking to create a better test for its own use; the test was eventually approved for the general population. Saliva tests demonstrate quality improvements for both consumers and producers: consumers benefit from a more pleasant testing experience, and producers benefit from the fact that saliva tests do not require the healthcare provider to come in close contact with the infected individual, keeping the providers safer.

Time costs have decreased with the introduction of at-home testing. This new offering reduces search costs of finding a nearby clinic and connects those

19. In less than 20 years, the Bureau of Labor Statistics Consumer Price Index for personal computers and peripheral equipment declined by 96 percent (December 1997 to August 2015). A nearly 100 percent price drop for a good that keeps getting better! See long-term price trends for computers, TVs, and related items at Bureau of Labor Statistics, US Department of Labor, The Economics Daily, https://www.bls.gov/opub/ted/2015/long-term-price-trends-for-computers-tvs-and-related-items.htm.
20. This brings us to our favorite healthcare advertising: billboards showing live waiting times in the emergency room. Are they encouraging you to wreck your car and take advantage of this low time-price of care?

needing a test through their local drugstore. Tests can also be picked up before they are needed, both a convenience for the consumer and an improvement for public health. Tests are now performed at the speed of "drugstore to couch +15 minutes," faster than driving to a clinic and idling in line. Testing in the comfort of your own couch is also a quality improvement for the consumer and reveals infection status faster, which is a quality improvement for controlling infection.

The last advantage of the arrival of at-home testing is skirting the logistical coordination between testing facilities and laboratories or clinical operations. Coordinated systems were necessary for safe sample acquisition, transport, and custody, and then efficient operations were needed to get the information back to the patient quickly before he or she infected others. These massive operations were straining medical supply chains and preventing medical staff from working in other areas of COVID care or indeed in ordinary healthcare operations. It made more sense to shift staff from running routine COVID tests back to caring for patients with heart disease, Alzheimer's, diabetes, and other serious conditions, all of which had higher-than-average non-COVID mortality rates when health resources were strained during the pandemic onset.[21]

One disadvantage of the private-market innovations detailed previously is that introducing many new products hampers learning by doing. Providers must choose which product best fits their needs and train their staff. Although having a variety of products adds flexibility—one can choose the testing systems most appropriate to the organization or individual—it comes at the cost of universal adoption. Additionally, lowering the costs of testing only addresses one side of the problem; it does not directly solve the problem of making the resulting information free and universal. In fact, it may make aggregation of information more complex, because different testing systems result in different levels of false positives and false negatives.

Public-Sector Responses

Public-sector tools offer several advantages in providing free and universally disseminated information, but they present a more complex problem for the costly, individual-testing component of our goal.

The public sector, as the overarching organization for the state or nation, has the universal component of information locked down.[22] Recall why it is useful to have information universally disseminated: nonrival information can be consumed

21. Steven H. Woolf, Derek A. Chapman, Roy T. Sabo, Daniel M. Weinberger, and Latoya Hill, "Excess Deaths from COVID-19 and Other Causes, March–April 2020," *Journal of the American Medical Association* 324, no. 5 (2020): 510–3.
22. Pun intended.

by multiple people simultaneously without hindering anyone's individual consumption. We also know that providing this information to as many people as possible will help our first goal of reducing infection, since uninformed individuals may contribute additional social costs from increased transmission rates. Together, this implies that providing information to as many people as possible has significant benefits.

If information is a good that can be produced by one producer yet consumed by everyone simultaneously, there is a logical argument for government provision of information. Using only one producer increases cost efficiency when providing the good requires a fixed infrastructure. A classic example is water or electricity provision, with extensive water pipes or electrical lines. Laying only one set of lines, rather than several competing networks, spreads the cost over all customers, resulting in a lower overall cost of services. This is an example of economies of scale. This same phenomenon exists in creating an information infrastructure of websites, information hotlines, and media relations.

One emerging method of monitoring infection levels that demonstrates the advantage of single-producer infrastructure is wastewater surveillance. The CDC has been working with local utilities to track COVID-19 in wastewater as an early indicator of growing infection in an area. This approach controls costs by tracking infection without the need for many individual tests, and it leads to more universal monitoring by surveying large sections of the community at once. When testing results are shared with local health departments, these agencies can spread an early warning that COVID-19 is increasing in a community.

Wastewater testing can be used where timely clinical testing is unavailable. It can also be implemented without concern for the community's health-insurance status or how quickly individuals seek out COVID testing when sick. The best implementation of wastewater testing will be at the local level, to incorporate local knowledge—for example, what community areas are served with decentralized systems (e.g., prisons or hospitals), how many community members are not connected into the system, and how this data can be used in combination with other local infection-surveillance data.

Another way that having one producer of information saves costs is by reducing the nonmonetary components of consuming this information. In a crisis, individuals use time to search for the latest accurate information. This cost of time is removed if public-health agencies have historically provided this information, such as during flu season, for weather emergencies, or for ongoing epidemics such as HIV. Individuals save time when they have the certainty of a single reliable producer of information for any emergency that may arise.

The other key characteristic of information is that it is largely nonexcludable: it's hard to prevent information from being consumed, and it's hard to give

back once it has been consumed. Put simply, information is expensive to produce but hard to charge money for (not great selling points for your next business venture). This type of good is often provided by the public sector. A canonical example is national defense. Military jets are pricey and need a large funding source; citizens also value the safety and peaceful sleep provided by this good. However, national defense isn't provided through, say, a Netflix-style subscription service. Why not? Because anyone who has freeloaded movies off a roommate knows that if there is a way to consume a good without paying, people will avail themselves of it! In the case of national defense, missile defense systems and good diplomatic relations cover both you and your next-door neighbor, regardless of whether your neighbor is current on his or her payment. One solution to this problem is general taxation, a uniquely public-sector tool. US citizens consume the public sector's national defense infrastructure, and the public sector charges them accordingly through taxation.[23]

The thorniest complication in our third goal for the public sector comes from the production of information through costly individual testing. To make information useful, we would like testing to be widely available. One way to do this is to keep the price of testing low. Public-sector responses during COVID-19 went even further and reduced this price to zero through mandated universal no-cost-sharing coverage. This is a straightforward approach; it quickly gets consumer prices down and simplifies the factors to consider in getting a test.

However, this approach is not as clean on the back end. When the price of a test is mandated to be zero, we have removed the connection between the benefit of a test and the cost of the test, which sadly still exists even if the consumer is not paying for it. This became particularly disastrous because consumers didn't know the price billed to insurers or government relief programs. Actual test prices varied widely. A study by the Kaiser Family Foundation of 93 hospitals found prices for COVID-19 diagnostic tests ranging between $20 and $1,419.[24] Mandated zero-dollar coverage means the foot traffic of the consumer is no longer connected to the dollars charged in the healthcare system, even though consum-

23. An interesting parallel exists between national defense and testing, in terms of unequal benefits matched to general taxation. One might argue that public-sector subsidization of testing will benefit those in areas with higher rates of infection, such as high population-density regions, whereas national defense covers the entire nation more uniformly. Although national defense covers the entire nation, it is also true that a strong military is more vital to certain areas, such as major cities or communities near nuclear-missile sites. General taxation for military defense does not equate these unequal benefits with tax payments in any explicit way.

24. Nisha Kurani, Karen Pollitz, Dustin Cotliar, Nicolas Shanosky, and Cynthia Cox, "COVID-19 Test Prices and Payment Policy," Kaiser Family Foundation, April 28, 2021, https://www.healthsystemtracker.org/brief/covid-19-test-prices-and-payment-policy/.

ers would clearly prefer the lower charge for the sake of their premiums and the public tax rolls.

This is a problem endemic to healthcare markets, which was present long before COVID-19 tests. When consumers of a (medical) good do not know the full cost of their choices, the benefits and costs of care are not effectively allocated. Insurers often address this problem, called *moral hazard*, with provider network restrictions for enrollees, such as the health maintenance organization (HMO) model. In this model, generous coverage is balanced by a restrictive list of locations. This problem of moral hazard is also present in publicly provided health insurance, such as Medicare Part D. In this program, the government is footing the bill, but consumers can choose their preferred plan. The solution in this case is to introduce bidding by insurers to offer a plan, where only those insurers with the lowest bids are allowed to be in the choice set for the enrollees. Approaches like this could be used to nudge individuals toward low-cost locations for testing. However, all these approaches come at a cost of much higher levels of bureaucracy, which itself adds to the overall costs of testing. The advantages of universal provision of information and tests must be weighed against the inevitably higher costs of producing this information.

Comparative Evaluation

GOAL 3: MONITOR ONGOING INFECTION

Private Markets		Public Sector	
Score	Examples	Score	Examples
Timeliness (speed of implementation)			
?	• Beholden to the regulatory environment; timeliness depended on the industry	**High**	• Pre-existing information infrastructure in public-health agencies simplified information dissemination
Effectiveness (addressing the core economic problem)			
High	• Health systems honed large-scale testing—economies of scale and learning by doing • Big organizations contained in one choice, all the costs and benefits of testing (e.g., NBA "Bubble")	**Low** **High**	• Mandated zero-dollar coverage disconnected choices from prices • Information can be consumed by all simultaneously and helped mitigate spread of infection
Flexibility (ability to adjust to diverse needs)			
High	• Multiple tests were quickly developed (e.g., swab, saliva, at-home, diagnostic, and antibody products)	**Low**	• Free tests are most effective with limited choice; adding flexibility adds bureaucracy
Scale (number of individuals impacted and complying)			
Low	• Aggregation of information was harder over multiple sites and methods • It is limited by individual organization size	**High**	• Mandated testing coverage from local up to federal levels made reach as universal as it can get

CONCLUSION

Although the COVID-19 pandemic ushered in a swarm of new problems, private markets and the public sector responded with equal ferocity. Responses from the public sector have the advantages of scale—able to impact large sections of the population at once—but are often accompanied by a high inefficiency cost that comes with increased bureaucracy and the inflexible nature of legislative approaches. Public-sector tools have advantages in providing centralized information to the public because of historical investments in this infrastructure through public-health agencies. In private markets, we may have only scratched the surface of the teeming activity manifested in response to the challenges of COVID-19 infection risk, rising unemployment, and abrupt demand for new products. Private-market solutions are nimble and often flexible for diverse needs, with different approaches arising in different industries. In fact, responses to many objectives of public-sector legislation were already well underway in private markets before legislation even passed. Going forward, policy makers and individuals can help foster the creative momentum unleashed by the pandemic by shedding onerous regulations and letting innovation continue to entertain us, heal the sick, and solve economic challenges in a post-pandemic world.

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