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Is a Requirement to Wear a Mask Economically Valid During COVID-19?

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ABSTRACT

Two of the most important categories of government intervention in response to COVID-19 are business closures and mask mandates. The scientific literature supports the efficacy of mask-wearing to reduce the transmission of respiratory viruses (including COVID-19). However, the efficacy is greater in stopping outbound transmission (meaning that my mask protects you) than inbound transmission (meaning that my mask protects me). Evidence suggests that the full benefits to society of wearing masks are far greater than the full costs to society of wearing masks. The author argues that mask-wearing is far more cost effective than business closures in controlling the spread of COVID-19. Moreover, the author argues that highly infectious diseases have an externality dimension. The person infected with COVID-19 makes a decision regarding whether to wear a mask based on their own perceived costs and benefits of mask-wearing, but that decision has consequences for those they come in contact with: the infected person's decision not to wear a mask imposes costs on others that are external to the infected person's decision process not to do so. The author further argues that some possible methods by which to deal with such an external cost (individual negotiations, a tax on spreading COVID-19, or as subsidy for wearing masks) are impractical. This makes a mask-wearing government mandate economically valid.

KEYWORDS

Covid-19; Externalities; Mask; Business Closure; Stay-At-Home Order

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INTRODUCTION

In December of 2019, an outbreak of coronavirus [hereinafter COVID-19] was detected in mainland China. The outbreak was caused by a new virus, technically known as the "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)." On February 12th, the World Health Organization named the disease caused by the novel coronavirus "Coronavirus Disease 2019" (COVID-19).[1] As of the date of this writing, COVID-19 has killed over 1.2 million people worldwide with nearly 240,000 of those deaths occurring in the United States.[2] Consider the two primary categories of government intervention in the United States in response to COVID-19: 1) business closures and stay-at-home orders; and 2) mandatory mask-wearing. By April 6, 2020, forty-three States had issued stay-at-home orders.[3] Moreover, virtually every State had some business closures, such as in the case of gyms, sporting venues, bars and indoor dining. In contrast, by April 6, 2020 (that same point in time), only seven States had mandated masks in public.[4] However, this has changed over time. By June 3, 2020 "[a]ll 50 US states [had] loosened restrictions put in place earlier in the pandemic, allowing some businesses to reopen."[5] Moreover, as of July 17, 2020, twenty-eight States had mandatory mask orders[6] and the

[1] World Health Organization, *Naming the Coronavirus Disease (COVID-19) and the Virus That Causes It*, WHO (last accessed Nov. 8, 2020), https://www.who.int/emergencies/diseases/novel-coronavirus-2019/technical-guidance/naming-the-coronavirus-disease-(covid-2019)-and-the-virus-that-causes-it.

[2] The New York Times, *COVID in the U.S.: Latest Map and Case Count*, NYT (Nov. 8, 2020), https://www.nytimes.com/interactive/2020/us/coronavirus-us-cases.html.

[3] *See* Jason Silverstein, *43 States Now Have Stay-at-Home Orders for Coronavirus. These Are The 7 That Don't*, CBS News (Apr. 6, 2020), https://www.cbsnews.com/news/stay-at-home-orders-states/.

[4] *See* Scottie Andrew & James Frio, *These Are the States That Require You to Wear a Face Mask in Public*, CNN (Apr. 20, 2020), https://www.cnn.com/2020/04/20/us/states-that-require-masks-trnd/index.html.

[5] Holly Secon, *An Interactive Map of the US Cities and States Still under Lockdown – and Those That are Reopening*, Business Insider (June 3, 2020), https://www.businessinsider.com/us-map-stay-at-home-orders-lockdowns-2020-3.

[6] *See* Arielle Mitropoulos, *28 States, Washington D.C., and Puerto Rico Have Issued Mask Mandates to Prevent Spread of COVID-19*, ABC News (July 17, 2020),https://abcnews.go.com/US/28-states-washington-dc-puerto-rico-issued-mask/story?id=71842266; Grace Hauck, *What States Require Face Masks in Public? Alabama, Arkansas, Colorado Join Growing List of States Where It's Mandatory*, USA Today (July 3, 2020), https://www.usatoday.com/story/news/health/2020/07/03/covid-face-masks-states-require-public/5371503002/.

nine largest brick and mortar retailers (including Walmart, Home Depot, and Lowes) now require shoppers to wear a mask.[7]

In this paper, I consider the possible economic rationales for governments to intervene in markets or personal affairs. I do this by introducing the economic concept of an externality (where one person's actions affect other people) first in general, then later, specifically, in the context of a mask mandate by the government. I briefly examine the scientific research on the effectiveness of masks, both with respect to air-borne infectious diseases in general and the evidence with respect to COVID-19.

1. THE ECONOMICS OF EXTERNALITIES

Like most economists, I prefer limited government interference in markets, business, and personal affairs. Economics has a short list of potentially-valid rationales for government intervention.[8] One of these potentially-valid rationales is an "externality," which is usually in the form of an external cost (sometimes called an external diseconomy). An external cost "occurs when an action by a firm or individual results in uncompensated costs or harm to others."[9] Perhaps the most commonly discussed external cost is pollution. For example, a steel company makes decisions regarding what technology to employ and how much steel to produce based upon the private costs it incurs vis-à-vis the private benefits it receives (revenues from the sale of the steel). What is not included in (or, in other words, is external to) the steel company's decision are the effects of sulfur dioxide, for example, that the steel plant emits, which can trigger respiratory illnesses for people near the plant.

[7] *See* Antonia Noori Farzan et al., *Top Nine Brick-and-Mortar Retailers Now Require Coronavirus Masks in U.S. Stores*, Washington Post (July 17, 2020), https://www.washingtonpost.com/nation/2020/07/17/coronavirus-live-updates-us/.

[8] Francis M. Bator, *The Anatomy of Market Failure*, 72 Q. J. Econ. 351, 357 (1958). (describing only three categories of market failure: monopoly, public goods, and externalities.) Moreover, one can argue that public goods, and even monopolies, are a form of externality. Carl J. Dahlman, *The Problem of Externality*, 22 J. L. & Econ 141, 142 (1979). If one accepts this perspective, externality is the central cause of market failure and the prime potential rationale for government intervention.

[9] W. Bruce Allen et al., Managerial Economics: Theory, Applications, and Cases 707 (8th ed. 2021). Often, discussions of external costs focus on a price for a market transaction (such as the price of steel when pollution occurs). However, a market transaction is not required for an externality as the quoted definition allows. *See also, e.g.*, James M. Buchanan & Wm. Craig Stubblebine, *Externality*, 29 Economica 371 (1962). The authors do not focus on market transactions but rather on "activities." Traditionally, the entities would be described as "economic agents," which are most commonly consumers and producers. *See* Gary Becker, Economic Theory 84-7 (1971). Hal R. Varian, Intermediate Microeconomics: A Modern Approach 569–89 (5th ed. 1999). Here, however, I will largely focus on externality effects of decisions outside of a typical market transaction.

These additional "social costs" are external to the steel company's decisions involving which technology to employ and how much steel to produce. The full welfare efficient or socially efficient results occur where the full social marginal costs (including the external costs) equal the full social marginal benefits (including any external benefits).[10]

It is noteworthy that the simple existence of an externality is insufficient to justify government intervention. Under certain circumstances, societal members can resolve (or reduce the impact of) the externality themselves by negotiating a result that is socially efficient. The key to such a result are well-established property rights and low transaction costs.[11] For example, if a cattle rancher and a wheat farmer exist on the same island, transaction costs are likely low enough that a solution to the problem of cattle wandering into the wheat field can be resolved by negotiation between the parties.[12]

Free markets (markets that exist without government interference) may try to reduce these externality problems via: a) voluntary clubs, consortia, or unions to jointly negotiate;[13] b) charities or major philanthropists; c) the collection and dissemination of information;[14] or d) lawsuits (including class action lawsuits).[15]

[10] *See* virtually any textbook on welfare economics. For the earliest complete treatment on the topic, *see generally* Arthur Cecil Pigou, THE ECONOMICS OF WELFARE (1920). For an intuitive treatment, *see* Tejvan Pettinger, *Social Efficiency*, Economics Help (Sept. 17, 2019), https://www.economicshelp.org/blog/2393/economics/social-efficiency. This concept is similar to "pareto efficiency," named after the Italian economist, Alfred Pareto. To be pareto optimal, there can be no change by which one agent can be better off without making other agents worse off.

[11] Nobel Laureate Sir Ronald Coase was an early pioneer in considering property rights and transactions costs (including the costs to collect information, negotiate and monitor contracts). *See* Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).; Ronald H. Coase, *The Problem of Social Cost*, 3 J. L. & ECON., Oct. 1960, at 1.

[12] Some of the solutions to this problem include building a fence, a switch to all farming, or a switch to all cattle ranching.

[13] Examples include environmental groups like the Sierra Club. For a list of such firms, *see e.g.*, Wikipedia, *List of Environmental Organizations*, Wikipedia (Oct. 12. 2020), https://en.wikipedia.org/wiki/List_of_environmental_organizations. One of the techniques such clubs may utilize is to file lawsuits or to pay for (or partially pay for) class action law suits that a law firm may find insufficiently profitable to accept on a standard contingency basis. *See, e.g.*, Mark Harcourt et al., *The Role of Unions in Addressing Behavioural Market Failures*, Econ. & Industrial Dem. (June 2019), https://doi.org/10.1177/0143831X19853027.

[14] This can be done via a charity, a club, or a government agency. I believe most people, and most economists, find such action less intrusive than other government action.

[15] A class action lawsuit is more feasible where there is a single firm or entity that has caused the damages, even when there are many damaged parties (often consumers of a specific product). Multiple potentially damaging firms make assessing and proving liability more difficult. Robert D. Cooper & Ariel Porat, *Liability Externalities and Mandatory Choices: Should Doctors Pay Less?,* 1 J. TORT L. 1, 5 (2006).

However, the larger the number of relevant entities:[16] 1) the more difficult it is to assess liability; 2) the more likely it is that there are increases in transaction costs; [17] and 3) the larger the extent of free-rider problems.[18] Therefore, in some circumstances, these free market "solutions" to the externality problem are too costly or insufficient in their effectiveness. In such cases, government intervention may be warranted.

Non-economists may expect that the government should completely stop the activity that creates an external cost (for example, by stopping all pollution, or dictating a technology to reduce pollution). Economics generally suggests that even when government intervention may be warranted, introducing market mechanisms can more efficiently deal with external costs. One such method is a tax on pollution to try reaching a point where the marginal cost of pollution (the marginal external cost on residents) exactly equals the marginal cost of pollution control.[19] The modern practical application of this approach includes "emissions trading" in which a firm that is positioned to more efficiently reduce pollution is encouraged to do so.[20] Generally, providing incentives to push participants toward the socially-optimal result is superior to mandating a solution such as a particular technology for pollution control or mandating that the entire population receive a vaccine.[21] Even in cases in which it appears clearly that government

[16] "Entities" include producers, consumers, or simply people affected by other entities' decisions. *See id.*

[17] *See, e.g.*, William C. Apgar& H. James Brown Microeconomics And Public Policy 252 (1987). (discussing free-market solutions and issues relating to the number of entities and quantity's likely effect on transactions costs).

[18] A "free-rider" is an entity that receives the benefit of an action (such as a club reducing pollution) without contributing to the payment for the action. *See, e.g., id.* at 327. A free-rider problem often occurs when there is a condition of non-excludability; it is not possible to exclude entities from receiving the benefits of the action. *See, e.g.,*Oliver Kim & Mark Walker, *The Free Rider Problem: Experimental Evidence*, 43 PUB. CHOICE 3 (1984). ; Charles R. Plott, *Externalities and Corrective Policies in Experimental Markets*, 93 Econ j. 106 (1983). (stating that "[w]ithin the simple setting explored here, the traditional models found in the economics literature are amazingly accurate."). Non-excludability is one of the two characteristics of a "public good." Often, a public good is supplied below the socially-optimal quantity. Some studies indicate free-riders were less of a problem than logic and economics suggested they should have been. *See, e.g.*, Peter Bohm, *Estimating Demand for Public Goods: An Experiment*, 3 Eur Econ. Rev 111 (1972). Gerald Marwell & Ruth E. Ames, *Economists Free Ride, Does Anyone Else? Experiments on the Provision of Public Goods IV*, 15 J. Pub. Econ. 295 (1981). ; John W. Sweeney Jr., *An Experimental Investigation of the Free-rider Problem*, 2 Soc. Sci. Res. 277 (1973). ; Vernon L. Smith, *An Experimental Comparison of Three Public Good Decision Mechanisms*, 81 Scandinavian J. Econ. 198 (1979). Alison L. Booth, *The Free Rider Problem and a Social Custom Model of Trade Union Membership*, 100 Q. J. Econ. 253 (1985).

[19] *See, e.g.*, Allen et al., *supra* note 9, at 707. *See also* Paul J. Feldstein, Health Policy Issues: An Economic Perspective 370 (3d ed. 2003).(stating that "[i]mposing a tax directly on pollution is preferable to such indirect methods of control pollution."). Many non-economists are surprised that such a "pareto optimal" result will not eliminate pollution. *See* William Baumol, *On Taxation and the Control of Externalities*, 62 Am. Econ. Rev. 307 (1972). ; Varian, *supra* note 9, at 569–589

[20] *See, e.g.*, Frank J. Convery, *Reflections—The Emerging Literature on Emissions Trading in Europe*, 3 Rev. Env't. Econ. & Pol'y 121 (2009). For information on the United States Environmental Protection Agency's emissions trading programs, *see* United States Environmental Protection Agency, *Emissions Trading Resources*, EPA (Apr. 30, 2020), https://www.epa.gov/emissions-trading-resources.

[21] *See* Dagobert L. Brito et al., *Externalities and Compulsory Vaccinations,* 45 J. Pub. Econ. 69 (1991).(arguing that taxes, subsidies, and provisions of information are superior to mandatory vaccinations).

intervention is appropriate, one must also consider the costs of government intervention, which can include the direct costs of the government agencies involved, the costs of entities complying with a government decision, and the potential for unintended consequences.[22] Ultimately, this will involve a comparison of an imperfect market result with an imperfect government intervention. [23] An infectious disease, such as COVID-19, also has an externality dimension: those infected persons who are not careful can impose an external cost on others they infect. The cost to others (from an increased probability of infection and its consequences) is likely external to a person's decisions to wash their hands frequently, socially distance, to avoid large gatherings, and to wear a mask.[24] Alternatively, one can say that the person wearing a mask confers an external benefit (by reducing the chance of infection). Later in this manuscript, I consider in more detail how one might deal with the external costs caused by individuals who decide not to wear masks.

Good economics requires an estimate of the benefits and costs of any governmental intervention.[25] It is difficult to estimate the costs of business closures during the COVID-19 pandemic, in part since some reductions in business activity would have occurred regardless of government mandates.[26] However, given the reduction in Gross Domestic Product [hereinafter G.D.P.],[27] the expenditures by Congress, and actions by the Federal Reserve, the cost is easily trillions of dollars.

[22] For a very intuitive read on the economics of government intervention for the non-economist (but written by an economist), *see generally* THOMAS E. HALL, AFTERMATH: THE UNINTENDED CONSEQUENCES OF PUBLIC POLICIES (2014). For a discussion of the divergence between theoretically-optimal health policies (to account for externalities) and actual policies, see Paul J. Feldstein, *supra* note19, at 374–75 (citing the Clean Air Act 1977 Amendments).

[23] *See , e.g.,* CHARLES WOLF JR., MARKETS OR GOVERNMENT: CHOOSING BETWEEN IMPERFECT ALTERNATIVES (1st ed. 1986).

[24] These costs may be "internalized" (for example, considered during the decision), or partially internalized, for friends and family. For strangers, internalization into the individual's decision process is far less likely.

[25] I believe it is best to make a two-step evaluation. The first is a comparison of the world with and without the government intervention. Here the relevant costs are not the traditional economist's first derivative of the total cost function with respect to quantity. Instead, the calculation involves a focus on the decision of government intervention and the costs and benefits associated with that intervention. Often, real world choices are discrete and "lumpy," as opposed to continuous. In the second step, to the extent that there is a continuum of government interventions, it becomes necessary to compare the marginal (or incremental) benefits of additional intervention to the marginal costs of additional intervention.

[26] Some reduction in GDP would occur due to supply chain issues, reduced tourism and travel, voluntary reductions in activity and consumer uncertainty, regardless of government mandates.

[27] The International Monetary Fund revised its forecast for 2020 for the United States economy from down 8% to down 6.6%. *See* Paul Wiseman, *IMF: U.S. Economy Will Drop 6.6% in 2020 in Face of Pandem*ic, ABC News (July 17, 2020), https://abcnews.go.com/Business/wireStory/imf-us-economy-drop-66-2020-face-pandemic-71850554. This still leaves a net drop (from a typical year's growth in real GDP) of at least 8.6% (which is equivalent to about $1.87 trillion). *See* U.S. Bureau of Economic Analysis, *Gross Domestic Product, Fourth Quarter and Year 2019 (Advance Estimate)*, BEA (Jan. 30, 2020), https://www.bea.gov/news/2020/gross-domestic-product-fourth-quarter-and-year-2019-advance-estimate.

2. PRECEDENTS AND ANALOGIES FOR MASK MANDATES

There are two categories of precedents related to requiring the use of masks. First, the federal Occupational Safety and Health Administration [hereinafter O.S.H.A] requires certain occupations to wear surgical masks and other occupations to wear N-95 respirators. Those facing such requirements must also be tested regularly to ensure the ability to properly fit in and wear the mask.[28] For medical workers, there is an external cost (benefit to others) of wearing a mask. This serves as the rationale for mask requirements. For medical workers, masks may reduce the probability that the wearer becomes infected with an airborne disease, or (if infected themselves) the mask may reduce the probability that the wearer unwittingly infects patients and other staff. However, for industrial workers (also covered by O.S.H.A), masks are intended to reduce (inbound) exposure to particulate matter (such as asbestos, paint, coaldust, or sawdust) or chemicals (such as solvents) rather than to reduce the spread of infectious diseases. For industrial workers, there are virtually no external costs (non-complying workers generally can't infect others with their respiratory disease, such as asbestosis).[29]

There are other government requirements that are partially comparable to a requirement to wear masks. Smoking (including e-cigarettes) is banned on most flights around the world. In the United States, only twelve States had "not enacted any general statewide ban on smoking in workplaces and/or bars and/or restaurants."[30] Most of those twelve States have laws requiring non-smoking sections in such establishments. These prohibitions were based in part upon evidence of the health dangers of second-hand smoke — an external cost — and analogies can be made to the COVID-19 pandemic.[31] Americans seem to have generally accepted smoking prohibitions. However, the externality rationale is much stronger for COVID-19 than for second-hand smoke: if you contract lung cancer from second-hand smoke, you cannot spread the cancer to others you come in contact with.

Consider just one aspect of modern life for which there is substantial government intrusion: driving. Americans have generally accepted laws requiring driver's licenses, proof of insurance, seat belts, airbags, crumple zones, fuel efficiency

[28] *See* Occupational Safety and Health Administration, *29 CFR Part 1910: Additional Ambient Aerosol CNC Quantitative Fit Testing Protocols: Respiratory Protection Standard*, United States Department of Labor (Sept. 26, 2019), https://www.osha.gov/laws-regs/federalregister/2019-09-26.

[29] *See* Mayo Clinic, *Asbestosis*, Mayo Clinic (Dec. 27, 2019), https://www.mayoclinic.org/diseases-conditions/asbestosis/symptoms-causes/syc-20354637.

[30] Wikipedia, *List of Smoking Bans in the United States*, Wikipedia (July 17, 2020), https://en.wikipedia.org/wiki/List_of_smoking_bans_in_the_United_States.

[31] *See* Barry Schwartz, *Secondhand Smoke, Moral Sanctions, and How We Should Respond to COVID-19*, Behavioral Scientist (June 22, 2020), https://behavioralscientist.org/secondhand-smoke-moral-sanctions-and-how-we-should-respond-to-covid-19/.

levels, car safety standards, emissions tests, speed limits, car-pool only lanes, and blood alcohol limits. Similarly, life jackets are required in boats,[32] football and motorcycle helmets are required in some States, and government restrictions on the maximum rent you can charge on a home exist in some cities.[33] These requirements have either weak externality-based justifications[34] or none at all.

However, mask requirements have triggered some surprisingly emotional reactions.[35] Store employees often suffer the brunt of anti-mask reactions including broken arms,[36] being punched in the face,[37] or even being shot to death.[38]

3. MASK EFFECTIVENESS

Research on the effectiveness of masks is not new. In 2011, a scientific article reviewed sixty-seven studies and found that "[s]imple and low-cost interventions [hand washing and wearing masks] would be useful for reducing transmission of epidemic respiratory viruses."[39]

A recent cross-country comparison found mask-wearing is highly correlated with low per-capita COVID-19 mortality rates.[40] Those countries with high COVID-19 rates and lower instances of mask-wearing were: Brazil, Turkey, Spain, Italy, the United

[32] Federal law requires children under the age of 13 to wear a life jacket while on a boat at all times. *See* . Other laws require a life jacket to be available for all those on board. *See, e.g.*, Penny Kanable, *Life Jackets*, Wisconsin Department of Natural Resources (May 16, 2019), https://dnr.wi.gov/topic/boat/pfd.html.

[33] *See, e.g.*, Wikipedia, Rent Control in the United States, Wikipedia (Oct. 27, 2020), https://en.wikipedia.org/wiki/Rent_control_in_the_United_States.

[34] Emissions tests do have an externality justification. There is something similar to an externality justification for right-of-way laws. However, there is a weaker externality justification for carpool-only lanes and fuel-efficiency levels.

[35] *See* Occupational Safety and Health Administration, *Respiratory Infection Control: Respirators Versus Surgical Masks*, OSHA Fact Sheet (May 2009), https://www.osha.gov/Publications/OSHA3219.pdf; Tina Hesman Saey, *Why Scientists Say Wearing Masks Shouldn't Be Controversia*l, Science News (June 26, 2020), https://www.sciencenews.org/article/covid-19-coronavirus-why-wearing-masks-controversial.

[36] *See* Los Angeles Police Department, *Two Suspects Arrested for Assaulting a Security Guard*, LAPD Online (May 11, 2020), http://www.lapdonline.org/newsroom/news_view/66538.

[37] *See* Chief Robert Schurr, *Brown, Elijah S – (A)(2) Aggravated Assault and 5 Additionally Charges*, Bucks Crime Watch PA (May 11, 2020), https://bucks.crimewatchpa.com/perkasieboroughpd/36078/arrests/brown-elijah-s-18-2702-a2-aggravated-assault-and-5-additional-charges.

[38] *See* Alec Snyder et al., *Three Family Members Charged in Shooting Death of Security Guard Who Told a Customer to Put on a Face Mask*, CNN (May 5, 2020), https://www.cnn.com/2020/05/04/us/michigan-security-guard-mask-killing-trnd/index.html

[39] Tom Jefferson et al., *Physical Interventions to Interrupt or Reduce the Spread of Respiratory Viruses*, Pub Med (July 6, 2011), https://pubmed.ncbi.nlm.nih.gov/21735402/.

[40] *See* American Thoracic Society, *Countries with Early Adoption of Face Masks Showed Modest COVID-19 Infection Rates*, Medical Xpress (June 24, 2020), https://medicalxpress.com/news/2020-06-countries-early-masks-modest-covid-.html (citing Sunny H.Wong et al., *COVID-19 and Public Interest in Face Mask Use*, 202 Am. J. Respiratory & Critical Care Med. 453 (2020).

States, Russia, France, and the United Kingdom. Those countries with low COVID-19 rates but high mask-wearing included: Vietnam, Cambodia, Hong Kong, Thailand, and Sri Lanka. The United States has COVID-19 mortality rates that are fifty times higher than any of these countries in the second category.[41]

In examining the effects of mask-wearing, it is important to distinguish between the benefits to the person wearing the mask and the benefits to others around the person wearing the mask. Several recent scientific studies indicate that cloth masks provide only some protection to the wearer, but result in much greater effectiveness in reducing the spread of the virus to others.[42] This asymmetry in protection is due to a mask's ability to prevent outbound droplets from becoming aerosolized as microdroplets.[43] This indicates that the private benefit of wearing masks is much smaller than the public benefit of wearing a mask (the external benefit to others who might have been infected). Therefore, the externality effect of mask-wearing during COVID-19 is stronger than other public health activities for dealing with other infectious diseases, such as taking a vaccine (where there is an externality effect, but the external benefits exceed the private benefits by a smaller degree than for mask-wearing during COVID-19).

A study in the Proceedings of the National Academy of Sciences found that "among all the strategies for reducing transmission, wearing face masks may be *the* central variable that determines the spread of the virus."[44] A study released on July 19, 2020 traced 139 patrons that were exposed to two hair stylists who were COVID-19-positive at the time, but the stylists wore masks.[45] None of the 139 patrons were infected while four of six close contacts/family members for the stylists outside of work (where no masks were worn) were infected.

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[41] *See* World Health Organization, *WHO Coronavirus Disease (COVID-19) Dashb*oard, WHO (July 20, 2020), https://covid19.who.int/.

[42] *See, e.g.*, Peter Szperling, *Should You Wear a Mask to Prevent the Spread of COVID-19?*, Ottawa News (Apr. 6, 2020), https://ottawa.ctvnews.ca/should-you-wear-a-mask-to-prevent-the-spread-of-covid-19-1.4885076. OSHA describes the idea that one of the uses of a surgical mask is to "place [the masks] on sick people to limit the spread of infectious respiratory secretions to others." Occupational Safety and Health Administration, *OSHA Fact Sheet*, OSHA (May 2009), https://www.osha.gov/Publications/OSHA3219.pdf.

[43] Without a mask, "a single cough or sneeze can produce 100,000 microdroplets, some less than 10 microns in size." In an enclosed space, without ventilation, these micro droplets can drift for 20 minutes. This increases the potential for viral spread. Douglas Broom, *This Japanese Experiment Shows How Easily Coronavirus Can Spread – and What You Can Do About It*, We Forum (Apr. 14, 2020), https://www.weforum.org/agenda/2020/04/coronavirus-microdroplets-talking-breathing-spread-covid-19/.

[44] Alice G. Walton, *Face Masks May be the Key Determinant of the COVID-19 Curve, Study Suggests*, Forbes (June 13, 2020), https://www.forbes.com/sites/alicegwalton/2020/06/13/face-masks-may-be-the-key-determinant-of-the-covid-19-curve-study-suggests/#1fb73bd56497.

[45] *See* M. Joshua Hendrix et al., *Absence of Apparent Transmission of SARS-CoV-2 from Two Stylists After Exposure at a Hair Salon with a Universal Face Covering Policy- Springfield, Missouri, May 2020*, CDC (July 14, 2020), https://www.cdc.gov/mmwr/volumes/69/wr/mm6928e2.htm.

Another study found "community mask use by well people could be beneficial, particularly for COVID-19, where transmission may be pre-symptomatic".[46] Still another large data multivariate regression approach found that "[i]n countries with cultural norms or government policies supporting public mask-wearing, per-capita coronavirus mortality increased on average by just 7.2% each week, as compared with 55.0% each week in remaining countries."[47] This same study found that lockdowns were negatively associated with mortality per capita, but that this effect was not statistically significant.[48] In mid-July of 2020, the Director of the Center for Disease Control, Dr. Robert Redfield, stated that "[i]f we could get everybody to wear a mask right now, I really do think over the next four, six, eight weeks, we could bring this epidemic under control."[49]

Health officials in the United States did not initially recommend mask-wearing for the general public, in part, due to a fear of redirecting supply away from medical professionals,[50] a concern that the public would be more likely to touch their faces while wearing a mask,[51] and an expectation that transmission was largely via viral particles on surfaces.[52] However, now, health officials universally suggest that the public wear a non-medical cloth mask when they can not socially distance themselves, especially indoors. Mask-wearing is now considered to be more important for at least four reasons: more evidence of airborne infection;[53] a high proportion of pre-symptomatic or

[46] C. Raina MacIntyre & Abrar Ahmad Chughtai, *A Rapid Systematic Review of the Efficacy of Face Masks and Respirators Against Coronaviruses and Other Respiratory Transmissible Viruses for the Community, Healthcare Workers and Sick Patients*, Int'l J. Nurs. Stud., Aug. 2020, at 1.

[47] Christopher T. Leffler et al., *Association of Country-wide Coronavirus Mortality with Demographics, Testing, Lockdowns, and Public Wearing of Masks*, MedRxIv (July 2, 2020), https://www.medrxiv.org/content/10.1101/2020.05.22.20109231v4. This effect was significant at the .001 level (which corresponds to a 99.9% confidence level). *See id.*

[48] *See id.*

[49] Fox Television Stations, *Widespread Wearing of Masks Could Get COVID-19 under Control within 4-8 Weeks, CDC Director Says*, Fox News (July 15, 2020), https://fox6now.com/2020/07/15/widespread-wearing-of-masks-could-get-covid-19-under-control-within-4-8-weeks-cdc-director-says/.

[50] *See* Elisabeth Buchwald, *U.S. Health Officials Say Americans Shouldn't Wear Face Masks to Prevent Coronavirus – Here are 3 Other Reasons Not To Wear Them*,Market Watch (Mar. 2, 2020), https://www.marketwatch.com/story/the-cdc-says-americans-dont-have-to-wear-facemasks-because-of-coronavirus-2020-01-30; Nina Bai, *Still Confused About Masks? Here's the Science Behind How Face Masks Prevent Coronavirus*, UCSF (June 26, 2020), https://www.ucsf.edu/news/2020/06/417906/still-confused-about-masks-heres-science-behind-how-face-masks-prevent. *See also* Mary Van Beusekom, *Data Do Not Back Cloth Masks to Limit Covid-19, Experts Say*, CIDRAP (Apr. 09, 2020), https://www.cidrap.umn.edu/news-perspective/2020/04/data-do-not-back-cloth-masks-limit-covid-19-experts-say.

[51] *See* Melissa Quinn, *Surgeon General Says Administration "Trying to Correct" Earlier Guidance Against Wearing Masks*, CBS News (July 12, 2020), https://www.cbsnews.com/news/coronavirus-surgeon-general-jerome-adams-wearing-masks-face-the-nation/ (providing the explanation by the U.S. Surgeon General on the reversal of the position on wearing masks).

[52] *See generally* Center for Disease Control and Prevention, *How COVID-19 Spreads*, CDC (June 16, 2020), https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/how-covid-spreads.html?deliveryName=USCDC_2067-DM31064.

[53] *See, e.g.*, Eden David & Dr. Mark Abdelmalek, *Why Scientists Think COVID-19 May Be Spread through Particles in the Air*, ABC News (July 8, 2020), https://abcnews.go.com/US/scientists-covid-19-spread-particles-air/story?id=71665634.

asymptomatic infectious people;[54] continued shortages of antigen or antibody tests;[55] and long delays in processing tests.[56] This is important, because "this will help people who may have the virus and do not know it from transmitting it to others."[57] Recent scientific evidence supporting mask-wearing is voluminous.[58]

The effectiveness of mask mandates is likely also influenced by the manner by which localities and their law enforcement choose to effectuate and enforce such mask mandates. States have varied in their enforcement of mask mandates.[59] For example, in Florida, the Miami-Dade Police Department has "cited hundreds of businesses and individuals for not following face mask rules, and the county has collected nearly $300,000 in fines."[60] On the other hand, in Austin, Texas, the police department rarely levies fines, although fines can potentially be as high as $2000 per day for individuals.[61] Many department leaders have said that "punishing people for not wearing masks – which have come to symbolize the pandemic's political divide – would put officers at the center of yet another fraught controversy."[62] Most police departments have focused on education rather than enforcement *per se*. Therefore, some have suggested that the mask mandate enforcement is mostly in the hands of private actors: businesses.[63]

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[54] *See* Seyed M. Moghadas et al., *The Implications of Silent Transmission for the Control of COVID-19 Outbreaks*, Proceedings of the National Academy of Sciences of the United States of America (July 6, 2020) https://doi.org/10.1073/pnas.2008373117. *See also* Lauren C. Tindale et al., *Evidence For Transmission of COVID-19 Prior to Symptom Onset*, eLife Sciences (June 22, 2020), https://elifesciences.org/articles/57149 (stating "[w[e found that the majority of incidences may be attributable to silent transmission from a combination of the pre-symptomatic stage and asymptomatic infections. Consequently, even if all symptomatic cases are isolated, a vast outbreak may nonetheless unfold.").

[55] *See* Morgan McFall-Johnsen, *The US is in the Middle of Another Coronavirus Testing Crisis – on a Far Larger Scale than Before*, Business Insider (July 10, 2020), https://www.businessinsider.com/another-coronavirus-testing-shortage-has-hit-us-2020-7.

[56] *See* Austin Kemker, *La. Experiencing Lengthy Delays in Getting COVID-19 Test Results Back*, WAFB9 (July 10, 2020), https://www.wafb.com/2020/07/10/la-experiencing-lengthy-delays-getting-covid-test-results-back/; Ken Alltucker, *'Pushing the Frontiers': Long Lines for COVID Tests, Stressed Labs Delay Results as Demand Spikes*, USA Today (July 11, 2020), https://www.usatoday.com/story/news/health/2020/07/11/covid-19-test-results-delayed-labs-struggle-cases-surge/5406936002/.

[57] U.S. Food and Drug Administration, *N95 Respirators, Surgical Masks, and Face Masks*,FDA (June7,2020), https://www.fda.gov/medical-devices/personal-protective-equipment-infection-control/n95-respirators-surgical-masks-and-face-masks%: :text=N95%20respirators%20and%20surgical%20masks%20are%20examples%20of,airborne%20particles%20and%20from%20liquid%20contaminating%20the%20face.

[58] *See, e.g.*, Center for Disease Control and Prevention, *Considerations for Wearing Cloth Face Coverings: Help Slow the Spread of COVID-19*, CDC (July 16, 2020), https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover-guidance.html#recent-studies.

[59] I am co-authoring a piece currently with Carly Gibbons, in which we detail the differing COVID-19 governmental responses by state. Further information on the scope and span of mask mandates can be studied in that article, titled *Gubernatorial Party Affiliation & COVID-19*, which will be forthcoming in an upcoming publication.

[60] Kristine Phillips, *Many Face Mask Mandates Go Unenforced as Police Feel Political, Economic Pressure*, USA Today (Sept. 16, 2020), https://www.usatoday.com/story/news/politics/2020/09/16/covid-19-face-mask-mandates-go-unenforced-police-under-pressure/5714736002/.

[61] *Id.*

[62] *Id.*

[63] *See* Carol Thompson, *Mask Up or Face a Misdemeanor: Michigan Stores Called on To Enforce Mask Rules*, Lansing State Journal (July 10, 2020), https://www.lansingstatejournal.com/story/news/2020/07/10/michigan-enforce-coronavirus-mask-misdemeanor-penalty-fine/5414862002/.

It is also difficult to estimate the optimal or efficient punishment for violation of a mask mandate when taking into consideration a general lax level of enforcement across the States.[64]

4. COSTS AND BENEFITS OF MASK MANDATES

Attempting to quantify the benefit of wearing masks is more difficult than simply recognizing the strong evidence of their ability to reduce the spread of COVID-19.[65] A model developed by the University of Washington's Institute for Health Metrics and Evaluation[66] projected (on July 10, 2020) approximately 44,800 fewer deaths in the United States by November 1, 2020, provided that 95% of the population wore masks. This reflected an incremental increase in mask use from 64% (the United States rate of mask use on July 10, 2020) to 95%.[67]

At that time, a mandatory mask mandate was estimated to be approximately four times more effective than retaining other existing mandates in terms of controlling the spread of COVID-19. On October 28, 2020, the projection was that approximately 62,800 fewer deaths would occur (by February 21, 2021) with 95% of the population engaging in mask-wearing (rather than the continued 69% of the population engaging in mask-wearing which existed on October 28, 2020).[68]

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[64] *See* Scott Tang, *Will it Work to Fine People Who Refuse to Wear a Mask?*, Market Place (Sept. 16, 2020), https://www.marketplace.org/2020/09/16/penalties-behavioral-economics-fine-people-who-refuse-wear-mask/.

[65] A sound measure of costs and benefits would carefully specify the decision and action in question, and then measure the costs and benefits associated with the decision as compared to the absence of the decision. *See*, R.H. Coase, Business Organization and the Accountant, Econ Lib (Oct.-Dec. 1938), https://www.econlib.org/book-chapters/chapter-coase-business-organization-and-the-accountant/ (stating that "[t]he first point that needs to be made, and strongly emphasized is that attention must be concentrated on the variations which result if a particular decision is taken."). ALASTAIR M. GRAY ET. AL., APPLIED METHODS OF COST-EFFECTIVENESS ANALYSIS IN HEALTHCARE (1st ed. 2001).

[66] *See* Institute for Health Metrics and Evaluation, *United States of America: COVID-19 Projections*, IHME (July 14, 2020), https://covid19.healthdata.org/united-states-of-america.This source explains that the "current projection" scenario assumes that social distancing mandates will continue to be lifted but will be re-imposed for six weeks if daily death rates reach 8 per million. The "mandates easing" scenario assumes that mandates will continue to be lifted and will not be re-imposed. The "universal masks" scenario assumes that mask wearing will reach 95% in 7 days and social distancing mandates will continue to ease but will be re-imposed for six weeks if daily death rates reach 8 per million. Mandates assumed are: "educational facilities closed, non-essential businesses closed, people ordered to stay at home, and large gatherings banned." *See id.*

[67] *See id.* This is assuming the same scenario descriptions as detailed in note 70. The 44,800 lives saved were incremental (marginal) to the increase in mask-wearing from 64% to 95%. It does not include the inframarginal benefits of mask wearing up to 64%.

[68] *See id.* This does not include the inframarginal benefits from mask wearing up to 69%.

However, easing of all mandates (but with mask-wearing at 69%) would lead to approximately 100,000 additional deaths by February 21, 2021.[69] It does appear, therefore, that compared to forecasts on July 10, 2020, variations in the other mandates (such as school closures) have become more important.

The University of Arkansas for Medical Services, College of Public Health's model of COVID-19 also considered the effects of mask use. Comparing a base case of "if conditions do not change" to "almost complete compliance with mask-wearing in public," infection rates and deaths drop by 70%.[70] Another recent study found that "the benefits of *each additional cloth mask* worn by the public are conservatively in the $3,000-$6,000 range due to their impact in slowing the spread of the virus."[71] A recent study by Goldman Sachs found that wearing masks as a partial substitute for business closures could save the United States $1 trillion.[72]

What are the costs of wearing masks? By October 2020, mask prices had dropped from levels observed earlier in the year. I estimate that the federal government could negotiate the purchase of seven double-layer cotton masks per person for less than $1.5 billion. Even this relatively-low estimate is likely not necessary, as there are already a large number of masks in the United States "market." The relevant issue is not the price of masks, but rather whether Americans will wear masks at all. There is some evidence of adverse effects caused by wearing medical-grade surgical masks and N-95 respirators (for example, headaches).

However, this literature largely focuses on N-95 respirators. There does not appear to be any meaningful scientific evidence of any dangers of wearing a non-medical grade cloth mask unless one has a pre-existing respiratory problem or claustrophobia.[73] Monica Gandhi, a professor of medicine and an infectious-disease expert at the University of California at San Francisco stated, "common surgical and cloth masks have 'zero impact' on oxygenation and quality of breathing." However, one could add another $50 billion to this analysis to account for inconvenience costs or other costs.

[69] The death forecasts as of October 28, 2020 for February 21, 2021 can be described as follows: base case/current projection = 385,610; 95% mask wearing (and continued other mandates) = 322,360; mandates eased = 485,607.

[70] *See* Fay W. Boozman, *Modeling the COVID-19 Pandemic in Arkansas*, UAMS (June 15, 2020), https://publichealth.uams.edu/search/COVID%20modeling (illustrating that this would cause cases to drop from 20,000 to 6,000 per day).

[71] Jason Abaluck et al., *The Case for Universal Cloth Mask Adoption and Policies to Increase Supply of Medical Masks for Health Workers*, SSRN (April 1, 2020), http://dx.doi.org/10.2139/ssrn.3567438.

[72] *See* Claire Gillespie, *Does Wearing a Face Mask Reduce Oxygen – and Can It Increase CO2 Levels? Here's What Experts Say*, Health (May 13, 2020), https://www.health.com/condition/infectious-diseases/coronavirus/does-wearing-face-mask-increase-co2-levels).

[73] *See* Nur Ibrahim, *Is It Dangerous to Wear a COVID-19 Protective Mask for Too Long?*, Snopes (May 8, 2020), https://www.snopes.com/fact-check/masks-dangerous-health/; Adrienne Dunn, *Fact Check: Wearing a Face Mask Will Not Cause Hypoxia, Hypoxemia or Hypercapnia*, USA Today (May 30, 2020), https://www.usatoday.com/story/news/factcheck/2020/05/30/fact-check-wearing-face-mask-not-cause-hypoxia-hypercapnia/5260106002/ (providing evidence through interviews with medical experts).

A recent article concludes that "[d]espite the public health benefits of mask usage, due to mask mandates likely being enforced discriminatorily, we advise caution against mask mandates."[74] While I can't quantify the costs of discriminatory enforcement of a mask mandate, the much higher rates of COVID-19 infection and mortality for minority populations suggest that if a cost-benefit analysis were done only for non-whites, the results would even more strongly support a mask-wearing mandate.[75] Additionally, a study (largely focusing on the costs and benefits of controlling the spread of influenza) found the benefits of 60% of the population engaging in mask-wearing to be between five and thirteen times greater than the cost.[76] I would expect much larger multipliers for COVID-19 with 95% compliance in mask-wearing.[77]

5. OPTIONS FOR "SOLVING" THE MASK WEARING EXTERNALITY ISSUE

In the presence of an infectious disease such as COVID-19, someone wearing a mask confers an external benefit on others (or alternatively, someone not wearing a mask can create external costs for others). Here I begin by discussing, in a general context, some of the ways in which externalities can be reduced. I, then, consider which of these techniques may (or may not) work for mask-wearing externalities. In a general sense, the possible externality problem "solutions" to consider are: 1) collect and disseminate information; 2) negotiation between parties; 3) pure liability (law suits); 4) taxes or subsidies; 5) having businesses decide; or 6) a government-instituted mask mandate.

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[74] *See* Robert Gatter & Seema Mohapatra, *COVID-19 and the Conundrum of Mask Requirements*, 77 Wash. & Lee L. Rev. 17 (2020).

[75] *See*, Brian P. Dunleavy, *CDC Data Highlight Racial Disparities in Spread, Scope of COVID-19 Pandemic*, UPI (July 10, 2020), https://www.upi.com/Health_News/2020/07/10/CDC-data-highlight-racial-disparities-in-spread-scope-of-COVID-19-pandemic/6211594399597/; *See also* Jonathan M. Wortham, *Characteristics of Persons Who Died with COVID-19 – United States, February 12 – May 18, 2020*, CDC (July 10, 2020), https://www.cdc.gov/mmwr/volumes/69/wr/mm6928e1.htm.

[76] *See* Shohini Mukerji et al., *Review of Economic Evaluations of Mask and Respirator Use for Protection against Respiratory Infection Transmission*, BMC Infectious Diseases (Oct. 13, 2015), https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-015-1167-6. One might suspect that part of the measured benefit was inframarginal (that is, measuring the benefit from those already wearing masks). However, in the United States, unlike some other countries, such as South Korea, there was virtually no mask-wearing by the general public. Virtually the entire measurement is marginal or incremental to the standard of 60% mask-wearing.

[77] The multiplier should be greater, because, compared to influenza, COVID-19 is more infectious, has a higher mortality rate, is physically somewhat larger (1.2 microns as opposed to 0.8 -1.0 microns), and is more likely to be trapped. Moreover, the multiplier should be greater after taking into consideration the presumption of a higher compliance rate.

Before discussing the possible solutions to the mask-wearing externality problem, it is useful to note that there is a market transaction (the purchase of masks) that I find to comprise a trivial part of the issue. Masks are now inexpensive and widely available. I argue that the absence of mask-wearing by a segment of the population in the United States, today, is not because these individuals lack masks or access to masks, but rather because they do not want to wear masks. For example, political rallies for President Trump generally provided facemasks to attendees.[78] However, the vast majority of attendees did not wear facemasks.[79] Therefore, the externality dimension of mask-wearing is not (in any meaningful way) related to a market transaction (such as the sale of masks), but rather to non-market decisions and actions by people interacting with other people, often in public places.

In Section I, I listed collection and dissemination of information as one of the ways clubs or governments may attempt to reduce the impact of externalities. There have been substantial efforts to disseminate information on the importance of mask-wearing, hand-washing, limiting the sizes of gatherings, and social distancing in reducing the spread of COVID-19. However, there is also substantial "misinformation,"[80] all of which is presented by those who are not epidemiologists or infectious disease experts.[81] Moreover, President Trump and some others in his administration have downplayed the severity of the pandemic[82] and have not encouraged mask-wearing.[83]

[78] *See, e.g.*, Courtney Subramanian & David Jackson, *Trump Campaign to Provide Temperature Checks, Face Masks to Tulsa Rally Attendees*, USA Today (June 15, 2020), https://www.usatoday.com/story/news/politics/2020/06/15/tulsa-rally-trump-campaign-provide-face-masks-temperature-checks/3191388001/.

[79] *See* J. Edward Moreno, *Most Trump Rally Attendees Opt Not to Wear Face Masks*, The Hill (June 20, 2020, 8:09 PM), https://thehill.com/homenews/campaign/503752-most-trump-rally-attendees-opt-not-to-wear-face-masks.

[80] Here, I define "misinformation" as that which is not supported by the majority of peer reviewed scientific literature.

[81] *See, e.g.*, Denis G. Rancourt, *Masks Don't Work: A Review of Science Relevant to COVID-19 Social Policy*, River Cities Reader (June 11, 2020), https://vaccinechoicecanada.com/wp-content/uploads/masks-dont-work-denis-rancourt-april-2020.pdf (written by a metals expert in physics that lost his academic position). To the layman, this could appear to be a peer-reviewed medical article. *See also*, the statements and tweets by Dr. Scott Atlas (a radiologist and former Fox News commentator, appointed as a White House Science advisor in August 2020). One of Dr. Atlas's tweets was removed by Twitter as misinformation. Cathy Bussewitz, *Twitter Blocks Tweet from Scott Atlas*, Washington Times (Oct. 18, 2020), masks/https://www.washingtontimes.com/news/2020/oct/18/twitter-blocks-scott-atlas-tweet-masks/ .

[82] *See, e.g.*, Grace Segers & Kathryn Watson, *Trump Admitted to Woodward He Downplayed Coronavirus Threat in Early Days of Outbreak*, Cbs News (Sept. 10, 2020, 11:22 AM), https://www.cbsnews.com/news/trump-woodward-book-claims-downplayed-covid-19-threat/; Juana Summers, *Timeline: How Trump Has Downplayed the Coronavirus Pandemic*, NPR (Oct. 2, 2020, 8:09 AM), https://www.npr.org/sections/latest-updates-trump-covid-19-results/2020/10/02/919432383/how-trump-has-downplayed-the-coronavirus-pandemic.

[83] *See, e.g.*, Robert Farley, *Trump Has Not Been 'Clear' in Support of Masks*, Fact Check (Sept. 25, 2020), https://www.factcheck.org/2020/09/trump-has-not-been-clear-in-support-of-masks/ .

This is likely a major cause of lower willingness to wear masks by Republicans than by Democrats.[84]

As noted in Section I, negotiations may reduce externalities when property rights are well-defined and transaction costs are low. However, disagreements exist over property rights with respect to mask wearing. A study by the Brookings Institution found that "64 percent of Americans believe that their right to not have to wear a mask or a scarf over their face is more important than reducing the likelihood of contracting the virus or spreading it to others."[85] This included a substantial portion of people who do wear a mask in public. In addition, transaction costs are extremely high. In contrast to the number of steel mills in the United States, every person is a potential "polluter" (potentially infecting other people). Moreover, the number of externality events is very large. If a person only goes out of their home twice per week to shop, and comes within less than six feet of another person ten times each trip they still have twenty incidents per week in which they might try to negotiate having other people wear masks. I expect that during the time spent in attempting to negotiate with the ten people, more than ten new people would come into the store. Others, say those forced to take public transit to work, who then work, and then make the trip back home, may be exposed to hundreds or thousands of people per week. Negotiation is simply not a viable alternative.

Next, consider a pure liability solution. In theory, if one could identify the entity that caused an infectious disease and prove liability, a pure liability solution is possible via individual lawsuits or class action lawsuits. However, except in rare circumstances, lawsuits involving infectious diseases are not successful.[86] Moreover, as noted above, a

[84] *See, e.g.*, James Joyner, *Republicans Refuse to Wear Masks*, Outside The Beltway (July 13, 2020), https://www.outsidethebeltway.com/republicans-refuse-to-wear-masks/ (stating that "[t]he one exception [to frequent mask wearing] is Republicans, among whom a majority say they wear masks infrequently — either sometimes (18%), rarely (9%) or never (27%)"). Moreover, a Gallup poll in July found that "27% of Republicans say they 'never' wear a mask outside their home, versus 1% of Democrats." *See* William Saletan, *Republican Voters Have Come Around on Masks*, Slate (July 31, 2020), https://slate.com/news-and-politics/2020/07/republicans-masks-coronavirus-polls.html. Another contributing factor may be differences in the level of trust in science between the political parties. *See* Felix Richter, *Has Trust in Science Become a Partisan Issue?*, Statista (Oct. 21, 2020), https://www.statista.com/chart/23248/trust-in-scientists-by-political-leaning/.

[85] Korin Miller, *Many Americans Say It's 'Their Right' Not to Wear a Mask. Experts Say it's a 'Threat' to the Country*, Yahoo! Life (Sept. 1, 2020), https://www.yahoo.com/lifestyle/many-americans-right-not-to-wear-mask-experts-say-threat-country-193153762.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuYmluZy5jb20v&guce_referrer_sig=AQAAAN6fF1FSy776JN-9Oa3FWoYO5posx7meGO_2uAooxrghjWUi55ACf7_2BxQAgy3NBeTXuxXaaMTvmjnnwT204PBsAg7Lv2ioH-EutVITtoeHPDtaYY3W_GZmoqXQ5rFRA-_HrFkakTYGlNO1UOdbJTYTfRlfCntccbHWhHyCgTRv.

[86] One of the rare exceptions involves HIV and STD criminal laws. During the early years of the HIV epidemic, several states implemented HIV-specific criminal exposure laws that applied even to behaviors that could not transmit HIV and applied regardless of actual transmission. *See HIV and STD Criminal Laws*, Centers For Disease Control And Prevention, https://www.cdc.gov/hiv/policies/law/states/exposure.html (last visited Dec. 21, 2020).

high proportion of the population that is infected are pre-symptomatic and asymptomatic. They have no knowledge of their infection and proving the source of one's infection will be virtually impossible.

It may also be possible to use a subsidy (a "carrot" rather than a "stick") to deal with an externality. One could theoretically consider taxing those not wearing a mask or subsidizing those wearing a mask (similar to the subsidies provided for immunizations).[87] There are three key differences between mask-wearing and immunization externalities. First, the cost of a mask is trivial. On the other hand, the cost of immunization can be meaningful to some people, especially low-income people. This means that subsidizing the market transaction of purchasing an immunization may be effective, but it is irrelevant for mask wearing. Second, in a lifetime, a parent may schedule a half dozen childhood immunizations. In contrast, many people may make a choice to put on (or not put on) a mask a dozen times a day. It is far more difficult to monitor mask-wearing than childhood immunization. Similarly, someone cannot "take off" an immunization. In addition, one of the studies that suggested subsidizing immunizations was often superior to mandated immunizations also found that when the interest rate was zero or when deficit spending was employed (such that future period tax payers would finance the program), government mandatory immunization was superior.[88] These findings approximate the current conditions through actions by the United States Federal Reserve Bank. As a practical matter, attempting to subsidize mask wearing, or tax those not wearing masks, is simply not practical.

There is a body of literature addressing free-riding (where the free-rider receives benefits but does not contribute to reducing a problem as mentioned in Section I). Some studies indicate that free-riders were less of a problem than logic and economics would suggest they should have been.[89]

[87] Childhood immunizations have been subsidized for many years in the United States as a method by which to reduce the externality problem associated with unvaccinated individuals. For a simple description, *see* JJAMES W. HENDERSON, HEALTH ECONOMICS AND POLICY 77 (5th ed. 2012). *see also* Feldstein, *supra* note19, at 371. Modern immunizations include: Hepatitis B, Rotavirus, Diphtheria, Pertussis and Tetanus (DTaP), Pneumococcal disease, Polio, Influenza, Varicella (chickenpox), MMR measles, Rubella, Mumps; Measles; and Meningococcal disease. *See generally, Vaccine History: Developments by Year*, CHILDREN'S HOSPITAL OF PHILADELPHIA https://www.chop.edu/centers-programs/vaccine-education-center/vaccine-history/developments-by-year (last updated Mar. 30, 2021); *see also Childhood Immunizations in the United States*, WIKIPEDIA, https://en.wikipedia.org/wiki/Childhood_immunizations_in_the_United_States (last visited May 19, 2021, 1:09 PM).

[88] *See* Pierre-Yves Geoffard & Tomas Philpson, *Disease Eradication: Private Versus Public Vaccination*, 87 AM. ECON. REV. 222, 227 (1997).

[89] *See, e.g.*, Bohm, *supra* note 18; Marwell & Ames, *supra* note 18; Sweeney Jr., *supra* note 18; Smith, *supra* note 18; Booth, *supra* note 18.

This implies that less intrusive approaches may be superior. In contrast, there is literature that indicates that economic agents behave as expected in the face of free-rider opportunities or external costs.[90] The implications that stem from the free-rider literature are mixed.

One approach could be to allow individual businesses to decide whether to require masks. This could lead to voluntary separation into two societal groups: mask-wearers and non-mask-wearers.[91] Unfortunately, many businesses would be unable to survive with only a portion of the total consumers. This is particularly true during the pandemic. Moreover, in many areas, there may be only one practical business location alternative for customers, particularly in low-income areas, urban-commercial islands, and in rural areas.

I believe, as a practical matter, mask mandates aimed to help to reduce the spread of COVID-19 are economically valid for the following reasons. First, the evidence of mask effectiveness is overwhelming. Second, a mask mandate may eliminate the need for more draconian measures, such as business closures, and masks are far more cost-effective than such measures. Third, one survey found that 82% of Americans supported a national mask mandate.[92] Other surveys suggest that the majority of Americans are in favor of mask mandates with penalties for those who do not comply and that this proportion is higher than those who actually wear masks.[93] This is consistent with a concept of Americans recognizing the potential for free-riders; the percentage support for mask-wearing appears to be higher when there is a mandatory mechanism to reduce free-riders.

Fourth, with approximately 325 million Americans over the age of five years, and with such Americans often coming into close contact with others several times a day, the number of potentially-infectious events (literally billions per day) makes non-mandatory mechanisms simply impractical.[94]

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[90] *But see, e.g.*, Kim & Walker, *supra* note 18. Charles R. Plott, Externalities and Corrective Policies in Experimental Markets, 93 Econ. J. 106 (1983) (stating that "[w]ithin the simple setting explored here, the traditional models found in the economics literature are amazingly accurate.").

[91] There would still need to be rules for public places, including public transit.

[92] Gabriela Schulte, *Poll: 32 Percent of Voters Support a National Face Mask Mandate*, The Hill (Aug. 3, 2020), https://thehill.com/hilltv/what-americas-thinking/510317-poll-82-percent-of-voters-support-a-national-mask-mandate. *See also* Brian Yermal Jr., *Nearly 3 in 4 Voters Support State Face Mask Mandate with Penalties For Those Who Don't Comply*, Morning Consult (July 22, 2020, 6:00 AM), https://morningconsult.com/2020/07/22/face-mask-polling/ (stating that 86% of Democrats support a mandate in their State that could result in a fine or jail time for people who don't wear masks, while 58% of Republicans also back such a measure and 35% opposing it).

[93] *See e.g.* sign.com, *Fines or Not Wearing a Mask* (July 29, 2021), https://www.signs.com/fines-for-not-wearing-a-mask/.

[94] In contrast, childhood vaccinations occur a small number of times in a person's life (depending on the diseases targeted).

CONCLUSION

The existence of an externality is one of the few potentially-valid rationales for government intervention in the affairs of business and citizens. The scientific evidence is overwhelming that mask-wearing can be effective in reducing the spread of COVID-19. The benefits of someone wearing a mask are largely external (the benefits accrue beyond the person deciding to wear a mask). The externality effect would occur even if masks only protected the wearer, but it is particularly strong since masks are better at stopping outbound viral spread (my mask protects you) than stopping inbound viral spread (my mask protects me). I find government-ordered business closures and stay-at-home orders far more onerous than mandatory mask orders. I estimate the cost per life saved via business closures and stay-at-home orders may be at least twenty times greater than mask-wearing. Moreover, surveys suggest a relatively high rate of proportion of Americans favor mandatory mask mandates with enforcement, and such preference is higher than the degree to which the population actually wears masks. I also find that non-mandatory methods of encouraging mask-wearing are largely impractical and insufficient to better "solve" (or at least reduce) the externality problem.