Can Not Wanting to Wear a Mask be Rational?

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9 November 2021

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by

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I thank the Editor John P. Conley and two anonymous referees for their helpful comments on a previous version of this note. In addition, I acknowledge financial support from the Gosnell endowment at RIT. The usual disclaimer applies.

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Abstract

I answer the question in the title by analyzing an office environment in which $n \in \mathbb{N}$ individuals work together in an enclosed area. The ith worker wears his mask for h_i hours per day and this action involves a disutility. His health benefit from wearing a mask depends on how his mask wearing compares with the mask wearing of his co-workers. In this setting, I first compute the symmetric Nash equilibrium that describes the optimal number of hours of mask wearing by each worker. Second, I compute the Pareto efficient level of mask wearing on the part of the n workers. Finally, I explain why there is excessive mask wearing in the Nash equilibrium and then point out that it can indeed be rational to not want to wear a mask.

Keywords: Mask, Nash Equilibrium, Pareto Efficiency, Rat Race

JEL Codes: I12, I31

1. Introduction

The work of Chaplin (2020) and Batabyal and Beladi (2022) tells us that the cause of the severe acute respiratory syndrome or SARS-like illness that subsequently became known as Covid-19 was a novel coronavirus, in particular, the SARS-CoV-2. On 30 January 2020, Covid-19 was declared by the World Health Organization (WHO) to be a Public Health Emergency of International Concern (PHEIC). The first case of Covid-19 arising from local, person-to-person spread in the United States (U.S.) was confirmed in mid-February 2020. On 11 March 2020, the WHO declared Covid-19 a pandemic.

Before the arrival of the various vaccines that are now being routinely used to inoculate citizens against Covid-19, the U.S. Centers for Disease Control (CDC) and other health agencies recommended the large-scale wearing of masks by citizens.[3] The logic behind wearing masks is straightforward. Wearing masks can help communities slow the spread of Covid-19 when worn consistently and correctly by a majority of people in public settings.[4] Put differently, wearing a mask protects not only the person wearing the mask but also those nearby.

Despite the existence of these health benefits, many people in the U.S.---sometimes called anti-maskers---are opposed to wearing masks. As noted by McKelvey (2020), some anti-maskers do not want to wear masks because they believe that being asked or required to do so would be an infringement of their personal freedoms and, more generally, their civil liberties. Others, as pointed out by Gillespie (2021), believe that by not wearing a mask, they are in control, and still others are simply in denial.

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Go to https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/coronavirus-mask/art-20485449 for more details on this point. Accessed on 12 July 2022.

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Go to https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html for additional details on this point. Accessed on 12 July 2022.

This state of affairs raises the following salient question: From an economic standpoint, *can* it be rational to not want to wear a mask? Although economists have done some work on the impacts of mask wearing,[5] to the best of my knowledge, there is *no* research on the potential rationality of not wanting to wear a mask. Therefore, the objective of this note is to answer the above question.

The remainder of this note is organized as follows: Section 2.1 presents the model in which I focus on an office environment populated by $n \in \mathbb{N}$ individuals who work together in an enclosed setting. The ith worker wears his mask for $h_i \geq 0$ hours per day and this action involves a disutility. His health benefit from wearing a mask depends on how his mask wearing compares with the mask wearing of his co-workers. Section 2.2 computes the symmetric Nash equilibrium that delineates the optimal number of hours of mask wearing by each office worker. Section 2.3 calculates the Pareto efficient level of mask wearing by the n workers and then points out that it can indeed be rational to not want to wear a mask. Section 3 concludes and then suggests two extensions of the research described in this note.

2. Mask Wearing in an Office

2.1. The theoretical framework

Consider an office environment in which $n \in \mathbb{N}$ individuals work together in an enclosed area. *Ceteris paribus*, these individuals prefer not wearing a mask to wearing a mask. The manager of this office has not put a mask mandate in place but the n workers are strongly encouraged to wear masks to keep themselves and their fellow workers safe from being infected by the coronavirus.

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See Karaivanov *et al.* (2020) and Kahane (2021) for more on this research.

In this setting, suppose that worker $i, i = 1,2, \dots, n$, decides to wear a mask for $h_i \geq 0$ hours per day to keep himself and his fellow workers safe. However, because workers do not like wearing masks, the decision to wear a mask for h_i hours per day gives rise to a disutility that can be described by the quadratic function $h_i^2/2$. The ith worker's health benefit from wearing a mask depends on how his mask wearing compares with the mask wearing of his fellow workers. To this end, let the ith worker's utility from mask wearing be described by the function $u(h_i/\hat{h})$ where $\hat{h}$ denotes the mean number of hours of mask wearing by all the workers in our office environment. Mathematically, this means that $\hat{h} = (1/n) \sum_{i=1}^{n} h_i$. Finally, I assume that the utility function $u(\cdot)$ is an increasing and concave function.

With this description of the theoretical framework out of the way, let me now compute the symmetric Nash equilibrium that describes the optimal number of hours of mask wearing by each office worker.

2.2. The symmetric Nash equilibrium

In a symmetric Nash equilibrium, each worker's choice of the number of hours during which he will wear a mask maximizes his utility given the mask wearing choices of the other workers in the office. Let me denote the total number of hours of mask wearing by all the workers except the ith worker by H. Then, it is clear that $\hat{h} = (1/n)\,(h_i + H)$. Using this notation, I can write the net utility function of the ith worker or $U(\cdot)$ as

$$U = u\left\{\frac{h_i}{\hat{h}}\right\} - \frac{h_i^2}{2} = u\left\{\frac{h_i}{(1/n)(h_i+H)}\right\} - \frac{h_i^2}{2}. \qquad (1)$$

The first-order necessary condition for the optimal number of mask wearing hours h_i is given by[6]

$$\frac{\partial U}{\partial h_i} = \frac{\partial u}{\partial\left[\frac{h_i}{(1/n)(h_i+H)}\right]}\left\{\frac{(1/n)(h_i+H)-(1/n)h_i}{[(1/n)(h_i+H)]^2}\right\} - h_i = 0. \quad (2)$$

In a symmetric equilibrium, I must have $h_i = h, \forall i$ and therefore $H = (n-1)h$. Using these two results to simplify equation (2), I get

$$\frac{n-1}{nh}u'(1) - h = 0. \quad (3)$$

Rewriting equation (3), I obtain

$$u'(1) = \frac{nh^2}{n-1} \Rightarrow h^* = \sqrt{\frac{(n-1)u\prime(1)}{n}}. \quad (4)$$

Equation (4) gives me an explicit expression for the symmetric Nash equilibrium number of hours of mask wearing or h^* that I seek. In this equilibrium, the optimal number of hours of mask wearing or h^* is the square root of a ratio function that depends on the total number of workers n and on the derivative of the utility function $u'(1)$. I now calculate the Pareto efficient level of mask wearing on the part of the n workers.

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It is straightforward to check that the second-order sufficiency condition is satisfied.

2.3. Pareto efficient mask wearing

To determine the Pareto efficient number of hours of mask wearing, I need to maximize the sum of the utilities of the individual workers. Now, invoking the notion of symmetry, this means that the Pareto efficient level of mask wearing is the solution to

$$max_{\{h\}} nU = n\left\{u(1) - \frac{h^2}{2}\right\}. \tag{5}$$

The partial derivative of the nU function with respect to h is given by

$$\frac{\partial(nU)}{\partial h} = -nh < 0. \tag{6}$$

The derivative in equation (6) is negative for *any* positive value of h. This tells me that the Pareto efficient number of hours of mask wearing by an individual worker is $h = 0$. I now explain the rationale for this stark result.

2.4. Discussion

The result in equation (6) arises because in the model I am analyzing, the decision to wear a mask is like participating in a *rat race*. As pointed out by Bardsley *et al.* (2013, p. 218), "the term rat race…[describes] situations in which an individual is enticed to overwork and where rents from this work are dissipated."

In the model of this note, the health benefit to an individual worker comes from wearing a mask for a *longer* period of time relative to how long the other workers are wearing their masks. That said, wearing a mask for a longer period of time is costly in terms of the disutility that it generates. Therefore, if all the n workers wear their masks for a longer time period, then they all lose. As a result, it is Pareto efficient to *not* wear a mask at all. In other words, there are circumstances in which not wanting to wear a mask *is* rational.

At this stage, it is important to emphasize the following five points. First, consistent with the title of this note, my primary goal here is to construct and analyze a straightforward microeconomic model and thereby demonstrate that circumstances exist in which it *can* be rational to not want to wear a mask. Second, my objective is *not* to show that not wanting to wear a mask is, in general, a sound course of action. To demonstrate such a result, at the very least, one would have to work with a *dynamic* model in which how mask wearing influences the transmission rate of Covid-19 is explicitly accounted for. When this is done, it is *possible* that we will find ourselves in a situation in which the number of hours during which an individual optimally ought not to wear a mask is *less* than the number of hours in a work day. As a referee has pointed out, one reason why this might happen is that there is a tradeoff between the positive benefits and the disutility form mask wearing in which the "disutility effect" dominates the "positive benefits" effect potentially because the relevant individuals either do not wear their masks correctly and/or wear cloth masks instead of wearing the more effective KN95 and N95 masks.

Third, in my static model, I *have* accounted for the health benefits of mask wearing in the utility function given by $u(h_i/\hat{h})$. I have *not* accounted for the "rate of disease transmission" because a rate is inherently a *dynamic* concept and my model is, as I have just pointed out, static. Fourth, even in a static model such as the one I have been working with here, if I were to focus on an *asymmetric* Nash equilibrium then I could not use the simplifying results that $h_i = h, \forall i,$ and that $H = (n-1)h$ and, as such, my section 2.2 results would be different. Finally, if I were to model mask wearing among workers in a way so that a worker's health benefit from wearing a mask depends on the absolute number of hours during which he wears a mask and *not* on how his mask wearing compares with the mask wearing of his fellow workers, then too my section 2.2 findings would change.

3. Conclusions

In this note, I studied an office environment in which $n \in \mathbb{N}$ individuals worked together in an enclosed area. The ith worker wore his mask for h_i hours per day and this action generated a disutility. His health benefit from wearing a mask depended on how his mask wearing compared with the mask wearing of his co-workers. In this setting, I first computed the symmetric Nash equilibrium that delineated the optimal number of hours in a day during which a mask ought to be worn by each worker. Second, I determined the Pareto efficient level of mask wearing on the part of the n workers. Finally, I explained why there was excessive mask wearing in the Nash equilibrium and then pointed out that it can be rational to *not* want to wear a mask.

The analysis conducted in this note can be extended in a number of different directions. Here are two possible extensions. First, it would be useful to study how the presence of a mask mandate with imperfect enforcement affects the decision to wear a mask by the office workers. Second, it would also be instructive to analyze a scenario in which the existence of a mask mandate results in some workers quitting their jobs so that they do not have to wear a mask. Studies of mask wearing that incorporate these aspects of the problem into the analysis will provide additional insights into how individuals trade off the health benefit from wearing a mask with the diminution in freedom that mask wearing entails.

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