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The Welfare Economics of Infectious Happiness

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Abstract

We summarise evidence for infectious happiness, exploring implications for a number of welfare issues: labour oversupply due to relative income effects, altruistic donation, public goods contribution. Awareness of infectiousness is welfare-improving, but not first-best optimal. Government intervention remains potentially beneficial.

Keywords: income, happiness, infectiousness, donation, labour
JEL: B5, D1, D6, H4, J2, N3

1. Introduction

There is emerging evidence that happiness is infectious. This has potentially important policy implications. Rather than attempt to summarise the voluminous happiness economics literature here, we will indicate some of the best review articles, only mentioning those results which are directly relevant. From section 2 onwards, our main task is to present a model which enables an analysis of the interaction between infectious happiness and the relative income effects explored in the existing literature.

The inception of happiness economics began with Easterlin, who examined the puzzle that reported levels of individual life satisfaction are positively related to income, yet there is no long run correlation between per capita GDP and happiness [3]. It is now widely accepted that the solution to the "Easterlin paradox" requires a happiness function which depends positively upon actual income and negatively upon the reference income of a comparison group (possibly local, national or international) [1] [6]. (Similar group-relative effects occur with other dimensions such as leisure, training or health [7].) If we interpret such happiness functions as directly motivating economic behaviour, one of the key implications is that individuals will oversupply labour in a decentralised equilibrium.

The possible infectiousness of happiness has only recently been investigated. A 20 year psychological study found that subjects' reported happiness was positively related to others', with the effect being strongest for workmates, neighbours and family members [4]. This empirical evidence is tentative, in particular due to the fact that hidden common factors may create a spurious observed infectiousness effect [2]. An unpublished study, using data from Chinese villages and an IV approach, also found evidence of infectious happiness [5]. Most recently, a study using an alternative IV found no evidence for the phenomenon within geographic and occupational groups in the United Kingdom [7]. However, one might still expect infectious happiness to be more likely in smaller more intimate groups.

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We examine the implications of infectious happiness for a number of key results in welfare economics. The consequences depend crucially upon the assumptions. Firstly, should the infectiousness externality be included in the SWF? We choose to do so, finding the social optimum by maximising the happiness of a representative individual, incorporating all infectiousness and relative income externalities. Secondly, are happiness-maximising agents aware of infectiousness? We initially assume that this is not so, since it seems plausible that some or most of the infectiousness effect is unconscious. We then consider the impact of conscious infectiousness[1].

2. Multiplier Effects

Take a group of N individuals, each with happiness H_i specified as:

$$H_i = \alpha Y_i - \gamma \bar{Y}_i - \delta L_i + Z_i + \beta \bar{H}_i \tag{1}$$

$Y_i = \ln(y_i)$ is the logarithm of individual i's income. $\bar{Y}_i = \bar{y}_i = \frac{1}{N-1} \sum_{j \neq i}^{N} \left[y_j \right]$ is the average income of all other individuals.[2] L_i is individual i's labour supply. $\bar{H}_i = \frac{1}{N-1} \sum_{j \neq i}^{N} \left[H_j \right]$ is the average happiness of all other individuals. Z_i includes all other determinants of happiness.

In order to establish that the aggregate multiplier effect will be finite and well-defined, we need to find expressions for $\frac{dH_i}{dZ_i}$ and $\frac{dH_i}{dZ_j}$ (where $j \neq i$), the total derivatives of own happiness and others' happiness with respect to an increase in Z, accounting for multiplier effects. Totally differentiating (1) yields:

$$\frac{dH_i}{dZ_i} = 1 + \beta \frac{d\bar{H}_i}{dZ_i} = 1 + \frac{\beta}{N-1} \sum_{j \neq i}^{N} \left[\frac{dH_j}{dZ_i} \right] \tag{2}$$

$$\frac{dH_i}{dZ_j} = \beta \frac{d\bar{H}_i}{dZ_j} = \frac{\beta}{N-1} \left(\frac{dH_j}{dZ_j} + \sum_{k \neq i,j}^{N} \left[\frac{dH_k}{dZ_j} \right] \right) \tag{3}$$

By symmetry, we can assume $\frac{dH_k}{dZ_j} = \frac{dH_j}{dZ_i} = \phi$ and $\frac{dH_i}{dZ_i} = \frac{dH_j}{dZ_j} = \psi$, so (2) and (3) become:

$$\psi = 1 + \beta\phi \qquad \phi = \frac{\beta}{N-1} \left(\psi + (N-2)\phi \right) \tag{4}$$

Solving (4) simultaneously yields:

$$\phi = \frac{\beta}{(1-\beta)(N-(1-\beta))} \qquad \psi = \frac{(1-\beta)(N-1)+\beta}{(1-\beta)(N-(1-\beta))} \tag{5}$$

From (5), provided $N \geq 2$ and $0 < \beta < 1$, ϕ and ψ are both positive and finite. It is also always the case that $\phi < \psi$. This means that the impact on individual i's happiness from an increase in their own Z_i is always greater then the impact from an increase in another's Z_j. As $\beta \longrightarrow 1^-$, $\phi \longrightarrow \infty$ and $\psi \longrightarrow \infty$. The multiplier effect therefore only remains non-explosive when $\beta < 1$. Both ψ and ϕ are increasing in β,[3] showing that increased infectiousness causes an increased multiplier effect.

[1] By "conscious infectiousness" we mean a positive happiness spillover of which agents are aware, thus operating in a manner analogous to altruism. Empirical evidence for altruism will generally therefore be consistent with the existence of conscious infectiousness.

[2] Note that having each individual's marginal happiness decreasing in own income but constant in average income of others gives the simplest formulation in which individuals will work finite amounts and also potentially make finite donations to others.

[3] The derivatives with respect to β are respectively $\frac{d\phi}{d\beta} = \frac{N-1+\beta^2}{(1-\beta)^2(N-1+\beta)^2}$ and $\frac{d\psi}{d\beta} = \frac{\beta((2-\beta)(N-1)+\beta)}{(1-\beta)^2(N-1+\beta)^2}$, which are both unambiguously positive.

3. Happiness Gain From Infectiousness

It is possible to calculate how much of the average individual's happiness is due to the aggregate infectiousness effect. Assuming an individual with average happiness $\bar{H}$ and who, with infectiousness absent, would also have happiness equal to the group average $\bar{V}$, we get:

$$\bar{H} = \psi\bar{V} + \phi\sum_{j\neq i}^{N}[\bar{V}] = (\psi + (N-1)\phi)\bar{V} = \frac{1}{1-\beta}\bar{V} \tag{6}$$

So, average happiness is increased by a factor of $\frac{1}{1-\beta}$ through infectiousness, and the proportion of individual happiness which is due to infectiousness is β. The percentage increase in happiness due to infectiousness will be $(100)\left(\frac{\beta}{1-\beta}\right)\%$. Given empirical estimates for β of roughly 0.3 to 0.33 [5], the implied increase in average happiness is therefore in the range of 43-50%.

4. Excess Labour Supply

The excess labour supply effect continues to hold equally strongly with infectious happiness. At first sight it might seem that infectious happiness provides a positive externality from additional income earned by each individual which could offset the negative relative income externality. This is however not so because although infectiousness increases the marginal social benefit from increased earned income, it also increases the marginal social cost proportionately, since both the happiness from income and the loss of happiness from work go through the multiplier. Similarly, the marginal 'envy' effects are also scaled. Thus, the mere presence of the multiplier (without consciousness of it) cannot neutralise the relative income externality.

If happiness-maximising individuals are unaware of infectiousness, then $\bar{H}_i$ from (1) will be constant, and will drop out in the FOC. Setting $\frac{dy_i}{dL_i} = w$ (where w is the real wage), and totally differentiating (1), gives us:

$$\frac{dH_i}{dL_i} = w\frac{\alpha}{y_i} - \delta = 0 \tag{7}$$

This can be rearranged to give the privately optimal earned income level y°:

$$y^\circ = \frac{w\alpha}{\delta} \tag{8}$$

The socially optimal outcome can be found by taking a representative individual's happiness and internalising the relative income and infectious happiness externalities by altering all individuals' income simultaneously:

$$\frac{dH}{dL} = \psi\left(w\frac{\alpha}{y} - w\gamma - \delta\right) + \phi(N-1)\left(w\frac{\alpha}{y} - w\gamma - \delta\right) = 0 \tag{9}$$

$$y^* = \frac{w\alpha}{\delta + w\gamma} \tag{10}$$

There is excessive earned income, with the inefficiency increasing in the relative income coefficient γ. Note that (8) and (10) are independent of β. The levels of privately and socially optimal labour supply would be the same with $(0 < \beta < 1)$ or without $(\beta = 0)$ infectious happiness.

5. Conscious Infectiousness

If individuals were to became aware of the infectiousness externality, they would recognise the indirect impact of their actions on their own happiness through changes in others' happiness. They would work less than if there were no

infectiousness effects.[4] Conscious infectiousness would also lead to higher individual contributions to a group public good[5] and to altruistic transfers from rich group members to poorer ones[6]. Awareness of infectiousness would be happiness-increasing, but would not yield the first-best level of happiness.

The policy problems posed by excess labour supply and the underprovision of public goods would remain even in a world of conscious infectiousness, but would be less severe with greater infectiousness. A smaller reference group would alleviate the excess labour supply inefficiency and incentivise redistributive donation (though when providing a public good it would be inefficient to exclude any of those who benefit from it from the reference group). These results clearly have broader relevance in shedding light upon the easier co-operation in small "tight-knit" groups relative to larger more disparate ones.

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[4] Assume that individuals are aware of infectiousness effects, and incorporate them into their own-happiness maximisation decision. Totally differentiating (1), using (5), gives the following FOC:

$$\frac{dH_i}{dL_i} = \psi\left(w\frac{\alpha}{y_i} - \delta\right) + \phi\left(-\frac{w}{N-1}\sum_{j\neq i}^{N}[\gamma]\right) = 0 \tag{11}$$

Solving (11) yields the following for privately optimal earned income:

$$y^{\circ} = \frac{w\alpha}{\delta + w\frac{\phi}{\psi}\gamma} \tag{12}$$

$\frac{\phi}{\psi} = \frac{\beta}{(1-\beta)(N-1)+\beta}$ is increasing in β, decreasing in N and is positive but less than 1. There is always some 'overwork' but a higher β and smaller N can partially offset the inefficiency. The intuition is that since the infectiousness effect depends upon the *average* happiness of the other group members, a larger group dilutes the internalisation of the relative income externality. As β increases, y° becomes closer to the social optimum. However, only as $\beta \longrightarrow 1^{-}$ will y° become first-best. Given $\beta < 1$, as $N \longrightarrow \infty$ the outcome becomes just as inefficient as with no infectiousness. This is because for large N the relative income effect on each individual becomes negligible.

The intuition for why the infectious happiness effect is never sufficient to fully offset the relative income externality can also be seen from the fact that both ψ and ϕ are increasing in β. Although as $\beta \longrightarrow 1$, $\phi \longrightarrow \psi^{-}$, both ψ and ϕ also simultaneously go to infinity. As long as $\phi < \psi$, the weighting on each other individual in an individual's happiness function remains less than that on oneself.

[5] We assume that each individual can contribute one unit of a public good with one unit of labour supply, and that one unit of the public good contributes one unit of income to *every* individual. Letting G_i be the individual contribution to the public good, setting $\frac{dL_i}{dG_i} = 1$ and $\forall j : \frac{dy_j}{dG_i} = 1$, since $\forall i : y_i = y$ in a symmetric equilibrium we have the following FOC:

$$\frac{dH_i}{dG_i} = \psi\left(\frac{\alpha}{y_i} - \gamma - \delta\right) + \phi\left(\sum_{j\neq i}^{N}\left[\frac{\alpha}{y_j} - \gamma\right]\right) = 0 \qquad y^{\circ} = \frac{\alpha\left(1 + \frac{\phi}{\psi}(N-1)\right)}{\gamma\left(1 + \frac{\phi}{\psi}(N-1)\right) + \delta} \tag{13}$$

The FOC for socially efficient provision, meanwhile, will be (using a representative individual's happiness function, denoting the simultaneous contribution by G):

$$\frac{dH}{dG} = (\psi + \phi(N-1))\left(\frac{N\alpha}{y} - N\gamma - \delta\right) = 0 \qquad y^{*} = \frac{\alpha N}{\gamma N + \delta} \tag{14}$$

Since $\left(1 + \frac{\phi}{\psi}(N-1)\right) = \frac{(N-1)+\beta}{(1-\beta)(N-1)+\beta}$ is always less than N and increasing in β and N, there is always underprovision, but the inefficiency is ameliorated as the infectiousness of happiness and reference group size increases (since y^{*} now depends upon N the best way to put this is that the equilibrium is most efficient if the reference group includes *all* individuals who benefit from the public good). The first-best outcome is only achieved as $\beta \longrightarrow 1^{-}$.

[6] Allowing individual i to transfer income to individual j by letting $\frac{dy_i}{dy_j} = -1$, and totally differentiating the expression for H_i from equation (1) using (5), gives the following FOC for an altruistic transfer from individual i to individual j that maximises i's utility.

$$\frac{dH_i}{dy_j} = \psi\left(-\frac{\alpha}{y_i} + \frac{\gamma}{N-1}\right) + \phi\left(\frac{\alpha}{y_j} - \frac{\gamma}{N-1}\right) = 0 \tag{15}$$

(15) can be rearranged to yield the following:

$$\frac{y_i}{y_j} = \frac{\psi}{\phi}\left(1 - \frac{\gamma}{\alpha(N-1)}y_i\right) + \left(\frac{\gamma}{\alpha(N-1)}y_i\right) \tag{16}$$

Since $\frac{\psi}{\phi} > 1$, then provided that $y_i < \frac{\alpha(N-1)}{\gamma}$, it will be the case that $\frac{y_i}{y_j} > 1$. Under this condition, since $\frac{\psi}{\phi} = \frac{N-1}{\beta} - (N-2)$, the ratio of income of the donor (i) to the donee (j) is increasing in N and decreasing in β. Altruistic giving will be greater, and income ratios closer to equal, the smaller is the group and the higher is β. As $\beta \longrightarrow 1^{-}$, $\frac{\psi}{\phi} \longrightarrow 1$ and $\frac{y_i}{y_j} \longrightarrow 1$.

When $\beta < 1$, as $N \longrightarrow \infty$, $\frac{y_i}{y_j} \longrightarrow \infty$, so the incentive for giving is diluted in a large group.

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