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Your Money or Your Time: Pricing, Queuing and Merit Good Egalitarianism

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Abstract:

We ask whether the objective of egalitarian allocation of a merit good could be achieved by making the good available at multiple outlets charging different money and time prices. Differential pricing could separate high and low wage buyers across outlets, and proportional allocation of supply could ensure that consumption is made independent of income, but dependent on relative strength of preference for the good. Thus, the standard efficiency costs of allocation by time are reduced. We find that differential pricing can achieve egalitarian distribution if preferences are homogenous and labour supply is upward sloping. Slight deviations occur if labour supply is backward bending, or preference for the merit good relative to other goods varies across the population.

Economic Keywords: queuing, egalitarianism, allocation by time

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1. Introduction

When it comes to society's concern over consumption inequality, some goods are definitely more equal than others. As Tobin (1970) observed, our general willingness to accept inequality is tempered for commodities essential to life and citizenship, such as voting, government services, basic health care and food, and early education. By and large, economists recommend that most distributional concerns can be met at least cost by redistributing income from rich to poor, and then allowing market prices to allocate resources to their most valued uses.

Nonetheless, Western societies have been persistently reluctant to abandon specific commodity subsidies and price ceilings, whether it be food stamps in the United States, compulsory public health care provision in Canada, or even tickets for key sporting events (Rosen, 2002). These policies have endured even when shortages or long queues result. Why? At a pragmatic level, governments may not be able to determine who is "truly" in need of income transfers, or the costs of such transfers in administration or work disincentives may be prohibitive. At a more profound level, however, goods subsidies and price ceilings may persist because of a value that Tobin (1970) coined *specific egalitarianism*. So, for example, Canadians may not desire to maximize the social welfare of the poor, but only ensure that they have the same access to health care as the rich (Romanow Commission, 2002). Rationing scarce health services by queues rather than price seems acceptable from this view, because time is more equally distributed than human capital and income (Nichols et al. 1971).

If economists were to consider specific egalitarianism as an objective, an interesting question remains as to how it could be achieved at least cost. This paper will consider an allocation mechanism that can achieve specific egalitarianism without forcing everyone to queue, and without requiring policy makers to identify who can and cannot afford to pay. We propose that a 'merit' good of concern could be made available through multiple outlets that ration by different combinations of price and time. A policy maker, by choosing the distribution of the good and its money (or time) price across outlets, can ensure than individuals self-select outlets by their earning capacity. Those with a relatively high earnings capacity will choose outlets that ration more by price than by time, and vice versa. Under conditions we identify, individuals with an identical strength of preference for a merit good will purchase the same amount regardless of income, while those who value it more highly relative to other goods will purchase more than those who value it less.

The layout of the paper is as follows. Section 2 provides a review of the literature on the distributional and efficiency aspects of queuing as an allocation mechanism. Section 3 provides a formal model of our allocation mechanism when preferences for the merit good are homogenous, while Section 4 extends our results when preferences are heterogeneous. We conclude with a discussion in Section 5.

2. Waiting for Godot

As noted by Nichols et al. (1971), Barzel (1974), O'Shaughnessy (2000), and Alexeev and Leitzel (2001), allocating scarce essential items by time rather than price can seem appealing in an egalitarian sense, because time is more evenly distributed than human or physical capital, or income. One could argue, of course, that compulsory allocation by time violates egalitarianism in favour of the poor, by penalizing those for whom time in line has a high opportunity cost. Nonetheless, when it comes to emergency relief and health care, citizenship and immigration, policing, and many other congestible public services, queuing is often judged the fairest allocation method.

Economists have traditionally criticized compulsory allocation by queue on two major efficiency grounds. First, buyers who wait in line are wasting a valuable resource, time, that does not get transferred to the seller. The opportunity cost of that time is not just leisure, but possibly forgone production. Thus, widespread queuing for goods in an economy would ultimately make fewer of these goods available. Secondly, since the time price of queuing penalizes those with a higher opportunity cost of time, queuing will by necessity transfer goods from some who value it more to others who value it less (Tobin 1970, Suen 1989, and O'Shaugnessy 2000). Far better to meet distributional concerns at a general level with a tax and transfer system, then allocate private goods by price, and congestible public services with user fees set at marginal social cost.

As others have pointed out, however, practical tax and transfer systems carry there own distortions in work disincentives (Tobin (1970), Bucovetsky (1984)) and imperfect targeting (Alexeev and Leitzel, 2001). Similarly, user fees for congestible public services may have regressive distributional effects (Nichols et al. (1971)). In response, a number of studies have compared the efficiency of queuing against alternative re-distributional instruments, such as tax/transfers, rationing, or rationing with resale (Bucovetsky (1984), Sah (1987) and Polterovich (1993), O'Shaugnessy (2000) and Alexeev and Leitzel (2001)).

A key insight by Nichols, Smolensky and Tideman (1971) was that much of the re-distributional potential of allocation by time could be preserved, and its inefficiency lessened, if people could *choose* whether to pay by money or by time. Private firms commonly offer goods at varying price / queue combinations to separate buyers by income and increase profit. Governments could do the same with merit goods, but rather to pursue distributional ends. Low wage individuals would self-select to pay by time, while those with a high wage would self-select to pay by money. If wage captures the opportunity cost of time, and differences in wages reflect differences in marginal product, then the time lost in queues would have low foregone cost in lost wages and production. In addition, the costly and error-prone apparatus of means testing individuals would be unnecessary. While Nichols et al. provide no formal model of differential pricing, O'Shaugnessy (2000) and Alexeev and Leitzel (2001)) do when comparing social welfare under such a system with that under conventional tax and transfer systems. Both of the latter studies assume, however, that preferences are identical across the population.

Though independently derived, our paper takes the mechanism proposed by Nichols et al. and formalized by O'Shaugnessy and Alexeev and Leitzel, and uses it to pursue the distributional aims identified by Tobin. We ask whether a policy maker can use differential time and money pricing to achieve specific egalitarianism in the distribution of a merit good. That is, we ask if people's purchase of a merit good can be made independent of income, but still dependent on relative strength of preference or need.

3. Our Basic Model with Homogeneous Preferences

Consider an economy of N individuals, each of whom has an identical preference ordering over leisure ℓ, a composite commodity y, and a merit good G. We will assume that agents have preferences that can be represented by the constant elasticity of substitution (CES) utility function:[1]

$$U(\ell, y, G) = \left(\ell^{\rho} + y^{\rho} + \theta G^{\rho}\right)^{\frac{1}{\rho}} \tag{1}$$

Theta (θ) represents the strength of preference for the merit good relative to the other goods. Rho (ρ) represents the individual's elasticity of substitution between the merit and other goods, ranging from perfect flexibility (ρ = 1), to Cobb Douglas (ρ = 0), to Leontieff (ρ = - ∞). As we shall see, the value of rho plays a key role in determining how differences in income affect people's time allocation decisions.

The price of leisure is a person's wage, *w*, while the price of *y* is normalized to 1. The *full* money and time price of the merit good at a given outlet is $P_G = wH + p$, where *p* is the money unit price, and *H* is the waiting time required per unit of *G* purchased.[2] All individuals have an identical time endowment, *T,* which they can spend working *L*, in leisure *ℓ*, or in line (*HG*). We assume that all income comes from labour.[3] To start, we shall also assume that *G* is available from only one outlet, and that all individuals face the same wage. An individual's problem is:

$$\underset{\ell,y,G}{Max}U = \left(\ell^{\rho} + y^{\rho} + \theta G^{\rho}\right)^{\frac{1}{\rho}}$$

$$\text{s.t.} \quad wL = pG + y, \qquad \ell = T - HG - L. \tag{2}$$

The corresponding demand functions are:

$$\ell^* = \left(\frac{w^{\frac{\rho}{\rho-1}}T}{w^{\frac{\rho}{\rho-1}} + (wH+p)^{\frac{\rho}{\rho-1}}\theta^{\frac{1}{1-\rho}} + 1}\right) = \left(\frac{w^{\frac{\rho}{\rho-1}}T}{w^{\frac{\rho}{\rho-1}} + P_G^{\frac{\rho}{\rho-1}}\theta^{\frac{1}{1-\rho}} + 1}\right),$$

$$y^* = \left(\frac{wT}{w^{\frac{\rho}{\rho-1}} + P_G^{\frac{\rho}{\rho-1}}\theta^{\frac{1}{1-\rho}} + 1}\right), \tag{3}$$

$$G^* = \left(\frac{wP_G^{\frac{1}{\rho-1}}\theta^{\frac{1}{1-\rho}}T}{w^{\frac{\rho}{\rho-1}} + P_G^{\frac{\rho}{\rho-1}}\theta^{\frac{1}{1-\rho}} + 1}\right),$$

Consider now the outlet for the merit good. Assume there exists a fixed supply of the merit good, *M*, which the policy maker has at his disposal.[4] The technical conditions are satisfied to ensure that there is a unique full price P_G that clears the outlet:[5]

$$NG^* = N\left(\frac{wP_G^{\frac{1}{\rho-1}}\theta^{\frac{1}{1-\rho}}T}{w^{\frac{\rho}{\rho-1}} + P_G^{\frac{\rho}{\rho-1}}\theta^{\frac{1}{1-\rho}} + 1}\right) = M \qquad (4)$$

Note that since it is the *full* price $P_G = wH + p$, which clears the outlet, the policy maker can set the money price p as desired, and let the per unit queuing time H equilibrate.

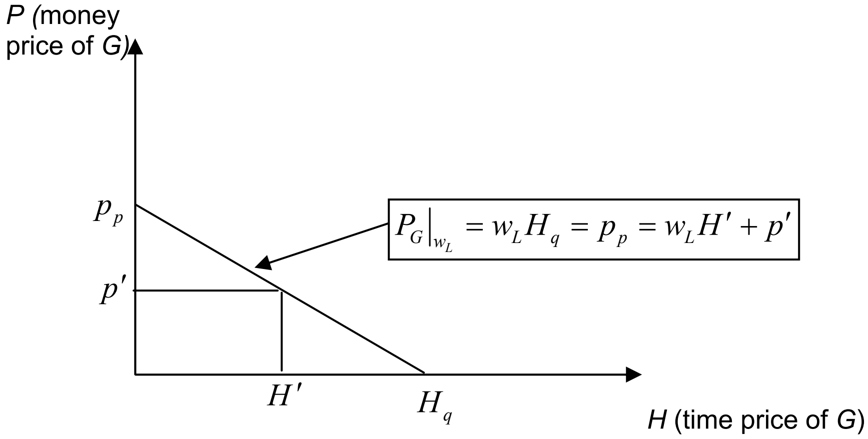
3.1 The Isoprice Line

Suppose that every individual has an identical constant (low) wage, w_L. At one extreme, the policy maker could set the money price at zero, causing the market for the merit good to clear purely by queuing, at $P_G = w_L H_q$. At the other extreme, the policy maker could set the money price just high enough to allocate purely by pricing, at $P_G = p_p$. Alternatively, he could set the money price at some intermediate level, $0 < p' < p_p$, resulting in an intermediate equilibrium queuing time $0 < H' < H_q$ and full price $P_G = w_L H' + p'$. Following Nichols et al. (1971), let us mark these pricing possibilities in (H,p) space in Figure 1.

With wage uniform at w_L, any linear (H,p) combination making P_G satisfy (4) will clear the market. For an individual with wage w_L, these (H,p) combinations form an isoprice line with slope equal to minus w_L. This person would pay the same full price at any point on the isoprice line, a higher full price at (H,p) combinations above it, and a lower full price at (H,p) combinations below it.

To introduce income inequality, we shall first consider the effect of an increase in wage on the price of the merit good. We shall consider the effect of a

Figure 1: An Isoprice Line For a Single Outlet and Income Group



wage rise on full price, but also on money price under pure pricing, and queuing time under pure queuing. Totally differentiating (4), and setting $dN = dM = dT = 0$, we have:

$$\left[\frac{w^{\frac{1}{\rho-1}}\theta^{\frac{1}{\rho-1}} + w^{-1}\theta^{\frac{1}{\rho-1}} + (1-\rho)P_G^{\frac{\rho}{\rho-1}}w^{-1}}{(w^{\frac{1}{\rho-1}}\theta^{\frac{1}{\rho-1}} + w^{-1}\theta^{\frac{1}{\rho-1}} + P_G^{\frac{\rho}{\rho-1}}w^{-1})(\rho-1)P_G}\right]dP_G =$$
$$\left[\left(\frac{1}{w^{\frac{1}{\rho-1}}\theta^{\frac{1}{\rho-1}} + w^{-1}\theta^{\frac{1}{\rho-1}} + P_G^{\frac{\rho}{\rho-1}}w^{-1}}\right)\left(\frac{1}{\rho-1}w^{\frac{1}{\rho-1}-1} - w^{-2}\theta^{\frac{1}{\rho-1}} - P_G^{\frac{\rho}{\rho-1}}w^{-2}\theta^{\frac{1}{\rho-1}}\right)\right]dw \tag{5}$$

Examining (5), we have $\frac{dP_G}{dw} > 0$ for all values of $\rho \in (-\infty, 1)$. Higher wages bid up the full price of the merit good. Higher wages will thus also bid up the nominal price in the case of pure pricing ($P_G = p_p$), or $\frac{dp_p}{dw} > 0$ for all $\rho \in (-\infty, 1)$. In contrast, higher wages may raise or lower equilibrium unit queuing time under pure queuing, H_q, depending on people's elasticity of substitution between goods. In particular, replacing P_G with $w_L H_q$ in (4) and differentiating with respect to H_q and w yields

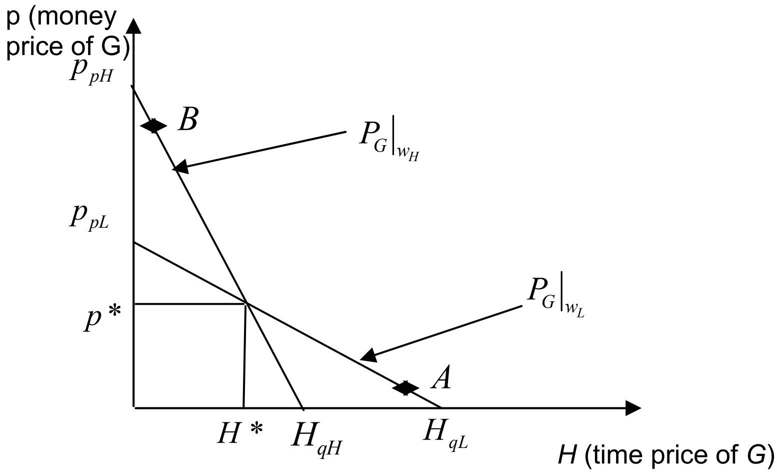
$$\left[\frac{\theta^{\frac{1}{\rho-1}} + w^{\frac{\rho}{1-\rho}}\theta^{\frac{1}{\rho-1}} + (1-\rho)H_q^{\frac{\rho}{\rho-1}}}{(\theta^{\frac{1}{\rho-1}} + H_q^{\frac{\rho}{\rho-1}} + w^{\frac{\rho}{1-\rho}}\theta^{\frac{1}{\rho-1}})(\rho-1)H_q}\right]dH_q = \left[\left(\frac{1}{\theta^{\frac{1}{\rho-1}} + H_q^{\frac{\rho}{\rho-1}} + w^{\frac{\rho}{1-\rho}}\theta^{\frac{1}{\rho-1}}}\right)\left(\frac{\rho}{1-\rho}w^{\frac{\rho}{1-\rho}-1}\theta^{\frac{1}{\rho-1}}\right)\right]dw \qquad (6)$$

Examining (6), we see that $\frac{dH_q}{dw} < 0$ for 0< ρ <1, $\frac{dH_q}{dw} = 0$ for ρ =0 and $\frac{dH_q}{dw} > 0$ for ρ <0. Intuitively, a higher wage brings offsetting income and substitution effects for goods whose purchase requires foregone labour. A higher wage prompts individuals to substitute away from queuing for *G* towards purchasing *y*, but also to demand more *G* because of an increase in real income. At high values of ρ (0< ρ <1), the substitution effect dominates. As a result, demand for queued *G* falls in wage, lowering the equilibrium queuing time required to clear the outlet. In contrast, at low values (-∞< ρ <0), the income effect dominates. A higher wage raises demand for queued G, raising equilibrium queuing time. For analogous reasons, positive ρ implies labour supply is upward sloping, while negative rho implies a backward bending labour supply. The sign of ρ turns out to be important for policy prescription, and so we shall develop our model under both cases.

3.2 High Substitution (0<ρ<1)

Returning to our isoprice diagram Figure 1, we can imagine the effect of raising everyone's income from w_L to w_H. Based on the partial derivatives derived from (5) and (6) for positive ρ, an individual's isoprice line of (*H,p*) combinations that clear the outlet will rotate clockwise, as shown in Figure 2. The line will rotate around a pivot point, whose exact location will depend on the difference between w_L

Figure 2: Isoprice Lines for Two Income Levels, $\rho > 0$



and w_H. With a slight change of interpretation, we can use Figure 2 to introduce multiple income groups and outlet choice to our model.

Suppose now that there are two income groups, with N_L individuals earning w_L, and $N_H = N - N_L$ earning w_H, where $w_H > w_L$.[6] To achieve equal consumption of G, the policy maker can create two outlets for the merit good. At a 'queuing' outlet, he sets a lower money price, p', to attract the poor, while at a 'pricing' outlet he sets a higher money price, p'', to attract the rich. The policy maker must then distribute the supply of the merit good M across the outlets, M_q and M_p, in proportion to the income distribution:

$$M_q = \frac{N_L}{N} M \quad \text{and} \quad M_p = \frac{N_H}{N} M \tag{7}$$

If the poor and rich separate to their respective outlets, each outlet will clear according to its own version of (4). With supply at a each outlet adjusted to the number of people at it, the isoprice lines of rich and poor at each outlet will differ only in wage. Their isoprice lines will then cross, just as in our thought experiment for a single outlet in Figure 2.

The policy maker can set the money price at the queuing outlet, p', within a broad range. At minimum it can be set at zero, resulting in the outlet clearing by 'pure queuing', or formally at the H_{qL} where

$$N_L G_L^* = N_L \left(\frac{w_L (w_L H_{qL})^{\frac{1}{\rho-1}} \theta^{\frac{1}{1-\rho}} T}{w_L^{\frac{\rho}{\rho-1}} + (w_L H_{qL})^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} + 1} \right) = M_q \tag{8}$$

At maximum p' can be set at the unique (H^*,p^*) combination that would simultaneously clear a proportionately stocked queuing outlet with poor people, or a proportionately stocked pricing outlet with rich people, or where

$$N_L G_L^* = N_L \left(\frac{w_L (w_L H^* + p^*)^{\frac{1}{\rho-1}} \theta^{\frac{1}{1-\rho}} T}{w_L^{\frac{\rho}{\rho-1}} + (w_L H^* + p^*)^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} + 1} \right) = M_q$$

and (9)

$$N_H G_H^* = N_H \left(\frac{w_H (w_H H^* + p^*)^{\frac{1}{\rho-1}} \theta^{\frac{1}{1-\rho}} T}{w_H^{\frac{\rho}{\rho-1}} + (w_H H^* + p^*)^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} + 1} \right) = M_p$$

The policy maker has similar flexibility in setting the money price at the pricing outlet. At maximum, p'' can be set to clear the outlet without any queuing when only rich people are in it, or the p_{pH} where

$$N_H G_H^* = N_H \left(\frac{w_H p_{pH}^{\frac{1}{\rho-1}} \theta^{\frac{1}{1-\rho}} T}{w_H^{\frac{\rho}{\rho-1}} + p_{pH}^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} + 1} \right) = M_p . \tag{10}$$

At minimum p'' can be set at the p^* already defined in (9). We now have sufficient background to present our results.

Proposition 1: Suppose a society has two income levels. If a policy maker creates two outlets, distributes the merit good proportionally as in (7), and chooses money prices ($0 \leq p' < p^*$) and ($p^* < p'' \leq p_{pH}$), he will induce a unique separating equilibrium where the rich choose the pricing outlet, and the poor choose the queuing outlet.

Proof: See Appendix I.1

The intuition for Proposition 1 can be grasped easily from Figure 2. Suppose the policy maker chooses p' for the queuing outlet that corresponds to point A on a poor person's isoprice line, and p'' for the pricing outlet that corresponds to point B on a rich person's isoprice line. This will constitute a separating equilibrium, because a poor person who switched from A to B would face an (H,p) combination that posed a higher isoprice given his low wage. Conversely, a rich person who switched from B to A would face an (H,p) combination that would pose a higher isoprice given his high opportunity cost of time. As we show in Appendix I.2, any individual with CES utility and a given wage will do best to choose the merit good outlet offering the lowest full price.

Once we have established that the rich and poor separate, it is easy to show that they purchase the same quantity of the merit good.

Proposition 2: The separating equilibrium above satisfies specific egalitarianism.

Proof: with money prices set by the policy maker, the queuing time at the pricing and queuing outlets adjust such that

$$N_L G_L^* = M_q \text{ and } N_H G_H^* = M_p \tag{11}$$

From proportional allocation as in (7), it follows that

$$G_L^* = M_q \frac{1}{N_L} = (\frac{MN_L}{N})\frac{1}{N_L} = \frac{M}{N} \text{ , and}$$

$$G_H* = M_p \frac{1}{N_H} = (\frac{MN_H}{N})\frac{1}{N_H} = \frac{M}{N} \quad (12)$$

Propositions 1 and 2 show that a policy maker can accommodate two income groups at two outlets with flexibility in setting money prices. It turns out that he can also create an equivalent pooled equilibrium at a single outlet where both income groups still purchase equal quantities of the merit good. To do so, the policy maker must set the money price at the unique level identified in (9).

Proposition 3: There exists a pooled outlet with a unique (H^*, p^*) at which both income groups face the same full price and consumption of G as at the separating equilibrium.

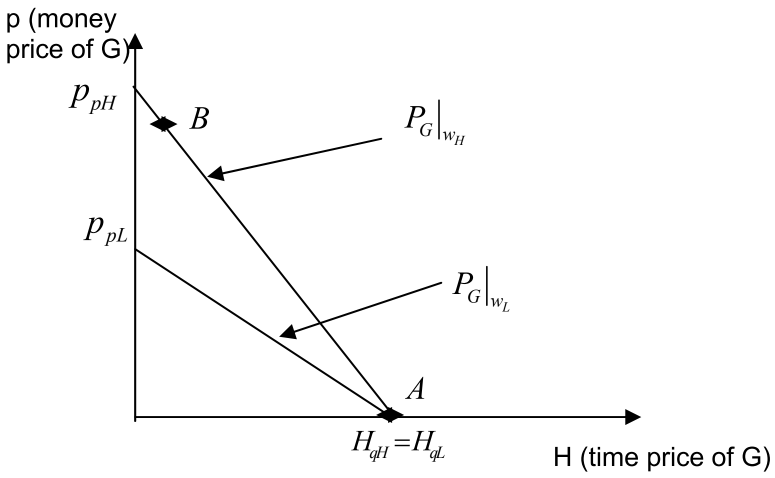
Proof: if the proportional allocation of the merit good is combined in a single outlet that charges (H^*, p^*), a low income person will face the equivalent full price at the pooled outlet as he did at the separating one ($P_{GL} = w_L H^* + p^* = w_L H' + p'$). This means he will be indifferent between the two equilibria, and still demand $G_L^* = M/N$. The high income person will also face the same full price at the pooled and separating outlets ($P_{GH} = w_H H^* + p^* = w_H H'' + p''$), be indifferent between them, and demand $G_H^* = M/N$. The pooled outlet will clear, as

$$N_L G_L^* + N_H G_H^* = N_L (M/N) + N_H (M/N) = M \quad (13)$$

3.2 Low Substitution ($-\infty < \rho \leq 0$)

Specific egalitarianism is not so easily achieved if the population has a low willingness to substitute between the merit good and other goods. It is easiest to see the problem, and our proposed solution, by considering first the boundary case of

Figure 3: Isoprice Lines for Two Income Groups, $\rho = 0$

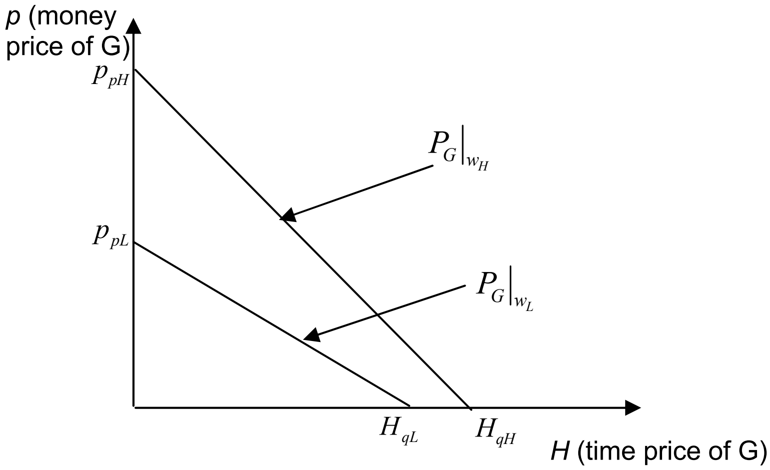


Cobb Douglas preferences, where $\rho = 0$. As we saw in (6), higher wages do not increase equilibrium queuing time under pure queuing when $\rho = 0$, because the demand for the merit good becomes independent of wage (the income and substitution effects just cancel). With proportional ticket allocation across two outlets, individuals from the separated income groups would face isoprice lines as in Figure 3.

Specific egalitarianism is still the unique equilibrium achieved here, but it is only weakly stable.[7] The formal proof is analogous to that in Appendix 1.1, but the intuition follows. With proportional allocation across a pricing and queuing outlet, a marginal rich person is now only indifferent between staying at the pricing outlet *B* and switching to the queuing outlet *A* that is targeted to the poor.[8] To keep the rich (weakly) out of the queuing outlet, the policy maker must set its money price p' exactly at zero, which maximizes the waiting aspect of its full price. To achieve the equivalent pooled equilibrium the policy maker similarly must set the single money price p^* at zero.

With even less willingness to substitute, ($\rho<0$), equilibrium queuing time under pure queuing rises with wage, as shown in (6). As illustrated in Figure 4, the isoprice lines of individuals in the two separated income groups no longer intersect

Figure 4: Isoprice Lines for Two Income Groups, $\rho < 0$



under proportional allocation, so the policy maker can no longer induce a separating equilibrium. A marginal high wage individual would face a lower full price by joining the queuing outlet. As a result, there is also no equivalent pooled equilibrium with a positive p^* and H^* where merit good consumption is equalized. This finding is of concern, because specific egalitarianism tends to be a policy objective for those goods that are "critical to life or citizenship." Such goods presumably have a low degree of substitution with other goods.

Our approach is to modify our proportional allocation rule so as to persuade the rich to remain at the pricing outlet, and consider how close to specific egalitarianism we can come. To begin, it can be shown by differentiating (4) for dP_G and dM that the full price of the merit good falls with its supply at an outlet. Graphically, an increased supply shifts the isoprice line of a member of an outlet to the left, and vice versa. We thus begin with proportional allocation across two outlets $M_q = (N_L/N)M$ and $M_p = (N_H/N)M$ as before, but transfer τ supply from the queuing outlet to the pricing outlet. We transfer just enough to make both isoprice lines in

Figure 4 intersect at a common time price under pure queuing, $H_{qL} = H_{qH} = H^*_q$ as in Figure 3, or until

$$N_L G^*_L = N_L \left[\frac{\theta^{\frac{1}{1-\rho}} T}{(H^*_q)^{\frac{1}{1-\rho}} + w_L^{\frac{\rho}{1-\rho}} (H^*_q)^{\frac{1}{1-\rho}} + (H^*_q)\theta^{\frac{1}{1-\rho}}} \right] = M_q - \tau^* \quad \text{and}$$

$$N_H G^*_H = N_H \left[\frac{\theta^{\frac{1}{1-\rho}} T}{(H^*_q)^{\frac{1}{1-\rho}} + w_H^{\frac{\rho}{1-\rho}} (H^*_q)^{\frac{1}{1-\rho}} + (H^*_q)\theta^{\frac{1}{1-\rho}}} \right] = M_p + \tau^* \qquad (14)$$

With the transfer, Proposition 1 is now restored as it was for the boundary case where $\rho = 0$. That is, if the policy maker creates two outlets, and allocates the merit good across them proportionally, but modified by τ^*, and sets $p'=0$ and $(0<p''\leq p_{pH})$, the poor and rich will separate. But as when $\rho = 0$ it is only weakly stable, because a marginal high wage individual would be indifferent between the two outlets. Proposition 3 is also restored, in that an equivalent pooled outlet exists at $p^* = 0$ and $H=H^*_q$ where both rich and poor face an identical full price to what they would face in separated outlets, and so demand together what they demanded separately.

Unfortunately, Proposition 2 is not restored. The transfer of the merit good from the queuing to the pricing outlet restored equilibrium, but at the expense of transferring consumption from poor to rich:

$$G^*_H = \frac{M_p + \tau^*}{N_H} = \frac{M}{N} + \frac{\tau^*}{N_H} \qquad (15)$$

$$G^*_L = \frac{M_q - \tau^*}{N_L} = \frac{M}{N} - \frac{\tau^*}{N_L}$$

However, we can claim that this disparity in consumption is minimized:

Proposition 4: the consumption of G will be more nearly equalized between rich and poor under our proposed separating equilibrium or its pooled equivalent, than at any other pooled or separating equilibrium.

Proof: see Appendix 1.3

Intuitively, the key for our claim is that our proposed separating equilibrium and its pooled equivalent require a zero money price for low wage individuals. Any other *pooled* equilibrium that raises money price and lowers the time price will increase the full price faced by low wage individuals, and lower the full price faced by high wage individuals. This will increase the disparity in their consumption of the merit good. Similarly, any other *separating* equilibrium, to exist, would require an even larger transfer of merit good supply from the queuing to the pricing outlet. This also would increase the disparity in merit good consumption.

To summarize our results so far, we have seen that if everyone has identical preferences but unequal wages, a policy maker can pursue egalitarian consumption of a merit good by making it available simultaneously at pricing-based and queuing-based outlets. Specifically, the policy maker can equalize consumption if people's elasticity of substitution between the merit good and other goods is high, but only approach equalized consumption if their elasticity of substitution is low. We have also seen that in each case the policy maker can achieve identical results using a single pooled outlet with a unique money and time price combination. We turn next to consider the case where preference (or need) for the merit good differs across the population.

4. Heterogeneous Preferences

In the case when people have heterogeneous preferences for the merit good, the policy maker's objective needs to be clarified. Variation in people's willingness-to-pay for a good derives from differences in income, but also from differences in relative strength of preference or need. If the policy maker wishes to respect the latter, then specific egalitarianism will require only that individuals with a *given* preference ordering receive the same quantity of a merit good, regardless of income. Those who value a good more highly relative to other goods should presumably receive more of it than others who value it less highly. As we shall see, the use of multiple outlets can go a long way to achieving this objective, though again the exact results depend on people's elasticity of substitution between goods, and on how much tastes differ between income groups.

We introduce heterogeneous preferences by allowing that individuals may place a "regular" θ_R or a "strong" weight θ_S on the merit good within utility (1), where $0<\theta_R<\theta_S$. Of N_L low wage individuals, a proportion s_L have θ_S weights, and $(1-s_L)$ have θ_R weights. Of N_H high wage individuals, s_H have θ_S weights, and $(1-s_H)$ have θ_R weights.

As we claimed earlier and proved in Appendix 1.2, individuals will choose between outlets based *only* on full price $P_G = wH+p$, and therefore not on their strength of preference for the merit good. However, the distribution of preference strengths among the people at an outlet *will* affect the (H,p) combinations that bring the outlet into equilibrium. For example, if only low wage individuals inhabit an outlet with supply M_q available, there will exist a unique P_G that equates supply and demand:

$$(1-s_L)N_L G_{L,R}* + s_L N_L G_{L,S}* =$$

(16)

$$(1-s_L)N_L\left(\frac{w_L P_G^{\frac{1}{\rho-1}}\theta_R^{\frac{1}{1-\rho}}T}{w_L^{\frac{\rho}{\rho-1}}+P_G^{\frac{\rho}{\rho-1}}\theta_R^{\frac{1}{1-\rho}}+1}\right)+s_L N_L\left(\frac{w_L P_G^{\frac{1}{\rho-1}}\theta_S^{\frac{1}{1-\rho}}T}{w_L^{\frac{\rho}{\rho-1}}+P_G^{\frac{\rho}{\rho-1}}\theta_S^{\frac{1}{1-\rho}}+1}\right)=M_q$$

Totally differentiating (16), it can be shown that $dP_G / ds_L > 0$. In words, an increase in the proportion of individuals with a strong preference for the merit good at an outlet will bid up the (*H, p*) combinations that clear it. This would shift out the isoprice line of an individual at that outlet.

With this feature in mind, our analysis proceeds as it did for homogeneous preferences. By differentiating (16), it can be shown as before that an increase in (uniform) wage among the people at an outlet will raise the full price that clears it, including the money price under pure pricing $\frac{dp_p}{dw} > 0$. As before, however, an increase in wage will *lower* the equilibrium time price under pure queuing, or $\frac{dH_q}{dw} < 0$, if ρ is positive, but raise it $\frac{dH_q}{dw} > 0$ if ρ is negative. We take both possibilities in turn.

4.1 High Substitution (0<ρ<1)

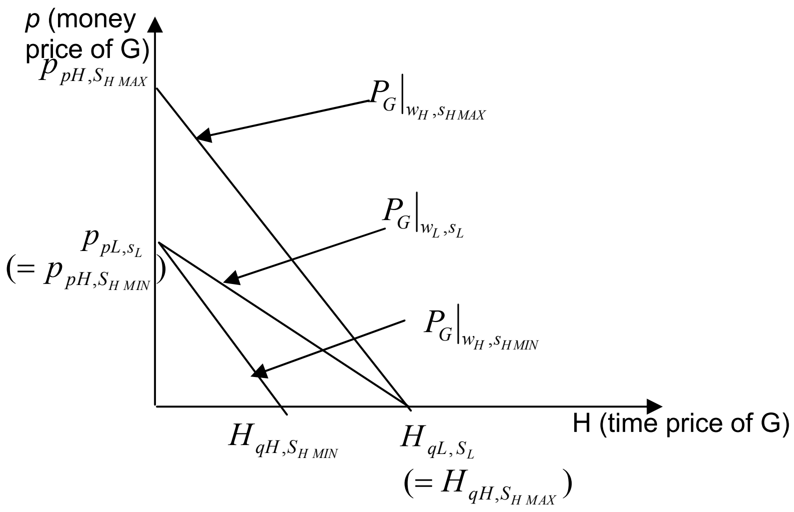
Assume as before that there are N_L individuals with w_L, and N_H individuals with w_H. The policy maker creates two outlets for the merit good and allocates M_q and M_p between them proportionately as in (7). Note that the isoprice line faced by an individual in a given outlet will be the same regardless of his strength of preference for the merit good. Consider the possibility that the high and low income groups separate across the two outlets; the poor to a 'queuing' outlet with a low p' and the rich to a 'pricing' outlet with high p''. Would this be a stable equilibrium as it was before? From the comparative statics for wage just mentioned, we know that the isoprice line for a low wage person at one outlet will be flatter than the isoprice line for a high wage person at the other outlet. As always, however, the isoprice lines must also cross in order for money prices to exist that make this separation stable. The isoprice lines will cross if there is a unique (H^*, p^*) combination that would make the merit good demand functions satisfy

$$(1-s_L)N_L G_{L,R}{}^* + s_L N_L G_{L,S}{}^* = M_q \quad \text{and}$$
$$(1-s_H)N_H G_{H,R}{}^* + s_H N_H G_{H,S}{}^* = M_p \quad . \tag{17}$$

Such an (H^*, p^*) will exist so long as the distribution of tastes for G is "not too different" across income groups. In particular, if we hold the proportion of low wage individuals with strong preferences s_L constant, the proportion of high wage individuals with strong preferences can vary between $s_{H\,Max}$ and $s_{H\,Min}$, as in Figure 5. A formal identification of $s_{H\,Max}$ and $s_{H\,Min}$ is deferred to Appendix 1.4, but the intuition is straightforward. The greater the proportion of strong preference people at an outlet, the greater its full price, making other outlets with less enthusiastic patrons more attractive. Thus, if s_H is too high at the pricing outlet relative to s_L at the queuing outlet, a high wage person (of either preference strength) would prefer to switch to the queuing outlet. Similarly, if s_H is too low, a low wage person with either preference would prefer to switch from queuing to the pricing outlet. With this new restriction, we can make the following claim:

Proposition 1A: Suppose a society has two income levels and two relative strengths of preference for G. If the distribution of preferences across income groups is sufficiently similar that ($s_{H\,Min} \le s_H \le s_{H\,Max}$) given s_L, and a policy maker creates two outlets, distributes the merit good as in (7), and chooses money prices ($0 \le p' < p^*$) and

Figure 5: Allowable Difference in Distribution of Preferences Across Outlets Given s_L



($p^*<p''\leq p_{pH}$), he will induce a unique separating equilibrium where the rich choose the pricing outlet, and the poor choose the queuing outlet.

Proof: so long as ($s_{H\,Min} \leq s_H \leq s_{H\,Max}$) given s_L, see Appendix 1.1 as before.

We turn next to ask whether this separating equilibrium equalizes consumption of G for people with identical preferences but different incomes. The outlet clearing condition at the queuing outlet satisfies

$$(1-s_L)N_L\left(\frac{w_L(w_LH'+p')^{\frac{1}{\rho-1}}\theta_R^{\frac{1}{1-\rho}}T}{w_L^{\frac{\rho}{\rho-1}}+(w_LH'+p')^{\frac{\rho}{\rho-1}}\theta_R^{\frac{1}{1-\rho}}+1}\right)+s_LN_L\left(\frac{w_L(w_LH'+p')^{\frac{1}{\rho-1}}\theta_S^{\frac{1}{1-\rho}}T}{w_L^{\frac{\rho}{\rho-1}}+(w_LH'+p')^{\frac{\rho}{\rho-1}}\theta_S^{\frac{1}{1-\rho}}+1}\right)=M_q\ ,$$

which given proportional supply (7) can be expressed as

$$(1-s_L)G_{L,R}*+s_LG_{L,S}*=\frac{M_q}{N_L}=\frac{M}{N}. \tag{18}$$

Similarly, the pricing outlet will clear at full price ($w_HH''+p''$) and satisfy

$$(1-s_H)G_{H,R}*+s_H G_{H,S}*=\frac{M_p}{N_H}=\frac{M}{N} \qquad (19)$$

Comparing (18) and (19), the consumption of G is equalized *across the average person of each income group*. Unfortunately, (18) and (19) do not imply that consumption is equalized across individuals of a given preference type, or that $G_{L,R}$ = $G_{H,R}$ and $G_{L,S}$ = $G_{H,S}$. Intuitively, the problem is that the effect of preference strength on a person's demand for the merit good, $dG/d\theta$ depends on variables such as full price, income, and preference distribution, each of which may differ across outlets. Thus, at the separating equilibrium, there is no reason to believe that individuals with a common θ at different outlets will purchase identical quantities of G .

Fortunately, the equalization of average consumption across income groups places some constraint on consumption inequality. In addition, we can also claim that differences in preference strength will dominate differences in income.

Proposition 2A: Under the (income) separating equilibrium defined in *Proposition 1A*, every individual with θ_S will receive more G than any individual with θ_R

Proof: the lowest consumption of a strong preference θ_S individual occurs when his wage is w_L (from $dG/dw > 0$) and everyone at his outlet has strong preferences, $s_L = 1$ that bid up full price ($dP_G/ds_L > 0$). From (18), the lower bound on consumption under these conditions is $G_{L,S} = M/N$. Conversely, the highest consumption of a regular preference θ_R individual occurs with w_H and $s_H = 0$.[9] From (19), the upper bound under these conditions is $G_{H,R} = M/N$.

Finally, an equivalent pooled equilibrium will correspond to our separating equilibrium. As with homogeneous preferences, this occurs at the unique (H^*,p^*) where the isoprice line for individuals of each income group cross, as defined in (17). The reasoning is analogous to the proof of Proposition 3, and is omitted.

4.2 Low Substitution ($-\infty<\rho<0$)

Recall that under homogeneous preferences a separating equilibrium under proportional allocation did not exist, or isoprice lines did not cross, when $\rho<0$. To keep every high income individual in the pricing outlet required a minimum supply transfer τ^* of the merit good from the queuing to the pricing outlet. Graphically, existence was restored once high and low income isoprice lines intersected at a common time price under pure queuing. The introduction of heterogeneous preferences does not change this finding, except that the size of τ^* will now depend on the distribution of strong preferences for G among each income group. Analogous to (14), τ^* is defined:

$$\begin{aligned}(1-s_L)N_L G^*_{L,R}(H^*_q)+s_L N_L G^*_{L,S}(H^*_q)&=M_q-\tau^*\\(1-s_H)N_H G^*_{H,R}(H^*_q)+s_H N_H G^*_{H,S}(H^*_q)&=M_p+\tau^*\end{aligned}\qquad(20)$$

For a given s_L, the minimum transfer τ^* required will rise as s_H rises, because high income people will face a higher price at the pricing outlet, and greater incentives to switch. Thus, with proportional allocation modified by τ^* in (20), and $p'=0$ and $0<p''\leq p_{pH}$, a policy maker will ensure a unique separating equilibrium as before (Proposition 1, 1A). Also as before, an equivalent pooled equilibrium exists with all M placed in an outlet with $p^*=0$ and H equilibrating at H^*_q (Proposition 3, 3A).

Unfortunately, the difficulties of low substitution and heterogeneous preferences combine here to affect the distribution of merit good consumption. Substituting proportional allocation into (20), it follows that

$$(1-s_L)G^*_{L,R}(H^*_q)+s_L G^*_{L,S}(H^*_q)=\frac{M}{N}-\frac{\tau^*}{N_L}$$

(21)

$$(1-s_H)G^*_{H,R}(H^*_q)+s_H G^*_{H,S}(H^*_q)=\frac{M}{N}+\frac{\tau^*}{N_H}$$

The average consumption of a person in each income group is no longer equalized, with the rich doing somewhat better on average than the poor. Recall our finding under Proposition 4 for homogeneous preferences that this equilibrium equalized the consumption of rich and poor more than any other pooled or separating equilibrium. This still holds for heterogeneous preferences; any other pooled equilibrium would represent a higher full price for low wage individuals, and lower full price for high wage individuals. Similarly, any other separating equilibrium, to exist, would require an even larger deviation from proportional allocation in the rich's favour.

Unfortunately, the deviation from proportional allocation needed to restore a separating equilibrium under $\rho < 0$ removes our certainty that any person with θ_S will receive more of the merit good than any person with θ_R (Proposition 2A). Using our previous reasoning, the lower bound on a θ_S' consumption of *G* falls to $M/N-\tau^*/N_L$, which is now below the upper bound on a θ_R's consumption of $M/N+\tau^*/N_H$. So, for example, we can no longer rule out that an individual with a strong preference for *G*, but a low wage, and in an outlet with many keen individuals, might receive less *G* than an individual with a low preference for G, but with a high wage, in an outlet with few keen individuals.

5. Discussion and Conclusion

In this paper, we have considered the problem of a policy maker whose objective is "specific egalitarianism", or that access to a particular good be made dependent on preference or need, but independent of income. We showed circumstances under which this objective could be achieved by making the good simultaneously available at outlets that differentially allocate by money and time. In particular, with two wage levels and CES utility, a policy maker could allocate a fixed supply of a merit good at two outlets in proportion to the income distribution, set a high money price at one, and a low (or zero) money price at the other. Queuing time would equilibrate at each outlet. Those with a high wage would choose the outlet with a high money price and little or no waiting, and those with a low wage would choose the outlet with low money price and a substantial queue. Differential pricing is likely to reduce the inefficiency of compulsory queuing or uniform disbursement, because time with high wage and production opportunity cost is saved, and differences in relative preference orderings are respected.

We find that when CES elasticity of substitution between goods is high (or labour supply is upward sloping) and preferences are homogeneous, our proposal equalizes merit good consumption across rich and poor. When elasticity is low (or labour supply is backward bending), the policy maker must transfer some supply of tickets to the outlet targeting the rich, and so merit good consumption is not fully equalized. We identify the minimum inequality that can be achieved over any money and time pricing policy over single or separating outlets.

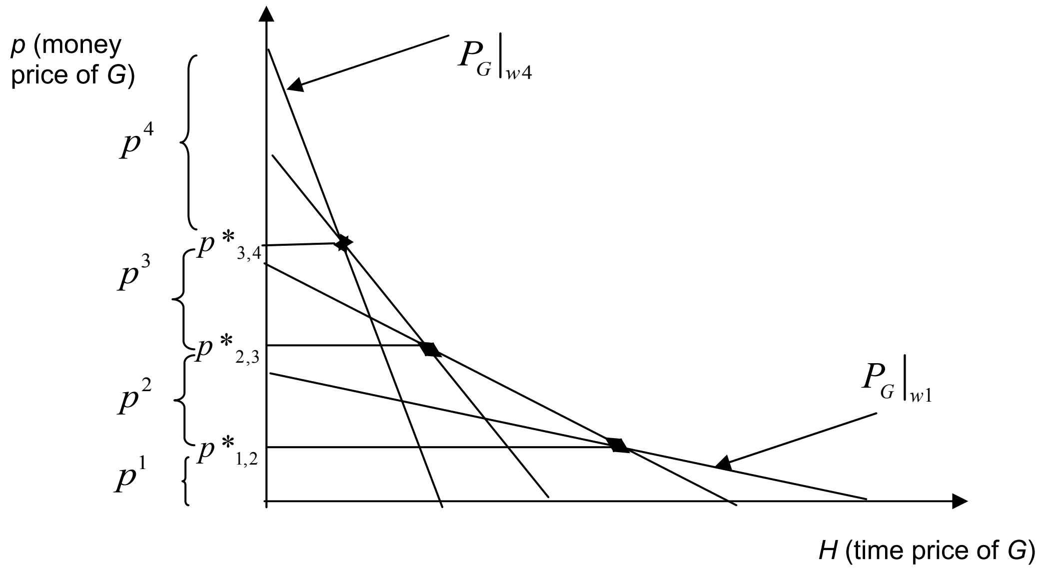
Next, when preferences for the merit good are heterogeneous, we find differential pricing will equalize taste-weighted average consumption across income groups, so long as taste distributions are sufficiently similar across income groups. At the individual level, however, those with a given strength of preference for the merit good will receive different quantities depending on their choice of outlet, and therefore their income. If elasticity of substitution between goods is high, however, those with a higher strength of preference for the good will always receive more of it than those with a lower strength, regardless of income. Unfortunately, if elasticity of substitution is low, we are unable to guarantee this priority in extreme cases.

Finally, in every case described above, we find an equivalent pooling equilibrium in which the policy maker may cater for two income groups at a single outlet. By choosing a unique money price, the policy maker can ensure individuals of each income group face the same full (time and money) price as they would at a separating equilibrium, and so purchase equivalent quantities of the merit good.

For simplicity, our analysis has been restricted to binary classifications of income and preference type. However, our results could readily be extended in a discrete framework to any countable finite number of wage levels and preference strengths. Figure 6, for example, illustrates how consumption could be equalized for four income groups ($w_1 < w_2 < w_3 < w_4$) at four outlets under a range of money prices ($p_1 < p_2 < p_3 < p_4$), or at two pooled outlets under unique money prices ($p^*_{1,2} < p^*_{3,4}$). More generally, it is anticipated that K income groups could be accommodated with K separating outlets, or $K/2$ pooled outlets.

Aside from (mitigated) efficiency costs, our proposed form of differential pricing requires the expense and complexity of administering multiple outlets. Certainly real world examples such as ferry tickets, sports and concert tickets, postal services, health care and immigration services offer at most a few price/time combinations. Nonetheless, with judicious money pricing, even a few outlets will

Figure 6: Isoprice Lines for Four Income Groups (ρ>0)



greatly diminish the disparity of income of individuals per outlet, and thus the inequality of consumption that results.

The informational requirements of differential allocation are modest; the policy maker must know a population's income and preference distribution, but not the position of any given individual. Even an exact knowledge of the preference distribution is not essential for separating equilibria, because the policy maker can set each outlet's money price within a range and achieve the same distribution of the merit good.

Our modelling approach suffers from several limitations. First, as Nichols et al. observed, the existence of non-labour income raises the possibility that wealthy retirees can join outlets targeted to the poor. Second, to properly compare the efficiency costs of time/price allocation with alternative redistributive policies we need a closed model in which the supply of the merit good is linked to the productive output of the economy. We plan to pursue both issues in subsequent work. Further extensions motivated explicitly by health care allocation are possible, including relaxing the constraint that time spent waiting cannot also be spent working, or making the merit good of greater value under lower queuing time.

What we have shown, however, is that the distributional objective of specific egalitarianism for a merit good can be achieved without compulsory queues or means tests, while respecting differences in people's relative preferences or needs.

Appendix

1.1 Proof of Proposition 1: Existence and Uniqueness of a Separating Equilibrium

Suppose the policy maker adopts proportional allocation across two outlets as in (7), and sets p' at a 'queuing' outlet and p'' at a 'pricing' outlet according to ($0 \leq p' < p^*$) and ($p^* < p'' \leq p_{pH}$), where p^* is defined by (9). Define α and β as the percentage of N_L and N_H, respectively, who choose the queuing outlet rather than the pricing outlet.

EXISTENCE: $\alpha = 1$ and $\beta = 0$ is a separating equilibrium.

Suppose all the poor go to the queuing outlet and all the rich go to the pricing outlet. If a single member of N_L switched to the pricing outlet, he would face a full price

$$w_L H'' + p'' > w_L H'' + \tilde{p} = w_L H' + p' \qquad \text{(A.1)}$$

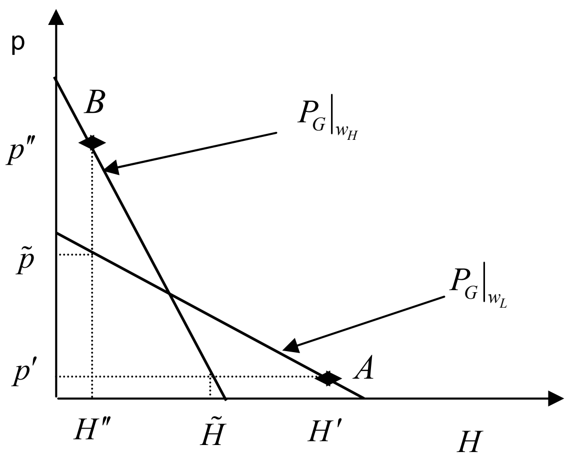
As in Figure A.1 below, the inequality follows from hypothetically comparing the money price $\tilde{p}$ that would clear the pricing outlet at queuing time H'' if its inhabitants had wage w_L rather than w_H, all else controlled. $\tilde{p}$ would be lower because $dp/dw > 0$. The final equality follows because (H'', $\tilde{p}$) is on the same isoprice line for low wage people as (H', p'). Thus any low wage individual faces a higher full price by deviating from the queuing outlet.

If a single member of N_H switched to the queuing outlet, he would face a full price

$$w_H H' + p' > w_H \tilde{H} + p' = w_H H'' + p'' \qquad \text{(A.2)}$$

Again, the inequality follows from hypothetically comparing the time price $\tilde{H}$ that would clear the queuing outlet at money price p' if its inhabitants had wage w_H rather than w_L, all else controlled. $\tilde{H}$ is lower because $dH/dw < 0$ for $\rho > 0$. The final equality follows because ($\tilde{H}$, p') is on the same isoprice line for a high wage individual as (H'', p''). Thus any high wage individual faces a higher full price by deviating from the pricing outlet.

Figure A1: Isoprice Lines for Two Income Levels, $\rho > 0$



UNIQUENESS: No other combinations of α and β yield an equilibrium.

Case 1: $0 \le \alpha < 1$ and $\beta = 0$.

If at least one low income person begins at the pricing outlet, the *least* he would by staying is $w_L H'' + p''$. The most he would pay in the queuing outlet is $w_L H' + p'$. Thus, by equation (A.1) the marginal low wage person would move to the queuing outlet.

Case 2: $\alpha = 1$ and $0 < \beta \le 1$.

If at least one high income person begins at the queuing outlet, the *least* he would pay by staying is $w_H H' + p'$. The most he would pay in the pricing outlet is $w_H H'' + p''$. Thus, equation (A.2) rules this out.

Case 3: $0 < \alpha < 1$ and $0 < \beta < 1$

For both income groups to willingly spread across two outlets in equilibrium, the full price each pays for the merit good must equalize at the margin.

For an N_L at either outlet, $w_L H' + p' = w_L H'' + p''$ (A.3)

For an N_H at either outlet, $w_H H' + p' = w_H H'' + p''$ (A.4)

Expressing (A.3) and (A.4) in terms of wage,

$$w_L = \frac{p'' - p'}{H' - H''} \quad \text{and} \quad w_H = \frac{p'' - p'}{H' - H''} \tag{A.5}$$

(A.5) implies $w_H = w_L$, which is a contradiction.

Case 4: $\alpha = 0$ and $0 < \beta < 1$

If all low income people go to the pricing outlet, $w_L H'' + p'' < w_L H' + p'$, and if high income people go to both, (A.4) must hold. Expressing both relations in terms of wage as in (A.5) implies $w_H < w_L$, which is a contradiction.

Case 5: $0 < \alpha < 1$ and $\beta = 1$

If low income people go to both outlets then (A.3) must hold, and if all high income people go to the queuing outlet, $w_H H' + p' < w_H H'' + p''$. Expressing both in relations in terms of wage implies $w_H < w_L$, which is a contradiction.

Case 6: $\alpha = 0$ and $\beta = 1$

If low income people all go to the pricing outlet and high income people all go to the queuing outlet, $w_L H'' + p'' < w_L H' + p'$ and $w_H H' + p' < w_H H'' + p''$.

Expressing both relations in terms of wage implies $w_H < w_L$, which is a contradiction.

Appendix 1.2 Proof that Individuals are Best Off Choosing the Merit Good Outlet with the Lowest Full Price

We claim that an individual will choose the merit good outlet that offers the lowest full price given his wage. (He adjusts his time allocation between work and queuing accordingly).

Proof: conditional on his choice of outlet, and individual's demand functions are given by (3). Substituting these into utility yields his indirect utility function.

$$V = \left((\ell^*)^\rho + (y^*)^\rho + \theta (G^*)^\rho \right)^{\frac{1}{\rho}} = \left(\frac{w^\rho \left(1 + P_G^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} w^{\frac{\rho}{1-\rho}} + w^{\frac{\rho}{1-\rho}} \right)}{w^\rho \left(1 + P_G^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} w^{\frac{\rho}{1-\rho}} + w^{\frac{\rho}{1-\rho}} \right)^\rho} T^\rho \right)^{\frac{1}{\rho}} \tag{A.6}$$

$$= \left(1 + P_G^{\frac{\rho}{\rho-1}} \theta^{\frac{1}{1-\rho}} w^{\frac{\rho}{1-\rho}} + w^{\frac{\rho}{1-\rho}} \right)^{\frac{1-\rho}{\rho}} T, \text{ where } P_G = wH + p$$

It follows that for any $\rho \in$ **(-∞,1)**

$V'\big|_{P_G'} > V''\big|_{P_G''}$ if and only if $P_G' = wH' + p' < P_G'' = wH'' + p''$ and vice versa.

Appendix 1.3: Proof that Merit Good Consumption is Most Nearly Equalized with Transfer τ^* or its Pooled Equivalent When $\rho<0$

Since our proposed separating equilibrium (with τ^* defined by (13) and money prices $0<p'<p_{pH}$ and $p''=0$), provides the same full price and consumption to both income groups as our pooled equivalent equilibrium ($p^* = 0$ and $H=H^*_q$), we shall use the latter for comparison with other pooled equilibrium.

A pooled pure queuing equilibrium satisfies

$$N_L G_L\ (w_L H_q^*) + N_H G_H (w_H H_q^*) = M \tag{A.7}$$

Any other pooled equilibrium will clear at some ($\tilde{H}, \tilde{p}$) that satisfies

$$N_L G_L\ (w_L \tilde{H} + \tilde{p}) + N_H G_H (w_H \tilde{H} + \tilde{p}) = M \tag{A.8}$$

This could include pure pricing. We claim that any $(w_L\tilde{H}+\tilde{p}) > w_L H_q^*$, and any $w_H\tilde{H}+\tilde{p} < w_H H_q^*$. Combining (A7) and (A8),

$$N_L\{G_L(w_L H_q^*) - G_L(w_L\tilde{H}+\tilde{p})\} = N_H\{G_H(w_H\tilde{H}+\tilde{p}) - G_H(w_H H_q^*)\} \qquad \text{(A.9)}$$

Given that $w_L H_q^* < w_H H_q^*$ and $w_L\tilde{H}+\tilde{p} < w_H\tilde{H}+\tilde{p}$, the two pair of full prices could be related in 6 possible ways.

Case 1: $w_L H_q^* < w_L\tilde{H}+\tilde{p} < w_H\tilde{H}+\tilde{p} < w_H H_q^*$
Case 2: $w_L H_q^* < w_H H_q^* < w_L\tilde{H}+\tilde{p} < w_H\tilde{H}+\tilde{p}$
Case 3: $w_L H_q^* < w_L\tilde{H}+\tilde{p} < w_H H_q^* < w_H\tilde{H}+\tilde{p}$
Case 4: $w_L\tilde{H}+\tilde{p} < w_H\tilde{H}+\tilde{p} < w_L H_q^* < w_H H_q^*$
Case 5: $w_L\tilde{H}+\tilde{p} < w_L H_q^* < w_H\tilde{H}+\tilde{p} < w_H H_q^*$
Case 6: $w_L\tilde{H}+\tilde{p} < w_L H_q^* < w_H H_q^* < w_H\tilde{H}+\tilde{p}$

Cases 2-5 are ruled out because each implies in (A.9) that demand is both rising and falling in full price. Case 6 is also ruled out because it implies the difference of the middle inequality is less than the difference between the first and last terms:

$$(w_H - w_L)H_q^* < (w_H - w_L)\tilde{H} \qquad \text{(A.10)}$$

This implies that $H_q^* < \tilde{H}$, or that equilibrium queuing time under pure queuing is less than it would be under an equilibrium with a positive money price. Yet by differentiating (A10) with respect to *H* and *p*, it can easily be shown that $dH/dp < 0$.

Case 1 alone is consistent with demand price monotonicity and $dH/dp < 0$, and implies that the rich face a lower full price, and the poor a higher full price, at any other pooled equilibrium. Thus consumption will be most equal at our pooled equivalent equilibrium.

Similarly, any other *separating* equilibrium will increase the discrepancy between the rich and poor's consumption of the merit good. Any other separating equilibrium, to exist, requires a transfer at least as great as the τ^* identified by (14). But from (15), this also would increase the discrepancy in consumption across outlets, and therefore between rich and poor.

Appendix 1.4 The Maximum Allowable Difference in Preference Distributions Across Income Groups for Existence of Separating Equilibrium, $0<\rho<1$.

Define $H_{qL,sL}$ as the pure queuing time price that would clear an outlet as in (16), with M_q supplied, s_L strong preferences, and only low income people present. Analogously, define $H_{qH,\,sH}$ as the pure queuing time that would clear an outlet with M_p supplied, preference distribution s_H, and only high income people present. For the marginal high income person to remain in the pricing outlet (*H″,p″*) requires:

$$w_H H'' + p'' = w_H H_{qH,\,sH} < w_H H_{qL,sL} = w_H H' + p' \qquad \text{(A.11)}$$

The highest s_H consistent with the inequality in (A.11) is $s_{H\ MAX.}$ For the marginal low income person to remain in the queuing outlet (H',p′) requires:

$$w_L H' + p' = p_{pL\ sL} < p_{pH\ sH} = w_L H'' + p'' \qquad \text{(A.12)}$$

The lowest s_H consistent with the inequality in (A.12) is $s_{H\ MIN.}$

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[1] Preferences are more general than in Alexeev and Leitzel (2001), who assume equal weight Cobb Douglas preferences between a single good and leisure. We are less general, however, than O'Shaugnessy (2000), who assumes general concave utility over a single good and leisure.

[2] This assumes that individuals must queue once per unit purchased, and that everyone in a given outlet will wait an identical period of time per unit purchased. This is a common way of modeling the time cost of queuing (Barzel (1974), Sah (1987), Suen (1989), Polterovich (1993), O'Shaughnessy (2000), Alexeev and Leitzel (2001)). Alternatives have been proposed, such as queuing time depending on show-up time (Holt and Sherman (1982)), or fixed time costs for any quantity of purchase (Weitzman, 1991).

[3] Nichols et al. (1971) raise the issue that savings or non-labour income could result in wealthy retired people queuing alongside the poor. We shall address non-labour income in a subsequent version of this paper.

[4] By making the supply of the merit good exogenous, the lost production aspect of queuing is obscured. We plan to close the model in subsequent work examining the efficiency aspects of specific egalitarianism.

[5] Uniqueness is satisfied in that the excess demand function (4) is monotonically decreasing in full price, takes on a negative value at an infinite price, and takes on an infinite value at zero price. The same conditions are satisfied with multiple outlets and heterogeneous preferences later in the paper.

[6] Wage differentials are exogenous here, but could reflect differences in productivity.

[7] We ignore marginal price effects of individual outlet choice in this model, assuming a large numbers case.

[8] That is, a single high wage individual thinking of switching outlets would pay full price $w_H (H_q + \varepsilon)$ if he joined the poor in queuing, whereas he would pay a full price *equivalent* to $w_H H_q$ if he remained in the pricing outlet.

[9] Strictly speaking, a separating equilibrium would likely not exist if $s_L = 1$ and $s_H = 0$ simultaneously. However, merit good consumption would be more nearly equalized at the maximum difference in s_L and s_H that would be consistent with existence.