Organ Procurement Systems and the Possibility of a Market for Human Organs

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Abstract

The shortfalls of nonmarket organ exchange systems suggests that a market system may provide a solution. This paper explores the literature surrounding organ and healthcare markets and policy. Using a partial equilibrium model, it creates a theoretical model for an organ market. The results of a free market indicate that government intervention via subsidy would be a tool that could help correct for market failures. However, without several key aspects of perfect competition, a market for human organs is not currently a feasible solution

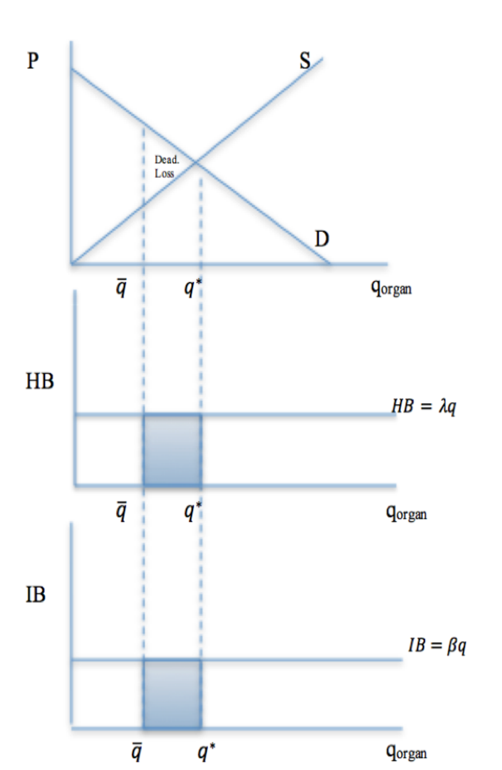
Introduction

As of October 2017, 116,624 patients are on the waiting list for an organ in the United States (OPTN, 2017). Of these 116,624 patients, an average of 20 will die per day on a waiting list for an organ. Over 7,000 candidates died while on the waiting list for a transplant (UNOS, 2017). A new patient is added approximately every 10 minutes (UNOS, 2017). This paper evaluates the use of a market mechanism as an alternative. It explores the competiveness and efficiency of various organ procurement and allocation systems (both legal and illegal) and the economic, socioeconomic, and ethical issues that are present. Through the creation of a theoretical model, we can observe the impact of an organ market under certain market conditions, and ultimately gain some insights as to whether or not such a market should exist.

Assumptions and Fixed Quantity

1. We assume perfect competition
2. However, there are two positive externalities:
   - Health Benefit
   - Information Benefit

- Under a fixed quantity system there is deadweight loss and the potential for an increase in welfare.



Free Market Model Results

Total Surplus: $TS = CS + PS + HB + IB$

Demand: $P = a - bq$

$CS = \frac{b}{2}q^2$

Supply: $P = cq$

$PS = \frac{c}{2}q^2$

Health Benefit: $HB = \lambda q$

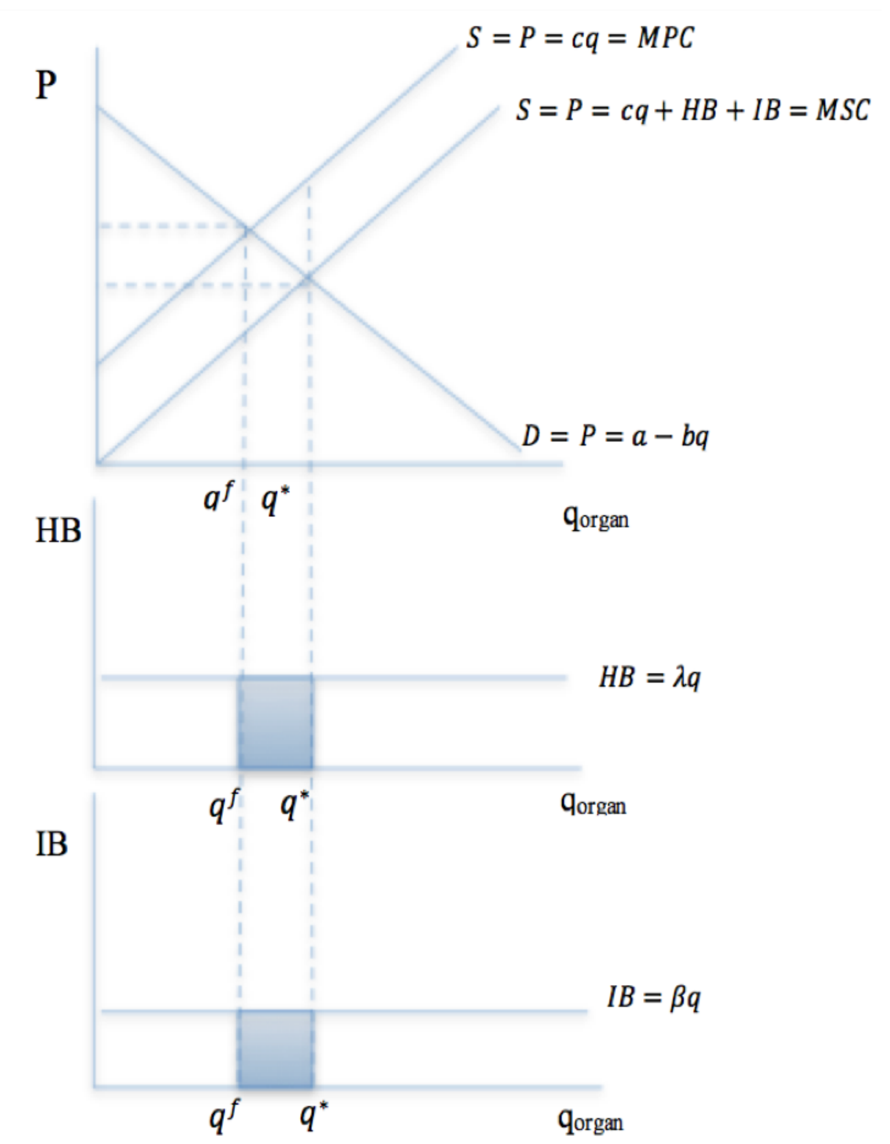
Information Benefit: $IB = \beta q$

Setting MC=MB: $q = (\frac{a}{b+c})$

Profit = TR-TC: $\pi = P * q - \frac{cq^2}{2}$

Equilibrium Price: $P = (\frac{ac}{b+c})$

The free market provides greater welfare than the fixed quantity system, but there is still room for improvement.



Government Subsidy

New Total Surplus: $TS = CS + PS - R + HB + IB$

Gov. Revenue: $R = sq$

New Supply: $P = cq - s$

New Quantity: $q = (\frac{a+s}{b+c})$

Totally differentiate TS with respect to subsidy: $\frac{dTS}{ds} = \frac{\partial CS}{\partial q}\frac{\partial q}{\partial s} + \frac{\partial PS}{\partial q}\frac{\partial q}{\partial s} - \frac{\partial R}{\partial q}\frac{\partial q}{\partial s} + \frac{\partial R}{\partial s} + \frac{\partial HB}{\partial q}\frac{\partial q}{\partial s} + \frac{\partial I}{\partial q}\frac{\partial q}{\partial s}$

Deriving quantity with respect to subsidy: $\frac{\partial q}{\partial s} = \left(\frac{1}{b+c}\right)$

$CS = \frac{b}{2}q^2$

Deriving CS and PS with respect to subsidy: $\frac{\partial CS}{\partial q} = bq$

$PS = \frac{c}{2}q^2$

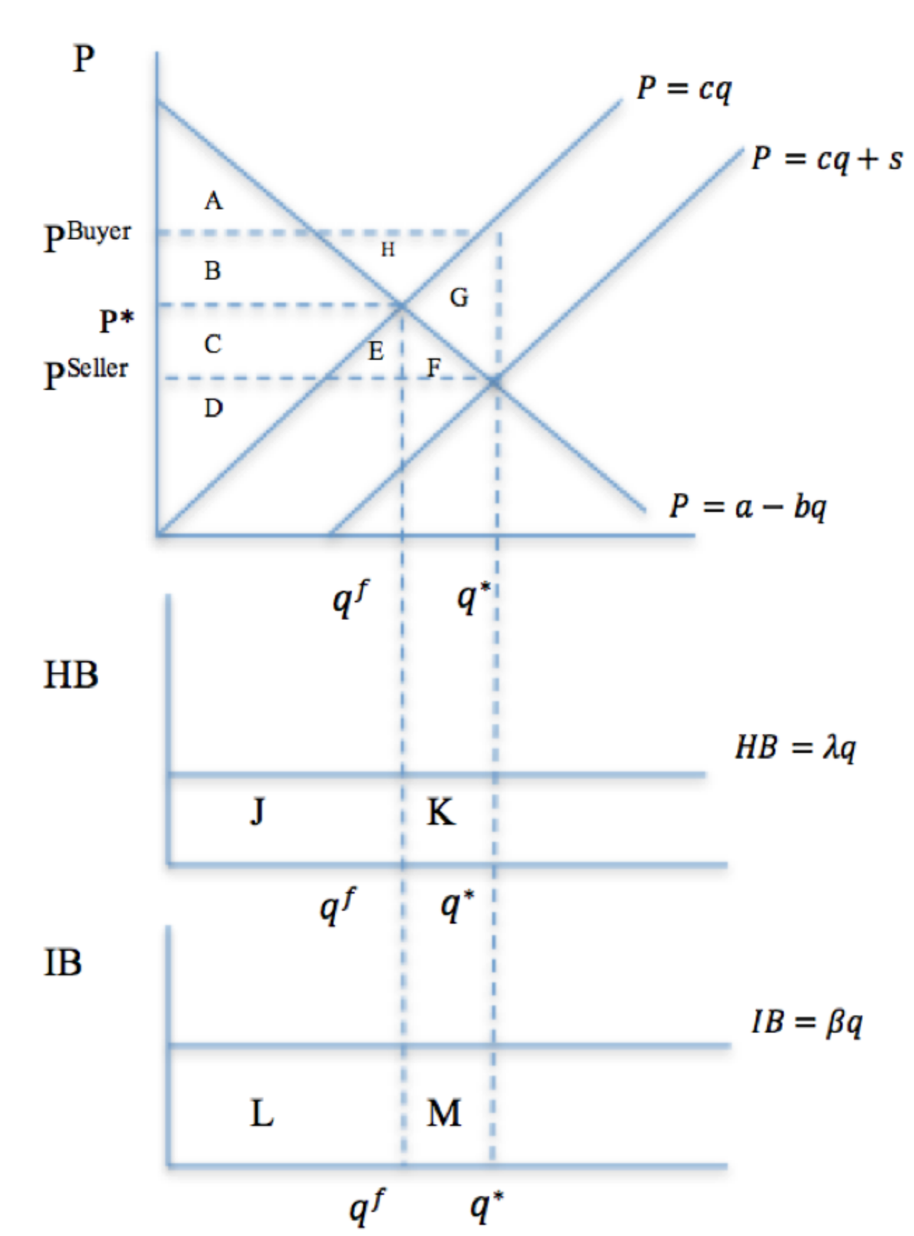
$\frac{\partial PS}{\partial q} = cq$

Deriving Revenue with respect to quantity and then subsidy: $\frac{\partial R}{\partial q} = -s$

$\frac{\partial R}{\partial s} = -q$

Deriving HB and IB with respect to quantity: $\frac{\partial HB}{\partial q} = \lambda$

$\frac{\partial IB}{\partial q} = \beta$



The Optimal Subsidy and Results

Plugging in all of the values, we find that the optimal subsidy is equal to the sum of both positive marginal benefits. Changes in welfare by adopting the subsidy are summarized on the right.

$$\frac{dTS}{ds} = bq\left(\frac{1}{b+c}\right) + cq\left(\frac{1}{b+c}\right) - q - s\left(\frac{1}{b+c}\right) + \lambda\left(\frac{1}{b+c}\right) + \beta\left(\frac{1}{b+c}\right) = 0$$

$$\frac{dTS}{ds} = -s\left(\frac{1}{b+c}\right) + \left(\frac{1}{b+c}\right)(\lambda + \beta) = 0$$

$$s = (\lambda + \beta)$$

	Change from Subsidy
CS	+CEF
PS	+BH
HB	+K
IB	+M
GR	-BCEFGH
TS	-G+KM

Discussion and Implications

- The results of the theoretical model demonstrate that an "altruistic" or fixed quantity system is not the most welfare-enhancing way to provide organs for transplant.
- A free market provides, for a price, an overall higher equilibrium level of organs. Externalities prevent the market from achieving optimality. A government subsidy helps account for these externalities.
- Real life markets are almost never perfectly competitive, and organs are not identical.
- The model does not account for ethical concerns, and focuses only on welfare maximization.
- Without government regulation, and if our assumptions do not hold, an organ market is not currently feasible.
- Advances in artificial organs may render the need for organ donation or sale obsolete.

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