SUPPLY AND DEMAND IN ORGAN DONATION: AN ECONOMIC ANALYSIS OF INCENTIVIZING KIDNEY TRANSPLANTS

by

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This paper researches the implications of allowing financial incentives for living kidney donors. Currently, the United States relies on either deceased or voluntary living donors to meet the growing need for kidney transplants, which has caused a severe shortage of kidneys. This shortage creates a significant public health challenge as patients endure long waiting lists, and thousands die preventable deaths each year while waiting for a kidney. The goal of a legalized kidney market is to align the supply of kidneys with the growing demand.

This paper replicates the model developed by Becker and Elias (2007), which estimated the payment necessary to incentivize organ donation, using updated data for 2025. By incorporating current estimates of the value of a statistical life, modern surgical risk, and wage data, the analysis provides a revised estimate of the compensation level required to encourage sufficient donor participation in today's context.

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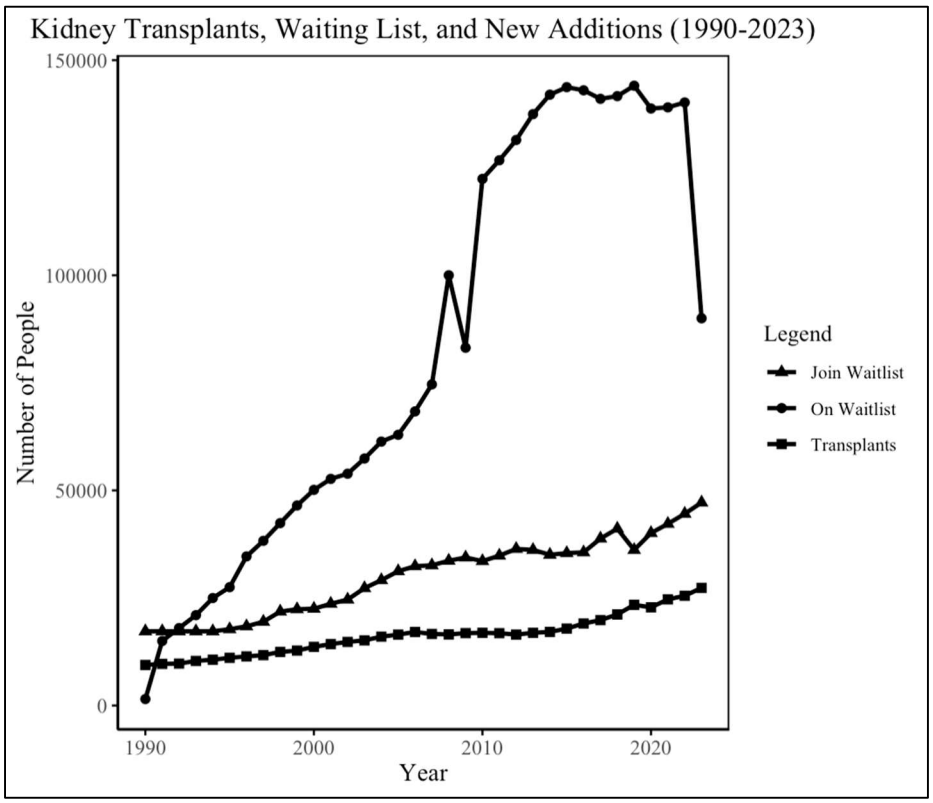
Introduction to Kidney Disease & Current Market

The number of people in the United States diagnosed with chronic kidney disease (CKD) has been steadily growing for the past fifty years. CKD is the gradual loss of kidney function; the kidneys filter out waste and toxins that can accumulate in the blood stream. Individuals with CKD lose the ability to filter out waste and toxins, allowing them to build up in the bloodstream (Mayo Clinic, 2023). Without medical intervention, CKD is fatal.

There are two treatments for CKD: dialysis and transplant surgery (Mayo Clinic, 2023). Dialysis is the process of artificially filtering out toxins from the bloodstream. Although dialysis is effective, it is not a complete cure and limits patients' quality of life. Patients on dialysis must spend a significant amount of time hospitalized. Further, dialysis comes with a variety of side effects. Most patients only live five to ten years while relying on dialysis. In comparison, kidney transplants completely cure CKD (National Kidney Foundation, 2025). The need for kidney transplants has grown as the number of people with CKD has increased (Becker & Elías, 2007). The number of individuals who join the kidney transplant waiting list has consistently grown by approximately six thousand people annually (Organ Procurement and Transplantation Network [OPTN], 2025). While kidney transplants have become more common, they have not grown at a rate high enough to meet the increasing waiting list (OPTN, 2025). The transplant waiting list is long enough that most patients wait an average of five years to receive a kidney and approximately five thousand people die waiting for a kidney every year (Becker & Elías, 2007). The primary reason kidney transplants do not occur at the rate patients need is because the supply of kidneys is far smaller than the demand for kidney transplants.

As shown in Figure 1, the number of patients on the kidney transplant waitlist has rapidly grown since 1990, and the gap between supply and demand of kidneys has grown alongside the waitlist. A significant decrease in the number of patients on the waitlist can be seen from the year

Figure 1:

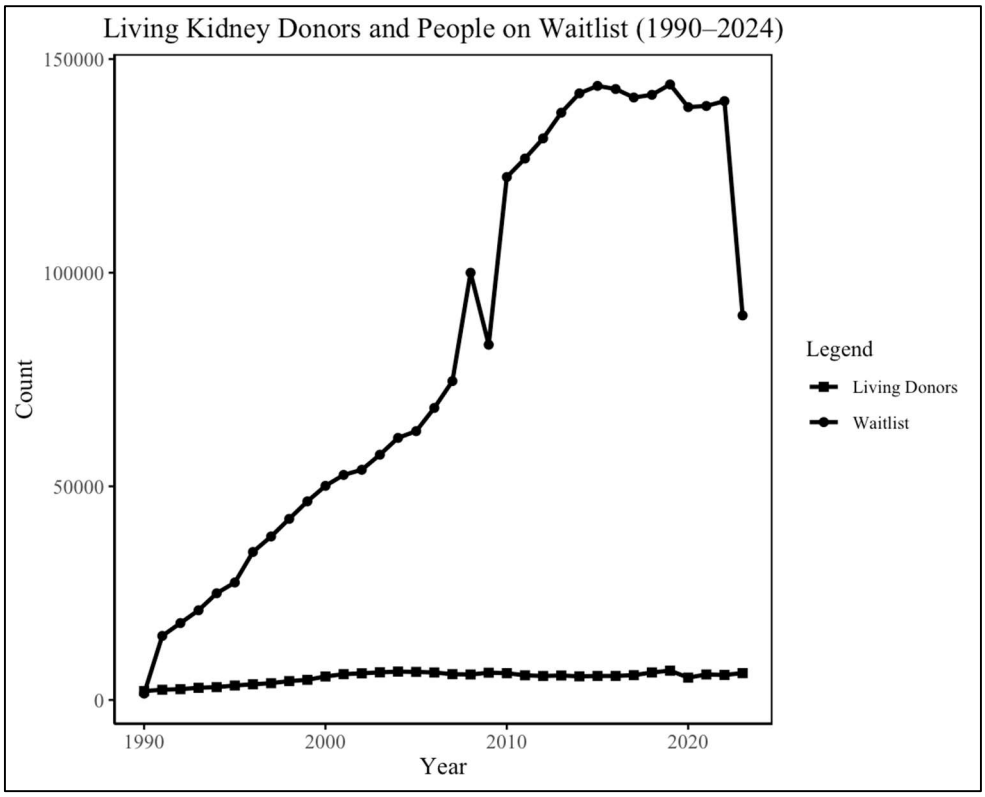


2022 to 2023. This decrease can be attributed primarily to a shift in the way the Organ Procurement and Transplant Network (OPTN) collected waitlist data. Prior to 2022, OPTN counted each individual registration as a person on the waitlist, including inactive patients and duplicate listing (OPTN, 2023). An inactive patient registration is a patient who still has an active registration but is not currently eligible for transplant surgery and a duplicate registration is when one patient is registered with different organizations to receive a kidney (OPTN, 2023). In 2023, OPTN stopped counting inactive and duplicate registrations as part of the annual number of patients on the waitlist, which is why there appears to be a drop in the number of

patients on the waitlist (OPTN, 2023). Despite the drop in 2023, the number of patients on the transplant list is still much higher than the number of transplant surgeries.

Kidneys are supplied through cadaver donations and live donations (National Kidney Foundation, 2025). Between the two, live donations have a significantly higher success rate; the average long-term survival for individuals who receive a kidney from a live donor is twelve to twenty years whereas individuals who receive a cadaver donation only live, on average, seven to eight years post-transplant (Koo et al., 1999). The transplant procedure is also considered less risky with live donors because the kidney is outside of the donor's body for a shorter time (Koo et al., 1999). Despite the superior outcomes associated with live donations, the number of kidneys supplied through live donations has remained relatively constant and low (OPTN, 2025). As shown in Figure 2, annually, the number of individuals on the waitlist is significantly higher than the number of live donors.

Figure 2:



Most live donations are made by someone close to the recipient— less than five percent of donations are made by someone the recipient does not know (National Kidney Registry, 2025). However, not everyone who wants to donate a kidney to a loved one can: to donate a kidney, the donor must have the same blood type as the recipient. Kidney Exchange Programs, established in the United States in 2000, sought to solve this issue (National Kidney Registry, 2025). Kidney Exchange Programs work by connecting different families who cannot donate a kidney to their loved one but are a match for another family. For example, if someone in family A was a match to donate a kidney to someone in family B and vice versa, Kidney Exchange Programs would connect the two families and they would both donate a kidney in exchange for the other family doing so as well (National Kidney Registry, 2025). Although Kidney Exchange Programs decreased the gap in supply and demand of kidneys, they did not do so to the extent that supply met demand (OPTN, 2025).

Figure 3:

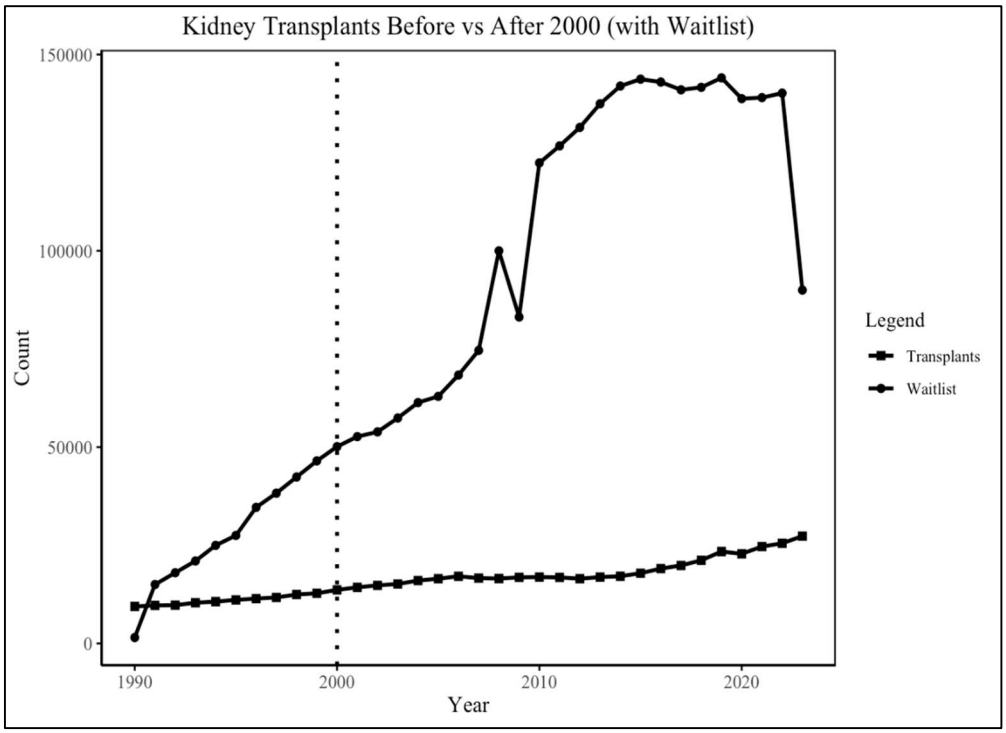


Figure 3 shows that the growth in number of live donors after Kidney Exchange Programs, marked by the parallel line at the year 2000, was small and still did not meet the demand for kidney transplants. Although there was a slight increase in transplants after Kidney Exchange Programs, the implementation of this program did not solve the supply and demand gap.

Another proposed solve to increase the supply of kidneys is implementaring an opt-out system for organ donation. Under this policy, all individuals would be automatically signed up as organ donors unless they opted out. Currently, the United States uses an opt-in model, which means that no one is an organ donor unless they sign up to be one. Many other countries, like Spain, Belgium, and Austria have switched to opt-in systems and observed a significant increase in the supply of organs for donation (Abadie & Gay, 2006). Specifically, Spain consistently has one of the higherst rates for organ donation in the world (Matesanz & Domingues-Gil, 2019). Proponents for implementing an opt-in system in the United States have faced pushback that the system will violate individual medical autonomy and may face criticism from communities who do not trust medical intitutions (Childress & Liverman, 2006). Because of this, the opt-in system has not yet gained much political support in the United States.

Current Market for Financial Incentives to Kidney Donors

Donors incur a financial burden when donating a kidney. If insured, the cost of surgery and postoperative care is most often covered (Van Pilsum Rasmussen et al., 2020). However, donors will lose wages from the time off work and must pay for travel, lodging, childcare, or any other personal expense involved with the donation. Donating a kidney requires most to take at least a month off work (Van Pilsum Rasmussen et al., 2020). Although some employers provide paid leave for employees who donate an organ, it is not guaranteed.

Despite the cost of kidney donation, paying someone any amount of money in exchange for donating an organ is currently illegal under the 1983 National Organ Transplant Act (NOTA). NOTA established the Organ Transplant and Procurement Network (OPTN), the body that governs organ transplants, and gave all authority to OPTN (National Organ Transplant Act, 1984). This centralized control has prevented any implementation of a legal compensation system for donors. NOTA's framework prioritizes an altruistic model of donation and does not currently allow for compensation beyond the reimbursement of direct expenses. However, it is possible that allowing payments would incentivize more people to donate and increase the supply of kidneys.

Economists Gary Becker and Julio Elias (2007) developed one of the first foundational models for introducing monetary incentives into organ donation. They conducted a supply and demand analysis of the kidney and liver markets, arguing that the organ shortage was not simply a result of limited supply, but rather the absence of price mechanisms to motivate individuals to donate. Their model estimated the financial compensation required to incentivize enough donors to close the gap between supply and demand.

Following Becker and Elias's work, subsequent researchers have examined how financial incentives might influence individuals' willingness to donate. Critics of this approach have raised ethical concerns, arguing that such incentives could exploit low-income individuals or compromise the voluntary nature of consent (Childress & Liverman, 2007).

Becker and Elias's study, done in 2007, found that a payment of $15,200 would be sufficient to incentivize individuals to donate a kidney to an extent that solved the supply and demand gap in kidney transplants. This paper replicates their model with updated data to determine what payment would be required to incentivize donation at the same level in 2025.

Methods

Part 1: Data Collection

I used data collected by the United Network for Organ Sharing and the Organ Procurement Transplantation network from 1990 to 2023. I collected data on the number of organ transplants per year, number of patients added to the organ transplant list per year, existing number of patients on transplant list, and number of donations for kidney transplants.

I used this updated data to replicate the supply and demand model created in Becker & Elias's 2004 paper Introducing Incentives in The Market for Live and Cadaveric Donations.

Part 2: Estimating the Price of a Kidney

I estimated the price of a kidney by identifying how much additional money an individual would require to be incentivized to donate a kidney. I assumed that the price of a kidney is made up of three components: monetary compensation for risk of death, monetary compensation for wages lost during recovery, and monetary compensation for the risk of reduced quality of life post operation (Becker & Elías, 2007). These three components can be reflected in the formula seen in Figure 4.

Figure 4:

$$I = M_R + M_T + M_Q$$

$I = required\ payment\ to\ incentivize\ donation$

$M_R = monetary\ compensation\ for\ risk\ of\ death.$

$M_T = monetary\ compensation\ for\ time\ off\ work$

$M_Q = monetary\ compensation\ for\ quality\ of\ life\ loss$

I calculated the first component, monetary compensation for risk of death, by multiplying the value of a statistical life (VSL) with the probability of death (Becker & Elías, 2007). Here,

the value of a statistical life is the money premium required to bear an increase in the probability of death. I will calculate the second component, monetary compensation for time off work, by dividing the average annual income by number of weeks in a year (Becker & Elías, 2007). Then, I multiplied the quotient by four because most donors take at least four weeks off work to recover from surgery. Lastly, I calculated the third component, the monetary compensation for quality-of-life loss, by multiplying the expected change in quality of life by the value of a statistical life (Becker & Elías, 2007). I added the monetary compensation for risk of death, monetary compensation for time off work, and monetary compensation for quality-of-life loss to identify the required payment to incentivize an individual to donate a kidney.

Part 3: Modeling Supply and Demand

One way of measuring the gap between supply and demand is by comparing the number of patients added to a transplant every year to the number of patients who die on the waitlist waiting for a transplant (Becker & Elías, 2007). The difference between these two numbers is equal to the gap between the supply and demand of kidney transplants. I used the following equations to calculate the gap between supply and demand in a given year.

Figure 5:

$$G_t = W_t - D_t$$

$$W_t = A_t - T_t$$

$$G_t = (A_t - T_t) - D_t$$

$G_t = gap\ between\ supply\ of\ kidneys\ and\ demand\ for\ kidney\ transplants\ in\ year\ t$

$A_t = number\ of\ additions\ to\ kidney\ transplant\ waitlist\ in\ year\ t$

$T_t = number\ of\ succesful\ kidney\ transplants\ in\ year\ t$

$D_t = number\ of\ patient\ deaths\ while\ on\ transplant\ waitlist\ in\ year\ t$

$W_t = number\ of\ patients\ on\ waitlist\ in\ year\ t$

Findings

Price of a Kidney

The Department of Health and Human Services estimates the current VSL to be 13.1 million dollars (U.S. Department of Health and Human Services [HHS], 2025). The risk of death from kidney transplant surgery has significantly declines over the past few decades. From 1990 to 2009 approximately every 3 out of 10,000 donors died from complications of surgery. However, in the past decade, about 1 out of every 10,000 donors died, so, the risk of death from donation is 0.01 percent (National Kidney Registry, 2025). Therefore, the monetary compensation for risk of death is 13.1 million multiplied by 0.01, which is $130,000.

Figure 6:

$$M_R = monetary\ compensation\ for\ risk\ of\ death$$

$$13{,}100{,}100 \times 0.01 = 130{,}000$$

$$M_R = \$130{,}000$$

The Bureau of Labor Statistics found the average annual income in 2024 to be $67,920 (U.S. Bureau of Labor Statistics [BLS], 2025). The average donor takes 4 weeks off work, thus, the monetary compensation for time off work is $67,920 divided by 52—for the 52 weeks in the year—multiplied by 4, or $5224.62.

Figure 7:

$$M_T = monetary\ compensation\ for\ time\ off\ work$$

$$\frac{67{,}920}{52} \approx 1306.15$$

$$1306.15 \times 4 = 5224.62$$

$$M_T = 5224.62$$

It is difficult to estimate the exact quality of life loss for a kidney donor; many donors go on to live normal lives (Becker & Elías, 2007). In fact, nearly 96% of a thousand donors

surveyed said they would donate a kidney again if they could (National Kidney Registry, 2025). That being said, donors do have to limit athletic activity post operation and are at a greater risk for high blood pressure (Becker & Elías, 2007. Becker and Elias assign an arbitrary $7,500 value as the monetary compensation for quality-of-life loss. To accurately replicate their model, I also assign an arbitrary $7,500 in 2004 dollars, adjusted to 2025 dollars using the consumer price index (CPI) to reflect inflation. The CPI in 2004 was approximately 188.9 and in 2025 is projected to be 312.8.

Figure 8:

$$Adjusted\ Value = Original\ Value \times \left(\frac{CPI\ in\ 2025}{CPI\ in\ 2004}\right)$$

$$Adjusted\ Value = 7{,}500\ \times \left(\frac{312.8}{188.9}\right)$$

$$Adjusted\ Value = 7{,}500\ \times 1.655\ \approx 12{,}412.50$$

Therefore, I found the amount required to incentivize an individual to donate a kidney can be divided into three components. The first is the monetary compensation for risk of death, equal to $130,000. The second is monetary compensation for time taken off work, which is equal to $5224.62. Lastly, the third component is monetary compensation for quality-of-life loss, equal to 12,612.67. Adding those components together I found that the required amount of money to incentivize donation is $147,837.29.

Figure 9:

$$M_R = monetary\ compensation\ for\ risk\ of\ death = \$130{,}000$$

$$M_T = monetary\ compensation\ for\ time\ off\ work = \$5224.62$$

$$M_Q = monetary\ compensation\ for\ quality\ of\ life\ loss = 12{,}612.67$$

$$I = M_R + M_T + M_Q$$

$$I = 130{,}000 + 5224.62 + 12{,}612.67 = 147{,}837.29$$

Supply & Demand Gap

Using the formula $G_t = W_t - D_t$, I model the supply and demand gap between kidney transplants in the Figure 3. The average cost of a kidney transplant without monetary incentives is $442,500. Adding a monetary incentive of $147,837.29 increases the price of a transplant to $590,337.29. Without the monetary incentive, the supply demand gap between kidneys donated and transplants demanded is $Q_0' - Q_0$. After introducing a $147,837.29 incentive for donors, the supply and demand gap decreases to $Q_1 - Q_0$. The total decrease in the supply and demand gap is equal to $Q_0 - Q_1$. The backward L-shaped supply curve labelled *SS* represents the supply of kidneys with no financial incentives in place for donors. This means the supply is purely made up of voluntary donations from family members, altruistic strangers. The vertical portion of the *SS* curve starts at Q_0, the total quantity of voluntary donations without financial incentives, and becomes vertical to represent the supply is now independent of price. When adding a financial incentive of $147,837.29 to donors, the total cost of the transplant increases, which decreases demand and increases supply to intersect at point *E*,* the equilibrium quantity of kidneys donated and transplanted at this cost.

Conclusion

A payment to potential donors will incentivize them to donate a kidney if the payment is high enough. Becker and Elias' 2004 model of monetary incentives in organ donation holds true for kidney donations in 2025. The primary is that the VSL has more than doubled since 2004, making the required payment to incentivize donors higher. In 2004 the required payment was $15,200 whereas the required payment in 2025 is $147,837.29.

Future work should more accurately determine what the quality-of-life loss for a kidney donor is, as this would allow for a more precise calculation of the compensation required to ethically and effectively incentivize donation.

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