Peer-to-Peer Rental Markets:

Some Simple Economics of the “Sharing Economy”

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November 14, 2014

# **Abstract**

The emergence of peer-to-peer rental markets allows owners of durable goods to rent out their excess capacity to non-owners. When the rental market emerges, both owners and non-owners economize on their usage until the market clears. Rental rates are increasing in consumer valuations, as a higher valuation increases demand or reduces supply among non-owners and owners, respectively. If the pre-rental market excess capacity of owners exceeds the capacity demanded by non-owners, a glut is possible. In the long-run, all consumers can revise their ownership decisions and when this occurs, the rental rate equals the product market purchase price and ownership does not depend on consumer valuation. The fraction of consumers owning in the long-run is the population average usage rate. If the market-clearing short-run rental rate is above the purchase price, ownership will increase in the long-run. In the long-run and short-run rental markets, the unlocked social surplus is increasing in the valuation of former non-owners and decreasing in the valuation of owners, though both groups see welfare increase in both the long- and short-runs. In the long-run P2P rental market a higher product market price is supportable, as owners can partially offset the purchase price through rental income. Because long-run rental rates equal the purchase price and consumers derive consumption value from the good even without rental, firms are not competitive in the long-run rental market.

JEL J01, J24, J3

# Introduction

Peer-to-peer rental markets allow owners of durable goods to share capacity with non-owners. These markets should be distinguished from ordinary rental markets, such as traditional apartments, where the owners are not users and rentals are often for much more sustained periods. Peer-to-peer (P2P) rental markets have expanded dramatically in recent years. Most of this increase has been driven by the capabilities of information technology, which substantially reduces the search costs of owners seeking renters and vice versa. Airbnb and Uber are perhaps the most dramatic examples. Reputations conveying the reliability of strangers are readily established, and the nature of goods – salient in the Airbnb case – is readily communicated. To be sure, P2P markets have long existed. Vacation homes are a notable example. But the markets that have arisen recently function much more efficiently, and are much more extensive.

When a P2P market emerges, both owners and non-owners economize on their usage until the market clears. Rental prices are increasing in consumer valuations, as a higher valuation simultaneously increases demand and reduces supply among non-owners and owners, respectively. In most instances, we would think, short-term boosts in valuation would affect the demand side more than the supply side. If so, the level of transactions would increase along with price. A typical situation would be a festival or sports championship.

We focus on the case where the efficient scale for the firm is ownership of one unit. That is because we posit that the owner uses the asset when it is not rented. Moreover, the value of using a second unit, say of a car or apartment, is minimal or zero. One reason why P2P markets can compete so successfully with firms that own multiple units, such as taxi fleets or hotels, is that they have an efficiency advantage if utilization would fall significantly short of 100%.

In the long-run, of course, consumers will revise their ownership decisions. When this does occur, the capitalized rental rate, that is rental price divided by the interest rate, will equal purchase price for a unit. Unlike traditional goods, the individuals who own the asset will not necessarily be those who value it the most, rather it will be those with some combination of gaining the most from it when demand is slack and missing it the least when demand is heavy. The fraction of consumers owning in the long-run is the average usage rate at any point in time.

When the capitalized rental rate exceeds the purchase price, there will be upward pressure and new supply will come on the market.

There are now a number of start-ups and several established firms that aim to facilitate peer-to-peer (P2P) rentals: these so-called “sharing economy” businesses have created rental markets for houses, cars, boats, bicycles, tools, cameras, parking spaces, and clothes. Perhaps the most prominent example of P2P rental markets is Airbnb, which allows individuals to rent out spare bedrooms, apartments or even entire homes. These platforms have been heralded by many observers: they promise to expand access to goods, diversify individual consumption, increase efficiency by increasing asset utilization and provide more ways for individuals to earn income. They might also reduce ownership and offer environmental benefits. Aside from the business interest in these platforms—Airbnb alone has attracted nearly $800 million in venture capital investment**[[1]](#footnote-1)**—these companies have also attracted policy interest—much of it negative. Critics charge that the primary competitive advantage of these platforms is the ability to duck costly regulations—regulations that often are intended to keep costs from being imposed on third-parties.**[[2]](#footnote-2)**

The somewhat obvious economic rationale for P2P rental markets is that most durable goods are used by their owners far less than 100% of the time: the excess capacity this under-utilization generates can be “shared” (i.e., rented to) non-owners that still value the good but whose planned usage (or income, storage space, credit rating etc.) prevents them from owning the good.

# Examples

The kinds of goods being traded in sharing economy have a number of characteristics. They are durable goods, as consumable goods would not have any excess capacity. So far, the most prominent examples have been for items that are expensive to purchase outright. If

Differ on whether or not the owner’s labor is mixed with their capital.

Airbnb/VRBO

Boats

Relayrides

GetAround

Liquid (Bikes)

Fon

BoatSetter

Yerdle

BoxBee

Parking Spaces

RentTheRunway (does not have a peer component I think)

UberX (mixes capital)

Laboratory Equipment Science Exchange

SnapGoods – household stuff

DogVacay (Kennel Space)

# Patterns of Ownership and Rental

## Pros of Ownership / Cons of Renting

Maintain all the residual control rights (Grossman Hart Moore), including the right to rent it out to others

Fully exposed to depreciation

No need to plan usage ahead of time

Mental cost of thinking about usage on the margin

No costs associated with transferring physical control

## Pros of Renting / Cons of Owning

Only “pay” for periods when actually used, so depending on price, could be less

No need to store the good when not using it

Not fully exposed (necessarily) to wear and tear on the good---the benefits of moral hazard

Can consume a more diverse bundle, as a different model can be rented each time

# Why Now? Technological Innovation and the Rise of Sharing

## Characteristics of historical “sharing economy”

High-cost brokers

High transaction costs, many borne by would-be sellers

The existence of high brokerage fees suggest search frictions are/were high.

Sharing happens among neighbors – lawnmowers, tools etc.

Fees

Some peer-to-peer rental markets have pre-Internet antecedents. People did rent out vacation homes to strangers, using tools like craigslist, classified ads and so on.

Airbnb case is illustrative. Finding an apartment would not be qualitatively different from finding a short-term rental. In some cities, apartment rentals have been very broker-heavy. Brokers know about availability---it would be prohibitive for the interested renter to try to talk to every apartment owner. The frictions are so great that brokerage can exist as a business. But the costs of brokering a transaction do not scale with the duration of the renal, and so there was no market for brokering short-term rentals. With Airbnb, the costs are reduced radically and so they can profitably broker very short-term rentals. In fact, they get a benefit from lots of shorter-term rentals because it increases the usefulness of their reputation system.

## Reputation Systems

Economists have long-recognized the importance of reputations in facilitating market transactions, but the literature was largely descriptive. With the rise of electronic commerce, reputation systems become designed components of markets. They---like any technology---have developed and improved over time.

First reputation systems were applied to markets where the buyer uncertainty was largely about the trustworthiness of the counter-party and less about the attributes of the good itself.

## Algorithmic match-making replacing by-hand matching

Easy for a computer-mediated market to keep track of the inventory, elicit preferences and then create on-the-fly matches. They can avoid congestion by clearing the market very quickly.

## Returns to market thickness

For many sharing economy sites, their usefulness is increasing dramatically in market thickness. With a thick market, stock-outs become rare. More transactions means more evaluations, which means a thicker market.

## Bandwidth and informational problems

High-resolution photographs.

## Measurement innovation

Ease of quickly taking pictures to document damage. Ease of emailing of texting a host about a problem. GPS that records precise mileage of a car driven. The Internet of things combined with more and cheaper embedded sensors, ubiquitious cameras etc. should reduce moral hazard and increase contractibility.

Why now?

**Emergence and improvement of reputation systems**

It took us a long time to figure out how to make them work. The first ones were quite amateurish (the eBay example).

The original eBay reputation has the sum or positive and negative votes.

Also – less risk of fake evaluations because evaluations are costly (Judith Chevalier has a paper on this).

Usefulness of evaluations also has an economy of scale.

Increases in computer mediation that facilitate measure measurement/contracting. For example, GPS technology and sophisticated maps make Uber possible.

Not quite yet but coming: We could imagine a next wave of technological innovation: keyless electronic doors that are programmed to open for certain people, remote cameras etc. We could even imagine things like self-storage locations with programmable entry set-up for self-serve renting for all sorts of things.

Higher bandwidth means greater ability to share information about goods and services: on Airbnb, I can see what kind of room I’m getting. I could have a video conference call with the owner if I was so inclined.

Thicker markets: search frictions are reduced through algorithmic means. Also, more likely to have a trade occur.

Indirect Network effects: As more people live their social and professional lives online, services that make use of the information contained in those networks becomes more useful. E.g, if 100% of the hosts have their Facebook accounts connected to the Airbnb profile, it’s more useful to me, as

Economies of scale – the usefulness of Airbnb is much greater if it does not regularly stock out.

Emerging in areas with high search and screening costs. The platforms also know that by creating enough

These kinds of exchanges between consumers have always been possible, but they often have substantial transaction costs, such as the costs of finding trading partners and overcoming informational problems. It is perhaps for this reason that much of the sharing of consumer goods historically has been between family members and neighbors rather than strangers. The emergence of platform-mediated reputation systems and other trust-building socio-economic technologies (plus in many cases, platform-providecreatd insurance) presumably allow the platforms to reduce the otherwise market-preventing transaction costs inherent in P2P rental.

Despite the simple economic rationale of increased utilization, this characterization raises several questions: what explains the initial distribution of ownership and non-ownership before the P2P rental market emerges? When it does emerge, what determines the rental rate and the quantity exchanged in the P2P rental market? How much consumer surplus is “unlocked” by the P2P rental market and how is it distributed? How does the short-run rental rate—where existing owners rent to non-owners—differ from the long-run in which owners and non-owners alike can revise their ownership decision in light of the existence of a P2P rental market? What is the effect on total product market demand—both in terms of market-clearing and elasticity? Can firms owning the good compete in the P2P rental market? What goods are particularly amenable to sharing and why?

This paper addresses these questions using a simple consumer theory model augmented with a survey of consumers. In the model, all consumers consider purchasing some durable good before the possibility of rental. The would-be owner's utility depends on how much the good would be “used” if purchased. This assumption that consumers must consider the time required to use a good in making their consumption plan is similar in spirit to [Becker (1965)](#Becker); the possibility of sharing a good is similar in spirit to [Varian (2000)](#Varian). Varian in particular discusses—in the context of information goods—how planned usage affects the rent-versus-own decision. I assume that goods offer declining—and eventually negative—marginal utility from use.**[[3]](#footnote-3)**  If the utility from the optimal level of usage is greater than the purchase price, the consumer buys the good.

With two consumer “types” that differ in the utility they derive from using the good, three possible market configurations are possible: (1) everyone buys the good; (2) no one buys the good; and (3) high types but not low types buy the good. I start the analysis by considering scenario (3), the “only high-types buy” scenario. I assume that a technological shock creates a P2P rental market that neither owners nor would-be renters foresaw. This creates a “short-run” P2P rental market in which equilibrium is defined by a rental rate that clears the market among existing owners and non-owners. The rental rate is increasing in the valuation of the high-types (which reduces supply) and the valuation of the low-types (which increases demand). Interestingly, both owners and non-owners use the good as if they were renting the good at the market-clearing rental rate. For renters the reason is that they do face that rental rate; for owners, they now face a marginal opportunity cost of usage, which is also the rental rate. The short-run market does not necessarily clear: if pre-P2P rental excess capacity exceeds demand, there is a glut. In practice, the inherent transaction cost of bringing excess capacity to the market would provide a price floor.

In addition to the short-run, I consider a long-run where owners and renters alike can revise their ownership decisions. If the short-run rental rate is below the purchase price, then ownership is less attractive, which will reduce *purchase* demand for product; likewise a rental rate above the purchase price increases ownership and hence purchase demand. In the long-run P2P equilibrium, the purchase price equals the rental rate.

In the long-run P2P rental market, both high- and low-types receive the same utility from owning or renting, decoupling individual preference from ownership. In practice, consumer risk-aversion would likely still cause higher-value consumers to be the owners, since a fall-off in market demand can be better absorbed by them though own-consumption [(Sinai and Souleles, 2005)](#SinaiAndSouleles).

The existence of a P2P rental market allows for a higher maximum price in a market, as the existence of a P2P rental market can generate positive demand for a good at prices for which even high-types would not buy without the possibility of rental. However, product markets with an “everyone buys” characterization pre-P2P rental can only reduce purchase demand.

To keep the analysis simple, I initially ignore transaction costs. I modify the basic framework to include these costs and consider how it changes the results. One of the main findings is that when transactions costs are sufficiently high, the P2P rental market cannot exist. This finding suggests that the technological changes—namely the maturation and increasing penetration of the Internet and web-based technologies—were the technological shock that made these P2P rental markets feasible.

To augment the theoretical analysis I conducted a survey designed to assess the basic assumptions of the model—particularly the assumption that forward-looking usage estimates driver purchase decisions—and to assess the good-specific factors that will affect the ease of establishing a P2P rental market in that good. Consumers were asked a series of questions about a single good (e.g., a BBQ grill) such as whether they own one, whether they have lent it out or borrowed it and, regardless of whether they own it, how much they would use it. If they do not own it, they were asked why. I also asked questions about how the good in question is characteristically used and how predictable that usage is: it is used in long, predictable blocks of time, or in small, granular chunks. Finally, the respondent was asked for their household income. For only a small number of goods (e.g., vacation homes) does income seem to be the limiting factor. For other goods, planned usage was primary.

Examples of sharing economy companies

Why now – search costs and liquidity

# **Examples**

# **Consumer's decision about how intensively to use a good**

Consider a consumer that has to decide how much of their time to allocate to the use of some purchased durable good. Their utility function is

|  |  |
| --- | --- |
|  |  |

where is the fraction of time they spend using the good and α ∈ (0,1) parameterizes their valuation of the good. Note that in contrast to a conventional utility function from consumer theory, marginal utility can be negative. Individual intensive margin demand is

|  |  |
| --- | --- |
| *x\* = α* | (2) |

and indirect utility is

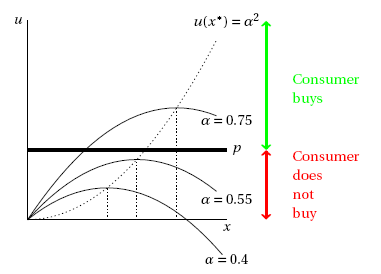
|  |  |
| --- | --- |
| *v*(*α*) *= u*(*x\**) *= α2.* | (3) |

The good costs *p* to own, and so a forward-looking consumer will buy if

|  |  |
| --- | --- |
| *α 2* > *p.* | (4) |

Note that for all *α2> p*, the consumer will have an amount of time 1 - *x\** when they are not using the good. Figure[1](#Figure1)illustrates the consumer problem by showing the utility from various levels of usage depending on *α*. The usage solution for each consumer is their *α* parameter and since indirect utility is just *α2*, the optimal usage for each value falls along the curve traced out by *x2*. The purchase price *p* determines who buys the good, with all those having *α2 > p* deciding to own and those below choosing not to purchase the good.

**Figure 1**: Consumer purchase problem



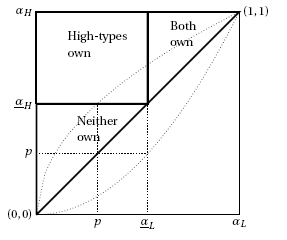
## 2.1 Three consumption possibilities with two consumer types

Consider a marketplace with two consumer types that are equally common: *αH* and *αL* with *αH* > *αL*. For a given price *p*, there are three market possibilities: when *αL2* *> p* everyone buys the good; when *αH2 > p > αL2*, high-types buy the good but low-types do not; when *αH2 < p* no one buys the good. This gives a market demand curve of

|  |  |
| --- | --- |
| *D(p)* = | (5) |

The three market possibilities are shown in Figure [2](#Figure2). The figure shows the space defined by *αH* ∈ [0,1] x *αL* ∈ [0,1] when *p* = . Since *αH* > *αL* by definition, we only consider the space above the 45 degree line. The upper-right triangle labeled “Both buy” is the region where both consumer-types buy and the lower-left triangle where neither buy. This area is defined by *αL2 > p* and *αH2 > p*. To show the geometry of the problem, the square of the valuation parameter is plotted in a faint dotted line; the associated minimal-but-still-purchasing valuation parameter is shown as *αH* and *αL* for the high- and low-types, respectively. The upper left rectangle shows the region where the high-types buy but the low-types do not, while the lower left triangle shows the region where neither buy. We are particularly interested in the rectangle where high-types buy but low-types do not, because in this region, the purchasing high-types have excess capacity, *αH* < 1, but the low-types still value usage of the good, *αL* > 0, despite their non-purchase. In this region, the immediate possibility of mutually beneficial trade exists between the two types, whereas in the other spaces a revision in the ownership decision is needed to support a P2P rental market.

**Figure 2.** Three consumer market possibilities in the absence of P2P rental with two consumer types



## 2.2 Short-run P2P rental market equilibrium

We now suppose that through some technological advance, it becomes possible for the high-types to costlessly rent their entire excess capacity to the low-types. As first, we will assume that no one can revise their purchase decisions in light of this advance. Call the resulting equilibrium the “short-run.” Before the possibility of rental, the high-types were simply consuming α*H* , giving 1−*αH*  to rent out. If they had purchased the good, the low-types would consume *αL*. However, with the new possibility of rental, each consumer's decision problem has changed. The new owner optimization problem is

(6)

Rental income

whereas the renter optimization problem is

Rental cost

(7)

where *r* is the taken-as-given rental rate. Both decision problems yield the same usage decision,

. (8)

where *i* indexes consumer type and assuming that *αi* > *r*. Let *xH = x\*(αH)* and *xL = x\*(αL).* For the rental market to clear

(9)

If the market clears, then the rental rate is thus

(10)

The quantity of the good exchanged is

(11)

Note that if 1 - *αH* > *αL*, then a negative rental rate would be market clearing. This condition arises when the owner's excess capacity even in the absence of a rental market, which is 1 - *αH*, exceeds the non-owner's demand, 1 - *αL*. **If all consumers were allocated the good and their cumulative usage, *αH* + *αL*, exceeds the capacity of the actual stock of purchased goods, then a positive rental rate is needed to clear the market.** Figure [3](#Figure3) illustrates market clearing with a positive rental rate and the glut condition. The rental market demand is simply *xL(r)*, whereas supply is 1−*xH (r)*. The market-clearing quantity is the optimal consumption of the low-types, *αL - r/2*. We add a supply curve with a lower *αH* value (which moves out the supply curve, in red) such that the offered supply at *r* = 0 exceeds demand, creating a glut. **It is also clear from the figure that if the valuation parameter of either type rises, short-run rental rates increase, as increases in valuation lower supply and increase demand.**

## 2.3 Social Surplus in the P2P rental market short-run

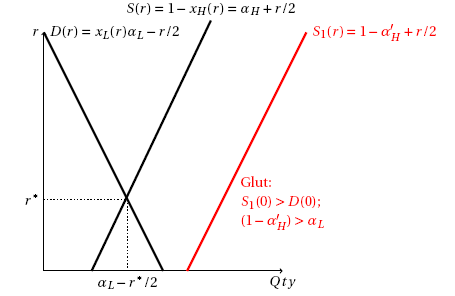
With the introduction of the P2P rental market there are several welfare-affecting changes: high-type consumption goes down (from *xH = αH* to *xH = αH - r/2*) and low-type consumption goes up (from *xL = 0* to *xL = αL - r/2*). Change in utility for the high-types from reduced consumption is

New P2P consumption utility

Old consumption utility

. (12)

**Figure 3**. Market clearing with two consumer types in a P2P rental market



This is negative, but it is compensated by the rental income. The greater the rental rate, the greater the loss in utility from reduced consumption. For the low-types, the change in utility from increased consumption is

(13)

The total change in consumer surplus from the introduction of the P2P rental market is thus:

(14)

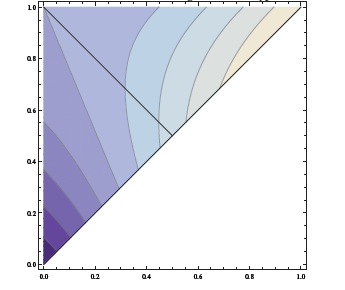
Figure [4](#id.6yz50470pmmj) is a contour plot of change in social surplus from the emergence of the P2P rental market for the space of possible valuation parameters. The figure shows what we might already intuit: higher values of *αL* increase the gain in social surplus. Indeed, *∂ΔS/∂αL* = 1 - *αH* + *αL* > 0 since *αH* < 1 and *αL* > 0. **The more the non-owners value the good, the greater the increase in social surplus from the emergence of P2P rental markets.** The case of *αH* is more complex. Recall that a positive rental rate only occurs when *αH* + *αL* > 0. **As such, an increase in the valuation of the high-types reduces social surplus from P2P rental markets in non-glut P2P rental scenarios:**

(15)

In Figure [4](#Figure4) the line stretching from (1,0) to (1/2, 1/2) indicates the glut/non-glut boundary. For all points to the right of that line, a higher *αH* valuation reduces social surplus. As, such the greatest social surplus is “unlocked” by the emergence of the P2P rental market when both purchasers and non-purchasers have similar, high valuations. In terms of the figure, the highest obtainable social surplus values for a fixed *αH* + *αL* run along the 45 degree line that indicates *αH ≈ αL.*

For simplicity, I have ignored income effects as a cause of the pattern of ownership. However, for goods where income effects are important in the consumer's ownership decision problem, the *αH* > *αL* requirement would no longer hold and potentially larger gains in social surplus would be unlocked by the P2P rental market emergence.

**Figure 4**: Consumer welfare as a function of high- and low-type consumer valuations



## 2.4 Long-run P2P rental equilibrium

In the long-run equilibrium, all parties can revise their ownership decisions. The utility from owning is

(16)

whereas the utility from renting is

(17)

where *rLR* is the market-clearing long-run rental rate. The first order condition for either choice is 2*αi−*2*xi− rLR* = 0 and so *xi\* = αi− rLR/*2. Computing the indirect utility for both decisions, we have

and (18)

Setting *vOWN = vRENT* to find the conditions under which a user would be indifferent between renting and owning, the *αi* term drops out and we are left with

(19)

**In the long-run P2P rental equilibrium, the rental rate equals the product market purchase price and ownership does not depend on usage patterns or valuation.**

For this new market to clear, we have to determine what fraction of consumers choose to own. Let *f* be the fraction of consumers that purchase the good in equilibrium. As ownership does not depend on valuation, we assume that both consumer types are equally likely to own. For the market to clear,

(20)

which simplifies to

(21)

**The fraction of consumers owning in the long-run is the average usage rate in the population.** In this long-run P2P rental equilibrium, even though both types own, we might expect in practice for higher-valuation types to be the ones to own, as they can better bear the risk in the rental rate, ala [**Sinai and Souleles (2005)**](#SinaiAndSouleles).

In the long-run P2P rental market equilibrium, there are no profits from owning to simply rent-out, since the good costs *p* and rental income is just *p*. However, owners and non-owners alike get a surplus. **This suggests that firms that derive no consumption value from the good can not compete in a competitive market: because the consumer has excess capacity after satisfying their own consumption, they can “profitably” sell their excess capacity at any price and still have positive utility; a firm owning simply to rent would make zero profit.** There is already perhaps some evidence that P2P rental markets are adversely affecting traditional firms: [**Byers et. al. (2013)**](#Byers) find that Airbnb is already winning customers from hotels catering to the lower-end of the market. Firms do have other advantages over consumers, such as economies of scale or expertise in minimizing transaction costs. However, this firm-level expertise might simply be offered to consumers without the firm taking ownership.**[[4]](#footnote-4)**

## 2.5 Product market demand in the long-run P2P rental market equilibrium

Most commentators considering the sharing economy assume that sharing economy platforms reduce ownership. The intuitive idea is that there is a fixed amount demand for some good—a “lump of consumption”—and that when idle goods are pulled into the market, demand can be met with a smaller total number of goods. **This is not the case: ownership increases if the product market price is below the short-run rental rate.** Intuitively, when the short-run rental rate is greater than the purchase price, a consumer could buy the good at *p* and rent out the entire capacity for *r* and since *r > p*, earn a profit.

To see this algebraically, first consider that in the long-run P2P equilibrium, the new product market demand curve, *D1*, is

*D1 (p)* = 2 *f*

*= xH (p)* + *xL(p)*

*= αH* + *αL − p.* (22)

In the pre-sharing product market, *D*0(*p*) = 1 since only the high-types purchased the good. Let *r*SR be the short-run rental rate, which we recall from Equation [10](#Equation10) is just *αH* + *αL* −1. If demand is higher after the long-run P2P equilibrium emerges, then

*D1*(*p*) > *D0*(*p*)

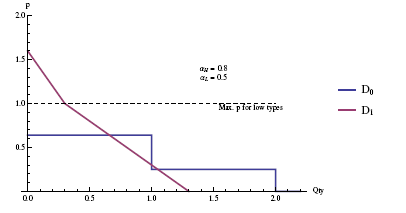
*αH* + *αL− p* > 1

*αH* + *αL*−1 *> p*

*r*SR > *p* . (23)

**If the market-clearing short-run rental rate is above the purchase price, ownership will increase.** This is likely to occur in situations where there are high valuations from both consumer types (making demand high and supply tight) as well as relatively low purchase prices.

**Figure 5**: Product market demand pre-P2P rental market and post-P2P rental market (long-run)



## 2.6 Long-run P2P equilibrium product market demand versus the original “no sharing” demand

Previously, there were “kinks” in the product market demand curve at *αH2* and *αL2*. In the long-run P2P rental equilibrium, product demand varies continuously, with *D*(*p*) = *xH*(*p*) + *xL*(*p*) = *αH* + *αL* − *p* when both consumer-types participate. Figure [5](#Figure5) illustrates the new product market demand curve, with the pre-P2P rental market curve indicated as *D0* and the post-P2P rental market by *D1*.

Recall that in the pre-P2P rental market with two consumer types, if *p* > *αH2*, then no consumer bought the good. **Figure** [**5**](#Figure5) **shows this and it shows that with the P2P rental market in long-run equilibrium, demand can be non-zero above this point.** Intuitively, if a would-be owner can earn rental income from their unused capacity, it seems likely that a higher product market price is supportable. The highest possible price that can support a market pre-P2P rental is 0 = *αH2*. In the long-run P2P market, *D*(*p*) = *αH* + *αL* − *p*, and so is 1 = *αH* + *αL*. **Since *αH* > *αH2* and *αL* > 0, 1 > 0; the existence of a P2P rental market can support a higher product market price.**

In this high-price range, the *D1* curve is kinked at *p* = 2*αL*. **The reason for this kink is that if 2*αL* < p, the low-types do not use the good in the long-run P2P equilibrium.** The reason is simple: if *p* > 2*αL*, usage of the good offers negative utility from any amount of usage and so the low-types use none. If *p* > 2*αL*, then the long-run P2P equilibrium is one in which the high-types simply trade with themselves, creating a market demand of just *D*(*p*) = *αH* − *p*/2. **The model suggests the possibility of a transitory short-run phase in which low-types get access that disappears once former-owners become renters and bid up rental rates.**

## 2.7 Long-run P2P rental market consumer surplus when both consumer types use the good

If both high- and low-types participate in the long-run P2P equilibrium, social surplus (assuming no price changes in the product market) is

(24)

whereas in the pre-P2P rental market, surplus was

. (25)

The long-run social surplus from the introduction of the P2P rental market is

. (26)

From the requirement that *αL2* < *p* < *αH2* and the assumption that the low-types use some of the good in equilibrium (2*αL* > *p*), we can show that Δ*S* > 0. **We can also show that social surplus from the long-run P2P rental market is increasing the low-type valuation, or Δ*S'*(*αL*) > 0, again because 2*αL* > *p*. For the high-types, Δ*S'*(*αH*) = -*p* < 0, and so the social surplus from sharing is reduced when the high-types have a higher valuation (as was the case in the short-run).**

## 2.8 Transaction costs

In practice, the utilization of a good—even with an efficient P2P rental market—will be far less than 100%. Setting up trades, making repairs, transporting goods and so on all take time. Furthermore, even durable goods are consumed more quickly when used more intensively. There are several ways one could model these kinds of practicalities.

For utilization, one modeling approach is to simply re-define what is the unit of time available and the corresponding *α*. For example, we might think of a the unit of time for a vacation home on a ski slope to be 4 months, with high-types wanting to take three week vacations and low-types one week vacations and one week in total lost to cleaning and maintenance. For transaction costs, we could think of owners in the P2P rental market as facing a cost of *c* that captures both the transaction costs of listing on a market, finding trading partners and so on, as well as the cost from increased usage that leads to either more extensive or more frequent repairs or faster replacement. In the short-run P2P equilibrium, *c* provides a price-floor in the rental market. In the long-run P2P equilibrium, the rental rate “includes” these costs, with *rLR* = *p* + *c*.

If *c* is sufficiently high, then no P2P rental market will exist in either the short- or long-run: many goods have “missing” rental markets because the rental rate *r* required to cover the added transaction costs of renting would be prohibitive. Goods that have unpredictable usage patterns would be particularly poor rental candidates. It is only with the emergence of computer-mediated platforms that seem to dramatically reduce transaction costs that a P2P rental market has emerged for some of these goods. Before these markets sprung up, simply finding an appropriate trading partner would be difficult, to say nothing of coming to terms, writing a contract, monitoring compliance, handling disputes, making payment and so on.

# **Conclusions**

As with all models, much was left out. However, there are “predictions” that follow from the logic of the model, if not the formal set-up. One area where P2P rental markets could have a long-term effect is on the diversity of goods consumed. For example, they might “convexify” consumption, with consumers renting a variety of goods that are horizontally differentiated. Consider that in some formulations of the consumer problem, consumers consume some positive amount of every good offered. This is obviously a large departure from empirical reality if we draw fine-grained distinctions between “goods.” For example, Amazon.com currently lists 6,238 results for “blender” in the Home & Kitchen category: presumably most households own far fewer than this, with most owning one or none.**[[5]](#footnote-5)** The reason for this pattern in the language of this model is clear: a consumer's *α* for Blender 2 *conditional* upon owning Blender 1 is quite low and so another blender is not purchased. However, if a rental market existed for both blender types, consumers could act upon their taste for diversity without owning a dozen blenders. Even if the blender example seems implausible, we should consider that very few consumers try to rent the car they normally drive or vacation in their hometown: presumably they diversify consumption in these cases precisely because they can.

As P2P rental markets become commonplace, manufacturers will begin designing products more attractive for this additional purpose. For example, locks on cars and houses that allow remote entry will be more appealing. The Internet-of-Things revolution will make it easier to identify goods that are not being used at a moment in time and perhaps facilitate trade automatically. Similarly, technologies that make it easier to monitor usage (GPS, embedded sensors, streaming video of how they are being used and so on) should make contracting easier and reduce some of the informational asymmetries that contribute to transaction costs. As more of economic and social life are computer-mediated, platforms will use this information to verify the identify and reputation of buyers and sellers, further mitigating moral hazard and adverse selection. Even without these changes, individuals will purchase more durable goods to reduce the frequency of replacement. Advertisers will trumpet the rental stream income from a purchase and highlight the advantages of residual control rights.

# **References**

**Becker, Gary S**, “A Theory of the Allocation of Time,” *Economic journal*, 1965, *75* (299), 493–517.

**Byers, John W, Davide Proserpio, and Georgios Zervas**, “The Rise of the Sharing Economy: Estimating the Impact of Airbnb on the Hotel Industry,” *Boston U. School of Management Research Paper (Forthcoming)*, 2013.

**Horton, John J**, “The Tragedy of Your Upstairs Neighbors: Is the Airbnb Negative Externality Internalized?,” *Available at SSRN*, 2014.

**Kuziemko, Ilyana, Michael I Norton, Emmanuel Saez, and Stefanie Stantcheva**, “How elastic are preferences for redistribution? Evidence from randomized survey experiments,” 2013.

**Sinai, Todd and Nicholas S. Souleles**, “Owner-Occupied Housing as a Hedge Against Rent Risk,” *The Quarterly Journal of Economics*, 2005, *120* (2), 763–789.

**Varian, Hal R.**, “Buying, Sharing and Renting Information Goods,” *The Journal of Industrial Economics*, 2000, *48* (4), 473–488.

**A Survey Questions**

The actual goods were:

* BBQ Grill
* toothbrush
* a men's suit
* blender
* canoe
* car
* cordless power drill
* hammer
* diamond necklace
* food processor
* hammer
* cat carrier (for transporting cats)
* high-end audio headphones
* high-end digitial [sic] camera
* iPad or tablet
* jet ski
* kid's boucy [sic] castle
* kitchen timer (or egg timer)
* mountain bike
* pick-up truck
* push lawnmower
* ride-on lawnmower
* tuxedo
* vacation home
* back-up electric generator
* portable air conditioner
* sewing machine
* Does your household own a **good**?
* Yes
* No
* Have you ever lent your **good** to someone else?
* Yes
* No
* NA - we do not own one.
* Have you ever borrowed a **good** from someone else?
* Yes
* No
* NA - we own one.
* Have you ever rented a good?
* Yes
* No
* NA - we own one.
* Regardless of whether your household owns a **good**, if you did own one, how much do you estimate it would be used by members of your household on average?
* We would not use this at all
* 1 minute a week (about 1 hour a year)
* 5 minutes a week (about 4 hours a year)
* 1/2 an hour a week
* 1 hour a week
* 1/2 an hour a day
* 1 hour a day
* 2 hours a day
* 4 hours a day
* 8 hours a day
* 16 hours a day
* 24 hours a day (I would continuously be using this good)
* Regardless of whether you actually own a **good**, how do you imagine it would be used if it was owned by your household (on a scale of 1 to 5):
* 1 - Used in one big block of time
* 2
* 3 - Used in a mixture of large and small blocks of time
* 4
* 5 - Used in many small blocks of time
* Regardless of whether you actually own a **good**, how predictable would your usage of it be if you did own it:
* 1 - Very predictable—I can plan usage many weeks in advance
* 2
* 3 - Somewhat predictable
* 4
* 5 - Very unpredictable—I would never know exactly when I would need to use it until right beforehand.
* If you do not own a **good**, what is the primary reason?
* NA - we own one.
* We wouldn't use it enough to justify the purchase price
* We would use it, but we simply do not have the money.
* I don't have the space for this item
* What is your total household income?
* Less than $10,000
* $10,000-$19,999
* $20,000-$29,999
* $30,000-$39,999
* $40,000-$49,999
* $50,000-$59,999
* $60,000-$69,999
* $70,000-$79,999
* $80,000-$89,999
* $90,000-$99,999
* $100,000-$149,000
* More than $150,000

1. http://www.crunchbase.com/organization/airbnb [↑](#footnote-ref-1)
2. See [Horton (2014)](#HortonJohn) for a discussion of the externalities imposed by Airbnb-style subletting in rented apartments. [↑](#footnote-ref-2)
3. Even in the absence of any direct marginal usage cost, individuals will generally not use a good 100% of the time.

   For example, a hobbyist guitar owner might play 5 hours a week, but few would play 50 voluntarily and 100 hours a week would hellish for nearly everyone. [↑](#footnote-ref-3)
4. A recently launched start-up called [**Guesty**](https://www.guesty.com/) aims to be a kind of property management company for Airbnb rentals. [↑](#footnote-ref-4)
5. As of October 8th, 2014. [↑](#footnote-ref-5)