When Are Marketplaces for Peer-to-Peer Trading of Usage Quotas Profitable?

Motivation. A growing number of businesses are being built around a business model that provides customers access to a product or a service up to a specified amount or a quota. A familiar example is smartphone data plans. Most of smartphone owners subscribe to one of monthly data plans that their service provider offers. Business models of this type are not limited to telecommunication industry. NetJets sells fractional ownership (or shares) of private jets. Customers can buy a prepaid card that entitles them to a certain number of flying hours a year. A similar model can be also observed at travel industry. At fractionalvillas.com customers can buy access to a villa for a specific month at a predetermined price. Other examples include cloud-based data storage (for a specified fee, a customer is able to store data up to a certain amount), and season tickets for sporting events (a ticket holder is able to attend up to a specified number of events).

In each of these cases, the firm providing the access (the service provider) offers customers a menu of prices and usage quotas and customers self-select the one which meets their needs the best. However, in most of these cases, the realized usage of customers is uncertain with some customers experiencing a need for usage (e.g., the need phone data) that is below their quota while others experiencing a need for usage that exceeds their quota. This possibility of either a shortfall or excess in realized usage offers an opportunity for a marketplace to emerge, in which customers trade unused quotas among each other.

Service providers have tended to resist the emergence of such marketplaces, as they are perceived as potentially cannibalizing demand and resulting in downward pressure on prices. To avoid the resale of live-event tickets, some providers issue paperless tickets. These tickets are not transferable at secondary markets such as Ticket Master or Stub-Hub and, at box office, customers need to present a photo ID to enter the event. However, a growing number of firms have recently allowed for these peer-to-peer markets to take place and, in some cases, firms facilitate the operations of such markets. To facilitate peer-to-peer car sharing, Ford is partnering with two major care sharing companies (Getaround in US and easyCar Club in Europe) to provide a platform for Ford owners to rent their vehicles. In a similar way, Toyota equips its cars with a new keyless entry system which allows users to unlock the doors and start cars with their smartphones. This mix reactions of firms to peer-to-peer motives our main research questions.
**Research Questions and Model.** The presence of peer-to-peer marketplaces for the trading of usage quotas raises several important questions. Under what conditions are such marketplaces beneficial to the service providers? When service providers benefit do consumers also benefit? If so, who among consumers benefit the most (e.g., those with low or high usage)? How does the presence of such a marketplace affect the design of contracts by the service provider (e.g., fees and quotas associated with each contract)? Would these marketplaces lead to more or less overall usage by consumers? In this paper, we address these and other related questions.

In particular, we consider an equilibrium model involving a service provider who sells access to a service or a product to a unit mass of risk neutral customers. Customers are heterogeneous in their consumptions which we assume is a discrete type-dependent random variable. A customer of a higher type is more likely to have a higher consumption. The service provider offers two contracts (or plans): a low usage plan with lower price and a more expensive plan with a higher usage quota. Customers observe the contracts and choose one before they learn their realized consumption. After customers privately learned their consumptions, if trading is allowed, they can trade with their peers. We show that there exists a unique equilibrium specified by a threshold on the customers’ type. The service provider has full pricing power and sets the contracts’ prices (with or without trading) such that her profit is maximized. The service provider’s profit consists of the revenue she earns from selling the contracts and the costs she incurs for each unit of usage. We assume the service provider’s service cost is linear.

**Summary of Results.** As in Figures 1, we characterize four well-defined regions. If the trading price is not too low both service provider’s profit (for trading prices more than the threshold $\pi_1^4$) and social welfare (for trading prices more than the threshold $\pi_1^4$) are both improved by peer-to-peer trading. The aggregate customers’ surplus increases if and only if the trading price is not too high (lower than $\pi_3^4$) or too low (higher than $\pi_2^4$). If the trading price is higher than the threshold $\pi_3^4$, high type customers’ surplus decreases by trading and the aggregate customers’ surplus may decrease. When the trading price is small the total quota decreases and it even may cause the total consumption with trading to become less than the case without trading. Any trading price lower than $\pi_2^4$ creates scarcity of quota and causes the aggregate
customers’ surplus with trading to drop below that of without trading. As in Figure 1, the *win-win* can be achieved when the trading price is moderate. The threshold $\pi_1^1$ ensures us that the provider’s profit, aggregate customer’s surplus, and social welfare do not decrease below their respective values when there is no trading. By keeping the price of the high plan moderate, the upper bound threshold $\pi_3^1$ is required to protect the aggregate customers’ surplus from decreasing below what it is when trading does not take place.

We prove the existence of these thresholds and their ordering. The order of thresholds does not change when the service cost changes and the win-win region in Figure 1 always exists for some reasonable range of trading prices. This leads us to our main takeaway; if the trading price is moderate, under any service cost there is a win-win gain opportunity that can be unlocked by peer-to-peer trading.

Our results are robust with respect to a few modifications in our base model described earlier. If the trading price is endogenized and it is set such that the demands and supplies match on the trading market, still the win-win situation can be achieved. Next, we can show that when the contracts’ prices stay unchanged, still the win-win region exists. However, with fixed contracts’ prices, the win-win region is characterized by only a lower bound on the trading price. Finally, if customers experience inconvenience for using the platform or the platform charges commission fee, our main insights continues to hold.

Figure 1: Summary of results