Markets vs. Products: Platform Participation Decisions

Tushar Shanker\textsuperscript{1}
Marshall Van Alstyne\textsuperscript{2}

WORKING PAPER - PLEASE DO NOT DISTRIBUTE

Abstract

In this paper, we introduce the concept of market expansion in a platform setting. Pure market expansion helps expand the size of the existing market while pure product innovations increase the value of a product to existing consumers. Using a simple analytical model, we first examine the platform participation incentives of monopolist sellers. Our results demonstrate how a platform can internalize a market expansion externality that monopolist non-competing sellers are unable to capture independently. Consequently, we show that, for a given level of product innovation, sellers can enjoy access to larger markets by joining a platform. We also find that, as the cost of innovation increases, market expansion becomes more attractive as compared to product innovation, explaining, to a certain extent, firms' investment in innovative social media engagement. Next, we show that, under competition, the level of market expansion achieved would be smaller than that achieved under monopoly. However, we find that competitive sellers would still prefer to join a platform than compete without market expansion. Finally, we show that platforms would prefer to have as few complementors selling substitutable products as possible. This tells us why some platforms practice category exclusivity. Our main contribution is the introduction of the concept of market expansion and a framework for analyzing this phenomenon using a simple tractable model.

\textsuperscript{1}Boston University - tshanker@bu.edu
\textsuperscript{2}Boston University & MIT - mva@bu.edu
Markets vs. Products: Platform Participation Decisions

Tushar Shanker, Marshall Van Alstyne

Version: May 28, 2014

1 Introduction

With the rise of information technology and fall in transaction costs, a number of firms have begun assuming the role of platforms that add value by allowing sellers to access more consumers or by consummating better matches between suppliers and their buyers. The hospitality industry is currently being disrupted by new intermediaries like Airbnb that use innovative means of matching suppliers (home-owners) with travelers. Similarly, Amazon challenged traditional book sales business models by allowing online book reselling and self-publishing opportunities. Furthermore it introduced innovation like Kindle Matchbook which effectively increase the size of the existing market. Such strategies represent market expansion aimed mainly at expanding the size of the current market to new consumers, in contrast to more familiar product innovations where sellers invest in increasing the value of the offering through new product features.

The possibility of product (P) and market (M) innovations leads to a number of interesting questions relating to firms’ strategic options.

1. How would a firm choose whether it should invest in product development or market access innovation? When is it privately better to invest in R & D versus investing in becoming an open platform?

2. Given the possibility of market expansion, how can a platform attract complementors? How does this affect the level of market expansion?
3. Firms appear to be investing heavily in social media engagement, but how would we even model this in a traditional product demand framework?

These are some of the puzzles we explore in our paper using a simple analytical model. Answers to such questions could help firms determine critical innovation strategies. In the smartphone industry, Blackberry, which invested mainly in P, was less successful in facing competition from Apple and Google, who organized themselves as intermediaries and chose a good mix of P and M. In reality, most innovations have some degree of P and M. However, given the amount of attention P has received so far, our contribution here is to introduce the fact that M is an available option for firms as well, and examine the implications of investing in M. The importance of market expansion is emphasized by the fact that many of Christensen’s disruptive innovations[5] start as inferior products. While they often are new technology, product capability does not necessarily exceed those available in the market and instead appeal to a new block of customers. Thus, studying market expansion that helps expand the market to a new block of consumers can help firms make more informed innovation decisions.

The following table presents illustrative examples of intermediaries that have utilized innovation to their advantage.

<table>
<thead>
<tr>
<th>Platform</th>
<th>Demand Side</th>
<th>Supply Side</th>
<th>Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloudary</td>
<td>Readers</td>
<td>Authors</td>
<td>TV Studio Partnership (M)</td>
</tr>
<tr>
<td>Google</td>
<td>Consumers</td>
<td>App Developers/Advertisers</td>
<td>Android (M) + Nexus 10 (P)</td>
</tr>
<tr>
<td>Uber</td>
<td>Commuters</td>
<td>Car Owners/Drivers</td>
<td>Driverless Cars (P)</td>
</tr>
<tr>
<td>Starbucks</td>
<td>Brand Loyal Customers</td>
<td>Franchisees</td>
<td>New Coffee Flavors (P)</td>
</tr>
<tr>
<td>Amazon Kindle</td>
<td>Book readers</td>
<td>Authors</td>
<td>Kindle Matchbook (M)</td>
</tr>
<tr>
<td>University Education</td>
<td>Students</td>
<td>Educators</td>
<td>Online Course Offerings (M)</td>
</tr>
<tr>
<td>Airbnb</td>
<td>Travelers</td>
<td>Home Owners</td>
<td>Mobile App (M)</td>
</tr>
</tbody>
</table>

Table 1: Examples of Product Innovation and Market Expansion

2 Literature Review

Platforms and market intermediaries have received a good amount of attention in academic literature. Bakos and Bailey [2] examine the different roles of an electronic intermediary while Bhargava et al. [3] relate an intermediary’s strategy to product quality. Similarly, a number of scholars in business-to-business marketing have explored intermediaries as well. For instance, Lucking-Reiley
and Spulber [9] study at the effect of electronic commerce on organizational structure. However, there is relatively little attention paid to the role of innovation by platforms.

Similarly, there exists a rich body of research covering different types of innovation. The ones most relevant to our paper are product innovation, service innovation and business model innovation. Eisenhardt and Tabrizi [7] discuss the process of product innovation while Dougherty [6] presents barriers to product innovation. Utterback and Abernathy [14] find that there will be patterns in the stimuli for innovation, types of innovation and barriers to innovation. Miles [10] introduced the concept of service innovation by exploring trends in the service economy and considering the special nature of services and it’s effect on products and processes. Chesborough [4] explores barriers to business model innovation, which could affect how companies commercialize products and ideas and offers suggestions for overcoming these barriers.

However, there seems to exist a gap in the literature with regards to understanding the trade-offs between market expansion and product or service (offering) innovation. Furthermore, very few papers seem to have explored these ideas in the context of platforms. Our paper seeks to address this gap by providing a framework for analyzing market expansion and it’s relation to product innovation in a platform setting. Such an analysis might even be of interest to scholars in marketing and IT who study social media engagement (analogous to market expansion) as the results have broader implications on technology and organizational structure.

More recently, there has emerged a growing body of literature on two-sided platforms. Parker and Van Alstyne [12] and Rochet and Tirole [13] have proposed a model for capturing two-sided network externalities. Parker and Van Alstyne [11] further explore the role of innovation in platform openness and control. With regard to organizational structure, Hagiu and Wright [8] seek to explain an intermediary’s decision to choose to be a marketplace versus a reseller. Our paper aims to extend this body of work by providing a simple model to study market expansion in platforms which, in the future, could possibly be adapted to provide a more tractable framework for analyzing markets with two-sided network effects.
3 Model and Results

Consider a unit mass of consumers with utility for a single good distributed uniformly over the unit interval. This gives us a linear demand \( q = 1 - p \) for a price \( p \) in the base model. To explore the effect of market expansion, we multiply the unit market size by \( \alpha \geq 1 \). Thus, \( \alpha \) represents increase in market size due to investment in market expansion with \( \alpha = 1 \) representing the case with no market expansion. Further, we assume that a firm in this market faces zero marginal cost of production but an increasing cost of market expansion \( c(\alpha^2 - 1) \) with \( c > 0 \). This means that the cost of achieving a level \( \alpha \) of market expansion is \( c(\alpha^2 - 1) \), which implies that it becomes progressively more costly to achieve higher levels of market expansion. Also, there is no additional innovation cost necessary to maintain the status quo \( \alpha = 1 \). Thus, demand in the presence of market expansion is given by \( q = \alpha(1 - p) \).

Similarly, we add the possibility of product innovation in this model by multiplying the unit product value by \( \beta \geq 1 \). Thus, \( \beta \) represents increase in value of the product due to investment in product innovation with \( \beta = 1 \) representing the case with no product innovation. Similar to the previous case, assuming same unit cost of innovation, the seller faces zero marginal cost of production but an increasing cost of product innovation \( c(\beta^2 - 1) \) with \( c > 0 \). This means that there is no additional innovation cost necessary to maintain status quo \( \beta = 1 \). Thus, demand in the presence of market and product innovation is given by \( q = \alpha(1 - \frac{p}{\beta}) \).

First, let us consider the perspective of a monopolist seller. The seller could choose to serve this market either independently or by associating with a platform as a complementor. The independent seller might be able to appropriate all revenue from sale while bearing all the cost of market expansion. A complementor, on the other hand, might only get a fraction of the revenue but does not bear the cost of market expansion. Thus, the seller faces a trade-off between greater unit revenue and greater market size.

From a platform’s perspective, serving the market will involve bearing all the cost of market expansion while resulting in only a fraction of the revenue. However, a platform could have \( n \) such
monopolist complementors selling different products in the market. Thus, the platform’s investment in market expansion could potentially have a wider impact. Now we try to determine the conditions under which a seller chooses to become a platform complementor versus selling independently.

3.1 Platform Participation and Market expansion

In this section, we derive conditions under which a monopolist seller wants to become a platform complementor versus selling independently. We also investigate the resulting levels of market expansion in each scenario. To simplify analysis, we first ignore the effects of product innovation by setting $\beta = 1$. We later show that similar results hold with $\beta > 1$ as well.

**Proposition 1:** In the Nash bargaining scenario, if more than two monopolist sellers choose to become platform complementors, the resulting level of market expansion is higher than that achieved by each of the sellers independently. That is, $\alpha^*_M < \alpha^*_P \forall n > 2$. 
**Proof:** First we solve for the optimum level of market expansion achieved by the monopolist seller selling independently.

\[ \Pi_M = \alpha (1 - p)p - c(a^2 - 1) \]

Taking first order conditions w.r.t. \( p \) and \( \alpha \) and solving, we get the following.

\[ p^*_M = \frac{1}{2}, \quad \alpha^*_M = \frac{1}{8c} \]
\[ \Pi^*_M = \frac{1}{64c} + c \]

Now we consider the case where the monopolist seller chooses to become a complementor with a platform that has \( n - 1 \) other similar complementors selling different products. Each has the same profit function, but there is no competition between sellers. In this case, each seller has to pay the intermediary a royalty rate of \( r \). In return, the intermediary bears the cost of market expansion \( c(a^2 - 1) \). The profit functions are given as follows.

**Complementor Profit:** \( \Pi_C = \alpha (1 - p)p(1 - r) \)

**Platform Profit:** \( \Pi_P = n\alpha (1 - p)pr - c(a^2 - 1) \)

Taking first order conditions and solving, we get the following.

\[ p^*_C = \frac{1}{2}, \quad \alpha^*_P = \frac{nr}{8c} \]
\[ \Pi^*_C = \frac{nr(1 - r)}{32c}, \quad \Pi^*_P = \frac{n^2 r^2}{64c} + c \]

We can see that \( \alpha^*_P = n\alpha^*_M \). In the Nash bargaining case, \( r = 50\% \implies \alpha^*_P = \frac{n}{2} \alpha^*_M \). Thus, we can see that, as long as \( n > 2 \), \( \alpha^*_P > \alpha^*_M \). □

More generally, as long as \( r > \frac{1}{n} \), \( \alpha^*_P > \alpha^*_M \).
**Implication:** This proposition implies that, even for a relatively low royalty rate, the seller can expect to gain access to a larger market by joining a platform than by selling independently. Thus, if to a larger market is the primary objective, then becoming a platform complementor is more beneficial than selling independently. This does not, however, present the full picture. Incentives for platform participation are explored in the next proposition.

**Proposition 2:** *As the cost of market expansion increases, the seller’s incentive to become a platform complementor becomes stronger. That is, as \( c(\alpha^*_M)^2 - 1 \) increases, \( \Pi^*_C - \Pi^*_M \) increases.*

**Proof:** From the previous proof, we have that \( \alpha^*_M = \frac{1}{8c} \). Thus, total cost of independent market expansion is \( c(\alpha^*_M)^2 - 1 = \frac{1}{64c} - c \) which is a decreasing function of \( c \). Similarly, the cost of market expansion for the platform is \( c(\alpha^*_P)^2 - 1 = \frac{n^2r^2}{64c} - c \) which is, again, decreasing in \( c \).

Now consider the difference in profits between being a platform complementor and being an independent seller.

\[
\Pi^*_C - \Pi^*_M = \frac{nr(1-r)}{32c} - \frac{1}{64c} - c
= \frac{2nr(1-r) - 1}{64c} - c
\]

This is, again, a decreasing function of \( c \) for a fixed \( n \) and \( r \). Now, cost of market expansion in both the independent and platform case increases as \( c \) decreases. However, when \( c \) decreases, \( \Pi^*_C - \Pi^*_M \) increases. Hence, increase in cost of market expansion causes the seller to prefer becoming a platform complementor instead of selling independently. ■

More precisely, as long as \( 0 \leq c \leq \frac{\sqrt{2nr(1-r) - 1}}{8} \), the seller would prefer to become a platform complementor instead of selling independently.

**Implication:** Propositions 1 and 2 have very important implications. Firstly, they tell us that sellers can achieve access to much larger markets by joining a platform as a complementor than could be achieved by selling independently. More importantly, we see that the platform, in effect, internalizes
a market expansion externality that non-competing sellers cannot capture independently. To appreciate the subtlety and significance of the second point, let’s consider the example of Amazon Kindle. At a high level of abstraction, authors could be seen as sellers who command monopoly power over their faithful readers. However, by associating with the Kindle platform as complementors, they are able to gain access to a much larger audience. More importantly, when Amazon invests in market expansion like Kindle First, where the Kindle market is expanded to users who value early access to a book, the externalities generated by the market expansion across multiple authors can be internalized by Amazon.

3.2 Welfare Implications

A useful benchmark is to compare the level of market expansion and social welfare achieved by the platform to that achieved by a social planner. Such an analysis would be highly useful for policy decisions. We continue with the model with no product innovation $\beta = 1$ and in which the seller has chosen to become a platform complementor.

**Proposition 3:** A welfare maximizing social planner achieves a higher level of market expansion and social welfare as compared to the platform. That is, $\alpha_{S}^* > \alpha_{P}^*$ and $SW_{S} > SW_{P}$ $\forall r, c, \forall n \geq 2$.

**Proof:** A social planner maximizes the overall welfare. Given $n$ monopolist sellers, the complementor and platform welfare is just equal to their respective profits ($\Pi_{C}$, $\Pi_{P}$). Consumer welfare and overall social welfare is given as follows.

**Consumer Welfare:**
\[
CW = \frac{1}{2} n(1 - p)\alpha(1 - p)
\]

**Social Welfare:**
\[
SW_{S} = CW + n\Pi_{C} + \Pi_{P}
\]
\[
= \frac{1}{2} n(1 - p)\alpha(1 - p) + n\alpha(1 - p)p(1 - r) + n\alpha(1 - p)pr - c(\alpha^2 - 1)
\]
\[
= n\alpha \left( \frac{1 - p^2}{2} \right) - c(\alpha^2 - 1)
\]

Now, a welfare maximizing social planner will set $p = 0$ because social welfare is decreasing in $p$. Furthermore, taking first order conditions w.r.t. $\alpha$, we get the social planner’s optimum level of
market expansion $a_S^* = \frac{n}{4c}$. Comparing this to the level of market expansion achieved by the platform $a_P^* = \frac{n r}{8c}$, we get that $a_P^* = \frac{a_S^* r}{2}$. Since the royalty rate $0 < r < 1$, we get that $a_P^* < a_S^*$.

Continuing along the same lines, we can see that the social welfare achieved by the social planner is given by $SW_S = c a_S^2 + c$ where $a_S^* = \frac{n}{4c}$. Social welfare achieved by the platform can be calculated as follows.

$$SW_P = \text{Platform surplus} + \text{Complementor surplus} + \text{Consumer surplus}$$

$$= \frac{n a_P^* (1-r)}{4} + \frac{n a_P^* r}{4} - c(a_P^* - 1)^2 + \frac{n a_P^*}{8}$$

$$= c a_P^2 \left( \frac{3}{r} - 1 \right) + c$$

Comparing, we get the following.

$$SW_S - SW_P = c a_S^2 - c a_P^2 \left( \frac{3}{r} - 1 \right)$$

$$= \frac{n^2}{64c} (r^2 - 3r + 4)$$

Now, since $0 < r < 1 \implies r^2 - 3r + 4 > 0$. Furthermore, $c, n > 0$. Thus, we get that $SW_S > SW_P$.

**Implication:** This proposition essentially tells us that the level of market expansion achieved by the platform will always be lesser than that achieved by the social planner. In fact, even in the case where the platform usurps all the profits generated from sale ($r = 100\%$), the level of market expansion achieved by the platform is only half that achieved by the social planner. This result is a useful benchmark to compare the efficiency of the platform mechanism. A naive interpretation of this result is that governments must try and achieve higher efficiency by restricting the royalty rate $r$ charged by platforms. However, restricting $r$ changes the platform’s incentives for innovation and could have unintended consequences. However, as expected, this result reveals that the social planner is able to achieve greater social welfare as compared to the platform regardless of the royalty rate charged by the platform.
3.3 Product Innovation

We now introduce the possibility of product innovation, that is, $\beta > 1$. As a simple corollary, we first show that the result from Proposition 1 still holds when the level of product innovation is the same under independent sale and platform sale.

**Corollary 1:** In the Nash bargaining scenario, for the same level of product innovation $\beta$, a higher level of market expansion is achieved by joining the platform than by selling independently. That is $\beta_M = \beta_P \implies \alpha^*_M < \alpha^*_P \forall n > 2$

**Proof:** We fix the product innovation under the independent and platform cases to be the same ($\beta_P = \beta_M$). First we solve for the optimum market expansion level in a monopolist independent seller market. The profit function for an independent seller is given as follows.

$$\Pi_M = \alpha p(1 - \frac{p}{\beta}) - c(a^2 - 1 + \beta^2 - 1)$$

$\text{FOC: } p^*_M = \frac{\beta_M}{2}, \quad \alpha^*_M = \frac{\beta_M}{8c}$

Now, let us consider the case when the seller joins the platform as a complementor. Proceeding similarly as in Proposition 1, we get the following.

Complementor Profit: $\Pi_C = \alpha (1 - \frac{p}{\beta})p(1 - r) - c(\beta^2 - 1)$

Platform Profit: $\Pi_P = n\alpha (1 - \frac{p}{\beta})pr - c(a^2 - 1)$

Taking first order conditions and solving, we get the following.

$$p^*_C = \frac{\beta_P}{2}, \quad \alpha^*_P = \frac{nr\beta_P}{8c}$$

Comparing, we get $\alpha^*_P = n\alpha^*_M$. In the Nash bargaining case, $r = 50\%$. Thus, as long as $n > 2$, we get $a^*_P > a^*_M$. ■
More generally, as long as \( r > \frac{1}{n} \), platforms will be able to achieve a higher level of market expansion than that achieved by independent sellers for a given level of product innovation.

3.4 Product Innovation vs. Market Expansion

Now we consider the important question of the comparison of market expansion to the traditional product innovation. In particular, we try to find the conditions under which one dominates the other in generating surplus for the platform and the complementors. We consider the problem of joint maximization of platform and complementor surplus in order to concentrate solely on the relative effects of the different types of innovation. We conduct the analysis for a fixed number \( n \) of complementors in the platform.

**Proposition 4:** As the cost of innovation increases, market expansion becomes more attractive as compared to product innovation. That is, as cost of innovation increases, \( \Pi_{MA}^* - \Pi_{PV}^* \) increases as well. More precisely, \( c < \frac{\sqrt{n}}{8} \Rightarrow \Pi_{MA}^* > \Pi_{PV}^* \).

**Proof:** We first solve for optimum profits with only product innovation \((\alpha = 1)\). In this case, the total surplus of the complementors and the platform is given as follows.

\[
\Pi_{PV} = p(1 - \frac{p}{\beta})n - nc(\beta^2 - 1) \quad \text{(Innovation cost for each product)}
\]

FOC: \( p_{PV}^* = \frac{\beta}{2}, \beta^* = \frac{1}{8c} \)

\[\Rightarrow \Pi_{PV}^* = \frac{n}{64c} + nc \]

Similarly, we analyze the market with only market expansion \((\beta = 1)\). In this case, the total surplus of the complementors and the platform is given as follows.

\[
\Pi_{MA} = p\alpha(1 - p)n - c(\alpha^2 - 1) \quad \text{(Innovation cost for entire market)}
\]

FOC: \( p_{MA}^* = \frac{1}{2}, \alpha^* = \frac{n}{8c} \)

\[\Rightarrow \Pi_{MA}^* = \frac{n^2}{64c} + c \]
Comparing the optimal surplus under each regime, we get \( \Pi_{MA}^* + c(n^2 - 1) = n\Pi_{PV}^* \). Now, consider the following inequalities.

\[
\frac{\sqrt{n}}{8} > c \\
\implies \frac{n}{64c} + nc > c(n + 1) \\
\implies \Pi_{PV}^*(n - 1) > c(n + 1)(n - 1) \\
\implies n\Pi_{PV}^* - c(n^2 - 1) > \Pi_{PV}^* \\
\implies \Pi_{MA}^* > \Pi_{PV}^*
\]

Finally, we can easily see that, as in Proposition 2, the cost functions in each case are decreasing functions of \( c \). This tells us that as long as \( c \) stays above a threshold, or if cost stays below a threshold, product innovation might be more attractive than market expansion. However, as soon as innovation cost increases beyond the threshold, market expansion begins to look more and more attractive.

**Implication:** This result is highly important for two major reasons. First of all, it helps inform platform strategy by providing a clear idea of when market expansion dominates product innovation. This is a strong result indicating that in environments with high cost of innovation, investment in market expansion might be higher as compared to investment in product innovation because the benefits from that investment are spread across multiple sellers who do not get the same benefit from independent (or competing) product innovation. Secondly, this result could also help explain firms’ investment in social media marketing. Enabling user engagement in an innovative manner in order to expand the potential market might be more profitable for firms than investing in increasing their current product’s value to the existing users.

### 3.5 Cournot Competition among Platform Complementors

In this section, we relax the monopolist complementor assumption and introduce Cournot competition between the complementors in the platform. This might be a more realistic representation
of platforms like Amazon and eBay where sellers could be competing with each other when selling substitutable products. Our aim is to try and understand the effect of competition on the overall level of market expansion. Thus, we ignore the effect of product innovation ($\beta = 1$) and assume for now that the number of complementors $n$ is exogenous.

**Proposition 5:** Optimum market expansion with Cournot competition among complementors is less than that with monopolist complementors. That is $\alpha^{MP}_P > \alpha^{CCP}_P \forall n > 2$.

**Proof:** Consider the market with $n$ sellers and market expansion $\alpha$. Demand in this market is given as $Q = a(1 - p)$, where $Q = \sum_{i=1}^{n} q_i$. Thus, profit for complementor $i$, given a royalty rate of $r$ as earlier, is given as $\Pi_C = q_i(1 - \sum_{j=1}^{n-1} \frac{q_j}{a})(1 - r)$. Using simple Cournot analysis, we can show that the quantities selected by each of the complementors in equilibrium is given by $q_1 = q_2 = ... = q_i = ... = q_n = \frac{\alpha}{n+1}$.

Given these quantities, we solve the platform’s maximization problem to find the optimal level of market expansion. The platform’s profit is given as follows.

$$\Pi_P = nq_i(1 - \sum_{j=1}^{n} \frac{q_j}{a})(r) - c(a^2 - 1)$$

$$= r \frac{n\alpha}{n+1} \left( 1 - \frac{n}{n+1} \right) - c(a^2 - 1)$$

$$= \frac{nra}{(n+1)^2} - c(a^2 - 1)$$

FOC: $\Rightarrow \alpha^{CCP}_P = \frac{nr}{2(n+1)^2c}$

From the proof of Proposition 1, we have that $\alpha_P^* = \frac{nr}{8c}$. Comparing we get that as long as $n \geq 2$, $(n+1)^2 > 4 \Rightarrow \alpha^{MP}_P > \alpha^{CCP}_P$. ■

**Implication:** This result is intuitively in agreement with what we might expect in general. As competition increases, there is distortion away from monopoly profits, thereby reducing the platform’s incentive to invest in market expansion.
**Corollary 2:** Under Nash bargaining, Cournot competitors could find it more profitable to compete in a platform’s expanded market than compete in the base (\(a = 1\)) market. That is, \(\Pi_C^P > \Pi_C^{CC}\) as long as \(c < \frac{n}{8(n+1)^2}\).

**Proof:** From the previous proposition, we have optimum market expansion under a platform regime with Cournot competitors as \(a_{P}^{CC} = \frac{nr}{2c(n+1)^2}\). This gives us profit for each of the complementors as \(\Pi_P = \frac{nr(1-r)}{2c(n+1)^2}\). Using simple Cournot analysis for the base market with \(a = 1\), we get profit for each of the competitors as \(\Pi^{CC} = \frac{1}{(n+1)^2}\). If selling through the platform has to be more profitable, we need the following condition.

\[
\Pi_P > \Pi^{CC} \\
\Rightarrow \frac{nr(1-r)}{2c(n+1)^2} > \frac{1}{(n+1)^2} \\
\Rightarrow c < \frac{nr(1-r)}{2(n+1)^2}
\]

In the Nash bargaining case, \(r = 0.5\). Thus, if \(c < \frac{n}{8(n+1)^2}\), the Cournot competitors find it more profitable to associate with the platform. ■

**Implication:** This corollary basically implies that as the cost of market expansion increases, we might see more sellers of substitutable products associating with platforms. One example of this phenomenon is that in recent times, we see a number of sellers of substitutable products selling through eBay and Amazon marketplace. This effect becomes all the more pronounced as the cost of expanding in the local market increases.

### 3.6 Category Exclusivity in Platforms

Given the Cournot competition result, we try to explain why we see platform sponsors providing some complementors with category exclusivity or monopoly power in certain categories. The question we are trying to answer is if the platform sponsor has the ability to control the degree of Cournot competition in the platform, what will be the optimal degree of competition allowed? For this, we begin with the same market model as in the previous section (pure Cournot competition). Again,
we are interested in the effect of market expansion, and hence, we set $\beta = 1$. We still assume that the number of complementors in the platform $n$ is exogenous, but now we give the platform sponsor the ability to choose the number of complementors $k$ whose products are perfect substitutes. Thus, the platform can choose $k$ such that those $k$ complementors face Cournot competition while the remaining $n - k$ complementors have monopoly power. Thus, $k = 0$ should give us the results of Proposition 1, while $k = n$ should give us the results of Proposition 5.

**Proposition 6:** A profit-maximizing platform sponsor will try to ensure that the market has no complementors selling substitutable products. That is, $k = 0$.

**Proof:** As mentioned earlier, let $k$ represent the number of platform complementors whose products are substitutes. If $r$ is the royalty rate as before, the platform’s profits in this mixed scenario (monopoly + competition) are given as follows.

\[
\Pi_{P_{mixed}} = \text{Profit from monopoly} + \text{Profit from Cournot competition} \\
= \frac{ar(n-k)}{4} + \frac{rk\alpha}{(k+1)^2} - c(\alpha^2 - 1) \\
\text{FOC: } \alpha^* = \frac{1}{2c} \left(\frac{r(n-k)}{4} + \frac{rk}{(k+1)^2}\right) \\
\]

Thus, $\alpha^*$ is a decreasing function of $k$. We can see that by setting $k = n$ in $\alpha^*$, we get $\alpha^*_{CC} = \frac{nr}{2c(n+1)^2}$ which is the level of market expansion when there is pure Cournot competition. Similarly, setting $k = 0$ gives us $\alpha^*_P = \frac{nr}{8c}$ which is the case when all the complementors are monopolists. Thus, by controlling $k$, the platform sponsor can control the level of Cournot competition on the platform.

Given this level of market expansion, let us consider the platform’s optimum profits.

\[
\Pi_{P_{mixed}}^* = \alpha^* \left[\frac{r(n-k)}{4} + \frac{rk}{(k+1)^2}\right] - c(\alpha^* - 1) \\
= \alpha^*^2 (2c - c) + c \\
= (\alpha^*^2 + 1)c
\]
Again, it can be verified that varying $k$ gives us the monopoly and Cournot competition solutions. Since the platform profit increases with $\alpha^2$, we get that the platform profit is also a decreasing function of $k$ (note that $\alpha \geq 1$). Thus, the platform will select the smallest possible $k$, which in this case happens to be $k = 0$.

**Implication:** This proposition confirms the intuition of basic competition models from industrial organization. Introducing competition in the form of substitutes distorts the platform profits away from the monopoly case. Ideally, the platform sponsor will want to keep competition to a minimum so that monopoly rents could be extracted by the complementors. In practice, however, there could be complementarities between platform complementors such that it might be optimal for the platform sponsor to allow competition in some categories while restricting entry in others. This framework could be used to explain the behavior of platforms like Twitter\(^1\) and Salesforce\(^2\) who have, in the past, restricted the number of complementors. Another method of implementing such exclusivity is by charging platform participation fees and increasing entry costs of complementors.

### 4 Limitations & Extensions

A logical next step for this paper is to address some of the limitations of our model in order to derive results that more closely reflect real world phenomena. A fundamental critique of this model we hope to address is that of a linear demand curve. We plan to examine the robustness of the results to other demand curve specifications. Also, most real world product innovations also bring about market expansion as well. Thus, there exists a weak or strong relationship between product and market expansion, which is not necessarily captured by our model yet. We hope to expand the model to introduce a relationship such that $\beta$ is a function of $\alpha$, and examine that situation.

Consequently, we hope to exploit this model’s flexibility and extend it to reflect the phenomenon of two-sided network externalities. The classical model of two-sided network externalities proposed by Parker and Van Alstyne\(^12\) and Rochet and Tirole\(^13\) captures the idea with the help of two

---

\(^{1}\)http://news.cnet.com/8301-10787_3-10082448-60.html  
\(^{2}\)http://www.bbc.co.uk/news/technology-19293793
markets for complementary goods. Using modifications to the model presented in this paper, we might be able to capture at least some of those insights in a single market framework, thus making the analysis more tractable and allowing for more involved explorations.

Similarly, we aim to use this framework to shed light on related phenomena like platform nesting, royalty rates for marquee complementors and multi-layer platform competition. Among other questions, we hope to answer questions relating to platform participation fees and its effect on overall innovation within the platform.

A related extension to this paper would be to test some of the results using empirical analyses. One possible area for investigation is the trade-off between market expansion and product innovation and its implications for social media marketing efforts. We might be able to work with firms to gain access to data that might help us delineate investment in product innovations and market expansion and the decisions that led to such investments. Hopefully such analyses can help further enrich the modeling efforts put forth in this paper. In addition, we also hope to study the implementation of market expansion using brand value.

5 Conclusion

In this paper, we introduced the concept of market expansion in a platform setting. Pure market expansion refers to innovations that help expand the size of the market. This is in contrast with pure product innovation which refers to increase in value of a product to existing consumers. These might, to a certain extent, be considered modeling abstractions because, in real world situations, innovations will usually have some degree of both product product innovation and market expansion. However, academic literature in this field has tended to focus mainly on product innovation. Thus, our main contribution in this paper is to provide a framework to begin analyzing the concept of market expansion, especially as applicable to platforms.

Using a simple analytical model, we first examined the platform participation incentives of monopolist sellers in the presence of only market expansion, that is, we initially assume no product
innovation. Our results demonstrate how a platform can internalize a market expansion externality that monopolist non-competing sellers might not be able to capture independently. Within this framework, we continued to analyze the welfare implications and demonstrated how a social planner can achieve a higher level of social welfare and market expansion as compared to a platform, the inefficiency stemming from the royalty rate charged by the platform intermediaries.

Consequently, we introduced the possibility of product innovation in the model and showed that, for a given level of product innovation, sellers can enjoy access to larger markets by joining a platform. We also showed that, as the cost of innovation increases, market expansion becomes more attractive as compared to product innovation. This can, to a certain extent, allow us to understand firms’ investment in social media engagement where user interaction is enabled through innovative means.

In the last two sections, we relaxed the monopoly seller assumption and introduced Cournot competition among sellers. We showed that, under competition, the level of market expansion achieved would be smaller than that achieved under monopoly. However, competitive sellers would still prefer to join a platform that invests in market expansion than compete without market expansion. Finally, using a more generalized model allowing the platform to choose the degree of competition between complementors, we showed that platforms would prefer to have as few complementors selling substitutable products as possible. This provides an explanation for the practice of category exclusivity we see in some platforms.

In conclusion, our main contribution in this paper has been the introduction of the concept of market expansion and a framework for analyzing this phenomenon using a simple analytical model. We have derived several results concerning market expansion in platforms. On a conceptual front, this paper has presented some results and empirically testable predictions that provide potential explanations of real world phenomena. Although the analyses in this paper were limited to simple functional forms, the model gives us a foundation for more detailed investigations. By addressing some of the limitations of the model and exploring the proposed extensions, we might be able to answer important questions relating to intermediary firm strategies in the presence of innovation.
References


