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# Re-strategizing Product-related Decisions in Response to Platform Owner's Entry

Short Paper

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## Abstract

*By offering products on self-owned platform marketplace, platform owner enters complementary market and poses competition that would trigger complementors to revise their product portfolio. Building on past works, we distinguish between three product-related decisions: new product launch, product variety and product differentiation. Using two-year data from Amazon.com, we empirically test how complementors re-strategize product-related decisions in response to platform owner's entry. We find that complementors decrease new product launch, and revise their product portfolio by reducing product variety but increasing product differentiation (i.e., position away) from platform owner. Furthermore, we show that complementors agglomerate together, offering products with lower differentiation from one another. Our results inform about the implications of platform owner's entry on complementors' products. We call for potential mechanisms to incentivize complementors' efforts in new products and direct complementors to specialize and agglomerate in products complementing platform owner's product offerings.*

**Keywords:** Platform owner's entry; product strategies; complementor

## Motivation

In a platform-based market, complementors (i.e., third-party sellers on e-commerce platform) sell products that contribute to their own profitability, and help platform grow (Boudreau 2012; Parker et al. 2017). Cognizant of the value of products, platform owners, such as Amazon.com, have entered the complementary market (i.e., the marketplace where complementors sell products) by directly selling products to consumers, which is termed as "*platform owner's entry*" (Zhu and Liu 2018).

When platform owner's entry occurs, complementors can re-strategize product-related decisions. Prior research has, however, overlooked the numerous possible decisions related to product offerings. A scrutiny of the literature would reveal two motivations driving this research. First, despite the research on pricing and other approaches of complementors facing platform owner's entry (e.g., Chen and Han 2018; He et al., 2020), few extant studies have examined the response in product portfolio apart from incumbent product improvement (Wen and Zhu 2019; Foerderer et al. 2018). A broader set of product-related decisions have been overlooked. Second, literature on platform governance emphasizes platform owner's actions to manage the products of complementors on the platform (Rietveld et al. 2019), rather than complementors' strategies in response to platform owner's entry. Hence, we lack an understanding of the implications of platform owner's entry on complementors' products to better inform about the deployment of governance mechanisms.

Building on past works, we consider three product-related decisions vital in response to platform owner's entry (e.g., Thomas 1999; Ren et al., 2011; Wang and Shaver 2014) and in platform value creation (i.e., Rietveld et al. 2019; Foerderer et al. 2021): *new product launch, product variety and product differentiation*. Our Research Question is: *How do complementors re-strategize their product-related decisions to counter platform owner's entry?*

As this is a research-in-progress, we tested our conjectures with some initial data from Amazon.com across two years. We find that platform owner's entry is negatively related to new product launch, which might be undesirable for innovation and expansion of the platform. We also observe a decrease in product variety, indicating that complementors are more specialized, focusing on a narrower range of products. In addition, complementors position away from platform owner by increasing product differentiation from platform owner, even though the common position lowers the differentiation from other complementors. Taken together, complementors are likely to infer platform owner's entry as a signal of low commitment and high competition. As a response to these inferences, complementors lower the incentive for creativity and growth on the platform, position away from platform owner to limit competition, and specialize and agglomerate in this new position. Further analyses on the sizes of complementors suggest that such re-strategizing decisions are more pronounced for large complementors.

We add to the literature on platform owner's entry (Zhu and Liu 2018; Jiang et al. 2011; Gawer and Henderson 2007) by advancing the understanding of complementors' responses. Unlike prior studies that emphasize pricing as an ex-ante action for complementors, but do not address the ex-post accommodation with platform owner's actual entry (e.g., Wen and Zhu 2019; Chen and Han 2016), we demonstrate the potential of product-related decisions as ex-post strategies countering platform owner's entry. By investigating three critical decisions for complementors, we uncover the complexity and flexibility of the response in product offerings, underscoring a new direction of strategizing for complementors. Furthermore, we inform platform owner about the implications of entry for complementors' products and explore the direct use of entry in directing complementors, thus, enriching the literature on platform governance (e.g., Rietveld et al. 2019; Hukal et al. 2020).

## **Related Work and Hypotheses Development**

### ***Response to Platform Owner's Entry***

Prior research on platform owner's entry has initially examined how platform owners enter the complementary market. They infer platform owner's incentives from the entry patterns (Zhu and Liu 2018; Jiang et al. 2011) and explore the organizational mechanisms that mitigate the negative effect of platform owner's entry on complementors' innovation (Gawer and Henderso 2007). With the increasing availability of complementors' data, researchers have recently examined their response to platform owner's entry.

Pricing has been recognized as a strategy deployed in the face of platform owner's entry threat (i.e., ex-ante the actual entry), either to slow down platform owner's entry or to maximize current profits. Chen and Han (2016) consider platform owner's learning from sales observations to decide if to sell the same product and theoretically model that complementors may distort product price (e.g., set a high price when the price sensitivity is high) to slow down platform owner's learning process and entry. Furthermore, Wen and Zhu (2019) argue that platform owner's price advantage makes it almost futile for complementors to fight and empirically show that complementors would secure a short-term return by increasing product price when identifying platform owner's entry threat. Although these studies support that pricing is a competitive strategy in response to entry (e.g., Simon 2005), they focus on ex-ante actions and do not address how complementors confront competition ex-post the actual entry.

Apart from pricing, researchers have identified other approaches in response to platform owner's entry. For example, intellectual property rights and downstream capabilities can reduce the risks of platform owner's entry through imitation (Huang et al. 2013). As another example, He et al. (2020) propose the disintermediation mechanism in which complementors use offline stores to build offline relationships with consumers and then encourage them to transact outside the platform. These strategies are less feasible due to the high investments in ex-ante defense and additional costs when interfacing with consumers.

There is a paucity of research on complementors' products. The few research, if any, primarily focuses on improvements of incumbent products. Researchers provide empirical evidence on how third-party developers update incumbent products (Wen and Zhu 2019; Foerderer et al. 2018) and exploit the demand spillover effect (Li and Agarwal 2017) within the category entered by platform owner. Nevertheless, these analyses tend to assume a complementor's immobility in the category of incumbent products. For example, when Google enters the market of photography apps, complementors would increase the updates of their

apps in the photography category (Foerderer et al. 2018), leaving much uncertainty about other products and the product portfolio beyond the focal category.

### ***Product-related Decisions***

We use the term product-related decisions to refer to a set of choices regarding the allocation of resources among different products and product portfolio decisions (Sorenson 2000; Foerderer et al. 2021). Building on the literature on incumbents' response to entry, we distinguish between three product-related decisions: new product launch, product variety and product differentiation. To date, little work has considered how complementors accommodate platform owner's entry by re-strategizing their product-related decisions.

New product launch refers to the decision to introduce one or more products that have not previously been introduced to the market, which has been recognized as a way to deter or limit entry (Thomas 1999). New products will positively affect the focal firm by expanding consumer demand (Mahajan et al. 1993) and cannibalizing competitors' market shares (Fosfuri and Giarratana 2009). Despite the benefits, launching new product might be risky due to uncertainty in demand prediction (Dean et al., 2016).

Product variety is defined as the number or range of the total set of products offered by a firm (Watson 2009). Both marketing and psychology literature have informed that high-variety products offer flexibility for uncertain preferences (Kahn 1998) and opportunity for variety seeking (McAlister and Pessemier 1982). However, stocking costs rise as firms keep a high variety (Sorenson 2000). More importantly, as the number of products and firms increases in the local market, capturing demand that has not been addressed becomes difficult, the value of high variety declines (Sorenson 2000; Ren et al. 2011).

Product differentiation refers to the distance between a dyadic pair in product space (Sweeting 2010; Wang and Shaver 2014). Two competing views on product differentiation prevail. On one hand, some researchers argue firms tend to position themselves away by increasing product differentiation from the competitors (Wang and Shaver 2014; Seamans and Zhu 2017), so as to limit competition and secure a sustained above-normal return (Peteraf 1993). On the other hand, some researchers argue that firms position themselves near competitors by offering similar products, so as to reduce uncertainty and benefit from spillover effects (Semadeni 2006). In particular, large and profitable firms may serve as role models that lead the positioning of other firms (Haveman 1993).

### ***Hypotheses Development***

New product might be less favored by complementors in the face of platform owner's entry. First, platform owner enters with a great advantage over complementors, due to better awareness and reputation, thereby attracting consumers and mitigating their concerns over credibility in an online environment (He et al., 2020). Platform owners are also blessed with price advantage (Wen and Zhu 2019), and can easily "steal" consumers away from complementors, often termed "business stealing" (Chen and Guo 2022). Therefore, it is almost futile for complementors to cannibalize platform owner through new products. Second, complementors face a difficult choice regarding new product launch due to demand uncertainty (Rietveld and Eggers 2018). As searching and marketing involve additional investment, new product launch becomes a high-risk option for complementors. Hence, we conjecture

***Hypothesis 1:*** Following platform owner's entry, complementors decrease new product launch.

High variety tends to provide better flexibility and opportunities in capturing heterogeneous consumers (Kahn 1998; McAlister and Pessemier 1982). However, when platform owner enters by offering a large number of products on the platform, online consumers have a higher probability of being aware of and switching to platform owner due to the lower costs of searching and switching (He et al., 2020). As a result, the chance of complementors capturing unserved consumers declines. This is similar to the diminishing benefits of product variety in the presence of a collocated store (Sorenson 2000; Ren et al., 2011). Moreover, a wide range of products increases the possibility of multimarket competition with platform owner and generates higher stocking costs. In contrast, complementors may obtain advantages in a niche by focusing on a few products. We next conjecture

***Hypothesis 2:*** Following platform owner's entry, complementors offer smaller product variety.

The competition-based repositioning literature posits that following a dominant firm approaching their product space, incumbents incline to reposition to differentiate from the dominant firm (Wang and Shaver 2014). As platform owner enters, complementors may have a lower incentive to situate in the same position as platform owner, where they are likely to confront direct competition. Instead, positioning away by increasing product differentiation from platform owner (e.g., Thomas and Weigelt 2000; Seamans and Zhu 2017) will minimize the competition and secure complementors a sustained return (Peteraf 1993).

When complementors choose to do so, they will tend to agglomerate because platform owner's entry will limit viable alternative positions available on the platform (Greve 1996). Complementors can differentiate by staying in fewer products entered by platform owner (overlapped products) and increasing the number of products that platform owner does not carry (non-overlapped products), hence driving them to a narrower set of products. In the presence of a single dominant marketplace, complementors may have no profitable alternative sales channel, so that they have to forgo the differentiation from one another and give way to the fiercer competition from platform owner. For these reasons, we propose our two hypotheses on product differentiation:

**Hypothesis 3a:** Following platform owner's entry, complementors reposition by increasing product differentiation from platform owner.

**Hypothesis 3b:** Following platform owner's entry, complementors reposition by decreasing product differentiation from other complementors.

## Method

### Data and Measures

We collected the data from Amazon.com for preliminary analyses, comprising 443,880 complementors (i.e., third-party sellers) who offered 974,595 unique products from June 2016 to December 2018. Amazon enters complementary markets by directly selling identical products as complementors in its marketplace. We define "platform owner's entry" as when Amazon first appears as a seller for a given product, and "the entry date" as the date of starting to sell that product. Amazon directly entered 325,652 products in our sample during the observation time. We operationalize all relevant variables at the complementor-month level to test the hypotheses.

### Dependent variables

**New product launch:**  $NewProd_{it}$  measures the logarithm of the number of new products launched by complementor  $i$  at time  $t$ . At the complementor level, we define a product as new if the complementor has not listed that product since the beginning of our dataset. We drop the first observation for each complementor to mitigate the bias caused by the sharp new product launch when starting a business on the platform.

**Product variety:** Following prior work on product variety (e.g., Van Herpen and Pieters 2002), we operationalize an *Entropy*-based approach to measure the variety of products across categories (Equation 1). If complementor  $i$ 's products comprise  $K$  number of categories, and the proportion of products in each category is  $p_{ikt}$ , then

$$Variety_{it} = - \sum_{k_i}^{K_i} p_{ikt} \times \ln(p_{ikt}) \quad 1$$

$Variety_{it}$  is 0 when a complementor only offers products in a single category; the higher the degree of  $Variety_{it}$ , the greater variety in products.

**Product differentiation:** Following prior work on strategic positioning (e.g., Seamans and Zhu 2017; Wang and Shaver 2014), we construct the measure of product differentiation, indicating the relative position of the focal complementor. We use the category information to construct a vector  $V_{it}$  with each element,  $v_{ikt}$ , indicating the proportion of products complementor  $i$  offers in category  $k$  at time  $t$ . We further construct vectors that describe the products offered by platform owner,  $V_{Platf,t}$ , and another complementor  $j$ ,  $V_{jt}$ , at time  $t$ .  $Diff\_Platf_{it}$  is the dyadic differentiation between complementor  $i$  and platform owner,

measured by the angle distance in radians between two product vectors and is normalized by  $\frac{\pi}{2}$  (Equation 2). The distance measure ranges from 0 to 1, with 0 indicating identical product positions. The greater the degree of differentiation, the more a complementor positions itself far away from platform owner.

$$Diff\_Platf_{it} = (\cos^{-1} \frac{V_{it} \cdot V_{Platf,t}}{\|V_{it}\| \|V_{Platf,t}\|}) / (\frac{\pi}{2}) \quad 2$$

We calculate the dyadic angle distance between complementor  $i$  and complementor  $j$  following Equation 3. We construct a measure of product differentiation of complementors  $i$ ,  $Diff\_Compl_{it}$ , by computing the minimum of all the distance measures between it and other complementors at time  $t$  (Equation 4).

$$Dis_{ijt} = (\cos^{-1} \frac{V_{it} \cdot V_{jt}}{\|V_{it}\| \|V_{jt}\|}) / (\frac{\pi}{2}) \quad 3$$

$$Diff\_Compl_{it} = \min_{j \in C_i} \{Dis_{ijt}\} \quad 4$$

### Independent variable

The independent variable measures platform owner's entry into complementors' products. We construct  $ProdEntry_{it}$ , capturing the logarithm of the number of products entered by platform owner while being offered by complementor  $i$  at time  $t$ . We expect that, given the shock by platform owner's entry, complementors would dynamically re-strategize product-related decisions and be reflected in the following periods. We first use a 1-month lag,  $ProdEntry_{it-1}$ , as the independent variable for the preliminary analyses. For robustness checks, we also construct alternative measures by varying the length of the lag.

### Moderator and controls

In practice, how a complementor responds to platform owner's entry might be constrained by some internal factors, such as firm characteristics (Wang and Shaver 2014). For our preliminary studies, we first focus on the size of complementors, which is measured by the logarithm of the total number of products offered by complementor  $i$  at time  $t$  ( $Size_{it}$ ). We expect complementors of large sizes to be resourceful and hence can better adopt effective strategies to counter platform owner's entry.

We include the following controls in our model specification. First, as pricing is a widely recognized strategy in response to entry (Simon 2005), we first control for  $PriceAdv_{it}$  measured by the average differences between complementor  $i$ 's historical lowest price for each product in its product set and the lowest price of the same product in the current market. Second, we include the number of categories that the complementor competes in ( $NumCat_{it}$ ), because more diversified complementors are found to be more positive to platform owner's entry (Foerderer et al. 2018). Third, we control the relationship between a complementor and the platform owner following Zhu and Liu (2018) who argued that Amazon is less likely to compete with complementors that use Fulfilment by Amazon (FBA), a back-end operations service, due to the revenue from those complementors. We measure  $Relation\_Platf_{it}$ , whether complementor  $i$  uses the platform-offered service. Fourth, we control the visibility of complementors which enables them to attract more consumers, establishing a stronger position in defending themselves. *BuyBox* on Amazon is a section displayed on the product webpage with "Add to Cart" button to recommend a complementor as default for consumers, leading to greater attention of the featured complementor. Thus, we measure whether a complementor  $i$  appears as default for one of its products ( $Visibility_{it}$ ). Last, researchers has also found organizational learning from past experiences to better counter a new entry (McCann and Vroom 2010). We control for the established experience with platform owner's entry,  $EntryExp_{it}$ , measured by the logarithm of the cumulated number of entry events that complementor  $i$  has faced since the beginning of the dataset. Finally, we obtain a sample of 255,612 unique complementors, contributing to 1,827,146 complementor-month observations. Table 1 reports the descriptive statistics.

	Mean	S.D.	Min	Max
<i>NewProd</i>	1.030	1.116	0.000	9.936
<i>Variety</i>	0.394	0.529	0.000	2.788
<i>Diff_Platf</i>	0.811	0.092	0.000	1.000
<i>Diff_Compl</i>	0.025	0.081	0.000	0.705
<i>ProdEntry</i>	0.298	0.654	0.000	7.889
<i>PriceAdv</i>	-1.00	14.033	-997.100	1228.433
<i>Size</i>	1.745	1.253	0.693	11.313
<i>NumCat</i>	2.314	2.516	1.000	24.000

<i>Relation_Plaf</i>	0.496	0.500	0.000	1.000
<i>Visibility</i>	0.293	0.455	0.000	1.000
<i>EntryExp</i>	1.064	1.275	0.000	10.700
<b>Table 1. Descriptive Statistics</b>				

Note: Number of observations=1,827,146

### Empirical Model

We adopt a fixed-effect model at the complementor level to test the hypotheses. The baseline regression model is:

$$Y_{it} = ProdEntry_{it} + PriceAdv_{it} + Size_{it} + NumCat_{it} + Relation\_Plaf_{it} + Visibility_{it} + EntryExp_{it} + C_i + T_t + \epsilon_{it}$$

$Y_{it}$  represents the four dependent variables that we focus on, namely:  $NewProd_{it}$ ,  $Variety_{it}$ ,  $Diff\_Plaf_{it}$ , and  $Diff\_Compl_{it}$ . We use  $C_i$  to control for the fixed effect on individual complementor, such as the characteristics that could be correlated with outcomes and platform owner's entry. Time fixed effect,  $T_t$ , is controlled by adding year and month dummies.

### Preliminary Results

We present our preliminary results in Table 2. In Column (1), the coefficient of *ProdEntry* is negative and statistically significant (-0.0429,  $p < 0.01$ ); a one-unit increase in the number of products entered by platform owner might yield an approximate 4.29% decrease in new products, supporting Hypothesis 1. Column (2) indicates a negative and statistically significant effect of platform owner's entry on product variety ( $\beta = -0.0753$ ,  $p < 0.01$ ), implying the variety of the focal complementor decreases by 0.0753. This result suggests that complementors tend to focus on a limited range of products and be more specialized in response to platform owner's entry. Thus, Hypothesis 2 is supported. Furthermore, the estimations on product differentiation in Columns (3) and (4) show the relative position that complementors specialize in. We obtain statistically significant coefficients of *ProdEntry*, suggesting that product differentiation from platform owner increases by 0.0024 while product differentiation from other complementors decreases by 0.0089, with platform owner's entry. As expected, complementors position away from platform owner by increasing the differentiation in products, but end up lowering the differentiation from one another and agglomerating together. These results support Hypotheses 3a and 3b.

	Main Effect				Heterogeneous Effect			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	NewProd	Variety	Diff_Plaf	Diff_Comp	lf NewProd	Variety	Diff_Plaf	Diff_Comp
<i>ProdEntry</i>	-0.0429*** (0.0016)	-0.0753*** (0.0011)	0.0024*** (0.0003)	-0.0089*** (0.0002)	-0.0238*** (0.0033)	0.1844*** (0.0031)	-0.0047*** (0.0008)	0.0202*** (0.0004)
<i>Size</i>	0.8944*** (0.0018)	0.0266*** (0.0010)	-0.0165*** (0.0004)	-0.0062*** (0.0001)	0.8965*** (0.0018)	0.0552*** (0.0009)	-0.0173*** (0.0004)	-0.0030*** (0.0001)
<i>ProdEntry</i> × <i>Size</i>					-0.0055*** (0.0011)	-0.0745*** (0.0011)	0.0020*** (0.0003)	-0.0084*** (0.0002)
<i>PriceAdv</i>	-0.0005*** (0.0002)	0.0001 (0.0000)	-0.0000* (0.0000)	0.0000 (0.0000)	-0.0005*** (0.0002)	0.0001* (0.0000)	-0.0000* (0.0000)	0.0000 (0.0000)
<i>Size</i>	0.0286*** (0.0008)	0.1916*** (0.0011)	-0.0074*** (0.0002)	0.0217*** (0.0002)	0.0295*** (0.0008)	0.2029*** (0.0010)	-0.0077*** (0.0002)	0.0230*** (0.0002)
<i>Relation_Plaf</i>	-0.0933*** (0.0033)	0.0380*** (0.0019)	-0.0042*** (0.0008)	0.0049*** (0.0003)	-0.0937*** (0.0033)	0.0335*** (0.0017)	-0.0041*** (0.0008)	0.0044*** (0.0003)
<i>Visibility</i>	-0.0015 (0.0014)	0.0172*** (0.0008)	-0.0040*** (0.0003)	0.0023*** (0.0001)	-0.0021 (0.0014)	0.0085*** (0.0006)	-0.0038*** (0.0003)	0.0013*** (0.0001)
<i>EntryExp</i>	-0.2488*** (0.0019)	-0.0764*** (0.0010)	-0.0029*** (0.0004)	-0.0108*** (0.0002)	-0.2471*** (0.0019)	-0.0542*** (0.0008)	-0.0035*** (0.0004)	-0.0083*** (0.0002)
_cons	-0.0838*** (0.0039)	-0.1130*** (0.0024)	0.7962*** (0.0010)	-0.0036*** (0.0004)	-0.0878*** (0.0039)	-0.1673*** (0.0021)	0.7977*** (0.0010)	-0.0097*** (0.0004)
Complementor FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year and Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1,827,146	1,827,146	1,827,146	1,827,146	1,827,146	1,827,146	1,827,146	1,827,146

Table 2. Effect of Platform Owner's Entry on Product-related Decisions

Note: Robust standard errors are clustered on individual complementor and given in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

We explore the heterogeneous responses of complementors of different sizes by adding an interaction term,  $ProdEntry \times Size$ , into estimations. Table 2, Column (5) shows a negative effect of platform owner's entry on new product launch ( $\beta = -0.0238$ ,  $p < 0.01$ ); furthermore, the negative effect is more pronounced when the size of the complementor increases, as captured by the negative coefficient of the interaction term ( $\beta = -0.0055$ ,  $p < 0.01$ ). In Column (6), although the main effect of platform owner's entry on variety seems positive, such effect is decreased with the size of complementors, as shown by the negative coefficient of the interaction term ( $\beta = -0.0745$ ,  $p < 0.01$ ). Taking account of the average decrease in product variety in Column (2), we explain that large complementors tend to decrease product variety and focus on a limited range of products, driving the average negative effect on product variety. Similarly, the effect of platform owner's entry on product differentiation are also driven by large complementors. The significant coefficient of the interaction terms in Columns (7) and (8) suggests that as sizes increase, complementors tend to increase product differentiation from platform owner ( $\beta = 0.0020$ ,  $p < 0.01$ ), while decreasing the differentiation from other complementors ( $\beta = -0.0084$ ,  $p < 0.01$ ). These findings are consistent with the effect of platform owner's entry in the full sample estimation reported in Columns (3) and (4).

The findings on large complementors imply that they react primarily to the low commitment and high competition triggered by platform owner's entry. Large complementors could be less dependent on a single platform. When complementors infer platform owner's entry as a value misappropriation signal, they have lower incentive for growth on that platform, explaining the decreases in new product launch and product variety. In addition, large complementors are able to pursue a new position given their larger resource endowments (Penrose 2009), seeking a sustainable market where their resources and capabilities are well suited to profit. They can position themselves away from platform owner through product differentiation and focus on this new position. Nevertheless, small complementors perform opportunistically in the face of platform owner's entry. They launch fewer new products to reduce risk while adding product variety to capture heterogeneous consumers and offering products with less differentiation from platform owner. This finding is consistent with the imitation in positioning in order to reduce uncertainty and benefit from the spillover effects (Haveman 1993; Semadeni 2006).

**Robustness checks:** We run additional regressions using alternative measures on dependent and independent variables to check the consistency of our results. The results are reported in Table 3. First, we compute the independent variable,  $ProdEntry$  using the average of the previous 3 months. As shown in Table 3, Columns (1)-(4), the results are consistent with that of our preferred specification in Table 2. Furthermore, we construct alternative measures for the dependent variables, and the results are reported in Columns (5)-(8). We construct  $If\_NewProd_{it}$ , that equals 1 if complementor  $i$  lists at least one new product at time  $t$ . For product variety, we replace the *Entropy* measure by a *Herfindahl-Hirschman Index* (HHI) measure, which considers the general product set and fraction of products in each category. The HHI-based measure takes the value of 1 when the products are in a single category. Last, we measure product differentiation following Equations 2, 3 and 4, but use a different vector with each element indicating whether complementor  $i$  offers products in category  $k$  at time  $t$ . These results are consistent with our main estimates in Table 2.

	Alternative IV				Alternative DVs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	NewProd	Variety	Diff_Plattf	Diff_Compl	If_NewProd (Binary)	Variety (HHI)	Diff_Plattf (alt_vector)	Diff_Compl (alt_vector)
<i>ProdEntry</i>	-0.1522*** (0.0037)	-0.0955*** (0.0020)	0.0009 (0.0006)	-0.0108*** (0.0003)	-0.0424*** (0.0009)	0.0398*** (0.0006)	0.0028*** (0.0000)	-0.0063*** (0.0003)
<i>NumProd</i>	0.8791*** (0.0024)	-0.0125*** (0.0011)	-0.0106*** (0.0004)	-0.0109*** (0.0002)	0.4221*** (0.0013)	-0.0230*** (0.0006)	-0.0064*** (0.0000)	-0.0025*** (0.0002)
<i>PriceAdv</i>	-0.0035*** (0.0006)	0.0004*** (0.0001)	-0.0003*** (0.0001)	0.0001*** (0.0000)	-0.0001* (0.0001)	-0.0000** (0.0000)	-0.0000** (0.0000)	0.0000 (0.0000)
<i>Size</i>	0.0314*** (0.0009)	0.1740*** (0.0010)	-0.0072*** (0.0002)	0.0197*** (0.0002)	-0.0075*** (0.0005)	-0.0848*** (0.0006)	-0.0350*** (0.0001)	0.0224*** (0.0002)
<i>Relation_Plattf</i>	-0.0939*** (0.0048)	0.0316*** (0.0025)	-0.0006 (0.0008)	0.0044*** (0.0004)	-0.0051*** (0.0020)	-0.0261*** (0.0012)	-0.0015*** (0.0001)	-0.0002 (0.0004)
<i>Visibility</i>	0.0059*** (0.0018)	0.0236*** (0.0009)	-0.0028*** (0.0003)	0.0032*** (0.0002)	0.0062*** (0.0009)	-0.0064*** (0.0005)	-0.0008*** (0.0000)	0.0026*** (0.0002)
<i>EntryExp</i>	-0.1576*** (0.0032)	-0.0418*** (0.0015)	-0.0047*** (0.0006)	-0.0066*** (0.0003)	-0.1534*** (0.0010)	0.0467*** (0.0006)	0.0027*** (0.0000)	-0.0037*** (0.0002)
<i>_cons</i>	0.7659*** (0.0015)	0.0239*** (0.0006)	0.7659*** (0.0015)	0.0239*** (0.0006)	-0.0559*** (0.0025)	1.0264*** (0.0014)	-0.0212*** (0.0070)	0.1055*** (0.0038)



Complementor FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year and Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	984,924	984,924	984,924	984,920	1,827,146	1,827,146	1,827,146	1,827,146

**Table 3. Robustness Checks**

Note: Robust standard errors are clustered on individual complementor and given in parentheses. \* p < 0.1, \*\* p < 0.05, \*\*\* p < 0.01.

## Discussion and Contributions

Moving forward, we plan to distinguish how the strategies offered by different combinations of product-related decisions vary across complementors by incorporating more complementor-level characteristics. The findings on complementor heterogeneity can provide implications for platform owner to direct complementors' agglomeration and specialization in accordance with platform value creation, thus advancing platform governance (e.g., Rietveld et al. 2019; Foerderer et al. 2021).

Upon completion, this research has 3 potential theoretical contributions. First, unlike prior research which analyzes pricing and other approaches ex-ante platform owner's entry (e.g., Chen and Han 2016; He et al., 2020), we consider the importance of products that support complementors' and platform's value creation and examine the shifts in product-related decisions accommodating platform owner's entry. Second, by distinguishing a set of decisions (i.e., new product launch, product variety and product differentiation) rather than an isolated decision (e.g., incumbent product improvement), we underscore the criticality of viewing product offerings more holistically (e.g., Foerderer et al. 2018; Wen and zhu 2019) and widen the strategies available to complementors. Finally, we emphasize that the coordination and forbearance within platform constitute a useful frame to ponder the implications of platform governance (e.g., Rietveld et al. 2019; Foerderer et al. 2021). Specifically, complementors' agglomeration and specialization in a position away from platform owner may help to complement the products sold by platform owner, echoing strategic works on platform governance toward value creation (e.g., Suseno et al. 2018; Gol et al. 2019).

Our findings can generalize lessons for platform managers and complementors. Entry might be beneficial for platform to reduce redundant efforts in certain products and direct complementors to strengthen the supply in areas with great potential and untapped value. Also, platform manager should be aware of the undesirable outcome of the decrease in new product launch and employ additional mechanisms to counter it. As complementors are "swimming with shark" in the face of competitive pressure from platform owner (Huang et al. 2013), it is advisable for complementors to get experienced in multiple products or categories, especially the nonblockbuster niche with lower entry threat, to construct a buffer space for repositioning.

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