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Product Market Competition and Strategic New Product Releases

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Abstract

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My dissertation examines how competition affects firms' decisions on new product releases. I introduce a disclosure-based measure of new product introduction using new product announcements collected from newswires. Then I provide large-scale evidence that firms increase the likelihood of announcing new products when competition increases. I also show that firms' responses vary cross-sectionally in a predictable pattern. Finally, I find some descriptive evidence that industry new product introduction is negatively correlated with foreign import penetration. This study leverages corporate disclosure to measure new product introduction and speaks to how firms adjust their product decisions in competition.

Product Market Competition and Strategic New Product Releases

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This work is dedicated to my family, Jiang Dai, Mingjun Zhang and Linzi Dai for their unwavering support and encouragement, and to my dearest grandpa Yue Dai in loving memory.

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Abstract

Economic theory suggests that strategic releases of new products can deter entrants and preempt competition. However, tracking new products is challenging due to the multitude of brands and product models. I introduce disclosure-based measures of new products using new product announcements collected from newswires, and examine how product market competition affects firms' new product releases. Using plausibly exogenous variations in tariff changes as a proxy for foreign competition, I find that firms are more likely to release new products when competition increases. Consistent with my predictions, I also find that the effect concentrates in industries that have higher sales concentration and lower patenting barriers, and in well-performing firms. Additionally, I find descriptive evidence that industry-wide new product releases are negatively correlated with concurrent foreign import changes. Taken together, my results suggest that firms respond to potential foreign competition with new products to deter entrants.

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Introduction

Product innovation is the cornerstone of firms' growth and the primary source of competitive advantage (Solow, 1957; Romer, 1990; Sorescu, Shankar and Kushwaha 2007). New product releases influence the behavior of various stakeholders including customers, competitors, and investors (Eliasherbg and Robertson 1988; Robertson, Eliashberg, and Rymon 1995). On the competitor side, economic theory suggests that firms are able to use new products to deter potential competitors when facing entry threat (Schmalensee 1978)[1]. By releasing new products, incumbent firms signal product market strength to competitors, and showcase their plan to fill the submarket, which will minimize the unmet demand, reduce the perceived profitability and change the entry decisions of potential competitors (Farrell 1987; Bayus, Jain, and Rao 2001). Anecdotal evidence also suggests that firms use new products to deter market entry (US vs. IBM 1969; FTC vs. Kellogg[2], General Mills, General Foods and Quaker Oats 1972[3]).

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[1] Schmalensee 1978 observes that between 1950 and 1972, all of the eighty-plus new products in the ready-to-eat cereal industry were introduced by few incumbent firms. He builds a spacial competition to model to explain how introduction of new products can deter market entry. In his model, customers and products are located in a multi-dimensional space. Customers pick the product that is closest to their position. To avoid price competition, an entrant best strategy is to enter at the midpoint between incumbent products. However, if the incumbent products are densely packed, the market share available to outsider may be too small to cover the costs of entry. Hence, by introducing new products to the market, incumbent firms can alter the prospects of industry and influence outsiders' entry decision.

[2] US vs. IBM 1969:
Excerpt from United States' Memorandum on the 1969 Case (https://www.justice.gov/atr/case-document/united-states-memorandum-1969-case):
'The Government averred that IBM predatorily priced and preannounced specific hardware that the Government termed "fighting machines." IBM
allegedly introduced certain products "knowing [the products] had unusually low profit expectations." Allegedly, IBM "developed and announced" the specified hardware products "primarily for the purpose or with the effect of discouraging actual and potential customers from acquiring . . . [competing products] . . . in markets . . . where IBM's monopoly position had eroded or threatened to erode."

[3] FTC vs. Kellogg, General Mills, General Foods and Quaker Oats 1972:
Excerpt from appeal (Federal Trade Commission, v. J. E. Lonning, President, and Kellogg Company, A corporation, Appellants, 539 F.2d 202 (D.C. Cir. 1976) https://law.justia.com/cases/federal/appellate-courts/F2/539/202/244452/):
"On April 26, 1972, the FTC issued a complaint that the four big players have introduced into the market a profusion of ready-to-eat cereal brands; they produce "basically similar" ready-to-eat cereals which are

Scholars have attempted to examine firms' new product strategies for decades. However, in terms of entry-deterring new product releases, existing studies focus on specific industries with limited sample size, the conclusions are mixed and direct evidence is limited (Mainkar, Lubatkin and Schulze 2006). On one hand, traditional industry concentration measures may not accurately reflect the entry threat from competitors (Ali et al. 2014). On the other hand, tracking new products in the product market space is challenging. Firms are constantly upgrading their product models and adding new features. Due to the multitude of brands and product models, it is difficult to capture the timing and the number of new products in a large product market consisting of thousands of players. In this paper, I introduce disclosure-based measures of new products using new product announcements from newswires. These measures allow me to track whether a firm has released any new products (the likelihood measure) and the number of new products released (the frequency measure) for a wide range of firms in a given time period. Then employing tariff changes as a proxy for foreign entry threat, I examine how product market competition affects firms' release of new products.

In contrast to the entry deterrence theory, firms may refrain from releasing new products when facing intensified competition. First, my measures of new products rely on corporate new product announcements. Such disclosures may come at a cost. Disclosing an upcoming product may alert competitors and incur aggressive retaliatory behaviors (Robertson, Eliashberg, and Rymon 1995). A long line of accounting literature also documents a negative relation between product market competition and disclosure (e.g.,

artificially differentiated by emphasizing and exaggerating trivial variations, which practices result in high barriers to entry into the ready-to-eat cereal market."

Bens 2010; Ells et al. 2012; Ali et al. 2014; Huang et al. 2017), consistent with the proprietary cost theory of disclosure (e.g. Verrechia 1983; Cao et al. 2018). Second, new products may cannibalize the sales of the firms' existing products and a broader product line is associated with higher production costs (Eliashberg and Robertson 1988). Third, if a company fails to deliver its new products, it incurs reputation costs and hurts the bottom line (Hoxmeier 2000; Hendrick and Singhal 1997)[4]. Finally, anecdotal evidence suggests that companies incur anti-trust litigation due to the use of new products as an entry deterrence tool (US vs. IBM 1969; FTC vs. Kellogg, General Mills, General Foods and Quaker Oats 1972). To conclude, it is empirically unclear whether firms use new products to deter entry in response to product market competition.

To measure the changes of entry threat from potential competitors, I use changes in import tariffs as a proxy following prior literature (Fresard 2010; Huang et al. 2017; Glaeser and Landsman 2020). Tariff changes are plausibly exogeneous to firms' disclosure choices and the staggered nature of changing rates allow me to observe the changes of market entry threat from foreign competitors in different industries at different times. Intuitively, a decrease (increase) in tariff rates represents more (less) potential competition from foreign entrants. Consistent with the theoretical prediction, I find that increasing product market competition is associated with a higher likelihood of releasing new products. A one standard deviation increase in competition corresponds to a one percentage point increase in the likelihood of issuing at least one new product. Given the unconditional probability of issuing new products is 26%, that is a 4% increase in the likelihood. However,

[4] Hendricks and Singhal (1997) find that delayed product announcements decrease firms' market value by 5.25% based on a sample of 101 firms' announcements of delayed new product introduction.

I find no evidence that product market competition is associated with the frequency of new products, probably due to noise in the frequency measure. I also find that firms' responses to tariff changes are asymmetric and the main effect concentrates in the increasing-competition scenario. Under the increasing-competition scenario, a one percentage point increase in competition increases the likelihood of releasing new products by sixteen percentage points. In comparison, firms do not decrease the likelihood of releasing new products when competition decreases. In both cases, I find no evidence that tariff changes affect the frequency of new products. Taken together, these results indicate that firms respond to increasing competition by increasing the likelihood of new products.

Firms' response to product market competition through new products also varies across industries and firms in a predictable pattern. First of all, firms in concentrated industries enjoy higher profits and possess stronger market power (Ravenscraft 1980). Hence they are more likely to use new products to preempt competition compared to other firms. Second, firms in industries with fewer patenting activities are unable to protect their profits through patenting and licensing (Eliashberg and Robertson 1988). Accordingly, they are more prone to foreign competition and have more incentive to compete through product strategies. Finally, well-performing firms can more credibly signal their market strength, saturate the market space and change the prospects of the industry. I predict that well-performing firms are more likely to release new products when facing intensified competition. Consistent with my predictions, I find that firms in concentrated industries or industries with low patenting barrier are more likely to respond to increasing competition with new products. Additionally, well-performing firms are more likely to respond in this fashion.

In the final set of additional tests, I find mixed descriptive evidence on whether new products are effective at deterring foreign competition. I find that the existence of at least one firm releasing new products in an industry and the percentage of firms issuing new products in an industry are significantly negatively associated with the concurrent changes in foreign import penetration. In terms of economic significance, having at least one firm that releases new products in an industry reduces the foreign import penetration by 4 percentage points. A ten percentage point increase in announcing firms is associated with a 0.9 percentage point decrease in import penetration. However, I do not find evidence that new products are significantly associated with import changes in future years.

My paper contributes to strategy literature on firms' use of new products to deter market entry. I provide disclosure measures of new product releases covering a large scale of firms that track the timing and the number of new products. I find that firms increase the likelihood of new product releases following tariff reductions, consistent with the entry-deterrence theory. Cross-sectionally, firms in concentrated industries, in industries with low patenting barriers and dominant firms are more likely to respond to entry threat through new product releases. These findings complement existing empirical work in industrial organization, marketing and strategy literature. (Conor 1981; Greenstein and Wade 1998; Bayus and Putsis 1999; Shankar 2006; Giachetti and Dagnino 2014; Jeong, Kim and Gang 2016; Fan and Yang 2020).

My paper also contributes to the accounting literature on the relation between corporate disclosure and product market competition (Burks et al. 2018; Bloomfield 2018; Tomy 2019; Bloomfield and Tuijin 2019; Glaeser and Landsman 2020). Prior literature documents firms' use of earnings announcements, capacity expansion disclosure and

patent disclosure to deter competition. I find that new product announcements as an indicator of new products can be an entry deterrence tool for companies. This paper is not the first to study the economic effects of new product releases. Past literature has studied the effects of new product releases on firms' stock return, financial performance and rival performance (for example, Chaney et al. 1991; Chen et al. 2002; Bayus et al. 2003; Sorescu, Shankar and Kushhwaha 2007). More recently, Chu et al. 2021 examine the relationship between the innovation disclosure in new product announcements and future firm performance. I expand the literature by shedding light on the entry-deterrence effects of new product announcements. Understanding the economics of new product announcements answers the call of Leuz and Wysocki for more research on nontraditional disclosure (Leuz and Wysocki 2016).

I organize the rest of the paper as follows. Section 2 reviews past literature and develops the hypotheses. Section 3 describes the construction of my new products measures. Section 4 describes my research design, data and sample. Section 5 presents my empirical results. Section 6 offers concluding remarks.

Literature Review and Hypotheses Development

Firms operate in a dynamic market competing with rival firms for market share and profit. Excess profitability encourages potential competitors to enter the market. Industrial organization and marketing literature have theorized various strategies that firms can employ to deter market entry and preempt competition. According to survey evidence, releasing new products is a method commonly used by managers. Smiley (1987) surveys 293 marketing and product managers on whether they try to limit market entry and what strategies managers would employ to deter market entry. More than half of the respondents

admit that they attempt to deter entry. For the existing product market, releasing new products and hiding profits are the most often-used strategies.

Economic theory also predicts that firms can use new products to deter entry. By filling the submarket with new products, incumbent firms saturate the market space, minimize the unmet demand and reduce the perceived profitability. Schmalensee (1978) observes that between 1950 and 1972, all of the eighty-plus new products in the ready-to-eat cereal industry were introduced by a few incumbent firms. He builds a spatial competition model to explain how introduction of new products can deter market entry. In his model, customers and products are located in a multi-dimensional space. Customers pick the product that is closest to their position. To avoid price competition, an entrant's best strategy is to enter at the midpoint between incumbent products. However, if the incumbent products are densely packed, then the market share available to outsiders may be too small to cover the cost of entry. Hence, by introducing new products to the market, incumbent firms can alter the prospects of their industries and influence outsiders' entry decisions.

There are several advantages to using new products as an entry deterrence tool. First, new product releases are promptly visible and directly influence the behavior of competitors (Schmalensee 1978; Bayus, Jain and Rao 2001). Second, beyond sending a signal directly to competitors, new product releases also serve as a marketing tool that attracts customers' attention and cultivates brand loyalty (Eliashberg and Robertson 1988; Greenleaf and Lehmann 1995). Finally, new product releases usually convey positive information to investors and generate positive financial returns (Chaney et al. 1991). Taken together, we posit that the likelihood (frequency) of new product releases is positively associated with product market competition.

Although existing literature has documented findings generally consistent with the preemptive role of product proliferation, the conclusions are mixed and direct evidence is scarce (Mainkar, Lubatkin and Schulze 2006) and the small sample limits the generalizability[5].

On the other hand, new product releases as a competitive strategy may also incur competitive and consumer disadvantage. On the competitive side, preannouncing an upcoming product shortens the timeframe for competitors to respond and possibly prompts competitors to react more aggressively (Eliashberg and Robertson 1988; Robertson, Eliashberg, and Rymon, 1995). On the consumer side, introduction of new products may postpone purchase decisions and cannibalize the market of existing products (Farrell and Saloner 1986; Gatgnon and Bansal 1987). On the regulatory side, anecdotal evidence suggests that companies face anti-trust investigations on the use of new products as an entry deterrence tool (Smilee 1988; US vs IBM 1969). Finally, if a company fails to deliver its new products (either delayed release or vaporware), this incurs reputation costs and hurts the bottom line (Hoxmeier 2000; Hendrick and Singhal 1997).

Additionally, even if theory predicts new products as an entry deterrence tool, it is still questionable whether firms do employ this strategy[6]. Firms have various other tools they could employ to preempt competition besides new products, for example capacity expansion, intensive advertising, patenting etc. Consequently, *ex ante* it is unclear whether

[5] See Appendix C for a summary of related studies.
[6] For example, while there is a long line of literature on limit pricing as an entry deterrence tool (e.g., Bain 1956; Sylos-Labini 1962), only 7% of managers think of it as a strategy frequently used (Smiley 1987).

market competition has any effect on firms' new product releases. Accordingly, my main hypothesis is

Main Hypothesis: Likelihood (frequency) of new product release is not associated with market competition

Firms' strategic release of new products also varies cross-sectionally, according to industry and firm characteristics. First of all, there is a wealth of evidence linking industry concentration with higher prices (Bayus and Putsis 1999). Consequently, firms in concentrated industries have a stronger incentive to deter entry and protect their monopolistic positions, compared to firms in competitive industries. Added to that, firms in concentrated industries also have more market power and better industry-wide coordination (Ravenscraft 1980), so their new product releases tend to be more credible. We conjecture that firms in concentrated industries are more likely to use new products to deter entry.

Second, firms can protect their market share using other methods instead of new products. Patenting creates significant technological and legal barriers for new competitors (Orr 1974; Smiley 1987; Eliashberg and Robertson 1988). Gilbert and Newbery (1982) theorize that firms have incentives to maintain their monopoly power by creating new patents. Anecdotal evidence also supports this idea[7]. Glaeser and Landsman (2021) also

[7] New York Times, "Damages Denied in Xerox Case", December 30, 1978 (https://www.nytimes.com/1978/12/30/archives/damages-denied-in-xerox-case-decision-called-appalling-scm-is.html).
Direct quote from the case decision:
"The monopoly provided by the basic patents can provide a period of competitive insulation in which the dominant company can continue to develop improvement patents to maintain an insurmountable lead over potential competitors."

documents that firms accelerate their patent disclosure when competition increases. Hence, firms in industries with high patenting barriers are less prone to predatory behaviors from new competitors. I conjecture that firms in industries with low patenting barriers are more likely to use new products to deter entry, compared to firms in industries with high patenting barriers.

Finally, the effectiveness of new products in deterring entry depends on whether the releasing firms could successfully fill the market space and alter the perception of potential entrants (Bloomfield and Tujin 2019). Poorly performing firms can hardly change the prospects of their entire industries, given their limited market power. Consequently, I predict that well-performing firms are more likely to use new products to deter entry.

Measure of New Products

My main variable of interest is firms' release of new products. To capture the timing and the number of new products released by each firm, I collect all the new product announcements between 2000 and 2018 from RavenPack. I search through both the RavenPack Dow Jones Edition and PR Edition to make sure that I capture as complete a universe of new products as possible. The RavenPack Dow Jones Edition captures news articles from major newswires such as Dow Jones Newswire, the Wall Street Journal, Barrons, and Market Watch. The RavenPack PR Edition captures news articles from major press release distribution networks such as PRNewswire, Canadian News Wire etc.

To make sure that all the new products are accurately identified, I impose several filters. First, I require the TYPE value of each news article to be exactly "product release", which indicates "the launch of new products or services or an upgrade to an existing one", according to the RavenPack taxonomy. Second, I require the relevance score to be 100 as

recommended by the RavenPack manual. This ensures that each news article is highly relevant to a specific firm. I further require the global novelty score to be 100. This filter ensures that each news article is the first to report this event across all versions of datasets in RavenPack, which removes duplicate articles for the same event.

To examine firms' behaviors of new product releases, I construct a likelihood measure and frequency measure of new products. The likelihood measure is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. The frequency measure is the number of new products that firm i releases in a given year, calculated as the natural log of 1 + the number of new products from firm i in year t.

To the best of my knowledge, existing databases that track new products, such as MINTEL and Nelson, mostly focus on B2C consumer products. For example, MINTEL focuses on delivering "detailed product data on new products in the food, drink, beauty and personal care, health and hygiene, home care and pet markets." In comparison, my disclosure-based measures of new products cover a wide range of industries. Table 1 Panel B presents the industry distribution of my sample based on Fama-French 12 industries. Over 75% of firms in the sample are in the manufacturing, business equipment and healthcare industries. The top four industries with highest probability of releasing new products in any given year are Business Equipment, Chemicals, Consumer Durables and Manufacturing.

There are also several caveats to using my disclosure-based measures. First of all, both my likelihood measure and frequency measure of new products involve type II error. It is likely that a firm has released a new product but there is no press release or news coverage of that new product, so my measures will not capture it. Given that firms do not announce

those products and there is no media coverage, those new products are usually not important and have marginal effects on the market. Second, the frequency measure of new products contains specific measurement errors due to the nature of RavenPack data. In constructing the measures, I require each news articles to have 100 (the highest) global novelty score. This is to ensure that I do not capture the same new product release event with duplicate news articles. However, the global novelty score is constructed in a 24-hour chained-event window. If two media report the same new product release with a difference of more than 24 hours with no other news coverage in-between, then my frequency measure will count two new products while there is actually only one new product released. Hence, my frequency measure of new products may contain duplicate events and overstate the actual number. Adding to that, the content of new product announcements also differs across firms. Some new product announcements only contain one specific product, while others could speak to a new brand which encompasses a number of new product models. Since my likelihood measure is a binary variable, it does not suffer from these measurement errors. In comparison, the frequency measure of new products is noisier than the likelihood measure.

Research Design and Data

1.1 Research Design

I am interested in examining whether firms release new products to deter market entry in product market competition. The endogeneity concern is that the level or change of product market competition is also a function of firms' product market strategies. Adding to that, even when precisely captured, measures such as industry concentration are not a clear proxy for competition (Ali et al. 2014). In my case, an

ideal proxy for the entry threat from potential competitors should be uncorrelated with firms' product strategies. Following prior literature (Fresard 2010; Huang et al. 2017; Glaeser and Landsman 2020), I exploit changes in import tariff rates as a plausibly exogenous variation in product market competition from foreign entrants. These tariffs are a major cost of foreign imports and create a barrier for foreign competitors. Since the tariffs are applied to the total value of foreign goods instead of to profits, even a small change in the rate can have a significant economic impact. The tariff rate changes happen to different industries at different times, which allows me to observe increasing/decreasing entry threats in a wide range of different industries. The tariff changes are unlikely to be influenced by individual firms' product strategies given that firms are more likely to express their views on trade policies through TACs, industry lobbying or direct contact with members of Congress (Huang et al. 2017). However, I do note that tariff changes is not a perfect setting, since I cannot fully rule out the possibility that firms as a whole form industry-wide collations which influence both the industry-wide product market strategies and the lobbying activities on tariffs (e.g. Jones 1991). I also note that the staggered nature of tariff changes may also bring bias to the estimates due to treatment heterogeneity (Bacon 2021; Baker et al. 2021; Barrios 2021).

I obtain U.S. import data between 2000 and 2018 from Peter Schott's website[8]. I compute the tariff rate for each industry-year (at SIC four-digit level) as the duties collected at U.S. Customs divided by the total value of the goods at the custom.

[8] I thank Peter Schott for making the data available publicly on his website: https://sompks4.github.io/sub_data.html

In the main test, I examine how tariff changes affect the probability and frequency of new products. Specifically, I estimate the following specification:

$$Outcome_{i,t} = \beta_1 \times TariffChange_{i,t} + \beta \times Controls + year_t + firm_i + \varepsilon_{i,t} \quad (1)$$

I examine two types of outcomes. The first is the probability of new products ($Release_{i,t}$). $Release_{i,t}$ is a binary variable that equals 1 if in a given year t, firm i releases at least one product and 0 otherwise. The second outcome is the frequency of new products ($Freq_{i,t}$), which is the natural logarithm of one plus the total number of new products that firm i has released during year t. $TariffChange_{i,t}$ is measured as -1× (tariff rate $_t$-tariff rate $_{t-1}$) ×100. A positive (negative) value indicates tariff reductions (increases), which proxies for an increasing (decreasing) entry threat from foreign competitors. The control variables include firm size, leverage, R&D intensity, CAPEX intensity, past stock return, return on assets, market-to-book value, sales growth, an indicator for loss firms, intangible intensity, PPE intensity, and the number of patents that firm i has filed in the past four years including year t (Chu et al. 2021).

While economic theory predicts that increasing market competition is associated with a higher likelihood (frequency) of new product releases, it is unclear whether decreasing market competition will have a symmetric effect on product strategies. To investigate whether tariff rate changes have an asymmetric effect on new product releases, I re-estimate equation (1) by splitting the sample based on the sign of tariff changes (tariff changes≤0 vs. tariff changes>0). I expect that the main effect is concentrated in the increasing competition scenario (tariff changes≤0).

I then examine how past and future tariff changes affect product strategies. Specifically, I expect that future tariff changes should not affect firms' new product strategies. I have no *ex-ante* predictions of how past tariff changes would affect new product releases.

$$Outcome_{i,t} = \beta_1 \times TariffChange_{i,t} + \beta_2 \times TariffChange_{i,t-1} + \beta_3 \times TariffChange_{i,t+1} + \beta \times Controls + year_t + firm_i + \varepsilon_{i,t} \quad (2)$$

In the cross-sectional tests, I examine whether firms in concentrated industries and industries with low patenting barrier are more likely to use NPAs to deter entry. Following prior literature, I use the Herfindahl–Hirschman Index (HHI) as a measure of industry concentration. This measure is also used by the Department of Justice and Federal Trade Commission. I calculate the industry concentration as the natural logarithm of HHI, which is the sum of squared market shares of firms in our sample at four-digit SIC level. I calculate market shares as the sales of each firm divided by the aggregated sales at four-digit SIC level in our sample.

To measure the level of patenting barrier in a specific industry, I use the average total citation-weighted number of patents that firms have filed in the past four years at four-digit SIC level. Following Kogan et al. (2017), for each patent, I calculate the citation-weighted number as one plus this patent's future citations divided by the average number of forward citations received by all patents granted in the same year. This a popular measure of firms' innovation output which accounts for both the number of patents and the importance of those patents.

Finally, in the supplementary test, I examine the effect of industry-wide new product releases on foreign imports. Specifically, I estimate the following model at four-digit SIC level:

$$ImportChange_{j,t}=\beta_1\times NewProducts_{j,t}+\beta\times Controls+year_t+industry_i+\varepsilon_{i,t} \quad (3)$$

$ImportChange_{j,t}$ is the total value of imports in year t minus that of year t-1 at four-digit SIC level, and scaled by the aggregate industry sales in year t. $NewProducts_{j,t}$ is a measure of industry-wide new product releases. I measure the industry-wide new products in two ways: (1) an indicator variable which equals 1 if at least one firm in industry j has released at least one new product in year t and 0 otherwise, and (2) the percentage of firms in industry j during year t that have released at least one new product. The control variables include tariff changes in year t and t-1, past import penetration, industry concentration, industry average sales growth, CAPEX growth and PPE growth (Bloomfiled and Tuijin 2019).

1.2 Data and Sample

I collect data from several sources. The new product data is constructed from RavenPack. The fundamental variables are obtained from Compustat. I merge the new product data with the Compustat data using the RavenPack mapping file through CUSIP. Appendix B provides examples of articles on new product announcements.

I collect the U.S. import data from Peter Schott's website. I merge the import data with the Compustat data using the historic SIC code at 4-digit level. I collect the patent

number and citation data from Noah Stoffman's website[9]. Since each patent is linked to a CRSP permno, I merge the patent data with the Compustat data using CRSP-Compustat linking table. I then delete firms in industries without import data, and firms that are not incorporated in the US. I also require firms to have non-missing control variables. My main sample includes 18,919 firm-year observations with 34,888 new product releases between 2001 and 2017. The sample starts from 2001 since 2000 is the first year that RavenPack starts coverage. It ends in 2017, since the U.S import data ends in 2018 and I require future tariff rates in our tests. All continuous variables are winsorized at 1% and 99%. Table 1 Panel A outlines my sample selection.

Table 2 reports the summary statistics of my main sample. The unconditional probability of new product releases is 26% in a given year. While on average, a firm announces 0.54 new products per year, the number of new products has a highly right-skewed distribution. A firm files 4.8 patents between year t and year t-3 on average (inclusive). The patent number distribution is also highly right-skewed as expected. On average, the tariff changes are negative indicating decreasing entry threat from foreign competitors. The average ROA is negative, indicating firms on average are incurring small losses. Moreover, around 40% of firm-year observations belong to loss firms.

Empirical Results

1.3 Main Results

The first step of our empirical analysis is to examine whether product market competition affects the likelihood and frequency of new product releases. I use tariff

[9] I thank Noah Stoffman for making the data publicly available on his website: https://github.com/KPSS2017/Technological-Innovation-Resource-Allocation-and-Growth-Extended-Data

changes as a proxy for changes in competition from foreign entrants. Competition is measured as $-1\times(\text{tariff rate}_{t}-\text{tariff rate}_{t-1})\times100$. A more positive (negative) tariff change indicates increasing (decreasing) entry threat from foreign competitors. Table 3 reports the results of estimating equation (1). For all regressions, standard errors are clustered by firm and year. Results are robust if standard errors are clustered by industry and year and if the likelihood of new product releases is estimated using a logit model.

In Column (1), I find that tariff changes are significantly positively associated with the likelihood of releasing new products at 5% level. The coefficient on tariff changes is 0.06, which implies that a one percentage point decrease in tariff rates increases the likelihood of new product releases by six percentage points. In terms of economic significance, this effect suggests that a one standard deviation increase in tariff rates corresponds to one percentage point increase in the likelihood of new product releases. Given the unconditional probability of releasing new products is 26%, that is a 4% increase in the likelihood. Column (2) reports the regression of the number of new products on tariff changes. The estimated coefficient on tariff changes is positive (0.04) but insignificant, probably due to the noise in the frequency measure. As discussed earlier, the frequency measure contains more measurement errors due to the nature of RavenPack datasets. One concern is that firms' product strategies are influenced by the business cycle (Geroski and Walters 1995), especially since my sample includes the 2007-2009 financial crisis. In Column (3) and (4) I re-estimate equation (1) excluding those years. Similarly, in Column (3), I find that tariff changes are significantly positively associated with the likelihood of new product releases at 5% level. In Column (4), I do not find evidence that tariff changes affect the frequency of new

product releases. Taken together, the results indicate that firms respond to product market competition through increasing the likelihood of new product releases, consistent with theoretic predictions.

Next, I examine whether competition has any asymmetric effects on new product releases. While economic theory focuses on how increasing competition from entry threat induces firms to introduce new products, it is empirically unclear whether decreasing competition would have a symmetric effect. I re-estimate equation (1) by splitting the sample into the increasing competition scenario (tariff changes≤0) and decreasing competition scenario (tariff changes>0). Table 4 Column (1) indicates that increasing competition is positively associated with higher likelihood of new product releases at 1% level. The estimated coefficient is 0.17. Column (2) indicates that increasing competition is positively associated with the number of new product releases but it is not statistically significant. Column (3) and Column (4) indicate that both the likelihood and the frequency of new product releases are not correlated with tariff changes at any significant level. These results suggest that firms' responses to product market competition holds only in the increasing-competition subsample. In the decreasing-competition subsample, firms do not respond to tariff changes through new product releases. An alternative story is that a tariff decrease implies the deterioration of firms' performance and firms take prompt actions through new products when things are turning bad. In comparison, firms do not need to make changes when things are doing well. In the tests, I control for firms' stock return, ROA, sales growth and indicators for loss firms. While it does not fully eliminate the possibility of the

alternative story, the residual components of new product releases are unlikely purely driven by firms' performance.

I then examine how past and future tariff changes affect new product releases. Since future tariff changes are not visible to firms yet, I expect that firms should not respond to them. Table 5 reports the results of regressing new product releases on past, current and future tariff changes. Column (1) suggest that firms only respond to current tariff changes but not to past tariff changes. After controlling for past tariff changes, the coefficient on current tariff changes is 0.06 and significant at 5% level. As expected, Table 5 Column (2) suggests that firms do not respond to future tariff changes. After controlling for future tariff changes, the coefficient on current tariff changes is 0.07 and significant at 5%. In Table 5 Column (3) I add both past and future tariff changes as control variables and only the coefficient on current tariff changes is significantly positive at 5% level.

1.4 Cross-sectional Results

1.4.1 Industry Concentration

Firms' strategic releases of new products to deter entry is influenced by the corresponding benefits and costs. Firms in more concentrated industries enjoy higher selling prices, so they are more incentivized to protect their monopolistic positions (Ravenscraft 1980). In contrast, firms in less concentrated industries already operate in a competitive environment. Firms in concentrated industries also possess stronger market power, so it is easier for them to change the prospect of their industries (Ravenscraft 1980). I expect that the strategic release of new products is more

pronounced in concentrated industries. I measure industry concentration as Herfindahl–Hirschman Index (HHI) and partition our sample based on the industry HHI. In each year, I categorize firms into two groups, the high concentration group and the low concentration group.

Table 6 reports the results of cross-sectional tests based on industry concentration. Column (1) and Column (4) split the whole sample based on HHI, and the estimated coefficients on TariffChange show marginal difference. Column (2) and Column (5) split the tariff-decreasing sample based on HHI, and I find that firms' releases of new products in response to tariff decrease is driven by firms in industries with high concentration. The coefficient on tariff changes is 0.24, which is eight times the coefficient for the low concentration subsample. Column (3) and Column (6) split the tariff-increasing sample based on HHI. Similar to prior results, I find no evidence that firms' releases of new products are significantly associated with tariff changes. Taken together, these results suggest that firms respond to decreasing tariff changes with product releases and that the effect is more pronounced for concentrated industries.

1.4.2 Patenting Barriers

Industries are also prone to foreign competition to different degrees. Patenting is a common way by which firms create technological and legal barriers for new competitors (Orr 1974; Smiley 1987; Eliashberg and Robertson 1988). Hence, firms in industries with high patenting barriers are less vulnerable to foreign competition after a tariff reduction. I predict that firms in industries with low patenting barriers are more responsive to foreign competition via new product releases. I measure industry patenting barrier as the average citation-weighted patent number within each industry

over the past 3 years (Kogan et al. 2017). In each year, I categorize firms into two groups, the low patenting barrier group and the high patenting barrier group, based on the industry average citation-weighted patent number.

In Table 7 Column (1) I find that firms' use of NPAs for entry deterrence is concentrated in industries with low patenting barriers. Again, the effect is stronger in the increasing competition scenario. Specifically, in Table 7 Column (2), I find that firms in low-patenting-barrier industries with a one percentage point increase in competition are 26% more likely to announce new products.

Table 7 reports the results of cross-sectional tests based on industry patenting barrier. Column (1) and Column (4) split the whole sample based on industry patenting barrier, and I find no evidence that firms in industries with low patenting barrier are more responsive to tariff changes. Column (2) and Column (5) split the tariff-decreasing sample based on industry patenting barriers, and I find that firms' releases of new products in response to tariff decrease is driven by firms in industries with low patenting barrier. The coefficient on tariff changes is 0.25, which is three times the coefficient for the high patenting barrier subsample. Column (3) and Column (6) split the tariff-increasing sample based on industry patenting barrier. Similar to prior results, I find no evidence that firms' new product releases are significantly associated with tariff decreases in either case. Taken together, the results suggest that firms respond to tariff decreases with product releases and that the effect is more pronounced for firms with low patenting barrier.

1.4.3 Well-performing Firms

The effectiveness of using new products to deter entry also varies by firm. To deter foreign competitors, incumbent firms need to credibly signal that the submarket will be saturated by new products. The success of new product releases depends on whether firms can market their products to customers and seize the market share. Well-performing firms are more likely to change the prospects of their industries, compared to underdogs. I predict that well-performing firms are more likely to use new products to deter entry.

In Table 8, I examine whether well-performing firms are more likely to use new products to deter entry. I measure well-performing firms by sales growth (Panel A) and return on assets (Panel B).

Table 8 Panel A presents the results of cutting the sample based on sales growth. Column (1) and Column (4) show that firms' response to tariff changes is driven by the subsample of high sales growth firms. The estimated coefficient on tariff changes for high sales growth firms is 0.11, significant at 5%, and the magnitude of the coefficient is three times that of the low sales growth sample. Column (2) and Column (5) show that firms' response to tariff decrease is driven by the subsample of high sales growth firms. The estimated coefficient on tariff changes for high sales growth firms during tariff reduction is 0.29, significant at 1%, and the magnitude of the coefficient is more than double that of the low sales growth sample. In Column (3) and Column (6), I find that firms are not responsive to tariff increases.

Table 8 Panel B presents the results of cutting the sample based on return on assets. Column (1) and Column (4) show that firms' response to tariff changes is driven by the subsample of high ROA firms. The estimated coefficient on tariff changes for high

ROA firms is 0.12, significant at 5%, while the coefficient for low ROA firms is positive but insignificant. Column (2) and Column (5) show that firms' response to tariff decrease is driven by the subsample of high ROA firms. The estimated coefficient on tariff changes for high ROA firms during tariff reduction is 0.33, significant at 1%, and the magnitude of the coefficient is more than four times that of the low ROA sample. In Column (3) and Column (6), I find that firms are not responsive to tariff increases.

1.5 Additional Tests

In the final set of tests, I examine whether new product releases are effective in deterring import penetration. Specifically, I examine how new product releases affect concurrent and future import penetration changes. I measure changes in import penetration as the changes in the total value of imports scaled by industry aggregate sales. In Table 9 Column (1), I examine whether the existence of announcing firms in an industry is associated with changes in concurrent import penetration. The estimated coefficient is -0.04 and significant at 5% level. This indicates that having at least one firm releasing new products in an industry reduces concurrent import penetration by 4%. In Table 9 Column (2), I examine whether the percentage of announcing firms in an industry is associated with changes in concurrent import penetration. The estimated coefficient is -0.09 and significant at 10% level. This indicates that a ten percentage point increase in announcing firms is associated with a 1% decrease in import penetration. In Table 9 Column (3) and Column (4), I do not find evidence that industry new product releases affect future import penetration. Taken together, I find descriptive evidence that product releases seem to be effective in deterring concurrent foreign competition but not future imports.

Conclusion

In this paper, I study how market competition affects firms' new product releases. Using tariff changes as a source of variation in the barrier to foreign competition, I examine whether firms increase the likelihood (frequency) of new product releases to deter foreign entry. I find that firms are more likely to release new products when competition increases. However, I do not find that tariff rates affect the frequency of new product releases, probably due to measurement errors. In cross-sectional tests, I find that the effect is stronger in concentrated industries, industries with low patenting barriers, and well-performing firms. Additional tests show that new product releases are negatively associated with concurrent import penetration. Overall, the results suggest that firms respond to product market competition through new product releases.

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Appendix A Variable Definitions

Variable Name	Definition
$Release_{i,t}$	An indicator variable that equals 1 if in a given year t, firm i releases at least one new product.
$Freq_{i,t}$	The natural log of 1 + the number of new products released from firm i year t.
$TariffChange_t$	$-1\times$ (tariff $rate_t$-tariff $rate_{t-1}$) $\times 100$
Size	The natural log of market value at the beginning of year t. Market value is calculated as prcc_f×csho.
Leverage	The leverage ratio at the beginning of year t. Leverage ratio is calculated as total long-term debt/average assets.
R&D	The R&D intensity, calculated as R&D expenses/average assets.
CAPEX	The Capex intensity, calculated as CAPEX expenses/average assets.
Return	The stock return over the past fiscal year.
ROA	Return on assets, calculated as ibc/average assets.
MTB	Market to book ratio at the beginning of year t.
SaleGrowth	The sales growth during the fiscal year.
Loss	An indicator for loss firms.
Intangible	The intangible assets scaled by average assets at the beginning of year t.
PPE	The property, plant and equipment scaled by average assets at the beginning of year t.
PatentNum	The natural log of one plus the number of patents filed by firm i between year t-3 and year t (inclusive).
$ImportChg_t$	Total value of imports in year t minus that of year t-1 at four-digit SIC level, and scaled by the aggregate industry sales in year t.
Release_Indicator	An indicator variable which equals 1 if at least one firm in industry j has released at least one new product in year t.
Release_Percent	The percentage of firms in industry j during year t that have released at least one new product.
LagImport	The total value imports in year t-1 scaled by the aggregate industry sales in year t-1.
Ind_Concentration	The industry concentration measure as Herfindahl–Hirschman Index.
Ind_Sale	The industry average sales growth in year t.
Ind_CAPEX	The industry average CAPEX growth in year t.
Ind_PPE	The industry average PPE growth in year t.

Appendix B Examples of New Product Announcements

Example 1

Chemtura Corporation Announces New Adiprene(R) Duracast(TM) Two-Component Urethane System

Date: 20080815

Chemtura Corporation literally recasts the rules of urethane manufacturing with new Adiprene(R) Duracast(TM) Two-Component Urethane System. This groundbreaking advancement enables customers to pour parts of all sizes, including some of the largest, most intricate parts ever--all with greater ease, toughness and durability than ever before possible. The two components of Adiprene(R) Duracast(TM), with its proprietary curative, offer high performance through superior phase segregation. With no MOCA or BDO cures, Adiprene(R) Duracast(TM) delivers significantly longer pot life and quick demold times. As a result, manufacturers gain tighter control over ratio and waste-and higher productivity at lower cost. With no TDI and no MOCA, Adiprene(R) Duracast(TM) has the potential for better long-term price stability.

Example 2

Sigma-Aldrich Corporation Launches Ascentis(R) Express C18, 5 Micron Particle Size Column

Date: 20120725

Sigma-Aldrich Corporation announced its Supelco(R) brand launched the Ascentis(R) Express C18, 5 micron particle size column to improve speed and increase efficiencies in high purity liquid chomatography (HPLC) procedures. The new columns are based on innovative Fused-Core(R) particle technology, which enables the production of columns capable of achieving greater speed and efficiencies than conventional 5 micron particle columns. The Ascentis Express family provides scientists a premier choice for performance improvement on traditional HPLC systems and eliminates the concerns associated with smaller particle columns. The new columns deliver the speed and resolving power of conventional 3 micron particle columns, as well as provide greater ruggedness and a longer life cycle than columns using sub 2 micron particles. Operating back pressures of the new column family are comparable to columns using 5 micron particles, ensuring pressure limits are not exceeded in conventional HPLC instrumentation. The Ascentis Express line is scalable from ultra high purity liquid chromatography (UHPLC) to legacy HPLC systems. Available in introductory phases C18 and F5, the conversion of current methods is simple. Conventional HPLC users can simply "drop-in" the replacement column without changing column dimensions, flow rates or sample prep.

Example 3

Johnson Controls Launches New Building Controls Technology

Date: 20030415

Johnson Controls Inc. is introducing the first Web services-based facility management platform in the industry. The Metasys(R)

building management system incorporates Microsoft's.NET-connected software, providing unmatched operational efficiencies and cost savings to owners of nonresidential buildings. This technology will allow businesses and other organizations to easily interconnect and manage a wide range of facility systems.

Appendix C Summary of Related Studies

Authors	Published Journal	Industry	Sample Size	Main Findings
Conor (1981)	American Journal of Agricultural Economics	Food industry	419 new products in 102 food categories	The level of sales concentration and advertising intensity is positively related to the number of new products in each food category
Greenstein and Wade (1998)	The Rand Journal of Economics	Commercial mainframe computer market	350 computer systems	A negative relationship between new product introduction and product density
Bayus and Putsis (1999)	Marketing Science	Personal computer industry	1,720 firm-year observations	The structural competitive factors plays an import role in determing product proliferation. No evidence of firms' use of product proliferation to deter entry.
Shankar (2006)	Management Science	Computer printer market	4 major manufacturers	Market leader are more likely to practice a product proliferation strategy while followers adop a price-figting strategy.
Giachetti and Dagnino (2014)	Strategic Management Journal	Mobile phone industry	3,527 mobile phone models introduced by 66 mobile phone vendors	An inverse U-shaped relationship between competitive intensity and the firm's product line length, with a positive slope at low and moderate levels of competitive intensity and a negative slope at high levels of competitive intensity.
Jeong, Kim and Gang (2016)	Technology Analysis & Strategic Management	US printer industry	1,849 printer products introduced by 342 manufacturers	An inverted U-shaped relationship between competitive intensity and product line length
Fan and Yang (2020)	American Economic Journal: Microeconomis	US Smartphone Market	3,256 smartphone-carrier-month observations	A reduction in competition leads to a decrease in the number of products across the quality spectrum. This decrease is accompanied by an increase in prices

Table 1. Sample Selection
Panel A: Sample Selection

Step	Sample Selection	Number of Firm-year Observations
1	Firm-year observations between 2001 and 2017; delete firms not incorporated in the US	100,854
2	Delete firm-year observations missing tariff and import data for year t, t-1, t+1	19,886
3	Delete firm-year missing control variables: firm size, leverage, R&D intensity, CAPEX intensity, past stock return, return on assets, market-to-book value, sales growth, an indicator for Loss firms, intangible intensity, PPE intensity	18,919

Panel B: Industry Distributions

Industry	No. of Observations	% of Sample	Probability of New Product Releases
Consumer Non-Durables	1,126	5.95%	0.19
Consumer Durables	808	4.27%	0.31
Manufacturing	3,358	17.75%	0.22
Energy	1,882	9.95%	0.06
Chemicals	469	2.48%	0.25
Business Equipment	5,412	28.61%	0.44
Healthcare	5,719	30.23%	0.18
Other	145	0.77%	0.04
Total	18,919	100%	0.26

This table presents the sample industry distribution based on Fama-French 12 Industries.

Table 2. Descriptive Statistics

Variable	Observations	Mean	Std	25th	Median	75th	Min	Max
$Release_{i,t}$	18,919	0.26	0.44	0.00	0.00	1.00	0.00	1.00
$Freq_{i,t}$	18,919	0.43	0.84	0.00	0.00	0.69	0.00	3.83
$TariffChange_t$	18,919	0.01	0.08	-0.01	0.00	0.01	-0.39	0.47
MV	18,919	5.98	2.12	4.45	5.89	7.35	1.17	11.82
R&D	18,919	0.10	0.15	0.00	0.05	0.13	0.00	0.96
CAPEX	18,919	0.05	0.08	0.01	0.03	0.05	0.00	0.60
Return	18,919	0.19	0.92	-0.28	0.02	0.35	-0.93	10.76
ROA	18,919	-0.08	0.28	-0.13	0.02	0.07	-1.82	0.39
MTB	18,919	2.06	1.92	0.91	1.42	2.45	0.17	17.06
Leverage	18,919	0.15	0.18	0.00	0.08	0.24	0.00	1.20
Sales Growth	18,919	0.22	0.91	-0.06	0.07	0.24	-0.88	18.20
Loss	18,919	0.42	0.49	0.00	0.00	1.00	0.00	1.00
Intangible	18,919	0.13	0.17	0.00	0.06	0.20	0.00	0.78
PPE	18,919	0.22	0.22	0.07	0.14	0.29	0.00	1.27
PatentNum	18,919	1.76	1.88	0.00	1.39	3.00	0.00	7.61

Table 3. Competition and New Product Releases

Variables	Whole Period		Excluding Financial Crisis	
	Release	Freq	Release	Freq
	(1)	(2)	(3)	(4)
TariffChange$_t$	**0.06****	**0.04**	**0.07****	**0.04**
	(2.25)	**(0.84)**	**(2.64)**	**(0.78)**
Size	0.00	-0.01	0.01	-0.00
	(0.92)	(-0.75)	(1.41)	(-0.19)
Leverage	0.01	0.07	0.02	0.08*
	(0.46)	(1.64)	(0.65)	(1.77)
R&D	0.01	0.05	0.03	0.08
	(0.22)	(0.62)	(0.67)	(0.97)
CAPEX	-0.07	-0.16	-0.08	-0.21
	(-1.16)	(-1.63)	(-1.14)	(-1.73)
PastRet	0.00	-0.00	0.00	-0.00
	(0.79)	(-0.71)	(1.23)	(-0.46)
ROA	-0.00	0.02	0.00	0.02
	(-0.06)	(0.60)	(0.18)	(0.75)
MTB	-0.00	-0.00	-0.00	-0.00
	(-0.73)	(-0.35)	(-1.42)	(-0.86)
SaleGrowth	0.00	0.00	-0.00	0.00
	(0.53)	(0.83)	(-0.02)	(0.41)
Loss	-0.01	-0.04**	-0.02*	-0.05**
	(-1.70)	(-2.59)	(-1.80)	(-2.81)
Intangible	0.09**	0.18**	0.07	0.14
	(2.43)	(2.27)	(1.68)	(1.70)
PPE	-0.11**	-0.20**	-0.12**	-0.20**
	(-2.80)	(-2.64)	(-2.66)	(-2.36)
PatentNum	0.00	0.01	0.00	0.01
	(0.28)	(0.73)	(0.30)	(0.53)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	18,919	18,919	15,243	15,243
Adj. R^2	0.500	0.639	0.489	0.618

This table presents the results of regressing likelihood (frequency) of releasing new products on tariff changes. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. Freq is the natural log of one plus the number of new products released from firm i in year t. TariffChange$_t$ is measured as -1×(tariff rate$_t$-tariff rate$_{t-1}$)×100. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Table 4. Asymmetric Relation between Competition and New Product Releases

Variables	Increasing Competition		Decreasing Competition	
	Release	Freq	Release	Freq
	(1)	(2)	(3)	(4)
TariffChange$_t$	**0.17****	**0.12**	**0.01**	**0.03**
	(2.70)	**(0.80)**	**(0.14)**	**(0.16)**
Size	0.01	-0.00	0.00	-0.01
	(1.14)	(-0.00)	(0.03)	(-0.43)
Leverage	0.01	0.05	-0.01	0.11*
	(0.43)	(0.91)	(-0.14)	(1.76)
R&D	0.03	0.06	-0.01	0.04
	(0.63)	(0.70)	(-0.10)	(0.35)
CAPEX	-0.10	-0.22	-0.01	0.07
	(-1.19)	(-1.48)	(-0.06)	(0.50)
PastRet	-0.00	-0.01	0.01*	0.01
	(-0.12)	(-0.90)	(1.76)	(1.26)
ROA	0.00	0.02	-0.02	-0.04
	(0.01)	(0.47)	(-0.89)	(-1.13)
MTB	-0.01*	-0.01	0.00	0.01
	(-1.86)	(-1.20)	(0.99)	(1.32)
SaleGrowth	0.00	0.01	-0.01	-0.00
	(1.09)	(1.19)	(-1.21)	(-0.57)
Loss	-0.01	-0.03*	-0.03**	-0.04*
	(-0.66)	(-1.76)	(-2.23)	(-1.89)
Intangible	0.07*	0.12	0.16**	0.28**
	(1.81)	(1.35)	(2.43)	(2.37)
PPE	-0.12**	-0.20**	-0.08	-0.17
	(-2.61)	(-2.14)	(-1.47)	(-1.64)
PatentNum	0.00	0.00	0.00	0.01
	(0.13)	(0.27)	(0.30)	(0.34)
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	12,557	12,557	6,332	6,332
Adj. R-square	0.499	0.653	0.512	0.631

This table presents the results of regressing likelihood (frequency) of releasing new products on tariff changes using subsamples. Increasing competition is defined as tariff changes<=0, while decreasing competition is defined as tariff changes>0. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. Freq is the natural log of one plus the number of new products released from firm i in year t. TariffChange$_t$ is measured as -1×(tariff rate$_t$-tariff rate$_{t-1}$)×100. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Table 5. Past and Future Tariff Changes and New Product Releases

VARIABLES	Release (1)	Release (2)	Release (3)
$TariffChange_t$	**0.06****	**0.07****	**0.07****
	(2.29)	**(2.17)**	**(2.19)**
$TariffChang_{t-1}$	**-0.02**		**-0.02**
	(-1.08)		**(-0.82)**
$TariffChang_{t+1}$		**0.02**	**0.01**
		(1.19)	**(1.05)**
Size	0.00	0.00	0.00
	(0.92)	(0.93)	(0.93)
Leverage	0.01	0.01	0.01
	(0.47)	(0.44)	(0.44)
R&D	0.01	0.01	0.01
	(0.23)	(0.24)	(0.24)
CAPEX	-0.07	-0.07	-0.07
	(-1.15)	(-1.14)	(-1.13)
PastRet	0.00	0.00	0.00
	(0.78)	(0.81)	(0.80)
ROA	-0.00	-0.00	-0.00
	(-0.06)	(-0.06)	(-0.06)
MTB	-0.00	-0.00	-0.00
	(-0.73)	(-0.72)	(-0.72)
SaleGrowth	0.00	0.00	0.00
	(0.53)	(0.51)	(0.51)
Loss	-0.01	-0.01	-0.01
	(-1.70)	(-1.69)	(-1.69)
Intangible	0.09**	0.09**	0.09**
	(2.43)	(2.43)	(2.44)
PPE	-0.11**	-0.11**	-0.11**
	(-2.80)	(-2.80)	(-2.80)
PatentNum	0.00	0.00	0.00
	(0.28)	(0.28)	(0.28)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	18,919	18,919	18,919
Adj. R-square	0.504	0.504	0.504

This table presents the results of regressing likelihood of new product releases on product market competition in year t-1, year t, and year t+1. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. $TariffChange_t$ is measured as $-1\times(\text{tariff rate}_t-\text{tariff rate}_{t-1})\times100$. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Table 6. Industry Concertation and New Product Releases During Tariff Changes

	Low Industry Concentration			High Industry Concentration		
	Whole Subsample	Increasing Competition	Decreasing Competition	Whole Subsample	Increasing Competition	Decreasing Competition
Variables	Release	Release	Release	Release	Release	Release
	(1)	(2)	(3)	(4)	(5)	(6)
TariffChange$_t$	**0.08**	**0.03**	**0.08**	**0.06***	**0.24*****	**-0.00**
	(1.26)	**(0.31)**	**(0.53)**	**(1.98)**	**(3.21)**	**(-0.05)**
Size	0.00	0.01	0.01	0.02*	0.02	0.01
	(0.64)	(0.68)	(0.38)	(1.92)	(1.69)	(0.51)
Leverage	-0.04	-0.04	-0.05	0.08**	0.10**	0.09
	(-1.46)	(-1.17)	(-1.32)	(2.33)	(2.44)	(1.21)
R&D	-0.00	0.02	-0.01	0.15	0.14	0.17
	(-0.01)	(0.30)	(-0.16)	(1.15)	(0.80)	(0.76)
CAPEX	-0.03	-0.05	0.01	-0.10	-0.08	-0.10
	(-0.47)	(-0.58)	(0.09)	(-0.64)	(-0.35)	(-0.48)
PastRet	0.00	0.00	0.01	0.00	-0.00	0.01
	(0.77)	(0.20)	(1.50)	(0.27)	(-0.21)	(1.31)
ROA	0.01	0.01	-0.02	-0.05	0.01	-0.08
	(0.44)	(0.21)	(-0.88)	(-0.86)	(0.11)	(-1.03)
MTB	-0.00	0.00	-0.00	-0.01	-0.02***	0.02
	(-0.04)	(0.11)	(-0.48)	(-1.67)	(-3.34)	(1.49)
SaleGrowth	0.00	0.01	-0.00	-0.00	0.01	-0.02
	(0.82)	(1.32)	(-0.75)	(-0.15)	(0.53)	(-0.94)
Loss	-0.00	0.01	-0.02*	-0.03**	-0.02	-0.04*
	(-0.13)	(0.39)	(-1.76)	(-2.24)	(-0.87)	(-1.91)
Intangible	0.09	0.08	0.12*	0.06	0.02	0.17*
	(1.63)	(1.38)	(1.93)	(1.39)	(0.37)	(1.89)
PPE	-0.01	0.01	-0.05	-0.28***	-0.36***	-0.16
	(-0.28)	(0.29)	(-0.63)	(-3.62)	(-3.94)	(-1.19)
PatentNum	0.00	-0.00	0.00	-0.00	-0.01	0.00
	(0.02)	(-0.06)	(0.13)	(-0.42)	(-0.54)	(0.27)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,465	6,499	2,966	9,454	6,058	3,396
Adj. R-square	0.484	0.498	0.467	0.496	0.486	0.515

This table presents the results of regressing likelihood of releasing new products on tariff changes using subsamples. Increasing competition is defined as tariff changes<=0, while decreasing competition is defined as tariff changes>0. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. TariffChange$_t$ is measured as -1×(tariff rate$_t$-tariff rate$_{t-1}$)×100. Industry concentration is measured by HHI. Low (high) industry concentration is defined as industry HHI smaller (larger) than the median HHI. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Table 7. Patenting Barrier and New Product Releases During Tariff Changes

	Low Patenting Barrier			High Patenting Barrier		
	Whole Subsample	Increasing Competition	Decreasing Competition	Whole Subsample	Increasing Competition	Decreasing Competition
Variables	Release	Release	Release	Release	Release	Release
	(1)	(2)	(3)	(4)	(5)	(6)
TariffChange$_t$	**0.07****	**0.25*****	**0.03**	**0.07**	**0.08**	**0.14**
	(2.65)	**(3.11)**	**(0.27)**	**(1.15)**	**(0.55)**	**(0.95)**
Size	-0.01	-0.01	0.00	0.02**	0.02*	0.02
	(-0.98)	(-0.73)	(0.10)	(2.31)	(1.82)	(0.96)
Leverage	-0.01	-0.03	-0.00	0.05	0.03	0.23**
	(-0.31)	(-0.90)	(-0.08)	(1.39)	(0.59)	(2.41)
R&D	-0.01	-0.03	0.05	0.07	0.13*	-0.03
	(-0.17)	(-0.31)	(0.62)	(1.06)	(1.79)	(-0.16)
CAPEX	-0.12**	-0.16**	-0.11**	0.11	-0.03	0.68
	(-2.80)	(-2.27)	(-2.49)	(0.58)	(-0.17)	(1.42)
PastRet	-0.00	-0.00	0.01	0.01*	0.00	0.03**
	(-0.34)	(-0.15)	(0.92)	(1.95)	(0.57)	(2.71)
ROA	-0.02	-0.05	-0.02	0.02	0.03	-0.03
	(-0.90)	(-1.59)	(-0.52)	(0.69)	(0.80)	(-0.56)
MTB	0.01	0.00	0.00	-0.01	-0.01**	0.01
	(1.65)	(0.73)	(0.59)	(-1.47)	(-2.22)	(1.07)
SaleGrowth	0.00	0.01	-0.01	-0.00	-0.00	-0.01
	(1.00)	(1.47)	(-0.94)	(-0.91)	(-0.39)	(-1.64)
Loss	-0.02*	-0.01	-0.03*	-0.01	-0.01	-0.02
	(-1.88)	(-0.88)	(-2.08)	(-0.60)	(-0.38)	(-0.51)
Intangible	0.12***	0.07	0.16	0.05	0.07	0.03
	(3.04)	(1.33)	(1.69)	(0.96)	(1.22)	(0.37)
PPE	-0.09***	-0.12**	-0.05	-0.12	-0.11	-0.52**
	(-3.10)	(-2.80)	(-1.00)	(-1.31)	(-1.17)	(-2.27)
PatentNum	0.01	0.02	-0.00	-0.00	-0.00	0.01
	(1.21)	(1.35)	(-0.29)	(-0.45)	(-0.52)	(0.60)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,833	5,853	3,980	9,086	6,704	2,382
Adj. R-square	0.431	0.377	0.503	0.518	0.531	0.495

This table presents the results of regressing likelihood of releasing new products on tariff changes using subsamples. Increasing competition is defined as tariff changes<=0, while decreasing competition is defined as tariff changes>0. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. TariffChange$_t$ is measured as -1×(tariff rate$_t$-tariff rate$_{t-1}$)×100. Low (high) patenting barrier is defined based on the sample median of industry average citation-weighted patent number. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Table 8. Well-performing Firms and New Product Releases During Tariff Changes

Panel A: Well-performing firms measured by sales growth

	Low Growth			High Growth		
	Whole Subsample	Increasing Competition	Decreasing Competition	Whole Subsample	Increasing Competition	Decreasing Competition
Variables	Release	Release	Release	Release	Release	Release
	(1)	(2)	(3)	(4)	(5)	(6)
TariffChange$_t$	**0.04**	**0.12**	**-0.05**	**0.11****	**0.29*****	**0.13**
	(0.87)	**(1.64)**	**(-0.43)**	**(2.15)**	**(2.95)**	**(0.84)**
Size	0.01	0.01	0.02*	-0.00	-0.00	-0.01
	(1.40)	(1.28)	(1.82)	(-0.02)	(-0.05)	(-0.90)
Leverage	-0.01	-0.03	-0.02	0.00	0.00	-0.03
	(-0.45)	(-0.73)	(-0.54)	(0.12)	(0.03)	(-0.47)
R&D	-0.02	-0.03	0.04	0.07	0.13*	0.02
	(-0.23)	(-0.32)	(0.52)	(1.33)	(1.92)	(0.25)
CAPEX	-0.04	-0.03	0.13	-0.04	-0.13	0.00
	(-0.39)	(-0.26)	(0.57)	(-0.59)	(-1.43)	(0.02)
PastRet	0.01*	0.00	0.02**	-0.00	-0.01	0.00
	(2.12)	(0.85)	(2.43)	(-0.98)	(-1.15)	(0.03)
ROA	-0.05	-0.04	-0.03	0.04	0.04	0.02
	(-1.58)	(-1.18)	(-0.64)	(1.71)	(1.40)	(0.59)
MTB	-0.01**	-0.01**	-0.01	0.00	-0.00	0.01
	(-2.68)	(-2.62)	(-0.76)	(0.85)	(-0.47)	(1.74)
SaleGrowth	0.01	0.02	-0.06	0.00	0.00	-0.00
	(0.22)	(0.82)	(-1.45)	(0.20)	(0.78)	(-0.66)
Loss	-0.02*	-0.01	-0.03*	0.00	0.01	-0.02
	(-2.07)	(-0.86)	(-2.10)	(0.23)	(0.48)	(-0.96)
Intangible	0.06	0.04	0.16	0.13**	0.10	0.15*
	(1.31)	(0.81)	(1.64)	(2.78)	(1.69)	(1.96)
PPE	-0.13**	-0.14**	-0.08	-0.11**	-0.12	-0.16
	(-2.48)	(-2.13)	(-0.81)	(-2.19)	(-1.68)	(-1.64)
PatentNum	-0.01	-0.01	-0.01	0.01	0.02*	0.01
	(-0.94)	(-1.26)	(-0.41)	(1.47)	(1.91)	(0.54)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,972	6,603	3,369	8,947	5,954	2,993
Adj. R-square	0.520	0.530	0.515	0.481	0.479	0.519

This table presents the results of regressing likelihood of releasing new products on tariff changes using subsamples. Increasing competition is defined as tariff changes<=0, while decreasing competition is defined as tariff changes>0. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. TariffChange$_t$ is measured as -1×(tariff rate$_t$-tariff rate$_{t-1}$)×100. Firm performance is measured by sales growth. Low (high) growth is based on industry-year median sales growth. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Panel B: Well-performing firms measured by ROA

	Low ROA			High ROA		
	Whole Subsample	Increasing Competition	Decreasing Competition	Whole Subsample	Increasing Competition	Decreasing Competition
Variables	Release	Release	Release	Release	Release	Release
	(1)	(2)	(3)	(4)	(5)	(6)
TariffChange$_t$	**0.01**	**0.07**	**-0.07**	**0.12****	**0.33*****	**0.02**
	(0.23)	**(0.71)**	**(-0.78)**	**(2.74)**	**(3.47)**	**(0.19)**
Size	0.00	0.01	-0.01	0.01	0.01	0.01
	(0.09)	(0.76)	(-0.80)	(1.20)	(0.45)	(0.61)
Leverage	0.01	-0.01	0.03	-0.00	0.03	-0.15
	(0.50)	(-0.33)	(0.65)	(-0.08)	(0.95)	(-1.71)
R&D	0.03	0.08	-0.06	-0.09	-0.07	-0.06
	(0.58)	(1.27)	(-0.88)	(-0.75)	(-0.46)	(-0.25)
CAPEX	-0.04	-0.07	0.06	-0.12	-0.18	-0.03
	(-0.60)	(-0.56)	(0.53)	(-1.40)	(-1.36)	(-0.14)
PastRet	0.01***	0.01	0.01*	-0.00	-0.01	0.02
	(3.49)	(1.37)	(1.75)	(-0.40)	(-1.25)	(1.51)
ROA	0.02	0.04	-0.06*	-0.15	-0.24**	0.13
	(1.08)	(1.46)	(-1.93)	(-1.65)	(-2.35)	(0.83)
MTB	0.00	0.00	0.00	-0.00	-0.01*	0.01
	(0.78)	(0.58)	(0.90)	(-1.03)	(-1.86)	(0.95)
SaleGrowth	-0.00	-0.00	-0.01	0.01*	0.01	-0.02*
	(-1.24)	(-0.59)	(-1.64)	(1.93)	(1.71)	(-2.10)
Loss	-0.02*	-0.01	-0.03	-0.02	-0.04	0.00
	(-1.85)	(-0.91)	(-1.45)	(-1.22)	(-1.37)	(0.13)
Intangible	0.06	0.05	0.09	0.17***	0.13*	0.31**
	(1.20)	(0.93)	(1.10)	(2.98)	(1.96)	(2.36)
PPE	-0.11**	-0.10*	-0.12	-0.10	-0.10	-0.14
	(-2.52)	(-1.82)	(-1.38)	(-1.26)	(-1.02)	(-1.09)
PatentNum	-0.00	-0.01	0.01	0.01	0.01	0.00
	(-0.42)	(-0.93)	(0.72)	(0.88)	(0.69)	(0.00)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	9,972	6,603	3,369	8,947	5,954	2,993
Adj. R-square	0.505	0.514	0.493	0.509	0.503	0.538

This table presents the results of regressing likelihood of releasing new products on tariff changes using subsamples. Increasing competition is defined as tariff changes<=0, while decreasing competition is defined as tariff changes>0. Release is an indicator variable that equals 1 if in a given year t, firm i releases at least one new product. TariffChange$_t$ is measured as -1×(tariff rate$_t$-tariff rate$_{t-1}$)×100. Firm performance is measured by ROA. Low (high) ROA is based on industry-year median ROA. The definitions of all other variables are in Appendix A. All regressions are clustered by gvkey and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).

Table 9 Effect of New Products on Import Penetration

VARIABLES	$ImportChg_t$ (1)	$ImportChg_t$ (2)	$ImportChg_{t+1}$ (3)	$ImportChg_{t+1}$ (4)
Release_Indicator	**-0.04****		**0.00**	
	(-2.80)		**(0.12)**	
Release_Percent		**-0.09***		**-0.02**
		(-1.95)		**(-0.55)**
$TariffChange_t$	0.03	0.03	-0.01	-0.01
	(0.33)	(0.41)	(-0.35)	(-0.31)
$TariffChange_{t-1}$	-0.01	-0.01	-0.04	-0.04
	(-0.15)	(-0.17)	(-1.18)	(-1.18)
$LagImport_t$	-0.02	-0.02	-0.00	-0.00
	(-0.85)	(-0.85)	(-0.05)	(-0.06)
$Ind\_Concentration_t$	0.00	0.00	0.00	0.00
	(0.97)	(1.42)	(1.66)	(1.74)
Ind_Sale_t	0.17**	0.17**	-0.02	-0.02
	(2.81)	(2.83)	(-0.26)	(-0.27)
Ind_CAPEX_t	-0.27	-0.27	-0.09	-0.08
	(-0.50)	(-0.50)	(-0.35)	(-0.34)
Ind_PPE_t	0.08	0.09	-0.26	-0.26
	(0.24)	(0.27)	(-1.04)	(-1.01)
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	1,920	1,920	1,920	1,920
Adj. R-square	0.135	0.136	0.129	0.129

This table presents the results of regressing import changes on product market competition. $ImportChg_t$ is total value of imports in year t minus that of year t-1 at four-digit SIC level, and scaled by the aggregate industry sales in year t. Release_Indicator is an indicator variable that equals 1 if at least one firm in industry j has released at least one new product in year t. Release_Percent is the percentage of firms in industry j during year t that have released at least one new product. $TariffChange_t$ is measured as $-1\times(\text{tariff rate}_t-\text{tariff rate}_{t-1})\times100$. The definitions of all other variables are in Appendix A. All regressions are clustered by industry and year. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels (two-tailed).