Style and quality: Aesthetic innovation strategy under weak appropriability ☆

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ABSTRACT

Counterfeiting challenges firms to capture the value created by product innovation. We characterize style and quality as key dimensions of product innovation strategy in contexts where aesthetic attributes drive product success. We examine distinct aesthetic innovation strategies that firms may use to innovate their existing products — developing new style variants, using higher quality attributes, or both. Our empirical test exploits unique data on authentic plastic model kits matched to product-specific counterfeits. Controlling for several confounders, we find that new style variants that include higher quality attributes are 20 % more likely to be copied relative to style variants that do not. We discuss implications for aesthetic innovation strategies in weak appropriability regimes.

1. Introduction

Capturing the value created by product innovation can be challenging. Counterfeits, often almost indistinguishable from the authentic products but sold at lower prices, cannibalize firms focusing on aesthetic innovation, such as producers of clothing, furniture, and toys (Fink et al., 2015; Qian, 2008). Across several different industries, firms invest in product innovation, but value capture is undermined by a weak appropriability regime (MacDonald and Ryall, 2004; Winter, 2006).[2]

Strategy scholars have emphasized product innovation to achieve differentiation advantage versus competitors (Baron, 2020; Cattani et al., 2017; Ceccagnoli, 2009) and to entice consumers with new products that are distinct from those a firm already sells (Bu et al., 2022). The viability of such strategies rests on the assumption that firms can appropriate a reasonable share of the value created via product innovation by controlling the quantity of products available for sale and their prices, preventing others to produce the same product through mechanisms such as intellectual property rights (Arora and Gambardella, 2010; Ceccagnoli and Rothaermel, 2008; Conti et al., 2013). However, many industries increasingly face a rapid proliferation of "exact copy" counterfeits, practically indistinguishable from the authentic product except for a lower price and different branding and packaging. This phenomenon challenges the ability of innovators to safeguard value capture through price and volume control.

Furthermore, technological innovation has received considerably more attention among management scholars than product aesthetics. Yet, many contemporary markets are characterized by relatively stable technologies and product categories, with innovation largely focused on developing new *versions* of existing products — e.g., a new style variant using different colors or patterns or a new variant using superior quality materials (Elsbach, 2009; Godart et al., 2020) rather than new technologies that provide a specific functionality (Eisenman, 2013; Krabbe

and Grodal, 2023). The concept of style, defined as a "recognizable pattern of aesthetic choices" (Godart, 2018, p. 121) is indeed central in several industries where aesthetic considerations play a central role, such as fashion, furniture, and toys. In these markets, new style variants of existing products — can be costly to develop, but relatively easy to copy, and thus often counterfeited. This poses a problem for businesses: which types of new products are more or less likely to be counterfeited?

This paper builds on and extends theories of aesthetic innovation in strategy by positing that, in markets characterized by relatively stable technologies and product categories, two distinct dimensions of innovation interact in the context of new product development (NPD). First, the development of new *style* variants of existing products, such as for example, a new version using different colors or patterns (Cillo and Verona, 2008; Elsbach, 2009) Second, the introduction of higher *quality* attributes, such as for example, a new version that uses superior materials or finer details (Hauser and Simmie, 1981; Sutton, 1986). We theorize that style and quality are orthogonal dimensions of product attributes that allow firms to pursue distinct aesthetic innovation strategies — i.e., offering new style variants, higher-quality attributes, or both — which result in different rates of counterfeiting across these product types.

We test our hypotheses by exploiting unique product-level data on plastic model kits, an industry in which competition from counterfeits that are often indistinguishable from the original product is rampant (Ceccagnoli and Rothaermel, 2008). Detailed hand-collected data on the entire population of plastic model kits depicting the fictional robots "Gundam" designed and manufactured by the Japanese firm Bandai Namco, allow us to quantify changes in the style and quality of components of each new product, and to match each product at risk of being copied with its actual counterfeits. Importantly, these products are produced and sold purely for creative expression, leisure, and hobbyist satisfaction, making aesthetic attributes (the intricacies of design, details, and visual appeal of a Gundam model kit) rather than technological constraints the core driver of product development.[3] This allows to postulate stable technology as a scope condition for our theory about style and quality as dimensions of product innovation strategy.[4]

Results show that new style variants of higher-quality products are 20 % more likely to be counterfeited, relative to style variants of lower quality products, after controlling for product popularity, product price, counterfeit price, and other confounders. We also find that style variants of higher-quality products face more severe price competition from counterfeits.

Overall, our contribution builds on the growing literature on aesthetic innovation in strategy to offer new insights on product innovation in weak appropriability regimes. First, by characterizing style and quality as distinct dimensions through which firms innovate upon their existing products, we develop a novel extension of theories of aesthetic innovation (Cattani et al., 2020; Krabbe and Grodal, 2023). Second, we provide evidence of differences in counterfeiting rates for distinct types of style variants of existing products, with implications for how scholars and practitioners should think about product innovation strategy in weak appropriability regimes. As we discuss below, some aspects of Gundam plastic model kits are idiosyncratic, but the context still promises to offer insight into product innovation strategy in other

settings where the aesthetic features of products are core drivers of value creation, but value capture is at risk.

2. Theory

2.1. Style and quality: product innovation strategy in aesthetic-centric industries

Firms aim to differentiate their products to gain a competitive advantage (Baron, 2020; Bu et al., 2022; Cattani et al., 2017). Introducing new product attributes via technological innovation has long been a primary area of investigation for strategy scholars (Ceccagnoli, 2009; Christensen et al., 1998; Grodal et al., 2023), the pre-eminence of this line of thought even overshadowing the significance of other ways to achieve distinctiveness, such as product aesthetics (Cattani et al., 2020; Godart et al., 2020). However, stable technologies and product categories increasingly characterize several contemporary markets where aesthetic innovations, such as new combinations of visible design attributes (like colors and patterns), rather than groundbreaking technological advancements, are crucial determinants of new product success (Eisenman, 2013; Godart, 2018; Krabbe and Grodal, 2023). In such contexts, firms innovate by increasing the objective quality of product attributes with superior materials, finer details, or by changing certain aesthetic attributes of the product to create a new style variant (Cillo and Verona, 2008). For example, fashion houses produce style variants of existing items, such as a sweater, by using the same cut sheets and materials but different colors. The same cut sheets are also used to create a higher-end sweater using better quality fabrics (Godart and Galunic, 2019).

The dimensions of style and quality provide a general conceptual framework within which to study product innovation strategy in context where the aesthetic innovation of an existing product category is the main driver of product development. Existing products can be innovated upon by changing their attributes, some of which may be viewed as aesthetic — defining the style of a product (e.g., color, pattern), and others as defining the objective quality of the product (e.g., superior material, fine details). Style and quality constitute therefore two distinct objectives of new product development (NPD) in aesthetic-centric industries.

Suppose, for example, that a firm designing and selling eyeglasses frames is developing a new version of an existing product. It might decide to allocate a given NPD budget to different objectives, such as experimentation with different materials to increase the objective quality of the frame, or experimentation with color palettes to create new styles. Both strategies aim to add value to a product but in different ways. Superior materials or finer details would constitute an improvement on the quality dimension. A new color palette would constitute an innovation on the style dimension. In either of the two scenarios the firm invests to add value to an existing product. As shown in Fig. 1, these circumstances can lead to three different types of new products. Quadrant A represents the existing *baseline product* that the firm wishes to innovate upon. A product that does not include new higher-quality

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[3] As of March 2022, Bandai Namco sold 735.7 million units (Bandai Namco, 2022)

[4] In principle, introducing a new technology may be another way to differentiate a product besides the style and quality of ist attributes. However, unlike industries where technological constraints shape both the aesthetic form and practical functionality of a product that is enjoyed by a customer (e.g., kitchen appliances, athletic shoes), plastic model kits of fictional robots serve a different purpose. The value of such products to a customer is not in a technology that enables a given benefit via specific functionality, but the style and quality of aesthetic attributes that captivate imagination.

Fig. 1. Dimensions of Aesthetic Product Innovation and Types of New Products.

attributes and is available only in one style; an example would be a conventional, black monochrome eyeglasses plastic frame.

Quadrant B illustrates a new *higher-quality* version of the product, but no style variants (higher quality, same style). An example of this outcome would be improving the frame by replacing acetate plastic with "Optyl", a material featuring greater strength and lower weight, but only offering the frame in the existing monochrome black style. Quadrant C illustrates an alternative strategy: developing a *new style* variant without using superior quality materials (same quality, new style), such as the eyeglasses previously described in Quadrant A —i.e., a conventional acetate plastic frame, but now dyed in a new violet–magnolia pattern. Finally, Quadrant D illustrates the option to develop a *style variant of a high-quality product*: a new product featuring both a new style and higher quality attributes. This outcome is exemplified by eyeglasses using the superior Optyl frame that are *also* dyed in the violet–magnolia pattern. These examples help to illustrate that firms can innovate upon their existing products by either investing in introducing style variants, improving the objective quality of product attributes, or both.

These distinct innovation strategies are likely to impose different NPD costs on the firm. A new product featuring objectively higher quality attributes will generally be more costly to develop compared to creating a new style variant of an existing product (Qian, 2014b; Qian et al., 2015).[5] Hence, firms that introduce style variants, use higher quality attributes, or both will face increasingly higher NPD costs. The objective our study is to test which strategy will result in products that face higher counterfeiting, which challenges the innovating firms to capture the value it creates. This is important because, although aesthetic innovation can be an effective strategy to achieve product differentiation, it presents multiple risks (Cattani et al., 2020; Krabbe and Grodal, 2023). First, developing new products entails substantial investment in research activities and personnel, making it a costly endeavor which may or may not be rewarded by customers (Cillo and Verona, 2008). Furthermore, when formal intellectual property protection is weak, the differentiation benefits of product innovation may be offset by the ease of counterfeiting (Gao et al., 2017; Qian, 2008; Qian and Xie, 2014). Under weak appropriability, a firm that wishes to safeguard value capture may want to evaluate alternative aesthetic innovation strategies considering the likelihood that the resulting new products will face cannibalization from counterfeits. Hence the need to understand which types of new products will face higher rates of counterfeiting.

2.2. New products and competition from counterfeits

The proliferation of "exact copy" counterfeits, which are often indistinguishable from the authentic products, raises concerns about the integrity of market dynamics and the ability of firms to capture the value they generate via product innovation. One of the primary incentives for counterfeiters lies in copying existing successful products and capitalizing on established demand, enabling a swift market entry while circumventing much of the costs of developing original products. Therefore, counterfeiters' replication costs and consumers' preferences for products of the authentic producer are likely to affect which products will face counterfeits. Ceteris paribus (e.g., two equally popular new products), consumers demand counterfeits if offered at lower prices compared to the authentic products sold in traditional channels (Qian,

2008; Qian et al., 2015), hence counterfeiters will be more likely to copy a product when the cost of doing so is lower.

In markets where aesthetic innovations contribute to determine product success counterfeiters' replication cost varies across products depending on the inclusion of higher quality attributes and/or new styles. Counterfeiting products that incorporate higher-quality attributes typically requires major changes to the production process, resulting in additional investment to realize these changes (Qian, 2014a). Thus, counterfeiters may have to alter substantially their workflow to incorporate higher quality attributes.

For example, in the fashion industry it is common for design houses to introduce new versions of existing garments that use the same cut sheet, but feature materials of superior quality, resulting in higher production costs due to different manufacturing processes and inputs (Cillo and Verona, 2008; Godart and Galunic, 2019).[6] Similarly, in the road bike industry it is common to introduce precision-engineered parts and components realized with new materials and new manufacturing tools. Yet, using higher quality materials often alters parts of the manufacturing process, requiring non-trivial capital investment on the part of counterfeiters (e.g., different tooling) to incorporate them appropriately into an existing workflow as well as greater capabilities in quality control to realize a counterfeit that is undistinguishable from the original product. Indeed, some studies have found that product differentiation based on higher quality attributes can temporarily delay entry by counterfeiters (Cho et al., 2015; Qian, 2014b).

By contrast, producing a counterfeit of a style variant of an existing product requires marginal investment by a counterfeiting firm to alter its production process because featuring a new style do not involve fundamental changes to the baseline product architecture. Thus, counterfeiters typically do not have to invest in new equipment to produce a counterfeit of a style variant of an existing product that does not include also higher quality attributes.

Industries where the manufacturing process is based on plastic injection molding offer many examples to support this assumption. For instance, the practice of "label slapping" in the toy industry is based on introducing new styles without altering the baseline product architecture. Indeed, when the toy company Kenner acquired the license to produce Star Wars toys in 1977 it took many of its existing toy designs and simply changed the color of the plastics to produce new "Star Wars" styled versions (Stern, 2017). Similar practices are common in other industries (e.g., kitchen accessories) suggesting that counterfeiters can redeploy an existing workflow with marginal modifications to produce an excellent copy of a style variant of an existing product.

In sum, all other things equal, the greater is the quality of new product attributes (e.g., a product introducing at least one new high-quality attribute), the higher the investment required for counterfeiters to copy it. In contrast, the investment necessary for counterfeiting a style variant of an existing product is likely to be lower. Accordingly, we advance the following hypotheses:

Hypothesis 1. *New style variants of an existing product will face more competition from counterfeits compared to the existing product.*

Hypothesis 2. *New higher-quality variants of an existing product will face less competition from counterfeits compared to the existing product.*

Consumers appreciate the cost savings afforded by counterfeits, but generally prefer to buy products by the authentic firm[7] (Qian et al., 2015; Qian and Xie, 2014). Hence, counterfeiters may faithfully

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[5] New higher-quality attributes typically require substantial investments to either develop the new attribute or fundamental changes to the production process to incorporate such attributes into new products (Qian, 2014b). Nike's substantial investments to continuously improve its air-cushioning technology provide an example. The original Nike Air Max debuted in 1987 and was the first shoe to showcase an Air unit. In 1997, the Air Max 97 introduced an Air unit along the entire sole. In 2017, a completely new Air unit debuted in the Nike Air VaporMax (Nike, 2017).

[6] For example, a higher quality material, such as synthetic spider silk, may replace nylon to create a premium parka jacket of the same design of a "baseline" parka jacket (Bain, 2016).

[7] Some consumers may also prefer authentic products because they derive some utility from the shopping experience that is afforded by acquiring the product via the legitimate marketing channels designed by the authentic firm.

replicate a product but must set lower prices to attract buyers.

Although counterfeiters can increasingly offer copies that are indistinguishable from the original product, they face a formidable challenge: the narrower the difference between the price charged by authentic firm and the break-even price of the counterfeit, the more attractive the option of buying the authentic product becomes for consumers. In other words, when the price difference is narrow, the utility consumers derive from buying the authentic product dominates the utility derived from the lower price of a counterfeit (Gao et al., 2017; Pun and DeYong, 2017).

The interaction between competitors' replication costs and consumers' preference for authentic products shapes the maximum price a counterfeit can charge for a product. Although counterfeiters face increased costs to counterfeit higher quality products and style variants of higher-quality products, these types of products also afford counterfeiters more room to manoeuvre in terms of lowering their price compared to the authentic firm while safeguarding a viable profit margin.[8] In contrast, style variants of products that do not include higher quality attributes may cost less to copy, but the likely relatively lower price charged by the authentic firm for such products leave less room to manoeuvre for counterfeiters to undercut the original price. Therefore, style variants of high-quality products afford counterfeiters the ability to entice consumers with relatively larger price differential with the authentic product. We thus hypothesize the following.

Hypothesis 3. *New products that offer both a new style variant and higher-quality attributes will face more competition from counterfeits, compared to new products that do not offer both.*

Our theory is predicated on the need of authentic firms to evaluate alternative new product innovation strategies with the aim of safeguarding value capture in the presence of counterfeiting. While the effect of product innovation on reducing competition from counterfeits is generally assumed to be positive in the literature (Cho et al., 2015; Qian, 2014a) — an assumption we test empirically — we believe it is important to also examine the interaction between style variants and higher quality attributes as alternative strategies to achieve product differentiation in industries where aesthetic innovation drives product success. This allows to derive richer empirical insights, so that an innovating firm can consider the likelihood that a new product will be copied vis a vis the different NPD costs that developing new styles and using higher quality attributes may require.[9]

3. Empirical analysis

Studying counterfeiting as a function of new product development decisions presents several empirical challenges. Most studies on counterfeiting use data at the firm or brand level (e.g., Qian, 2014a). Thus, differences between products are usually not accounted for, thereby making it difficult to isolate the value of specific innovation strategies at the product-level. Second, detailed product-level data on counterfeits are typically unavailable due to the illegal nature of counterfeiters' activities. We aim to overcome these challenges by focusing on a complete population of products for which we can observe product-specific counterfeits.

3.1. Empirical setting: counterfeits of plastic model kits

We study Bandai Namco, a Japanese firm that retains the exclusive rights to manufacture and sell plastic model kits replicating characters in the fictional Gundam universe, a popular science fiction media franchise. Our hand-collected data set documents all the authentic model kits—and their counterfeits—over a three-decade period (1980–2010).

Gundam plastic model kits (a.k.a. "Gunpla") began selling in 1980 and have enjoyed sustained worldwide success ever since, attracting the attention of counterfeiters that consistently produce high-quality counterfeits, virtually indistinguishable from the authentic products (MS-Nation, 2016). Counterfeits of Gundam kits are illegally sold—in both physical stores and online outlets—at a discount compared with the authentic products. Competition from counterfeits is a major threat to Bandai Namco's plastic model kits business.[10]

Gundam model kits offer an ideal empirical setting for our study. First, publicly available information allows us to document in detail all the products released by the firm; thus, we have data on each product's release date, price, technical features, and so forth. This data set was assembled from extensive documentation provided by the firm and from the efforts of Gundam fans to document each plastic model kit on specialty websites. Second, Bandai continues to manufacture all products—even the very oldest. Finally, unlike prior studies, which focused on brand-level counterfeiting rates (e.g., Qian, 2014a), we can reliably match each counterfeit to a specific authentic Gundam model kit. Hence, we are able to recover *product-level* effects.

3.2. Data sources and data collection procedures

We collected detailed information on the design and technical features of all Gundam model kits released by Bandai by using the Gundam Wiki (MS-Nation, 2016). For each model kit, we collected the unique Bandai product ID, the name, grade, scale, release date, price, and any associated media franchise. We also coded specific design features of each model kit by analyzing textual descriptions via Python's NLTK natural language processing library. Design features include the type and color of the plastic used, accessories, and special finishes (e.g., glossy or matte). For each product, we then systematically identified counterfeits from a list of online stores selling plastic model kits that was vetted by industry specialists. We further independently examined all the counterfeit Gundam kits and matched each one to a specific authentic product marketed by Bandai. For each counterfeit, we recorded information on its price, design, and technical features. We further validated our approach by conducting semi-structured interviews with key executives in the plastic model industry. Our final data set includes complete data on all the 776 authentic Bandai model kits released during the period 1980–2010 and on 233 counterfeits.

3.3. Dependent variables

We use three dependent variables whose values are determined by matching each authentic Gundam plastic model kit to its counterfeits.

3.3.1. Likelihood of counterfeiting
Is an indicator variable that is set to 1 when there is at least one counterfeit on the market and 0 where there are no counterfeits.

3.3.2. Number of counterfeits
Is a count of all the distinct counterfeits of each Gundam plastic model kit. We normalize the variable by computing the natural

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[8] High quality products and style variants of high-quality products are typically sold by the authentic firm at higher prices. Counterfeiters, however, do not sustain any R&D and marketing cost for such product, these have been already sustained by the authentic firm.

[9] In the online appendix we offer a stylized model to explicitly formalize our theoretical arguments and assumptions regarding counterfeiters decisions as well as the logic underpinning each hypothesis. Using the model we numerically illustrate why developing new products that feature higher-quality attributes generally requires the authentic firm to sustain higher NPD costs compared to developing style variants of existing products.

[10] This is evidenced from the numerous enforcements that Bandai has conducted. For example, in 2020, Bandai worked specifically with the Chinese government to stifle the relatively numerous and popular counterfeits arising from Chinese firms (for details see, Bandai-Namco, 2020).

logarithm of (1 plus) its value.

3.3.3. Counterfeit price discount

Is the percentage difference between the product Manufacturer Suggested Retail Price, published by Bandai and the observed price of a counterfeit of the focal Gundam plastic model kit (for products with multiple counterfeits, we consider the average price). Prices are expressed in Japanese Yen and adjusted for inflation. We normalize the variable by computing the natural logarithm of (1 plus) its value.

3.4. Explanatory variables

3.4.1. Style variant

We consider a product a style variant if it presents aesthetic differences (e.g., a new color palette or pattern) compared to other existing products, denoting a new style has been introduced for an existing product. A particular feature of plastic model kits— a manufacturing process based on injection molding—allow us to develop an objective measure. Model kits are manufactured off molds, which are used to produce plastic plates from which individual parts are then cut off by the end users. Each mold is uniquely identifiable. A Gundam plastic model kit is classified as a style variant of an existing product if it uses the exact same *mold(s)* as that of a previously released kit, but different aesthetic attributes. For example, the Gundam model kit RX-78-2 comes in different style variants, such as RX-78-2 Gold Version, which shares the same molds, but comes in a different color palette and is marketed as a variant of the original model kit. We define *Style Variant* as an indicator variable set equal to 1 for model kits that use the same mold(s) as a previously released kit but different aesthetic attributes (and set to 0 otherwise). This strict definition of *Style Variant* allows us to pinpoint with precision the base case from which we measure innovation. This is important for several reasons. First, for conceptual clarity, the base case — i.e., the existing product that the firm is innovating upon — must be clearly defined. Second, establishing the base case allows us to define the *Product Family* — the baseline product and all its variants — which we can cluster our errors around, thereby alleviating worries of serial correlation in counterfeiting rates.

3.4.2. High quality

Bandai produces a large variety of Gundam models, which are categorized into different grades that correspond to different objective product quality tiers. In particular, the so-called Perfect Grade (PG) and Master Grade (MG) quality tiers cater to experienced and discerning customers who are willing to pay higher prices so they can enjoy the finest model details. Lower grades within each distinct product family are not as expensive but are manufactured using different molds that are less detailed. We exploit this natural distinction among product quality tiers to create our *High Quality* measure: an indicator variable that is set equal to 1 for PG- and MG-grade model kits and 0 otherwise.

3.5. Control variables

We incorporate a wide range of control variables to account for potential sources of heterogeneity.

3.5.1. Scale

The physical size of a model kit may affect illicit firms' decisions about creating a counterfeit. We incorporate dummies to account for heterogeneity in the size of different models.

3.5.2. Product price

Authentic products that are sold at a higher price may be counterfeited more. We control for this by including the natural log of each model kit's Manufacturer Suggested Retail Price, published by Bandai. Prices are in Japanese Yen and adjusted for inflation.

3.5.3. Product popularity

Popular model kits are more likely to face competition from counterfeits. Bandai does not release a breakdown of sales figures by model, but a reasonable proxy for a model's popularity is whether it receives a review on YouTube. Thus, *Product Popularity* is set equal to 1 if the model has been reviewed at least once by the four most popular reviewers of Gundam model kits on YouTube (and to 0 otherwise).[11]

3.5.4. Series

Bandai leverages the specific design of each Gundam robot across different product categories linked to specific media franchises. Each model kit is based on one among 109 different anime series from which the source material is drawn. To impose the strictest empirical test possible, we consider spinoff series (which derive their primary materials from core series) as separate series. We then incorporate dummies to account for unobserved heterogeneity between series.

3.5.5. Product release date

The likelihood of counterfeiting may be affected by when the authentic product was released. We added the natural logarithm of the number of days since the product was first released as a control variable.

3.5.6. Product release year

The likelihood of counterfeiting may be affected by temporal trends. We added release year dummies to represent the year in which the original model kit is released.

3.5.7. Product family

A product family includes different model kits that are based on the same mold and belong to one of 4 distinct product quality tiers, or "grades". In other words, each product family represents a base product and all its style variants. We added dummies to represent the product family to which each model kit belongs. We cluster errors around product families to alleviate concerns of serial correlation in counterfeiting rates for products that use the same mold of a common original product.

Table 1 presents a summary of the variables and data sources used in our analysis, and Table 2 provides descriptive statistics and correlations.

4. Results

We wish to understand which product innovation strategy is associated with more (less) counterfeits. Our estimation strategy is a panel study, with the panel set at the *Product Family* level. For each *Product Family*, we record instances of products that were *Counterfeited* (or not).[12] Hence, for each product *i* in a product family *f* at time *t*, we estimate the following model:

$$Counterfeited_{if} = \beta_1 SV_{ift} + \beta_2 HQ_{ift} + \beta_3 \left(SV_{ift} \, x \, HQ_{ift} \right) + \gamma \left(Controls_{ift} \right) + \chi_{ift} + \varepsilon_{ift}$$

The coefficients for *Style Variant (SV)* and the interaction between *Style Variant* and *High Quality (HQ)* are the main parameters of interest for our hypotheses.

Results are presented in Table 3, which reports estimates from ordinary least-squares (OLS) models with robust standard errors (clustered at the Product Family level) to facilitate interpretation of the interaction term. The high dimensional nature of our data and specifications – namely the inclusion of several levels of fixed effects, together with the

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[11] We considered all the video reviews done by the most popular Gundam model kit YouTube channels according to viewership (Type V3, jabman025, Prime92, and Mecha Gaikotsu).

[12] Each style variant can only be released *after* the base product is released. Thus each style variant is essentially a repeated observation (in time) of the respective base product.

Table 1
Summary of variables and data sources.

Variable	Definition and measure	Source
Outcome variables		
Counterfeited	Whether a specific Gundam plastic model kit has been counterfeited; dummy variable equal to 1 only if a counterfeit of the product was marketed at least once during the observation period.	List of online stores vetted by industry specialists
Number of counterfeits	Total number of different counterfeits of the product available on the market during the observation period (natural log).	List of online stores vetted by industry specialists
Counterfeit price discount	Percentage difference between the product Manufacturer Suggested Retail Price, published by Bandai for a specific Gundam plastic model kit and the price of its counterfeit (natural log). For products with multiple counterfeits, we consider the average price. Prices are expressed in Japanese Yen and adjusted for inflation.	List of online stores vetted by industry specialists
Explanatory variables		
Style variant	Whether a product presents aesthetic differences (e.g., a new color palette or pattern) compared to an existing product. Products are manufactured off steel molds, which are used to produce plastic plates from which individual parts are then cut off (see Fig. 2a for an example). All molds are uniquely identifiable. A product is a style variant if it uses the same *mold (s)* as a previously released product, but a different style; dummy variable set to 1 if style variant and 0 otherwise.	The Gundam Wiki
High quality	Whether a product uses higher quality attributes (e.g., more detailed molds). Bandai produces versions of the same product that correspond to different objective product quality tiers. Perfect Grade (PG) and Master Grade (MG) kits offer the most detailed components. Other grades are manufactured using less detailed molds; dummy variable that is set equal to 1 for PG- and MG-grade products and 0 otherwise.	The Gundam Wiki
Control variables		
Authentic product price	Manufacturer's suggested retail price for a specific Gundam plastic model kit (natural log).	The Gundam Wiki
Product popularity	Dummy variable taking value 1 if a product has been reviewed by YouTube's top four Gunpla reviewers and 0 otherwise.	YouTube
Scale	Indicator variables corresponding to different physical sizes of the same product.	The Gundam Wiki
Series	Indicator variables corresponding to the anime series on which the product is based.	The Gundam Wiki
Product release year	Indicator variables corresponding to the year in which the product has been released.	The Gundam Wiki
Product release date	Natural logarithm of the number of days since the product was released.	The Gundam Wiki
Product family	Indicator variables corresponding to the Product Family — defined as all the variants as well as the original product — of which a new product is part of because it uses the same mold.	The Gundam Wiki

relatively short nature of our panels – favors the choice of OLS over nonlinear models due to the incidental parameter problem (Greene and Zhang, 2019; Lancaster, 2000; Wooldridge, 2015). In such cases, logit, tobit, negative binomial and other nonlinear models can lead to biased and inconsistent maximum likelihood estimates (Greene, 2004; Hahn and Newey, 2004; Lancaster, 2000). Therefore, the bulk of our results are based on linear OLS models.[13] Dummy variables corresponding to the *Scale*, *Series*, and *Product Release Year* are always included in the specifications. With fixed effects being included at the *Product Family* level, this should alleviate additional concerns of time-invariant heterogeneity across the products.[14] Finally, standard errors are clustered at the *Product Family* level to address potential concerns of serial correlation in counterfeiting rates across products within the same product family.

Column 1 of Table 3 presents a model with only control variables included. Products that sell at higher prices are more likely to be counterfeited, because of their higher expected profit margin.[15] Popular products are also counterfeited more, as demand is likely greater, but newer products (i.e., those with a later *Product Release Year*) are counterfeited less; this may indicate that counterfeiters take some time to consider whether to copy recently released products.

In column 2 of Table 3 we include the variable *Style Variant* which has a positive and economically significant effect on the probability of being counterfeited. On average, style variants of existing products are about 7.7 % more likely to be counterfeited, but in column 3 the interaction variable *Style Variant x High Quality* shows that style variants of higher quality products are *18 %* more likely of being counterfeited.[16] Interestingly, with the inclusion of the interaction effect, the base effect for *Style Variant* decreases in magnitude and is no longer significant. In other words, the interaction between *Style Variant* and *High Quality* accounts for most of the variation between the two variables in their economic relationship with the likelihood of counterfeiting.

The model in column 4 uses random rather than fixed effects for each *Product Family* and shows that *High Quality* attributes are associated with less counterfeiting.[17] Consistent with the results reported in column [3], the interaction between *Style Variant* and *High Quality* continues to be positively associated with the likelihood of counterfeiting. Estimates are also highly similar in magnitude.

Overall, the results presented in Table 3 support Hypothesis 1 and Hypothesis 3 while we do not find support for Hypothesis 2. In other words, new products that feature higher quality attributes are associated with lower counterfeiting (H1) while style variants of existing products are not (H2). However, new style variants of higher quality products are substantially more likely to be counterfeited (H3). Fig. 2 and Fig. 3 illustrates these results.

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[13] Results using logit and negative binomial specifications are reported in Table 6 and broadly confirm the main results. However, as expected due to the nature of the data, certain specifications do not converge.

[14] The main effect for the High Quality variable is always included in all specifications, but drops out due to collinearity with the product family fixed effects and is therefore only reported in random effects models.

[15] In models 1, 2, and 3 we are exploring variation within a Product Family cell, where prices are largely consistent across the products, hence the price of authentic products in these models are not correlated with likelihood of being counterfeited. When fixed effects at the Product Family level are removed in model 4, higher prices are — as expected — positively correlated with the likelihood of the focal product being counterfeited.

[16] Note that because there is no within-panel variation in *High Quality* (since the quality tier is the same for each product family), the variable drops out in the saturated model specification.

[17] Although the specification does not allow identification at the level of the individual *Product Family* it is useful to develop insights into the base effect for the inclusion of *High Quality* attributes. Results are consistent with prior research indicating it can reduce entry by counterfeiters (Cho et al., 2015; Qian, 2014a; Qian and Xie, 2014).

Table 2
Descriptive statistics and correlations.

	Obs.	Mean	S.D.	Min.	Max.	1	2	3	4	5	6	7	8
1 *Counterfeited*	771	0.30	0.46	0	1	1.00							
2 *Number of Counterfeits*	771	0.33	0.54	0	3	0.21	1.00						
3 *Counterfeit Price Discount*	771	0.50	0.31	0.06	0.89	−0.03	−0.01	1.00					
4 *Style Variant*	771	0.30	0.46	0	1	0.05	0.03	−0.01	1.00				
5 *High Quality*	771	0.32	0.47	0	1	−0.11	0.18	0.08	0.07	1.00			
6 *Authentic Product Price*	771	3080.9	4295.8	300	40,000	−0.03	0.13	0.11	−0.02	0.57	1.00		
7 *Authentic Product Release Date*	771	15,784	2189.5	7640	18,414	−0.06	−0.03	0.18	−0.12	−0.04	0.04	1.00	
8 *Product Popularity*	771	0.37	0.48	0	1	−0.08	0.02	−0.18	0.09	0.07	−0.09	0.12	1.00

Table 3
Product innovation strategy and likelihood of counterfeiting (OLS).*

Variable	[1]	[2]	[3]	[4]
Style Variant		0.08**	0.02	0.02
		(0.03)	(0.03)	(0.03)
Higher Quality				−0.23**
				(0.09)
Style Variant × Higher Quality			0.18***	0.16***
			(0.05)	(0.05)
Authentic Product Price	0.04	0.07	0.07	0.19***
	(0.06)	(0.06)	(0.07)	(0.05)
Authentic Product Release Date	−2.48	−2.16	−2.27	−1.14
	(2.02)	(2.10)	(2.05)	(1.64)
Product Popularity	0.08**	0.08**	0.05	0.03
	(0.04)	(0.04)	(0.04)	(0.03)
Scale Dummies	Yes	Yes	Yes	Yes
Series Dummies	Yes	Yes	Yes	Yes
Product Release Year Dummies	Yes	Yes	Yes	Yes
Product Family Fixed Effects / Random Effects	FE	FE	FE	RE
Observations (Products)	771	771	771	771
Product Families	417	417	417	417
R^2 (within)	0.41	0.42	0.43	0.35

Notes: The dependent variable is *Counterfeited*. Robust standard errors clustered at the Product Family level are reported in parentheses.

* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

In Table 4 we repeat the analyses in Table 3 with *Number of counterfeits* as the dependent variable and obtain consistent results — new style variants of higher-quality products are associated with 10 % more counterfeits.

While we are cautious with inference, given the fidelity of the estimates and identification at the level of the individual product family, our results suggest that counterfeiters' decisions to copy a new product are strongly influenced by style and quality as key aesthetic attributes of the authentic product.[18] Fig. 4 illustrates the predictive margins of the interaction between *Style Variant* and *High Quality* reported in Column 3 of Table 3.

4.1. Robustness tests and extensions

To challenge our main results further, we perform a series of extensions and robustness checks.

First, to probe the underlying mechanism behind our hypotheses we examine the price differential between authentic products and counterfeits, because counterfeits attract buyers with prices that are lower than the price of the authentic product. In Table 5, we examine to what extent style and quality attributes are associated with differences

between the price of the authentic product and that of its counterfeit(s). We estimate regression models like those reported in Table 3, but only for those products which have been counterfeited and using *Counterfeit Price Discount* as dependent variable. Our theory predicts that counterfeiters can offer a relatively larger "discount" for a *Style Variant* of a *High Quality* product.[19] If our theory holds, controlling for the price of the original product, we should expect the coefficient on the *Style Variant* x *High Quality* interaction to be negative, indicating a larger price differential between the authentic product and its counterfeit(s). Indeed, this is what we observe in both fixed effects (Column 1) and mixed effects models (Column 2). In this subsample we lose some statistical significance, but the direction of the effects is consistent with our theory. Despite the relatively low number of observations together with the high load we imposed on the specifications, we still managed to recover much of the variance in our estimations, which gives us added confidence in our results. Hence, we interpret the results as broadly suggestive that our proposed mechanisms are valid.

A second set of robustness checks involves using nonlinear rather than linear models. Table 6 incorporates specifications analogous to those used in Tables 3 and 4 but using logit and negative binomial models. In the interest of parsimony, we show only the fully saturated models which converged; and where possible, we report exponentiated coefficients to facilitate interpretation. Results indicate that our main findings are robust to using these models.

Furthermore, although we control for product popularity and the media franchise that a specific Gundam robot belongs to, a concern is that our main results may be driven by the allure of a few *iconic* products (i.e., Gundam robots that are culturally significant in the global community of enthusiasts), rather than style and quality as key dimension of aesthetic innovation strategy. Towards this end, we collected additional data to attempt to identify "iconic" Gundam products. Our findings remain consistent when adding a variable to control for such characters (detailed descriptions of the method and results are available in the online Appendix).

Finally, we also probed alternative operationalizations of the *Style Variant* and *High Quality* constructs. The main results are confirmed when testing a different operationalization of *Style Variant* where we include products which have some degree of variation in molding for accessories within a product family, instead of being regarded as belonging to a separate family (e.g., robots that have the same body, but a slightly different gun). We also test a different operationalization of the *High Quality* construct based on the products' discrete Grade levels. Our results are confirmed under this alternative operationalization, which also shows that the largest magnitude of the moderating effect of introducing a new *Style Variant* occurs in the highest product quality tiers (Perfect Grade and Master Grade). These results are available in the

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[18] Each counterfeit can only be created *after* the corresponding authentic product has been released, hence the possibility of reverse causality does not affect our study.

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[19] Counterfeiters have limited room to manoeuvre in terms of price "discount" for selling a copy of an authentic product that does not include any higher quality attribute. In contrast, style variants of higher quality products afford counterfeiters a relatively larger room to manoeuvre in terms of price differential with the authentic product, because the price of the authentic product is generally higher to begin with.

Fig. 2. a — Gundam Plastic Model Kits: Component in Plates and Assembled Product.
Note. The figure shows the plates containing the plastic components that constitute a MG RX-78-2 Gundam Plastic Model Kit. In each plate individual components are connected to other components by "sprues", the waste pieces on the plastic casting left by the hole through which the mold was filled. Consumers remove the components form the plates and assemble them into the finished product, shown on the right.

Fig. 3. b — Style Variants and Higher Quality Gundam Plastic Model Kits: Examples
The figure shows different versions of the "baseline" RX-78-2 Gundam plastic model kit. The four products displayed offer different levels of quality — e.g., Perfect Grade offer superior detail and articulation compared to Master Grade (within each distinct product family a Master Grade kit is generally less expensive than a Perfect Grade kit but is manufactured using less detailed molds) — and different style variants — e.g., normal colors vs transparent plastics.

Table 4
Product innovation strategy and number of counterfeits.*

Variable	[1]	[2]	[3]	[4]
Style Variant		0.06**	0.01	0.01
		(0.02)	(0.02)	(0.02)
Higher Quality				−0.17**
				(0.07)
Style Variant × Higher Quality			0.14***	0.13***
			(0.04)	(0.04)
Authentic Product Price	0.02	0.04	0.07	0.142***
	(0.04)	(0.05)	(0.07)	(0.04)
Authentic Product Release Date	−2.76	−2.52	−2.27	−1.33
	(1.7)	(1.79)	(2.05)	(1.30)
Product Popularity	0.06**	0.06**	0.05	0.03
	(0.03)	(0.02)	(0.04)	(0.02)
Scale Dummies	Yes	Yes	Yes	Yes
Series Dummies	Yes	Yes	Yes	Yes
Product Release Year Dummies	Yes	Yes	Yes	Yes
Product Family Fixed Effects / Random Effects	FE	FE	FE	RE
Observations (Products)	771	771	771	771
Product Families	417	417	417	417
R^2 (within)	0.41	0.42	0.43	0.35

Notes: OLS. The dependent variable is *Number of Counterfeits*. Robust standard errors clustered at the Product Family level are reported in parentheses.
* $p < 0.10$.
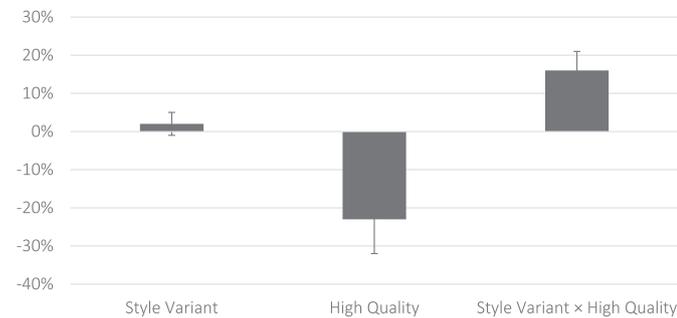** $p < 0.05$.
*** $p < 0.01$.

Fig. 4. Main Results: Product Innovation Strategy and Competition from Counterfeits.
Notes: The vertical axis shows changes in the percentage change in the probability of observing a counterfeit of a new Gundam model kit resulting from the three NPD strategies illustrated in Fig. 1. These bars represent a plot of the coefficients included in column 4 of Table 3. The error bars display robust standard errors.

online Appendix.

4.2. Qualitative insights from the plastic model kits industry

Our confidence in the findings we report is further buttressed by qualitative insights derived from recent NPD projects at the firm that we study as well as interviews with 2 experts in the plastic injection process and 2 executives from the plastic model kits industry. Interestingly, Bandai created a new product quality tier (i.e., "Real Grade", or "RG") for Gundam model kits in 2010 and has invested considerable innovation effort in by developing new styles within this level of product quality, particularly by releasing new color combinations. The RG line of products is deliberately intended as "intermediate" quality tier—with regard to the relative detail and complexity of the molds used—between the MG (higher quality) and HG (lower quality) product lines. Indeed, the average prices of RG model kits are (slightly) higher than HG kits and much lower than MG kits. Further, the RG line is distinguished by an exceptionally low number of baseline products that utilize new molds,

Table 5
Product innovation strategy and counterfeit price discount.

Variable	Counterfeit Price Discount			
	[1]	[2]	[3]	[4]
Style Variant		0.0119	−0.0103	−0.0785*
		(0.0439)	(0.0505)	(0.0442)
High Quality				−0.0101
				(0.181)
Style Variant × High Quality			0.0987	0.0831
			(0.0846)	(0.0802)
Authentic Product Price	0.488***	0.496***	0.517***	0.248**
	(0.107)	(0.0995)	(0.102)	(0.113)
Authentic Product Release Date	9.811***	10.15***	9.634***	6.728**
	(3.129)	(3.595)	(3.666)	(3.085)
Product Popularity	0.0163	0.0172	0.00278	−0.0401
	(0.0433)	(0.0452)	(0.0451)	(0.0326)
Scale Dummies	Yes	Yes	Yes	Yes
Series Dummies	Yes	Yes	Yes	Yes
Product Release Year Dummies	Yes	Yes	Yes	Yes
Product Family Fixed Effects / Random Effects	FE	FE	FE	RE
Observations	226	226	226	226
Product Families	145	145	145	145
R^2 (within)	0.70	0.70	0.71	0.64

Notes: OLS. Robust standard errors clustered at the Product Family level are reported in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

Table 6
Alternative model specifications: proportional models.**

Variable	[1]	[2]
	Logit	Negative Binomial
Style Variant	1.274	0.737
	(0.534)	(0.097)
Higher Quality	0.114	
	(0.111)	
Style Variant × Higher Quality	6.746***	1.701*
	(4.855)	(0.512)
Control variables	Yes	Yes
Scale Dummies	Yes	Yes
Series Dummies	Yes	Yes
Product Release Year Dummies	Yes	Yes
FE / RE	RE	FE
Observations (Products)	547	226
Log-likelihood	−171.443	−158.376

Notes: The dependent variable is *Counterfeited* in column 1 and *Number of Counterfeits* in column 2; odds ratios are given in column 1, whereas incidence rate ratios are given in column 2. Robust standard errors clustered at the Product Family level are reported in parentheses.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

relying instead on creating style variants based on the same base molds.[20] Remarkably, RG kits are experiencing relatively low rates of counterfeiting. Our data suggests that <3 % of all RG kits released so far have been counterfeited. In contrast, >23 % of all MG kits released in the same period have been counterfeited. Although limited, these

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[20] The chief distinguishing feature for the RG line relative to the MG line is that the inner frame of the model is casted as a single sprue tree rather than built up from multiple sprues as a MG kit typically involves. This allows Bandai to develop style variants easily off a common inner frame. The frame however is typically less detailed than that for the MG line and PG line. RG products are therefore of relatively lower quality compared with MG and PG products.

qualitative data suggest that, in line with our empirical results, Bandai Namco attempted to cope with competition form counterfeits by devoting its innovative efforts to a strategy of relatively lower quality attributes but high number of new style variants — as our theory and empirical results would suggest.

Semi structured interviews with two executives in the plastic model kit industry alluded to similar dynamics. Although this qualitative evidence is limited, it is consistent with our quantitative insights. For instance, one executive remarked that *"the design and research costs are high in this industry, but counterfeiting is rampant. Hence, we are always looking for ways to [innovate] more cheaply"*. Another executive explained further: *"The challenge is to create products which give [the] impression of being different while … [not spending] more on innovative efforts. [Yet] we have to constantly introduce new products and innovate, and so finding the right balance in our product portfolio is very important"*.

Further, we conducted interviews with two researchers in a leading technical university in the US, who are experts in the manufacturing processes required to produce plastic model kits. The informants were given the opportunity to physically examine a few examples of the plastic model kits in our sample and noted that they are of extremely high standard and quality. They explained that the costs required to produce individual molds for each product and to set up the manufacturing process would be substantial. One of the researchers opined that it is likely to cost conservatively a few hundred thousand dollars just to produce a mold for a single plate of plastic components. The products in our sample generally include multiple plates and each plate requires a specific mold. Thus, creating a new set of molds to manufacture a new higher quality product is projected to cost upwards of 5 to 10 million dollars. This estimate does not include other development (e.g., product design) and marketing costs, which are likely to be substantial.

The researchers also opined that reverse engineering the original products is likely to require substantial investment from the counterfeiters, namely in the acquisition of plastic injection machines, the creation of molds capable of reproducing the detailed and intricate features in the original plastic plates, and fine tuning the manufacturing process to achieve consistency. However — they noted — such costs are likely to be orders of magnitude lower than the new product development cost sustained by the original creator, because the costs sustained to design and optimize the molds from scratch as well as other developmental and marketing costs are bypassed by the counterfeiters. They concluded that they would not be surprised that the authentic firms would be adjusting their product innovation strategies in reaction to counterfeiting. Although we are cautious about extrapolating from limited qualitative evidence, these remarks offer an interesting parallel to our quantitative findings.

5. Discussion

We study product innovation strategy in a context where aesthetic innovation is the main driver of product success but appropriability is weak. A central contribution of our research is to theorize style and quality as distinct dimensions of aesthetic innovation that allow firms to create and capture value by innovating upon their existing products. Our empirical test exploits unique product-level data on all the plastic model kits depicting the fictional robots "Gundam" — a class of products facing high rates of counterfeiting and for which aesthetic attributes are the core driver of product development. Results show that style variants of higher-quality products are 20 % more likely to be counterfeited and face higher price competition from counterfeits compared to style variants that do not include higher quality attributes.

5.1. Theoretical implications and contributions

In advancing style and quality as distinct dimensions of product innovation, our work contributes to the literature that has examined aesthetic innovation as a driver of competitive advantage (Godart et al., 2020; Krabbe and Grodal, 2023) which has been arguably brought about by a renewed interest and appreciation for strategies to achieve differentiation in industries where aesthetic considerations, rather than technological constraints, drive product innovation (Cattani et al., 2020; Eisenman, 2013; Godart, 2018).

Research on aesthetic innovation has typically focused on how producers can gain a competitive advantage by introducing radical changes to the aesthetic codes that govern a given product category and on the drivers of shifts and stability in the aesthetics of product categories (Krabbe and Grodal, 2023; Rindova and Petkova, 2007). Yet radical aesthetic innovation is a relatively rare event punctuating long periods of stability in the both the aesthetic and functional form of a product category (Eisenman, 2013). Our conceptualization of a style variant as an "incremental" version of an existing product based on a new pattern of aesthetic attributes contributes to research on the role of aesthetics and style in strategy (Cattani et al., 2020; Godart, 2018) and to the literature that has studied the drivers and consequences of within-organization distinctiveness (Bu et al., 2022; Cattani et al., 2017). Our study is also one the first to focus on style variants as a form of aesthetic innovation that can provide effective product differentiation in contexts where capturing the value created via other types of innovation may be challenging.

Product aesthetics attract considerable attention among management scholars because several industries are characterized by relatively stable technologies and product categories, with innovation efforts largely focused on developing new variants of existing products — e.g., a new version using different colors or patterns (Elsbach, 2009; Godart et al., 2020) rather than offering radically new products based on new technologies (Eisenman, 2013; Grodal et al., 2023; Krabbe and Grodal, 2023). Our study on the strategic use of style and quality attributes offers a general framework that may be applied in other industries where aesthetic considerations play a central role in product development, such as fashion, furniture, and toys. In these contexts, new versions of existing products can be costly to develop yet are often counterfeited. Our study offers empirical evidence on the likelihood that alternate strategies to achieve aesthetic innovation will result in products that are more or less likely to be copied.

Our work also builds on and extends theories of product innovation in the context of weak appropriability regimes (Busby, 2019; Ceccagnoli, 2009; MacDonald and Ryall, 2004). A rich tradition of studies has emphasized technological innovation as a driver of competitive advantage and examined different strategies that firms may employ to capture the value created by their innovations, such as patents and trade secrets (Arora and Gambardella, 2010; Ceccagnoli and Rothaermel, 2008). Our study shifts the attention towards the appropriability challenges faced by aesthetic innovations due to the proliferation of counterfeits, which are often indistinguishable from the authentic product and widely available in online marketplaces (Clover, 2016). A major contribution of our approach is matching each authentic new product with its specific counterfeits to recover product-level effects. Although some studies have found that innovating upon products by offering higher quality attributes may temporarily reduce counterfeiting (Cho et al., 2015; Qian, 2014a) this strategy can impose high new product development costs. Our results corroborate these previous findings, but also show that new style variants that include higher quality attributes are 20 % more likely to be copied relative to style variants that do not.

This result is both surprising and somewhat counterintuitive, with implications for firms that rely on aesthetically innovative products that are sold in restricted quantities (e.g., fashion goods, toys). It suggests that, when aesthetic innovation is paramount, firms may be able to innovate upon their existing products by offering novel attributes that customers are willing to pay for, such as style variants, without higher quality attributes that may require higher new product development costs. But why would firms not develop style variants of higher-quality products? In principle, by not developing such products the authentic

Fig. 5. Main Results: Interaction between Style and Quality.
The vertical axis in the interaction plot shows changes in the percentage change in the probability of observing a counterfeit of a new Gundam plastic model kit. The chart illustrates predictive margins for the model specification presented in column 4 of Table 3. The error bars display robust standard errors.

firm gives up the opportunity to sell an additional unit of a product for which there is a relatively lower fixed cost per unit (the manufacturing process for the higher-quality product has already been tested and the R&D investments have already been made), potentially higher margins (arising from higher prices for a style variant of a higher quality product), and the chance of being copied are at worst the same as for baseline quality products (as illustrated in Fig. 4 and Fig. 5). A hypothesis is that the authentic firm may decide to forgo potential additional sales if counterfeiters can easily flood the market with counterfeits that are practically undistinguishable from the authentic product. But why would a firm want to do so and for which types of new products?

In several markets firms develop and sell products at different quality tiers, typically restricting the quantity of higher quality products and selling them at relatively higher prices (Aspers and Godart, 2013; Balachander and Stock, 2009; Gierl and Huettl, 2010; Godart and Galunic, 2019; Stock and Balachander, 2005). A benefit of restricting the quantity of high-quality tier product units available to customers (e.g., a style variant of a higher quality product) is demand spillovers to lower quality tiers products (e.g., a style variant of a lower quality product) for which the quantity of product units available to customers is instead not restricted (Amaldoss and Jain, 2008). Strategies based on deliberately restricting the quantity of certain products are very common and are supported by a large literature on limited edition products and scarcity effects, i.e., marketing strategies exploiting exclusivity (Godart and Galunic, 2019). The fashion industry provides examples of firms that rely on differentiation as competitive strategy, aiming to sell some products at a high price by deliberately restricting their quantity to achieve exclusivity. Counterfeits are particularly problematic in these contexts because they violate the exclusivity condition. At the same time, in industries focused on aesthetic innovation the cost of developing style variants of existing products may be substantially lower, if compared to embedding higher-quality attributes, but the innovations that can be achieved via style variants can be subtle yet impactful. Our results are thus particularly relevant in this context.

Strategies that firms can use to create style variants of existing successful products without introducing higher quality attributes in ways that are, relatively, not costly for the authentic firm may include: Colorways — i.e., style variants where changes to the pattern of aesthetic attributes are limited to the color palette (e.g., the Bandai-Namco Gundam RX-78-2 Ver.3.0 is a style variant of the baseline RX-78-2 Gundam that uses transparent plastics, the Louis Vuitton Neverfull GM N41360 is a style variant of the baseline Neverfull GM M40990 that uses "Damier Azur" canvas in place of the traditional "Monogram"; the

Adidas Superstar 35th Anniversary collection consisted of multiple new style variants of a sneaker that has been continuously marketed since 1970); limited edition collaborations — i.e., style variants of existing products created in partnership with other brands to infuse new aesthetics into existing products (e.g., Bandai-Namco Gundam x Nike SB Unicorn Model Kit, Louis Vuitton x Supreme Monogram Bandana); Interactive customization and user-generated content integration — i.e., design software that allows customers to customize the product's appearance before purchase. Customers can experiment with various styles and colors, resulting in a personalized style variant of an existing product (e.g., Louis Vuitton "Make It Your Own" handbags and accessories). This not only allows customers to personalize their purchases but also creates a continuous stream of unique style variants that are tied to the creativity and preferences of individual consumers, making replication by counterfeiters more challenging.

5.2. Limitations and future research

Our work is not without its limitations. For one, the illicit nature of counterfeiting activities and the lack of reliable data on counterfeiters precluded more systematic quantitative analysis about the firms that produce the counterfeits we observe, which prevents us from incorporating internal predictors of the propensity to counterfeit a product and market share data. Prior studies on illegal markets suggest that future studies using ethnographic methods may be able to shed more light on these important aspects (e.g., Levitt and Venkatesh, 2000).

We would also be remiss if we did not point out how certain features of our empirical setting may affect the generalizability of our findings. First, our study focuses on a narrowly defined population of products —plastic model kits depicting the fictional robots Gundam. While this offers several benefits, it may limit the generalizability of our results. The value of product innovation in the plastic model industry (to a customer) is in the style and quality of aesthetic attributes that captivate imagination. Yet, aesthetic and technological innovation clearly interact in other industries where the functionality of product attributes concurs to shape consumer willingness to pay beyond the style and quality of attributes (e.g., kitchen appliances, athletic gear). In such contexts, incorporating a new technology may be a way to differentiate products, alone or in combination with style variants and higher quality attributes. It is thus possible that a product featuring a new technology may be stylistically equivalent, and of equal (or even inferior) quality compared to an existing product (Krabbe and Grodal, 2023). Moreover, even in contexts where aesthetic considerations may strictly dominate functional attributes in product innovation (e.g., ornaments, artworks), the dimensions of style and quality may not fully account for other attributes that may shape consumer demand and hence the likelihood that style variants of such products face counterfeiting. For example, a new style variant may use a color palette to which some consumers may ascribe higher or lower status if compared to other style variants of the same product, or certain styles may unexpectedly acquire cultural relevance in relation to entities, events, or social practices that are external to the focal industry.

Finally, the context we study is like other settings where aesthetic innovation is the primary driver of competition because ownership of long-lasting intellectual property rights (e.g., trademarks, copyrights) confers a firm the exclusive right to manufacture and sell products that incorporate aesthetic features protected by such intangible assets. However, plastic model kits of the fictional robots Gundam manufactured and sold by Bandai-Namco differ in important ways if compared to other massively counterfeited products tied to valuable IP, such as Louis Vuitton handbags. Plastic model kits sell for prices that are considerably lower than luxury goods and are not generally considered status symbols, hence customers likelihood to substitute counterfeits to authentic products and social norms may differ across industries. Altogether, these limitations provide important boundary conditions for the validity of our theoretical arguments and empirical results. We therefore warn

against generalizing our framework and results to industries that may differ in important ways from the empirical context we study.

In conclusion, this paper addresses how firms can create and capture value via aesthetic product innovation. Results show large differences in counterfeiting rates for distinct types of style variants of existing products, with implications for how scholar should think about aesthetic innovation strategy in weak appropriability regimes, and by extension, for the boundary conditions of existing approaches to the problem.

CRediT authorship contribution statement

Enrico Forti: Conceptualization, Methodology, Writing- Original draft preparation, Writing - Review & Editing, Visualizations, Investigation, Supervision, Project administration, Corresponding author. **Kenny Ching:** Conceptualization, Econometrics, Formal analysis, Data curation, Project administration, Supervision, Writing- Original draft preparation, Writing - Review & Editing. **Spyridon Katsampes:** Data Collection, Data curation. **Konstantinos Mammous:** Data Collection, Data curation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi. org/10.1016/j.respol.2023.104947.

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