Fake Entry*

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Abstract

We show the financial interests of a generic-drug manufacturer's largest shareholders in a branded competitor predict the generic's likelihood of being the first to challenge a drug patent. Conditional on a challenge, these common-ownership links predict settlements and delayed generic entry in exchange for payments to the generic. The stock price reactions are positive for the brand but negative for the generic, implying wealth transfers from one portfolio firm to another, with net benefits to investors. These facts suggest that in supracompetitive markets, corporate objectives depend on shareholder preferences.

Keywords: ownership, corporate objective, corporate governance

JEL Classification: L12, G32, D22, L21, K11

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Because the Fund normally invests at least 80% of its assets in the stocks of companies related to the health care industry, the Fund's performance largely depends – for better or for worse – on the overall condition of this industry. Vanguard Health Care Fund Prospectus (May 25, 2017)

Investors say competition needs to be put aside for the greater good... Institutional investors in 15 major pharmaceutical companies have called on the drugmakers to set aside rivalries and short-term interests and cooperate... Reuters (April 17, 2020)

Pay-for-delay deals are a bad prescription for America; when drug companies agree not to compete, consumers lose. Jon Leibowitz, Chairman of the the the Federal Trade Commission (January 13, 2010)

1 Introduction

What is the objective function of the firm? A convenient and ubiquitous assumption across all subfields of economics is that widely held corporations maximize their own value, irrespective of shareholders' preferences. The Fisher separation theorem proves that the assumption of own-firm value maximization is warranted under a number of assumptions, including that the firm is a price taker. The interpretation of empirical findings in the literature, tends to implicitly assume that the theorem's predictions hold, without checking the assumptions.[1]

The question thus arises of whether widely held corporations maximize their own value not only in theory but also in practice, and whether own-value maximization depends on the competitiveness of their product markets. An alternative hypothesis that firms maximize the value of their most influential investors' portfolios: if influential shareholders of one firm have large ownership stakes in other firms, these shareholders could financially benefit from taking value-destroying decisions in one firm for the benefit of these other firms. If that were the

[1]Own-firm value and investors' portfolio value can differ when firms strategically interact. Hart (1979) shows the price-taking assumption is *necessary* for shareholders to agree on firm value maximization as the objective of the firm. Theory further predicts that when firms strategically interact in the product market and shareholders are sufficiently diversified, shareholders unanimously prefer firms to maximize industry profits rather than their own value (e.g., Diamond, 1967; Drèze, 1974; Grossman and Hart, 1979; Rotemberg, 1984). No widely accepted theory for the objective of the firm exists for intermediate cases.

case, much of extant theory in corporate finance, and by extension in other areas of economics including industrial organization, trade, labor, and macroeconomics, could be enriched by re-examining standard questions while assuming alternative objective functions of the firm. It hence appears important to address the *empirical* question of whether such situations do in fact occur in practice. Do widely held corporations sometimes take value-destroying decisions for the benefit of the value of their largest shareholders' portfolios?

In this paper, we document in a specific industry that some firms predictably make decisions that systematically destroy firms' own value, while the same decision benefits the value of the portfolio of their largest shareholders. Specifically, we examine the market-entry attempts and settlement decisions of generic-drug companies into the product markets of branded drugs, as well as accompanying stock price reactions. In particular, we study whether ownership predicts *which* generic posts the first (fake) entry threat to the market and whether the entrant settles with the rival offering the branded drug, thus precluding actual entry by other generics and helping the branded drug maintain its monopoly for longer. We then examine how the equity market for the generic's and the brand's shares reacts to both entry and the announcement of settlements.

The pharma industry provides an ideal laboratory for addressing this question, among others, because of a well-defined product market, and a unique institutional setting. Pursuant to the Hatch-Waxman Act of 1984, generic manufacturers are allowed to file Paragraph IV certifications with the Food and Drug Administration (FDA) in order to enter into a drug market before patents covering a branded product expire (see Figure A.1 of Online Appendix). A brand company typically responds by filing infringement lawsuits against generic entrants. The two parties then either enter into a settlement agreement or go to trial with a likelihood that the court might dismiss the case (see Figure A.2 of Online Appendix).[2] The FDA does not approve another Paragraph IV application for the same drug until after the first generic markets the drug for 180 days. By entering into a "pay-for-delay" settlement, the brand incumbent can pay the first generic in exchange for the forfeit of the exclusivity or for the delay of marketing, which

[2]Settlement requires the initiation of a lawsuit. More than 95% brand-name firms file lawsuits in response to Paragraph IV challenges. As a result, our analysis does not focus on whether common ownership affects the likelihood of filing a lawsuit.

precludes other generic firms from entering the market.[3] As such, the Paragraph IV setting offers a unique and valuable opportunity to examine whether regulatory and legal mechanisms designed by regulators to promote competition ultimately foster firm collusion (e.g., Marshall, Meurer, and Richard, 1994; Starc and Wollmann, 2023).

We first document the extent of common ownership of industry competitors in the sector (see Table 1). To illustrate, Table 2 reports the stakes the 20 largest generic shareholders hold in the generic manufacturer and the stakes they hold in the brand incumbent whose patents are challenged by that generic manufacturer. On average, the generic's largest shareholder owns 10.3% of generic shares and 4.3% of brand shares. Due to size differences between brand and generic, the holdings of the largest five generic shareholders are sufficient for them to care more about the typically much larger brand's profits than the generic's profits. By influencing the generic's conduct, and in particular by protecting the expensive branded drug's product market, the generics' largest shareholders can affect the brand's profits.[4]

Table A.1 of Online Appendix provides four examples of infringement lawsuits to compare the top five generic shareholders who do and do not hold stakes in the brand plaintiff. The data suggest that, as a coalition, the generic common owners not only have substantial economic incentives on the brand side but also are able to influence the generic's behavior over the preferences of non-common owners.

Having documented the ownership links, we turn to examining whether they predict firm behavior. We report three sets of main results. First, we find the extent to which a generic's

[3]Although consumers suffer losses from pay-for-delay settlements, whether parties entering such agreements face legal risks depends on different court interpretations, resulting in negligible litigation risks in practice (see Subsection 6.4). The Federal Trade Commission's (FTC) investigations and enforcement actions against these settlements somewhat deterred the use of pay-for-delay settlements between April 1999 and 2004. However, since 2005, several appellate courts have misapplied antitrust laws to uphold such agreements. As a result, patent settlements combining restrictions on generic entry with brand-to-generic compensation have reemerged. In FTC v. Actavis (filed January 29, 2009), the FTC sought to establish that pay-for-delay agreements should be presumed illegal under antitrust law. However, the Supreme Court ruled that such agreements must instead be evaluated under the "rule of reason" to determine whether they violate antitrust law. For related studies, see FTC (2002), FTC (2010), FTC (2013), Shapiro (2003), Bulow (2004), Hemphill (2006), Panattoni (2012), Hemphill and Sampat (2011a,b), Hemphill and Sampat (2012), Bokhari (2013), Bokhari et al. (2020), Lemus and Temnyalov (2020), Palikot and Pietola (2023), and Li, Lo, and Thakor (2024). In Section 3, we provide institutional details regarding both Paragraph IV certification and pay-for-delay settlements entered by brand-name plaintiff and generic defendant.

[4]Research by IQVIA (formerly Quintiles and IMS Health, Inc.) shows that the average generic drug price is only 3.6% of the pre-expiration price of its brand version, and generic drug prices drop by 51% within 12 months after the 180-day exclusivity period expires. Jacobo-Rubio, Turner, and Williams (2020) estimate that a $1 of annual sales of the drug increases the brand's monetary gain by about $7.55 and the generic's monetary gain by about $.12.

largest shareholders hold financial stakes in the brand-name incumbent is strongly and positively associated with the likelihood that this generic acts as the first Paragraph IV filer to challenge the patents protecting the brand's product market. The strongest effects of common ownership on the likelihood of a generic acting as the first filer are attributable to the five largest and presumably most powerful generic shareholders' portfolio stakes. We establish the above findings first with fixed-effect panel regressions, which difference out a large number of potentially omitted variables. The intuition is that by preempting other generic manufacturers, who would compete fiercely, from entering, the commonly owned generic preserves profit margins of the brand that would otherwise approach zero after the brand's patent and the 180-day exclusivity period expires.[5]

Second, our panel-regression results suggest the likelihood that, conditional on a Paragraph IV filing, the two parties enter into a settlement agreement, increases in the extent to which shareholders in the generic defendant hold financial stakes in the brand plaintiff, and the strongest effects are again attributable to the five largest generic shareholders.[6] The economic magnitude is such that a one-standard-deviation increase in common ownership increases the probability of settlement by 4.2 percentage points, which is 12.8% of the sample mean.

One reason to challenge an interpretation of the above correlations as a causal effect of common ownership on product-market behavior is that both ownership and Paragraph IV filing (or settlement) could be determined by the same, unobserved factors that are not differenced out by fixed effects. Alternatively, ownership could depend on product-market behavior — a reverse-causality concern. To examine that possibility, we first test whether common ownership varies either before or around entry or settlement times. We do not find evidence to support that hypothesis. We further test whether our main results remain qualitatively similar when we use only variation caused by BlackRock's acquisition of Barclays Global Investors. We find common ownership changes that are mechanically caused by the event indeed predict both

[5]Three facts suggest the prevalence of entry threat due to multiple potential entrants. First, because our sample exclusively focuses on branded drugs challenged by generics through Paragraph IV, each patent is challenged by an average of three distinct generic manufacturers. This number represents a lower-bound estimate of entry threat since we do not account for potential entrants who ultimately choose to wait until the patent expires. Second, in about 50% of cases, multiple generic manufacturers compete to be the first filer on the same day after regulatory protection for patent challenges expires. Third, generic manufacturers typically do not know each other's entry plans because the FDA maintains confidentiality of Paragraph IV filings.

[6]We measure settlement using a consent decree, where the plaintiff and defendant request the court to monitor their agreement. In such cases, the court oversees the implementation of monetary exchanges or restructured interactions between the parties.

post-event first-filer probabilities and settlement probabilities.

Third, we show that settlements are accompanied by negative announcement returns for the generic and positive returns for the brand[7] and that the largest and most powerful generic shareholders gain more from their holdings in the brand than they lose from the negative returns in the generic. In generic-brand pairs with high common ownership, the top three generic shareholders collectively lose US$444 million, while the top three brand shareholders collectively gain US$1,822 million. In pairs with low common ownership, this pattern does not hold. Our evidence rejects the FTC's assumption that pay-for-delay agreements are always "win-win" for the brand and generic (FTC, 2010).

We propose that the above empirical findings are easiest to understand if one assumes generic firms maximize not their own value but the portfolio value of their largest investors. Such investors holding large stakes in the brand can mean sacrificing their own firm's value for the value of a rival. For example, as our analysis shows, the brand might want to settle at terms that are unattractive to the generic *firm* — but that are attractive to the generic firm's *shareholders* when they hold large stakes in the brand.[8]

To illustrate the full reasoning behind this proposal, we use the model presented in Section A.1 of Online Appendix. Thinking about the counterfactual clarifies the intuition behind this strategy: if a generic whose shareholders hold no stakes in the brand were to enter the market, that generic would not be as readily willing to settle in ways that transfer wealth to the brand. Instead, a non-commonly owned generic would be less likely to settle and thus more likely to compete away the brand's margins — perhaps to the benefit of consumers but to the detriment of shareholders as a group. Alternatively, the generic would settle, but only under such terms that make the brand share the additional rents with the generic. Either way, it is more attractive for the brand's shareholders to maximize the length during which it can charge monopoly prices in the product market. They can achieve that outcome by allowing or

[7]The Medicare Modernization Act of 2003 required brand and generic firms to submit their confidential settlement agreements to the FTC, which only publicly reports summaries of the agreement terms. As such, one limitation is that researchers often lack information on the explicit delay of generic entry or the amount paid by the brand. Following Drake and McGuire (2016) and Drake and McGuire (2024), we circumvent this limitation by using stock price movements around settlements to estimate the value implications for settled brand plaintiffs and generic defendants.

[8]For similar reasons, common ownership might make it easier for the two parties to agree on how to split the increased shareholder pie, i.e., the settlement amount. Brooks, Chen, and Zeng (2018) find that common ownership is associated with more M&A, which may be due to smoother bargaining over the surplus of the transaction also.

inducing a generic to make the costly sacrifice of being the first Paragraph IV filer and then settling on terms that are attractive to the brand. By doing so, the commonly-owned entrant prevents a more competitive and less cooperative rival from entering.

To examine the corporate governance mechanism, we examine whether the minority shareholders implement their preferences by appointing directors, inspired by a recently burgeoning literature on common directors (e.g., Lemley, Manjunath, Kahrobai, and Kumar, 2022; Barone, Schivardi, and Sette, 2023; Geng, Hau, Michaely, and Nguyen, 2023b; Gopalan, Li, and Žaldokas, 2023) and FTC/DOJ enforcement priorities focusing on Clayton Act Section 8 violations. We read proxy statements from parties that entered into a settlement agreement, around which the first generic experienced negative abnormal stock returns. We do not find evidence that the settlement decisions that destroy generic firm value but benefit its largest shareholders through their holdings in the brand are associated with directors who have a connection to the brand or to the largest shareholders.[9]

Finally, we ask whether generic and brand managers face significant litigation risks. We review lawsuits involving first generic manufacturers or their managers who entered into settlements that destroy generic firms' own valuation. We find both generic and brand managers face negligible and remote litigation risks as a result of settlements. We discuss the rationale behind this finding in Subsection 6.4.

2 Related Literature

These findings provide systematic empirical evidence to inform a thus-far theoretical or anecdotal debate on the objective of the firm that informs foundational assumptions in the common ownership literature (e.g, Azar and Vives, 2021; Ederer and Pellegrino, 2024).[10] The present paper contributes first evidence of situations in which firms not controlled by a majority shareholder make value-destroying decisions for the benefit of commonly owned rivals.

Our findings also contribute to a more applied literature on common ownership and competition. The finding that common ownership of industry rivals likely causes higher product prices in some markets in specific industries has triggered a vigorous policy debate and new

[9] In a similar spirit, Geng, Hau, Michaely, and Nguyen (2023a) find no incremental effect on product-market outcomes after controlling for the effect of common ownership on firm profitability.

[10] One case study is discussed by Schmalz (2015), but no systematic study of wealth transfers across commonly owned firms exists.

literature in industrial organization and antitrust law. However, whether the findings also have first-order implications for corporate finance depends on whether the findings imply firm objectives depend on shareholder portfolios and preferences, thus rejecting the predictions of the Fisher separation theorem. For example, Azar et al. (2018) speculate whether their evidence suggests a rejection of the Fisher separation theorem, but their evidence does not necessitate that conclusion. He and Huang (2017) find cross-held firms experience higher market share growth; however, this evidence also does not distinguish between different firm objective functions. Antón, Ederer, Giné, and Schmalz (2022) show that a model in which firms maximize their own value but their cost structure depends on common ownership can explain a causal link between common ownership and product prices at the market level, as documented in Azar et al. (2018) and later literature. To the best of our knowledge, the only paper that shares a similar spirit with our study is Fazio and Žaldokas (2024). The authors find that shared ownership ties explain firms' "suicide strategy" in public procurement: the lowest bidders withdraw after the auction concludes, allowing the second-lowest bidders to win at higher prices.

Our study also relates to Harford, Jenter, and Li's (2011) study of mergers under common ownership. The authors document that, at the time, in the industries they study, "cross-holdings are too small to matter in most" cases and "do not explain value-reducing acquisitions." Unlike the M&A case in Matvos and Ostrovsky (2008), where bidders' losses are targets' gains, generic shareholders can increase the overall size of the pie shared by shareholders by guaranteeing a longer period during which the brand can charge high prices to consumers due to the absence of generic competition. In particular, we provide the most direct evidence that shareholder expropriation via "tunneling" extends to the Berle and Means (1932) world of widely held firms. In widely held firms, tunneling incentives are studied by (Backus et al., 2021; Amel-Zadeh et al., 2022).[11]

Although our main motivation is conceptual, our study is also important given the enor-

[11]Three takeaways are worth mentioning. First, our documented wealth transfer occurs between legally independent firms through arm's-length transactions, which is in contrast to wealth transfers between related parties through self-dealing transactions mediated by controlling shareholders (e.g., Johnson, La Porta, Lopez-de Silanes, and Shleifer, 2000; D'Acunto, Weber, and Xie, 2019). Second, wealth transfer in our setting occurs in the presence of diversified institutional investors holding shares in single-class firms, whereas tunneling in prior literature is typically driven by under-diversified large shareholders with excess control over cash-flow rights, often established through a pyramidal ownership structure (e.g., Claessens, Djankov, and Lang, 2000). Third, we show wealth transfer from one portfolio firm to another takes place in common-law countries, where legal protection of minority shareholders is strong; by contrast, tunneling by controlling shareholders is more frequent in civil-law countries, where government and family control is pervasive.

mous public-health implications of entry deterrence in the market for affordable pharmaceuticals. We thus also contribute to a literature of product-market entry with overlapping ownership. Vives and Vravosinos (2025) analytically show that an increase in common ownership will harm welfare by inducing insufficient entry, and by magnifying the negative impact of an increase of entry costs on entry. Xie and Gerakos (2020) and Xie (2021) show common ownership correlates with settlement. Neither study supports evidence suggesting a causal interpretation, neither studies effects on entry, and neither studies shareholder wealth implications. Moreover, those papers' measurement of ownership omits insiders and blockholders, which explains much of the variation in common ownership (Amel-Zadeh, Kasperk, and Schmalz, 2022) and for that reason alone reports likely biased estimates. Ours is the first paper showing common ownership predicts fake entry by the *first* generic challenger, thus blocking further entry by other challengers and leading to potentially welfare-reducing settlements. Third, and most importantly, our study is the first to complement an analysis of product-market entry with an analysis of accompanying stock-market reactions and wealth transfers among commonly owned firms. A second related paper in this literature is by Newham, Seldeslachts, and Banal-Estanol (2019). The authors examine the empirical relation between common ownership and generic entry in the setting of Paragraph *III* (!) certification, in which generic manufacturers make an entry decision *after* the expiration of all patents protecting the branded drug. In such a scenario, a drug market is opened up by the end of regulatory protection in the US, and no patent disputes, settlements, and thus wealth transfers are involved. To the extent that Paragraphs III and IV serve as the FDA's complementary tools to facilitate generic entry, our study does not address whether common ownership overall facilitates or hinders entry in the pharmaceutical industry.

In a third closely related paper in this literature, Li, Liu, and Taylor (2022) study product-market *exit* of commonly owned firms. This paper shows that, once a commonly owned project shows first promise in trials, venture capital investors shut down lagging drug projects and withhold funding from lagging startups. This finding is broadly consistent with Cunningham, Ederer, and Ma (2021), who argue that incumbent firms acquire innovative targets primarily to discontinue the targets' innovation projects and preempt future competition. See Azar (2012), Schmalz (2018, 2021), Backus, Conlon, and Sinkinson (2020), and Gerardi, Lowry, and Schenone (2024) for reviews of the literature on common ownership.

3 Institutional Background

This section provides a background review about the Paragraph IV certification and pay-for-delay settlements.

3.1 Paragraph IV certification

In 1984, Congress adopted the Hatch-Waxman Act, which reduced regulatory barriers to the entry of generic drugs. Prior to 1984, generic-drug manufacturers had to repeat the same expensive, lengthy clinical trials that brand-name companies had already conducted. Furthermore, the investigation and testing of a branded drug covered by patents could subject generic manufacturers to patent-infringement lawsuits.

The Hatch-Waxman Act offers four paths (or Paragraphs) for a generic manufacturer to produce a branded drug product. The entry process begins with the generic manufacturer filing an abbreviated new drug application (ANDA) with the FDA under one of the four Paragraph certifications. Under Paragraph IV certification, the generic manufacturer argues the generic drug does not infringe on patents covering a branded product or that the patents at issue are simply invalid. Under this provision, generic manufacturers file ANDAs to challenge the validity of patents so that generic drugs can be marketed before patents expire.[12]

A distinct feature of Paragraph IV is that the FDA rewards 180-day exclusivity to the first generic submitting this certification. Once this exclusivity right is granted, the FDA may not approve another Paragraph IV application for the same product until six months after the first generic markets its product. Brand-name companies often pay the first-generic manufacturer to hold the generic product off the market for a certain period of time so that all generics cannot enter the market.

Figure A.1 of Online Appendix illustrates the time period during which Paragraph IV generic entry is allowed. When a brand-name company submits a New Drug Application (NDA) to the FDA for approval they are required to list all relevant patents in the FDA Orange Book. In addition, the FDA will also grant each newly approved product a regulatory protection called "data exclusivity" lasting for five years (seven years for orphan drugs and five

[12] A Paragraph I certification is issued when the drug innovator has not filed patents to cover its branded product. Paragraph II certification involves a branded drug's patents having expired, and Paragraph III certification relates to the generic manufacturer acknowledging that patents covering the branded product will expire on a certain date, and that it will enter only after that date.

and a half years for pediatric drugs) that runs concurrently with patent protection. During this data-exclusivity period, regardless of whether underlying patent(s) are valid, no generic entry may occur. At the end of data exclusivity, only patents protect branded products. The period running from the end of data exclusivity to the expiration of patents protecting a branded drug is referred to as "marketing exclusivity." Paragraph IV generic entry is only allowed during the marketing-exclusivity period.

3.2 Pay-for-delay settlement

Despite settlements having various forms, they share one common feature: the brand-name company pays the generic firm in one of several ways (discussed), whereas the generic firm agrees to delay entry, and thus generates value for the brand, which gets to enjoy a delay of the end of its patent-protected monopoly.

More specifically, a generic firm files a Paragraph IV challenge seeking to market a generic version of a branded drug prior to the expiration of patents covering the drug. Rather than take a chance it might lose the patent-infringement lawsuit, the brand-name company agrees to pay the generic firm in exchange for its agreement to abandon its Paragraph IV challenge and to delay entry. The surplus thus created for the shareholders of generic and brand comes from increased consumer rents, compared with a more competitive equilibrium in which the generic does not delay entry.[13]

Relevant to our study, one important issue concerns the timing of settlement. According to Hemphill (2007), in many settlements, the Paragraph IV challenger retains eligibility for the 180-day exclusivity period by agreeing to enter at a particular date that is at least 180 days prior to patent expiration. The economic incentive for the Paragraph IV filer to retain the eligibility for the 180-day exclusivity is as follows. Because the patent at issue is never adjudicated, the generic firm does not risk the possibility that it will lose the infringement

[13]The brand-name company can transfer value to the generic filer in different ways. First, it can pay cash, including over-payment for goods and services provided by the generic firm. The amount of cash paid varies greatly across the settlements. Brand-name companies typically pay generic manufacturers between $1.75 million and $132.5 million for a delay period of between four months and 10 years (FTC, 2010). Second, the generic firm agrees to license the brand company's intellectual property or to develop new products for sale by the innovator. Third, brand-name pharmaceutical companies sometimes agree to not compete through an authorized generic (Berndt, Mortimer, Bhattacharjya, Parece, and Tuttl, 2007). Authorized generics are brand-name pharmaceutical products marketed as generics and can substantially reduce the revenues a first generic earns. Fourth, the brand-name company either overpays for goods and services provided by the generic firm or sets a very low price for goods and services provided to the generic firm.

lawsuit. If the generic firm lost, it would not only be forced to wait until patent expiration but also lose the 180-day entitlement. By reaching an agreement on entry dates, the generic firm retains the entitlement, turning the mere probability of enjoying it (if it won the patent suit) to a near certainty.

4 Data

In this section, we introduce several sets of raw data and explain how we construct common ownership.

4.1 Paragraph IV lawsuit documents

Our data on entry come from The Paragraph Four Report®, which is an electronic publication of Parry Ashford Inc. The company tracks and analyzes Paragraph IV activities. The database starts with Paragraph IV cases that were active as of November 1, 2003. Active branded products are those that had a Paragraph IV challenge, had a pending lawsuit, and were not available as a generic as of November 1, 2003. The company followed each case through completion (i.e., settlement or court of appeals).

For each case closed, we read the progress summary and documents attached to each case to discern the final outcome. We classify challenge outcomes into five categories: the brand does not file suit, the brand wins, the brand loses, the parties settle, the parties dismiss the case, and unknown. Figure 1 provides a snapshot of the online publication.

Our sample starts with active Paragraph IV cases as of November 1, 2003, and ends with Paragraph IV cases closed before December 31, 2017. Our unit of observation is a distinct patent-infringement lawsuit triggered by a Paragraph IV application filed by a generic firm to challenge a branded drug. We treat different formulations (e.g., tablets, capsules, and injections) under the same trade name (i.e., the active ingredient of the branded drug) as

different products.[14] In other words, we define a challenge at the level of the date on which a brand manufacturer files a patent-infringement lawsuit against an ANDA filer challenging the formulation of a trade name. We collect 2,415 distinct Paragraph IV challenges. We further exclude cases (1) in which the brand-name company does not sue the generic ANDA filer for patent infringement and (2) for which the start date of litigation is not available.

From the online Paragraph Four Report®, we manually extract the relevant data fields. For each Paragraph IV challenge that results in patent infringement litigations, we collect (1) the name of the brand and generic manufacturers involved in the litigation, (2) the timeline of the litigation (e.g., the date on which a brand company files a patent-infringement suit), (3) the trade name and formulation of the challenged product, (4) patents at issue, (5) the district court, (6) the names of the lead attorneys/law firms and judge, and (7) a brief summary of the progress of the case with critical scheduled dates.

Table 3 presents descriptive statistics of our sample for empirical analysis. It consists of 2,023 unique patent-infringement lawsuits caused by Paragraph IV challenges to 1,578 unique patents covering 521 unique trade names. These 2,023 challenges are launched by 202 distinct generic manufacturers. The 521 trade names are owned by 157 distinct brand-name companies. Additionally, in about 86% of brand-generic pairs, both litigating parties are publicly listed firms. Common-(institutional) ownership linkage can only exist when both generic and brand are widely held corporations. Finally, nearly 90% of trade names have only one formulation challenged, 8.5% have two formulations challenged, and less than 2% have more than two formulations challenged.[15]

[14] One concern with treating different formulations under the same trade name differently is that if one generic typically challenges all formulations under a branded drug, and if Paragraph IV litigation outcomes do not vary across formulations under the same drug challenged by the same generic, treating different formulations as different products artificially inflates the number of observations. For several reasons, however, we argue the above issue is less a concern. First, only 10% of trade names are associated with more than one formulation (see Panel C of Table 3). Second, out of 187 generic-tradename pairs in which one generic challenges multiple formulations under the same trade name, about 13% pairs have litigation outcomes that differ across formulations. Third, in approximately 6% of cases, the same generic challenges different formulations under the same trade name at different time points, rendering the necessity to separate formulations to consider time-varying common ownership. Fourth, untabulated results confirm that our results are robust to treating different formulations under the same trade name as the same product.

[15] Figure A.3 of Online Appendix plots the distributions of the number of these 2,023 challenges and the settlement rates over calendar years in which lawsuits are filed. Table A.2 of Online Appendix presents the sample distributions of the Paragraph IV litigation outcomes across US Federal District Courts following the filing of an ANDA under Paragraph IV certification with the FDA. Settlement rates vary substantially across courts.

4.2 First generic challenger

The Paragraph Four Report® provides the dates on which the brand sues the generic ANDA filer for patent infringement. The company does not provide the date/month in which generic manufacturers file ANDA applications under Paragraph IV. We are not aware of any public sources (e.g., FDA websites) providing such dates either. The lack of these dates can introduce measurement error if we determine the first ANDA filer based on when the brand incumbent in turn sues the generic firm. To address this concern, we conduct a fuzzy search for the first ANDA filer. We define an entry date as the earliest of (1) the date an ANDA was filed (if data are available), (2) the date the ANDA filer(s) noticed the brand incumbent, and (3) the date the brand sued the ANDA filer. The Paragraph Four Report® includes original documents for summons, complaints, and answers related to each lawsuit. From these documents, we search for (1) and (2) as mentioned above. Among all generics challenging the same drug, the first-filer is defined as the one with the earliest of the above three dates. Under this method, the first generic triggers 686 out of 2,023 lawsuits.

4.3 Data on pharmaceutical firms' ownership

Amel-Zadeh et al. (2022) and Gerardi et al. (2024) suggest measures of common ownership merely based on 13-F filings lead to biased results because they mask the true variation of ownership. For accurate measures, we also need to capture non-institutional insiders and blockholders. To that end, we start with ownership data from Capital IQ under the S&P Global Market Intelligence. The Ownership dataset provides detailed institutional, mutual fund, and insiders/individuals equity share ownership data for public and private companies, along with public float shares and buys and sells of insiders and major shareholders. The ownership data is available starting from the first quarter of 2004.

In Table 1, we shed light on the extent of common ownership in the current U.S. pharmaceutical industry. For a sample of generic manufacturers and brand patent owners included by our sample, we list the top 10 shareholders for the nine most frequent Paragraph IV challengers (generic manufacturers) and the nine most challenged patent owners (brand-name companies), as well as their ownership observed in the fourth quarter of 2016. Table 1 shows generic manufacturers are more often smaller and held by blockholders and insiders. Common ownership is more pronounced among bigger pharmaceutical companies.

4.4 Common ownership

Following Rotemberg (1984), Backus et al. (2021), Antón et al. (2022), and Boller and Scott Morton (2021), we use a measure of common ownership that calculates the extent to which the most influential shareholders in one firm also hold financial stakes in other firms. This measure can be interpreted as an alternative objective of the firm, whereby firm j maximizes a weighted average of its M shareholders' (indexed by i) portfolio profits that arise from cash-flow rights β_{ik} in N different firms (k) that make profits π_k, whereas γ_{ij}s are the respective shareholders' voting shares:

$$\max \Pi_j = \sum_{i=1}^{M} \gamma_{ij} \sum_{k=1}^{N} \beta_{ik} \pi_k = \pi_j + \sum_{k \neq j} \underbrace{\frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}}_{\kappa_{jk}} \pi_k. \tag{1}$$

In equation (1), firm j (the generic manufacturer) internalizes externalities on other firms k (brand incumbent). However, firm j only does so to the extent κ_{jk} that owners with economic interests in firm k (β_{ik}) have control rights over firm j (γ_{ij}), relative to the control and cash-flow rights they have over firm j. The measure reflects that large generic shareholders have more influence on generic managers' behavior than a collection of small shareholders with diverging economic interests that is equally large in aggregate. This property addresses the concern with alternative measures that treat generic shareholders equally (Harford et al., 2011).

Because generic entrant j and brand-name incumbent k are the only two players in the pre-entry game, and because the payoff of any litigation outcome is forward-looking, we modify firm j's objective function as follows:

$$\max \Pi_j = \mathbb{E}\pi_j + Kappa_{jk} \mathbb{E}\pi_k, \tag{2}$$

where $\mathbb{E}\pi_j$ is the present value of future profits, net of entry costs, if a generic substitute is allowed to be sold before patents expire. $Kappa_{jk}$ (κ in the model) is the profit weight that generic manufacturer j places on the present value of the monopolistic profits from selling the brand drug during the remaining life of patents by the brand incumbent k. The profit weight of $Kappa_{jk}$ is the principal object of interest in the common-ownership hypothesis (Backus et al., 2020, 2021).

Backus et al. (2021) further shows that under proportional control ("one share, one vote"),

each profit weight $Kappa_{j,k}$ can be decomposed into the following two terms:

$$Kappa_{jk} = \underbrace{cos(v_j, v_k)}_{\text{overlapping ownership}} \times \underbrace{\sqrt{\frac{IHHI_j}{IHHI_k}}}_{\text{relative IHHI}}. \tag{3}$$

The first term of "overlapping ownership" is the cosine of the angle between the vector β_j of ownership positions β_{ij} that shareholders (indexed by i) hold in generic firm j and the corresponding vector k for brand firm k. The cosine similarity captures the overlap in ownership and is the origin of the incentive to internalize the profits of another firm. Without large short positions, the similarity metric is restricted to the [0, 1] interval.

The second term is the ratio of the "investor Herfindahl-Hirschman indices" $IHHI_j = \sum_i \beta_{ij}$ and $IHHI_k = \sum_i \beta_{ik}$ for shareholders of firm j and k (also see Antón et al. (2022) and Boller and Scott Morton (2021)). This second term ties the theory of common ownership to the notion that investor concentration drives a wedge between control rights and cash-flow rights, and, all else being equal, firms with concentrated investors will place more weight on their own profits and less weight on competitor profits.

Our main measure of common ownership is the profit weight that the top 20 generic shareholders put in the brand firm as of the beginning of the quarter in which a patent-infringement lawsuit is filed (*Kappa20* thereafter). Panel A of Figure 2 shows a secular uptrend of average *Kappa20*, cosine similarity, and investor HHI over the sample period of 2004Q1 – 2017Q4. In each quarter, these metrics are averaged across firm-by-firm pairs, where firms are selected as long as they appear at least once in The Paragraph Four Report®, either as a defendant or as a plaintiff.

Amel-Zadeh et al. (2022) find the average profit weight across pairs of 4-digit SIC competitors that are S&P 500 single-class firms steadily grew from 0.47 in 2004 to 0.75 in 2020, whereas our calculated mean profit weight across all generic-brand pairs grew from 0.05 in 2004Q1 to 0.12 in 2017Q4. The difference in the level of common ownership is due to the difference in samples, whereas a majority of generic entrants in our sample are predominantly owned by under-diversified blockholders and insiders. As for the decomposed components, the mean cosine similarity steadily increased from 0.07 in 2004 to 0.19 in 2017, whereas the mean IHHI increased from 0.13 to 0.23. Panel B of Figure 2 provides histograms of the distribution of *Kappa20* across generic-brand pairs in 2004Q1 and 2017Q4, respectively.

5 Empirical results

In this section, we test the two predictions derived from the model. We present baseline regression results using fixed-effect panel regressions and the instrumental variable approach. In Section A.1 of Online Appendix, we present a theoretical framework that guides our empirical analysis. Specifically, we derive theoretical predictions that guide our empirical regression specifications in Subsection 5.3 and Subsection 5.4, respectively.

5.1 Sample

Our ownership data start in 2004. However, we also exclude patent-infringement lawsuits filed prior to the fourth quarter of 2003 for another important reason. That is, on December 8, 2003, President George W. Bush signed the Medicare Prescription Drug, Improvement, and Modernization Act (MMA) into law, after it passed in Congress by a close margin. The new regulation limited each patent owner to only *one* 30-month stay of a generic-drug applicant's entry for resolution of a patent challenge. The FTC began receiving patent settlement agreements in January 2004 pursuant to the MMA of 2003.[16]

To understand how the first generic entrant is determined, a key step is identifying which generic manufacturers might make the first attempt to enter the market. It is improper for us to only include actual Paragraph IV filers because, without conditioning on actual filers racing to be the first generic, common ownership might lead to lower fake entry rates.[17]

As such, our sample on the determinants of the first generic includes both those who filed challenges under Paragraph IV (actual filers) and those who, based on observable characteristics, were likely to enter but ultimately did not file challenges (potential filers). These two types of firms weigh the costs and benefits to decide whether to challenge existing patents or wait. If they choose to challenge, they then consider whether to take the case to court or settle.

Following Scott Morton (1999), Scott Morton (2000), Scott Morton (2002), and Kyle

[16] Prior to the new regulation, because a lawsuit typically triggers a 30-month stay of the FDA approval of generic drugs, brand incumbents often listed additional patents to trigger multiple, non-concurrent 30-month stays, thereby delaying entries without using pay-for-delay settlements. For legal background, see Legislative and Regulatory Responses to the FTC Study on Barriers to Entry in the Pharmaceutical Marketplace: Hearing Before the Committee on the Judiciary, United States Senate, One Hundred Eighth Congress, First Session, June 17, 2003. (U.S. Government Printing Office, 2003).

[17] Newham et al. (2019) examine a setting of Paragraph III, where the expiration of patent protection opens up the entry decisions of generic manufacturers into drug markets. The authors find an increase in common ownership leads to a reduction in actual generic entry. Geng et al. (2025) find common ownership reduces the likelihood of patent litigation between firms.

(2006), we use data from the FDA Orange Book and apply three criteria to identify generic firms that did not file Paragraph IV challenges but had the potential to do so. First, we assess a firm's activeness in the generic drug market by counting its total number of ANDA applications, regardless of the type of Paragraph certification. Second, the generic firm must have prior production experience matching the branded drug's drug-dosage form/route. Third, the generic firm must have experience in the same therapeutic category as the branded drug.[18] These criteria help us identify generic firms with the capability to challenge patents but chose not to do so.

For each year-quarter, we rank generic firms based on the three criteria outlined above. To qualify as a potential entrant in our analysis, a firm must rank in the top 5th percentile across all three metrics. On average, these firms have submitted 57 ANDA applications to the FDA, shared dosage form and administration route expertise with the branded drug 12 times, and entered the same ATC2 therapeutic market as the branded drug 16 times.[19] The sampling procedure above yields 1,597 actual filers and 1,659 potential filers that are included in our sample.

5.2 Common ownership does not change around Paragraph IV challenges and lawsuits

Before our formal analysis, we first assess two theoretical possibilities in which the level of common ownership could change prior to the arrival of either a Paragraph IV challenge or a subsequent patent-infringement lawsuit. First, shareholders of a brand plaintiff might anticipate the above events in advance, and as a result, they actively invest upfront in stakes in all potential generic entrants to "create" more common ownership. With common ownership, the two litigating parties' commitment to a settlement becomes more credible and the generic defendant will have to accept a worse deal in settlement to protect its financial position in the brand plaintiff. If the above scenario is true, we might find a correlation between common ownership and Paragraph IV challenge (or settlement) whose interpretation would be different than if ownership were pre-determined.

Second, brand plaintiffs can make more credible threats to go to trial by taking a short

[18] We categorize therapeutics using the 2-digit Anatomical Therapeutic Chemical (ATC) Classification System.
[19] Our findings remain robust to using alternative thresholds to define potential entrants.

position in generic defendants' stock (see Choi and Spier, 2018).[20] If the above conjecture is true, an observed positive correlation between common ownership and settlement might be driven by a negative effect of brand ownership of the generic on the likelihood of two litigating parties *not* going to trial.

To examine whether evidence for these hypotheses exists, we estimate the following ordinary linear squares (OLS) equation on the sample in which at least one shareholder of the generic entrant holds stakes in the brand incumbent. Sample units are measured at the generic-brand-year-quarter level:

$$Kappa20_{jks} = \alpha + \sum_{s=-8}^{s=+8} \beta_s \times First\ Filling_{jks} + \phi_j + \phi_k + \phi_s + \varepsilon_{jks}, \tag{4}$$

where $First\ Filing_{jks}$ is a dummy variable indicating the s^{th} $(-8 \leq t \leq 8)$ quarter relative to the event quarter in which the first generic j files a Paragraph IV challenge against brand firm k, and 0 otherwise. *Kappa20* is the profit weight that the top 20 shareholders of a generic defendant put on the brand plaintiff as of the beginning of the quarter in which a patent-infringement lawsuit is filed (see equation (2)). Figure 3 plots $\hat{\beta}_t$ and the 95% confidence intervals estimated from equation (4). The coefficients are not statistically different from zero. In other words, we fail to detect any systematic changes in common ownership around the Paragraph IV application by the first generic.

Figure 4 plots $\hat{\beta}_t$ and its 95% confidence intervals from estimating the following equation:

$$Kappa20_{jks} = \alpha + \sum_{s=-8}^{s=+8} \beta_s \times Lawsuit_{jks} + \phi_j + \phi_k + \phi_s + \varepsilon_{jks}, \tag{5}$$

where $Lawsuit_{jks}$ is a dummy variable indicating the s^{th} $(-8 \leq t \leq 8)$ quarter prior to a litigation initiated by brand plaintiff k against generic defendant j, and 0 otherwise. We again do not detect any systematic changes in common ownership around when brand-name incumbents file a lawsuit against generic Paragraph IV filers.

[20] See also "New Hedge Fund Strategy: Dispute the Patent, Short the Stock" (Wall Street Journal, April 7, 2015).

5.3 Determinants of the first generic

In this section, we establish our first main result. Specifically, we ask whether generic manufacturers are more likely to be the first filer if their shareholders hold more brand shares. Given competition among multiple generic firms, private coordination between commonly owned entrants and incumbents — that is, potential entrants with common ownership stay out of the drug market — seems to be an ineffective mechanism to block other potential entrants from entering the same market. Instead, from the perspective of a common owner, joint-value maximization implies generic manufacturers with common ownership should secure the 180-day exclusivity by challenging the branded drug as early as possible.

In the sample that includes both actual and potential filers (see Subsection 5.1 for details), we use the following linear probability model to estimate the effect of common ownership on the likelihood that a Paragraph IV filer is the earliest filer:

$$First_{jkms} = \alpha + \beta \times Common\ Ownership_{jks-1} + X' \times \gamma_1 + \phi_k + \phi_j + \phi_l + \phi_s + \varepsilon_{jkms}, \quad (6)$$

where $First_{jkms}$ indicates whether j is the first generic manufacturer among all firms that file Paragraph IVs to challenge patents covering the branded drug m owned by brand firm k. Common ownership (*Kappa20*) for a generic manufacturer j is measured as of the beginning of year-quarter s in which the first generic files. The vector of X' includes the following variables: (1) a set of dummy variables indicating a drug's market size regarding sales (if observable),[21] (2) a dummy indicating whether a generic is the first challenger of the formulation of a trade name, (3) a dummy indicating whether several generics simultaneously challenge patents protecting a brand drug, (4) a dummy indicating whether a generic j has production experience in the brand drug's form/route (*Route*) over the past three years, (5) a dummy indicating whether a generic j has production experience in the brand drug's therapy class (*Therapy*) over the past three years, and (6) the logarithm of the number of patents covering the branded drug. To address omitted variables, we use ϕ_j, ϕ_k, ϕ_l, and ϕ_s to capture fixed effects from the generic defendant j, the brand plaintiff k, the federal district court l, and the year-quarter s when the

[21] We create a set of indicator variables coded as 1 if the branded drug at issue is ranked between N-24 and N among the top 200 pharmaceutical drugs by retail sales in the year when the lawsuit was filed. The benchmark group is brand drugs that were ranked below 200 and hence their sales were not publicly available.

brand sues. We cluster standard errors at the level of U.S. Federal District Court.[22]

Panel A of Table 4 presents descriptive statistics for our sample. After accounting for potential entrants, the share of the first generic challenger is 17.4%. Prior to the first generic filing a Paragraph IV with the FDA, our unreported statistics indicate that 22.2% of generic-brand pairs have common ownership. The mean and standard deviation of *Kappa20* (*Kappa5*) are approximately 4.2% (3.6%) and 13.5% (13.1%), respectively. Finally, the frequency with which the top 20 generic shareholders put more than 10% weight on the brand is 11.2%.

Panel A of Table 5 presents the linear probability estimates of the effect of common ownership on the likelihood of a generic manufacturer acting as the first Paragraph IV filer. For simplicity, we report only the main independent variable of interest in Table 5, while we provide the full set of estimated coefficients in Table A.3 of Online Appendix. Through all regression specifications, common ownership strongly positively predicts that a generic will be the first filer. A one-standard-deviation increase in common ownership (*Kappa20*) is associated with a 3.2- to 4.3-percentage-point increase in the likelihood of being the first generic. This number is about 18.2%-24.8% of the sample mean.

We now examine the robustness of these results. In Panel B of Table 5, we construct a dummy variable indicating whether the level of *Kappa20* exceeds a certain cutoff (i.e., 10%) to address the concern that the baseline results are driven by the nonlinearities in the way *Kappa20* is calculated.[23] On average, generic defendants putting more than a 10% profit weight (*Kappa20*) on the brand plaintiff are 8-10 percentage points more likely to be the first Paragraph filer.

Following Backus et al. (2021), we also decompose *Kappa20* into two sub-components — cosine similarity structure and investor HHI — to evaluate the separate effects of overlapping ownership and shareholder concentration on the determinants of the first generic. Panel C and D present the estimates for cosine similarity and investors' HHI. The results show the effect of common ownership on the first filer is driven by the cosine similarity but not investor

[22] Our estimates are quantitatively similar if we cluster standard errors at the level of generic defendant or at the level of drug market (identified by the trade name). Each trade name identifies a unique active ingredient and thus captures unobservables such as expected revenue of the brand before patent expiration, elasticity of demand, customer mix, switching costs, FDA regulations, and advertising intensity (Scott Morton, 1999, 2000).

[23] We choose 30% as the cutoff to estimate the impact of common ownership on fake entry because our untabulated statistics suggest that the market capitalization of the brand is, on average, about three times that of the generic. This suggests that for generic shareholders to care more about the brand than their own firm, they would need to place at least 30% weight on the brand firm. Our estimates remain similar if we choose any cutoff ranging from 0% to 50%.

concentration.

In Panel E, we estimate specifications that assume control only by the largest five generic shareholders in the calculation of common ownership. As Panel E of Table 5 shows, common ownership by the five largest generic shareholders significantly increases the likelihood that a generic firm becomes the first Paragraph IV filer.

As a complement to the above top-five-shareholder analysis, we also run two placebo tests that do the opposite: we calculate the common ownership as if only shareholders ranked below the top five, or below the top 10, controlled the generic firm. Estimates from Panels F and G of Table 5 suggest common ownership calculated in these two ways does not predict who will become the first Paragraph IV challenger. We interpret this result as a successful "placebo" test: a measure calculated only with shareholders who do not have much influence over the firm does not help predict who will be the first entrant.

5.4 Determinants of settlement

In this subsection, we test whether common ownership also predicts the likelihood of settlement conditional on patent challenges.

In the main specification, we regress a dummy variable — indicating whether two litigants enter into a settlement agreement — on common ownership, measured as the profit weight (*Kappa20*) that the top 20 shareholders of the generic defendant assign to the brand plaintiff. Many factors affecting litigation outcomes may also be correlated with common ownership. In our baseline analysis, we address various such omitted variable concerns with explicit controls and a full set of defendant, plaintiff, court, and time fixed effects.

Specifically, in the sample that only includes actual Paragraph IV filers, we lay out the following linear probability regression model:

$$Settle_{jkms} = \alpha + \beta_1 \times Kappa20_{jks-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \varepsilon_{jkms}, \tag{7}$$

where $Settle_{jkms}$ is an indicator variable equal to 1 if the two litigants entered into a consent decree with respect to *at least* one patent dispute triggered by lawsuit i filed by brand plaintiff k as of year-quarter s against generic defendant j challenging the brand drug m, and 0 otherwise.

Panel B of Table 4 presents descriptive statistics of our regression sample. We first note

substantial variation exists in settlement outcomes. Namely, 37.8% of lawsuits were settled, 36.3% were dismissed, and only 27.4% went to trial. Conditioning on trial, unreported statistics (at patent level) reveal a 53.5% chance that the brand plaintiff will lose an infringement lawsuit.[24] Second, for about 30.9% of cases, at least two generic manufacturers were involved with challenging patents covering the same branded product on the same day.[25] Third, the share of the first generic challenger accounts for 32.8%. Fourth, generic manufacturers on average challenged 1.5 patents in each case. Fifth, about 23.9% and 55.2% of Paragraph IV challenges were initiated by generic manufacturers with previous production experience in dosage form/route and therapy class, respectively.

Table 6 presents results from our baseline panel regressions. Column (1) regresses the dummy variable indicating settlement on our principal measure of common ownership (*Kappa20*) without adding any control variables and fixed effects. Common ownership (*Kappa20*) is significantly positively associated with the likelihood of settlement. A one-standard-deviation increase in *Kappa20* is associated with an almost 4-percentage-point increase in the settlement rate. This number is approximately 11% of the sample mean. Column (2) includes a set of drug- and firm-level covariates, and our coefficient estimates for *Kappa20* are almost identical. As columns (3) – (5) suggest, our estimates are robust to the inclusion of district-court, year, defendant, and brand fixed effects. In Table A.4 of Online Appendix, we provide a full set of coefficients estimated from equation (7). Regarding coefficient estimates for other covariates, the first generic is 11 percentage points more likely to settle, simultaneous Paragraph IV challengers are 6 percentage points more likely to settle, generic defendants with previous experience in dosage form/route are 4 percentage points less likely to settle, generic defendants with previous experience in therapy class are 10 percentage points less likely to settle, and the two litigating parties having disputes over top-ranked drugs are less likely to settle.

All specifications use firm fixed effects to remove firm-invariant characteristics and time fixed effects to account for trends in settlement that are firm specific and may change over time. The inclusion of these fixed effects ensures we avoid spurious inferences from time trends or time-invariant firm entry/entry-deterrence policies. Importantly, because our regressions

[24] Our statistics are broadly consistent with Jacobo-Rubio et al. (2020), who examine 274 Paragraph IV ANDAs filed between 1985 and 2010. In their sample, approximately 18% of cases are resolved without going to court. Settlements are fairly common, making up about 36% of outcomes, while 46% proceed to trial. Among those litigated cases, generic firms prevail around 40% of the time.

[25] We observe several generic manufacturers simultaneously challenging the same branded product on the same date after the data exclusivity expires (see Figure A.1 of Online Appendix for details).

include firm (and year-quarter) fixed effects, the results should be interpreted as within-firm (and within-time) associations. Not only are the two litigating parties with high common ownership more likely than parties with low common ownership to settle, but generic firms also appear to adjust their preferences toward settlements depending on whether their shareholders currently place a lot of weight on the profits of patent owners.

Panels B–G of Table 6 provide robustness checks in a spirit similar to Table 5. Specifically, we use various alternative forms of common ownership. We also conduct placebo tests by assuming only shareholders ranked below the top five, or below the top 10, controlled the firm. We reach the same conclusion: common ownership of the several largest generic shareholders is positively correlated with the likelihood of settlements.[26]

5.5 Variation due to the BlackRock-BGI acquisition

The above discussion illustrates that the fixed effects employed in the panel regressions difference out a large number of potentially omitted variables and associated biases in the estimates. However, time-varying omitted variables may persist; also, the results could be due to reverse causality: common ownership could be correlated with shareholders' anticipation of entries, lawsuits, and settlements. To examine whether this explanation of our panel results is likely, we focus on variation caused by BlackRock's acquisition of Barclays Global Investors (BGI) in 2009.

5.5.1 Background on BlackRock's acquisition of BGI

Following the financial crisis that began in 2007, Barclays tried to strengthen its balance sheet. On March 16, 2009, Barclays received a $4 billion bid from CVC Capital Partners for its iShares family of exchange-traded funds, along with an option to solicit competing offers. BlackRock announced a bid to acquire iShares' parent division, BGI, for $13.5 billion on June 11, 2009 (i.e., in 2009Q2). The history of Barclays' attempt to sell iShares to investors other than BlackRock suggests the divestment decision was not driven by considerations regarding how the iShares portfolio would combine with BlackRock's portfolio to affect Paragraph IV litigation

[26] As an unreported robustness check, we restrict the sample to brand-generic pairs in which both parties are publicly listed. We do so because we consider the fact that pairs with a zero possibility of having common ownership (e.g., private-public or private-private pairs) might differ systematically from public-public pairs with a positive probability of having common ownership. The estimates suggest even larger magnitudes for the positive association between common ownership and settlement rate.

outcomes. Moreover, world-wide pharmaceutical stocks constituted only a very small share of BGI's portfolio, and thus, pharmaceutical companies were unlikely to be pivotal to BlackRock's decision to acquire BGI for the purpose of influencing Paragraph IV challenges, which alleviates reverse causality concerns.

Although pharmaceutical stocks constituted only a small part of the merging parties' portfolios, both BlackRock and BGI were among the largest owners of some drugmakers but not others. The variation across portfolio firms in the extent to which the BlackRock-BGI combination changed their ownership structure translates into variation across brand-generic pairs because different combinations of brand incumbent and generic entrant litigate in response to different Paragraph IV challenges.

We illustrate the above point using two examples. In the first example, BlackRock was the largest and BGI was the 11th largest shareholder of Abbott Laboratories (i.e., generic defendant) in 2009Q1. As a result, merging BlackRock and BGIs' equity portfolios had a positive but small effect on Abbott's ownership structure. At the same time, BlackRock was the second largest and Barclays was the third largest shareholder of Medicis Pharmaceutical Corporation (i.e., brand plaintiff) in 2009Q1, and a hypothetically combined BlackRock-BGI entity would have been the first largest shareholder of the brand firm in 2009Q1, and hence much more powerful. In this example, the implied change of common ownership is positive.

In the second example, BlackRock held the largest stake in Amgen (i.e., generic defendant) before the merger and BIG held the 13th largest stake. As a result, merging BlackRock and BGIs' equity portfolios increased BlackRock's power in Amgen's ownership structure. By contrast, although BlackRock was the fifth largest shareholder of Cephalon (i.e., brand plaintiff), BIG did not hold any shares in Cephalon, and hence, a hypothetically combined BlackRock-BGI entity would not have changed Cephalon's ownership structure.

5.5.2 Instrumental variable approach

For each brand-generic pair, we start by calculating generic shareholders' profit weight on the brand plaintiff as of 2009Q1 ($Kappa20^{09Q1}$), the quarter before the acquisition was announced. We then calculate the counterfactual, common ownership ($\widehat{Kappa20}^{09Q1}$) for the same pair in the same quarter with the only difference being that we treat the holdings of BlackRock and BGI as if they had been held by a single entity already. We label the difference between the

latter and the former the "implied change in common ownership ($\Delta Kappa20$)," expressed as follows:

$$\Delta Kappa20_{jk} = \widehat{Kappa20}_{jk}^{09Q1} - Kappa20_{jk}^{09Q1}. \tag{8}$$

Figure 5 plots histograms of the distribution of implied percentage changes in *Kappa20* across 1,743 Paragraph IV lawsuits included in the regression sample of Table 6.

The *exclusion restriction* is that the cross-sectional distribution across generic Paragraph IV patent challengers in the implied increase in common ownership from a hypothetical, pre-merger combination of BlackRock and BGI's equity portfolios is uncorrelated with errors in the entry and settlement regressions (see equations (6) and (7)). This assumption could fail, for example, if we systematically mismeasured drug-level characteristics causing challenge and settlement at brand-generic pairs in ways that begin to correlate after the acquisition, with the increase in common ownership implied by a hypothetical combination of pre-announcement ownership of BlackRock and BGI. Although we are not aware of a particular reason to expect such a correlation, such a possibility remains a limitation of our analysis.[27]

The benefit of a continuous-treatment version of instrument is that it makes use of more variation; the relative cost of using it is to potentially increase measurement error. To mitigate the concern of measurement error while using more variation, we transform the measure in equation (8) into percentile rank forms ($\Delta Rank_{jk}$).[28] By doing so, we construct our instrumental variable for *Kappa20* as follows:

$$IV = \Delta Rank_{jk}. \tag{9}$$

Panel As of Table 7 and Table 8 present the first-stage regressions with respect to the determination of first entry and the settlement rate. The percentile-rank-transformed, implied change in common ownership is a strong instrument for the level of common ownership during the post-2009Q2 period. Specifically, the *F-statistics* from weak identification tests are 160 (column (5) of Table 7) and 36 (column (5) of Table 8) for the two most restrictive specifications. Panel Bs of Table 7 and Table 8 report the second stage of the IV estimation. We find a positive and economically sizable effect of common ownership on both the likelihood of first

[27] One concern regarding our exogeneity assumption is that the composition of portfolios for BGI and BlackRock might have been similar, which motivated BlackRock to acquire BGI. In this case, the implied changes in Kappa ($\Delta Kappa20$) are likely to be highly correlated with the levels of actual Kappa as of 2009Q1 ($Kappa20^{09Q1}$). We examine this concern, and find the correlation between $\Delta Kappa20$ and $Kappa20^{09Q1}$ is zero.

[28] Our results are similar when we use the continuous-treatment version of instrument. The results are available upon request.

entry and the likelihood of settlement. The effect is positive and highly statistically significant, with coefficients ranging from 0.38 to 0.82 in Table 7 and 0.11 to 0.39 in Table 8, which are markedly higher than the effects estimated in panel regressions.[29]

5.6 Multiple generics challenging patents on the same day

As a robustness check, we repeat the same analysis in equation (7) but exclude branded drugs whose patents are challenged by more than one first-generic manufacturer on the same day. Table A.5 of Online Appendix presents results estimated from both the linear probability model and IV approaches. Compared to Panel A of Table 6 (linear-probability estimates) and Panel B of Table 8 (IV estimates), the size of coefficients and statistical significance remain similar.

For background, same-day patent challenges typically occur when the expiration of the exclusivity period allows generic manufacturers to submit ANDAs containing a paragraph IV certification, and multiple ANDA applicants compete to be first generic. In the Hatch-Waxman Act of 1984, the U.S. Congress did not address the specific situation in which multiple ANDA applicants would submit patent challenges on the same day. Similarly, the FDA does not address this specific situation either. The FDA, however, intends to treat all generic manufacturers challenging patents on the same day as first generics, and to allow all first generics to share the 180-day exclusivity.[30]

6 Do settlements transfer wealth?

In this section, we show that by using settlements, common owners transfer wealth within their portfolio from the first generic challenger to the brand.

[29] Our research design is not affected by generic criticisms of using institutional mergers as a source of identification. Lewellen and Lowry (2021) argue differential effects of the BlackRock-BGI merger across a broad sample of treatment versus control firms across industries could be contaminated by how firms from different industries responded to the financial crisis differently. Our within-industry analysis does not use across-industry variation for identification. Second, we estimate both the baseline and IV strategy by excluding Paragraph IV lawsuits that occurred during the Great Recession, and we document that the positive correlation between common ownership and the likelihood of settlement remains fairly robust. Our results are available upon request.

[30] Specifically, during the 180-day exclusivity period, FDA may approve any other first ANDA applicants, but no other applicants. Any first applicant whose ANDA is approved after start of the exclusivity period will share the remaining days of exclusivity. For technical details, see Guidance for Industry 180-Day Exclusivity When Multiple ANDAs Are Submitted on the Same Day.

6.1 Stock returns around settlement

If common ownership delays generic entry more, the life of a branded drug should be extended longer after a settlement, and hence, the brand plaintiff's stock price surrounding the settlement agreement should increase with the level of common ownership. Similarly, if influential generic shareholders put more profit weights on the brand plaintiff and are willing to accept a deal that destroys generic shareholder value, the generic defendant's stock price surrounding the settlement agreement should decrease with the level of common ownership.

We specify the following regression for the event study. Specifically, we compare event stock returns surrounding settlements between the first and other generics, and across generic firms with differential profit weights that the top 20 generic shareholders put on the brand plaintiff (*Kappa20*):

$$\begin{aligned} CAR_{jki} = \alpha + \beta_1 \times First_{jkm} \times Kappa20_{jks-1} + \beta_2 \times Kappa20_{jks-1} + +\beta_3 \times First_{jkm} \\ +X' \times \gamma + \phi_k + \phi_l + \varepsilon_{jki}, \end{aligned} \tag{10}$$

where CAR_{jki} is the cumulative market-adjusted return for the brand plaintiff over the window of (-5, +5) relative to the event day on which the generic defendant(s) j and the brand plaintiff k enter into a settlement agreement with respect to lawsuit i.[31]

The first four columns of Table 9 estimate the impact of common ownership on the change in firm value for brand plaintiffs around settlements. Across all specifications, we show that brand-value creation through settling with the first generic only occurs if the generic defendant places a higher profit weight on the brand. As our estimates suggest, a settlement with the first generic does not increase brand value in the absence of common ownership with the brand. However, brand plaintiffs experience positive daily abnormal returns if they settle with first generics that have high common ownership. A one-standard-deviation increase in *Kappa20* raises brand value by 0.7%-1% after the first generic settles with the brand. Our results in the first four columns are consistent with the notion that settlements deter generic entry by delaying marketing under the protection of 180-day exclusivity. We find that the common

[31] One assumption that underlies equation (10) is that all Paragraph IV litigations are conducted in the form of public hearings, in which interested parties are well aware of the resolution of the patent disputes. Unfortunately, our data do not distinguish between public and private hearings in recording the disputes. We therefore likely have measurement error in our dependent variable, which possibly biases the analysis against finding a significant relation.

ownership effects on settlements entered into by the first generic only exist in situations where top generic shareholders have sufficiently large cashflow incentives in the brand incumbent.

Panel A of Figure 6 visualizes the dynamics of cumulative abnormal returns for stocks of settled brand incumbents. To mirror the event-study regression analysis, we separately plot dynamics for brand stocks with and without high common ownership. We classify stocks into the high-common-ownership group if their *Kappa20* is above 0.3 and into the low- or zero-common-ownership group if *Kappa20* is either positive but below 0.3 or zero. We show both groups experienced a sizable jump in abnormal returns immediately after the event, suggesting settlement with the first generic indeed extends the monopoly life of branded drug. However, the high-common-ownership group outperforms its counterpart by an extra 1%, and their stock prices start to run up even before the settlement date, suggesting the market anticipates settlement. More interestingly, abnormal returns of the group with low common ownership go down before the event day, suggesting the market anticipates negotiation breakdowns due to fierce competition between the two litigants without common ownership.

We next investigate the value implications of common ownership for generic Paragraph IV filers entering into settlement agreements. We find that, although the settled first generic without common ownership earns 0.7%-9% abnormal returns over the window (-5, +5), the settled first generics with higher common ownership experience more negative returns. The second four columns of Table 9 present our estimation results. In columns (5)-(8), we show that a one-standard-deviation increase in *Kappa20* reduces generic value by 0.8%-1% following a settlement agreement between the first generic and the brand. These results are consistent with the theory that generics with a shareholder base holding significant stakes in the brand are more likely to sacrifice their own position to block entry by other generics, who would either compete more aggressively or extract higher settlement fees from the brand.

Panel B of Figure 6 visualizes the dynamics of cumulative abnormal returns for stocks of settled first generics. In contrast to stocks from the low-common-ownership group, which experienced positive abnormal returns surrounding the settlement event, stocks for the high-common-ownership group experienced negative returns around settlement, consistent with common ownership causing wealth transfer from the first generic to the brand plaintiff through the (publicly unobservable) deals structured by pay-for-delay settlements.

In the next section, we calculate the dollar amount of transferred wealth within each

individual shareholder's portfolio from one firm to another.

6.2 Estimating the dollar amount of wealth transfer

We estimate each individual shareholder's losses and gains around settlement agreements. This empirical exercise serves two purposes. First, our shareholder-level analysis responds to Harford et al.'s (2011) concern with the literature started by Matvos and Ostrovsky (2008). Namely, on the one hand, influential generic shareholders might have smaller stakes in the brand and, therefore, care little about whether branded sales fall off the patent cliff; on the other hand, generic shareholders with large brand stakes might have little influence in the generic and are unlikely to influence generic-firm behavior. Although our measure of *Kappa20* weights each shareholder's generic stakes to calculate the profit weight that she assigns to the value of brand firms, by treating all cross-held shares as a consolidated block, we are not able to completely exclude a spurious correlation between the large brand stakes of some shareholders and the large generics stakes of others, which might lead to incorrect conclusions about shareholders' objectives.

Second, even if the most influential generic shareholders hold large enough stakes in the brand, one needs to ensure the economic gains for them to promote anticompetitive behaviors outweigh the costs. Lewellen and Lewellen (2021) estimate that an average institution's economic gain from promoting collusion is too small to justify costly engagement and coordination by common owners, presumably because institutional investors overweight in own firms and underweight in rival firms.

We thus calculate dollar amounts that institutional investors gain or lose from potentially anticompetitive settlements in narrowly defined industries occupied by one incumbent and one potential entrant. Note a lessening of competition implies asymmetric dollar amounts of gains (losses) per 1% increase (decrease) in the value of the incumbent (entrant), because the size of an average incumbent is much larger than that of an average entrant.

Table 10 presents our shareholder-level estimation of the average wealth changes experienced by individual common owners surrounding settlements between the first generic and the brand. We identify a total of 654 shareholders of the settled first generic who also held stakes in the brand as of the date the lawsuit was filed. Each individual shareholder is assigned to a different basket based on the rank of their corresponding generic ownership. For

example, *Rank*="Top 1" refers to the largest shareholder of the settled first generic, while *Rank*="Top 1-3" refers to the top three largest shareholders.

Below, we illustrate how we calculate averaged generic-side wealth changes around settlements:

$$\Delta W^g = \frac{\sum_{i=1}^{n} CAR(\text{-}5,\text{+}5)_i^g \times Shares_i^g \times Value_i^g}{N}, \tag{11}$$

where $CAR(\text{-}5,\text{+}5)_i^g$ is the cumulative market-adjusted returns of the settled generic firm held by shareholder i over the $(-5,+5)$-day window centered on the settlement event. $Shares_i^g$ is shareholder i's stake (in percent) in the generic as of when a lawsuit starts. $Value_i^g$ is the generic's stock-market capitalization (millions USD) six trading days prior to the settlement event.

Table 10 presents a striking pattern: on average, most shareholders of the settled first generic experience losses on the generic, but their gains on the brand more than compensate for these losses. More importantly, this pattern only holds among generic shareholders who put a sufficiently high profit weight on the settled brand plaintiff. In Panel A, we present our calculation by combining all common owners in each rank category, without distinguishing the level of *Kappa*. For the largest shareholders, their average generic losses are \$150 million, but averaged brand gains are \$472 million. These gains exceed the losses incurred by the largest shareholders in the first generic by \$322 million. As we examine the two largest, three largest, and four largest shareholders, we observe that their generic losses are also much smaller in dollar terms compared to their brand gains. For example, the top three largest shareholders, as a coalition, lose an average of \$90 million on the generic, but they gain \$377 million from the brand. A similar pattern applies to other top N shareholder coalitions.

In Panels B and C of Table 10, we compare generic losses with brand gains by distinguishing whether *Kappa20* at the level of the generic firm exceeds the 30% cutoff. When common ownership is high, as Panel B suggests, the largest shareholders lose \$258 million on the generic side but gain \$840 million on the brand side; on average, the top three shareholders lose \$148 million in the generic but gain \$607 million in the brand. When common ownership is low, as Panel C suggests, the largest shareholders gain \$159 million on the generic side but lose \$634 million on the brand side. On average, the top three shareholders gain \$62 million in the generic but lose \$246 million in the brand. These contrasting patterns between the two panels are consistent with generic firms maximizing the portfolio value of their largest investors. In

particular, when common ownership is low (e.g., the average *Kappa20* in this group is 0.15), the first generic firm erodes the brand's profit margin by negotiating a pay-for-delay settlement.[32]

6.3 Stock returns around the time the first generic files Paragraph IV

Our event-study analysis in equation (10) only measures the wealth effects around settlements. The analysis does not include the reaction of stock markets around when the first generic files a Paragraph IV challenge. One theoretical possibility is that the net wealth effects are overall negative for the brand incumbent despite the positive abnormal returns around settlements. We therefore ask the following questions: How do stock returns react to Paragraph IV challenges filed by the first generic? Do stock markets anticipate that what will eventually happen (i.e., settlement between the first generic and brand) implies wealth effects for the two disputing parties?

The first four columns of Table 11 estimate the impact of common ownership (calculated from the generic to the brand) on the value of brand-name incumbent (-5, +5) days relative to the date on which the first generic files a Paragraph IV challenging the brand.[33] We show the profit weight that generic shareholders put on the brand is strongly positively associated with the brand's abnormal daily returns, suggesting the stock market anticipates that, with a higher level of common ownership, a resolution of dispute can be more anticompetitive. As the next four columns of Table 11 show, however, common ownership bears zero correlation between abnormal daily returns associated with the first generic. The non-results of the last four columns are likely due to the sample for this analysis being unrepresentative. More generic firms than brand incumbents are private firms. As such, no inference can be made from this supplementary analysis on the overall level of wealth gains in the portfolio of the shareholders.

[32] Note that the shareholder-level average returns do not necessarily need to align with firm-level returns, as shown in Figure 6. For example, if more common owners are present in firms experiencing negative returns around settlement, then even if the average firm-level returns around settlement are zero, shareholder-level returns may be negative.

[33] Unfortunately, Paragraph Four Report® does not provide us with dates in which non-first generic manufacturers file Paragraph IVs with the FDA. As a result, we are not able to benchmark brand returns around the first generic entry with brand returns around other generic entries.

6.4 Governance Mechanism

One potential mechanism through which the first generic, by destroying its own value, settles with the brand is that generic directors "interlock" by also serving on the boards of the brand. Indeed, the Clayton Act of 1914 outlawed board overlap between close competitors. The generic-brand board interlock can be created by generic directors having a connection to either the brand or to common owners. To check whether the wealth transfer is due to board interlock, we focus on the 22 generic-brand pairs in which the settled first generic experienced negative cumulative market-adjusted returns around the event of settlement. We use these firms' proxy statements to manually check whether, in the year the settlement happened, generic directors were connected to either the brand or to the largest shareholders holding both the generic and brand. We fail to find any evidence suggesting board interlock is associated with our results.[34]

A second related issue is that if settlements that destroy their own firm's value expose the CEOs of generic manufacturers to significant litigation risk, it is not clear whether these CEOs, with their own career concerns, would have enough incentives to go against the interests of their own shareholders. To assess whether this channel might be relevant and explain our results, we collect data from the Federal Judicial Center's (FJC) Integrated Database on the type of civil lawsuits, their object, and the litigating parties to assess the extent of litigation risks facing generic CEOs who entered into value-destroying settlement agreements.

We notice that the management teams of generic manufacturers are typically subject to two types of litigation risk. First, they have frequently been sued by investors for violating shareholder fiduciary duties as stipulated by the Securities Exchange Act of 1934, either due to false and misleading statements or because of their failure to disclose value-relevant information.[35]

[34] We found only three cases suggesting generic directors had a very remote connection to the brand incumbent. When Perrigo and Medtech Products settled in 2008Q1, Gary K. Kunkle, Jr. (then lead independent director of Perrigo) served as president of Vistakon, a division of Johnson & Johnson, which was the parent of Medtech Products. When Teva and Bristol-Myers Squibb settled in 20093Q, William S. Marth (then President and CEO of Teva North America) held various positions with the Apothecon division of Bristol-Myers Squibb prior to joining Teva in July 1999. When Teva settled with Merck in 2009Q2 and 2009Q3 concerning different drugs, Abraham E. Cohen (then director of Teva) was a Senior Vice President of Merck & Co. from 1982 to 1992.

[35] In the cases Highfields Capital I LP v. Perrigo Co. and Burlington Loan Management DAC v. Perrigo Co., filed on March 10, 2020 and February 12, 2020, respectively, the plaintiffs claimed that most Perrigo shareholders rejected the offer due to false statements made by the defendants while resisting Mylan's hostile takeover bid during the relevant period. In the case Linus Aruliah v. Impax Laboratories Inc.; Larry Hsu; G. Frederick Wilkinson, filed on August 13, 2014, the plaintiffs argued that false and misleading statements about quality control issues at Impax's Taiwan production facility kept shareholders uninformed about the new drug Rytary. In the case Mulligan v. Impax Labs., Inc., filed on March 7, 2013, the plaintiffs alleged that the defendants made several false statements and failed to disclose various adverse facts about Impax, thereby misleading the investing public about Impax's prospects and business.

Second, because pay-for-delay settlements hurt customer welfare, generic firms have been sued by the FTC and the states for violating either the Sherman Act or the Clayton Act.[36] In fact, generic managers are more often sued for other antitrust reasons, including collusion among generic firms and opioid distribution.[37] However, since these antitrust lawsuits occur very infrequently, take place much later after Paragraph IV litigations are settled, and can take many years to resolve, generic managers face either negligible or remote litigation risks as a result of entering into settlements. In fact, we did not observe any lawsuits related to the value-destroying settlements.

The last issue concerns whether brand-name incumbents, who suspiciously engage in pay-for-delay practices, face a significant risk of litigation. While both intuition and anecdotal evidence suggest such a risk exists, there are compelling arguments that the threat of litigation is not substantial enough to deter settlement agreements. First, within the legal framework of settlements, risk-averse litigants are permitted to resolve disputes through negotiation. As such, reverse payments are not necessarily anti-competitive, especially when risk aversion and asymmetric information shape decision-making processes (Shapiro, 2003). For example, when the FTC challenged reverse payment settlements as anti-competitive, some courts ruled that as long as the generic drug's entry date preceded the patent's expiration, the settlement was within the "scope of the patent" and therefore beyond the reach of the antitrust laws.[38] Second, specialized expertise in pharmaceutical patent law is scarce. Due to staff shortages and budget limits, the FTC only focuses on the most egregious pay-for-delay cases.[39]

For each generic-brand pair that entered into settlements destroying generic value, we also manually searched for lawsuits filed by the FTC against the brand regarding pay-for-delay

[36] To illustrate, we present several such examples, but none of them seem to have been triggered by settlements in our sample. In the case Maryland et al. v. Perrigo Company, filed on August 17, 2004, the FTC and several states claimed that in June 1998, Perrigo paid Alpharma to withdraw its generic version of Children's ibuprofen from the market, creating a pay-for-delay deal. In the case State of California v. Teva Pharmaceutical Industries, Ltd. et al., filed on July 29, 2019, California argued that Teva used four pay-for-delay agreements to postpone the entry of generic competition, thereby illegally maintaining its monopoly over Provigil sales from 2006 to 2012.

[37] In Federal Trade Commission v. Perrigo Company; Alpharma Inc., filed on August 17, 2004, plaintiffs alleged that defends conspired to stop competing. In case Mayor and City Council of Baltimore v. Teva Pharmaceuticals Industries Ltd., filed on March 11, 2022, the plaintiff alleged that Teva Pharmaceuticals and its associated companies played a role in the opioid crisis in Baltimore.

[38] This legal reasoning was applied in several cases including Schering-Plough Corp. v. FTC, 402 F.3d 1056 (11th Cir. 2005); In re Ciprofloxacin Hydrochloride Antitrust Litig., 544 F.3d 1323, 1332–37 (Fed. Cir. 2008); and In re Tamoxifen Citrate Antitrust Litig., 466 F.3d 187, 212–13 (2d Cir. 2006).

[39] For anecdotal evidence, see "We are using all the tools we have": Lina Khan's FTC takes aim at Big Pharma's "patent thickets", arguing they keep old drugs too pricey.

settlements. We found only one FTC complaint in response to the settlement between Endo Pharmaceuticals, the brand-name company, and Impax Laboratories, the first generic. The complaint, filed on April 7, 2016, in the Eastern District of Pennsylvania, alleged that Endo paid the first generic companies that filed for FDA approval to eliminate the risk of competition for Opana ER and Lidoderm, in violation of the Federal Trade Commission Act.[40]

7 Conclusion

This paper shows holdings in brands by large shareholders of generic-drug manufacturers predicts which generic enters and whether settlement occurs. Settlement is accompanied by negative stock returns of generics, whereas brands show a positive stock return reaction. These findings suggest entry and settlements are accompanied by wealth transfers from one firm to another, although those transfers occur largely within shareholder portfolios, from the value of their generic shareholding to their brand shareholding. Shareholders appear to anticipate settlement and settlement terms to some extent, as evidenced by positive stock returns at the time a commonly-owned generic enters the product market. These findings are a first indication that some widely held corporations (generic manufacturers), some of the time, make value-destroying decisions that are consistent with maximizing the financial interests of their largest and most influential shareholders.

The conceptual importance of the findings is that taken at face value, they reject the prediction of the Fisher separation theorem, on which much of corporate finance theory is built, and which holds that firms maximize their own value irrespective of shareholder interests. We hypothesize that the failure of the prediction is due to the firm not being a price taker – one of the key assumptions of the theorem.

If the findings were to hold more generally, re-examining standard questions on corporate finance – on capital structure, cash holdings, executive compensation, and so on – while relaxing the assumption of own-firm profit maximization may be worthwhile. Whether the empirical facts documented in the laboratory of generic entry enjoy broader support is an interesting area for future research. Similarly, whether common ownership between incumbents and potential entrants deters entry may be a fruitful area for research on entry deterrence (Scott Morton, 1999, 2000; Ellison and Ellison, 2011; Goolsbee and Syverson, 2008; Hochberg, Ljungqvist, and

[40] For details about the case, see Endo Pharmaceuticals/Impax Labs.

Lu, 2010; Cookson, 2017, 2018). In particular, it is interesting to question whether ownership structure and regulation might have jointly caused free entry to fail in certain industries (e.g., Gutièrrez and Philippon, 2018, 2019).

Whereas our analysis focuses on publicly traded companies, the incidence of common ownership may be even more pronounced in private markets. Asil, Barrios, and Wollmann (2023) show potentially anticompetitive private-equity transactions tend to escape antitrust scrutiny, because of the complicated deal structure they tend to employ. Therefore, antitrust authorities interested in strengthening enforcement should not take our paper to indicate public markets are necessarily the most urgent priority. Instead, the public-company setting we employ merely illustrates the point that broadly held corporations should not always be assumed to maximize their own value, irrespective of their shareholders' interests.

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Figure 1: Paragraph IV report from Parry Ashford Inc.

This figure provides an example of an observation in our data (i.e., a challenge by a generic manufacturer of a brand's patents). In this example, the generic manufacturer and the brand manufacturer enter into a settlement agreement.

Arthrotec®(diclofenac and misoprostol) Delayed-release Tablets
Company PFIZER
Date of First Filing November 28, 2008 (75mg/0.2mg) and June 29, 2009 (50mg/0.2mg)

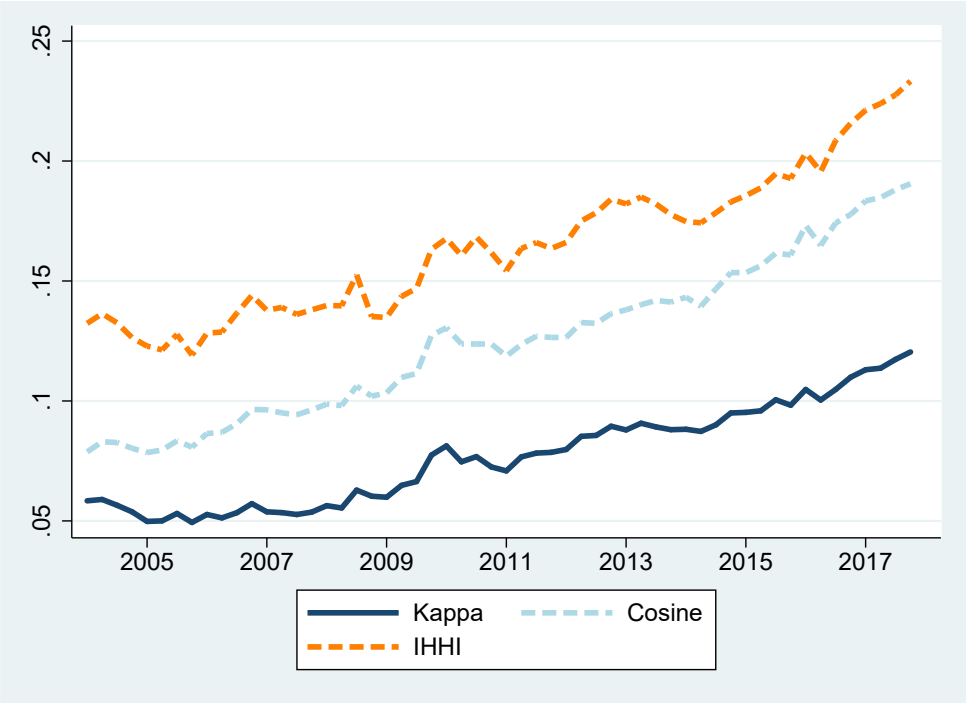
Paragraph IV Applicant: Teva Pharamceuticals (Barr)
Case Name: PFIZER v. TEVA PHARMACEUTICALS
Court/Case #: New York Southern District Court (nysdc) 1:2009cv03965
Date Filed: 4/21/2009
Judge: Sullivan
Product Strength: 75 mg/0.2 mg and 50mg/0.2mg
Litigated Patents (expiration): 5,601,843 (2/11/2014)
Non-Litigated Patents (expiration): 5,698,225 (5/3/2010)
Plaintiff Lawyer/Firm: Thom Beck/Sidley Austin
Defendant Lawyer/Firm: David Hashmall/Goodwin Procter
Related Case: None. Amended Complaint adds 50mg/0.2mg strength
Status: The parties entered settlement agreement and consent judgment entered 1/22/10.
Complaint Amended Complaint Answer
Consent Judgment

Product Links from FDA and USPTO
Orange Book Patent & Exclusivity Data
'843 Patent
'225 Patent

Figure 2: Time-series and cross-sectional variation of common-ownership concentration

Panel A of the figure plots common ownership (*Kappa20*) and its two decomposed components (i.e., cosine similarity and IHHI) from 2004Q1 to 2017Q4 (see equations (2) and (3) for detailed descriptions). *Kappa20* is the profit weight of the top 20 generic shareholders put in the brand incumbent as of the beginning of the quarter in which a patent-infringement lawsuit is filed (see equation (2)). In Panel A, the X-axis is calender year and the Y-axis is *Kappa20* and its two components (see Subsection 4.4 for details). Panel B of the figure plots the distribution of *Kappa20* for 2004Q1 and 2017Q4. In Panel B, the X-axis is *Kappa20* and the Y-axis is the density.

Panel A: Time trends of Kappa and its decomposed components



Panel B: Conditional distribution

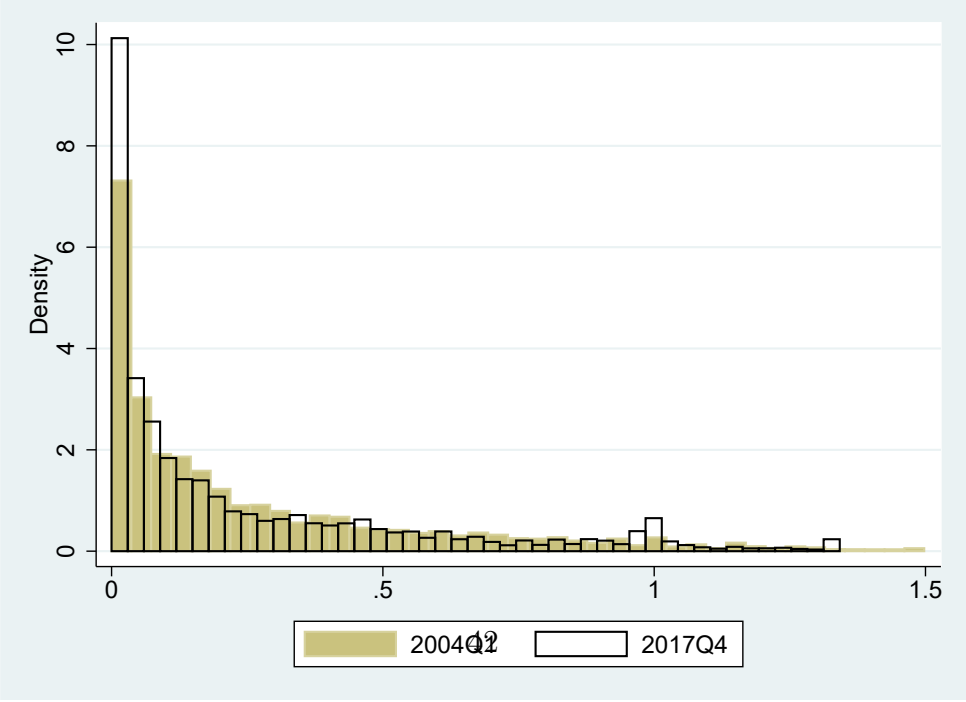


Figure 3: The evolution of common ownership around the time the first generic files a Paragraph IV challenge

This figure plots the estimated coefficients $\hat{\beta}_s$ and the 95% confidence intervals from the following equation:

$$Kappa20_{jks} = \alpha + \sum_{s=-8}^{s=+8} \beta_t \times First\ Filing_{jks} + \phi_j + \phi_k + \phi_s + \epsilon_{jks},$$

where $First\ Filing_{jks}$ is a dummy variable indicating the s^{th} $(-8 \leq t \leq 8)$ event quarter prior to the Paragraph IV challenge filed by the first generic j, and 0 otherwise. The sample period is from 2004Q1 through 2020Q4. We require at least one shareholder of the generic defendant holds stakes in the brand plaintiff. The excluded period is the event quarter $s = -1$. The X-axis is the event quarter and the Y-axis is the estimated coefficient.

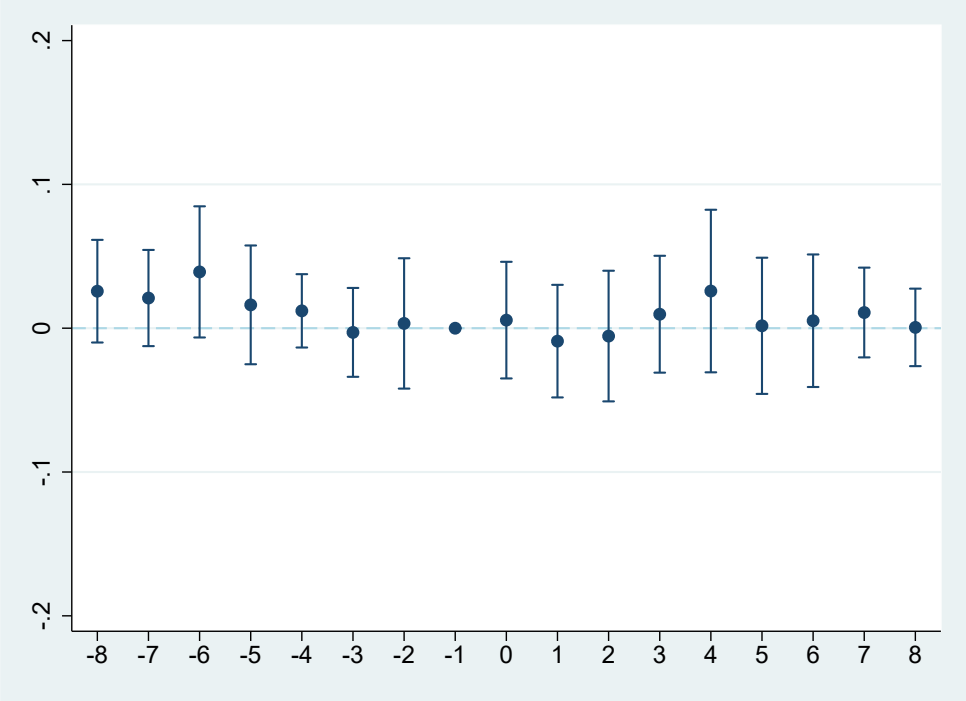


Figure 4: The evolution of common-ownership around the Paragraph IV litigation

This figure plots the estimated coefficients $\hat{\beta}_s$ and the 95% confidence intervals from the following equation:

$$Kappa20_{jks} = \alpha + \sum_{s=-8}^{s=+8} \beta_t \times Lawsuit_{jks} + \phi_j + \phi_k + \phi_s + \epsilon_{jks},$$

where $Lawsuit_{jks}$ is a dummy variable indicating the s^{th} $(-8 \leq t \leq 8)$ event quarter prior to a litigation initiated by brand plaintiff k against generic defendant j, and 0 otherwise. The sample period is from 2004Q1 through 2020Q4. We require that at least one shareholder of the generic defendant holds stakes in the brand plaintiff. The excluded period is the event quarter $s = -1$. The X-axis is the event quarter and the Y-axis is the estimated coefficient.

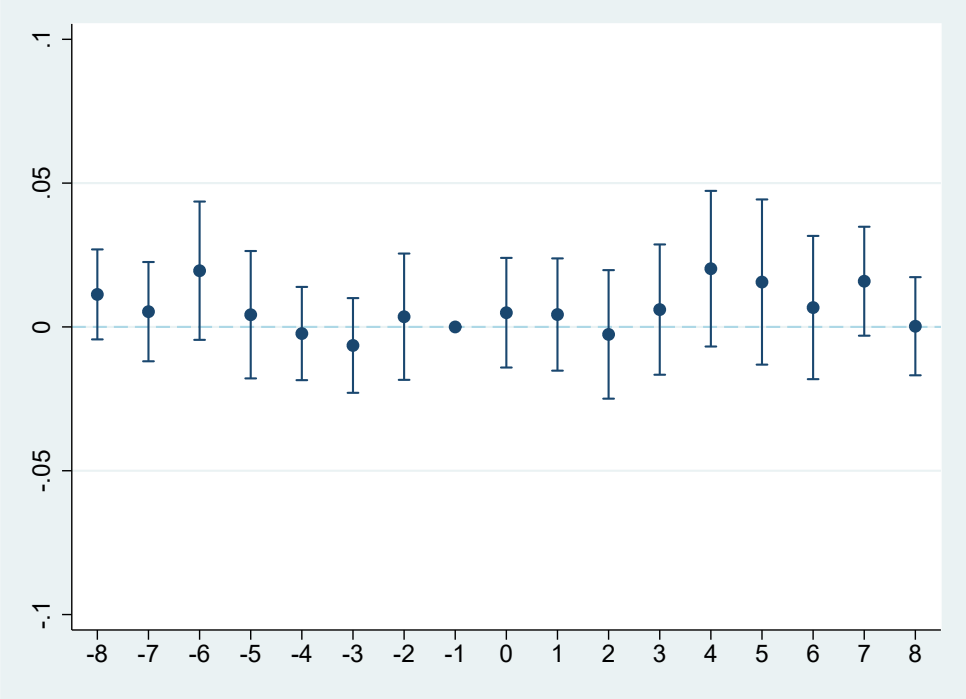


Figure 5: Cross-sectional distribution of implied change of common ownership (BlackRock-BGI DiD)

The figure plots the distribution of implied changes in the profit weight the top 20 generic shareholders put in the brand plaintiff ($\Delta Kappa20$) across 1,543 Paragraph IV lawsuits with zero changes and 214 lawsuits with positive changes, respectively. $\Delta Kappa20$ is calculated as follows:

$$\Delta Kappa20_{jk} = \widehat{Kappa20}_{jk}^{09Q1} - Kappa20_{jk}^{09Q1},$$

where the generic manufacturer and brand incumbent are indexed by j and k, respectively. $Kappa20^{09Q1}$ is the top 20 generic shareholders' profit weight on the brand plaintiff as of 2009Q1. $\widehat{Kappa20}^{09Q1}$ is the counterfactual, profit weight for the same generic-brand pair in the same quarter with the only difference being that we treat the holdings of BlackRock and BGI as if they had been held by a single entity already. The X-axis is the implied changes in $Kappa20$ and the Y-axis is the density.

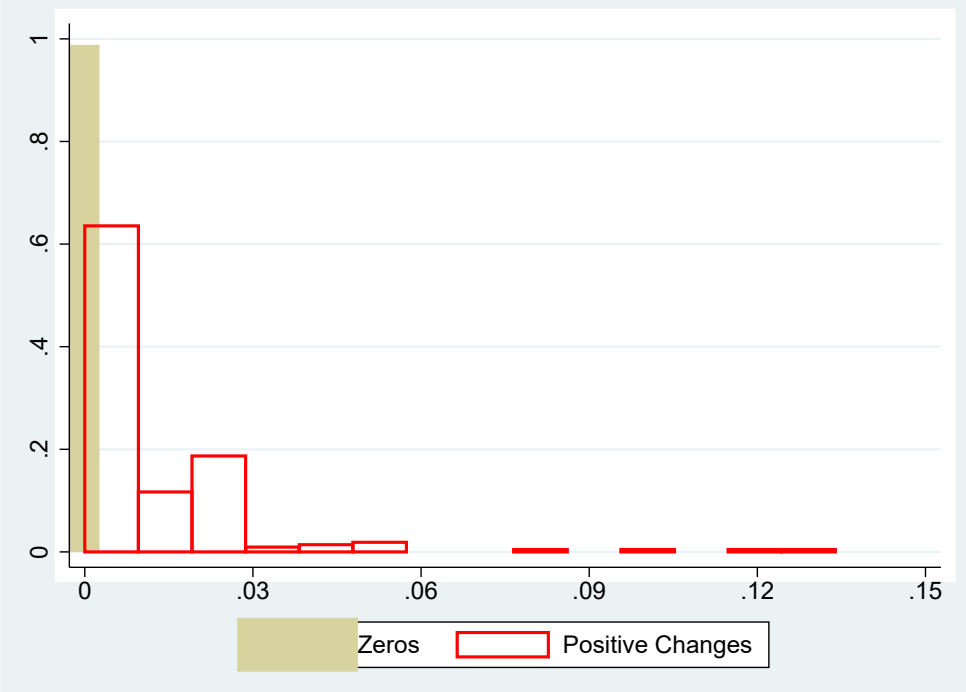
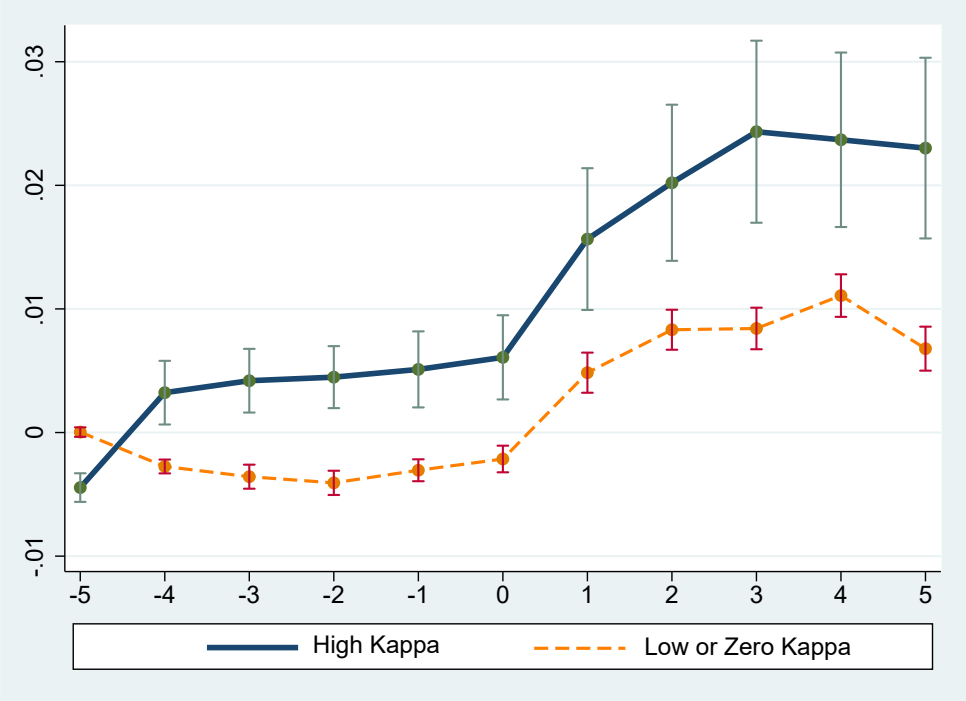


Figure 6: Accumulative abnormal returns around settlement

The figure compares the accumulative market-adjusted daily stock returns between firms with high common ownership and firms with low or zero common ownership around the (-5, +5) event-day window relative to the date the generic defendant of Paragraph IV lawsuits and the brand-name plaintiff enter into a settlement agreement. A brand incumbent or first generic has high common ownership if *Kappa20* is above 0.3. Conversely, it has low common ownership if *Kappa20* is either positive but below 0.3, or equal to zero. *Kappa20* is the profit weight the top 20 generic shareholders put on the brand incumbent as of the beginning of the quarter when a patent-infringement lawsuit is filed (see equation (2) for detailed descriptions). Panel A plots the comparison between settled brands with and without high common ownership. Panel B plots the comparison between settled first generics with and without high common ownership. The X-axis represents the event day, while the Y-axis shows the cumulative abnormal returns, calculated from event day -5 to event day +5. Confidence intervals are set at the 95% level.

Panel A: Settled brand



Panel B: Settled first generic

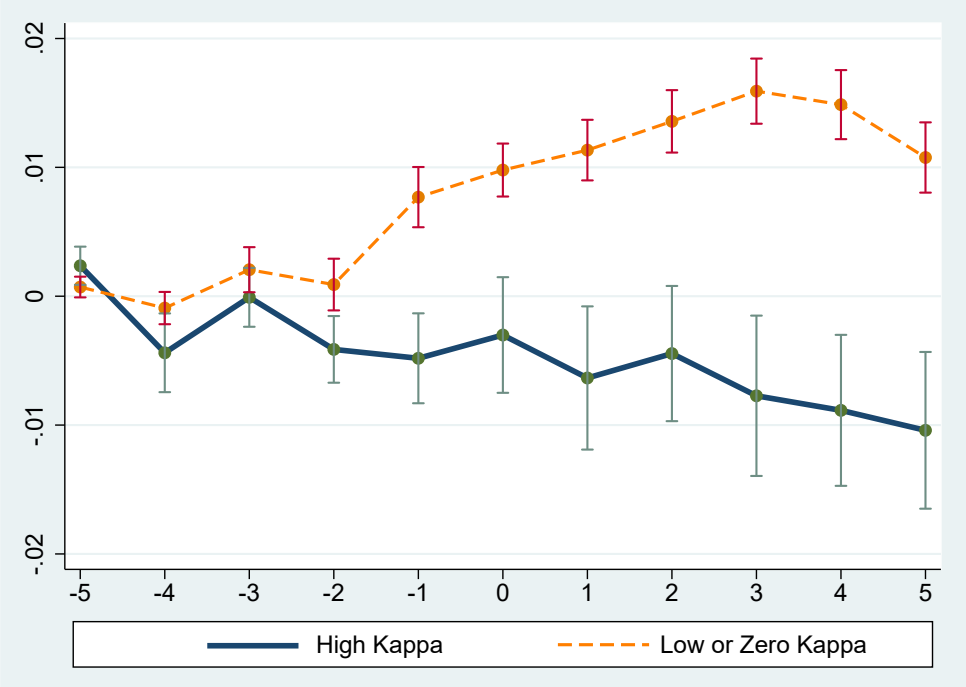


Table 1: Illustrative cases of brand-generic pair common-ownership links

This table shows the largest beneficial owners and corresponding stakes for an illustrative sample of generic manufacturers and brand-name companies as of 2006Q4. The data source is Capital IQ under the S&P Global Market Intelligence.

Panel A. Generic manufacturers

Teva	%	Viatris	%	Sandoz	%
Allergan	9.89	Abbott	13.03	JPMorgan Chase	8.74
Capital Rsrch & Mgmt.	9.63	Wellington	8.45	Sandoz Fam Fndn.	3.40
Fidelity	6.14	BlackRock	7.37	Capital Rsrch & Mgmt.	3.22
Franklin Templeton	5.57	Vanguard	5.28	BlackRock	3.04
Barrow Hanley	3.20	Paulson & Co	3.85	Novartis Fndn.	2.60
BlackRock	3.11	State Street	3.73	Dodge & Cox	2.42
Norges Bank Invt. Mgmt.	3.04	GreenLight Cap	1.62	UBS	2.34
BNY Mellon Asset Mgmt.	1.92	UBS	1.30	Vanguard	2.24
Vanguard	1.77	Migdal MF	1.12	Norges Bank Invt Mgmt	2.02
Highfields Cap Mgmt.	1.66	BNY Mellon Asset Mgmt.	1.02	Credit Suisse	1.29
Lupin	%	Dr. Reddy's	%	Sun	%
Lupin Invt.	12.46	Kambam Reddy	25.85	Dilip Shanghvi	9.60
Zyma Lab	12.33	First Sentier Investors	7.30	Viditi Invt.	8.37
Rahas Invt.	10.21	Brown Brothers Harriman & Co.	4.90	Tejaskiran Pharm Ind	8.12
Visionmed Invt.	9.77	First State Invt. Mgmt.	4.35	Virtuous Finance	8.08
First Sentier Investors	2.78	Life Insurance Corp of India	4.04	Family Invt.	7.60
Royal Bank of Scotland	2.43	BlackRock	3.57	Quality Invt.	7.60
JPMorgan Chase	1.95	Fisher Investments	3.44	Life Insurance Corp of India	3.51
Rakesh Jhunjhunwala	1.84	Vontobel Asset Mgmt.	1.94	Virtuous Share Invt.	3.49
BlackRock	1.78	Vanguard	1.87	Sudhir Valia	2.01
Singapore	1.76	Dilip Shanghvi	9.60	Aditya Medisales	1.67
Par Pharmaceutical	%	Impax	%	Aurobindo Pharma	%
Fidelity	15.00	BlackRock	11.39	Kallam Reddy	45.86
TPG Capital	9.94	Vanguard	8.09	HDFC Asset Mgmt.	6.33
Vanguard	8.44	Hound Partners	6.00	Meenakshi Sivakumaran	2.51
BlackRock	7.45	Invesco Specialized Products	5.47	Trident Chemphar Limited	2.08
Capital Rsrch & Mgmt.	7.03	Columbia Mgmt. Invt.	3.23	BlackRock	1.45
State Street	4.33	State Street	3.16	Aditya Birla Sun Life	1.31
Paulson & Co	3.52	Franklin Templeton	2.91	Abu Dhabi Invt. Auth	1.31
Glenview Cap Mgmt.	1.91	Two Sigma Invt.	2.87	Stichting Pensioenfonds ABP	1.09
Camber Cap Mgmt.	1.75	North Tide Capital	2.71	Rakesh Jhunjhunwala	1.09
Miller Value Partners	1.52	Dimensional Fund Advisors	2.43	State Bank of India	0.93

Panel B. Brand firms

Pfizer		AbbVie		GlaxoSmithKline	
BlackRock	7.38	Capital Rsrch & Mgmt.	11.29	BlackRock	5.99
Vanguard	6.63	Vanguard	6.74	Capital Rsrch & Mgmt.	3.75
State Street	5.29	BlackRock	5.69	Legal & General Invt. Mgmt.	2.79
J.P. Morgan	1.47	State Street	4.39	State Street	2.71
T. Rowe Price Group	1.33	Northern Trust Group	1.32	Vanguard	2.51
Northern Trust	1.32	BNY Mellon Invt. Mgmt.	1.17	Norges Bank Invt. Mgmt.	1.86
BNY Mellon Invt. Mgmt.	1.18	State Farm	0.93	Fidelity	1.74
Wellington	1.13	Federated Hermes	0.93	Aberdeen Asset Mgmt.	1.56
Capital Rsrch & Mgmt.	1.11	Geode Capital Mgmt.	0.86	UBS	1.55
Columbia Mgmt. Invt. Advisers	1.04	UBS	0.82	Columbia Mgmt. Invt. Advisers	1.46
Merck & Co.		Janssen Pharmaceuticals		Allergan	
Vanguard	6.70	Vanguard	7.03	Vanguard	7.19
BlackRock	6.66	BlackRock	6.27	Wellington	6.78
Capital Rsrch & Mgmt.	5.55	State Street	5.64	BlackRock	6.46
State Street	4.54	State Farm	1.39	Goldman Sachs	6.28
Wellington	4.50	Capital Rsrch & Mgmt.	1.33	State Street	5.33
BNY Mellon Asset Mgmt.	1.57	Wellington	1.28	Fidelity	3.92
T. Rowe Price Group	1.37	Northern Trust	1.27	T. Rowe Price Group	2.78
Northern Trust	1.29	BNY Mellon Asset Mgmt.	1.16	ClearBridge Invt.	2.44
Norges Bank Invt. Mgmt.	1.00	Fidelity	1.12	Legg Mason Int. EQ	2.38
Franklin Templeton	0.99	Norges Bank Invt. Mgmt.	1.03	J.P. Morgan	1.72
Shire		Abbott Laboratories		Bristol-Myers Squibb	
BlackRock	8.66	Vanguard	6.94	Wellington	8.87
Jennison Associates LLC	2.57	BlackRock	5.97	Vanguard	6.87
Vanguard	2.49	State Street	4.60	BlackRock	5.97
Paulson & Co	2.44	MFS	2.33	State Street	4.05
Legal & General Invt. Mgmt.	2.15	T. Rowe Price	2.27	Capital Rsrch & Mgmt.	3.16
M&G Invt. Mgmt.	2.08	BNY Mellon	1.96	Fidelity	2.63
Marathon Asset Mgmt.	1.98	Northern Trust	1.56	T. Rowe Price	2.21
State Street	1.95	Macquarie	1.33	Dodge & Cox	1.35
PPM America	1.70	Wellington	1.16	Northern Trust	1.32
Fidelity	1.66	Flossbach von Storch	1.09	Jennison Associates	1.30

Table 2: Ownership by the 20 largest generic institutional shareholders

This table reports ownership stakes that the 20 largest generic shareholders hold in the generic manufacturer and brand incumbent whose patents are challenged at least once by the generic manufacturer over our sample period. Regardless of when the generic-brand pair is formed as a result of a patent-infringement lawsuit, we include ownership stakes of the generic-brand pair over the entire sample period. We exclude generic-brand pairs in which no generic shareholders hold stakes in the brand incumbent.

		Generic Ownership %			Brand Ownership %		
Shareholder Rank	N	Mean	Median	Std	Mean	Median	Std
1	5,580	10.319	9.842	4.492	4.286	2.909	3.996
2	6,709	6.389	6.399	2.603	4.029	3.035	3.494
3	6,367	4.930	4.586	2.096	3.850	2.780	3.407
4	6,669	3.731	3.398	1.619	4.138	3.254	3.547
5	6,081	3.104	2.957	1.411	3.775	2.686	3.556
6	6,238	2.620	2.498	1.251	3.316	2.125	3.316
7	5,585	2.172	2.073	0.957	2.757	1.584	2.915
8	5,401	1.830	1.786	0.817	2.716	1.582	2.751
9	5,404	1.638	1.660	0.686	2.863	1.682	2.838
10	4,406	1.430	1.428	0.634	2.708	1.544	2.804
11	4,795	1.231	1.184	0.578	2.665	1.536	2.689
12	4,966	1.162	1.103	0.530	2.668	1.567	2.631
13	4,449	1.028	0.973	0.463	2.393	1.375	2.393
14	4,461	0.957	0.966	0.414	2.379	1.338	2.958
15	4,498	0.884	0.873	0.393	2.090	1.235	2.781
16	4,661	0.785	0.789	0.348	2.397	1.392	2.392
17	3,924	0.787	0.775	0.355	2.181	1.311	2.235
18	4,032	0.716	0.717	0.312	2.163	1.268	2.328
19	3,582	0.682	0.669	0.308	2.106	1.286	2.286
20	3,099	0.600	0.577	0.292	1.908	1.276	2.247

Table 3: Sample

This table presents descriptive statistics for our sample of patent-infringement lawsuits triggered by patent challenges by generic-drug manufacturers. A challenge occurs when a generic-drug manufacturer files an ANDA under Paragraph IV certification with the FDA. In a Paragraph IV certification, the generic manufacturer argues its generic drug does not infringe on patents covering a branded product or that the patents at issue are simply invalid. Under this provision, generic manufacturers can challenge the validity of patents so that the effective patent life of a branded drug can be reduced. We start with Paragraph IV cases that were active as of November 1, 2003. Active cases refer to those that had a pending lawsuit. We define a challenge at the level of the date that a brand files a patent-infringement lawsuit against a generic manufacturer, challenging the formulation (e.g., tablet, capsule, and injection) of a brand name that defines a patent-protected drug. Panel A presents the data structure of the sample and the frequency with which drugs and patents in the sample are challenged by a brand filling lawsuits. Panel B presents the distribution of private and publicly listed firms at the challenge level. A firm's listing status is identified based on whether its stock price data are available on the date the brand files a lawsuit. Panel C presents the distribution of the number of formulations across 521 branded drugs (identified by the trade name).

Panel A: Structure of raw data

Patents at issue	1,578
Brand-name drugs	521
Brand incumbents	157
Generic challengers	202
Formulations of brand-name drugs	587
Infringement lawsuits	2,023

Panel B: Distribution by listing status

Generic public & brand public	1,251	61.8%
Generic public & brand private	118	5.8%
Generic private & brand public	428	21.2%
Generic private & brand private	226	11.2%
Total	2,023	100.0%

Panel C: Distribution by the number of formulations

1	467	89.60%
2	44	8.50%
3	9	1.70%
5	1	0.20%

Table 4: Descriptive statistics

This table presents descriptive statistics. In Panel A, the sample unit is at the level of the date that the first generic manufacturer files a Paragraph IV to challenge the formulation (e.g., tablet, capsule, and injection) of a trade name (i.e., the name of the branded drug). Common-ownership-related variables are measured as of the beginning of the quarter in which the first patent-infringement lawsuit with respect to a trade-name-formulation combination is filed. The sample includes 1,597 Paragraph IV filers and 1,659 non-Paragraph IV filers (see Subsection 5.1 for detailed descriptions). In Panels B, the sample unit is at the level of the date that the brand sues a generic manufacturer challenging the formulation (e.g., tablet, capsule, and injection) of a trade name (i.e., the name of the branded drug). Common-ownership-related variables are measured as of the beginning of the quarter in which a patent-infringement lawsuit is filed. *Kappa20* (*Kappa5*) is the profit weight the top 20 (top 5) generic shareholders put in the brand incumbent (see equation (2) for detailed descriptions). *Kappa20* $\geq$ *30%* is an indicator variable coded as 1 if *Kappa20* is greater than or equal to 30%, and 0 otherwise. *Cosine20* and *IHHI20* are the two components of a decomposition of *Kappa20* (see equation (3) for detailed descriptions). *First* is an indicator variable coded as 1 if the generic manufacturer is the first generic. *Settle*, *Dismiss*, and *Trial* are three dummy variables indicating whether the two litigants settle, dismiss, or go to trial for at least one disputed patent at issue. *Group* is an indicator variable coded as 1 if more than two generic manufacturers challenge patents covering the same branded drug on the same day, and 0 otherwise. *# Patents* is the number of litigated patents. *Route Exp* is an indicator variable coded as 1 if the generic manufacturer has production experience in drug-dosage form/route within the last three years. *Therapy Exp* is an indicator variable coded as 1 if the generic manufacturer has production experience in therapy class, measured by the 2-digit Anatomical Therapeutic Chemical (ATC) Classification System, within the last three years. *Rank N* is an indicator variable coded as 1 if the branded drug at issue is ranked between N-24 and N among the top 200 pharmaceutical drugs by retail sales in the year when the lawsuit is filed.

	Panel A. Entry sample							
	Mean	Std	Min	p10	p50	p90	Max	N
Kappa20	0.042	0.135	0	0	0	0.129	1.652	3,256
Kappa20 $\geq$ 30%	0.052	0.222	0	0	0	0	1	3,256
Cosine20	0.065	0.167	0	0	0	0.272	0.935	3,256
IHHI20	0.110	0.298	0	0	0	0.419	3.183	3,256
Kappa5	0.036	0.131	0	0	0	0.072	1.856	3,256
First	0.174	0.379	0	0	0	1	1	3,256
#Patents	1.957	1.941	1	1	1	4	24	3,256
Rank25	0.055	0.228	0	0	0	0	1	3,256
Rank50	0.022	0.148	0	0	0	0	1	3,256
Rank75	0.040	0.197	0	0	0	0	1	3,256
Rank100	0.029	0.168	0	0	0	0	1	3,256
Rank125	0.039	0.193	0	0	0	0	1	3,256
Rank150	0.037	0.188	0	0	0	0	1	3,256
Rank175	0.021	0.142	0	0	0	0	1	3,256
Rank200	0.020	0.139	0	0	0	0	1	3,256
Route Exp	0.230	0.421	0	0	0	1	1	3,256
Therapy Exp	0.624	0.485	0	0	1	1	1	3,256

	Panel B. Litigation sample							
	Mean	Std	Min	p10	p50	p90	Max	N
Settle	0.378	0.485	0	0	0	1	1	1,743
Dismiss	0.363	0.481	0	0	0	1	1	1,743
Trial	0.274	0.446	0	0	0	1	1	1,743
Kappa20	0.047	0.140	0	0	0	0.168	1.368	1,743
Kappa20 $\geq$ 30%	0.064	0.244	0	0	0	0	1	1,743
Cosine20	0.076	0.185	0	0	0	0.357	0.935	1,743
IHHI20	0.113	0.280	0	0	0	0.499	1.998	1,743
Kappa5	0.043	0.142	0	0	0	0.141	1.570	1,743
First	0.328	0.469	0	0	0	1	1	1,743
#Patents	1.940	1.780	1	1	1	4	24	1,743
Group	0.309	0.462	0	0	0	1	1	1,743
Rank25	0.075	0.263	0	0	0	0	1	1,743
Rank50	0.037	0.188	0	0	0	0	1	1,743
Rank75	0.042	0.200	0	0	0	0	1	1,743
Rank100	0.040	0.195	0	0	0	0	1	1,743
Rank125	0.034	0.182	0	0	0	0	1	1,743
Rank150	0.030	0.170	0	0	0	0	1	1,743
Rank175	0.020	0.140	0	0	0	0	1	1,743
Rank200	0.021	0.144	0	0	0	0	1	1,743
Route Exp	0.239	0.427	0	0	0	1	1	1,743
Therapy Exp	0.552	0.497	0	0	1	1	1	1,743

Table 5: Determinants of the first generic

This table presents estimates of the effect of common ownership on the probability that a generic-drug manufacturer that files a Paragraph IV with the FDA will be the first Paragraph IV filer:

$$First_{jkmt} = \alpha + \beta \times Common\ Ownership_{jkt-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkmt},$$

where the dependent variable is a dummy variable indicating whether the generic manufacturer is the first generic that files the Paragraph IV with the FDA. *Common ownership* is measured as of the beginning of the quarter in which the first patent-infringement lawsuit with respect to a tradename-formulation combination is filed. The sample includes 1,597 Paragraph IV filers and 1,659 non-Paragraph IV filers (see Subsection 5.1 for details). In Panel A, *Common Ownership* is measured as *Kappa20* (see equation (2) for detailed descriptions). In Panel B, *Common Ownership* is measured as $Kappa20 \geq 30\%$, which is an indicator variable coded as 1 if *Kappa20* is greater than or equal to 30%, and 0 otherwise. In Panels C and D, we use the two components of a decomposition of *Kappa20* (see equation (3) for a detailed description) to measure *Common Ownership*. In Panel E, *Kappa5* is the profit weight the top five generic shareholders put on the brand incumbent. In Panels F and G, *Common Ownership* are the profit weights of the top 6-20 (*Kappa620*) and 11-20 (*Kappa1120*) generic shareholders put on the brand incumbent, respectively. See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
	Panel A: Kappa20				
Kappa20	0.267***	0.274***	0.320***	0.235***	0.245***
	(0.067)	(0.068)	(0.066)	(0.049)	(0.052)
Adj. R^2	0.01	0.01	0.03	0.10	0.13
	Panel B: Kappa20 $\geq$ 30%				
Kappa20 $\geq$ 30%	0.114***	0.118***	0.137***	0.107***	0.100***
	(0.035)	(0.035)	(0.039)	(0.034)	(0.031)
Adj. R^2	0.00	0.01	0.03	0.10	0.13
	Panel C: Cosine Similarity				
Cosine20	0.216***	0.218***	0.248***	0.191***	0.176**
	(0.071)	(0.073)	(0.062)	(0.069)	(0.083)
Adj. R^2	0.01	0.01	0.04	0.10	0.13
	Panel D: IHHI				
IHHI20	0.083***	0.085**	0.098***	0.061**	0.072***
	(0.029)	(0.031)	(0.032)	(0.027)	(0.019)
Adj R^2	0.00	0.00	0.03	0.09	0.13
	Panel E: Kappa top 1-5				
Kappa5	0.285***	0.294***	0.330***	0.250***	0.253***
	(0.069)	(0.068)	(0.067)	(0.053)	(0.076)
Adj. R^2	0.01	0.01	0.04	0.10	0.13
	Panel F: Placebo Tests: Kappa top 6-20				
Kappa620	0.053*	0.054	0.055	0.021	-0.003
	(0.030)	(0.035)	(0.038)	(0.040)	(0.044)
Adj R^2	0.00	0.00	0.03	0.09	0.13
	Panel G: Placebo Tests: Kappa top 11-20				
Kappa1120	0.023	0.022	0.022	0.015	0.018
	(0.015)	(0.014)	(0.017)	(0.015)	(0.017)
Adj R^2	0.00	0.00	0.03	0.09	0.13
Controls		✓	✓	✓	✓
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓
N	3,256	3,256	3,256	3,256	3,256

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 6: Effect of common ownership on the likelihood of settlement

This table presents linear-probability-model estimates of the effect of common ownership on settlement:

$$Settle_{jkms} = \alpha + \beta_1 \times Common\ Ownership_{jks-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where the dependent variable is an indicator variable coded as 1 if the two parties settle a litigation for at least one disputed patent, and 0 otherwise. The sample only includes actual Paragraph IV filers. In Panel A, *Common Ownership* is measured as *Kappa20* (see equation (2) for detailed descriptions). In Panel B, *Common Ownership* is measured as $Kappa20 \geq 30\%$, which is an indicator variable coded as 1 if *Kappa20* is greater than or equal to 30%, and 0 otherwise. In Panels C and D, we use the two components of a decomposition of *Kappa20* (see equation (3) for a detailed description) to measure *Common Ownership*. In Panel E, *Kappa5* is the profit weight the top five generic shareholders put on the brand plaintiff. In Panels F and G, *Common Ownership* are the profit weights the top 6-20 (*Kappa620*) and 11-20 (*Kappa1120*) generic shareholders put on the brand plaintiff, respectively. See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
	Panel A: Kappa20				
Kappa20	0.254***	0.259***	0.274***	0.311***	0.312**
	(0.066)	(0.076)	(0.083)	(0.080)	(0.141)
Adj R^2	0.00	0.03	0.08	0.10	0.25
	Panel B: Kappa20 $\geq$ 30%				
Kappa20 $\geq$ 30%	0.183***	0.196***	0.208***	0.223***	0.206***
	(0.041)	(0.049)	(0.053)	(0.048)	(0.070)
Adj R^2	0.01	0.01	0.08	0.09	0.25
	Panel C: Cosine Similarity				
Cosine20	0.209***	0.213***	0.217***	0.253***	0.313***
	(0.061)	(0.047)	(0.053)	(0.066)	(0.079)
Adj R^2	0.01	0.03	0.08	0.10	0.25
	Panel D: IHHI				
IHHI	0.130***	0.138***	0.133***	0.140***	0.113**
	(0.042)	(0.034)	(0.036)	(0.039)	(0.045)
Adj R^2	0.01	0.03	0.08	0.09	0.25
	Panel E: Kappa top 1-5				
Kappa5	0.246***	0.250***	0.274***	0.307***	0.313**
	(0.070)	(0.081)	(0.085)	(0.084)	(0.138)
Adj R^2	0.00	0.03	0.08	0.10	0.25
	Panel F: Placebo Tests: Kappa top 6-20				
Kappa620	0.079**	0.076**	0.089***	0.067**	0.028
	(0.039)	(0.033)	(0.023)	(0.031)	(0.020)
Adj R^2	0.00	0.03	0.08	0.09	0.24
	Panel G: Placebo Tests: Kappa top 10-20				
Kappa1120	0.030***	0.029***	0.029***	0.021*	0.016
	(0.009)	(0.009)	(0.009)	(0.010)	(0.012)
Adj R^2	0.00	0.03	0.08	0.09	0.25
Controls		✓	✓	✓	✓
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓
N	1,743	1,743	1,743	1,743	1,743

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 7: Determinants of the first generic: IV estimations, post-2009Q2 period

This table presents the first stage (Panel A) and second stage (Panel B) of instrumental variable (IV) estimates of the effect of common ownership on the likelihood of settlement in the post-2009Q2 period. The first-stage regression is specified as follows:

$$Kappa20_{jks-1} = \alpha + \beta_1 \times IV + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where *Kappa20* (endogenous variable) is the profit weight the top 20 generic shareholders put on the brand plaintiff as of the beginning of the quarter in which the first patent-infringement lawsuit with respect to a tradename-formulation combination is filed. *IV* is the percentile-rank transformed $\Delta Kappa20$ (see equation (8) and equation (9) for detailed descriptions). The second-stage regression is specified as follows:

$$Settle_{jkms} = \alpha + \beta_1 \times Kappa20_{jks-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where the dependent variable is an indicator variable coded as 1 if the two parties settle a litigation for at least one disputed patent, and 0 otherwise. ϕ_j, ϕ_k, ϕ_l, and ϕ_s represent full sets of generic manufacturer, brand-name-firm, district-court, and time (year-quarter) fixed effects, respectively. See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
	Panel A. First stage				
IV	0.274***	0.275***	0.267***	0.247***	0.202***
	(0.021)	(0.021)	(0.019)	(0.021)	(0.017)
N	1,762	1,762	1,762	1,762	1,762
F-stat	171.90	163.69	191.79	143.48	160.67
	Panel B. Second stage				
Kappa20	0.395*	0.375*	0.489**	0.558**	0.824***
	(0.235)	(0.218)	(0.233)	(0.240)	(0.198)
N	1,762	1,762	1,762	1,762	1,762
Controls		✓	✓	✓	✓
Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 8: Effect of common ownership on the likelihood of settlement: IV estimations, post-2009Q2 period

This table presents the first stage (Panel A) and second stage (Panel B) of instrumental variable (IV) estimates of the effect of common ownership on the likelihood of settlement in the post-2009Q2 period. The first-stage regression is specified as follows:

$$Kappa20_{jks-1} = \alpha + \beta_1 \times IV + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where *Kappa20* (endogenous variable) is the profit weight the top 20 generic shareholders put on the brand incumbent as of the beginning of the quarter a patent-infringement lawsuit is filed (see equation (2) for detailed descriptions). *IV* is the percentile-rank transformed $\Delta Kappa20$ (see equation (8) and equation (9) for detailed descriptions). The second-stage regression is specified as follows:

$$Settle_{jkms} = \alpha + \beta_1 \times Kappa20_{jks-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where the dependent variable is an indicator variable coded as 1 if the two parties settle a litigation for at least one disputed patent, and 0 otherwise. ϕ_j, ϕ_k, ϕ_l, and ϕ_s represent full sets of generic manufacturer, brand-name-firm, district-court, and time (year-quarter) fixed effects, respectively. See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
	Panel A. First stage				
IV	1.238***	1.252***	1.275***	1.158***	0.603***
	(0.113)	(0.106)	(0.091)	(0.061)	(0.100)
N	1,255	1,255	1,255	1,255	1,255
F-stat	120.42	140.19	197.50	357.61	36.18
	Panel B. Second stage				
Kappa20	0.107***	0.111***	0.106***	0.170***	0.389***
	(0.027)	(0.027)	(0.028)	(0.048)	(0.129)
N	1,255	1,255	1,255	1,255	1,255
Controls		✓	✓	✓	✓
Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 9: Effect of common ownership on brand's and generic's abnormal returns around settlement

This table presents estimates of the effect of common ownership on the market-adjusted daily stock returns around the date the generic defendant of Paragraph IV lawsuits and the brand-name plaintiff enter into a settlement agreement. The sample consists of firms that have entered into settlement agreements. We estimate the following linear regression:

$$CAR_{jki} = \alpha + \beta_1 \times First_{jkm} \times Kappa20_{jks-1} + \beta_2 \times Kappa20_{jks-1} + \beta_3 \times First_{jkm} + X' \times \gamma + \phi_k + \phi_l + \epsilon_{jki},$$

where CAR_{jki} is the cumulative market-adjusted return for the brand plaintiff (columns (1)-(4)), or for the generic defendant (columns (5)-(8)), over the window of (-5, +5) relative to the event day on which the generic defendant(s) j and the brand plaintiff k enter into a settlement agreement with respect to lawsuit i. *Kappa20* is measured as the profit weight the top 20 generic shareholders put on the brand plaintiff as of the beginning of a patent-infringement lawsuit (see equation (2) for detailed descriptions). Cases in which the two parties go to trial are excluded. Dependent variables are winsorized at the 1% and 99% levels. See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses and are clustered at the U.S. federal district court level.

	Brand Return				Generic Return			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kappa20 × First	0.053***	0.061***	0.050***	0.044*	-0.046***	-0.052***	-0.048***	-0.044**
	(0.015)	(0.013)	(0.010)	(0.025)	(0.013)	(0.010)	(0.008)	(0.018)
First	0.002	0.001	0.003	0.001	0.006	0.007**	0.009**	0.009**
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)
Kappa20	-0.010	-0.012	-0.004	0.007	0.016	0.025*	0.027**	0.021**
	(0.008)	(0.008)	(0.011)	(0.013)	(0.013)	(0.012)	(0.012)	(0.010)
Constant	-0.000	-0.001	-0.000	-0.002	0.001	0.003*	0.002	-0.001
	(0.001)	(0.004)	(0.003)	(0.002)	(0.002)	(0.002)	(0.004)	(0.006)
Controls		✓	✓	✓		✓	✓	✓
Court			✓	✓			✓	✓
Brand Firm FE				✓				
Generic Firm FE								✓
N	514	514	514	514	336	336	336	336
Adj R^2	0.01	0.02	0.06	0.31	0.00	0.01	-0.00	0.02

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table 10: Shareholder-by-shareholder calculation of dollar amount of wealth transfer

This table presents the shareholder-by-shareholder calculation of dollar amount of wealth transfer from generic defendant to brand plaintiff. The sample unit is at the level of shareholders of the first generic that enters into a settlement agreement with the brand plaintiff. These generic shareholders hold stakes in the settled brand incumbent. Panel A consists of all common owners without distinguishing their level of common ownership. Panel B consists of common owners whose *Kappa20* is above 0.3. Panel C consists of common owners whose *Kappa20* is below 0.3. *Kappa20* is the profit weight the top 20 generic shareholders put on the brand incumbent as of the beginning of the quarter when a patent-infringement lawsuit is filed (see equation (2) for detailed descriptions). *Rank* refers to generic shareholders' rank based on their ownership in the generic. For example, "Top 1-3" refers to the top three generic shareholders. N refers to the number of shareholders within each shareholder rank. ΔW^g and ΔW^b (in million USD) represent the average gains or losses for the generic and brand, respectively. We calculate the change of generic value (ΔW^g) as the average value across all shareholders within each *Rank* category, as follows:

$$\Delta W^g = \frac{\sum_{i=1}^{n} CAR(\text{-}5,\text{+}5)_i^g \times Shares_i^g \times Market\ Value_i^g}{N},$$

where $CAR(\text{-}5,\text{+}5)_i^g$ is the cumulative market-adjusted returns of settled generic defendant held by shareholder i over the $(-5,+5)$-day window centered on the settlement event. $Shares_i^g$ is shareholder i's stake (in percent) in the generic as of when a lawsuit starts. $Market\ Value_i^g$ is the generic's market capitalization (millions USD) as of the beginning of the event window. The change of brand value (ΔW^b) is calculated analogously.

	ΔGeneric Value (ΔW^g)			ΔBrand Value (ΔW^b)		
			Panel A: Pooled Sample			
Rank	Mean	t-stat	N	Mean	t-stat	N
Top 1	-149.07	-1.24	23	471.85	1.11	24
Top 1-2	-108.98	-1.56	47	323.85	1.37	50
Top 1-3	-90.05	-1.61	69	376.67	2.07	74
Top 1-4	-76.73	-1.76	91	388.30	2.58	96
Top 1-5	-70.75	-1.81	108	352.22	2.63	115
Top 1-10	-57.20	-2.18	189	203.17	2.28	200
Top 1-20	-47.70	-2.52	317	191.68	2.90	337
			Panel B: High Common Ownership			
Rank	Mean	t-stat	N	Mean	t-stat	N
Top 1	-257.74	-1.67	17	840.35	1.57	18
Top 1-2	-181.42	-1.95	34	588.41	1.88	36
Top 1-3	-147.97	-1.96	50	607.29	2.59	54
Top 1-4	-123.81	-2.02	63	621.77	3.20	67
Top 1-5	-102.24	-1.82	73	566.17	3.15	78
Top 1-10	-75.22	-1.86	116	367.28	2.79	124
Top 1-20	-58.03	-1.98	192	338.03	3.48	204
			Panel C: Low Common Ownership			
Rank	Mean	t-stat	N	Mean	t-stat	N
Top 1	158.81	3.41	6	-633.66	-2.20	6
Top 1-2	80.47	2.51	13	-356.43	-2.07	14
Top 1-3	62.35	2.56	19	-246.02	-1.49	20
Top 1-4	29.20	1.20	28	-151.08	-0.80	29
Top 1-5	-5.05	-0.20	35	-98.82	-0.66	37
Top 1-10	-28.57	-1.30	73	-64.60	-0.76	76
Top 1-20	-31.85	-1.93	125	-32.79	-0.45	133

Table 11: Effect of common ownership on brand's and generic's abnormal returns around the first generic challenges

This table presents estimates of the effect of common ownership on the market-adjusted daily stock returns around the date the first generic files a Paragraph IV with the FDA. We estimate the following linear regression:

$$CAR_{jki} = \alpha + \beta \times Kappa20_{jks-1} + X' \times \gamma + \phi_k + \phi_l + \epsilon_{jki},$$

where CAR_{jki} is the cumulative market-adjusted return for the brand incumbent (columns (1)-(4)), or for the first generic filer (columns (5)-(8)), over the window of (-5, +5) relative to the event day in which the first generic manufacturer j files a Paragraph IV with the FDA challenging patents covering drugs owned by brand incumbent k. *Kappa20* is measured as the profit weight the top 20 generic shareholders put on the brand as of the beginning of the year-quarter s in which the first generic files a Paragraph IV. Dependent variables are winsorized at the 1% and 99% levels. See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses and are clustered at the U.S. federal district court level.

	Brand Return				Generic Return			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Kappa20	0.054**	0.047**	0.041**	0.041*	0.014	-0.004	-0.000	0.006
	(0.023)	(0.018)	(0.019)	(0.024)	(0.021)	(0.022)	(0.029)	(0.026)
Constant	-0.003	-0.003	0.018	0.041**	0.004	-0.017*	0.038	-0.060*
	(0.005)	(0.008)	(0.014)	(0.015)	(0.005)	(0.009)	(0.047)	(0.029)
Controls		✓	✓	✓		✓	✓	✓
Court			✓	✓			✓	✓
Brand Firm FE				✓				
Generic Firm FE								✓
N	314	314	314	314	136	136	136	136
Adj R^2	0.01	-0.02	-0.01	0.47	-0.01	-0.01	-0.02	0.13

standard errors in parentheses

$*p < 0.10, **p < 0.05, ***p < 0.01$

Online Appendix

Martin Schmalz and Jin Xie

This Online Appendix provides supplementary material to the manuscript titled "Fake Entry" coauthored by Martin Schmalz (University of Oxford) and Jin Xie (Peking University).

A.1 Model

We now use a simple model to illustrate how pay-for-delay settlements affect the first Paragraph IV filer's ability to create value for the brand incumbent at the sacrifice of its own shareholders' interests. We begin by outlining a benchmark scenario in which we model the strategic decisions faced by generic firms whose shareholders do not own the brand incumbent. The benchmark case addresses two key questions: First, how much cost should separately owned generic entrants incur to become the first filer, and second, given patent infringement lawsuits, whether generics should settle with the brand or pursue litigation. The model then analyzes how common ownership enhances both generics' incentives to compete for first-filer status and their willingness to settle. We demonstrate that when generic shareholders hold large stakes in the brand, the shareholders benefit on net when a wealth transfer of settlement gains from one portfolio firm to another occurs.

A.1.1 Benchmark: Paragraph IV without common ownership

We consider a drug market with one brand incumbent and n symmetric generic manufacturers without common ownership, indexed by $j \in 1, ..., N$. We assume generic and brand firms are risk-neutral and ignore discounting. The brand owns a patent of uncertain validity, which any generic manufacturer can challenge in court. The patent's strength is common knowledge and is captured by θ. Suppose there are only two litigation outcomes: the patent either is valid and infringed with probability θ, or is invalid with probability $1 - \theta$.[1] If at least one generic initiates litigation and a court rules the patent invalid, all generic manufacturers — including those that do not file Paragraph IVs — gain the legal right to enter the market by launching their own generic versions of the branded drug.

Assume the aggregate (inverse) demand curve is

$$D(p) = A - q, \tag{A.1}$$

[1] When we assume patent strength is common knowledge, a theoretical possibility arises: if a patent is very strong, none of the generic manufacturers (including those with common ownership) would file patent challenges. However, we find that assumption less realistic, as our empirical analysis exclusively examines branded drugs whose patents have been challenged by at least one generic manufacturer, suggesting that the patent strength observed in real data corresponds to what would be classified as "weak patents." Alternatively, we could model patent strength as private information specific to each generic manufacturer. However, doing so would complicate the model, which we do not aim to literally incorporate into our empirical tests. Instead, our study focuses on predictions that can also be derived from models with weaker epistemological assumptions.

where $A > 1$ and marginal cost is a constant c.[2] Prior to generic entry, the brand operates as a monopolist, setting a monopolistic price at $p_b^M = \frac{A+c}{2}$ and earning a monopolistic profit as follows:

$$\pi_b^M = \frac{(A-c)^2}{4}. \tag{A.2}$$

During the 180-day exclusivity period, the first generic and the brand incumbent engage in Cournot duopoly competition, resulting in an equilibrium price of $p^D = \frac{A+2c}{3}$ and equal profits for both firms as follows:

$$\pi^D = \frac{(A-c)^2}{9}. \tag{A.3}$$

If the court invalidates the patent, the market transitions to a Cournot oligopoly with $N+1$ firms. The equilibrium price becomes $p^C = \frac{A+(N+1)c}{N+2}$, and each firm earns a profit as

$$\pi^C = \frac{(A-c)^2}{(N+2)^2}. \tag{A.4}$$

The timeline of events is structured as follows. At $t = -1$, generic firms decide their costly efforts, which are measured by K, to secure the first-filer status. Following Scott Morton (1999), we model generic firms as simultaneously investing K in Paragraph IV challenges. Indeed, FDA maintains confidentiality of ANDA filings under Paragraph IV, and generics withhold disclosure of their plans due to strategic motivations.

The cost K a generic incurs to obtain the first-filer status includes managerial efforts the firm has made to prove that the patents in question are invalid or will not be infringed by its production, use, or sale of the drug product for which the ANDA is submitted. FTC reports, court filings, law firm publications, news articles, and academic research frequently note that generics invest in pre-litigation due diligence, including laboratory tests and seeking third-party analyses (e.g., legal, scientific, or regulatory advice), to gauge the strength of branded patents

[2]The marginal cost c refers exclusively to the drug's manufacturing expenses, which both the brand and generics incur at the same level. This cost does not account for R&D or clinical trials, which are exclusively borne by the brand.

and to avoid costly lawsuits.[3] Moreover, the FDA's guidance implicitly acknowledges the need for generics to validate non-infringement or patent invalidity, which often involves laboratory comparisons (e.g., bioequivalence studies) and legal opinions. Third, the cost K also includes firms' physical expenses related to Paragraph IV filing activities.[4]

At $t = -1$, when the manager of focal generic firm j chooses the level of K_j to influence the probability of obtaining the first-filer status, she acknowledges the positive probability that other generics are paying K_{-j} to compete for the first-filer status. We assume that the probability of rival investment is constant and firm j's expectation of rivals' average investment is $\bar{K}_{-j}$. Note that strategic interactions (e.g., whether filings are complements or substitutes) are beyond the scope of the model.[5]

After paying K_j, the probability for generic j to have a first-filer status is $\mathbb{P}(K_j, \bar{K}_{-j}) \in [0, 1]$, which is an increasing and concave function of K_j. $\mathbb{P}(K_j, \bar{K}_{-j})$ satisfies the following first- and second-order conditions with respect to K_j:

$$\frac{d\mathbb{P}(K_j, \bar{K}_{-j})}{dK_j} > 0, \tag{A.5}$$

and

$$\frac{d^2\mathbb{P}(K_j, \bar{K}_{-j})}{dK_j^2} < 0. \tag{A.6}$$

At $t = 0$, the brand and generic firms decide whether to settle.[6] At $t = T$ (with $0 < T < 1$), patent litigation concludes. If the court invalidates the patent, all generic firms enter the market immediately. At $t = 1$, the patent expires, authorizing unrestricted generic entry.

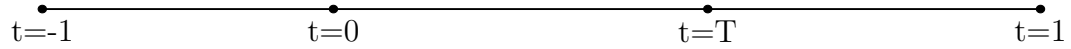
[3] Multiple sources confirm that being the first Paragraph IV is costly. First, FTC reports highlight costs from pre-litigation risk assessments (e.g., analyzing "Authorized Generics" and "Pay-for-Delay" deals). Second, court records in Paragraph IV cases (e.g., Mylan v. Sanofi and Teva v. AstraZeneca) show generics spending on lab tests and expert analyses to challenge patents. For details, see Mylan Wins District Court Decision Against Sanofi's Lantus®SoloSTAR®Patent and AstraZeneca Pharmaceuticals LP v. Teva Pharmaceuticals USA. Pharma law firms (e.g., Hyman, Phelps & McNamara) note generics invest in prior art searches, chemical studies, and legal strategies for patent challenges. Third, academic studies find generics conduct early research to target weak patents and avoid lawsuits (e.g., Hemphill and Sampat, 2012).

[4] In several cases, generic firms' representatives had sought to be the first to submit a patent challenge by "lining up outside, and literally camping out adjacent to, an FDA building for periods ranging from 1 day to more than 3 weeks." For details, see Guidance for Industry 180-Day Exclusivity When Multiple ANDAs Are Submitted on the Same Day.

[5] This simplification isolates the comparison of first-filer probabilities between focal generics with and without common ownership, holding generic competition constant.

[6] A settlement can be reached either before or after courts take an action. Similar to Shapiro (2003), we do not distinguish between settlements occurring before and after patent litigation, because both types of settlements take place in the shadow of an ultimate court ruling on patent validity and/or infringement.

Timeline of events



Generic chooses cost K to be the first generic	Generic and brand decide whether to settle or go trial	Litigation resolved, generic entry allowed if patent not infringed	Patent expires

Settlement at t=0: Absent settlement, if the brand and generic proceed to trial, the expected number of days during which the brand retains monopoly sales is given by $T + \theta(1 - T)$, where $1 - T$ denotes the time until patent expiration and θ denotes the probability of patent invalidation. Under these assumptions, the brand's expected profits (prior to patent expiration) at $t = 0$ can be expressed as

$$\mathbb{E}_{t=0}(\pi_b) = T\pi^M + (1 - T)[\theta\pi^M + (1 - \theta)\pi^C], \tag{A.7}$$

where, between t=T and t=1, the brand is expected to earn a profit under Cournot competition with N+1 firms with probability $1-\theta$, if the patent is invalid. Without the 180-day exclusivity, the expected payoff to generics is:

$$\mathbb{E}_{t=0}(\pi_j) = (1 - T)(1 - \theta)\pi^C. \tag{A.8}$$

We next introduce the 180-day exclusivity into the game. Assume τ is the length of the exclusivity period that the FDA rewards the first generic. The brand's expected profits with and without settling with the first generic are

$$\mathbb{E}_{t=0}(\pi_b) = \begin{cases} \pi^M - S_1 & \text{Settle} \\ T\pi^M + \underbrace{\theta(1 - T)\pi^M}_{\text{Patent valid}} + \underbrace{(1 - \theta)(\tau\pi^D + \omega\pi^C)}_{\text{Patent invalid}} & \text{Trial,} \end{cases} \tag{A.9}$$

where $\omega = 1 - T - \tau$ represents the remaining days after the 180-day exclusivity expires but before the patent expires. S_1 is the brand's payment to the first generic, $(1-\theta)\tau\pi^D$ is the brand incumbent's expected profit when competing with the first generic during the exclusivity period, and $(1 - \theta)\omega\pi^C$ is the expected profit when competing with N generics after the exclusivity

period expires. We assume S_1 satisfies the condition as follows:

$$(1-\theta)(\tau\pi^D + \omega\pi^C) < S_1 < \pi^M, \tag{A.10}$$

where $(1-\theta)(\tau\pi^D + \omega\pi^C)$ is the expected payoff to the generic if two parties go to trial, and π^M is the maximum payment that the brand can afford.[7] The first generic's expected profit before patent expiration, with or without entering into a pay-for-delay settlement, is expressed as follows:

$$\mathbb{E}_{t=0}(\pi_1) = \begin{cases} S_1 & \text{Settle} \\ (1-\theta)(\tau\pi^D + \omega\pi^C) & \text{Trial.} \end{cases} \tag{A.11}$$

After a settlement, the expected total gains accruing to the two litigants are the following:

$$\begin{aligned} \mathbb{E}_{t=0}(\Delta\pi_b - \Delta\pi_1) &= (1-\theta)(1-T)\pi^M - 2(1-\theta)(\tau\pi^D + \omega\pi^C) \\ &> (1-\theta)(1-T)\pi^M - 2(1-\theta)(\tau\pi^D + \omega\pi^D) \\ &= (1-\theta)(1-T)(\pi^M - 2\pi^D) \\ &= (1-\theta)(1-T)\frac{(A-c)^2}{36} > 0. \end{aligned} \tag{A.12}$$

Equation (A.12) suggests that, if a court rules the patent invalid at $t = T$, a pay-for-delay settlement allows the brand to pay the first generic S_1 to stay out of the market until patents expire at $t = 1$. In exchange, the brand earns monopoly profits for 1–T days instead of earning duopoly profits for τ days and later facing tough competition from N generic manufacturers. Equation (A.12) suggests settlement increases total producer surplus.

Because each generic Paragraph IV filer can independently challenge the patent in court, brand incumbents often pursue settlements not only with the first generic challenger but also with subsequent filers. This strategy mitigates the risk that a later generic's successful patent invalidation could nullify the first filer's 180-day exclusivity — if the first generic has not yet launched its product — thereby triggering unrestricted market entry by all generics. If the first generic has already launched, legal disputes may determine whether its exclusivity remains enforceable, but courts increasingly prioritize competition in such scenarios.[8]

[7] Because generic manufacturers are risk natural, the term $(1-\theta)(\tau\pi^D + \omega\pi^C)$ represents their reservation utility.

[8] Under the FDA's "failure-to-market" rule, the first generic filer loses its 180-day exclusivity if it fails to commercially market the drug within 75 days of either (1) a final court decision invalidating the patent or (2) the expiration of all statutory stays (e.g., settlements or regulatory holds).

The N^{th} ($N \geq 2$) generic's profit with and without entering into the pay-for-delay settlement is expressed as follows:

$$\mathbb{E}_{t=0}(\pi_N) = \begin{cases} S_N & \text{Settle} \\ (1-\theta)\omega\pi^C & \text{Trial,} \end{cases} \tag{A.13}$$

where we assume $S_1 \geq S_N$.

Paragraph IV Filing Decision at t=-1: At time t=-1, the generic manufacturer chooses cost K to be the first generic. Suppose the probability of two parties entering into a settlement agreement is $F_1 = F(u \leq S_1)$ for the first generic, and $F_N = F(u \leq S_N)$ for other generics, and u is a random variable capturing the generic's (or its key decision-maker's) reservation utility. At t=0, bargaining between the two parties might break down with a probability of $1 - F_1$ (e.g., Harsanyi, 1961). At time $t = -1$, the generic's expected payoff of filing a Paragraph IV can be expressed as follows:

$$\begin{aligned} \max_{K_j} \mathbb{E}_{t=-1}(\pi_j) \quad = \quad & \max_{K_j} \mathbb{P}(K_j) \underbrace{[F_1 S_1 + (1-F_1)(1-\theta)(\tau\pi^D + \omega\pi^C)]}_{\text{First generic's profit}} \\ & + [1 - \mathbb{P}(K_j)] \underbrace{[F_N S_N + (1-F_N)(1-\theta)\omega\pi^C]}_{\text{Other generic's profit}} - K_j, \end{aligned} \tag{A.14}$$

where, at t=-1, the generic manufacturer j sets K_j to maximize its expected profit. Taking the derivative of $\mathbb{E}_{t=-1}(\pi_j)$ with respect to K_j, the first order condition is

$$\frac{d\mathbb{P}(K_j)}{dK_j}\Big|_{K_j=K^*} \underbrace{\{F_1 S_1 - F_N S_N + (1-\theta)[(1-F_1)\tau\pi^D + (F_N - F_1)\omega\pi^C]\}}_{\text{Profit difference}} = 1, \tag{A.15}$$

where the left-hand side of equation (A.15) represents the marginal increase in the probability that a Paragraph IV filer becomes the first generic per dollar invested in K_j, multiplied by the profit difference between the first generic and the non-first generic. The right-hand side represents the marginal cost of this investment. Because $S_1 \geq S_N$ and $S_1 > (1-\theta)\gamma\pi^C$, the

following calculation suggests the profits of the first generic exceed those of other generics:

$$\begin{aligned} A &= F_1 S_1 - F_N S_N + (1-\theta)[(1-F_1)\tau\pi^D + (F_N - F_1)\omega\pi^C] \\ &\geq F_1 S_1 - F_N S_1 + (1-\theta)[(1-F_1)\tau\pi^D + (F_N - F_1)\omega\pi^C] \\ &= (F_1 - F_N)[S_1 - (1-\theta)\omega\pi^C] + (1-\theta)(1-F_1)\tau\pi^D > 0. \end{aligned} \tag{A.16}$$

A.1.2 Main Results: Paragraph IV with common ownership

Settlement at t=0: According to equation (2) to be illustrated in Subsection 4.4, if influential generic shareholders hold stakes in the brand, the generic manager puts a profit weight of κ on the branded drug (see equation (1)). Given the same total gain accruing to the two litigated parties after a settlement (see equation (A.12)), the expected payoff for common owners of the first generic is the following:

$$\mathbb{E}_{t=0}(\pi_1') = \kappa(\pi^M - S_1) + S_1, \tag{A.17}$$

where the prime symbol denotes firm choices and payoffs under common ownership. The probability that the first generic accepts the settlement offer is

$$F_1'[u < \kappa(\pi^M - S_1) + S_1]. \tag{A.18}$$

Taking the first-order derivative with respect to κ in equation (A.18) yields the following result:

$$\frac{dF_1'[u < \kappa(\pi^M - S_1) + S_1]}{d\kappa} = f_1'(u)(\pi^M - S_1) > 0, \tag{A.19}$$

where $f_1'(u)$ is the density function of $F_1'(u)$. Equation (A.19) also holds if the settlement is between non-first generics and the brand. This leads to the following result with respect to the relation between common ownership and the likelihood of settlement.

Proposition 1: *Given that the brand incumbent offers payment S_1 to the first generic and S_N to the later Paragraph IV filers, the probability that two parties settle is an increasing function of the profit weight that generic shareholders put on the brand incumbent (κ).*

Paragraph IV Filing Decision at t=-1: At time t=-1, the generic manufacturer whose large shareholders put a profit weight of κ on the brand decides the optimal level of K_j to maximize its expected payoff from filing a Paragraph IV challenge. At time $t = -1$, the generic's problem from challenging patents is:

$$\begin{aligned}\max_{K_j'} \mathbb{E}_{t=-1}(\pi_j') \quad = \quad & \max_{K_j'} \mathbb{P}(K_j') \underbrace{[F_1' S_1 + (1 - F_1')(1-\theta)(\tau\pi^D + \omega\pi^C)]}_{\text{First generic's profit}} \\ & + [1 - \mathbb{P}(K_j')] \underbrace{[F_N' S_N + (1 - F_N')(1-\theta)\omega\pi^C]}_{\text{Other generic's profit}} - K_j'. \end{aligned} \tag{A.20}$$

Taking the derivative of $\mathbb{E}_{t=-1}(\pi_j')$ with respect to K_j', the first order condition is

$$\frac{d\mathbb{P}'(K_j')}{dK_j'}\Big|_{K_j'=K'^*} \underbrace{\{F_1' S_1 - F_N' S_N + (1-\theta)[(1-F_1')\tau\pi^D + (F_N' - F_1')\omega\pi^C]\}}_{\text{Profit difference}} = 1, \tag{A.21}$$

where the second term on the left-hand side of equation (A.21) represents the difference in expected profits before patent expiration between first and non-first generics under common ownership κ. Taking the first-order derivative with respect to κ in this second term yields the following result:

$$\frac{dF'(\kappa)}{d\kappa}\{(\pi^M - S_1)[S_1 - (1-\theta)\tau\pi^D] - (\pi^M - S_N)[S_N - (1-\theta)\tau\pi^C]\} > 0. \tag{A.22}$$

We now compare two optimal investment levels, $K_1'^*$ and $K_2'^*$, and therefore $\mathbb{P}(K_1')$ and $\mathbb{P}(K_1')$, for two generic firms with common ownership levels κ_1 and κ_2, where $\kappa_1 > \kappa_2$. Based on equation (A.22), which suggests that the marginal profit of becoming the first generic is an increasing function of κ, to have equation (A.21) hold, we have the following:

$$\frac{d\mathbb{P}'(K_1')}{dK_1'}\Big|_{K_1'=K_1'^*} < \frac{d\mathbb{P}'(K_2')}{dK_2'}\Big|_{K_2'=K_2'^*} \Leftrightarrow \mathbb{P}(K_1'^*) > \mathbb{P}(K_2'^*). \tag{A.23}$$

This leads to the following result with respect to the relation between common ownership and a generic manufacturer's incentive to be the first Paragraph IV filer.

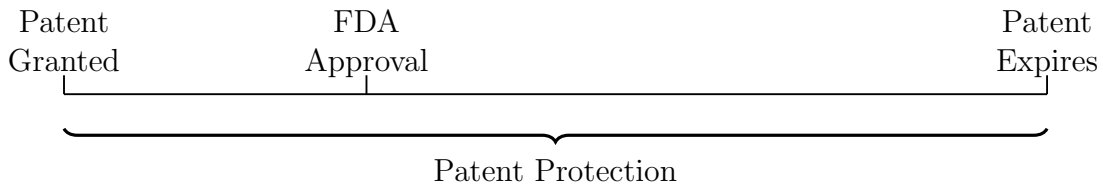
Proposition 2: *Given that the brand incumbent offers a payment of S_1 to the first generic and S_N to other generics, and that generic entry incurs a cost K, the probability of a generic*

manufacturer being the first Paragraph IV filer is an increasing function of the profit weight that generic shareholders assign to the brand incumbent (κ).

Figure A.1: Marketing exclusivity and Paragraph IV patent challenge

This figure demonstrates the two types of protection conferred on branded drugs. Panel A demonstrates the protection of patents covering a branded drug from the grant of that patent until the expiration of it. Panel B demonstrates that when a new drug is approved by the FDA, a regulatory protection called "data exclusivity," which runs concurrent with patent protection, protects the underlying clinical data for five-year period (seven years for orphan drugs and five and a half years for pediatric drugs). A period from the conclusion of data exclusivity to the expiration of patents is called "market exclusivity." During the marketing-exclusivity period, a branded drug is protected only by its patents until they expire, and Paragraph-IV challenges occur only during this period.

Panel A. Patent protection



Panel B. Data exclusivity

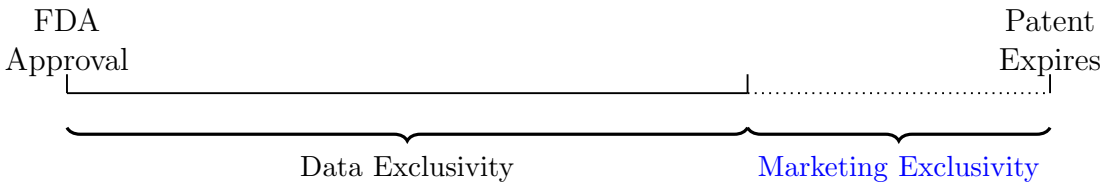


Figure A.2: Paragraph IV decision tree

This figure plots the decision tree for a generic firm to file an abbreviated new drug application (ANDA) with the FDA under a Paragraph IV certification.

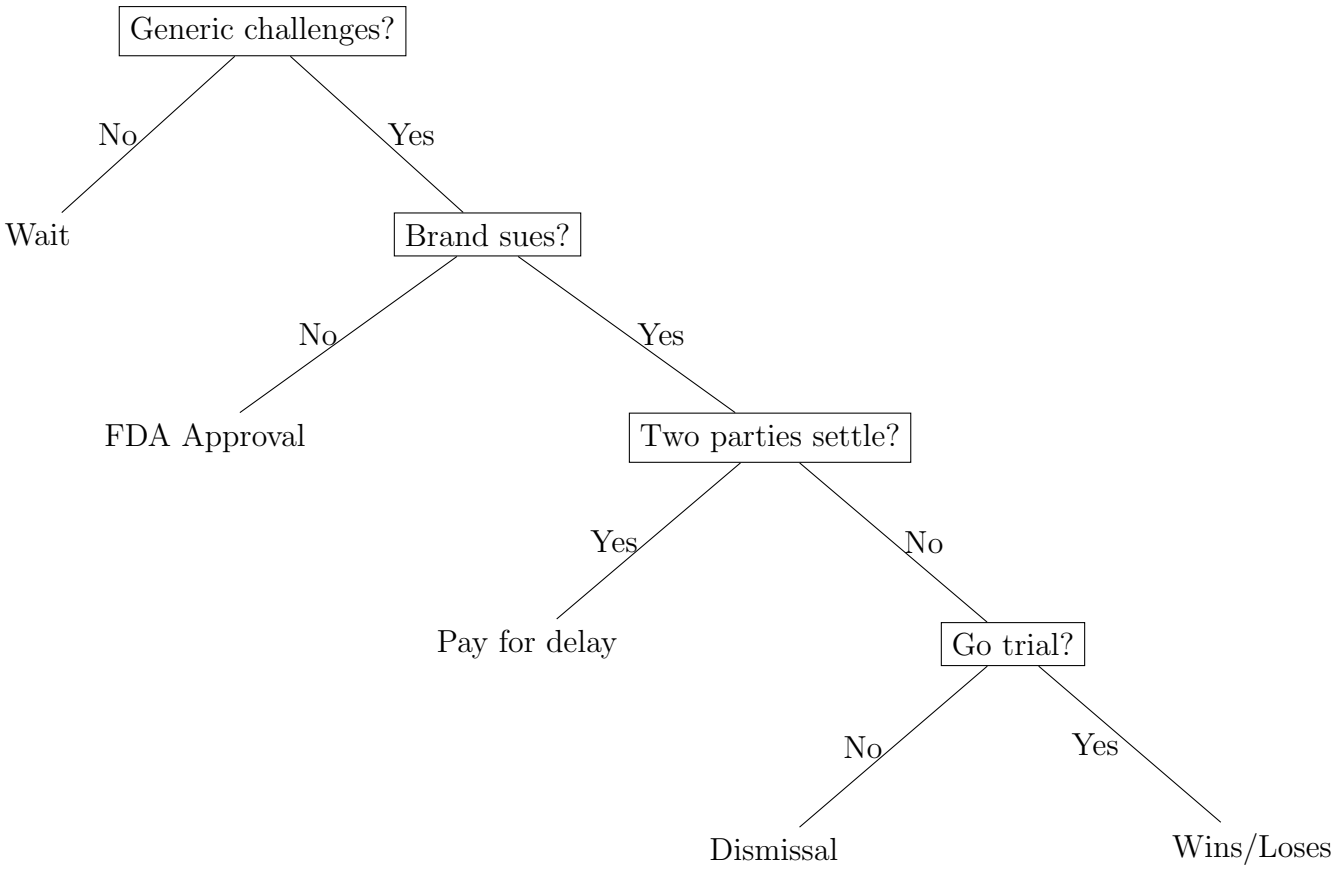
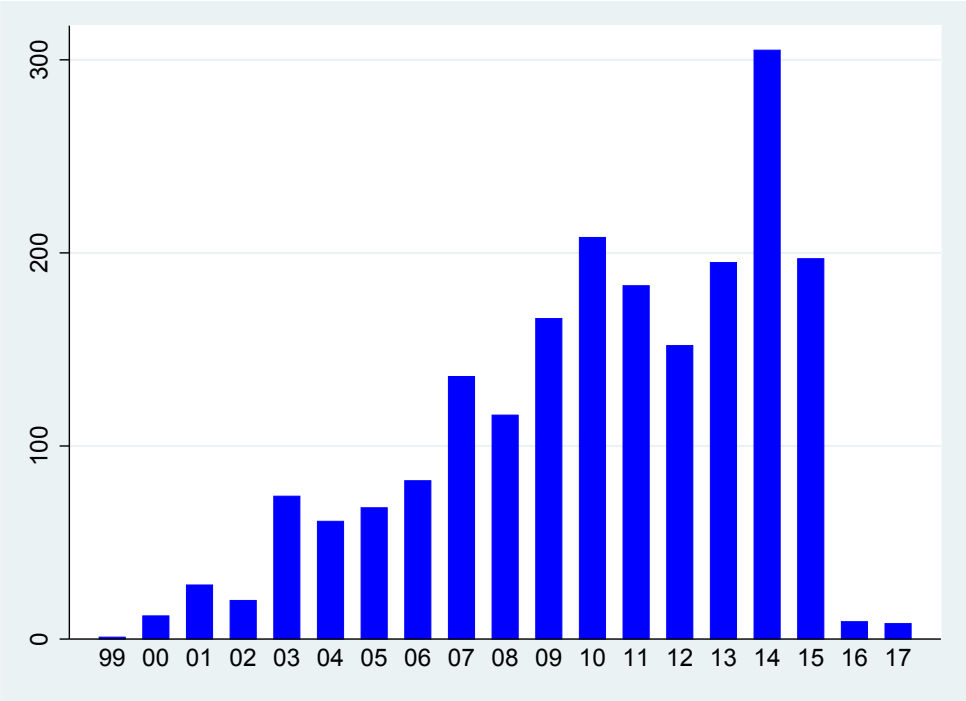


Figure A.3: Time trend of Paragraph IV challenges and settlement rates

Panel A plots the number of Paragraph IV litigations over years. Panel B plots the mean of settlement rates over years. The X-axis is the calender year and the Y-axis is the number of Paragraph IV challenges in Panel A and the settlement rate in Panel B.

Panel A: Number of Paragraph IV challenges



Panel B: Settlement rate

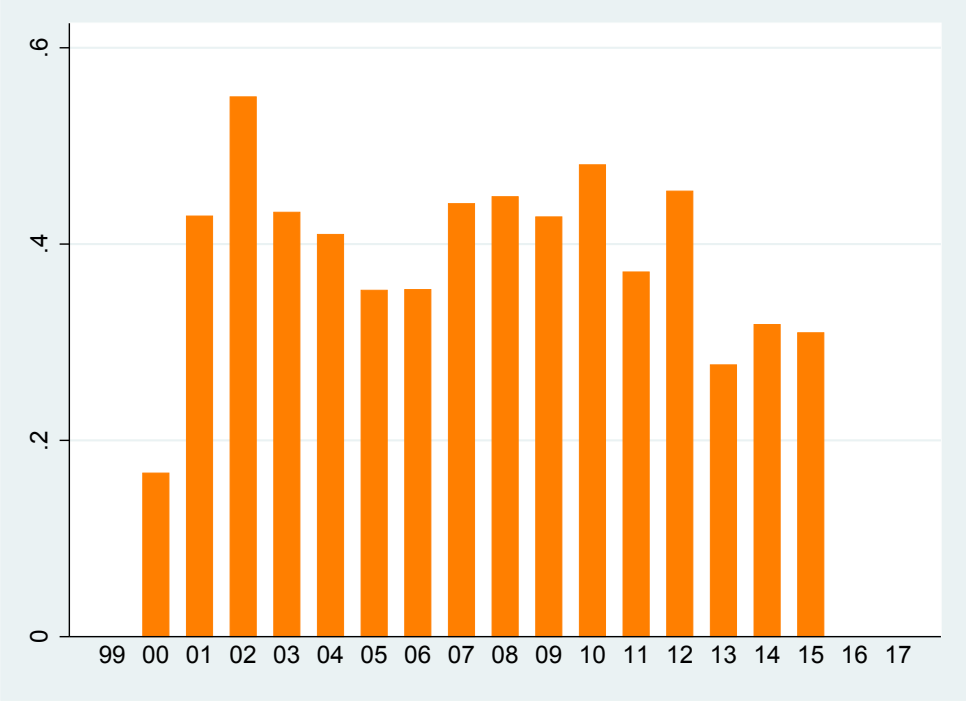


Table A.1: How influential are generic common owners?

This table uses four cases with extremely high *Kappa20* to show that, among the top five generic shareholders, common owners dominate over non-common owners in voting rights. *Kappa20* is the profit weight the top 20 generic shareholders put on the brand incumbent as of the beginning of the quarter when a patent-infringement lawsuit is filed (see equation (2) for detailed descriptions).

Panel A: Teva vs. Merck (2009Q3)

	Generic Ownership%	Brand Ownership%
Capital Rsrch & Mgmt.	13.7	13.0
Wellington	3.6	4.4
AllianceBernstein	3.1	2.9
FMR	2.8	2.2
Jennison Associates	2.2	0.8
Top 5 generic common owners	25.3	23.2
Top 5 generic non-common owners	0.0	
Kappa20	0.9	

Panel B: Innopharma vs. Spectrum Pharmaceuticals (2015Q2)

	Generic Ownership%	Brand Ownership%
BlackRock	6.4	14.3
Vanguard	5.8	6.5
State Street	5.1	7.6
Wellington	1.8	3.7
Top 5 generic common owners	19.0	32.1
Top 5 generic non-common owners	2.8	
Kappa20	1.4	

Panel C. Mylan vs. Medicines Co. (2014Q3)

	Generic Ownership%	Brand Ownership%
BlackRock	7.9	10.3
Vanguard	7.3	6.6
Wellington	5.5	14.0
State Street	4.3	3.5
Top 5 generic common owners	24.9	34.4
Top 5 generic non-common owners	5.9	
Kappa20	1.0	

Panel D. Perrigo vs. Eli Lilly (2016Q2)

	Generic Ownership%	Brand Ownership%
Vanguard	6.7	6.0
BlackRock	6.1	6.3
Capital Rsrch & Mgmt.	6.0	1.6
State Street	3.9	3.7
Top 5 generic common owners	22.7	17.6
Top 5 generic non-common owners	3.8	
Kappa20	0.6	

Table A.2: Paragraph IV litigation outcomes across U.S. federal district courts

This table presents the distributions of the Paragraph IV litigation outcomes at the patent level across the U.S. Federal District Courts following the filing of an ANDA under Paragraph IV certification with the FDA. We start with cases active as of November 1, 2003. We define a Paragraph IV challenge at the level of the date that a brand files a patent-infringement lawsuit against a generic manufacturer, challenging the formulation (e.g., tablet, capsule, and injection) of a trade name (i.e., the name of the branded drug). Multiple patents can be involved in a Paragraph IV challenge. Paragraph IV challenges that did not trigger lawsuits are excluded.

	# Challenges	Settlement	Dismiss	Trial
California Central District	17	35.3%	47.1%	23.5%
California Northern District	16	56.3%	12.5%	31.3%
California Southern District	2	0.0%	100.0%	0.0%
Colorado District	3	66.7%	33.3%	0.0%
Delaware Disctrict	727	36.5%	39.2%	24.9%
District of Columbia	4	25.0%	75.0%	0.0%
Florida District	1	0.0%	0.0%	100.0%
Florida Middle District	4	50.0%	0.0%	25.0%
Florida Southern District	12	41.7%	16.7%	41.7%
Georgia Northern District	9	66.7%	0.0%	44.4%
Illinois Norther District	63	36.5%	36.5%	27.0%
Indiana Southern District	60	20.0%	35.0%	45.0%
Maryland District	34	47.1%	47.1%	5.9%
Massachusetts District	18	16.7%	66.7%	5.6%
Michigan Eastern District	9	44.4%	11.1%	44.4%
Michigan Western District	2	100.0%	0.0%	0.0%
Minnesota District	4	50.0%	0.0%	50.0%
Nevada District	14	7.1%	21.4%	57.1%
New Jersey Disctrict	713	43.5%	32.0%	27.5%
New York Eastern Disctrict	7	28.6%	28.6%	42.9%
New York Sourthern District	172	47.7%	34.9%	20.9%
North Carolina Eastern District	14	7.1%	35.7%	57.1%
North Carolina Middle District	10	10.0%	60.0%	40.0%
North Carolina Western District	1	0.0%	0.0%	100.0%
Ohio Southern District	2	100.0%	0.0%	0.0%
Pennsylvania Eastern District	25	12.0%	64.0%	20.0%
Pennsylvania Western District	1	0.0%	0.0%	100.0%
Pennyslvania Middle District	1	0.0%	100.0%	0.0%
Puerto Rico District	1	100.0%	0.0%	0.0%
Texas Eastern District	20	20.0%	20.0%	70.0%
Texas Northern District	12	75.0%	25.0%	0.0%
Vermont District	1	0.0%	0.0%	100.0%
Virgina Eastern District	14	7.1%	35.7%	57.1%
West Virginal District	3	0.0%	0.0%	100.0%
West Virginia North District	15	33.3%	60.0%	20.0%
Unknown	12	0.0%	16.7%	83.3%
Total	2,023	38.6%	35.6%	27.4%

Table A.3: Determinants of the first generic: full sets of coefficients

This table presents estimates of the effect of common ownership on the probability that a generic-drug manufacturer that files a Paragraph IV with the FDA will be the first Paragraph IV filer:

$$First_{jkmt} = \alpha + \beta \times Common\ Ownership_{jkt-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkmt},$$

where the dependent variable is a dummy variable indicating whether the generic manufacturer is the first generic that files the Paragraph IV with the FDA. *Common Ownership* is measured as the profit weight the top 20 generic shareholders put on the brand incumbent one quarter prior to the year-quarter in which the first generic files the Paragraph IV (*Kappa20*). ϕ_j, ϕ_k, ϕ_l, and ϕ_s represent full sets of generic manufacturer, brand-name-firm, district-court, and time (year-quarter) fixed effects, respectively. Time is measured at the level of year-quarter in which the first generic files a Paragraph IV. See Table 4 for descriptions of control variables (the vector of X). Standard errors are clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
Kappa20	0.267***	0.274***	0.320***	0.235***	0.245***
	(0.067)	(0.068)	(0.066)	(0.049)	(0.052)
Ln(#Patent)		-0.011	-0.016**	-0.023***	-0.015
		(0.009)	(0.008)	(0.007)	(0.012)
Rank25		-0.029	-0.006	0.012	0.043
		(0.029)	(0.033)	(0.030)	(0.028)
Rank50		0.015	0.035	-0.043	-0.074**
		(0.029)	(0.048)	(0.037)	(0.031)
Rank75		-0.090**	-0.101***	-0.135***	-0.134***
		(0.035)	(0.034)	(0.033)	(0.039)
Rank100		0.008	0.041	0.014	0.030
		(0.047)	(0.051)	(0.045)	(0.039)
Rank125		-0.013	0.008	0.012	-0.022
		(0.055)	(0.049)	(0.086)	(0.075)
Rank150		-0.070***	-0.090***	-0.142*	-0.081
		(0.015)	(0.028)	(0.072)	(0.051)
Rank175		0.020	0.029	0.072***	0.119**
		(0.084)	(0.041)	(0.025)	(0.046)
Rank200		-0.050**	-0.068***	-0.079**	-0.028
		(0.023)	(0.024)	(0.034)	(0.052)
Route Exp		0.014	0.006	0.023	0.039**
		(0.017)	(0.018)	(0.018)	(0.017)
Therapy Exp		-0.005	-0.027**	-0.026	-0.064***
		(0.016)	(0.013)	(0.018)	(0.020)
Constant	0.163***	0.176***	0.190***	0.380*	0.459***
	(0.005)	(0.012)	(0.012)	(0.206)	(0.157)
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓
N	3,256	3,256	3,256	3,256	3,256
Adj R^2	0.01	0.01	0.03	0.10	0.13

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table A.4: Effect of common ownership on the likelihood of settlement: Full sets of coefficients

This table presents estimates of the following regression model:

$$Settle_{jkms} = \alpha + \beta_1 \times Kappa20_{jks-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where the dependent variable is an indicator variable coded as 1 if the two parties settle a litigation for at least one disputed patent, and 0 otherwise. *Kappa20* is the profit weight the top 20 generic shareholders put on the brand incumbent as of the beginning of the quarter when a patent-infringement lawsuit is filed (see equation (2) for detailed descriptions). ϕ_j, ϕ_k, ϕ_l, and ϕ_s represent full sets of generic manufacturer, brand-name-firm, district-court, and time (year-quarter) fixed effects, respectively. Time is measured at the level of year-quarter in which the lawsuit is filed by the brand incumbent. See Table 4 for descriptions of control variables (the vector of X). Standard errors in parentheses are clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
Kappa20	0.254***	0.259***	0.274***	0.311***	0.312**
	(0.066)	(0.076)	(0.083)	(0.080)	(0.141)
First		0.111***	0.092***	0.094***	0.088***
		(0.033)	(0.025)	(0.023)	(0.024)
Ln(#Patents)		0.014	0.018	0.010	0.015
		(0.020)	(0.023)	(0.022)	(0.013)
Group		0.060***	0.027	0.033	0.028
		(0.019)	(0.017)	(0.019)	(0.018)
Rank 25		-0.068	-0.107*	-0.099	-0.029
		(0.045)	(0.062)	(0.076)	(0.053)
Rank 50		-0.099**	-0.206***	-0.216***	-0.244***
		(0.039)	(0.060)	(0.071)	(0.056)
Rank 75		-0.056	-0.089	-0.058	-0.044
		(0.170)	(0.132)	(0.118)	(0.105)
Rank 100		0.004	-0.116*	-0.093**	-0.127**
		(0.063)	(0.062)	(0.040)	(0.058)
Rank 125		0.155**	0.128*	0.076	0.137***
		(0.058)	(0.070)	(0.045)	(0.044)
Rank 150		0.096***	0.094***	0.102**	0.052
		(0.030)	(0.019)	(0.042)	(0.078)
Rank 175		-0.029	-0.060	-0.046	-0.172
		(0.116)	(0.093)	(0.079)	(0.172)
Rank 200		0.046	-0.067	-0.078	-0.078
		(0.071)	(0.050)	(0.066)	(0.094)
Route Exp		-0.039**	-0.033	-0.021	-0.034
		(0.019)	(0.030)	(0.032)	(0.024)
Therapy Exp		-0.097***	-0.090***	-0.078*	-0.062
		(0.032)	(0.032)	(0.045)	(0.037)
Constant	0.366***	0.370***	0.132	0.301**	0.026
	(0.024)	(0.058)	(0.130)	(0.139)	(0.518)
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓
N	1,743	1,743	1,743	1,743	1,743
Adjusted R^2	0.00	0.03	0.08	0.10	0.25

standard errors in parentheses
$*p < 0.10, **p < 0.05, ***p < 0.01$

Table A.5: Effect of common ownership on the likelihood of settlement: Excluding branded drugs challenged by multiple first generics on the same day

This table presents estimates of the effect of common ownership on settlement after excluding patent-protected drugs whose patents are challenged by multiple first-generic manufacturers on the same day. A patent-protected drug is defined at the formulation (e.g., tablet, capsule, and injection) under a brand name. Panel A presents linear-probability-model estimates of the effect of common ownership on settlement:

$$Settle_{jkms} = \alpha + \beta_1 \times Common\ Ownership_{jks-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkms},$$

where the dependent variable is an indicator variable coded as 1 if the two parties settle a litigation for at least one disputed patent, and 0 otherwise. *Common Ownership* is measured as *Kappa20* (see equation (2) for detailed descriptions). Panel B presents the second stage of instrumental variable (IV) estimates of the effect of common ownership on the likelihood of settlement in the post-2009Q2 period. *Kappa20* is instrumented by the percentile-rank transformed Δ*Kappa20* (see equation (8) and equation (9) for detailed descriptions). See Table 4 for descriptions of control variables (the vector of X). Standard errors are in parentheses clustered at the U.S. federal district court level.

	(1)	(2)	(3)	(4)	(5)
	Panel A. Linear-probability-model estimates				
Kappa20	0.294***	0.306**	0.342**	0.375**	0.443*
	(0.085)	(0.113)	(0.127)	(0.142)	(0.240)
N	1,371	1,371	1,371	1,371	1,371
Adj. R^2	0.01	0.02	0.08	0.10	0.25
	Panel B. IV estimates				
Kappa20	0.120***	0.122***	0.101***	0.134*	0.402**
	(0.036)	(0.035)	(0.033)	(0.070)	(0.200)
N	959	959	959	959	959
Controls		✓	✓	✓	✓
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓