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Do Corporations Maximize their Own Value?

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Abstract

The first generic challenger to a branded drug tends to feature an investor base that has substantial stakes in the branded drug's manufacturer. Such ownership links between generic and brand also predict pay-for-delay settlements that delay generic competition in the brand's market in return for a payment to the generic. Such settlements are accompanied by positive stock price reactions for the brand but systematically negative reactions for the generic, implying wealth transfers from one portfolio firm to another. These facts suggest corporate objectives depend on shareholder preferences, rejecting the Fisher Separation Theorem's key prediction.

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 Federal Trade Commission (January 13, 2010)

1. Introduction

What is the objective function of the firm? A ubiquitous assumption across all sub-fields of economics is that corporations maximize their own value, irrespective of its shareholders' preferences. The interpretation of empirical findings in the literature implicitly relies on that assumption. This convenient assumption has a shaky theoretical foundation, but is rarely ever tested against the alternative hypothesis that firms maximize the value of their most influential investors' portfolios.¹ Indeed, there is reason to believe that firms maximize a different objective. For example, if influential shareholders of one firm have large ownership stakes in rivals, these shareholders could financially benefit from taking value-destroying decisions for the benefit of rivals. If that were the 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. To find out whether such an endeavor is potentially worthwhile, it seems important to first address the *empirical* question whether such situations

¹Own-firm value and investors' portfolio value can differ when firms strategically interact. Fisher (1930) is often cited as the rationale behind the assumption of own-firm value maximization. Firms are price takers in that theory. Hart (1979) shows that 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 (Rotemberg, 1984). No accepted theory for the objective of the firm exists for more complicated and realistic cases.

do in fact occur. Do firms 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 make decisions that systematically destroy firms' own value, while the same decisions benefit the value of the portfolio of their largest shareholders. Specifically, we examine market-entry 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 common ownership predicts *which* generic first enters the market, whether the entrant settles with the rival offering the branded drug, thus precluding entry by other generics and helping the branded drug maintain its monopoly for longer.² 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.

We first document the extent of common ownership of industry competitors in the sector. To illustrate, Table 1 reports stakes the 20 largest generic shareholders hold in the generic manufacturer and stakes that 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. The holdings of the largest five shareholders are sufficient for them to care more about the typically much larger brand's profits than the generics. 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.³

We find that the extent to which the generic's largest shareholders hold financial stakes in the branded drug's manufacturer predicts both which generic first enters the incumbent brand's product market and, conditional on entry, whether a settlement between generic and brand is reached. Settlements are accompanied by negative announcement returns for the generic and positive announcement returns for the brand. The largest generic shareholders gain more from their holdings in the brand than they lose from the negative returns in the generic. As such, value-destroying product market decisions by generic manufacturers are explainable by their

²Brand-name companies can prevent all generic entries by paying the first generic to delay the entry (e.g., Bulow, 2004; Hemphill and Lemley, 2011); see also (FTC, 2002, 2010, 2013). Pursuant to Paragraph IV of the Hatch-Waxman Act of 1984, the FDA does not approve another Paragraph IV application for the same product until after the first generic markets the generic drug for 180 days. By entering into a "pay-for-delay" settlement, the brand incumbent pays the first generic in exchange for the forfeit of the exclusivity or for the delay of marketing, which precludes other generic firms from entering the market.

³An average generic price is only 3.6% of the pre-expiration price of its brand version, and generic drugs suffer a price reduction of 51% within 12 months after their loss of 180-day exclusivity. From 2006 to 2016, US sales of generics only account for 18% of brand prescription medication sales. Medicines Use and Spending in the U.S. – A Review of 2016 and Outlook to 2021, page 43. May 2017. Published by IQVIA (formerly Quintiles and IMS Health, Inc.), an American multinational company serving the combined industries of health information technology and clinical research.

largest shareholders' portfolio holdings in their rivals. We establish the above findings first with fixed-effect panel regressions, which difference out a large number of potentially omitted variables. Our panel-regression results suggest that the likelihood that conditional on entry and then lawsuits, 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. 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. We control for drug sales and fixed effects at the generic-defendant, the brand-plaintiff, federal-district-court, and time levels. The strongest effects of common ownership on the likelihood of settlement are attributable to the five largest generic shareholders.

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 entry (or settlement, or settlement terms) could be determined by the same, unobserved factors 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 that effect. We further test whether our main result remain qualitatively similar when we use only variation caused by BlackRock's acquisition of Barclays Global Investors. We find that common ownership caused by the event indeed predicts post-event settlement probability.

We propose that these empirical findings are easiest to understand if one assumes that generic firms maximize not their own value but the portfolio value of their largest investors. When such investors hold large stakes in the brand, this can mean sacrificing the own firm's value for the value of a rival. Thinking about the counterfactual makes the mechanism of this strategy clear: if a generic whose shareholders hold no stakes in the brand would enter the market, it would not be as ready 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 effectuate that outcome by allowing or inducing a generic they can influence to make the sacrifice to both enter the market and then settle at terms attractive to the brand. By doing so, the commonly-owned entrant prevents a more competitive and less cooperative rival to enter. As such, the facts we document can be explained by the portfolio

interests of the generic firms' largest shareholders.

2. Related Literature

The main import of the finding that firms whose largest shareholders hold large stakes in rivals not only appear to put weight on rival profits, but do so to an extent that hurts their own value is in informing a thus-far largely theoretical debate on the objective of the firm with a long history.⁴ However, our findings also contribute to a recently burgeoning more applied literature on common ownership and competition. The finding that common ownership of industry rivals in airlines (Azar et al., 2018; Park and Seo, 2019; Azar and Vives, 2021) and other industries likely cause higher product prices in some markets in specific industries have triggered a vigorous policy debate and new literatures in industrial organization and antitrust law. However, whether the findings also have first-order implications for corporate finance depends on whether they imply that firm objectives depend on shareholder portfolios and preferences, thus rejecting the predictions of the Fisher Separation Theorem. Azar et al. (2018) speculate whether their evidence suggests a rejection of Fisher Separation Theorem, but their evidence does not in fact give rise to that conclusion: Antón et al. (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 the literature. (The same model explains why there is no robust link between common ownership and profit margins, as likewise found in the literature.) By contrast to the extant literature, the present paper contributes first evidence of situations in which firms make value-destroying decisions for the benefit of commonly-owned rivals, thus rejecting the prediction of the Fisher Separation Theorem, with far-reaching implications for the study of corporate finance. Our study of product market entry also relates to Harford et al.'s (2011) study of mergers under common ownership, who 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.

While our main motivation is conceptual, our study is also important in their own right,

⁴Individual data points have been discussed informally, e.g. by Schmalz (2015), but no systematic study of wealth transfers across commonly-owned firms exists.

given the enormous public-health implications of competition in the market for affordable pharmaceuticals. We thus also contribute to a literature of generic entry under common ownership. Xie and Gerakos (2020) and Xie (2021) show that common ownership correlates with settlement, but has no causal evidence and does not show any effects on entry. Moreover, those papers' measurement of ownership omits insiders and blockholders, which make for much of the variation in common ownership (see Amel-Zadeh et al. 2022) and for that reason alone reports likely biased estimates. Ours is the first paper showing that common ownership predicts entry by the *first* generic challenger, thus blocking further entry by challengers with less common ownership, and leading for potentially welfare-reducing pay-for-delay 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 et al. (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 there are no patent disputes, settlements, and thus wealth transfers involved. A third closely related paper in this literature is on product market *exit* of commonly owned firms, by Li et al. (2022). This paper shows that Venture Capital investors cut funding to early-stage, not publicly traded drug development projects once a commonly owned project shows first promise in trials.

3. Background

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. 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.

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.

The FDA rewards 180-day exclusivity to the first generic submitting a Paragraph-IV 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.

3.2. Settlement

Despite various forms of settlements, they share one common feature: the brand-name company pays the generic firm in one of various ways (discussed), whereas the generic firm agrees to delay entry and thus generates value for the brand, who gets to enjoy a delay of the end of its patent-protected monopoly. More specifically, a generic firm files Paragraph IV challenge seeking to market a generic version of a branded drug prior to the expiration of patents covering the drug. The brand-name firm, rather than take a chance that it might lose the patent-infringement lawsuit, agrees to pay the generic firm to 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 to a more competitive equilibrium in which the generic does not delay entry.

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. For example, Watson filed an ANDA with FDA seeking approval to the generic version of Lidoderm jointly produced by Endo and Teikoku. The

two brand-name companies entered into a settlement agreement. Pursuant to the agreement, Endo/Teikoku granted to Watson a license to sell Watson’s generic product. In return, Watson pays to Endo royalty payments equal to twenty-five percent of all gross profit of the product.⁵

Third, brand-name pharmaceutical companies sometimes agree to not compete through an authorized generic (Berndt et al., 2007). Authorized generics are brand-name pharmaceutical products marketed as generics and can substantially reduce the revenues a first generic earns. Under the Hatch-Waxman Act, although the first generic can market its drugs with no competition from other generics for 180 days, the rule does not protect the first-filer generic from competition from an authorized generic during those 180 days.⁶ 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.

Relevant to our study, one important issue is regarding the timing of settlement. As concluded by 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 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.

Based on timing, settlements are classified according to whether they fully resolve the underlying patent litigation. The first type of settlement is called “compete settlement”, in which case the first generic often retain potential entitlement to the exclusivity period, without fear of losing it by losing a patent suit. The second type is “incomplete settlement”, in which case the first-filing generic firm received no assurance of being able to enjoy the exclusivity period.

⁵<https://www.sec.gov/Archives/edgar/data/1100962/000119312512250184/d359761dex101.htm>

⁶According to the same FTC staff study, 25% of patent-settlement agreements from 2004–2008 that were with a first generic involved an explicit agreement by the brand to not launch an authorized generic, combined with an agreement by the first generic to defer entry past the date of the agreement.

4. Data

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 A.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 Paragraph IV application filed by a generic firm to challenge a branded drug. We treat different formulations (e.g., tablets, capsule, and injection) under the same trade name (i.e., the active ingredient of the branded drug) as different products. 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.⁷

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 on the progress of the case with critical scheduled dates.

Table 2 presents descriptive statistics for our sample. It consists of 2,023 unique Para-

⁷About seven percent of challenges did not trigger the brand's lawsuit against generic manufacturers and, hence, we are not able to have the timeline of litigation. We therefore exclude challenges that did not lead to lawsuits from our analysis.

graph IV challenges to 1,578 unique patents covering 521 unique trade names. The 2,023 challenges are launched by 202 distinct generic manufacturers. The 521 trade names are owned by 157 distinct brand-name companies.

Figure A.2 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.1 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 determined 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 a entry date as the earliest of (1) the date an ANDA was filed (if data are available), (2) the date the brand incumbent was noticed by the ANDA filer(s), 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, 686 out of 2,023 lawsuits are triggered by the first generic.

4.3. Data on pharmaceutical firms' ownership

Amel-Zadeh et al. (2022) show that 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, buys and sells of insiders and major shareholders. The ownership data is available starting from the first quarter of 2004.

In Table 3, 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 9 most frequent Paragraph IV challengers (generic manufactures), and the 9 most challenged patent owners (brand-name companies), as well as their ownership observed in the fourth quarter of 2016. Table 3 shows that generic manufacturers are more often of smaller size and held by blockholders and insiders. Common ownership is more pronounced among bigger pharmaceutical companies.

4.4. Common ownership

Similar to Backus et al. (2021b), Antón et al. (2022), and Boller and Scott Morton (2021), we use a measure of common ownership based in the IO literature and used in antitrust practice, including O’Brien and Salop (2000) and Gilo et al. (2006). We calculate profits weights reflecting to which extent shareholders of a generic entrant hold shares in a competing brand-name incumbent. The measure can be interpreted as firm j maximizing 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:

$$\max \Pi_j = \sum_{i=1}^M \gamma_{ij} \sum_{k=1}^N \beta_{ik} \pi_k = \pi_j + \sum_{k \neq j} \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}} \pi_k. \quad (1)$$

In Equation 1, firm j (the generic manufacturer) internalizes externalities on other firms k (brand incumbents) to the extent λ_{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 small shareholders with potentially 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 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:

$$\max \Pi_j = \mathbb{E}\pi_j + Kappa_{jk} \times \mathbb{E}\pi_k, \quad (2)$$

where $Kappa_{jk} = \frac{\sum_i \gamma_{ij} \beta_{ik}}{\sum_i \gamma_{ij} \beta_{ij}}$ is the profit weight that generic defendant j places on the present

value of monopolistic profits from selling the branded drug during the remaining life of patents by the brand plaintiff k . $\mathbb{E}\pi_j$ is the present value of future profits, net of entry costs, if a generic substitute is allowed to be sold before patents expire. The empirical question is whether the profit weight $Kappa_{jk}$ helps explain product market behavior and associated stock returns.

Backus et al. (2021b) further show that under proportional control (“one share, one vote”), each profit weight $Kappa_{jk}$ can be decomposed into the following two terms:

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

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 firm k (also see Antón et al. (2022) and Boller and Scott Morton (2021)), respectively. 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 top 20 generic shareholders put in the brand firm as of the beginning of the quarter in which a patent-infringement lawsuit is filed ($Kappa_{20}$ thereafter). Panel A of Figure 1 shows a secular uptrend of averaged $Kappa_{20}$, 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 for at least once in in The Paragraph Four Report®, either as a defendant or as a plaintiff.

Backus et al. (2021a) find that the averaged profit weight across all pairs of firms in the S&P 500 index steadily grew from 0.2 in 1980 to 0.7 in 2017, whereas our calculated mean profit weight across all generic-brand pairs grew from 0.05 in 2004Q1 to 0.12 in 2017Q4. Such a stark difference in the secular uptrend is explained by sample firms, that is, the scope of our study is narrowed down on the pharmaceutical industry, where a majority of generic entrants are owned by under-diversified blockholders and insiders. Our low profit weights are somewhat

consistent with what reported by Amel-Zadeh et al. (2022). The authors show that accounting for blockholders' and insiders' holdings reveals that the level of common ownership is lower than previously believed.

As for the decomposed components, the mean cosine similarity steadily increased from 0.07 in 2005 to 0.19 in 2017, whereas the mean IHHI increased from 0.13 to 0.23.⁸ Panel B of Figure 1 provides histograms of the distribution of *Kappa20* across generic-brand pairs in 2004Q1 and 2017Q4, respectively.

5. Empirical results

5.1. Sample

Our ownership data starts in 2004. However, we also exclude patent-infringement lawsuits filed prior to the fourth quarter of 2003 for another important reason. That is, 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. On December 8, 2003, President George W. Bush signed the Medicare Prescription Drug, Improvement, and Modernization Act (MMA) into law, after passing 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.⁹ The FTC began receiving patent settlement agreements in January 2004 pursuant to the MMA of 2003.

Table 4 presents descriptive statistics of our regression sample. We note, first, that there is substantial variation in settlement outcomes. Namely, 37.8% of lawsuits were settled, 36.3% dismissed, and only 27.4% went to trial. Second, for about 30.9% cases, at least two generic manufacturers were involved with challenging patents covering the same branded product on the same day.¹⁰ Third, the share of first generic challenger counts for 32.8%. Fourth, generic

⁸By multiplying IHHI by 10,000, Backus et al. (2021a) report a 250 of investor concentration as of 2014. The authors find a much lower IHHI presumably because they do not account for blockholders' and insiders' holdings for the S&P 500 constituents.

⁹For 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).

¹⁰FDA grants each new approved product a length of "data exclusivity," which runs concurrently with patent protection. During this data exclusivity period, regardless of the status of the underlying patent(s), no generic entry is allowed. At the conclusion of data exclusivity, branded products are protected only by their patents, which are subject to generic manufacturers' challenge. This is why we observe several generic manufacturers simultaneously challenging the same branded product on the same date after the data exclusivity expires.

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.

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

Before formally estimating the effect of common ownership on generic entry and settlement, 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-name plaintiff might anticipate the above events in advance, and as a consequence, 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 pay-for-delay settlement becomes more credible and the generic defendant will have to accept a worse deal in settlement to protect its financial positions in the plaintiff. If the above scenario is true, we might find a correlation between common ownership and challenge or settlement whose interpretation would be different than if ownership was pre-determined.

Second, brand plaintiffs can make more credible threats to go to trial by taking a short position in generic defendants’ stock (see Choi and Spier, 2018).¹¹ 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 a trial.

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

$$Kappa20_{jks} = \alpha + \sum_{s=-8}^{s=+8} \beta_s \times First\ Filing_{jks} + \phi_j + \phi_k + \phi_s + \varepsilon_{jks}, \quad (4)$$

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-name firm k , and 0 otherwise. $Kappa20$ is the profit weight of top 20 shareholders of a generic defendant put in the brand-name defendant as of the beginning of the quarter in which a

¹¹See also “New Hedge Fund Strategy: Dispute the Patent, Short the Stock” (Wall Street Journal, April 7, 2015).

patent-infringement lawsuit is filed (see equation (2)).

Figure 2 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 3 plots $\hat{\beta}_t$ and its 95% confidence intervals from estimating the following equation:

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

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.

5.3. Determinants of the first generic

In this section, we establish our first main result. We ask whether generic manufacturers that filed a Paragraph IV 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 entrant and incumbent — 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 into the same market. Instead, from the perspective of a common owner, joint-value maximization implies that generic manufactures with common ownership should secure the 180-day exclusivity by challenging the branded drug as the earliest as possible.

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 with the FDA to challenge patents covering the branded drug m owned by brand-name firm k . Common ownership ($Kappa20$) for a generic manufacturer j is measured

as of the beginning of quarter s in which the first generic files.¹²

The vector of X' includes the following variables: (1) a set of dummy variables indicating a drug's market size regarding sales (if observable),¹³ (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 number of patents covering the branded drug. The inclusion of these variables is motivated by prior studies on the determination of generic entry in the pharmaceutical industry (e.g., Scott Morton, 1999, 2000; Kyle, 2006; Ellison and Ellison, 2011; Hemphill and Sampat, 2011).

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 brand sues. We cluster standard errors at the level of U.S. Federal District Court. 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 tradename).¹⁴

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 only report the main independent variable of interests in Table 5 but provide a full set of estimated coefficients in Table A.2. Through all regression specifications, common ownership strongly positively predicts that conditioning on eventually filing a Paragraph IV, a generic will be the first filer. A one-standard-deviation increase in common ownership is associated with a 3.7-4.6 percentage points increase in the likelihood of being the first generic. This number is about 10.9-13.6% 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*

¹²For each drug being challenged, Paragraph Four Report® does not provide us with dates in which individual generic manufacturers file Paragraph IVs with the FDA. On 1,514 cases, however, Paragraph Four Report® provides exact information about when the first generic challenges. Our study of the determinants of the first generic focuses on these 1,514 cases.

¹³We 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.

¹⁴Each 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).

is calculated. On average, generic defendants putting more than 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. (2021a), we also decompose profit weights 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 that the effect of common ownership on the first filer is driven by the cosine similarity but not by investor 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 strongly positively increase the settlement rate.

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 ten, controlled the firm. Estimates from Panels F and G of Table 5 suggest that common ownership calculated in these two ways does not predict who will become the first generic challenger. We interpret this result as a successful “placebo” test: a measure calculated only with shareholders who do not have much influence or control over the firm does not help predict who will be the first entrant.

5.4. *Determinants of settlement*

The previous section established that common ownership predicts the likelihood to be the first entrant. In this subsection, we test whether common ownership also predicts the likelihood of settlement conditional on entry.

In the main specification, we regress a dummy variable indicating whether two litigants enter into a settlement agreement on common ownership — the profit weight that top 20 shareholders of generic defendant put on the brand plaintiff ($Kappa20$). 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, we lay out the following linear probability regression model:

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

where $Settle_{jkms}$ is an indicator variable set equal to 1 if the two litigants entered into a settlement agreement 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.

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 $Kappa$ 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.3, we provide a full set of coefficients estimated from Equation 7. Regarding coefficient estimates for other covariates, the first generic is 11-percentage-point more likely to settle, simultaneous Paragraph IV challengers are 6-percentage-point more likely to settle, generic defendants with previous experience in dosage form/route are 4-percentage-point less likely to settle, generic defendants with previous experience in therapy class are 10-percentage-point 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 that we avoid spurious inferences from time trends or time-invariant firm entry/entry-deterrence policies. Importantly, because our regressions include firm (and year-quarter) fixed effects, the results should be interpreted as within-firm (and within-time) associations. It is not only the case that the two litigating parties with high common ownership are more likely to settle versus parties with low common ownership. Rather, generic firms appear to change their attitudes toward settling lawsuits based on whether or not 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 a various alternative forms of common ownership. We also conduct placebo tests by assuming only shareholders ranked below the top five, or below the top ten, controlled the firm. We reach at the same conclusion: common ownership of the several largest generic shareholders is positively correlated with the likelihood of settlements.

In Table 7, we restrict our sample on brand-generic firm pairs in which both parties are

publicly listed firms. This is 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. Specifically, we identify firms' listing status by checking whether their stock prices are available on the date when a lawsuit is filed. As Table 7 indicates, the estimates reflect even larger magnitudes for the positive association between common ownership and settlement rate. In column (5), for example, a one-standard-deviation increase in $Kappa20$ increases the likelihood of settlement by 6.6 percentage points.

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 lawsuits and settlements.

To examine whether this is a likely explanation of our panel results, we focus attention to variation caused by BlackRock's acquisition of Barclays Global Investors (BGI) in 2009. On June 11, 2009, BlackRock announced its bid to acquire BGI, iShares' parent division. The acquisition was formally completed in December 2009. Pharmaceutical stocks constituted only a small share of BGI's portfolio, and thus drug makers are unlikely to have been central to BlackRock's decision to acquire BGI.

For each brand-generic pair entering into a patent-infringement litigation, 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:

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

The exclusion restriction is that the cross-sectional distribution across sample units in the implied change in $Kappa20$ from a hypothetical, pre-merger combination of BlackRock's and BGI's

equity portfolios is uncorrelated with errors in the settlement-rate regression. Figure 4 plots histograms of the distribution of implied percentage changes in *Kappa20* across Paragraph IV lawsuits.

The benefit of a continuous-treatment version of instrument is that it makes use of more variation; the relative costs of using it is to potentially increase measurement error. To mitigate the concern of measurement errors while using more variation, we transform the measure in Equation 8 into percentile rank forms ($\Delta Rank_{jk}$).¹⁵ By doing so, we construct our instrument variable for *Kappa20* as follows:

$$IV = \Delta Rank_{jk} \times Post, \quad (9)$$

where *Post* is an indicator variable coded as 1 if the brand plaintiff sues the generic defendant after 2009Q1, and 0 otherwise.¹⁶

DiD design: We first estimate the following DiD specification, interacting $\Delta Rank_{jk}$ with year-fixed effects, for all periods between 2004 and 2017:

$$Settle_{jkm t} = \alpha + \sum_{t=2004}^{2015} \beta_t \times \Delta Rank_{jk} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_t + \varepsilon_{jkm t}, \quad (10)$$

where we drop the interactions with 2009, which serves as the base period, and thus the estimated β_t coefficients represent the change in the difference between more and less treated generic-brand pairs between 2009 and the given period.

Figure 5 reports the DiD estimation results. While the difference between more and less treated groups fluctuates around zero somewhat during the pre-period, the overall trend before the announcement is flat. The trend changes shortly after the announcement of the acquisition, and the coefficients are significantly positive for most periods after the announcement.

IV design: The main disadvantage of a reduced form DiD is that it estimates a causal effect from an exposure to the BlackRock-BGI acquisition before and after the shock rather than a causal effect from a change in common ownership. For this reason, we complement the DiD

¹⁵Our results are similar to we use the continuous-treatment version of instrument (see Table A.4).

¹⁶As for the results regarding the determinants of first entry (i.e., Table 5), we are not able to use the IV ($=\Delta Rank_{jk} \times Post$) as instrument because ownership is measured as of the beginning of the first entry, which could lead lawsuits for many years. As a result, we do not have enough variation of implied change of common ownership after 2009Q1.

analysis above with an IV strategy to obtain a quantitative estimate of the effect of common ownership on the likelihood of settlement from the variation generated by the BlackRock-BGI acquisition.

Panel A of Table 8 presents the first-stage regression. The percentile-rank transformed level of the implied change in common ownership is a strong instrument for the actual change in common ownership. Specifically, the *F-statistics* from weak identification tests range from 165 to 497. Panel B of Table 8 reports the second stage of the IV estimation. We find a positive and economically sizable effect of common ownership on the likelihood of settlement. The effect is positive and highly statistically significant, with coefficients ranging from 0.487 to 1.213, which are markedly higher than the effects estimated in panel regressions.

6. Do settlements transfer wealth?

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

6.1. Stock returns around settlement

If common ownership blocks generic entry, the life of a branded drug should be extended after a settlement, and hence, the brand plaintiff's stock price surrounding a settlement agreement should increase with the level of common ownership.

We specify the following regression for the event study. Specifically, we compare event stock returns surrounding lawsuit resolutions between settled and dismissed cases, between the first and other generics, and across generic firms with differential profit weights that top 20 generic shareholders put on the brand plaintiff (*Kappa20*).¹⁷

$$\begin{aligned}
CAR_{jki} = & \alpha + \beta_1 \times Settle_{jki} \times First_{jkm} \times Kappa20_{jks-1} + \beta_2 \times Settle_{jki} \times First_{jm} \\
& + \beta_3 \times Settle_{jki} \times Kappa20_{jks-1} + \beta_4 \times First_{jkm} \times Kappa20_{jks-1} + \beta_5 \times First_{jkm} \\
& + \beta_6 \times Settle_{jki} + \beta_7 \times Kappa20_{jks-1} + X' \times \gamma + \phi_k + \phi_l + \varepsilon_{jki},
\end{aligned} \tag{11}$$

where CAR_{jki} is the cumulative market-adjusted return for the brand plaintiff over the window of (-3, +3) relative to the event day in which the generic defendant(s) j and the brand plaintiff k enter into a settlement agreement with respect to lawsuit i . s indicates the year-quarter in

¹⁷We exclude resolutions of lawsuits that ended up with trails, because it is difficult to form *ex ante* predictions about the return difference between trailed cases and settled cases.

which a lawsuit is filed.

One assumption that underlies Equation 11 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.

The first four columns of Table 9 estimate the impact of settlement on the value of brand plaintiff. As column (1) suggests, a settlement on average reduces brand value by 0.4% but a settlement with the first generic increases brand value by 1%, and the estimates are robust to the inclusion of district-court and brand-firm fixed effects (see column (2)). Our results in the first two columns are consistent with the notion that settlements deter generic entries through the delay of marketing under the protection of 180-day exclusivity. In columns (3)-(4), we show the brand-value creation through settling with the first generic is especially pronounced if the generic defendant puts a higher profit weight on the brand plaintiff.

We next investigate the value implication of common ownership for generic Paragraph IV filers entering into a settlement agreement. We find that the first generics with higher common ownership experienced more negative returns around a settlement agreement. The second four columns of Table 9 present our estimation results. Columns (5)-(6) suggest that, on average, settled first generics did not earn lower returns than other settled generics. However, columns (7)-(8) suggest that settled first generics with higher *Kappa20* earn significantly lower returns around settlement. These results appear consistent with the theory that generics with a shareholder base that has significant stakes in the brand sacrifice themselves more often to block entry by other generics who would compete harder or extract a higher settlement from the brand.

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 patent cliff; on the other hand, generic

shareholders with large brand stakes might have small stakes 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 assure that the economic gains for them to promote anti-competitive behaviors outweigh the costs to do so. 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 institutional investors gain or lose from potentially anticompetitive settlements in narrowly-defined industries (at the drug level) occupied by one incumbent and one potential entrant. Note that 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 averaged wealth changes experienced by individual common owners surrounding the resolution of lawsuits. We perform this analysis for two scenarios based on whether the settlement occurs with the first generic challenger or not; for the purpose of comparison, we also perform this same shareholder-level analysis surrounding dismissals of a lawsuit.

We end up having 765 individual generic shareholders holding stakes in the brand as of when a lawsuit is filed. We assign each individual shareholder into different baskets based on (1) the rank of her corresponding generic ownership and (2) the four event categories (e.g., settlement or dismissal, first vs. other generics). Below, we illustrate how we calculate averaged generic-side wealth changes around settlements.

$$\Delta W^g = \frac{\sum_{i=1}^n CAR(-3, +3)_i^g \times Shares_i^g \times Value_i^g}{N}, \quad (12)$$

where $CAR(-3, +3)_i^g$ is the cumulative market-adjusted returns of the settled generic firm held by shareholder i over the $(-3, +3)$ -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) four trading days prior to the settlement

event.

Panel A of Table 10 presents a striking pattern — on average, most shareholders of the settled first generic lose on the generic but their gains on the brand far more than make up for the losses. For the largest shareholders, their averaged generic losses are \$264 million but averaged brand gains are \$318 million. These gains exceed the losses the largest shareholders suffer in the first generic by \$54 million. Note that among top-ranked common owners, the largest shareholders gain by the least dollar amounts, presumably because they heavily hold the first generics (10.7%) that experience negative event stock returns. Moving toward the second, third, and four largest shareholders, we find that these common owners' generic losses are negligible compared to their brand gains. For example, the second largest shareholders, as a group, lose an average of \$41.2 million on the generic but gain \$513.7 million from the brand. A similar pattern holds for the third and fourth, and even for the seventh, ninth, and tenth shareholders.

Panel B of Table 10 presents our shareholder-by-shareholder calculation of wealth changes when the brand settles with generics that are not the first challengers. Except for No. 4 shareholders, other top five shareholders have experienced net losses ranging from \$20-\$200 million, and the top 3 shareholders lose on both sides. For example, the largest shareholders lost an average of \$263 million on the generic and an average of \$198 million on average on the brand. This finding may help understand why settlements between not-first-entrants and the brand are much less economically attractive for shareholders as a group than the settlements with the first, typically commonly-owned, generic.

Panel C and D of Table 10 show that common owners experience large dollar amounts of brand losses when the court dismisses the case, thus making it impossible to create shareholder wealth, and transfer wealth from generic to brand. When the court decides that the brand's claim is not one for which the law offers a legal remedy, Paragraph IV challenges are valid and generic entries could happen upon FDA approvals. It is therefore not surprising to observe that common owners experience net losses, although some of them gain on the generic side.

6.3. Stock returns around the first generic files Paragraph IV

Our event-study analysis in Equation 11 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 with the FDA. One theoretical possibility is that the net wealth effects are overall negative for the brand-name 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 what will eventually happen (i.e. settlement between the first generic and brand) implies wealth effects for the two disputing parties?

The first two columns of Table 11 estimate the impact of common ownership (calculated from the generic to the brand) on the value of brand-name incumbent (-3, +3) days relative to the date in which the first generic files a paragraph IV challenging the brand.¹⁸ We show that the profit weight that generic shareholders put on the brand is strongly positively associated with the brand's abnormal daily returns, suggesting that the stock market anticipates that, with a higher level of common ownership, a resolution of dispute can be more anticompetitive. As the next two columns of Table 11, however, common ownership bears zero correlation between abnormal daily returns associated with the first generic. The non-results of the last two columns are likely due to the sample for this analysis to be 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.

7. Conclusion

This paper shows that 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 that entry and settlements are accompanied by wealth transfers from generics to brands. Brands' 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 firms (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; earlier findings in the literature of anticompetitive effects of common ownership do not necessarily imply value destruction for the benefit of rivals.

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,

¹⁸Unfortunately, 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.

and which holds that firms maximize their own value irrespective of shareholder interests. If the findings were to hold more generally, it may be worthwhile to re-examine standard questions on corporate finance – on capital structure, cash holdings, executive compensation, etc. – while relaxing the assumption of own-firm profit maximization. Whether the empirical facts documented in the laboratory of generic entry enjoy broader support is an interesting area for future research.

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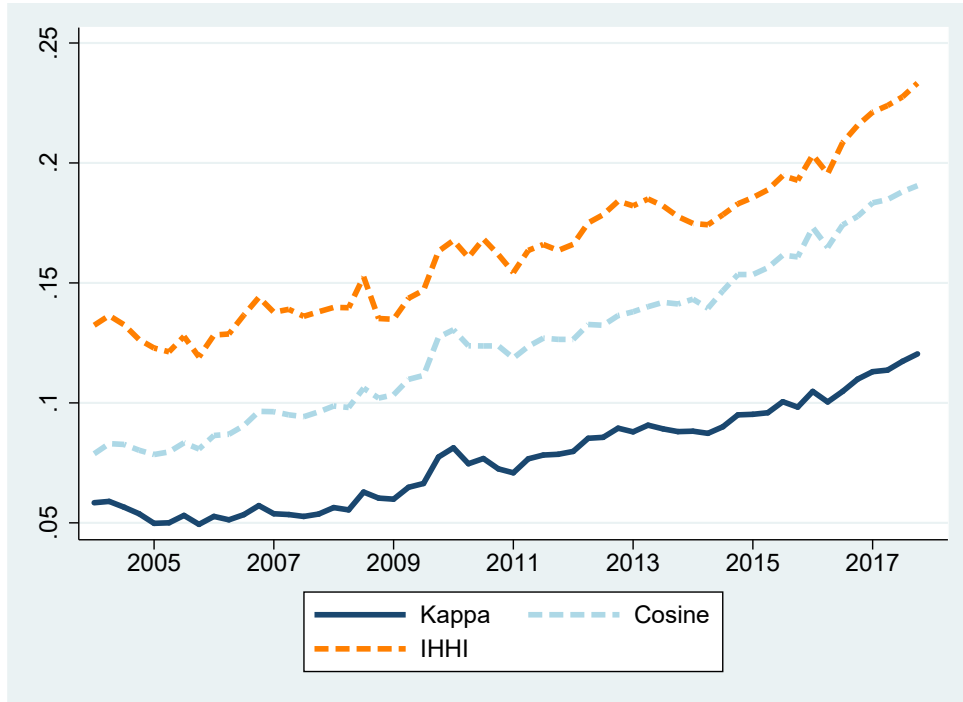
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Fig. 1. Time-series and cross-sectional variation of common ownership concentration

The upper 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 top 20 generic shareholders put in the brand defendant as of the beginning of the quarter in which a patent-infringement lawsuit is filed (see equation (2) for detailed descriptions). The lower figure plots the distribution of kappa for 2004Q1 and 2017Q4.

Panel A: Time trends of Kappa and its decomposed components



Panel B: Conditional distribution

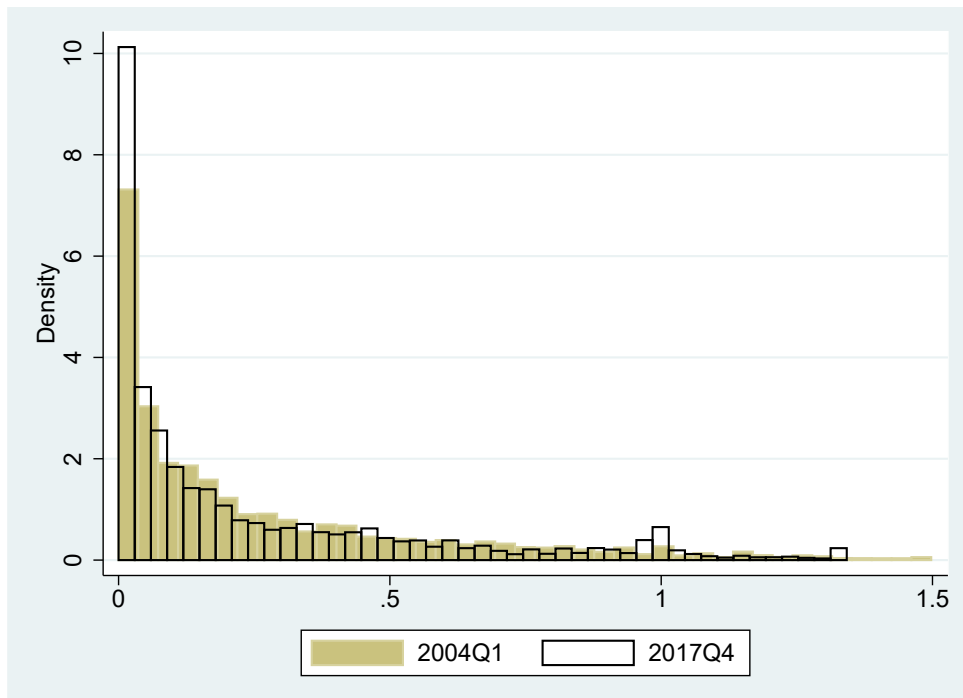


Fig. 2. The evolution of common ownership around the first generic files a Paragraph IV challenge

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} ($-8 \leq t \leq 8$) 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 that at least one shareholder of the generic defendant hold stakes in the brand plaintiff. The excluded period is the event quarter $s = 0$.

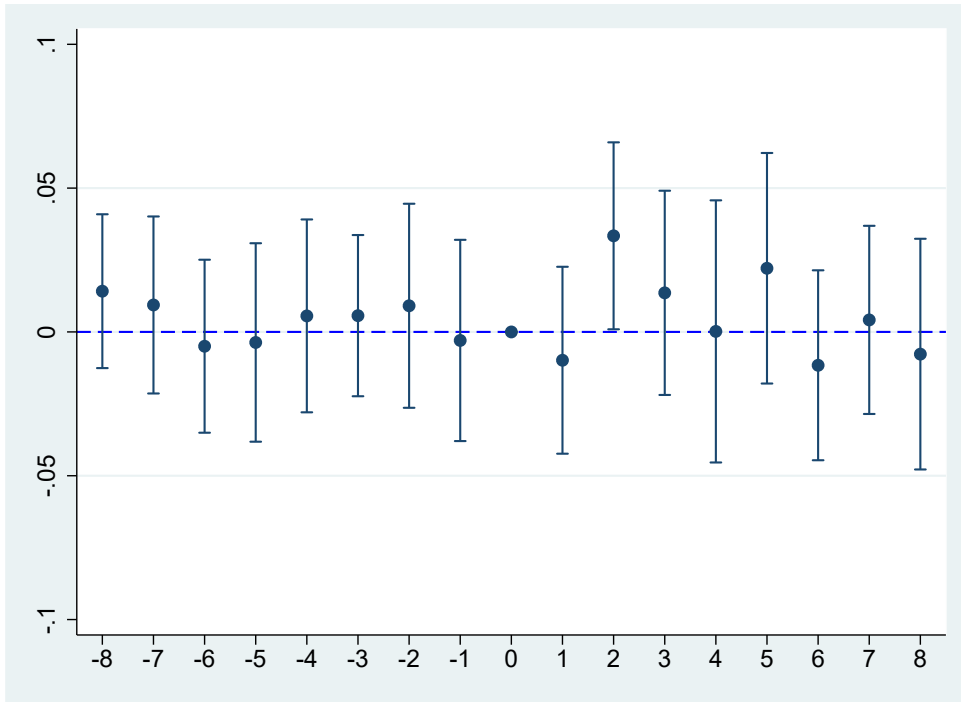


Fig. 3. The evolution of common ownership around the Paragraph IV litigation

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} ($-8 \leq t \leq 8$) 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 hold stakes in the brand plaintiff. The excluded period is the event quarter $s = 0$.

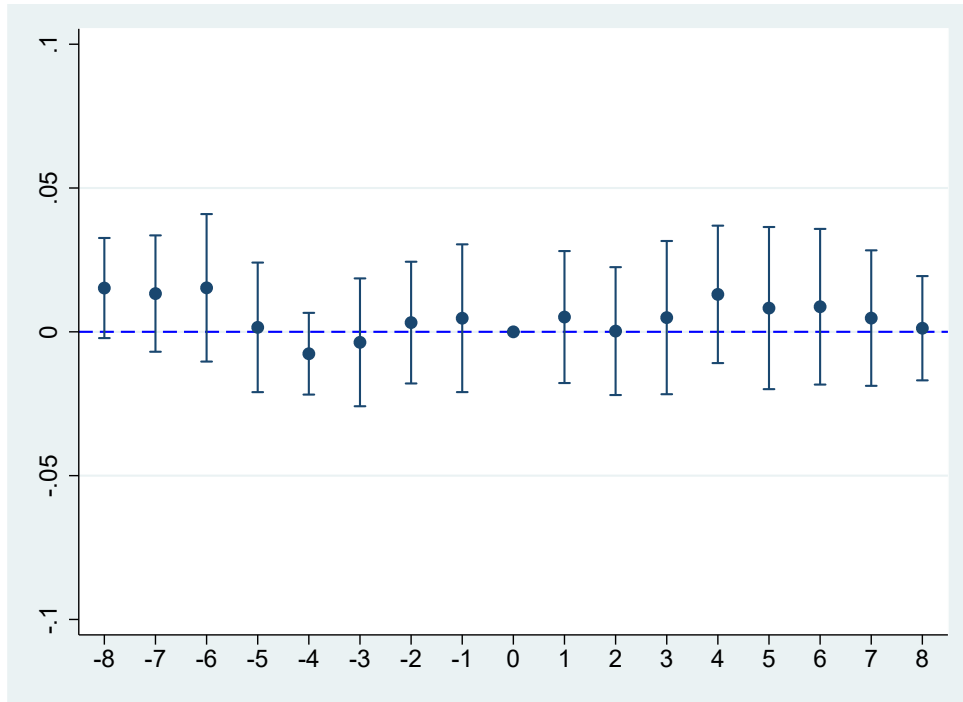


Fig. 4. Cross-sectional distribution of implied change of common ownership (BlackRock-BGI DiD)

The graph plots the distribution of implied changes in the profit weight of 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 generic defendant and brand plaintiff are indexed by j and k , respectively. $Kappa20^{09Q1}$ is 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.

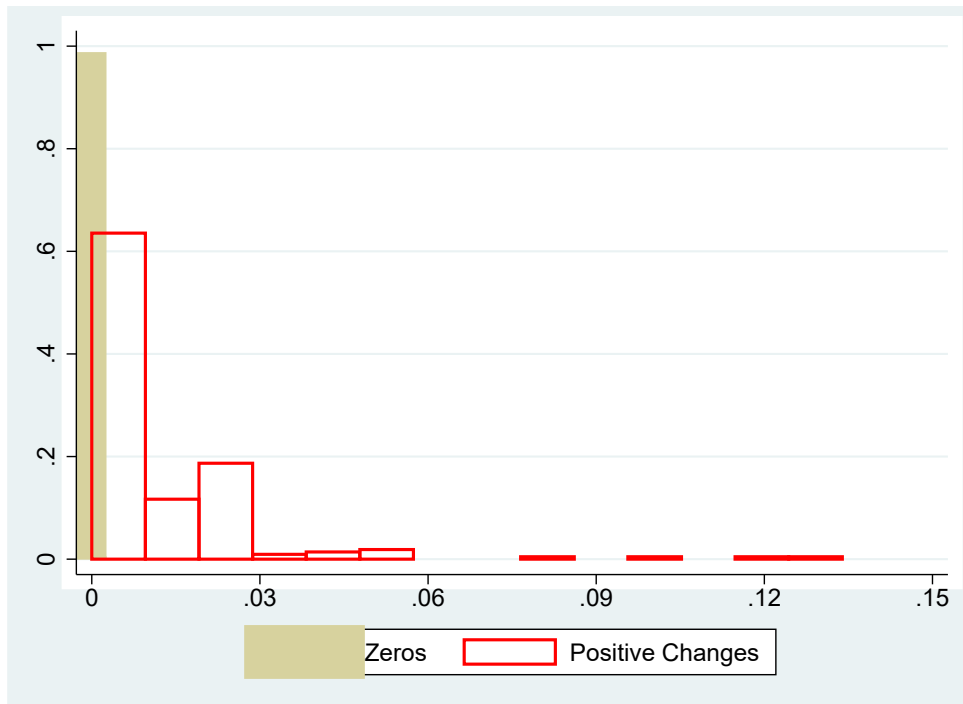


Fig. 5. **Estimated coefficients of BlackRock-BGI acquisition treatment indicator interacted with year fixed effect**

The graph plots the estimated coefficients ($\hat{\beta}_t$) and their 95% confidence intervals on interactions of the treatment variable $\Delta Rank$ with year fixed effects from the following regression specification for all periods between 2004 and 2015 (year 2009 is excluded):

$$Settle_{jkm t} = \alpha + \sum_{t=2004}^{2015} \beta_t \times \Delta Rank_{jk} + X' \times \gamma_1 + \sum_{t=2004}^{2015} \theta_t \times X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_t + \epsilon_{jkm t},$$

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. $\Delta Rank$ is the percentile-rank-form transformed $\Delta Kappa20$ (see Equation 8 for details). Standard errors are clustered at the U.S. Federal District Court level.

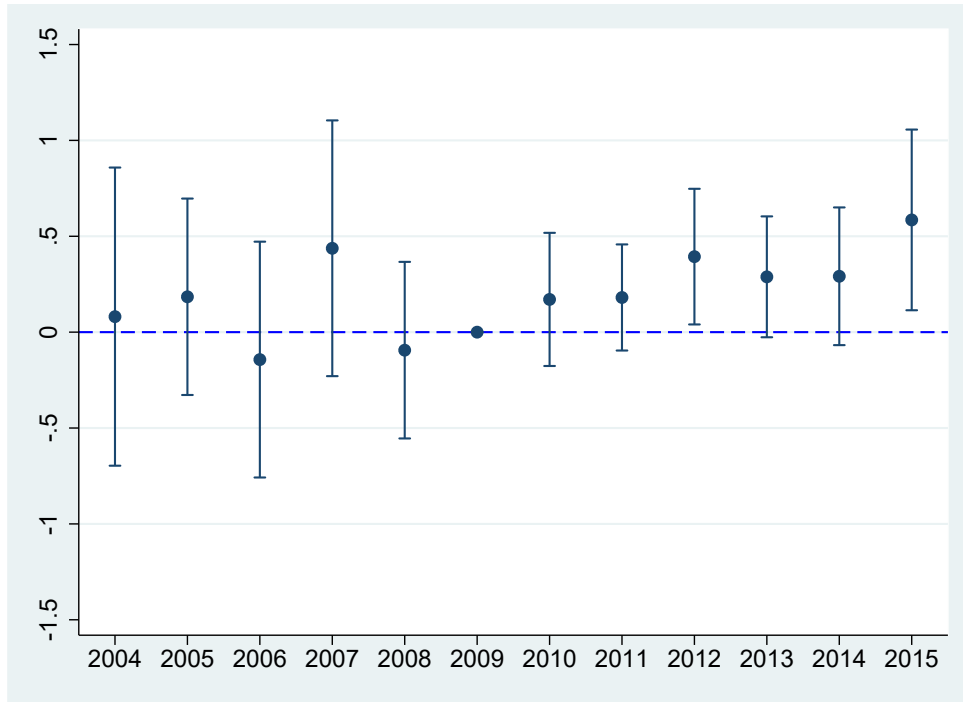


Table 1: **Ownership by the 20 largest generic institutional shareholders**

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. Despite when the generic-brand pair is formed as a result of 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 financial stakes in the brand incumbent.

Shareholder Rank	N	Generic Ownership %			Brand Ownership %		
		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 2: **Sample**

This table presents descriptive statistics for our sample of 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 under 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 with a brand filing 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 is available on the date the brand files a lawsuit.

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
Challenges	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%

Table 3: 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			
	Viatrix	Sandoz	
Teva	%	%	%
Allergan	9.89	13.03	JPMorgan Chase
Capital Rsrch & Mgmt.	9.63	8.45	Sandoz Fam Fundn.
Fidelity	6.14	7.37	Capital Rsrch & Mgmt.
Franklin Templeton	5.57	5.28	BlackRock
Barrow Hanley	3.20	3.85	Novartis Fundn.
BlackRock	3.11	3.73	Dodge & Cox
Norges Bank Invt. Mgmt.	3.04	1.62	UBS
BNY Mellon Asset Mgmt.	1.92	1.30	Vanguard
Vanguard	1.77	1.12	Norges Bank Invt Mgmt
Highfields Cap Mgmt.	1.66	1.02	Credit Suisse
Lupin	%	%	%
Lupin Invt.	12.46	25.85	Sun
Zyma Lab	12.33	7.30	Dilip Shanghvi
Rahas Invt.	10.21	4.90	Viditi Invt.
Visionmed Invt.	9.77	4.35	Tejaskiran Pharm Ind
First Sentier Investors	2.78	4.04	Virtuous Finance
Royal Bank of Scotland	2.43	3.57	Family Invt.
JPMorgan Chase	1.95	3.44	Quality Invt.
Rakesh Jhunjhunwala	1.84	1.94	Life Insurance Corp of India
BlackRock	1.78	1.87	Virtuous Share Invt.
Singapore	1.76	9.60	Sudhir Valia
			Aditya Medisales
Par Pharmaceutical	%	%	%
Fidelity	15.00	11.39	Aurobindo Pharma
TPG Capital	9.94	8.09	Kallam Reddy
Vanguard	8.44	6.00	HDFC Asset Mgmt.
BlackRock	7.45	5.47	Meenakshi Sivakumaran
Capital Rsrch & Mgmt.	7.03	3.23	Trident Chemphar Limited
State Street	4.33	3.16	BlackRock
Paulson & Co	3.52	2.91	Aditya Birla Sun Life
Glenview Cap Mgmt.	1.91	2.87	Abu Dhabi Invt. Auth
Camber Cap Mgmt.	1.75	2.71	Stichting Pensioenfonds ABP
Miller Value Partners	1.52	2.43	Rakesh Jhunjhunwala
			State Bank of India

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 Invnt. 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 Invnt. Mgmt.	1.17	Norges Bank Invnt. Mgmt.	1.86
BNY Mellon Invnt. 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. Invnt. Advisers	1.04	UBS	0.82	Columbia Mgmt. Invnt. Advisers	1.46
Merck & Co.					
Janssen Pharmaceuticals					
Vanguard	6.70	Vanguard	7.03	Allergan	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 Invnt.	2.44
Norges Bank Invnt. Mgmt.	1.00	Fidelity	1.12	Legg Mason Int. EQ	2.38
Franklin Templeton	0.99	Norges Bank Invnt. Mgmt.	1.03	J.P. Morgan	1.72
Shire					
Abbott Laboratories					
BlackRock	8.66	Vanguard	6.94	Bristol-Myers Squibb	8.87
Jennison Associates LLC	2.57	BlackRock	5.97	Wellington	6.87
Vanguard	2.49	State Street	4.60	Vanguard	5.97
Paulson & Co	2.44	MFS	2.33	BlackRock	4.05
Legal & General Invnt. Mgmt.	2.15	T. Rowe Price	2.27	State Street	3.16
M&G Invnt. Mgmt.	2.08	BNY Mellon	1.96	Capital Rsrch & Mgmt.	2.63
Marathon Asset Mgmt.	1.98	Northern Trust	1.56	Fidelity	2.21
State Street	1.95	Macquarie	1.33	T. Rowe Price	1.35
PPM America	1.70	Wellington	1.16	Dodge & Cox	1.32
Fidelity	1.66	Flossbach von Storch	1.09	Northern Trust	1.30
		Jennison Associates		Jennison Associates	

Table 4: **Descriptive statistics**

This table presents descriptive statistics. In Panel A, 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 branded drug). In Panel B and C, 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 branded drug). $Kappa20$ is the profit weight of top 20 generic shareholders put in the brand defendant as of the beginning of the quarter in which a patent-infringement lawsuit is filed (see Equation 2 for detailed descriptions). $Kappa20 \geq 10\%$ is an indicator variable coded as 1 if $Kappa20$ is greater than or equal to 10%, and 0 otherwise. $Cosine20$ and $IHHI20$ are the two components of a decomposition of $Kappa20$ (see Equation 3 for detailed descriptions). $Settle$, $Dismiss$, and $Trail$ are three dummy variables indicating whether the two litigants settle, dismiss, or go to trial for at least one disputed patent at issue. $First$ is an indicator variable coded as 1 if the generic defendant is the first generic. $Group$ is an indicator variable coded as 1 if more than two generic manufacturers challenge the same drug on the same day, and 0 otherwise. $Ln(\# Patents)$ is the logarithm of the number of litigated patents. $Route Exp$ is an indicator variable coded as 1 if the generic defendant 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 defendant has production experience in therapy class, measured by the two-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.

	Mean	Std	Min	p5	p10	p25	p50	p75	p90	p95	Max	N
Panel A. Common ownership (first entry)												
Kappal20	0.044	0.147	0.000	0.000	0.000	0.000	0.000	0.000	0.133	0.326	1.948	1525
Kappal20 \geq 10%	0.134	0.341	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1525
Cosinel20	0.064	0.165	0.000	0.000	0.000	0.000	0.000	0.000	0.294	0.484	0.950	1525
IHHI120	0.119	0.353	0.000	0.000	0.000	0.000	0.000	0.000	0.421	0.786	4.643	1525
Kappal5	0.039	0.148	0.000	0.000	0.000	0.000	0.000	0.000	0.089	0.293	2.177	1525
First	0.338	0.473	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1525
Panel B. Common ownership (lawsuit)												
Kappal20	0.047	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.168	0.354	1.368	1743
Kappal20 \geq 10%	0.126	0.332	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1743
Cosinel20	0.076	0.185	0.000	0.000	0.000	0.000	0.000	0.000	0.357	0.530	0.935	1743
IHHI120	0.113	0.280	0.000	0.000	0.000	0.000	0.000	0.000	0.499	0.747	1.998	1743
Kappal5	0.043	0.142	0.000	0.000	0.000	0.000	0.000	0.000	0.141	0.311	1.570	1743
Panel C. Litigation-level characteristics												
Settle	0.378	0.485	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1743
Dismiss	0.363	0.481	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1743
Trail	0.274	0.446	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1743
First	0.328	0.469	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1743
Ln(#Patent)	0.435	0.602	0.000	0.000	0.000	0.000	0.000	0.693	1.386	1.609	3.178	1743
Group	0.309	0.462	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1743
Rank25	0.075	0.263	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1743
Rank50	0.037	0.188	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Rank75	0.042	0.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Rank100	0.040	0.195	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Rank125	0.034	0.182	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Rank150	0.030	0.170	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Rank175	0.020	0.140	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Rank200	0.021	0.144	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1743
Route Exp	0.239	0.427	0.000	0.000	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1743
Therapy Exp	0.552	0.497	0.000	0.000	0.000	0.000	1.000	1.000	1.000	1.000	1.000	1743

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:

$$First_{jkm t} = \alpha + \beta \times Common\ Ownership_{jkt-1} + X' \times \gamma_1 + \phi_j + \phi_k + \phi_l + \phi_s + \epsilon_{jkm t},$$

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. 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. In Panel A, *Common Ownership* is measured as *Kappa20* (see Equation 2 for detailed descriptions). In Panel B, *Common Ownership* is measured as $Kappa20 \geq 10\%$, which is an indicator variable coded as 1 if *Kappa20* is greater than or equal to 10%, 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 of top 5 generic shareholders put in the brand plaintiff. In Panels F and G, *Common Ownership* are the profit weights of top 6-20 (*Kappa620*) and 11-20 (*Kappa1120*) generic shareholders put in 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					
Kappa120	0.252*** (0.066)	0.255*** (0.063)	0.298*** (0.097)	0.211** (0.082)	0.128* (0.066)
Adj R ²	0.00	0.01	0.06	0.17	0.20
Panel B: Kappa20 ≥ 10%					
Kappa20 ≥ 10%	0.119*** (0.033)	0.119*** (0.034)	0.136*** (0.048)	0.100* (0.053)	0.078 (0.050)
Adj R ²	0.01	0.01	0.06	0.17	0.20
Panel C: Cosine Similarity					
Cosine20	0.313*** (0.070)	0.308*** (0.076)	0.314*** (0.107)	0.236** (0.095)	0.200** (0.086)
Adj R ²	0.01	0.02	0.07	0.17	0.20
Panel D: IHHI					
IHHI	0.072** (0.028)	0.067** (0.026)	0.085** (0.037)	0.057 (0.037)	0.012 (0.040)
Adj R ²	0.00	0.01	0.06	0.17	0.20
Panel E: Kappa top 1-5					
Kappa15	0.279*** (0.080)	0.285*** (0.082)	0.314** (0.115)	0.236** (0.102)	0.176** (0.084)
Adj R ²	0.00	0.01	0.06	0.17	0.20
Panel F: Placebo Tests: Kappa top 6-20					
Kappa620	0.055** (0.024)	0.051* (0.025)	0.046* (0.025)	0.017 (0.037)	-0.032 (0.061)
Adj R ²	0.00	0.01	0.06	0.17	0.20
Panel G: Placebo Tests: Kappa top 10-20					
Kappa1020	0.025* (0.014)	0.020 (0.015)	0.016 (0.016)	0.008 (0.027)	-0.006 (0.035)
Adj R ²	0.00	0.01	0.06	0.17	0.20
Controls		✓	✓	✓	✓
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓
N	1,514	1,514	1,514	1,514	1,514

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. In Panel A, *Common Ownership* is measured as *Kappa20* (see Equation 2 for detailed descriptions). In Panel B, *Common Ownership* is measured as $Kappa20 \geq 10\%$, which is an indicator variable coded as 1 if *Kappa20* is greater than or equal to 10%, 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 of top 5 generic shareholders put in the brand plaintiff. In Panels F and G, *Common Ownership* are the profit weights of top 6-20 (*Kappa620*) and 11-20 (*Kappa1120*) generic shareholders put in 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*** (0.066)	0.259*** (0.076)	0.274*** (0.083)	0.311*** (0.080)	0.312** (0.141)
Adj R ²	0.00	0.03	0.08	0.10	0.25
Panel B: Kappa20 ≥ 10%					
Kappa20 ≥ 10%	0.111*** (0.030)	0.116*** (0.030)	0.115*** (0.035)	0.129*** (0.031)	0.116*** (0.039)
Adj R ²	0.01	0.03	0.08	0.09	0.25
Panel C: Cosine Similarity					
Cosine20	0.209*** (0.061)	0.213*** (0.047)	0.217*** (0.053)	0.253*** (0.066)	0.313*** (0.079)
Adj R ²	0.01	0.03	0.08	0.10	0.25
Panel D: IHHI					
IHHI	0.130*** (0.042)	0.138*** (0.034)	0.133*** (0.036)	0.140*** (0.039)	0.113** (0.045)
Adj R ²	0.01	0.03	0.08	0.09	0.25
Panel E: Kappa top 1-5					
Kappa5	0.246*** (0.070)	0.250*** (0.081)	0.274*** (0.085)	0.307*** (0.084)	0.313** (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** (0.039)	0.076** (0.033)	0.089*** (0.023)	0.067** (0.031)	0.028 (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*** (0.009)	0.029*** (0.009)	0.029*** (0.009)	0.021* (0.010)	0.016 (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: Effect of common ownership on the likelihood of settlement: Both generic and brand firms are publicly listed

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

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

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. In Panel A, *Common Ownership* is measured as *Kappa20* (see Equation 2 for detailed descriptions). In Panel B, *Common Ownership* is measured as $Kappa20 \geq 10\%$, which is an indicator variable coded as 1 if *Kappa20* is greater than or equal to 10%, and 0 otherwise. 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				
Kappa120	0.326*** (0.071)	0.347*** (0.086)	0.376*** (0.110)	0.398*** (0.111)	0.450** (0.181)
N	1,089	1,089	1,089	1,089	1,089
Adj. R ²	0.01	0.06	0.10	0.10	0.24
	Panel B. Kappa > 10%				
Kappa20 ≥ 10%	0.109*** (0.030)	0.118*** (0.036)	0.121*** (0.042)	0.127*** (0.041)	0.141* (0.069)
N	1,089	1,089	1,089	1,089	1,089
Adj. R ²	0.01	0.05	0.09	0.09	0.24
Controls		✓	✓	✓	✓
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓

Table 8: **Effect of common ownership on the likelihood of settlement: IV estimations**

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. The first-stage regression is specified as follows:

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

where *Kappa20* (endogenous variable) is the profit weight of top 20 generic shareholders put in the brand plaintiff as of the beginning of the quarter a patent-infringement lawsuit is filed (see Equation 2 for detailed descriptions). *Kappa20* is instrumented by $\Delta Rank \times Post$. $\Delta Rank$ is the percentile-rank-form transformed $\Delta Kappa20$ (see Equation 8 for detailed descriptions). *Post* is an indicator variable coded as 1 if the brand-name plaintiff sues the generic defendant after 2009Q1, and 0 otherwise. 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					
$\Delta Rank \times Post$	0.261*** (0.014)	0.260*** (0.015)	0.257*** (0.012)	0.231*** (0.011)	0.168*** (0.013)
F-stat	353.7	302.5	496.9	441.3	164.9
Panel B. Second stage					
Kappa20	0.487*** (0.115)	0.511*** (0.127)	0.605*** (0.137)	0.814*** (0.187)	1.213*** (0.218)
Controls		✓	✓	✓	✓
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 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. We estimate the following linear regression:

$$CAR_{j,ki} = \alpha + \beta_1 \times \text{Settle}_{j,ki} \times \text{First}_{j,km} \times \text{Kappa20}_{j,ks-1} + \beta_2 \times \text{Settle}_{j,ki} \times \text{First}_{j,km} + \beta_3 \times \text{Settle}_{j,ki} \times \text{Kappa20}_{j,ks-1} + \beta_4 \times \text{First}_{j,km} \times \text{Kappa20}_{j,ks-1} + \beta_5 \times \text{First}_{j,km} + \beta_6 \times \text{Settle}_{j,ki} + \beta_7 \times \text{Kappa20}_{j,ks-1} + X' \times \gamma + \phi_k + \phi_l + \epsilon_{j,ki},$$

where $CAR_{j,ki}$ 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 (-3, +3) relative to the event day in 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 of top 20 generic shareholders put in 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)
Settle×First×Kappa20			0.090** (0.034)	0.056** (0.025)			-0.051** (0.020)	-0.063* (0.032)
Settle×First	0.014*** (0.004)	0.014*** (0.003)	0.007* (0.004)	0.009*** (0.002)	0.005 (0.008)	0.010 (0.008)	0.010 (0.009)	0.016 (0.010)
Settle	-0.004*** (0.001)	-0.005*** (0.002)	-0.003* (0.001)	-0.005*** (0.002)	0.002 (0.002)	-0.001 (0.003)	0.001 (0.002)	-0.002 (0.002)
First	-0.007* (0.004)	-0.007 (0.004)	-0.005* (0.003)	-0.005 (0.004)	-0.005* (0.003)	-0.006* (0.003)	-0.007*** (0.002)	-0.007*** (0.002)
Settle×Kappa20			-0.033 (0.032)	0.003 (0.017)			0.012 (0.020)	0.016 (0.027)
First×kappa20			-0.047 (0.031)	-0.031 (0.020)			0.022* (0.011)	0.026* (0.013)
Kappa20			0.023 (0.033)	-0.008 (0.014)			-0.006 (0.013)	-0.001 (0.015)
Constant	0.004*** (0.001)	-0.003 (0.004)	0.004*** (0.001)	-0.003 (0.005)	0.002 (0.002)	-0.024*** (0.007)	0.002 (0.002)	-0.022*** (0.007)
Controls	✓	✓	✓	✓	✓	✓	✓	✓
Court FE	✓	✓	✓	✓	✓	✓	✓	✓
Brand Firm FE	✓	✓	✓	✓	✓	✓	✓	✓
Generic Firm FE								
N	989	989	989	989	631	631	631	631
Adj R ²	0.00	0.23	0.01	0.23	-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. *Rank* refers to generic shareholders' rank based on their ownership in the generic. *N* refers to the number of shareholders within each shareholder rank. $Share^g$ ($Share^b$) refer to generic (brand) ownership. *Gain%* refers to the percentage of generic shareholders with $\Delta W > 0$, where $\Delta W = \Delta W^g + \Delta W^b$. ΔW^g and ΔW^b (Million USD) are gains/losses on the generic and brand, respectively. We calculate ΔW^g as follows:

$$\Delta W^g = \frac{\sum_{i=1}^n CAR(-3, +3)_i^g \times Shares_i^g \times Market Value_i^g}{N},$$

where $CAR(-3, +3)_i^g$ is the cumulative market-adjusted returns of settled generic defendant held by shareholder *i* over the $(-3, +3)$ -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. ΔW^b is calculated analogously.

Rank	N	<i>Share</i> ^g	<i>Share</i> ^b	Gain%	ΔW^g	ΔW^b	N	<i>Share</i> ^g	<i>Share</i> ^b	Gain%	ΔW^g	ΔW^b
with first generic												
1	24	10.66	4.59	65.2%	-263.08	318.25	34	10.42	4.19	50.0%	-123.09	-198.20
2	26	5.91	4.54	62.5%	-41.21	513.70	27	7.64	5.61	42.9%	-178.49	-19.15
3	27	4.50	4.03	56.0%	-87.59	507.11	36	5.93	3.82	46.9%	-41.57	-99.94
4	25	3.82	3.46	40.0%	-41.25	381.02	33	5.19	4.57	58.6%	75.92	101.87
5	21	3.77	4.07	36.8%	-48.06	39.93	25	4.05	4.60	45.5%	60.53	-67.70
6	21	3.17	2.52	55.6%	80.42	106.58	35	3.01	3.11	48.1%	-81.34	-64.96
7	14	2.22	1.89	75.0%	-24.86	184.05	15	2.45	3.02	75.0%	11.27	-137.33
8	19	1.96	2.49	52.9%	-21.07	-35.57	25	2.49	2.63	47.4%	45.46	-40.58
9	25	1.99	2.89	40.9%	-26.06	125.38	17	2.43	2.38	69.2%	7.92	87.89
10	19	1.51	2.92	50.0%	-22.78	232.71	16	2.12	1.77	64.3%	59.69	-204.32
with other generics												
1	9	8.10	3.86	55.6%	-9.26	-913.28	14	8.75	4.56	33.3%	-95.01	-55.26
2	15	5.98	3.53	35.7%	-32.87	-360.02	23	7.36	4.47	47.1%	-53.11	-604.07
3	8	5.04	1.71	28.6%	33.62	-309.14	23	5.20	4.02	41.2%	12.15	-415.76
4	17	5.12	4.89	29.4%	-53.39	-757.16	20	4.46	3.87	44.4%	-16.75	-314.48
5	11	4.24	2.62	50.0%	0.11	378.72	14	2.67	2.73	50.0%	20.13	10.95
6	11	3.24	2.30	45.5%	-68.91	-145.89	16	3.21	4.23	63.6%	132.80	92.96
7	12	3.65	1.60	66.7%	-33.45	13.95	10	1.40	1.92	40.0%	-18.96	-378.78
8	12	3.28	3.21	33.3%	-16.94	-934.04	19	2.16	2.55	61.5%	21.29	21.53
9	11	2.43	2.38	30.0%	-33.86	-294.86	16	1.59	2.33	41.7%	-45.32	-66.32
10	5	2.27	3.67	0.0%	-47.26	-1,859.62	15	1.54	2.94	45.5%	-25.10	-79.02

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-name company (columns (1)-(2)), or for the first generic filer (columns (3)-(4)), over the window of (-3, +3) 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-name company k . $Kappa20$ is measured as the profit weight of top 20 generic shareholders put in the brand plaintiff 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)
Kappa120	0.057*** (0.014)	0.032*** (0.010)	0.009 (0.022)	-0.017 (0.026)
Constant	-0.002 (0.002)	0.015** (0.007)	0.006* (0.003)	-0.033 (0.024)
Controls		✓		✓
Court FE		✓		✓
Brand Firm FE		✓		
Generic Firm FE				✓
N	314	314	136	136
Adj R ²	0.02	0.63	-0.01	0.10

Online Appendix

Fig. A.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)

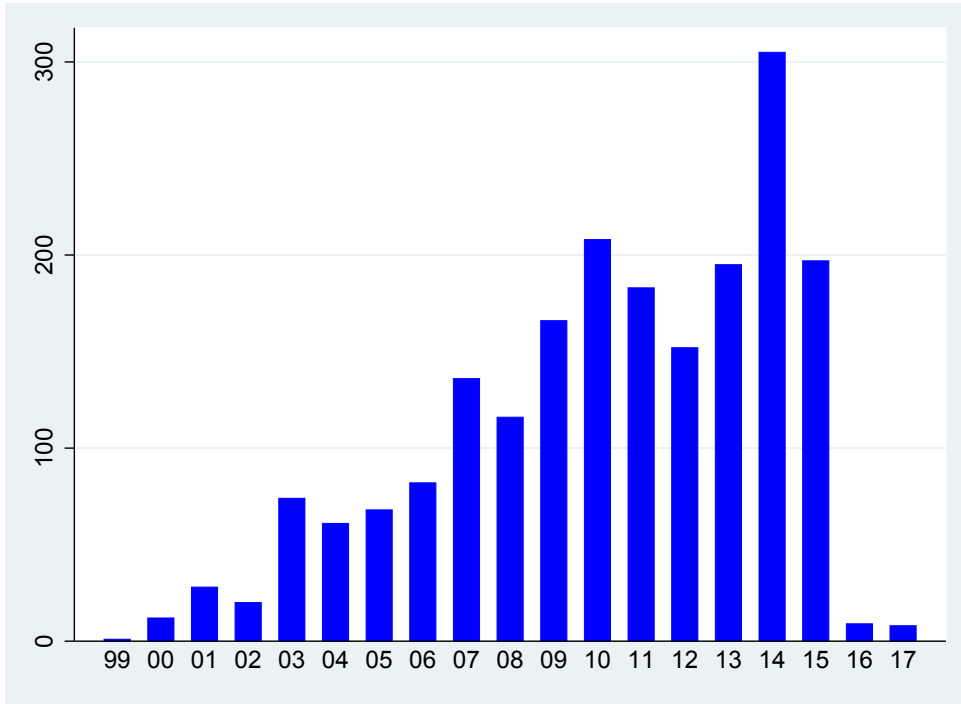
Paragraph IV Applicant: Teva Pharamceuticals (Barr)
Case Name: PFIZER v. TEVA PHARMACEUTICALS
Court/Case #: New York Southern District Court (nysdc) 1:2009cv03965
Date Filed: 4/21/2009
Judge: Sullivan
Product Strength: 75 mg/0.2 mg and 50mg/0.2mg
Litigated Patents (expiration): 5,601,843 (2/11/2014)
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](#)

Fig. A.2. 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.

Panel A: Number of Paragraph IV challenges



Panel B: Settlement Rate

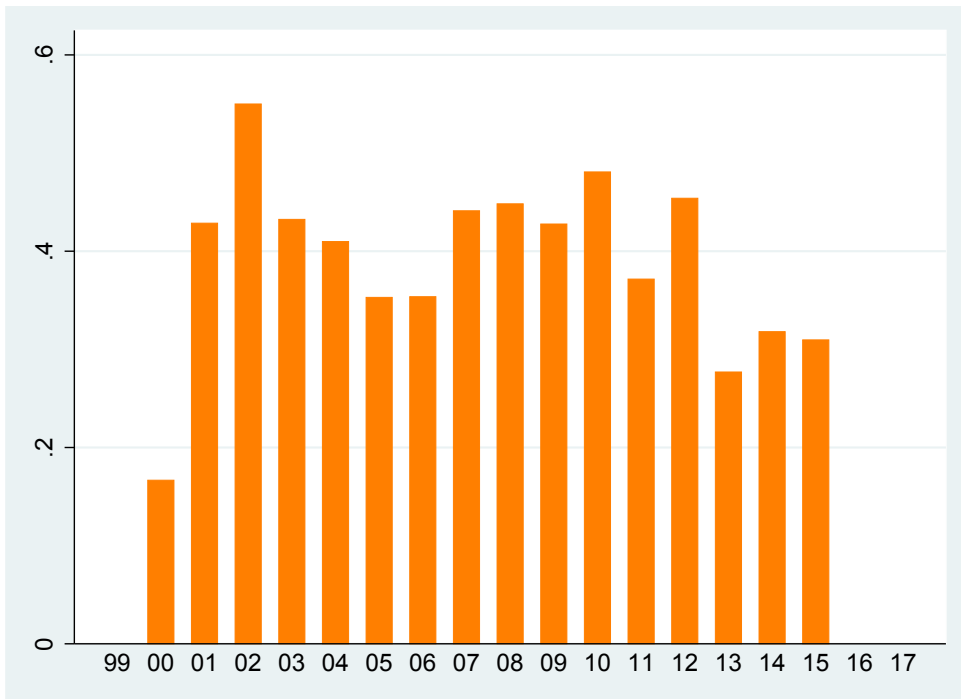


Table A.1: **Paragraph IV litigation outcomes across U.S. Federal District Courts**

This table presents the distributions of the challenge 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.

	# Challenges	Settlement	Dismiss	Trail
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 District	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 Northern 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 District	713	43.5%	32.0%	27.5%
New York Eastern District	7	28.6%	28.6%	42.9%
New York Southern 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%
Pennsylvania 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%
Virginia Eastern District	14	7.1%	35.7%	57.1%
West Virginia 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.2: **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. 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 the profit weight of top 20 generic shareholders put in the brand plaintiff one quarter prior to the year-quarter in which the first generic files the Paragraph IV (*Kappa120*). 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)
Kappa120	0.252*** (0.066)	0.255*** (0.063)	0.298*** (0.097)	0.211** (0.082)	0.128* (0.066)
Ln(#Patents)		-0.015 (0.018)	-0.027 (0.017)	-0.045*** (0.014)	-0.044** (0.018)
Rank25		-0.054 (0.073)	0.027 (0.085)	0.061 (0.101)	0.161 (0.098)
Rank50		-0.095 (0.063)	-0.054 (0.087)	-0.166*** (0.058)	-0.103* (0.051)
Rank75		-0.190*** (0.053)	-0.179*** (0.047)	-0.206*** (0.059)	-0.152*** (0.027)
Rank100		-0.082* (0.046)	-0.082 (0.072)	-0.141* (0.073)	-0.032 (0.074)
Rank125		0.036 (0.103)	0.042 (0.109)	-0.095 (0.112)	-0.097 (0.109)
Rank150		-0.109* (0.060)	-0.102 (0.063)	-0.086 (0.057)	-0.043 (0.037)
Rank175		0.054 (0.153)	-0.026 (0.039)	0.018 (0.042)	0.026 (0.069)
Rank200		-0.084 (0.085)	-0.085 (0.086)	-0.114* (0.058)	-0.121 (0.087)
Route Exp		0.017 (0.030)	0.016 (0.030)	0.028 (0.018)	0.026 (0.029)
Therapy Exp		0.063*** (0.021)	0.046*** (0.015)	0.032 (0.029)	0.034** (0.015)
Constant	0.329*** (0.018)	0.314*** (0.021)	0.324*** (0.012)	0.471** (0.180)	0.593*** (0.193)
District Court FE			✓	✓	✓
Time FE			✓	✓	✓
Generic Firm FE				✓	✓
Brand Firm FE					✓
N	1,514	1,514	1,514	1,514	1,514
Adj R ²	0.00	0.01	0.06	0.17	0.20

standard errors in parentheses

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

Table A.3: **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 of top 20 generic shareholders put in the brand plaintiff 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 plaintiff. 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*** (0.066)	0.259*** (0.076)	0.274*** (0.083)	0.311*** (0.080)	0.312** (0.141)
First		0.111*** (0.033)	0.092*** (0.025)	0.094*** (0.023)	0.088*** (0.024)
Ln(#Patents)		0.014 (0.020)	0.018 (0.023)	0.010 (0.022)	0.015 (0.013)
Group		0.060*** (0.019)	0.027 (0.017)	0.033 (0.019)	0.028 (0.018)
Rank 25		-0.068 (0.045)	-0.107* (0.062)	-0.099 (0.076)	-0.029 (0.053)
Rank 50		-0.099** (0.039)	-0.206*** (0.060)	-0.216*** (0.071)	-0.244*** (0.056)
Rank 75		-0.056 (0.170)	-0.089 (0.132)	-0.058 (0.118)	-0.044 (0.105)
Rank 100		0.004 (0.063)	-0.116* (0.062)	-0.093** (0.040)	-0.127** (0.058)
Rank 125		0.155** (0.058)	0.128* (0.070)	0.076 (0.045)	0.137*** (0.044)
Rank 150		0.096*** (0.030)	0.094*** (0.019)	0.102** (0.042)	0.052 (0.078)
Rank 175		-0.029 (0.116)	-0.060 (0.093)	-0.046 (0.079)	-0.172 (0.172)
Rank 200		0.046 (0.071)	-0.067 (0.050)	-0.078 (0.066)	-0.078 (0.094)
Route Exp		-0.039** (0.019)	-0.033 (0.030)	-0.021 (0.032)	-0.034 (0.024)
Therapy Exp		-0.097*** (0.032)	-0.090*** (0.032)	-0.078* (0.045)	-0.062 (0.037)
Constant	0.366*** (0.024)	0.370*** (0.058)	0.132 (0.130)	0.301** (0.139)	0.026 (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.4: Effect of common ownership on the likelihood of settlement: IV estimations, Continuous-Treatment

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. The first-stage regression is specified as follows:

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

where $Kappa20$ (endogenous variable) is the profit weight of top 20 generic shareholders put in the brand plaintiff as of the beginning of the quarter a patent-infringement lawsuit is filed (see Equation 2 for detailed descriptions). $Kappa20$ is instrumented by $\Delta Kappa20 \times Post$ (see Equation 8 for detailed descriptions). $Post$ is an indicator variable coded as 1 if the brand-name plaintiff sues the generic defendant after 2009Q1, and 0 otherwise. 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				
$\Delta Kappa20 \times Post$	15.488*** (0.899)	15.379*** (0.877)	14.969*** (0.912)	13.219*** (1.168)	10.305*** (0.831)
F-stat	269.2	307.6	269.2	128.2	153.7
	Panel B. Second stage				
$Kappa20$	0.455*** (0.120)	0.513*** (0.141)	0.677*** (0.165)	0.781*** (0.195)	1.119*** (0.267)
Controls		✓	✓	✓	✓
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

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