The Cost of Antitrust and Firm Strategic Mergers and Acquisitions

Abstract

This study examines how antitrust enforcement influences firms' M&A strategies. We build a theoretical model illustrating two asymmetric firms with differing local market shares. The model yields that when antitrust policies tighten, firms with high local market shares shift investments toward nonlocal markets, while those with lower shares maintain their original investment structure. Paradoxically, this shift undermines antitrust goals, reducing firm welfare and market competition. To explain this, we introduce "antitrust risk" as an explanatory factor to reconcile the seemingly contradictory results. Exploiting the staggered implementation of industry-specific antitrust policies in China, we find supporting empirical evidence that when enforcement is strengthening, overall M&A activities decrease but cross-regional M&As increase, especially for firms that are sensitive to antitrust risk (i.e., high market share firms and private-owned firms). This structural shift also diminishes competition, displaces R&D investment, and worsens firm performance.

JEL classification: D25, D40, D62, G34, L40

Keywords: Antitrust Enforcement, Mergers and Acquisitions, Firm Investment, Antitrust Error

1. Introduction

Antitrust enforcement is considered the foundation of market economy, making sure that all market participant has an equal opportunity in market competition. However, there are long-standing concerns about the efficiency of current antitrust enforcement (see e.g., Grullon, Larkin, and Michaely, 2019; Gilbert, 2023). In apparent, restraining antitrust enforcement holds back potential monopolistic behaviors such as collusion, exclusionary conduct, and anticompetitive merger. In stealth, however, the affected firms may adopt strategic behaviors that dilute the effects of antitrust enforcement, or so much as to even hurt market competition. In this paper, we focus on firm M&A behaviors and study how restraining antitrust policies may affect firm's strategic M&A choices, leading to worse economic outcomes and even paradoxically hurting market competition.

As an external intervention to the market, antitrust enforcement is often subject to the criticism of inefficient policy intervention.[1] Antitrust enforcement risks antitrust error of false positives (i.e., punishing the innocent) or false negatives (i.e., missing the guilty), where the former could bring long-term detrimental effect due to stare decisis in subsequent enforcement, posing greater dangers to the overall economy (Easterbrook, 1984; Devlin and Jacob, 2010). Consequently, scholars have argued that antitrust policy should seek to minimize these "error costs" — the combined costs of incorrect decisions and enforcement costs. However, given recent advancements in antitrust theory and practice, these critiques have become less frequent (Hovenkamp, 2022).

On the other hand, discussions over antitrust enforcement as an external market intervention distorting market activities become increasingly popular. For example, court's

[1] For example, the Chicago School argues that the market has its own corrective capabilities, requiring government intervention only in rare cases of market failure.

judgments and interpretations on key cases, the introduction of new merger guidelines, the enactment and revision of antitrust legislation, as well as key personnel changes in antitrust agency can cause exogenous shocks to the market, interrupting regular market operations, affecting product market outcomes, and shifting welfare distribution. Consistent with the assertions, prior literature finds that unsatisfactory antitrust enforcement and intervention may hurt product market outcomes as well as the overall economy (see e.g., Eckbo, 1983; Shapiro, 2019; De Loecker, Eeckhout, and Unger, 2020; Thatchenkery and Katila, 2023).

Mergers and acquisitions (M&A) play a crucial role in corporate strategy, serving as vehicles for growth, innovation, and adaptation to market shocks.[2] They are also a primary focus of antitrust regulation, given their potential to drive anti-competitive outcomes. Firms pursue M&As for varied reasons, such as seeking synergies, expanding business lines, promoting innovation, or addressing external challenges (see e.g., Phillips and Zhdanov, 2013; Bena and Li, 2014; Arikan and Stulz, 2016; Fresard, Hoberg, and Phillips, 2020). Recent studies highlight how lax antitrust enforcement fosters anti-competitive mergers, detrimental to competition (see e.g., Eliason et al., 2020; Cunningham, Ederer, and Ma, 2021; Heim, Hü schelrath, Laitenberger, and Spiegel, 2022; Kamepalli, Rajan, and Zingales, 2022; Kepler, Naiker, and Stewart, 2023; Ha, Ma, and Zaldokas, 2024).

In this paper, we present a theoretical model integrating the classic discussion of antitrust enforcement errors and the current focus on market distortion, arguing that even elevated stringency of antitrust enforcement can negatively impact market outcomes through structural changes in firm M&A behaviors. Given limited attention and efficiency constraints, antitrust agencies tend to focus their enforcement efforts and penalties based on

[2] See for example Hossain (2021), "*merger and acquisition (M&A) have become a foremost strategic alliance for business, product and geographic tactics in global market.*"

firm market share.[3] While straightforward, this approach is often insufficient to capture true monopoly power and may introduce distortions.[4] Thus, a restraining antitrust policy could elevate firms' concern for antitrust error risks[5], modeled as such that firm with larger market share faces higher punishment probability and bigger expected penalty, and prompting them to adjust their strategic choices accordingly.

Our model describes a market with two asymmetric local firms competing on price and investment, where investment strategies vary based on firm size and market positioning. Larger firms are capable of both local and nonlocal investments, while smaller firms are limited to local investments. Local investment is characterized as helping firm to compete in local market by lowering the production cost, for example local acquisitions (cost-saving through the economy of scale) and R&D investments (cost-saving through technology innovation). Meanwhile, nonlocal investment has no direct impact on local market, for example cross-regional M&As. When antitrust enforcement is strengthened, the sensitivity of expected punishment on firm's market share, which we call the punishment intensity, will become larger.

Our model yields that under certain condition, higher punishment intensity makes competing for local market share more costly and induces firm to either decrease local

[3] Firms with larger market share are considered more capable of conducting monopoly behaviors. Thus, in antitrust enforcement, market share is often one of the most important criteria for determining whether a company has big market power, a prerequisite for determining whether certain behaviors are subject to the Rule of Reason and would hurt competition. Additionally, the relevant market used to determine market share is often confined to a specific geographic area, commonly referred to as the local market.

[4] See for example, Farrell and Shapiro (2010) discusses how the link between market shares and competitive effects can be weak and/or confusing; Hoberg and Phillips (2016) and Eaton, Guo, Liu, and Officer (2022) argue that market share can inaccurately capture market competition because current definition and boundary of "market" itself is problematic.

[5] Note that although we call the term "antitrust error risk", it can be generalized and understood as the overall antitrust risk. Intuitively, firm behavior perceived as monopolistic under a strict antitrust enforcement can be non-monopolistic under a lax antitrust enforcement. In other words, "antitrust error" is a conceptual term sensitive to the stringency of antitrust scrutiny. Hereafter, we use the term "antitrust error risk" and "antitrust risk" interchangeably, but both are referred to as the risk of becoming the target of antitrust enforcement.

investment or make more nonlocal investment as substitution. In other words, upon elevated antitrust enforcement stringency, a rational competition strategy for local firms is to compete less aggressively in general, or at least to compete less aggressively in local market and seek market expansion elsewhere, so as to lower the probability of becoming the target of antitrust agency, especially for firms facing higher antitrust error risk. The regulation-driven nonlocal investment is in essence a cross-regional regulatory arbitrage, crowding out local investment, raising equilibrium price, representing a damage to market competition. Furthermore, the model implies that if firm is rational and choose an optimal investment target to maximize its gain from an M&A transaction, then when a new antitrust policy elevates firm's concern for antitrust error, it will deviate firm from its optimal target choice and choose a less efficient target instead, indicating a damage to firm welfare.

Based on the theoretical discussions, we have the following hypotheses that under a local market share-based[6] antitrust enforcement mechanism: (1) more stringent policies in general discourages firm M&As, especially those may damage market competition; (2) firms are strategically motivated to engage in cross-regional M&As, especially for firms with high local market share; (3) as the cost of antitrust, such policy-driven M&As crowd out the cost-saving local investments, hurt firm performance as well as product market outcomes.

China's evolving antitrust framework provides an ideal setting for investigating these hypotheses. Different from countries like the U.S., where antitrust verdict relies heavily on legal procedures, China adopts a administrative-dominant antitrust enforcement, where

[6] Note that here we stress on "local market share" instead of the national market share that prior literature conventionally refers to. Prior literature shows that there is a diverging trend in national and local market concentration recently (Rossi-Hansberg, Sarte, and Trachter, 2021), addressing the importance to discuss the welfare implications in the context of local market.

governmental agency, the Administration for Market Regulation, wields comprehensive authority over investigations, rulings, and penalties. From 2015 to 2023, Chinese government announced a series of antitrust administrative orders targeting at different industries, creating differences in enforcement stringency for firms in different industries. Moreover, Chinese administrative orders are featured with immediate effectiveness upon announcement, making the orders hard to be anticipated and diluted by expectations. Such enforcement background satisfies a staggered differences-in-differences setting which allows us to identify the causal effect of elevated antitrust enforcement on firm M&A behaviors.[7]

Using our hand-collected data on antitrust administrative penalty cases in China, we first confirm that following the policies, affected industries experience a significantly increase in penalty intensity. Specifically, within a specific province, antitrust policy-affected industries on average experience 0.681 more cases annually, which is equal to a 63% (0.681/1.08) relative increase from the mean. Moreover, controlling for observable case and geographic characteristics, administrative investigation into affected firms is on average -186.126 days shorter than that of other firms, which represents a 49% (-186.126/378.08) decrease from the mean. Both results confirm that the authority indeed elevates their attention toward the policy affected firms. In addition, we also confirm that the existence of lower enforcement attention to the cross-regional antitrust cases. Followed by the policies, the investigation length of cross-regional policy-affected cases is on average 146.640 days longer, representing a 39% (146.640 /378.08) increase from the mean.

After confirming the differences in regulation stringency between local and cross-regional antitrust activities, we turn to our main analysis of how this affects firm's M&A

[7] Detailed list of the administrative orders is provided in section 4.

behaviors. Consistent with our hypothesis (1), we find that strengthening antitrust policies in general discourage firm M&A transactions. Namely, firms affected by the antitrust policies conduct 0.154 less M&A transactions per year than unaffected firms, which is equivalent to a 9% (-0.154/1.74) decrease from the mean. In terms of different types of M&A, we find that acquisitions for stock (in particular acquisitions for absolute control) are significantly negatively affected whilst acquisitions for asset do not witness a similar change.

Next, we look into whether antitrust policies affect cross-regional M&As differently as in our prior discussion. Consistent with our hypothesis (2), we find that firms affected by the antitrust policies on average involve in 0.040 more cross-regional M&As per year as compared to unaffected firms, which represents a more than 22% (0.040/0.18) increase from the mean. Such increase poses a striking contrast with the overall shrinking trend of total M&As, confirming that antitrust policies could indeed cause differences in firm's strategic choices in terms of different M&A types.

To further illustrate on how changes in antitrust enforcement affect firm M&A choices differently, we conduct tests using firm size and state ownership as proxies for different level of antitrust punishment intensity. We find that firms with uniform elevated punishment intensity (i.e., "big firms") decrease M&A activities in general[8], firms with different punishment intensity in local and cross-regional market (i.e., "small firms") increase cross-regional M&As, and firms with little concerns for antitrust punishment intensity (i.e., state-owned firms) are insensitive to strengthened antitrust policies and display no significant changes in total and all types of M&As. The results confirm that

[8] The intuition is that in our sample of publicly listed firms, the "big" ones are those who typical have already prevailed in national instead of local market, thus are subject to uniformly high punishment intensity no matter which regional market they go.

even though restraining antitrust policies in general discourages anticompetitive M&As, different firms with different level of punishment intensity and antitrust error risks reacts differently, and some can avoid the elevated regulation intensity through cross-regional investment.

Finally, we turn to the real economic implications of antitrust enforcement. Consistent with the hypothesis (3), our empirical results show that the total R&D expenditure decreases, confirming that the costly cross-regional M&As crowd out funds available for local innovative investment. As a result, firm's post-policy market performance become worse. The announcement returns are negative for cross-regional M&As conducted by policy affected firms. In the long run, the affected firms show a slight increase in profit margins, indicating a decreased market competition.

Our work contributes to the existing literature in several ways. First, we contribute to the literature on the effect of antitrust enforcement on real economy. Prior literature shows that current antitrust enforcement is unsatisfactory with both industrial concentration and the market power of big companies on the rise (see e.g., Van Reenen, 2018; Grullon, Larkin, and Michaely, 2019; Autor et al., 2020; Bajgar et al., 2021; Gilbert, 2023). Related to our perspective of firm M&A behavior, critiques of antitrust enforcement mainly focus on how lax thresholds lead to worse product market outcomes through anticompetitive mergers and kills industrial innovation (see for example, Eliason et al., 2020; Cunningham, Ederer, and Ma, 2021; Kamepalli, Rajan, and Zingales, 2022; Nocke and Whinston, 2022; Kepler, Naiker, and Stewart, 2023). Different from these studies, we revisit a classic discussion of antitrust error, find that even strengthening antitrust enforcement could give

rise to anticompetitive and inefficient M&As, harmful to both the firm and the product market.

Second, we extend the literature on the determinants of firm cross-regional M&As. Prior literature finds that firms conduct M&As for internal incentives such as seeking for coordination effect, economics of scale, market domination, complementary capability, and innovation (see e.g., Coase, 1937; Stigler, 1950; Perry, 1978; Eckbo, 1992; Snyder, 1996; Phillips and Zhdanov, 2013; Bena and Li, 2014; Arikan and Stulz, 2016; Kaul and Wu, 2016; Fresard, Hoberg, and Phillips, 2020), or due to external shocks such as policy uncertainty and industry linkage (see e.g., Ahern and Harford, 2014; Bonaime, Gulen, and Ion, 2018) Mostly related to our study, a strand of literature finds that banks conduct cross-border M&A to seek regulatory arbitrage arising from differences in cross-border financial regulation (see e.g., Carbo-Valverde, Kane, and Rodriguez-Fernandez, 2012; Karolyi and Taboada, 2015); in corporate literature, prior research shows that geography, the quality of accounting disclosure, and bilateral trade affects cross-border M&As (Erel, Liao, and Weisbach, 2012), and difference in access to bank credit drives US cross-state M&As (Cornaggia and Li, 2018). Our works shows that, besides the above motivations, the heterogeneity in antitrust punishment intensity for local and nonlocal investment also motivates firm to conduct more cross-regional M&As.

Third, our paper has some policy implications. Although we use China as the background setting, we believe our conclusions are applicable to as well as beneficial for antitrust practices worldwide. Over the past decades, China has gone through profound antitrust reform, from the phase without any antitrust policies to the current stage with an extensive set of antitrust policies, providing a wealthy sample with numerous instances of

enforcement shifts for empirical design to capture the effect of antitrust policy on real economy. In contrast, for example, the U.S. merger guidelines have only changed a few times over the last century, with significant time spans between each revision. Using our hand-collected data for antitrust administrative penalty cases, we find that antitrust enforcement can trigger firm's strategic behaviors that may hamper policy efficiency and in contrary harm market competition, thus requiring policymakers' specially attention. Our results highlight the importance of a more precise and refined antitrust enforcement system.

The rest of the paper proceeds as follows: Section 2 reviews the related literature on Antitrust policy and firm M&As; Section 3 constructs and develops our base theoretical models; Section 4 describes our data and main empirical methods; Section 5 discusses our main results; and Section 6 concludes.

2. Literature Review

2.1 Literature on Antitrust Regulation

Antitrust regulation plays a fundamental role in securing market competition, making sure resources are properly and efficiently allocated through market mechanism. However, there's widespread dissatisfaction with the existing antitrust enforcement world-widely (see e.g., Gilbert, 2023).

For the past decades, industrial concentration has been on the rise, and big companies have gained increasing market power. For example, some studies find that the increase in market power has become an important source of value creation for U.S. corporates (Shapiro, 2010, 2018; Grullon, Larkin, and Michaely, 2019; Autor et al., 2020). This trend is similar for major European economies as well as Australia and Japan. (Van Reenen, 2018; Koltay et al., 2020; Bajgar et al., 2021).

Prior literature shows that increased market power can have large side effects not only in product price, the traditional focus of consumer welfare, but also lead to reduced product quality and variety, reduced service, and even diminished innovation and economic development (see e.g., Eckbo, 1983; Shapiro, 2019; De Loecker, Eeckhout, and Unger, 2020; Melamed, 2020; Thatchenkery and Katila, 2022).

Despite its importance, as market intervention, antitrust enforcement is challenged by critiques on its limitations, among which antitrust error has been the subject of prolonged discussions in the legal community. Antitrust error cost is firstly asserted by Easterbrook (1984). It is mainly used by the Chicago School to criticize that antitrust policy is too stringent, leading to increasing false positive and false negative errors in the course of enforcement. However, this point of view is less prevailing nowadays and there are other voices that false negatives are more dangerous in current antitrust enforcement practice (see e.g., Devlin and Jocobs, 2010; Hovenkamp, 2022).

2.2 Literature on M&A

As one of the most important firm decisions, M&A has always been the focus of corporate finance research. To explain why firms conduct M&A, different theories give different answers. Neoclassical theory propose that firms conduct M&A to internalize market transaction costs, avoid holdup problems, and create value for their shareholders (see for example, Coase, 1937; Perry, 1978; Klein, Crawford, and Alchian, 1978; Williamson, 1979; Eckbo, 1992; Trautwein, 1990; Andrade, Mitchell, and Stafford, 2001; Arikan and Stulz, 2016). Market power theory predicts that M&A is one of the most important strategies that a firm adopt to enhance its market power and exploit monopoly profits (see for example, Stigler, 1950; Snyder, 1996, 1998). In addition, other factors, such as promoting innovation (especially when innovation is properly priced), industrial shocks,

product market space, policy uncertainty and regulation arbitrage, also affect firm M&A decisions (see for example, Phillips and Zhdanov, 2013; Ahern and Harford, 2014; Bena and Li, 2014; Bonaime, Gulen, and Ion, 2018; Nguyen and Phan, 2017; Fresard, Hoberg, and Phillips, 2020; Eaton et al., 2022).

Based on the above theories, value creation in M&A could arise from different sources, including economies of scale or scope, increases in managerial efficiency, improvements in production techniques, increases in market power, or in product market synergies. Empirical works in general concur with the theoretical predictions and document a number of specific channels of the sources of synergies from M&A. For example, post-merger value can come from interest tax shields, reduced cost, improved cash flows and productivity from better resource allocation, product differentiation, enhanced bargaining and pricing power, and improved operating and innovation efficiency (e.g., Devos, Kadapakkam, and Krishnamurthy, 2009; Hoberg and Phillips, 2010; Bhattacharyya and Nain, 2011; Maksimovic, Phillips, and Prabhala, 2011; Ahern, 2012; Bena and Li, 2014; Sheen, 2014; Li, Qiu, and Shen, 2018; Hsu, Li, Liu, and Wu, 2022; Li and Wang, 2023).

Recent works focusing on corporate governance find that structured management practices, competent CEO, related human capital, better CSR performance, corporate cultural similarity, and social ties between acquirers and targets also play a part in post-merger value creation (see for example, Ishii and Xuan, 2014; Bereskin, Byun, Officer, and Oh, 2018; Lee, Mauer, and Xu, 2018; Doukas and Zhang, 2021; Bai, Jin, and Serfling, 2022)

However, some studies investigate post-merger outcomes under the context of agency theory, predicting that mergers are value-destroying, especially for mature firms with

excessive cash holdings and entrenched management (Mueller,1972; Jensen, 1986, 1993; and Morck, Shleifer, and Vishny, 1990).

2.3 Literature on M&A and Antitrust

M&As are one of the major competition strategies that a firm adopt to increase their market competitiveness and market power (see for example, Stigler, 1950; Snyder, 1996, 1998). However, empirical works find different results for the anticompetitive effect of M&As. For example, Bhattacharyya and Nain (2011) finds that horizontal M&As increase the acquirer's buying power over its suppliers; Cunningham, Ederer, and Ma (2021) and Kamepalli, Rajan, and Zingales (2022) find that firms conduct acquisitions to deliberately kill its (potential) competitors. Meanwhile, other works (see e.g., Eckbo, 1983, 1992; Fee and Thomas, 2004; Shahrur, 2005) finds no rising market power for incumbents in the takeover industries. To reconcile the mixed empirical findings, Fathollahi, Hartford, and Klasa (2022) introduces a measure for industry product similarity and shows that in industries with higher product similarity, horizontal acquisitions are more likely to reduce competition intensity.

When talking about M&As that might affect market power, the typical focus of both regulation and academia is big corporations with sky-high value deals. However, small sized deals that are rarely known to the public could also have great anticompetitive effect. Recent works tend their focus on the consequences of relaxing antitrust enforcement leading to such "midnight mergers" and "stealth acquisitions". For example, Wollmann (2019) finds that immediately after an abrupt increase in US horizontal exemption threshold, mergers between competitors and just below the threshold rise sharply. Moreover, acquirers intentionally adopt different techniques throughout the course of an M&A process to avoid antitrust scrutiny, including keeping the deal size below the scrutiny

threshold, or keeping the deal undisclosed; such "midnight mergers" and "stealth acquisitions" benefits the acquirer's shareholder value, but have big consequences for product market competition. (e.g., Barrios and Wollmann, 2022; Kepler, Naiker, and Stewart, 2023; Oh, 2023).

3. Theoretical Analysis

We illustrate our main analysis using a simple model consisting of two asymmetric firms competing in the same product market. Each firm faces the choice between local and nonlocal investment. Assume the two markets are independent. False positive antitrust errors are defined as a potential punishment on firms with higher local market shares because they are more likely to affect local competition and thus attract attention from regulators. In this case, nonlocal investment, in the form of cross-region M&As, adds limited risk to get punished by the regulator, as compared to local investment, because it has limited effects on local market competition.

3.1 Baseline Model

We start from a baseline model where two firms compete with each other in the local market using investment then price. There are two firms, $i = \{A, B\}$ competing for a local market with total sum of 1. They each produce a type of products and sell them at price $p_i \in [0, \bar{p}]$. The demand of each firm depends on the prices they set, $D_i = D_i(p_i, p_{-i})$. Since the total demand is 1, we can simplify the notations as $D_A = D(p_A, p_B), D_B = 1 - D(p_A, p_B)$. Each firm's demand is twice continuous differentiable and is positively related with its own price and negatively related with its rival's price. Thus,

$$D \in [0,1], \frac{\partial D}{\partial p_A} > 0, \frac{\partial D}{\partial p_B} < 0$$

We assume firms have constant marginal production cost $c_A, c_B \geq 0$ and $c_A \leq c_B$, so that firm A is the one who has a comparative advantage. Before they compete in price, firms have an opportunity to make a local investment θ_i to decrease the production cost in the local market. Examples of this type of investment include local mergers (achieving cost-saving through economies of scale), and R&D (achieving cost-saving through technology innovation). Thus, the production cost is reduced to $c_i - \theta_i$. However, the investment has a cost of $k_i(\theta_i)$. We assume that,

$$k_i'(0) \to 0, k_i'(c_i) \to \infty, k_i''(\theta_i) \geq 0$$

By these assumptions, the cost of investment is convex, since firms usually have increasing difficulties in raising funds for investment.[9] We also assume the cost is convex enough so that the cost reduction can never profitable enough to exceed the production cost.

Thus, the payoff of the firm is,

$$\pi_i = (p_i - c_i + \theta_i) D_i(p_i, p_{-i}) - k_i(\theta_i)$$

The timeline of the game is as follows. In the first stage, the two firms set the local investment θ_i. In the second stage, both firms see θ_i and sets their price p_i. In the third stage, consumers form their demand and make the purchase, while firms achieve their own payoffs.

[9] The convexity of investment represents the budget constraint faced by firms. When the investment amount is small enough, firm may use its cash holdings, which has the lowest opportunity cost. When investment is large and exceed corporate cash holdings, firm would have to raise fund through debt then equity financing. Usually, the more funds the firm raise, the higher the capital costs. This is also known as the Pecking Order Theory.

The game is a one period version of the incremental investment game with a price choice additionally (Athey and Schmutzler, 2001). It captures firms' efforts to compete for market share in two dimensions: quality and price. We model the investment as cost-saving but the intuition here suits also for demand-promoting investment, such as expenses on advertisement, reputation and quality. For example, a cost-saving improvement means firms can achieve higher demand with the same markup, which is in turn demand improving.

We start from the stage 2 pricing game. Denote $\tilde{c}_i = c_i - \theta_i$ as the real marginal cost a firm faces. Firms are to choose an optimal price to solve the profit maximization problem,

$$\max_{p_i} (p_i - \tilde{c}_i) D_i(p_i, p_{-i})$$

We assume π_i is twice continuous differentiable and concave in p_i, $\partial^2 \pi_i / \partial p_i^2 \leq 0$. Given that the strategy set is nonempty, convex and compact, and the payoff is continuous, there is a unique equilibrium for this pricing game. We denote the equilibrium price and equilibrium payoff as $p_i^*(\tilde{c}_i, \tilde{c}_{-i})$ and $\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})$. We also assume for an inner solution of the equilibrium, so the price never reaches $\bar{p}$. Note the equilibrium price and payoff are only functions of real marginal cost.

We try to solve how the equilibrium price and payoff are affected by $\tilde{c}_i$. The concavity of π_i ensures that $2\partial D_i / \partial p_i + (p_i - \tilde{c}_i)\partial^2 D_i / \partial p_i^2$, which means the linear term dominates the second-degree term. This happens when D is not too concave or convex. Therefore, take a closer look,

$$\partial^2 \pi_i / \partial p_i \partial p_{-i} = \partial D_i / \partial p_{-i} + (p_i - \tilde{c}_i) \partial^2 D_i / \partial p_i \partial p_{-i}$$

If the second-degree term is small enough, then $sign(\partial^2 \pi_i / \partial p_i \partial p_{-i}) = sign(\partial D_i / \partial p_{-i})$, which means prices are strategic complementarities. Thus, the game is essentially a supermodular game, yielding conclusions as in Lemma 1.

Lemma 1 *(Vives, 2005): given* $\partial^2 \pi_i / \partial p_i \partial p_{-i} \geq 0$, $\partial p_i^*(\tilde{c}_i, \tilde{c}_{-i}) / \partial \tilde{c}_i > 0$ *and* $\partial p_i^*(\tilde{c}_i, \tilde{c}_{-i}) / \partial \tilde{c}_{-i} > 0$.

Proof*: See Appendix C.*

The intuition above is well-discussed in the supermodelar game literature with strategic complementarities. An increase in $\tilde{c}_i$ incentivizes firm *i* to raise its price. With rival's price increases, firm -*i* would want to raise its price as well, which in turn reinforces firm *i*'s incentive to further raise the price.

We now focus on the equilibrium payoff. As $\tilde{c}_i$ is the disadvantage of firm *i*, we assume that $\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})$ is decreasing in $\tilde{c}_i$ and increasing in $\tilde{c}_{-i}$. Using the implicit function of $\partial \pi_i^*(\tilde{c}_i, \tilde{c}_{-i}) / \partial \tilde{c}_i$, we get again that when $\partial^2 \pi_i / \partial p_i \partial p_{-i}$ is small enough, $\partial \pi_i^*(\tilde{c}_i, \tilde{c}_{-i}) / \partial \tilde{c}_i < 0$ is guaranteed. In terms of $\partial \pi_i^*(\tilde{c}_i, \tilde{c}_{-i}) / \partial \tilde{c}_{-i}$, a higher $\tilde{c}_{-i}$ means higher p_{-i}^*. If firm *i* keep its p_i constant, it can get same markup while experiencing higher demand. Thus if p_{-i}^* is higher, $\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})$ becomes larger.

Next, we turn to the stage 1 investment game. $\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})$ is decreasing in $\tilde{c}_i$, thus increasing in θ_i. In addition, as in Athey and Schmutzler (2001), it is reasonable to assume

that $\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})$ is convex in $\tilde{c}_i$ and $\partial^2 \pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial \tilde{c}_i \partial \tilde{c}_{-i} \leq 0$. This would happen if the demand is nearly linear so that both the markup and demand is not too concave or convex in terms of $\tilde{c}$.[10]

Given that $\partial^2 \pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial \tilde{c}_i \partial \tilde{c}_{-i} \leq 0$ and θ is a linear part in $\tilde{c}$, $\partial^2 \pi_i^*/\partial \theta_i \partial \theta_{-i} \leq 0$. Thus, in the investment game, firms' strategies are strategic substitutes. We assume k_i is convex enough, and there is a unique and continuous best response given the rival's strategy. Thus, there exist a unique equilibrium. The equilibrium investment amount is denoted as $\theta_i^*(c_i, c_{-i})$. In this case, following Vives (2005), we can reframe the game as a supermodular game with strategic complementarities where firms' strategy are $s_i = \theta_i$ and $s_{-i} = -\theta_{-i}$. Then we have $\partial^2 \pi_i^*/\partial s_i \partial s_{-i} \geq 0$. In addition, $\partial^2 \pi_i^*/\partial s_i \partial -c_i = \partial^2 \pi_i^*/\partial - \tilde{c}_i \partial - \tilde{c}_i \geq 0$ and $\partial^2 \pi_{-i}^*/\partial s_{-i} \partial -c_i = \partial^2 \pi_{-i}^*/\partial \tilde{c}_{-i} \partial - \tilde{c}_i \geq 0$. Thus, again using result 5 in Vives (2005), we can get Lemma 2.

Lemma 2*: Given* $\partial^2 \pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial \tilde{c}_i^{\,2} \geq 0$ *and* $\partial^2 \pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial \tilde{c}_i \partial \tilde{c}_{-i} \leq 0$, $\theta_i^*(c_i, c_{-i})$ *is decreasing in* c_i *and increasing in* c_{-i}.

Proof*: See Appendix C.*

[10] We follow these assumptions throughout the paper. Especially, a linear demand case fits all these assumptions.

Lemma 2 shows that firms with higher advantage (lower c_i or higher c_{-i}) will invest more. The intuition is simple that the return from investment is higher if firm has a comparative advantage against its rival.[11]

Together, Lemma 1 and Lemma 2 show that how the marginal cost c_i will affect the equilibrium investment and price. It lies the foundation for our further analysis of the antitrust error and nonlocal investment.

3.2 Antitrust enforcement and antitrust error risks

A key question in this section is how to model antitrust errors. Stringent antitrust enforcement often brings higher antitrust error risks for firms because enforcement itself cannot be one hundred percent accurate. The identification and punishment of monopoly behavior are often lacking of criteria for absolute objectivity, and subject to the mainstream opinions of economics, the views of judges and various random factors. This is giving birth to antitrust errors, which consists false positive errors where firms are punished without uncertain monopoly behaviors and false negative errors where firms with illegal behavior escape from punishment. Here we mainly focus on the false positive errors, where firms get punished without enacting competition-damaging monopoly behaviors.

With a new antitrust policy in place, not only are those who do engage in antitrust behavior more likely to get caught, but those who do not engage in monopoly behavior or whose damaging effects on competition are not easy to verify are more likely to be a potential target for the authorities. In other words, all affected firms are put under more stringent monitoring from the authorities and facing an elevated antitrust risk.

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[11] Also note that π_i includes the investment cost k_i but we omit it in the expression sometimes. It is because k_i is only related with θ_i and not directly related with $\tilde{c}_i$ and c_i. This is similar to Athey and Schmutzler (2001) where the adjustment cost is not related with the state variable (which is c_i in our context).

The expected cost of antitrust risk a firm face equals the probability of getting caught times the amount of penalty. We assume that a firm's market share is positively related to the probability and the amount of punishment by authorities.[12] For simplicity, we rewrite the equation of the expected cost of antitrust risk as a linear function of market share,

$$\tilde{\phi}_i(D_i) = \phi D_i$$

where ϕ is what we call the punishment intensity, and D_i is firm i's market share. When antitrust regulation is strengthened, the punishment intensity ϕ becomes larger. We assume ϕ is small enough so the markup is positive at equilibrium and there is no consideration of leaving the market. Thus, the total expected cost of being punished equals a firm's market share times the punishment intensity. The expected payoff with antitrust risk is,

$$\pi_i = (p_i - c_i + \theta_i - \phi) D_i(p_i, p_{-i}) - k_i(\theta_i)$$

Generally speaking, the cost of antitrust risk is a punishment on market share D_i. In other words, antitrust risk negatively affects firm's profit margin on demand. A natural intuition from this is that as firm's benefits from competing for larger market share is decreased due to antitrust risk, they will compete less for the market share.

We denote the new real margin cost as $\tilde{c}_i = c_i - \theta_i + \phi$. c_i can be seen as a state variable. An increase of ϕ has the same effect as both the state variable c_i and c_{-i} are increased by ϕ. Rewrite $\theta_i^*(c_i + \phi, c_{-i} + \phi)$ as $\theta_i^*(c_i, c_{-i}; \phi)$. Thus, to see how price

[12] This is because big firms are easy targets because they are more likely to (be noticedly) engage in monopoly activities due to their size and publicity. In fact, most of the antitrust policies are brought up by the authorities in direct link with big firms. For example, the Sherman Act was built against the Standard Oil, who was then controlling 90% of the U.S. refineries and pipelines. Recently, the EU's Digital Markets Act and Digital Services Act are clearly aimed at internet unicorn companies.

and investment would change after the punishment intensity becomes higher when regulation is strengthened, we have,

$$\mathrm{d}\theta_i^*(c_i, c_{-i}; \phi)/\mathrm{d}\phi = \partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i + \partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}$$

Using Lemma 2, it yields in the RHS that the two terms are of opposite sign, representing two types of effect in shaping $\mathrm{d}\theta_i^*(c_i, c_{-i}; \phi)/\mathrm{d}\phi$ that could leave the overall effect uncertain. On the one hand, increased punishment intensity would induce firm to lower its investment, for a higher marginal cost would limit the revenue from investment. We call this the "internal effect". On the other hand, increasing rivals' marginal cost brings opportunities for the firm to gain more revenue from investment. Thus, a higher punishment intensity can also incentivize the firm to invest more. We call this the "external effect". In reality, we usually see the former is larger than the later. If so, the "internal effect" dominates, and the antitrust risk leads to decreased investment. However, in such a supermodular game, the external effect can be amplified because a higher rival cost leads to a lower investment of its rival, which in turn reinforce a higher investment for the firm itself. In a special linear case where $D_i(p_i, p_{-i}) = 1 - p_i + p_{-i}$, these two terms are of equal magnitude, so that the equilibrium investment is unaffected by the punishment intensity.

Next, we turn to the equilibrium price. We have shown the equilibrium price are only functions of $\tilde{c}_i$. Thus, a key question is whether the investment would increase enough to exceed the punishment intensity so that $\tilde{c}_i$ increases. To see this, observe that,

$$d\tilde{c}_i(\theta_i^*, c_i, \phi)/d\phi = -\mathrm{d}\theta_i^*(c_i, c_{-i}; \phi)/\mathrm{d}\phi + 1$$

In the first scenario where the internal effect dominates, $|\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i| > |\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}|$, and $d\tilde{c}_i(\theta_i^*, c_i, \phi)/d\phi > 1$, the equilibrium prices will be higher, damaging the competition and harming the consumers. What's more, an increase in the punishment intensity will have a much larger effect on the real marginal cost. The antitrust error risk can harm the competition even severer. This harm comes from two sources. The first is that a potential punishment would make firm compete less for the market share and in turn leads to a higher price. The second is that firm's incentive of investment is crowded out, thus leads to an even higher price.

In the second scenario where $|\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}|$ is in a moderate range, $|\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i| < |\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}| < 1 + |\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i|$, higher punishment intensity causes the firm to invest more and compete more fiercely. However, the benefit of investment cannot surpass the competition damage from the punishment for a larger market share. In this situation, the prices would increase, and competition is damaged, but in a smaller magnitude.

Only in the third scenario where $|\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}| > 1 + |\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i|$, a higher punishment intensity can lead to fiercer competition and lower price. However, this is unlikely to happen in reality, or at least cannot happen for all c_i if k is convex enough. This is because when c_i is small enough then an increase in ϕ would make the $\tilde{c}_i$ negative and bounded by the investment cost. In addition, this cannot happen for both firms. To see this, note that the best response of θ_i is only associated with $\tilde{c}_{-i}$ and c_i. Therefore, if $c_{-i} - \theta_{-i}^*(c_i, c_{-i}) > c_{-i} + \phi - \theta_{-i}^*(c_i + \phi, c_{-i} + \phi)$, $\theta_i^*(c_i +$

$\phi, c_{-i}+\phi) = argmax\pi_i^*(c_i+\phi-\theta_i, c_{-i}+\phi-\theta_{-i}^*(c_i+\phi, c_{-i}+\phi))$. Denote a new strategy as $\theta'_{-i} = -\phi+\theta_{-i}^*(c_i+\phi, c_{-i}+\phi) > \theta_{-i}^*(c_i, c_{-i})$. Thus, consider that firm -*i*'s marginal production cost remains as c_{-i} but it plays a new strategy θ'_{-i}. An increase of its own marginal cost ϕ and a higher investment lead to a lower θ_i than $\theta_i^*(c_i, c_{-i})$. It yields $\mathrm{d}\theta_i^*(c_i, c_{-i}; \phi)/\mathrm{d}\phi < 0$ and $d\tilde{c}_i(\theta_i^*, c_i, \phi)/d\phi > 0$.

Above we develop our discussions of $\tilde{\phi}_i(D_i)$ on a linear case assumption. Now we consider a more general case where $\tilde{\phi}_i(D_i)$ is not linear. It is usually when firm is small enough, it can hardly be recognized as enacting monopoly behavior. Especially, considering exclusive behavior, firm has to be affirmed as having significant market power so as to get punished. Such affirmation usually requires large enough market share. Therefore, big firms have higher probability of getting punished. In addition, the amount of penalty is usually determined based on firm's revenue, which is an increasing function of market share. Thus, it is reasonable to assume that big firms face higher punishment intensity. When a new policy is enacted and the authorities are eager to find a target to punish, small firms may face a smaller increase in punishment intensity compared to big firms. In this sense, we can see $\tilde{\phi}_i(D_i)$ as a convex function, and after a policy the convexity is even larger. Thus, $\tilde{\phi}_i'(D_i)$ is higher for big firms. However, there can be special cases where big firms are more likely to be caught but the probability and the penalty is less sensitive to the market share. In such cases, $\tilde{\phi}_i'(D_i)$ is lower for big firms.

In summary, the shape of $\tilde{\phi}_i(D_i)$ can be various and determined by the authorities' strategy. Considering a same game with a nonlinear form of $\tilde{\phi}_i(D_i)$. The equilibrium demand is D_i^*. It is easy to verify that the equilibrium strategy is the same with $\tilde{\phi}_i(D_i)$ in the form of $\tilde{\phi}_i'(D_i)_{|D_i=D_i^*} * D_i$. Thus, we capture a simple logic here that it is the punishment intensity at equilibrium demand that really matters. We can transform the game into linear form $\tilde{\phi}_i(D_i)$ but different firm may face different punishment intensities. Therefore,

$$\pi_i = (p_i - c_i + \theta_i - \phi_i) D_i(p_i, p_{-i}) - k_i(\theta_i)$$

We can consider an extreme case where two firms have extremely different c_i so their market share difference and, in turn, the punishment intensity difference are big enough, and where the punishment intensity of the small firm (say firm -*i*) remains but that of the big firm (say firm *i*) rises. Thus, we can see that,

$$\mathrm{d}\theta_i^*(c_i + \phi_i, c_{-i})/\mathrm{d}\phi_i = \partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i < 0$$

The investment of the big firm shrinks, but the investment of the small firm increases. The real marginal cost of the big firm is higher, and the small firm is lower, causing contradictory effects on price.

3.3 Non-local Investment

In previous sections, local market investment is made to lower the production cost and in turn increase demand if the firm keeps the same markup. However, if after an antitrust policy is enacted and the punishment for larger market share is intensified, a nonlocal investment which has no impact on local market share is thus relatively more

profitable. In this section, we consider the case when a bigger firm, say firm A has the opportunity to make nonlocal investment, which is in the form of cross-regional merger. The local investment on production cost and the nonlocal investment are substitutes under budget constraints.

Why would firms enact cross-region M&As? One reason is that firms can achieve synergies from nonlocal firm, such as acquiring new technologies and human capital. This would in turn helps firm compete in local market. Thus, technically speaking, a cross-region M&A in this form is not purely a nonlocal investment. In contrast, when a nonlocal investment is only made because firm thinks a nonlocal target's value is underestimated, then such investment is essentially a financial investment and has no direct effect on the local market. It is worth noting that a cross-region M&A that brings synergies to the nonlocal target is a nonlocal investment. The synergy does not affect local market and can be seen as a reason why the nonlocal target is underestimated in the view of the acquiring firm.

So, what is the connection between local investment and nonlocal investment? Local investment and nonlocal investment are substitutes under firm budget constraint. Assume the firm faces a rather tight budget constraint, a more dollar for the local investment crowds out the same amount for the nonlocal investment or face additional financial cost to raise another dollar for the nonlocal investment.

We assume firm A now can set nonlocal investment $I \in R_+$ simultaneously with local investment θ_A. Nonlocal investment yields a revenue of $F(I)$. We assume that F is twice continuous differentiable and,

$$F(0) = 0, F'(I) > 0, F''(I) < 0, F'(0) \to \infty, F'(\infty) \to 0$$

This ensures there is an inner solution of an optimal *I*.

The timeline is modified as follows. In the first stage, firm A sets local investment θ_A and nonlocal investment *I*, while firm B sets only local investment θ_B. In the second stage, both firms see θ_i and I and sets their price p_i. In the third stage, consumers form their demand and make the purchase, while firms achieve their own payoff.

The payoff of firm B remains but firm A's payoff is now,

$$\pi_A = (p_A - c_A + \theta_A - \phi)D_A(p_A, p_{-A}) - k_A(\theta_A + I) + F(I)$$

We also assume that $\partial^2\pi_A/\partial I^2 \partial^2\pi_A/\partial\theta_A{}^2 \geq (\partial^2\pi_A/\partial I\partial\theta_A)^2$.

It is easy to verify that the pricing game remains as the optimal prices are only function of real marginal cost $\tilde{c}_i$. Thus, we start from the investment game and keep the notations in the previous sections. We have,

$$\begin{aligned}&\pi_A^*(c_A - \theta_A + \phi, c_B - \theta_B + \phi, \theta_A)\\ &= (p_A^*(\tilde{c}_A, \tilde{c}_B) - c_A + \theta_A - \phi)D_A(p_A^*(\tilde{c}_A, \tilde{c}_B), p_B^*(\tilde{c}_A, \tilde{c}_B))\\ &- k_A(\theta_A + I) + F(I)\end{aligned}$$

Considering strategy noted by -*I*. $\partial\pi_A^*/\partial\theta_A\partial - I = k_A''(\theta_A + I) > 0$ and $\partial\pi_B^*/\partial\theta_B\partial - I = 0$. Therefore, the investment game with payoff π_A^* and π_B^* and strategy θ_A, $-\theta_B$ and *I* is a supermodular game. Thus, we have,

Lemma 3*: Given* $\partial^2\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial\tilde{c}_i{}^2 \geq 0$ *and* $\partial^2\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial\tilde{c}_i\partial\tilde{c}_{-i} \leq 0$, $\theta_i^*(c_i + \phi, c_{-i} + \phi)$ *is decreasing in* $c_i + \phi$ *and increasing in* $c_{-i} + \phi$. $I^*(c_A + \phi, c_B + \phi)$ *is increasing in* $c_A + \phi$ *and decreasing in* $c_B + \phi$. θ_A^* *is negative related with* I^*.

The result can be achieved directly using Lemma 2 and considering the new supermodular game with strategy $-I$. Lemma 3 shows that local investment and nonlocal investment are strategic substitutes. See the FOC in terms of *I*, $F'(I^*) = k'(\theta_A^* + I^*)$. Thus, for any given θ_A^*, I^* can be implicitly solved, and a higher θ_A^* means a lower I^*.

Therefore, using methods in Section 3.2, we can examine how I^* is related with ϕ. Again, the result depends on the inner effect and the external effect. If for firm A, $|\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i| > |\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}|$, then a higher punishment intensity leads to a higher nonlocal investment. Thus, we have Proposition 1.

Proposition 1*: Given* $\partial^2\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial\tilde{c}_i^{\,2} \geq 0, \partial^2\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial\tilde{c}_i\partial\tilde{c}_{-i} \leq 0$ *and* $|\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_i| > |\partial\theta_i^*(c_i, c_{-i}; \phi)/\partial c_{-i}|$*, nonlocal investment* I^* *will be lower if there is an uniformly punishment intensity increase.*

Proposition 1 shows that if the firm is more sensitive to its own state than its rival's state, which is rather common in reality, the punishment intensity raised by a new antitrust policy would lead to more nonlocal investments. The intuition is that punishment on the market share lowers the profitability on local investment to compete for market share and thus make way for nonlocal investment, which does not help competing for market share.

Considering heterogeneous punishment intensity increase, we have,

Corollary 1*: Given* $\partial^2\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial\tilde{c}_i^{\,2} \geq 0$ *and* $\partial^2\pi_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial\tilde{c}_i\partial\tilde{c}_{-i} \leq 0$*, an increase in* ϕ_A *leads to higher nonlocal investment* I^* *and lower local investment* θ_i^*.

Corollary 1 shows that the increasing nonlocal investment is more likely when big firm faces larger increase in the punishment intensity after the policy.

Now we consider the welfare effect of nonlocal investment. Without having a specific form of demand function, it is unlikely to derive the consumer surplus to measure the competition damage. However, we can capture such damage through price markup. If price markup is higher for both firms, then the consumer surplus is bound to be lower.

Concerning an equilibrium, $(\theta_A^*, I^*, \theta_B^*)$ with I^* positively related with ϕ. If nonlocal investment is not possible, then I is zero and θ_A^* rise a little bit. This in turn makes θ_B^* lower, reinforcing an even higher θ_A^*. Therefore, the new equilibrium without nonlocal investment is with a higher θ_A^* and lower θ_B^*. Thus $\tilde{c}_A$ is lower but $\tilde{c}_B$ is higher. By Lemma 1, the equilibrium price is positively related with the two real marginal costs. Note we assume firm A is the bigger firm and have more market share. If firm A is more sensitive to the $\tilde{c}_A$'s change, the equilibrium price of firm A will be lower and affects more consumers. If so, nonlocal investment harms competition by making firm invest less and set higher prices. However, this is not always the case. If firm B's investment is very sensitive to $\tilde{c}_B$, it may invest a lot and then cause the competition much fiercer. In summary, the total welfare effect of the nonlocal investment, in the form of cross-regional M&A, is unsure. If the acquiring firm has dominant effects on the market, the cross-regional M&As induced by the antitrust error risks may harm the competition because it crowds out more local investment.

In summary, what we find has great policy implications. Antitrust error risks may harm competition in such way that it crowds out local investment and discourages competition in local market. Furthermore, firms will make more nonlocal investment when the punishment intensity is higher and direct resources to seek for costly nonlocal

opportunity, which damages firm welfare as well. Together the crowding out of local investment as well as the worsening performance of firm may eventually lead to higher price markup in the local market and damage competitions.

4. Data and Methodology

4.1. Methodology

4.1.1. Empirical Design: A Staggered Difference-in-Difference

To empirically examine our theoretical model built above, we employ a staggered difference-in-differences identification strategy by exploiting the staggered enactment of antitrust administrative orders on different industries.

Chinese antitrust enforcement is characterized by strong administrative dominance. Local bureaus for market regulation are granted comprehensive authority to investigate, make decisions on the convictions of antitrust behaviors, and also to impose penalties directly.[13] On the one hand, such administrative-led enforcement is more flexible when the government want to adjust its antitrust policies, and more efficient and less time-consuming as compared to litigation processes. On the other hand, however, the dominant role played by local governmental agencies in antitrust enforcement also give rise to amplifying concerns over antitrust errors, especially for firms with larger local market share.[14] We provide detailed institutional backgrounds on China's antitrust enforcement and its evolution in Appendix B.

[13] In contrast, in the United States, antitrust authorities Federal Trade Committee (FTC) and the Department of Justice (DOJ) play crucial roles in investigating and initiating actions against antitrust violations, but the final determinations regarding convictions and penalties are made by the courts.

[14] Local antitrust agencies have the first order authority within their administrative region. Thus, with limited attention and resources, they tend to devote less into trans-regional antitrust cases.

Over the years, Chinese government have released a number of antitrust policies in the form of administrative orders. Such policies lead to stricter scrutiny and more rigorous enforcement on firm behaviors that could affect market competition, including M&A decisions. Some of these policies are overarching and can affect all industries, but some target on specific industries. Unlike the antitrust laws and general antitrust policies that would be released for public comments before their actual enactment dates, industry-specific antitrust administrative orders usually come into effect immediately upon announcement[15]. In other words, these industry-specific antitrust administrative orders are exogenous for firms operating within the industries, so that they are unlikely to anticipate these policies and change their behaviors prior to the announcement dates. These policies allow us to exploit a staggered difference-in-difference design to capture of the true impact of antitrust enforcement on firm behavior. We list these policies in the below table.

DATE	POLICY	RELATED INDUSTRY
2015-04-07	Provisions on Prohibiting the Abuse of Intellectual Property Rights to Exclude or Restrict Competition	M72, M73, M74, M75
2018-03-07	Notice of the National Railway Administration on Issuing the Detailed Rules for the Implementation of the Fair Competition Review System (for Interim Implementation	C37, G53
2018-09-08	Notice by the Ministry of Transport of Issuing the Results of Review of the Existing Policies and Measures Excluding or Restricting Competition	G53, G54, G55, G56, G57, G58, G59, G60
2019-01-04	Guidelines of the Anti-monopoly Commission of the State Council for Anti-monopoly in the Automotive Industry	C36
2019-01-04	Guidelines of the Anti-monopoly Commission of the State Council for Anti-monopoly in the Field of Intellectual Property Rights	M72, M73, M74, M75
2020-04-04	Announcement of the State Administration for Market Regulation on Supporting Antitrust Law Enforcement for Epidemic Prevention, Control, and Resumption of Work and Production	C14, C27, C35, D44, D45, D46, F51, F52, G53, G54, G55, G56, G57, G58, G59, G60, H61, H62, L72
2020-07-09	Announcement of the Ministry of Industry and Information Technology on Carrying out the Joint Rectification Action for the Broadband Access Market of Commercial Buildings	I63

[15] For example, the 2022 Antitrust Law was released for public comments in January 2020. The 2020 Antitrust Compliance Guide was released for public comments in November 2019. On the contrary, the Antitrust Guide for API Industry was released by the State Council on November 15th, 2021, and immediately became effective upon the release.

2021-02-07	Guidelines of the Anti-monopoly Commission of the State Council for Anti-monopoly in the Field of Platform Economy	I64, I65
2021-09-07	Notice of the Ministry of Transport on Maintaining Fair Competition Market Order and Accelerating the Standardization of Ride-Hailing Services	G54, I64
2021-11-15	Guidelines of the Anti-monopoly Commission of the State Council for Anti-monopoly in the Field of Active Pharmaceutical Ingredients (APIs)	C27

To quantitatively validate the staggered enactment of antitrust administrative orders on different industries indeed lead to strengthened antitrust enforcement, i.e., increased "punishment intensity", we first conduct an industry-level case count test. To do so, we aggregate the total count of antitrust administrative penalty cases within a particular industry at the provincial level on an annual basis and construct a province-industry-year panel.

The specification is as follows, for industry *j* in province *g* in year *t*:

$$Case\ Count_{jgt} = \alpha + \beta_1 Antitrust_{jt-1} + \gamma D_{t-1} + \rho_g + \sigma_j + \tau_t + \varepsilon_{jgt}, \quad (1)$$

where $Antitrust_{jt}$ is the staggered Difference-in-Differences treatment indicator that is set to one if firm *i* is operating within the policy-affected industry *j* at time *t* after the policy are enacted. Thus, β_1 is our coefficient of interest. If the industry-specific antitrust administrative orders indeed lead to more attention and stricter scrutiny from strengthened enforcement, the coefficient β_1 will be positive. In other words, holding everything else constant, there should be more administrative penalty cases within the targeted industries.

D_{t-1} is a set of observable provincial control variables, such as GDP growth, population, economic structure. We also include province fixed effects ρ_g, industry fixed effects σ_j, and year fixed effects τ_t to control for any unobservable province-specific,

industry-specific, and year-specific characteristics that might affect the dependent variable, respectively.

Next, we construct a measure proxy for the punishment intensity, *investigation length*, calculated as the number of days from the initiation of the administrative investigation by the enforcement department of a given case to its conclusion. Holding everything else constant, shorter investigation length represents increased punishment intensity from the antitrust agencies.

The specification is as follows, for firm *i* in province *g* who operates within industry *j* and is involved in antitrust administration penalty case *c* at time *t*:

$$Investigation\ Length_{icjgt} = \alpha + \beta_1 Antitrust_{jt-1} + \gamma D_{t-1} + \rho_{gt} + \sigma_j + \varepsilon_{icjgt}, \quad (2)$$

where *Investigation Length*$_{icjgt}$ is the administrative investigation length of case *c*; *Antitrust*$_{jt}$ is the staggered Difference-in-Differences treatment indicator that is set to one if firm *i* is operating within the policy-affected industry *j* at time *t* after the policy are enacted. Thus, β_1 is our coefficient of interest. If the industry-specific antitrust policies indeed lead to stricter antitrust enforcement, the coefficient β_1 will be negative.

D_{t-1} is a set of observable firm-level and case-level control variables, such as firm age, firm size, number of employees, listing state, penalty amount, and whether trans-provincial. Detailed variable descriptions are provided in the Appendix A. In addition, we include province×year fixed effects ρ_{gt} to control for any time-varying unobservable province-level characteristics (for example, a provincial-level administrative order for better market competition environment) that might affect the dependent variable. We also include industry fixed effects σ_j to control for any industry-specific characteristics that might affect the dependent variable.

4.1.2. Antitrust Enforcement on M&As

For our main analysis on whether strengthened concern for elevated antitrust punishment intensity leads to changes in firm M&A behaviors, we aggregate the total count of the (different types of) M&A transactions that a firm has conducted within the year to proxy for the (different types of) M&A intensity at the firm-year level. Figure 2 plots the total M&A transactions in the transportation industry and in digital communication industry, respectively, as compared to other industries before and after the antitrust administrative orders targeted at the two industries are enacted. Both panel (a) and panel (b) show a significant divergence in the total number of M&A transactions in the two affected industries as compared to those in other industries after the industry-specific antitrust orders are issued.

We again use a staggered Difference-in-Difference design to empirically capture the effect of antitrust administrative orders on M&A behaviors of the affected firms. The specification is as follows, for firm *i* in province *g* who operates within industry *j* in year *t*:

$$M\&A_{ijgt} = \alpha + \beta_1 Antitrust_{jt-1} + \gamma D_{t-1} + \rho_{gt} + \sigma_i + \varepsilon_{ijgt}, \quad (3)$$

where $M\&A_{ijgt}$ is the total number of M&A transactions (or different types of M&A transactions in the heterogeneity tests) that firm *i* has conducted within year *t*; $Antitrust_{jt}$ is the staggered Difference-in-Differences treatment indicator that is set to one if firm *i* is operating within the policy-affected industry *j* at time *t* after the policy are enacted. Again, β_1 represents our coefficient of interest. If the industry-specific antitrust policies elevate firms' concern for stricter scrutiny and intenser punishment by antitrust agencies on M&A transactions, the coefficient β_1 will be negative, indicating a decreased M&A intensity for the treated firms.

D_{t-1} is a set of firm-level controls, for example, firm key financials, firm age, management, ownership structure. Detailed variable descriptions are provided in the Appendix A. In addition, we include province×year fixed effects ρ_{gt} to control for any time-varying unobservable province-level characteristics. We also include firm fixed effects σ_i to control for any firm-specific characteristics that might affect the dependent variable.

Thus, our empirical strategy identifies the treatment effect through two sources of variation. First, in a given year, the treatment effect is identified by comparing the differences in M&A behaviors between firms in the policy-affected industries and those not affected. Second, within a given firm, the treatment effect is identified by comparing within firm how M&A behavior changes as exposed to the industry-wide antitrust policies. Thus, in our empirical settings above, the coefficient estimate β_1 captures the additional changes in a firm's M&A behavior relative to other firms in the same province that are not affected by the strengthened antitrust enforcement.

After the main test, we further examine whether antitrust policies affect firms with differently level of antitrust punishment risk in heterogenous ways. Introducing firm types as proxies for differently level of punishment intensity concerns, we begin with specification (3) and interact firm type indicators with the staggered DiD indicator, $Antitrust_{jt}$. For firm i in province g who operates within industry j in year t:

$$M\&A_{ijgt} = \alpha + \beta_1 Antitrust_{jt-1} + \beta_2 Antitrust_{jt-1} \times Firm\,Type_{jt-1} + \beta_3 Firm\,Type_{jt-1} + \gamma D_{t-1} + \rho_{gt} + \sigma_i + \varepsilon_{ijgt}, \quad (4)$$

where $Firm\ Type_{jt}$ is an indicator that represents firm i's type at time t. The coefficient estimate of β_2 captures the different treatment effect of antitrust policies on M&A behavior

for different types of firms. If the treatment effect is indeed heterogenous and varying with firm types, the coefficient β_2 will be statistically significant.

4.1.3. Real Effects of Antitrust Enforcement

We then examine what are the real effects of the antitrust policies. The specification is as follow:

$$Firm\ Performance_{ijgt} = \alpha + \beta_1 Antitrust_{jt-1} + \gamma D_{t-1} + \rho_{gt} + \sigma_i + \varepsilon_{ijgt}, \quad (5)$$

where *Firms Performance*$_{ijgt}$ is a set of financial and market performance variables of firm i in year t; *Antitrust*$_{jt}$ is the staggered Difference-in-Differences treatment indicator that is set to one if firm i is operating within the policy-affected industry j at time t after the policy are enacted. β_1 represents our coefficient of interest. If the industry-specific antitrust policies affect the market structure and have real effects on the firms operating within the affected industries, then the coefficient estimates should be statistically significantly different from zero.

4.1.4. Empirical Challenge for Identifying the Unbiased Treatment Effect of Antitrust Policies

The main assumption underlying the above Difference-in-Differences design is that without the effect of the antitrust policies, the average change in the M&A behaviors of the treated and control firms would have been the same, i.e., there is no pre-existing trend in our main dependent variables before the treatment between the treated group and the control group. We validate the robustness of our empirical design for this assumption by exploiting a set of dynamic placebo models suggested by De Chaisemartin and d'Haultfoeuille (2020).

Figure 3 plots the coefficient estimates of staggered antitrust administrative orders on firm M&A transactions with heterogenous treatment effects in event time for firms in industries affected by strengthened antitrust policies relative to those in other industries. The figure shows that all coefficients in the pre-periods are close to zero, thereby supporting the assumption that there are no statistically significant pre-existing trends in M&A behaviors across policy-affected and policy-unaffected firms before the policy enactment dates. At the same time, the post-period coefficient estimates are statistically significantly different from zero, and persistent until 4 years after the enactment of the policies.

One challenge with our identification strategy is that M&A behaviors of firms in antitrust policy-affected industries and those in other industries could be fundamentally different. Suppose these differences exist and are correlated with how firm M&A behavior changes over time. In that case, the estimate of the treatment effect β_1 in the above specifications could be picking up responses stemming from these differences in omitted firm- or industry-level characteristics instead of the effects of differences in antitrust enforcement.

We address this concern in two ways. First, in our main specifications, we include a set of firm-year level variables to control for any time-varying firm characteristic that might affect our result. In addition, we also include firm fixed effects to control for any unobservable firm-level characteristics.

Another challenge with our empirical strategy is concern about the two-way fixed effects (TWFE) estimator providing biased estimates in cases when the treatment is staggered and there exists heterogeneity in treatment effects (see e.g., De Chaisemartin and

d'Haultfoeuille, 2020; Goodman-Bacon, 2021; Baker, Larcker, and Wang, 2022; Roth, Sant'Anna, Bilinski, and Poe, 2023; Borusyak, Jaravel, and Spiess, 2024).[16] To mitigate concerns regarding the reliability of TWFE estimators, we validate our findings using the adjusted difference-in-differences estimator proposed by De Chaisemartin and d'Haultfoeuille (2020), hereafter referred to as the "heterogeneous" estimator. By eliminating the 2 × 2 difference-in-differences comparisons between the newly-treated and the already-treated units, the heterogeneous estimator consistently captures the average treatment effects at the time when a group starts receiving treatment.

4.2. Data Description and Variable Construction

4.2.1. Antitrust Administrative Penalty Data

We scrape the detailed administrative punishment documents from the State Administration of Market Regulation website. The documents have detailed information on the parties involved in the case, including the party name, Unified Social Credit Code (USCC)[17], legal nature of the party[18], legal representative(s), registration address, and business scope; overview of the case, including the cause and the course of the case, violation date[19], investigation start date, punishment issue date, etc. Appendix A provides

[16] For example, Goodman-Bacon (2021) discusses that the treatment effect estimate derived from a TWFE model represents a weighted average of all possible 2 × 2 difference-in-differences comparisons between groups of the treated and control at different time intervals. If the treatment effects are homogenous across all treated groups at any time periods, the TWFE estimator is reliable for estimating the Average Treatment Effect on the Treated (ATT). However, if treatment effects vary across groups or time, the consistency of TWFE estimator on ATT is compromised. In cases of significant heterogeneity, the TWFE estimator might even produce estimates with opposite signs compared to the actual effects.

[17] Unified Social Credit Code (USCC) is a unique 18-digit number issued to all companies and organizations upon registration in Mainland China by the Chinese government. It is usually referred to as the "Business Registration Number". This includes all types of Chinese companies, even sole traders, as well as organizations such as schools, hospitals and charities. Note that organizations registered in Hong Kong, Macau and Taiwan do not have this code as, when it comes to registration, they are in each separate jurisdiction.

[18] Legal nature of the party refers to whether the party is an entity or a nature person, and, if an entity, the form of the company (e.g., LLP, LLC, etc.)

[19] Violation date has varying meanings with different subcategories of the antitrust cases. Specifically, for Concentrations of Undertakings cases, violation date refers to the date that the concentration agreement (or

detailed descriptions of each variable. Because chief administrative departments for antitrust enforcement have changed throughout the years, we complement the document sets by hand-collecting historical administrative punishment documents issued by the previous antitrust enforcement departments, including the Ministry of Commerce and the National Development and Reform Commission (NDRC), from their website.[20] Figure 1 panel (a) plots the total antitrust administrative penalty cases over years, indicating an overall enforcement strengthening trend.

After collecting the documents of the antitrust cases, we use NLP package to process the document texts and exact the data we need. However, as described above, the documents are heterogenous both in terms of the nature of the underlying cases, as well as the enforcement administrations. Thus, they are not in the exact same format identifiable by the text processing package. In order to get the information as comprehensive and accurate as possible, we have to read through most of the documents and manually collect the data we need.[21] The table below shows top 20 industries with the most antitrust administrative penalty cases. Figure 1 panel (b) plots the density map of cases and involved parties across Chinese provinces.

INDUSTRYNAME	PENALTY CASE
Business Services	102
Wholesale	82
Science and Technology Promotion and Application Services	47

the M&A agreement) is officially signed. For Abuse of a Dominant Market Position cases, it refers to the date that the abusing action starts. For Monopoly Agreement cases, it refers to the date that the underlying monopoly agreement is signed.

[20] In addition to the administrative punishment cases, we also consider the legal cases concerning antitrust behaviors. Using the keywords "Antitrust", "Monopoly", "Abuse of a Dominant Market Position", "Concentrations of Undertakings", "Market Competition", and "Market Concentration", we are able to identify 981 legal cases covering the year of 2009 to 2023 with their final judgement documents in PKU LAW Database. However, because of the different natural and process of legal judgements and administrative penalties, we argue that the former is less affected by administrative orders and thus do not include the legal cases in our main sample construction.

[21] We thank research assistants Yingxue Li, Xinyang Li, Yi Ou, and Ziteng Zhang, for their diligent work throughout the course of data collection and data processing.

Software and Information Technology Services	30
Retail Trade	28
Transportation and Warehousing	27
Energy Production and Supply	25
Non-metallic Mineral Products	19
Repair of Motor Vehicles, Electronic Products and Household Products	12
Professional and technical services	12
Finance	11
Research and experimental development	10
Pharmaceutical Manufacturing	10
Chemical raw materials and chemical products manufacturing	10
Leasing	9
Automobile Manufacturing	9
Recreation and Culture	9
Metal Products Industry	6
Real Estate	6
Electrical Machinery and Equipment Manufacturing	5
Building decoration, renovation and other construction industries	5

We drop observations if the violation year is missing and if the involved party only consist of foreign companies.[22] The final sample of the antitrust cases have 370 antitrust administrative penalty cases, with 1,084 parties involved, covering the year of 1999 to 2023.[23] There are repeated violators of the antitrust rules in our sample, especially for recent years. As far as we know, we are the first to construct a comprehensive dataset on the Chinese Antitrust cases with granular details applicable to economic research.

Next, we match the antitrust case data with the Chinese Business Registration Data to get additional details on the party involved besides those that appear in the Antitrust case documents, including industry code, organization age, registered capital, and the number of employees.[24] Finally, we match the antitrust case data with the CSMAR listed company database on company social credit code and, if social credit code is missing, on company name to get the involved parties' listing information.

[22] Such cases are usually initiated by multinational firms on a global market basis, thus irrelevant of the research purpose of the paper.
[23] We define the sample covering period as the year when antitrust behavior happened.
[24] Chinese Business Registration Data is a longitudinal data that keeps track of new business registration on a yearly basis.

Our final sample for antitrust administrative penalty cases has 1,129 party-year observations. Table 1 Panel A provides the summary statistics. The first antitrust administrative penalty case in China was announced in 2010. The administrative cases investigate into monopolistic behaviors that happened as early as in 1999. The average time spent for the antitrust enforcement administration to investigate a case is 378 days. *Alibaba Group* incurred the largest penalty ever given, exceeding 18 billion RMB, for abusing its dominant market position from 2015 to 2020.

4.2.2. M&A and Firm Data

We obtain M&A transaction data from CSMAR. The database keeps track of all M&A transactions that has at least one listed firm involved (either as buyer, seller, or underlying). The initial sample at transaction-firm level has 127,709 observations from 2004 to 2022.[25] Following prior literature (see for example, Jiang, 2022; Jiang, 2021; Zhao et al., 2020; Liu, Huang, and Zhou, 2019), we drop M&A transactions that has a deal value less than 1 million RMB, and transactions with discrepancies in terms of deal size. We also exclude stock-buybacks and debt-restructurings, because they are irrelevant to the research purpose of this paper.

In addition, for transactions that are initiated by one buyer in approximate days (usually less than a week) with the same or similar underlying, we treat them as one M&A transaction. For example, Company A initiated three stock acquisitions from Company B's stockholders within a week, with each acquisition targeting at 20%, 20%, and 11% share of stock, respectively. Before the transactions, Company A held no stock of Company B.

[25] We start our sample at 2004 because the Chinese government issued its first ever Antitrust administrative policy, the enactment of which is June 2003. Later in 2007, China announced the Antitrust Law, which would come into effect in 2008. Thus, we argue that "Antitrust" would only be a concern for firm's M&A behavior after 2003.

However, after the transactions, Company A hold a total of 51% share of Company B's stock, becoming the largest stockholder of Company B. In this case, we would classify these series of stock acquisitions as one transaction, and the post-acquisition share of Company A is 51%. The final M&A transactions data has 126,075 observations. Table 1 Panel B provides the summary statistics.

To investigate how restraining Antitrust enforcement affect a firm's M&A choices, we construct the (different types of) M&A intensity measure at the firm level, as the total count of the (different types of) M&A transactions that a firm has conducted within the year based on the above M&A transactions data. We then merge the M&A intensity measures with CSMAR listed firm financial statement database to get the firm's annual financials, and CSMAR listed firm basic information database to get the firm's other data including firm industry[26], age, listing state, office address, management, and ownership structure. This essentially create a panel data at firm-year level. We exclude firms that are delisted, firms with missing total asset and industry code, and firms that have a market value less than 1 million RMB.

The final sample contains 56,953 firm-year observations, covering a period from 2004 to 2022. Table 1 Panel C provides the summary statistics. The average deal takes 71 days to finish the entire transaction process, with a deal size of more than 25 million RMB.

[26] Dataset for firm financial statements also include firm industries. However, its classifications are often imprecise. For example, Sunflower Corporation (Chinese name: "向日葵"), whose security code is 300111, is misclassified by the financial statement dataset as belonging to the electronic manufacturing. However, according to the annual reports from its official website, the company belongs to medicine manufacturing industry, which is the exact industry identified by the listed firm basic information dataset in CSMAR. The misclassification rate is over 5% of the total sample.

5. Results

5.1. Antitrust Administrative Orders on Antitrust Enforcement

Table 2 presents results on how antitrust administrative orders affect antitrust enforcement. In Panel A, we conduct an industry-level case count analysis. The positive and statistically significant coefficient estimate of 0.681 on $Antitrust_{t-1}$ implies that, within a specific province, Antitrust policy-affected industries on average experience 0.681 more cases annually, which is equal to a 63% (0.681/1.08) relative increase from the mean.

In Panel B, we examine at the case-level how industry-wide antitrust policies affect the days it takes for the antitrust agency to conclude a case, holding everything else constant. In columns 1, we conduct a base-line analysis with only the treatment indicator variable. In columns 2 and 3, we further add case- and firm-level controls. For all three specifications, the coefficient estimates are statistically significant and adding controls has little effect on the statistical significance of the coefficient estimates.

The negative and statistically significant coefficient estimate of -186.126 in column (2) on $Antitrust_{t-1}$ implies that, on average, administrative investigation into firms that are operating within industries affected by the antitrust administrative orders is of -186.126 days shorter than that of other firms, implying an increased antitrust punishment intensity faced by the affected firms. The shortened investigation length represents a 49% (-186.126/378.08) decrease from the mean.

In column (3), we further examine whether interprovince cases involving cross-regional parties receive different treatment effect. Consistent with our hypothesis, the highlighted punishment intensity (and, in turn, antitrust risks) is less prevalent for cross-regional antitrust cases as compared to local cases. There is no similar decrease in investigation length for cross-regional cases involving parties from different provinces as

compared to those with only local parties involved. This result echos with the fact that the local nature of antitrust agencies could confine them to focus less on trans-regional antitrust cases.

5.2. Does Antitrust Restrictions affect firm M&As?

After confirming that antitrust policies do lead to elevated enforcement intensity, we next examine whether antitrust restrictions change firm M&A behaviors.

Table 3 reports the results from regressions examining how antitrust enforcement affect the total count of M&A transactions. In the first two columns, we count the total number of successful M&A transactions (*Successful M&A Count*) as our dependent variables. Meanwhile, in column (3) and (4), we further include M&A transactions that fail to go through and construct a comprehensive count variable, *M&A Count*. Although, following literature convention, most of our analysis hereafter is based on successful M&A transactions, we include the total count because it to some extent more accurately captures a firm's active intention in M&A decisions.

As discussed in the prior section, our staggered DiD design suffers little from the heterogeneity in treatment that may rise biased estimates from the classic TWFE model. Nevertheless, we report results from both the TWFE model (column (1) and (3)) as well as the heterogenous model (column (2) and (4)) proposed by De Chaisemartin and d'Haultfoeuille (2020).

In column (1), the negative and statistically significant coefficient estimate of -0.154 on $Antitrust_{t-1}$ implies that, on average, firms affected by the antitrust administrative orders conduct 0.154 less M&A transactions per year than unaffected firms, which is equivalent to a 9% (-0.154/1.74) decrease from the mean. In column (2), the heterogenous estimator

yields similar result, confirming that our empirical model is robust to the heterogenous treatment effect.

In column (3), the negative and statistically significant coefficient estimate of -0.196 on $Antitrust_{t-1}$ implies that, on average, firms affected by the antitrust policies choose to involve in 0.196 less M&A activities per year as compared to unaffected firms, which represents a more than 6% (-0.196/3.10) decrease from the mean. Again, the heterogenous estimator yields similar result as the TWFE estimator.

5.3. Antitrust Restrictions on different types of M&As

After confirming that antitrust enforcement in general lead to decreased M&A activities, we further investigate into the specific types of M&As and how antitrust policies affect them.

Table 4 reports the results from regressions examining how antitrust enforcement affect M&A transactions with different types of the underlying. If firms change their M&A behaviors due to antitrust concern, we expect M&As with stock underlying, especially after which the acquirer become the largest stockholder, see bigger treatment effect from the antitrust policies than M&As with asset underlying. Because the former is more closely related to potential changes in market power, which are closely monitored by antitrust agency, than the later.

Consistent with the hypothesis, the coefficient estimates of $Antitrust_{t-1}$ on stock acquisitions in column (1) and column (2) are negative and statistically significant, with an economic magnitude representing a 10% (-0.168/1.70) decrease from the mean. Moreover, in column (5) and column (6), we focus only on M&A transactions wherein the acquirer becomes the largest stockholder in the acquired entity after the transactions. The coefficient estimates of $Antitrust_{t-1}$ consistently to be negative and statistically significant. Meanwhile,

the coefficient estimates of $Antitrust_{t-1}$ on asset acquisitions in column (3) and column (4) is not statistically significantly different from zero.

Table 5 reports the results from additional tests examining how antitrust policies affect different types of M&As. Results suggest that strengthening antitrust policies lead to significantly less sell-side M&As, indicating firms in the affected industries are less likely to become an acquisition target[27], horizontal and conglomerate M&As.

Collectively, the set of results confirm the above hypothesis that, following the enactment of antitrust policies, strengthened scrutiny on firms' antitrust behaviors would make them conduct less M&A transactions that could lead to potential changes in market power.

6.4. Antitrust Enforcement on Cross-regional M&As

As confirmed in section 4.1, antitrust risks are more prevalent to local cases as compared to cross-regional ones, which opens possibility for firms to seek regulatory arbitrage. Table 6 reports the results from regressions examining how antitrust policies affect cross-regional M&A transactions.

Consistent with our hypothesis, following the staggered adoption of industry-wide antitrust administrative orders, affected firms increase their cross-regional M&A activities as compared to unaffected firms, contrastingly different from the decreasing trend of the overall M&A transactions. In column (1), the positive and statistically significant coefficient estimate of 0.040 on $Antitrust_{t-1}$ implies that, on average, firms affected by the antitrust policies involve in 0.040 more cross-regional M&A activities per year as compared to unaffected firms, which represents a more than 22% (0.040/0.18) increase

[27] We also conduct this test using probit model. Result is still consistent with our findings here. However, for the consistency in formatting, we do not report the probit result in our table.

from the mean. The heterogenous estimator in column (2) yields similar result as the TWFE estimator. Notably again, cross-regional M&A is the only type of M&As that see an increase upon the enactment of antitrust policies.

5.5. Heterogenous Effects of Antitrust Enforcement on M&As

To further illustrate that changes in antitrust punishment intensity upon strengthened antitrust enforcement affect firm M&A choices differently, we conduct tests using firm size and state ownership as proxies for different level of antitrust punishment intensity.

First, we split our sample based on firm size. The "big firms" in our sample are the public firms who operate in national or even global market, and already possess a dominating market power. Thus, they are closely monitored by antitrust agencies regardless of they acquiring locally or cross-regionally. In other words, they face uniformly elevated punishment intensity despite of the market region after the enactment of the antitrust policies. As a comparison, "small firms" in our sample are the main focus for our analysis who operate in one or several local markets and have the option to use local or nonlocal M&As to expand their business. When antitrust policies elevate their concerns for antitrust risks, or punishment intensity, in local market, they are more likely to benefit from regulatory arbitrage through cross-regional M&As.[28]

Table 7 reports the results from regressions examining how antitrust enforcement affect M&A transactions by firm size. Results confirm the above hypothesis and show that bigger firms and smaller firms in our sample indeed choose different M&A strategies when facing restricting antitrust enforcement, and that only smaller firms choose to do more cross-regional M&As. This result indicates that there indeed exist possibilities of

[28] Note that the "big firms" and "small firms" in our sample here does not correspond to the local big firms and local small firms in our theoretical analysis section. More so, the "small firms" in our sample more resemble to the big local firm in our theoretical model.

regulatory arbitrage for the affected firm, and we discuss the implications of such possibilities in next sections.

In addition, we use state ownership as another proxy for different level of antitrust punishment intensity. In China, state-owned firms typically have deep economic and political connection with the government and are thus less sensitive to changes in antitrust enforcement. In other words, state-owned firms face no significant changes in antitrust punishment intensity before and after the enactment of the antitrust administrative orders.

Table 8 reports the results from regressions examining how antitrust restrictions affect M&A transactions by firm ownership types. Consistent with our hypothesis, M&A behaviors of state-owned firms are insensitive to changes in antitrust enforcement both in terms of the total count as well as the different types. The results again confirm that strengthened antitrust enforcement give rise to different levels of punishment intensity faced by firms when conducting M&A transactions. Heterogenous firms adopt different strategies to avoid such antitrust costs.

5.6. Antitrust Restrictions on Firm Post-M&A Performance

Classis economic theory assumes that firm makes a decision in order to maximize its profit. In this case, if firms, under the concern for elevated antitrust risk, make suboptimal investment choice, this would hurt firm performance. Instead, if antitrust enforcement at the nation level improves market efficiency (e.g., alleviate local protectionism), cross-regional investments may instead be the new optimal choice for firms with extended profit possibility frontier, thus leading to a better firm performance.

Table 9 presents the results of antitrust policies on firm post-M&A market performance. Column (1) and (2) reports how antitrust policies affect the deal premium paid to the target. The coefficient estimates of Antitrustt-1 on deal premiums in column (1)

and column (2) are both negative and statistically significant, implying again that antitrust enforcement discourages firm M&As. Column (3) to (6) reports how antitrust policies affect firm's short-term market performance. In column (3), the insignificant coefficient estimates of Antitrustt-1 on CAR (+0, +3) indicates that restricting antitrust enforcement in general does not affect firm's short-term announcement return. However, In column (4), the negative and significant coefficient estimates of Antitrustt-1 on on CAR (+0, +3) indicates that market evaluations on post-policy cross-regional M&As are negative. This result is more consistent with an antitrust enforcement leading to suboptimal choice story.

5.7. Real Effects of Antitrust Restrictions on M&As

The primary goal for any antitrust policy is to promote fair market competition and, in turn, contribute to greater economic development. After confirming that antitrust policies affect firm M&A behaviors, and in particular open room for regulatory arbitrage, we further investigate into what are the real economic implications of such relationship.

Table 10 reports the results from regressions examining the real effects of antitrust policies on the affected firms. In column (1), the positive and statistically significant coefficient estimate of 0.019 on $Antitrust_{t-1}$ implies that, on average, firms affected by the antitrust policies experience a 1.9 percentage point increase in profit margin as compared to unaffected firms, representing a more than 32% (0.019/0.06) increase from the mean and indicating a decreased competition for the affected industries. The heterogenous estimator in column (2) yields similar result as the TWFE estimator.

In column (3), the negative and statistically significant coefficient estimate of -0.039 on $Antitrust_{t-1}$ implies that, on average, firms affected by the Antitrust policies experience a 3.9 percentage point decrease in R&D expenditure as compared to unaffected firms, representing a more than 65% (-0.039/0.06) decrease from the mean and indicating a

decreased investment into innovation. Again, the heterogenous estimator in column (2) yields similar result as the TWFE estimator.

5.8. Robustness Tests

Because the antitrust administrative orders are issued by different administrative department, there might be concerns that the orders have different policy effects. Thus, we conduct a robustness test that only consider the antitrust administrative orders issued by the Chinese State Council on firm M&A behaviors. Table 11 reports the results. Only considering the policies issued by the Chinese State Council does not affect the robustness of our main analysis results.

6. Conclusions

In conclusion, while antitrust enforcement is intended to ensure a competitive and fair market, its impacts are multifaceted and complex. This paper explores how antitrust policies can influence firms' strategic behaviors, particularly mergers and acquisitions, in ways that may counteract the intended benefits of these policies. Our analysis suggests that although antitrust enforcement aims to mitigate monopolistic practices and promote competition, it can sometimes lead to unintended strategic responses from firms. These responses can dilute the effectiveness of the enforcement and, paradoxically, harm market competition.

Moreover, the potential for stringent antitrust enforcement poses risks to the economic landscape. False positives can lead to long-term negative consequences due to the precedent set for future enforcement, while false negatives may allow harmful monopolistic behaviors to persist unchecked. Prior literature primarily focuses on the

implications of these errors on legal practice, whereas our paper discusses their economic implications through changes in firms' anticipated antitrust risk.

Therefore, it is crucial for policymakers to continuously refine antitrust strategies, balancing the need to prevent monopolistic practices with the recognition of firms' adaptive strategies, and ensuring that antitrust enforcement effectively promotes a competitive and healthy market economy.

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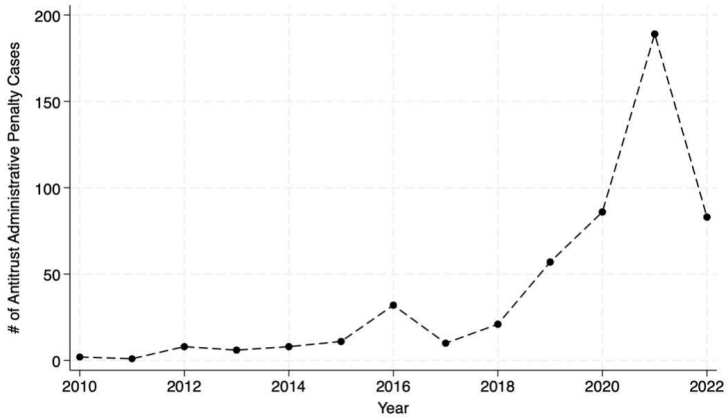
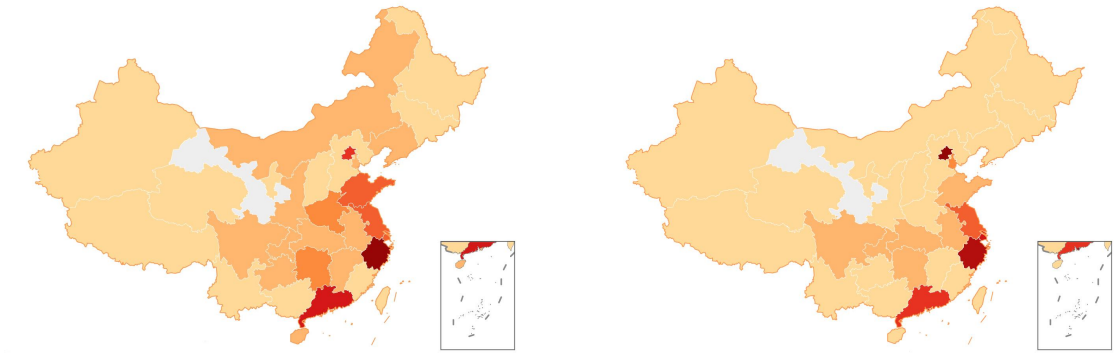
Figure 1
Administrative Penalty Cases



(a) yearly count of the nation-wide antitrust administrative penalty cases

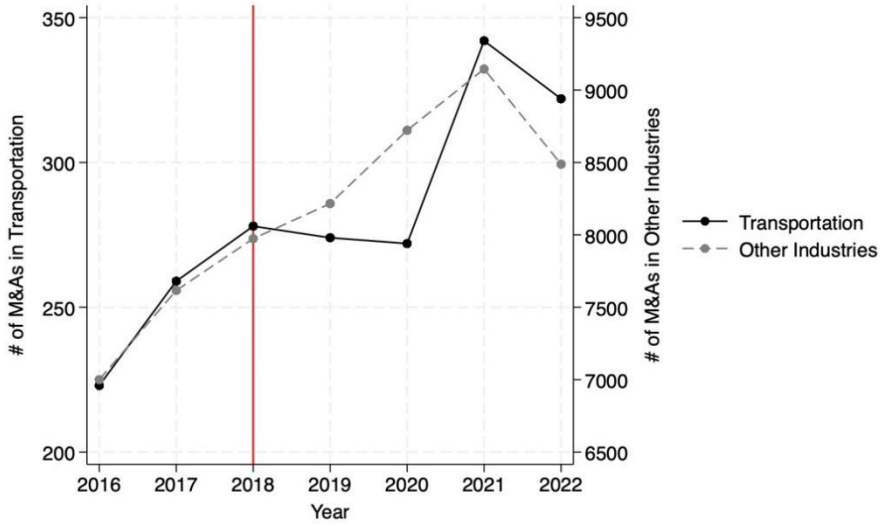


(b) antitrust administrative penalty cases and involved parties across province

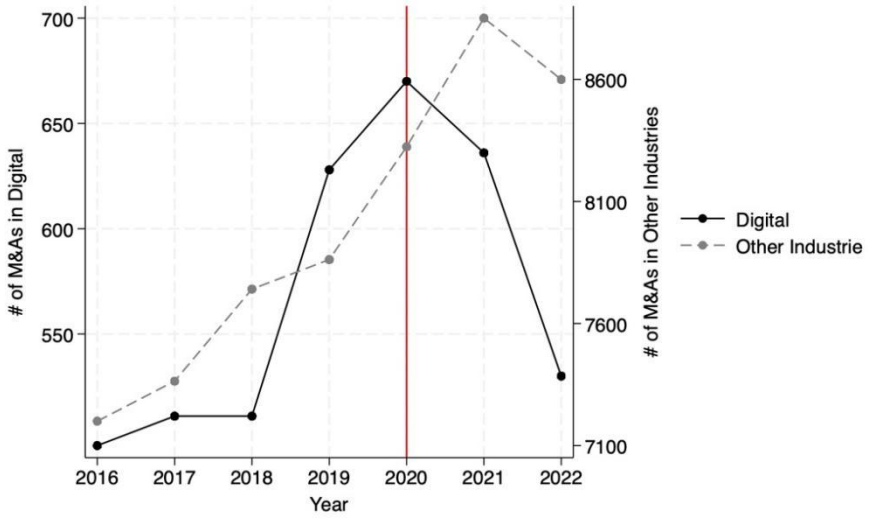
Figure 1 shows the time trend and geographic distribution of antitrust administrative penalty cases in China over the past decade. Panel (a) plots the yearly count of the nation-wide antitrust administrative penalty cases. Panel (b) plots the cumulative punishment density map across Chinese provinces.

Figure 2

Antitrust Policies on M&A Transactions: Transportation and Digital Communication



(a) the antitrust administrative order on Transportation industry in 2018



(b) the antitrust administrative order on Digital Communication industry in 2020

Figure 2 plots the total M&A transactions in the digital communication industry and transportation industry as compared to other industries before and after the industry-specific antitrust administrative orders were enacted.

Figure 3
The DiD Estimators of Staggered Antitrust Policies on M&A Transactions with Heterogenous Treatment Effects

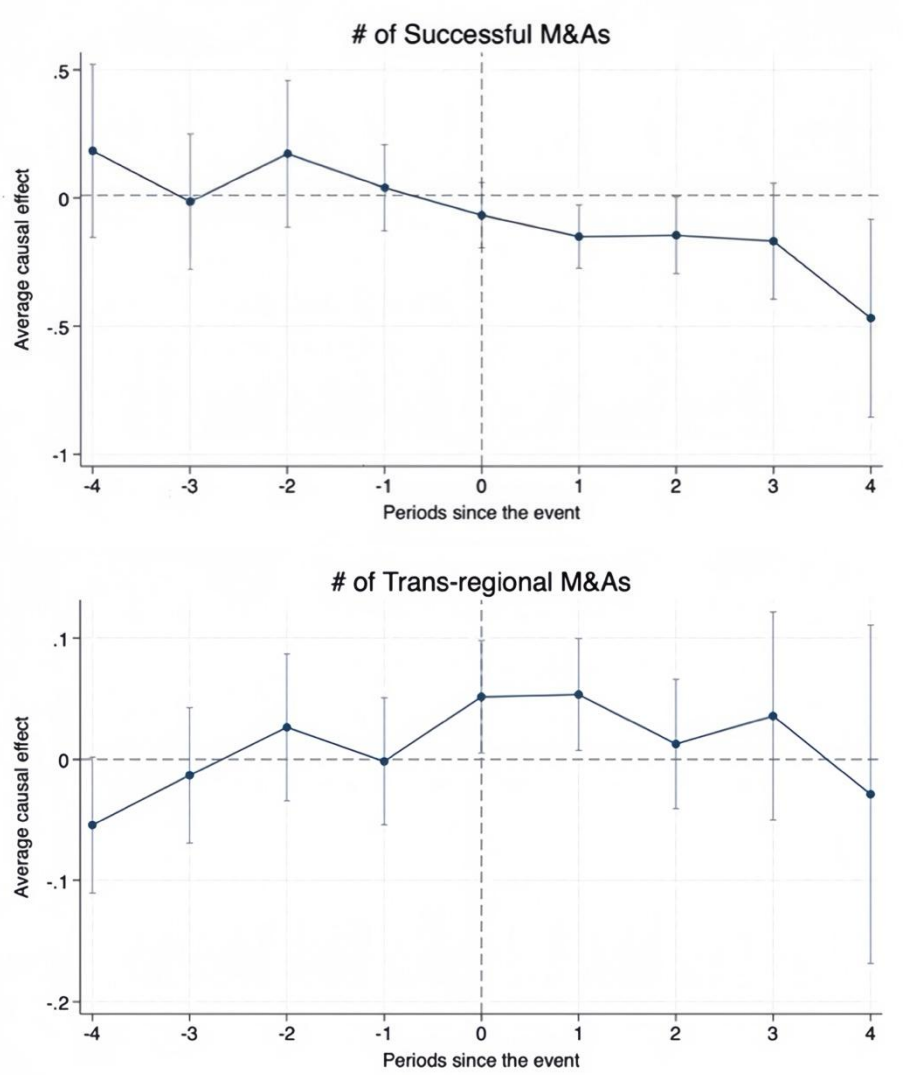


Figure 3 plots the DiD estimators of staggered antitrust administrative orders on M&A transactions with heterogenous treatment effects before and after the industry-specific policies were enacted.

Table 1
Summary Statistics

This table reports summary statistics for the main variables in our regression models. *Antitrust* is the Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the antitrust policies are enacted. *Case Count* is the annual aggregate of Antitrust administrative penalty cases within a specific industry at the provincial level. (*Successful*) *M&A Count* is the total number of (successful) M&A transactions that a firm has conducted within the year. Table 1 provides further definitions of variables.

Panel A: Antitrust Cases

	N	Mean	Median	Std Dev	Min	Max
Antitrust	1,129	0.25	0.00	0.43	0.00	1.00
Cross-regional (case)	1,129	0.32	0.00	0.46	0.00	1.00
Penalty Amount	1,129	35.37	0.40	648.00	0.00	18,228.00
Registered Capital	924	10.47	0.20	101.33	0.00	2,958.60
Employee	825	800.87	99.00	1976.12	50.00	10,000.00
Age	1,129	8.08	6.00	8.69	0.00	139.00
Investigation Length	959	378.08	267.00	310.76	40.00	1,758.00
Public	1,129	0.08	0.00	0.27	0.00	1.00
Case Count	35,200	1.08	0.00	2.96	0.00	31.00

Panel B: Firm-level

	N	Mean	Median	Std Dev	Min	Max
Antitrust	47,072	0.12	0.00	0.32	0.00	1.00
M&A Count	47,072	3.10	2.00	3.50	1.00	214.00
Successful M&A Count	47,072	1.74	1.00	2.84	0.00	214.00
Cross-regional	47,072	0.18	0.00	0.59	0.00	33.00
Buy	47,072	0.19	0.00	0.62	0.00	21.00
Sell	47,072	1.48	1.00	2.69	0.00	214.00
Asset Acquisition	47,072	0.04	0.00	0.23	0.00	10.00
Stock Acquisition	47,057	1.70	1.00	2.83	0.00	214.00
Largest Stockholder	47,072	0.33	0.00	0.76	0.00	21.00
Horizontal	47,072	0.07	0.00	0.36	0.00	21.00
Vertical	47,072	0.13	0.00	0.52	0.00	21.00
Conglomerate	47,072	0.20	0.00	0.55	0.00	21.00
Size	47,072	22.02	21.80	1.45	19.12	27.00
ROA	47,072	0.04	0.04	0.08	-0.37	0.24
Leverage	47,072	0.45	0.44	0.23	0.05	1.17
PE Ratio	47,072	78.35	37.30	37.30	4.96	960.13
Book-to-Market	47,072	0.64	0.65	0.25	0.00	1.72
R&D Expenditure	19,262	0.06	0.04	0.49	0.00	28.05
Age	47,072	9.67	8.00	7.35	0.00	32.00
Fixed Ratio	47,057	0.22	0.18	0.17	0.00	0.72
Profit Margin	47,072	0.06	0.08	0.32	-2.11	0.68

Table 2
Antitrust Policies on Law Enforcement

This table reports the results from regressions examining how tightening Antitrust policies affect Antitrust law enforcement. The dependent variable in Panel A *Case Count* is the total number of Antitrust administrative penalty cases within a particular industry at the provincial level on an annual basis. The dependent variable in Panel B *Investigation Length* is the number of days from the initiation of an administrative investigation by the enforcement department to its conclusion in a given case. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Industry-level

	D.V.= Case Count
$Antitrust_{t-1}$	0.681***
	(2.88)
Province Controls	Yes
Province FEs	Yes
Industry FEs	Yes
Observations	35,200
Adjusted R^2	0.104

Panel B: Firm-level

	D.V.= Investigation Length		
	(1)	(2)	(3)
$Antitrust_{t-1}$	-157.821***	-186.126***	-283.444***
	(-3.66)	(-4.23)	(-4.87)
$Antitrust_{t-1}$ × Trans-region			146.640**
			(2.20)
Trans-region			-168.550*
			(-1.91)
Penalty Amount		3.058*	2.222*
		(2.06)	(1.74)
Age		0.093	0.167
		(0.11)	(0.18)
Log. Registered Capital		-15.381***	-11.353
		(-3.36)	(-1.50)
Employee		0.003	0.004
		(0.89)	(1.02)
Public		-13.212	-30.556
		(-0.25)	(-0.49)
Year × Province FEs	Yes	Yes	Yes
Industry FEs	Yes	Yes	Yes
Observations	759	553	553
Adjusted R^2	0.747	0.719	0.748

Table 3
Antitrust Restrictions on M&As

This table reports the results from regressions examining how antitrust restrictions affect M&A transactions. The dependent variable (*Successful*) *M&A Count* is the total number of (successful) M&A transactions that a firm has conducted within the year. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	D.V.= Successful M&A Count		D.V.= M&A Count	
	(1) TWFE	(2) Heterogenous	(3) TWFE	(4) Heterogenous
$Antitrust_{t-1}$	-0.154***	-0.140***	-0.196***	-0.197*
	(-3.45)	(-2.88)	(-3.03)	(-1.77)
Size	0.181***	0.235***	0.435***	0.523***
	(3.49)	(6.82)	(5.16)	(9.66)
Leverage	0.154	0.059	0.574***	0.516***
	(1.20)	(0.44)	(3.48)	(2.92)
PE Ratio	0.000	0.000	0.000	0.000
	(0.25)	(0.50)	(0.99)	(1.11)
Book-to-Market	-1.183***	-1.301***	-1.476***	-1.583***
	(-6.32)	(-10.15)	(-7.61)	(-10.19)
Revenue Growth	-0.009	-0.014	0.027*	0.023
	(-0.74)	(-1.33)	(1.89)	(1.47)
Fixed Ratio	-0.034	0.106	-0.482**	-0.388*
	(-0.16)	(0.68)	(-2.19)	(-1.85)
ROA	-1.458***	-1.212**	-0.844	-0.444
	(-2.86)	(-2.24)	(-1.32)	(-0.66)
Profit Margin	-0.223*	-0.307**	-0.483**	-0.561***
	(-1.81)	(-2.38)	(-2.65)	(-2.68)
Cash Flow	0.001	0.001	-0.002	-0.001
	(0.22)	(0.33)	(-0.50)	(-0.21)
Female CEO	-0.032**	-0.031	-0.162**	-0.193*
	(-2.52)	(-0.97)	(-1.79)	(-1.84)
Year × Province FEs	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Observations	43,891	42,671	43,891	42,671
Adjusted R^2	0.085		0.175	

Table 4
Antitrust Restrictions on M&As: Underlying and Target Control

This table reports the results from regressions examining how antitrust restrictions affect M&A transactions with different underlying. The dependent variable for column 1-2, *Stock Acquisition*, refers to the total count of successful M&A transactions conducted by a firm within the year, wherein stocks serve as the underlying target for the transactions. The dependent variable for column 3-4, *Asset Acquisition*, refers to the total count of successful M&A transactions conducted by a firm within the year, wherein assets serve as the underlying target for the transactions. The dependent variable for column 5-6, *Largest Stockholder*, refers to the total number of successful M&A transactions conducted by a firm within the year, wherein the acquirer becomes the largest stockholder in the acquired entity after the transactions. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	D.V.=Stock Acquisition		D.V.=Asset Acquisition		D.V.=Largest Stockholder	
	(1) TWFE	(2) Heterogenous	(3) TWFE	(4) Heterogenous	(5) TWFE	(6) Heterogenous
$Antitrust_{t-1}$	-0.168***	-0.157***	-0.002	0.003	-0.083**	-0.036**
	(-3.73)	(-3.00)	(-1.04)	-0.7	(-2.50)	(-2.23)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	40,512	39,825	40,512	39,825	40,512	39,825
Adjusted R^2	0.059		0.086		0.127	

Table 5
Antitrust Restrictions on M&As: Types

This table reports the results from regressions examining how antitrust restrictions affect M&A transactions. The dependent variable for Panel A column 1-2, *Buy*, refers to the total count of successful M&A transactions conducted by the firm within the year, where the firm acts as the acquirer. The dependent variable for Panel A column 3-4, *Sell*, refers to the total count of successful M&A transactions conducted by a firm within the year, where the firm is the acquired target. The dependent variable for Panel B column 1-2, *Horizontal*, refers to the total count of successful horizontal M&A transactions conducted by a firm within the year. The dependent variable for Panel B column 1-2, *Vertical*, refers to the total count of successful vertical M&A transactions conducted by a firm within the year. The dependent variable for Panel B column 1-2, *Conglomerate*, refers to the total count of successful conglomerate M&A transactions conducted by a firm within the year. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Buy and Sell

	D.V. = Sell		D.V. = Buy	
	(1) TWFE	(2) Heterogenous	(3) TWFE	(4) Heterogenous
$Antitrust_{t-1}$	-0.150***	-0.137***	-0.011	-0.005
	(-3.70)	(-2.73)	(-0.72)	(-0.45)
Firm Controls	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Observations	40,512	39,825	40,512	39,825
Adjusted R^2	0.066		0.078	

Panel B: Horizontal, Vertical, and Conglomerate

	D.V. = Horizontal		D.V. = Vertical		D.V. = Conglomerate	
	(1) TWFE	(2) Hetero.	(3) TWFE	(4) Hetero.	(5) TWFE	(6) Hetero.
$Antitrust_{t-1}$	-0.010*	-0.012	0.000	0.000	-0.025*	-0.027
	(-1.81)	(-1.35)	(0.04)	(0.03)	(-1.98)	(-1.24)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	40,512	39,825	40,512	39,825	40,512	39,825
Adjusted R^2	0.088		0.081		0.120	

Table 6
Antitrust Restrictions on M&As: Cross-regional

This table reports the results from regressions examining how antitrust restrictions affect transregional M&A transactions. The dependent variable for *C*ross-*regional*, refers to the total count of successful cross-regional M&A transactions conducted by the firm within the year. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	D.V. = Cross-regional	
	(1)	(2)
	TWFE	Heterogenous
$Antitrust_{t-1}$	0.040**	0.040***
	1.81	2.75
Firm Controls	Yes	Yes
Year × Province FEs	Yes	Yes
Firm FEs	Yes	Yes
Observations	40,512	39,825
Adjusted R^2	0.1	

Table 7
Antitrust Restrictions on M&As by Size

This table reports the results from regressions examining how antitrust restrictions affect M&A transactions by firm size. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Big Company* is an indicator variable that equals to 1 if the size of a company's total asset is above the industry median. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Total and Different Types of M&As

	D.V.			
	Successful M&A Count	Largest Stockholder	Horizontal	Conglomerate
	(1)	(2)	(3)	(4)
Antitrust $_{t-1}$ × Big Company	-0.202***	-0.111**	0.016	-0.055***
	(-2.94)	(-2.61)	-0.75	(-3.27)
Antitrust $_{t-1}$	-0.007	-0.005	-0.031***	0.015
	(-0.08)	(-0.15)	(-3.06)	-0.81
Big Company	0.132	-0.009	-0.011	0.01
	(1.65)	(-0.28)	(-0.74)	-0.95
Firm Controls	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Observations	44,602	44,602	44,602	44,602
Adjusted R^2	0.086	0.085	0.085	0.070

Panel B: Cross-regional

	D.V. = Cross-regional
Antitrust $_{t-1}$ × Big Company	-0.021
	(-1.09)
Antitrust $_{t-1}$	0.032***
	(2.95)
Big Company	0.020
	(1.31)
Firm Controls	Yes
Year × Province FEs	Yes
Firm FEs	Yes
Observations	44,602
Adjusted R^2	0.094

Table 8
Antitrust Restrictions on M&As by Ownership

This table reports the results from regressions examining how antitrust restrictions affect M&A transactions by firm size. The dependent variable for *Cross-regional*, refers to the total count of successful cross-regional M&A transactions conducted by the firm within the year. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *State-owned* is an indicator variable that equals to one if the firm is state-owned. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Total and Different Types of M&As

	D.V.			
	Successful M&A Count	Largest Stockholder	Horizontal	Conglomerate
	(1)	(2)	(3)	(4)
Antitrust $_{t-1}$ × State-owned	0.185**	0.048	0.004	-0.012
	(2.35)	(1.64)	(0.25)	(-0.72)
Antitrust $_{t-1}$	-0.225***	-0.070***	-0.016*	-0.038**
	(-3.76)	(-3.14)	(-1.77)	(-2.35)
State-owned	-0.155**	-0.041	0.019*	-0.014
	(-2.48)	(-1.49)	(1.88)	(-0.56)
Firm Controls	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Observations	37085	37085	37085	37085
Adjusted R^2	0.267	0.095	0.070	0.058

Panel B: Cross-regional

	D.V. = Cross-regional
Antitrust $_{t-1}$ × State-owned	-0.001
	(-0.03)
Antitrust $_{t-1}$	0.037***
	(2.97)
State-owned	-0.011
	(-0.62)
Firm Controls	Yes
Year × Province FEs	Yes
Firm FEs	Yes
Observations	37085
Adjusted R^2	0.060

Table 9
Market Reaction to Antitrust Restrictions

This table reports the results from regressions examining the market reaction of antitrust restrictions. The dependent variable for *Premiums*, refers to the natural logarithm of amount the acquirer paid in addition to the book value of underlying assets in an M&A transaction. *CAR (+1, +5)* is the cumulative abnormal return with a window period of (+1,+5) day after the transaction announcement date. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Cross-regional* is an indicator variable that is set to one if the acquirer and the target are in different province, and zero otherwise. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	D.V.= Premiums		D.V.= CAR (+0, +3)		D.V.= CAR (+1, +5)	
	(1)	(2)	(3)	(4)	(5)	(6)
$Antitrust_{t-1} \times$ Cross-regional		-0.022		-0.007***		-0.006***
		(-0.24)		(-4.29)		(-3.64)
$Antitrust_{t-1}$	-0.159***	-0.152**	0.000	0.001	-0.000	0.001
	(-2.77)	(-2.41)	(0.29)	(1.14)	(-0.16)	(0.65)
Cross-regional		0.149***		0.012***		0.007***
		(5.29)		(23.48)		(12.71)
Deal Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Observations	47,008	47,008	225,588	225,588	225,588	225,588
Adjusted R^2	0.626	0.626	0.135	0.137	0.128	0.128

Table 10
Real Effects of Antitrust Restrictions

This table reports the results from regressions examining the real effects of antitrust restrictions. The dependent variable for *Cross-regional*, refers to the total count of successful Cross-regional M&A transactions conducted by the firm within the year. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *KZ index* is a proxy for firm's financial constraint. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	D.V.= Profit Margin		D.V.= R&D Expenditure		
	(1) TWFE	(2) Heterogenous	(3) TWFE	(4) Heterogenous	(5) TWFE
Antitrust $_{t-1}$ × KZ index					-0.052***
					(-2.58)
Antitrust $_{t-1}$	0.020**	0.021***	-0.039**	-0.057***	-0.006*
	(2.22)	(2.57)	(-2.12)	(-4.03)	(-2.01)
KZ index					0.001*
					(1.94)
Firm Controls	Yes	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes
Observations	40,732	39,712	40,514	39,827	29289
Adjusted R^2	0.287		0.453		0.683

Table 11
Robustness: Antitrust Policies Issued by the State Council

This table reports the results for the robustness test that only consider the antitrust administrative orders issued by the state department. The dependent variable *Successful M&A Count* is the total number of successful M&A transactions that a firm has conducted within the year. The dependent variable *Cross-regional*, refers to the total count of successful cross-regional M&A transactions conducted by the firm within the year. $Antitrust_{t-1}$ is the staggered Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted. *Firm Controls* include all firm-level control variables that have appeared in Table 3. Appendix A provides further definitions of variables. T-statistics in parentheses are calculated from heteroscedasticity-robust standard errors clustered by industry and year. *, **, and *** denote significance at the 10%, 5%, and 1% levels, respectively.

	D.V.= Successful M&A Count		D.V.= Cross-regional	
	(1) TWFE	(2) Heterogenous	(3) TWFE	(4) Heterogenous
$Antitrust_{t-1}$	-0.181***	-0.162***	0.069***	0.067*
	(-3.80)	(-2.51)	(3.04)	(1.97)
Firm Controls	Yes	Yes	Yes	Yes
Year × Province FEs	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes
Observations	43,891	42,671	40,512	39,825
Adjusted R^2	0.175		0.315	

Appendix A. Variable Definitions

Dependent Variables	*Definition*
Investigation Length	The number of days from the initiation of an administrative investigation by the enforcement department to its conclusion in a given case.
Case Count	The total number of Antitrust administrative penalty cases within a particular industry at the provincial level on an annual basis.
(Successful) M&A Count	The total number of (successful) M&A transactions that a firm has conducted within the year.
Cross-regional	The total count of successful cross-regional M&A transactions conducted by the firm within the year.
Buy	The total count of successful M&A transactions conducted by the firm within the year, where the firm acts as the acquirer.
Sell	The total count of successful M&A transactions conducted by a firm within the year, where the firm is the acquired target.
Horizontal	The total count of successful horizontal M&A transactions conducted by a firm within the year.
Vertical	The total count of successful vertical M&A transactions conducted by a firm within the year.
Conglomerate	The total count of successful conglomerate M&A transactions conducted by a firm within the year.
Asset Acquisition	The total count of successful M&A transactions conducted by a firm within the year, wherein assets serve as the underlying target for the transactions.
Stock Acquisition	The total count of successful M&A transactions conducted by a firm within the year, wherein stocks serve as the underlying target for the transactions.
Largest Stockholder	The total count of successful M&A transactions conducted by a firm within the year, wherein the acquirer becomes the largest stockholder in the acquired entity after the transactions.
Premiums	The natural logarithm of the difference between deal value and book value.
CAR (+0, +3)	The cumulative abnormal return with a window period of (+0, +3) day after the transaction announcement date.
CAR (+1, +5)	The cumulative abnormal return with a window period of (+1, +5) day after the transaction announcement date.
Profit Margin	The percentage of revenue that exceeds the costs of goods sold.
R&D Expenditure	The ratio of a company's R&D expenditure relative to its total revenue.
Independent Variables	*Definition*
Antitrust	The Difference-in-Differences treatment indicator that is set to one if the observation is operating within the policy-affected industries after the policies are enacted.
Penalty Amount	The total monetary sum issued as a penalty to a party by the administration in millions in RMB.
Registered Capital	The total amount of the registered capital of the entity in billions in RMB.

Appendix A. – *(continued)*

Employee	The total number of the entity's current employees.
Age	The age of the firm.
Public	An indicator that is set to one if the entity is a listed public company, and zero otherwise.
Size	The natural logarithm of a company's total assets.
Leverage	The ratio of total debts divided by total assets in a company.
PE Ratio	The ratio of a company's current stock price to its earnings per share.
Book-to-Market	The ratio of a company's book value relative to its market value.
ROA	The ratio of total profits relative to total assets in a company.
Cash Flow	The ratio of operating cash flow divided by total revenue
Female CEO	An indicator variable that is set to 1 if firm CEO is female.
State-owned	An indicator variable that equals to one if the firm is state-owned, and zero otherwise.
KZ index	The proxy for firm's financial constraint brought by Kaplan and Zingales (1997).
Fixed Ratio	The proportion of fixed assets relative to total assets in a company.

Appendix B. Institutional Backgrounds

Compared to the United States and the European Union, China's antitrust practice started later. Since the promulgation of the Anti-Monopoly Law in 2008, China's antitrust regulation has witnessed significant changes, frequently and profoundly impacting different markets in China. Over these years, China's antitrust agencies have undergone several adjustments and reorganizations, and antitrust-related laws and regulations have increased, forming a distinct antitrust system. This system not only promotes fair market competition but also provides vital support for the healthy development of China's economy. This rapid progress in antitrust is, in fact, due to the construction of a government-led antitrust system, forming a unique administrative directive-style of antitrust law enforcement and judiciary. In this system, China's antitrust enforcement faces a balance between rapidly responding to the market, precisely targeting monopolistic behaviors, and the predictability and independence of law enforcement and judiciary.

C.1 The Evolution of China's Antitrust Agencies

In the United States, antitrust enforcement heavily relies on legal proceedings. The Department of Justice's Antitrust Division only has the power to investigate and prosecute, while the Federal Trade Commission, although more independent from the judiciary, also operates through internal legal processes. Additionally, U.S. antitrust actors include various government levels and private lawsuits. Contrarily, China's antitrust enforcement is primarily government-driven with minimal reliance on litigation, focusing on administrative directives for penalties. In 2022, State Administration for Market Regulation (hereafter SAMR), legally concluded 187 antitrust cases with fines totaling 784 million Chinese yuan and reviewed 794 merger cases, of which 5 were conditionally approved with

restrictive terms.[1] Non-governmental entities play a limited role in China's antitrust practices, highlighting the importance of government antitrust bodies in this domain.

Prior to the enactment of China's Anti-Monopoly Law in 2008, there was no dedicated antitrust institution in the country. Antitrust functions were dispersed across various government departments, each handling antitrust matters within their respective scopes. For instance, price monopolies were addressed by departments responsible for price regulation, while other market competition issues fell under the purview of trade or commercial administration departments. This setup lacked the concentration and specialization needed for antitrust enforcement. The establishment of a more systematic and specialized antitrust legal framework began with the implementation of the Anti-Monopoly Law. The government formed the Anti-Monopoly Committee, a coordinating body consisting of members from various departments, including the deputy premier of the State Council and leaders from related sectors. The specific antitrust enforcement tasks were then concentrated in three departments: the National Development and Reform Commission (for price monopolies), the Ministry of Commerce (for merger review), and the State Administration for Industry and Commerce (for non-price monopolies). In 2018, these departments' antitrust responsibilities were integrated into the newly established State Administration for Market Regulation, akin to the U.S. Federal Trade Commission, marking a significant step in the unification of China's antitrust enforcement efforts. The formation of the Anti-Monopoly Bureau under the State Administration for Market Regulation in 2021 further demonstrated the government's commitment to antitrust regulation.

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[1] See *the 2022 Annual Report on China's Antitrust Enforcement* released by the State Administration for Market Regulation

Since the implementation of the Anti-Monopoly Law in 2008, China has continuously refined its antitrust institutional framework. The centralization of antitrust power within the government culminated in the establishment of the SAMR. However, this consolidation of power remains within the internal structure of the government, lacking a new balance of power from outside the government. As a result, it does not possess an independent characteristic similar to that of the U.S. Federal Trade Commission.

C.2 China's Antitrust Laws and Regulations

China's primary antitrust legislation is the "Anti-Monopoly Law of the People's Republic of China," which came into force on August 1, 2008, and was amended in 2022. The law specifies three types of monopolistic behaviors: reaching monopoly agreements among operators; abuse of market dominance; and mergers that eliminate or restrict competition. China's Anti-Monopoly Law also specially regulates administrative monopolies, referring to anti-competitive behaviors by administrative agencies and entities with public power. Besides regulating monopolistic behaviors, the law also stipulates procedures for investigating these behaviors and legal responsibilities.

The powers of antitrust law enforcement agencies in China stem from the Anti-Monopoly Law. These agencies have the authority to investigate and, upon identifying violations such as monopoly agreements or abuse of market dominance, can order the cessation of illegal activities, confiscate illegal gains, and impose penalties. For illegal business concentrations, they can mandate a halt and return to pre-concentration status, coupled with financial penalties.

The establishment of China's Anti-Monopoly Law was relatively late and initially quite general. Even after the 2022 amendments, the law still contains many ambiguities, leading to inconsistency in rulings for similar cases and providing substantial interpretative

leeway to enforcement agencies. Therefore, under the State Council's Anti-Monopoly Committee, these agencies have frequently issued departmental regulations and normative documents to specifically regulate and interpret monopolistic behaviors in certain areas, such as the guidelines for the platform economy issued in 2021 and the interim provisions against monopoly agreements in 2019. These documents clarify the application of the Anti-Monopoly Law in specific scenarios and reflect the future direction of antitrust enforcement. At the same time, these documents have a considerable degree of symbolic significance, indicating which areas the relevant institutions will pay attention to in the next stage.

C.3 Characteristics of China's Antitrust Enforcement Procedures

China's antitrust enforcement procedures, distinct from the U.S., reflect a clear administrative dominance. For behaviors like collusion and abuse of market dominance, agencies make decisions based on evidence and implement penalties. For merger reviews, relevant agencies provide opinions. The Anti-Monopoly Law allows for administrative reconsideration or litigation against decisions, but there are no precedents in practice yet. This reflects a focus on administrative reviews over judicial processes in China's antitrust enforcement. Additionally, the government's absolute power in identifying and penalizing monopolistic behaviors emphasizes direct government supervision over market behaviors, a reflection of China's unique legal and administrative traditions.

China's administrative-led antitrust approach allows for rapid market response and timely curbing of monopolistic behavior, minimizing related harm. This system's detachment from lengthy litigation processes leads to unpredictability of antitrust policies. Government perspectives on potential monopolistic practices are often reflected in newly issued documents and case announcements, impacting the market abruptly and significantly.

Contrastingly, in the U.S., certain court rulings (such as the Leegin case), appointments of key figures (like Lina Khan's appointment signaling tighter regulation of tech unicorns), and new legislative proposals (for example, the proposal of the "Ending Platform Monopolies Act"), can abruptly impact the market. However, due to the process of case hearings and policy debates, and the time required for the passage of bills, these impacts are not absolute. They tend to be diluted by expectations, preventing a concentrated effect.

Additionally, the administrative nature of China's antitrust enforcement grants agencies substantial discretion and the possibility of political intervention. In China's antitrust practice, filing cases, investigations, and penalties all come from the hands of antitrust agencies, without interference from the legal system. This makes it difficult for relevant companies to absolve themselves once they are targeted by law enforcement agencies. At the same time, investigations by antitrust enforcement agencies are easily influenced by political attitudes. The stance of higher-level departments on relevant cases could significantly impact the final penalties.

Therefore, it suggests that China's policies often extend beyond their textual implications, reflecting tighter governmental regulation in relevant sectors. The lack of transparency in enforcement procedures further emphasizes this symbolism. In this sense, the enactment of specific antitrust policies in a particular field actually reflects the government's intention to regulate that field. Due to the limited energy and resources of antitrust enforcement agencies, this may lead to more 'false positives' and 'false negatives.' False positives are concentrated in the areas where antitrust enforcement agencies focus their attention, while false negatives occur in areas currently overlooked by these agencies. Therefore, companies in sectors under scrutiny by antitrust enforcement tend to be more

cautious about competing for market share, hoping to avoid being targeted for enforcement by antitrust agencies. It is evident that the consequences of antitrust errors here do not lie in their impact on subsequent precedents but rather in their ability to cause structural effects on the market, leading to firms' adjustments in response to the regulatory focus.

Appendix C. Proof of Lemmas

Proof of Lemma 1

The pricing game with payoff $\pi_i(p_i, p_{-i}; \tilde{c}_i, \tilde{c}_{-i})$ is a supermodular game given $\partial^2\pi_i/\partial p_i \partial p_{-i} \geq 0$. Because $\partial^2\pi_i/\partial p_i \partial \tilde{c}_i = -D_i/\partial p_i > 0$ and $\partial^2\pi_i/\partial p_i \partial \tilde{c}_{-i} = 0$, we have $\partial p_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial \tilde{c}_i > 0$ and $\partial p_i^*(\tilde{c}_i, \tilde{c}_{-i})/\partial \tilde{c}_{-i} > 0$.

Proof of Lemma 2

Because $\partial^2\pi_i^*/\partial s_i \partial -c_i \geq 0$, $\partial^2\pi_{-i}^*/\partial s_{-i} \partial -c_i \geq 0$ and $\partial^2\pi_i^*/\partial s_i \partial s_{-i} \geq 0$, it is a supermodular game yielding that equilibrium s_i and s_{-i} is positive related with $-c_i$, which means $\theta_i^*(c_i, c_{-i})$ is decreasing in c_i and increasing in c_{-i}.