

IMPACTS OF ENTRY BY COUNTERFEITERS*

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This paper uses a natural experiment to test the impact of counterfeiting under weak intellectual property rights. I collect new panel data from Chinese shoe companies from 1993–2004. By exploiting the discontinuity of government enforcement efforts for the footwear sector in 1995 and the differences in authentic companies' relationships with the government, I identify and measure the effects of counterfeit entry on authentic prices, qualities, and other market outcomes. The results show that brands with less government protection differentiate their products through innovation, self-enforcement, vertical integration of downstream retailers, and subtle high-price signals. These strategies push up authentic prices and are effective in reducing counterfeit sales.

I. INTRODUCTION

Since the early 1990s, protection of intellectual property rights (IPR) has been at the top of the international trade agenda, resulting in a set of globally harmonized IPR specified in the World Trade Organization Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). IPR advocates believe in the stimulating effects IPR have on innovation, which fuels faster economic growth. Scholars have shown such stimulating effects to be very limited in practice, however, with inconclusive results from country case studies (Scherer and Weisburst 1995; Kortum and Lerner 1998; Sakakibara and Branstetter 1999) and cross-country panel results that establish stimulating effects only in countries with higher development and education levels (Qian 2007, 2008). Other related research discusses the effects of IPR implementations on the direction of innovative activity (Moser

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2003) and foreign direct investments (Branstetter, Fisman, and Foley 2006) and pinpoints the shortcomings of current patent systems (Gans, Hsu, and Stern 2003; Jaffe and Lerner 2004). Although the shift in policy focus from lowering trade barriers to an international rule of law for IPR is highly controversial (Lanjouw and Cockburn 2001; McCalman 2001), curbing counterfeiting through tightening IPR protection has been a common practice worldwide to foster brand values. Despite this practice being so common, little research attention has been paid to the flip side of IPR, that is, determining the economic principles underlying counterfeit infringements and the way in which IPR owners sustain themselves in the absence of governmental IPR monitoring.

In this paper, I identify a natural experiment that allows me to investigate how markets function with less government IPR enforcement. This natural experiment was created by the Chinese government's emergent reallocation of IPR enforcement resources away from monitoring footwear and fashion products to the other sectors in response to several food-poisoning and gas-explosion accidents in the early 1990s. Counterfeiters massively entered the Chinese footwear industry in the mid-1990s after the policy shift, infringing on brands of both multinational corporations and Chinese enterprises. Within the footwear industry, the Chinese leather- and sports-shoe sectors include most of the companies that have their own brands and account for approximately US\$6 billion in annual sales. Some Chinese brands, such as Anta and Li-ning, occupy a Chinese-market share close to Nike's. My data set includes both domestic brands and multinational brands operating in China and is supplemented by the Chinese Industrial Census database, an eBay-in-China data set, product catalog information, and interviews. The natural experiment and the unique panel data set facilitate a systematic analysis of a wide range of economic issues pertaining to counterfeiting. I probe into the origins and impacts of counterfeits, which claim brand names that they do not own, and I propose potential remedies.

Many insights emerge from this study. Brands with less government protection seek to differentiate their products and self-enforce their IPR through several strategic moves: investing in product attributes that are difficult to imitate, such as shoe-surface materials, technology, and elegant appearance; investing in nonprice signals including but not limited to licensed outlets

(vertical integration); establishing brand-protection offices to monitor the market and to assist the government with enforcement; and even employing subtle price signals.¹ All these strategies lead to higher authentic prices. I find that the prices set by the authentic manufacturers that were infringed upon rose by 45%, on average, two years after their counterfeiters entered the market. The prices of the generic brands without counterfeits followed a smooth and slightly upward time trend, while the counterfeit prices remained level. I additionally show that investing in enforcement activities and switching from wholesale to largely retail distribution are effective in deterring counterfeit entry or at least in reducing counterfeit sales.

Although no accurate financial value of global counterfeiting is available, estimates exist to reflect its massive nature. The World Customs Organization (WCO) estimates that over 500 billion euros of traded world merchandise in 2004 may have been counterfeit (WCO 2004). Therefore, the effects of counterfeits on market prices and authentic-producer marketing strategies are pertinent issues to address. However, prior literature on counterfeits is scarce. Darby and Karni (1973) theorize the reasons for and determinants of using fraud information as a means of attracting customers. They suggest utilizing branding and client relationships as tools for monitoring quality but do not discuss what happens when brands are counterfeited. For example, counterfeiters' attempts to infringe upon brands may generate asymmetric information complexities. Previous literature on pricing under asymmetric information on entrants' quality are confined to analysis with exogenous quality levels (Nelson 1974; Milgrom and Roberts 1986; Metrick and Zeckhauser 1999). Additionally, there is a dearth of empirical studies on counterfeits or underground economics in general. The illicit nature of counterfeiting implies under-the-table activity and difficult-to-measure effects, and past economic studies on illegal behavior have mainly relied on self-reported data (for example, Levitt and Venkatesh [2000] on a drug-selling gang).

This study provides a framework to synthesize various theories on quality uncertainties and endogenous sunk costs (ESC),

1. Companies' self-enforcement is prevalent even in advanced and highly institutionalized contexts. For instance, the luxury house LVMH assigned approximately 60 full-time employees and spent more than US\$16 million on investigations and legal fees in 2004 alone. Many brands (e.g., Fendi and Abbott) use holograms to distinguish their products from forgeries.

a term coined by Sutton (1991),² and serves as a fairly clean empirical test of the theory. I collect detailed annual financial information from 31 domestic and multinational shoe companies of different sizes and brands in China to analyze the impacts of counterfeits over a recent twelve-year period.³ In addition, I gather external data to verify self-reported data and to augment analysis drawn from the Chinese Industrial Census database, an eBay-in-China data set, and product catalog information. I then provide suitable instruments for various levels of counterfeit entry and sales. The panel structure of my data enables me to better correct potential omitted-variable bias and helps to improve the precision of the entry-effect estimator. The study of multiple companies of different sizes and brands further makes the results generalizable. My findings that authentic companies strive to upgrade quality, invest in self-enforcement, and build company stores after counterfeiters enter demonstrates the value of disentangling quality uncertainties. These strategies can also broadly be considered as ESC. Using a stylized vertical differentiation model with asymmetric information, I thus demonstrate that the findings are consistent with theory predictions and have generalizable implications.

The rest of the paper is organized as follows. Section II describes the empirical research design and identification strategies. Section III introduces data, followed by empirical results in Section IV. Section V provides theoretical foundations for the findings, and Section VI concludes and discusses policy implications. The remaining details are available in Qian (2006) and in the *QJE* online supplementary materials for this article.

II. STUDY DESIGN

In testing the impacts of entries by counterfeiters, the ideal experiment would randomly assign counterfeit entry for a set of brands in a large pool while other brands would be kept immune from counterfeiting. If I define the authentic company's

2. Athey and Schmutzler (2001) and Ellickson (2004) also theorize and identify examples that show quality investments as strategic complements and ways of sustaining market dominance.

3. I collected and analyzed city-level data as well, and I found that authentic prices do not vary a great deal across regions. They differ by about US\$1, which approximately accounts for transportation costs. There is a lack of variation in counterfeit entry across regions. However, I still conduct city-level IV estimations as robustness checks.

strategy profile as $\sigma = (\text{Quality, Enforcement Expenditures, Advertisement, Licensed Company Stores, Price})$, then the question of entry effects on each element in σ could simply be addressed with OLS regressions of the element on the binary indicator variable of entry. Formally,

$$(1) \quad \log(\sigma_{at}) = \beta_0 + \beta_1 \times \text{Counterfeit}_{at} + \beta_2^T \times \text{Year Dummies}_t + \beta_3^T \times \text{Firm Dummies}_a + \epsilon_{at},$$

where σ_{at} denotes the response variable of authentic company a in year t , and the indicator variable Counterfeit_{at} equals 1 if there are positive amounts of counterfeits for brand a in the year t . The fixed effects for year (12 years) and firm (31 branded companies) control for year-specific confounding factors and time-invariant firm attributes. The exogeneity of counterfeit entry, however, may not hold in reality, because entry is more likely to occur if the original producer has a larger markup, easier-to-copy quality, or a looser trademark management team. These unobserved time-variant firm characteristics are not captured by the fixed effects, resulting in correlation between Counterfeit_{at} and ϵ_{at} in equation (1). Simple OLS without accounting for this entry endogeneity will lead to biased β_1 estimates.⁴

Given these concerns, I seek appropriate instruments for the counterfeit entry variable to identify its effects. The IV (instrumental variable) strategy relies on a natural experiment in Chinese IPR enforcement change and its differential impacts on different brands. The remainder of this section explains the necessary details.

The advantage of studying the Chinese shoe industry primarily comes from the natural experiment, which stems from an enforcement change around the year 1995, due to external shocks exogenous to the shoe sector. In China, copyright and trademark laws were restored after 1976. In 1985, the Chinese government established the Quality and Technology Supervision

4. The omitted variable bias potentially enters OLS in two directions: an upward bias due to brand effects, which correlate positively with the price outcome and counterfeit entry; and a downward bias due to internal management effects, which are positively correlated with the price outcome but negatively correlated with the brand's counterfeit entry. In particular, a brand with good internal management may effectively ward off counterfeits as well as maintain high-standard products with relatively high prices. In fact, when log prices are simply regressed on the fake entry dummy and a year trend, the entry coefficient is very large (0.78). Although the company fixed effects help control for the omitted brand effects, they do not control for the time-variant management effects. The resulting OLS entry coefficient is, therefore, biased downward, as compared to the IV estimates.

Bureau (QTSB),⁵ with a branch in each city and joint forces nationwide, to supervise product quality and outlaw counterfeit localities. Due to a series of accidents arising from low-quality or counterfeit agricultural products and gas tanks, the Chinese government issued notifications around 1995 to enhance quality supervision and combat counterfeits in seven main sectors prone to hazardous materials.⁶ The majority of the Bureau workforce and funding went into these sectors, leaving loopholes for counterfeits to enter the footwear industry. For instance, in the early 1990s, approximately 10%–12% of the Bureau's resources were devoted to the footwear sector; this number, however, fell to 2% after 1995 (QTSB yearbooks). As seen in the data, authentic companies experienced significant counterfeit entry after this loosening of governmental monitoring and enforcement, with the highest level of entry occurring in 1996.

As expressed in interviews, authentic shoe producers were surprised at the massive entry of counterfeits but soon reacted. The branded companies that had been infringed upon set up their own brand-protection offices to compensate for the lack of government monitoring. As Figure I shows, the drop in government trademark-enforcement expenditures in the shoe sector corresponds to both massive counterfeiting entries and investments in self-enforcement by authentic producers in the sample after 1995. The solid line in Figure I plots the total private deflated enforcement expenditures of these branded companies over time.⁷ The company fixed-effects regression of the log of company enforcement investments on a legislation dummy is positive and significant at the 5% level (coefficient = 3.2).

In light of the enforcement changes, which are shown to have instigated massive counterfeit entries, the ideal experiment

5. It was recently renamed the "Administration of Quality Supervision, Inspection and Quarantine." The Bureau enlarged its personnel and funding in 1991 in a joint effort with legislation to protect IPR and monitor product quality.

6. These sectors included pharmaceuticals; agricultural products (including fertilizers, pesticides, and other materials or instruments); fiber and cotton (particularly bacteria-infected or bleached counterfeits); food; tobacco; alcohol; and gas. Notification No. 52 of late 1994 highlighted fiber and cotton quality supervision, and Notification No. 10 of early 1996 highlighted gas and other major hazardous products.

7. The self-enforcement costs include all costs associated with brand protection activities in each brand-protection office. They consist of expenses for sending employees to monitor the market, working with the government to track down counterfeit localities, and organizing or engaging in anti-counterfeit conferences, etc. Litigation costs are included but, in accordance with the law, are mostly paid by the party that lost in court (in this case, the counterfeiters).

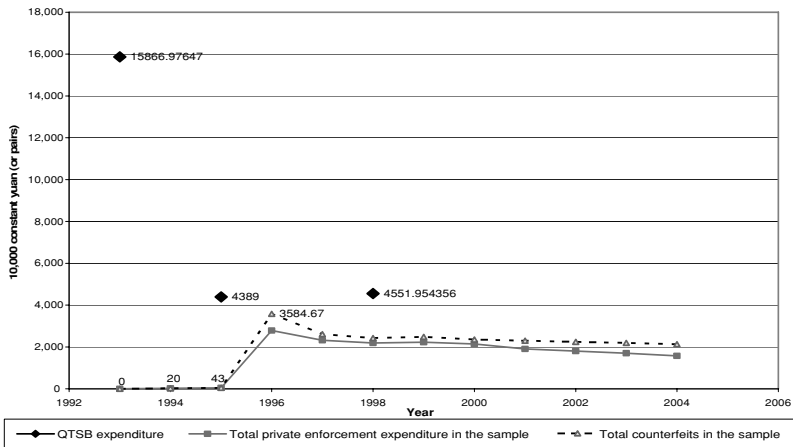


FIGURE I
Public and Private Enforcement Expenditures

Note. This figure plots the trademark enforcement expenditure (in 10,000 constant Chinese yuan, deflated by the WDI CPI index with 1995 as the base year) in the shoe sector by the Quality and Technology Supervision Bureau (QTBS) and the sampled companies, and the total number (in 10,000 pairs) of counterfeits in the sample each year. Only three data points are available for the QTBS expenditure in the shoe sector.

would translate into randomly loosening IPR enforcements for a group of brands in China at a certain time, while leaving the IPR enforcements of the other brands unchanged. Although the government enforcement change mainly presents itself with time variations, I was able to bring in brand-level variations through measuring the relationship between each sampled authentic producer and the government. Pertinent details will be discussed in the following paragraphs, but the bottom line is straightforward: After the enforcement-legislation change, the monitoring of counterfeits became decentralized, resulting in company-level supervision, carried out primarily through authentic manufacturers' own initiatives to protect their own brands. However, the authentic companies still had to rely on the government to outlaw the counterfeit localities once these were discovered by their own enforcement employees, because only the government had this authority. Therefore, companies that had a poor relationship with the government received less attention and experienced more counterfeits. I thus exploit the interaction between the enforcement-legislation change and a proxy for the relationship between an

authentic company and the government to identify “randomized” counterfeit entry decisions⁸ and to infer entry impacts.

Before the enforcement change, the QTSB conducted regular inspections of shoe markets and factories. They confiscated and shut down counterfeit localities on the spot. The monitoring mechanism was, therefore, quite uniform across different brands. After the enforcement change, however, companies that had a good relationship with the government received faster responses when they reported counterfeit cases. All else being equal, this type of phenomenon reduced the incentives of counterfeiters to infringe upon these brands.⁹ Brand-level variation in relationships with the government (the QTSB in particular) is therefore helpful for exploring the variation in the effects of the policy shift on counterfeit entry and sales for different brands and, in turn, its effects on different authentic prices and other norms. The challenge is to obtain a proxy for such a relationship.¹⁰ I seek a relationship proxy that is most relevant in explaining brand-level variation in counterfeiting and least influential on authentic-price and marketing outcomes, except when it affects counterfeiting. Based on these criteria, the number of days it took a branded company to obtain ISO certificates nationwide is the most appropriate proxy.

Since the late 1980s, all registered companies in China have been *mandated* to meet the standards set by the International

8. Circumstances under which counterfeiters of a brand are more likely to enter for exogenous reasons that are not related to the brand holder’s price and quality prospects.

9. Chinese news agencies broadcast counterfeit-confiscation news and consequently counterfeiters are likely to know which brands are harder to infringe upon.

10. Previous literature on political connectedness largely measures country-level corruptions. Fisman (2001) pioneered such company-level measurement by linking the response of the share returns of firms traded on the Jakarta stock exchange to a string of rumors about the adverse state of President Suharto’s health. However, it is hard to identify a political figure similar to Suharto in the Chinese context that I am examining. The shareholders or directors of the sampled shoe companies also did not participate in electoral votes, a scenario used in Khwaja and Mian (2005) to document the political connectedness of firms in Pakistan. The World Bank World Business Environment Survey (WBES) measures political connectedness with managers’ impressions of how fast things get done in dealing with governments (Batra, Kaufmann, and Stone 2003). The only other alternative I found is a recent paper by Mobarak and Purbasari (2006), who propose that whether an Indonesian company acquired import licenses reflects its political connectedness. In the event that the political-connectedness element might play a role in the Chinese import-licensing system, I gather data for the sampled companies (see online Appendix A). However, I use them only in supplemental analyses because they do not reflect a company’s relationship with the government agency of interest, that is, the agency that is in charge of IPR enforcements and that influences counterfeit entry and quantities.

Standards Organization (ISO).¹¹ For the shoe industry, the ISO sets standards for the basic equipment a company uses and the basic rules pertaining to the environment and labor. The QTSB is in charge of ISO certification. For some companies, one month was sufficient to obtain the ISO certificate, but for others, the application date and grant date were more than 300 days apart. Of the companies that spent a long time fulfilling the ISO requirements, some were small, and others medium or large.

Through close readings of documents and multiple interviews with companies and the QTSB, I was able to confirm that the standards were rather basic and the differences in application times were largely due to bureaucracy. Notably, the standard for companies to be registered as legal enterprises surpassed the basic quality standard specified by the ISO. The companies also had to pass internal qualifications as outlined by the ISO before submitting their applications to the QTSB (QTSB 2000). Thus, the variation in application time is largely due to relationships and not product quality or other company factors. Each registered branch of a branded company needed to apply for an ISO certificate through its local QTSB office.¹² I use the number of work days it took each branded company to obtain ISO certificates, averaged across all the relevant cities where that company had production or management branches, as a proxy for the company's relationship with the government in the national market. This is a more objective relationship proxy than managers' impressions recorded in World Bank surveys (Batra, Kaufmann, and Stone 2003).

The sampled shoe companies had to comply with two sets of ISO standards, one established in 1994 and the other in 2000. I obtain each company's application and grant dates for an ISO certificate corresponding to each set of standards and calculate the number of workdays between each pair of application and grant dates. I then construct a variable that equals the number of workdays between the application and grant dates for the 1994 certificate through the year 2000 and that equals the number of workdays to obtain the 2000 certificate from the year 2001 on. The correlation between the number of days to obtain both sets of

11. This differs from the United States, where companies adopt ISO standards voluntarily.

12. For instance, the brand Senda originated in Yancheng city and applied for an ISO certificate there; its subsidiaries in Shanghai, Jianhu, Beijing, Jilin, etc., also applied for and obtained ISO certificates from the corresponding QTSB branches.

ISO certificates is very high, 0.96, suggesting that the relationship between a company and the government was rather steady in the period under examination. Further, there are more variations in the ISO indicator across brands or firms within the same local area than across regions. When I regress the ISO values on the series of dummies indicating the city of application, none of the cities carry statistically significant coefficients. The p -values of these coefficients range from .23 to .64.¹³

There is also no significant correlation between this relationship proxy and the company's size, sales, product quality, or production costs in my data. The largest correlation amounts to only 0.08. The manager of a famous Chinese-branded company complained about its poor relationship with the QTSB and the consequent slow response in fighting its counterfeits: "Our company bases success on our ability and product quality and [we] never cared to work on relationships [guanxi]. It is frustrating that we have to go through slow processes in some applications such as the ISO and wait months before the government outlaws the reported localities of our counterfeits."¹⁴ In addition, Chinese consumers hardly notice these ISO certificates. Therefore, the ISO does not signal product quality and is not likely to influence prices in any way other than through affecting counterfeit entry and quantity.¹⁵

Figure II exhibits a generally positive relationship between the average number of workdays a branded company took to obtain the ISO certificates and the mean quantity of counterfeit sales it experienced after 1995. This correlation remains significant in regressions of counterfeit entry or sales on ISO days, after taking out company- and year-fixed effects. Section IV.B provides more data to support IV validity.

III. DATA

I collected data through a combination of external data sources and original survey research. I acquired the Chinese Bureau of Statistics Industrial Census database, which contains detailed financial information and basic company characteristics

13. I also regress the number of days for passing each of the two sets of ISO standards, respectively, on the application city's per-capita income, growth rate, CPI, and income inequality measure for the relevant years and find no significant coefficients.

14. I have translated these quotations into English from the original Chinese.

15. Many sectors are privatized in China, the footwear industry included. None of the companies in my sample is state-owned. Shoe prices are also freely set by supply and demand.

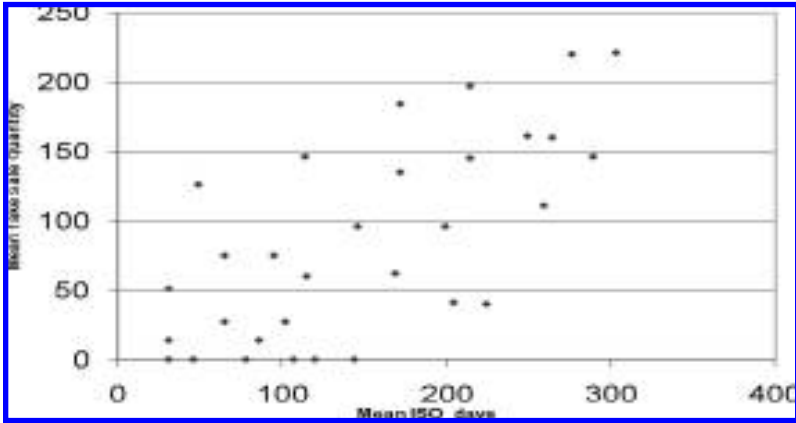


FIGURE II

Plot of Mean Fake Sale Quantity against the Relationship Proxy Post Enforcement Change

Note. This figure shows a general positive correlation between the average counterfeit sale quantity (in 10,000 pairs) and the number of workdays it took the corresponding branded company to obtain the ISO certificate from the government, which is a proxy for the company's relationship with government. The longer it takes to obtain an ISO certificate (higher values for the "ISO" variable), the worse is the relationship.

(such as size and age) for all registered companies in China. However, only five years of census data were available: 1995 and 1998–2001. Although the database includes the main products of each company, it does not contain any data on prices. I did not find systematic information about counterfeiting in the existing Chinese or international data sources. It was, therefore, necessary to supplement the readily available data with my own survey research in China.

The data I gathered consist of detailed information taken from companies' annual financial statements and other relevant company records on 31 branded companies and their corresponding counterfeits for the years 1993–2004. These companies were surveyed and interviewed through a stratified random sampling method. Guided by the research design, I obtained data on the average prices and costs of their three product-quality levels (high, medium, low), their brands' total domestic sales, the number of personnel and amount of expenditure used for trademark enforcement, advertisement expenditure, and the total number of licensed company stores. Descriptive statistics for variables of interests are displayed in Table I. In my surveys, I specifically

TABLE I
SUMMARY STATISTICS BEFORE AND AFTER THE POLICY CHANGE

Variable	Pre-1995	Post-1995
Share of government resources devoted to monitoring the shoe sector	0.11 (0.004)	0.02 (0.001)
Workdays authentic company took to pass ISO (relationship proxy)	142 (116.5)	149 (112.6)
Number of company stores (retail stores established by an authentic brand)	0 (0)	684 (533.5)
Authentic brand-protection office personnel (head count)	0.17 (0.46)	4.0 (2.23)
Quantity (in 10,000 pairs)		
Fake sale quantity	Median 0 When exists, ranges from 1.2 to 1.87	85.71 (75.85)
Authentic sale quantity	309.38 (725.76)	558.28 (995.82)
Prices, costs, and other numerairs (deflated, in US\$)		
Fake shoe price	Median 0 When exist, range from 8.33 to 10.4	7.32 (4.2)
Fake shoe cost	Median 0 When exist, range from 2.2 to 3.56	2.66 (1.56)
Authentic high-end shoe price	43.3 (20.46)	61.48 (40.58)
Authentic high-end shoe cost	33.53 (19.14)	47.01 (30.03)
Authentic medium-end shoe price	27.25 (10.24)	32.32 (18.71)
Authentic medium-end shoe cost	19.61 (8.97)	24.71 (13.50)
Authentic low-end shoe price	16.94 (8.18)	18.81 (10.48)
Authentic low-end shoe cost	14.8 (6.70)	14.42 (7.67)
Self-enforcement costs of authentic brands	520 (1,550)	81,380 (83,140)
Advertising expenditure	1,496,700 (2,724,200)	2,381,500 (3,329,300)
Real GDP per capita PPP	310.25 (5.57)	488.13 (2.83)
Annual sales and consumption (deflated, in million US\$)		
Total sales of an authentic brand	50.47 (89.88)	78.29 (105.0)
Domestic sale of authentic	46.41 (90.03)	49.18 (71.91)
Household consumption	3,150 (20)	4,800 (30)

TABLE I
(CONTINUED)

Variable	Pre-1995	Post-1995
Percentages ($\times 100\%$)		
Economic growth	12.99 (0.15)	8.43 (0.03)
Gini	37.13 (0.34)	43.82 (0.08)
Consumption as share of national income	57.76 (0.32)	57.40 (0.02)
<i>N</i> obs.	62	310

Note. This table presents the summary statistics of the data set, slicing it into two parts: data prior to the year 1995, when the Chinese government reallocated enforcement resources away from the footwear sector to fill in the needs of the safety sectors, and data after 1995. Each row reports the means and standard deviations (in parentheses) of a variable in the two time lines. All company-level data are gathered through original interviews and surveys. The percentage of government resources devoted to monitoring the shoe sector is obtained from the Quality and Technology Supervision Bureau. Real GDP per capita PPP, growth rates, consumption over income, and household consumption are obtained from the World Bank *World Development Indicators (WDI)*. Prices and costs are deflated using the Consumer Price Index published in the WDI (Year 1995 was set as the base year in the database). Gini coefficients are extracted from the U.N. Human Development Reports.

requested the companies' assistance in obtaining data from their databases.¹⁶ The data provided by the companies corroborate those recorded in the Industrial Census for the years available. The sales, sale costs, profits, and export aggregates of my sample mirror the trends in the census of shoe companies. In addition, the price data in my surveyed sample mirror the general price trends of the three quality levels in the eBay data set collected by researchers at the University of Chicago. All the data checks as well as sampling and survey methods are detailed in the online Appendices.

In addition, I coded and compiled product-level data from the companies' and stores' annual catalogs. These product catalogs helped in better controlling for quality and costs. I compiled a data set of the different characteristics for each type of shoe listed in the catalogs, consisting of the material, comfort level, decorative patterns, support and cushioning features, ventilation, etc. Recognizing the importance of validating the data from firm reports (Bresnahan 1989), I ran hedonic regressions of the unit production costs, as provided by the sampled companies, on the corresponding material, machinery, and other characteristics of

16. The company contacts put a premium on accuracy and most of the time would not even give casual estimates during interviews. Every time I had a follow-up question, they would respond only after having checked their files.

the shoes, as recorded in the catalogs. I conducted the analyses on the samples of leather shoes and sport shoes separately. These characteristics together account for 90% of the cost variation (online Appendix A.1). These results lend credibility to the company data.

I then collected data on counterfeit sale quantities, prices, and costs from the brand-protection office of each authentic company. Because the branded companies and the government, the QTSB in particular, worked together to track down counterfeits, the QTSB shared with each branded company their statistics on the corresponding brand's counterfeits and the corresponding counterfeiters' internal financial statements that they confiscated. Given the unusual nature of the data, it is important to consider both their reliability and limitations. On the very basic question of authenticity, I have no reason to doubt that the data actually represent the branded companies' records of discovered counterfeits, the QTSB's records of counterfeits eradicated from the marketplace and production locations, and the counterfeiters' financial records. These bookkeeping records were kept internally as a tool for managing day-to-day operations of the counterfeiting companies and were confiscated along with all the counterfeits when the government investigated and shut down these illegal entities. The QTSB also shared some statistics on the characteristics of the shoes they confiscated from the counterfeiters. The details are discussed in online Appendix A.

To understand the potential biases and limitations of the data, it is worth noting that these data on counterfeits were made available in sums for each brand. That is, each branded company sent me the aggregated number of counterfeits and the average counterfeiting prices and costs of a particular brand in each sampled year. According to these brand-protection offices and the QTSB, the variation in terms of counterfeiting sophistication (production costs) is small. Counterfeiters consistently used inferior and cheap materials to produce shoes and usually only charged a fraction of the authentic product's price, to attract customers. Another limitation is that only the discovered or captured counterfeits are reflected in the data. Although the branded companies reported that they were able to track down most of their counterfeits and the remaining ones were minor and did not greatly affect them, it is prudent to view the counterfeit sales as the lower bounds of the true values. To ameliorate this

potential bias, I generate a dummy variable for a counterfeiting presence, which takes on a value of one if a branded company experiences any amount of counterfeiting, and zero otherwise. I primarily study the impact of counterfeiter entry and presence on the authentic brands. I then supplement the analyses and check the robustness of the results by examining the impacts of the level of counterfeiting on the authentic brands.

To control for the overall economic environment and consumer purchasing power, I extract the GDP, per capita PPP (henceforth “pcPPP”), GDP growth, Consumer Price Index (CPI), household consumption, and total consumption as a share of GDP for China in the sampled years from the World Development Indicators (WDI) database. I also extract the annual Gini coefficients in China from the U.N. Human Development Reports. As discussed in Section II, neither the counterfeiting treatment variable nor the policy-shift experiment (supplemented with brand-level variation in relationships with the local governments) exhibits regional variation. This implies that regional factors are not likely to cause bias in estimates even if omitted. Nonetheless, I collect regional-level income per capita, growth, price, and inequality data and conduct robustness checks, as reported in the online Appendices.

IV. EMPIRICAL ANALYSIS AND RESULTS

IV.A. A General Picture of the Counterfeiting Era

To provide a general sense of the trends, Table I displays the descriptive statistics of the variables used in the analyses pre- and post-1995, the benchmark year for the government’s allocation of resources away from the shoe industry to tightly monitor the safety sectors. The drop in the mean percentage of government resources devoted to monitoring the shoe sector from 11% to 2% is accompanied by a massive entry of counterfeiters. Whereas the median of the counterfeit-sale quantity across brands was zero before 1995 (with some 10,000 pairs for just a few brands), counterfeits reached 857,100 pairs on average across the sampled brands in the years after. It is interesting to observe the subsequent changes in the authentic companies. They began to invest enormously in self-enforcing their trademarks (651,014 deflated yuan, approximately US\$81,377, on average post-1995).

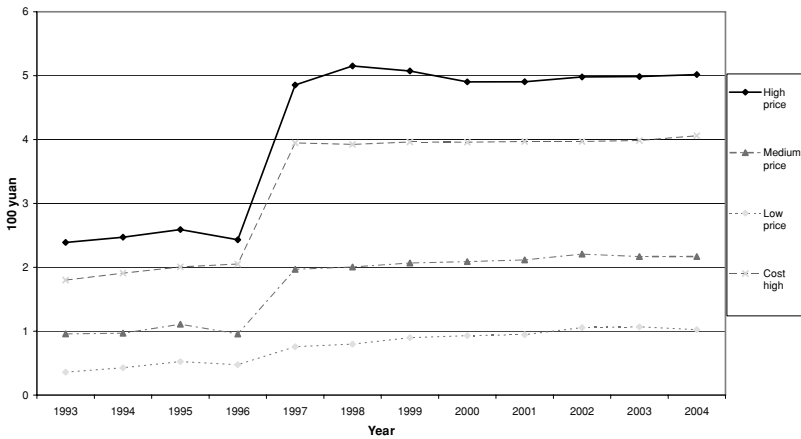


FIGURE III

Deflated Prices and Costs for an Infringed Chinese Brand (FakeEntry = 1996)

Note. This figure presents the price and cost of high-end products and the price of medium- and low-end products of the Chinese-originated brand, deflated at the 1995 CPI.

However, establishing a company's own brand-protection office and investing in self-enforcement was not enough to compensate for the lack of government enforcement. Authentic companies had to seek additional strategies. These included changes in pricing and quality upgrades. These companies also established their own retail stores for the first time after 1995 to gain better control of the distribution and to signal authenticity and superior quality of their products.

Figures III–V display some visual checks on the impacts of counterfeits. I first plot the unit cost and price (both deflated) trends for each company and its counterfeits, if any, over the sampled time period. Figure III shows the trend for a representative company that experienced noticeable counterfeit entry since 1996, and Figure IV exhibits the trend for its counterpart, another representative company, that had similar starting prices but was not infringed upon during the sampled period. Many of the infringed-upon companies experienced some initial drop in prices. However, their highest and medium prices increased shortly after the counterfeits entered the market, coinciding with the upward drift in unit costs. In contrast, the price and cost trends for the companies free of counterfeiting were very smooth, with no shifts comparable to those of the infringed-upon brands.

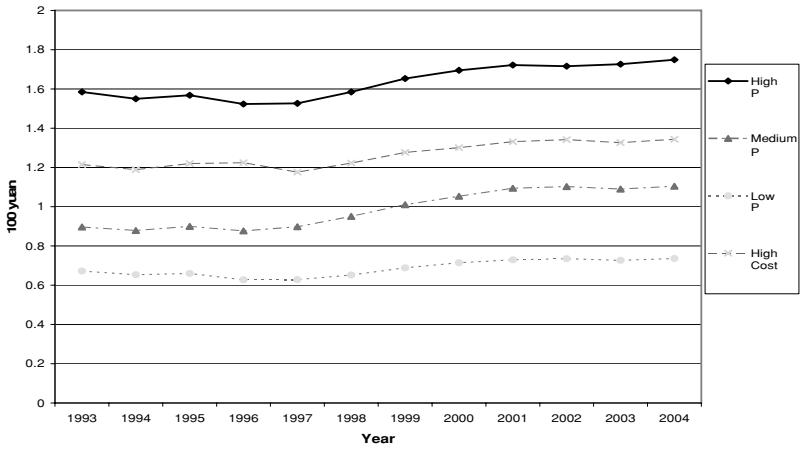


FIGURE IV

Deflated Prices for a Noninfringed Chinese Company

Note. This figure presents the time trends of the authentic prices for the high-, medium-, and low-end products and the costs of authentic high-end products, all deflated at the 1995 CPI.

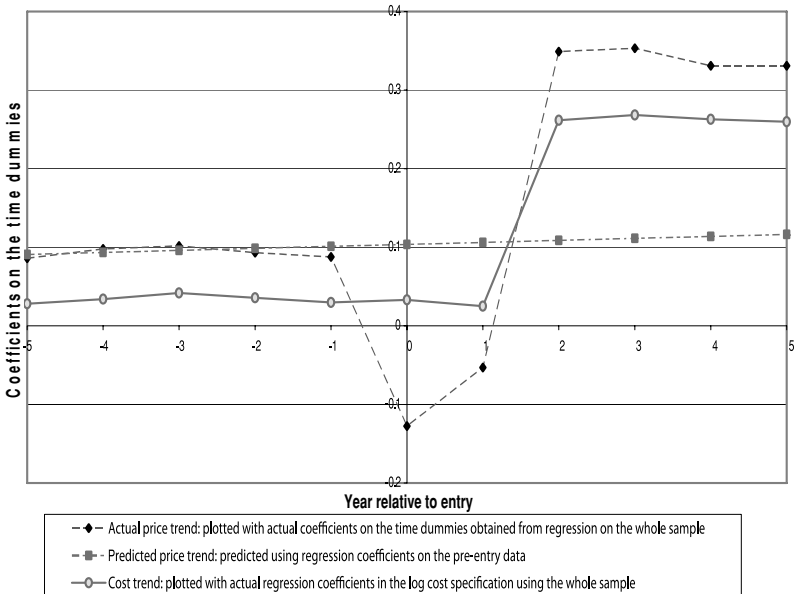


FIGURE V

Time Plot of Average Log Deflated Authentic Prices and Costs

Note. This figure plots the regression coefficients on the dummies (indicating the year relative to counterfeit entry), with log deflated authentic price or cost as the response variable.

To examine the cost and price dynamics pre- and post-entry more formally, I regress the log of the deflated authentic costs and prices on a set of dummies indicating the years relative to counterfeit entry (from five years prior to entry to five years after) and plot the coefficients on these time lines (the dashed diamond line for the price specification and the solid circle line for the cost specification in Figure V). The pattern is similar to that of single-company plots: rather smooth price movement prior to entry, an initial drop upon entry, an upward drift shortly after entry (again coinciding with the upward jump in unit costs), and finally leveling off.¹⁷ A counterfactual experiment based on the price trend pre-entry¹⁸ shows a smooth and slightly upward trend in authentic price over time, as plotted by the dotted squared line. The discrepancy between the forecast prices based on pre-entry trends and the actual post-entry prices clearly reveals a discontinuous change in price levels after counterfeit entry. Similarly, unit costs experienced a discontinuous change post-entry. This corresponds to the upgrades in shoe materials and technologies, illustrated in the hedonic regression results (online Appendix A) and reported by managers to be a means of differentiating their products from counterfeits.

The discontinuous changes in authentic prices are not the result of a fashion trend, because the deflated price trend for the footwear industry in the American market over the same period has been smooth and even declining (online Figure A.1; American Apparel and Footwear Association 2005). Besides quality upgrades, the sampled authentic companies also differentiated through vertical integration. Online Figure A.2 demonstrates a representative case in which the number of company stores correlated with a decline in the counterfeit sale quantities.

In addition to the above descriptive statistics, a series of OLS regressions demonstrates a positive correlation between counterfeit entry and the authentic company's product quality (as proxied by the unit costs), advertising expenditures, the number of company stores, enforcement expenditures, and the price. Details are included in online Appendix B.1.

17. The coefficient on the dummy for one year after entry is negative in the figure, although some companies had already raised prices. This is mainly due to the heterogeneous response times across companies. Some authentic manufacturers were able to improve quality or engage in other countervailing strategies within a year, but most companies took two or more years to do so.

18. I regress the actual coefficients on these year dummies on the years before entry and predict the coefficients in the counterfactual experiment (i.e., no entry) from this regression.

IV.B. Testing Counterfeiting Effects with Instrumental Variable Estimations

In this section, I start with the first-stage estimation results to further illustrate the IV's validity. I then discuss the overall IV estimation results when various authentic producers' strategies and outcomes are regressed on lagged counterfeit entry (instrumented). Finally, I trace the authentic price dynamics over time and test the price signaling effects. This analysis provides some insight into the short- and long-run impacts of counterfeit entry and the implications of asymmetric information.

First Stage Instrumental Variable Estimates. I construct an IV, Loose, to benchmark the years with diverted government enforcement efforts for shoes (Loose = 0 prior to 1995 and 1 starting from 1995). As explained in Section II, I use this enforcement change and its interaction with the relationship between a branded company and the government (proxied by the days it took the brand to pass ISO standards, averaged across its subsidiaries in various regions) as the main instrumental variables for counterfeit entry. Because the enforcement change was due to a series of accidents that took place in other industries, it is plausibly exogenous. The IV exclusion restrictions are also fulfilled because tightened government enforcement elsewhere is not expected to affect shoe prices directly. Because authentic prices are set by market equilibrium, and the ISO time proxies for the relationship of a company only with the QTSE, this ISO proxy does not affect prices or other norms directly.

The first-stage regression model is

$$\begin{aligned} \text{Counterfeit}_{at} = & \gamma_0 + \gamma_1 \times (\text{Relation} \times \text{Loose})_{at} + \gamma_2 \times \text{Loose}_t \\ & + \gamma_3 \times \text{Relation}_{at} + \gamma_4^T \times \text{Year Dummies}_t \\ (2) \quad & + \gamma_5^T \times \text{Firm Dummies}_a + \epsilon_{at}, \end{aligned}$$

where Counterfeit_{at} is defined similarly to its definition in (1). Relation_{at} is the ISO proxy for the relationship between authentic company a and the government, and $(\text{Relation} \times \text{Loose})_{at}$ stands for the interaction variable between this relationship proxy and the enforcement-change indicator.¹⁹ In alternative specifications, I replace the counterfeit entry dummy with counterfeit sale

19. I only include the most important instruments because additional weaker instruments might reduce IV effectiveness. The results in this paper are robust qualitatively to alternative statistical models as in Qian and Xie (2008).

TABLE II
FIRST-STAGE REGRESSIONS AND INSTRUMENT RELEVANCE

Dependent variable	Fake entry			Fake quantity
	(1) IV1	(2) IV2	(3) IV3	Authentic quantity (4) IV2
Loose	0.72*** (0.04)	0.27*** (0.05)		0.49*** (0.06)
Relation		0.001 (0.001)	0.001 (0.001)	0.002 (0.001)
Loose × Relation		0.014*** (0.002)	0.002*** (0.000)	0.002*** (0.000)
Year trend	-0.000 (0.000)	0.04** (0.01)		-0.02* (0.01)
Year fixed effects	No	No	Yes	No
<i>N</i> obs.	372	372	372	372
Wald Chi ² (or <i>F</i> -stat)	135	179	49.3	51

Note. IV1: Enforcement legislation change—loose, a dummy that equals 1 in 1995 onward, and year trend. IV2: Interaction between legislation change and a company's relationship with its local government—relation (proxied by the number of work days between the application and grant dates of ISO certificate for an authentic company), Loose × Relation, Loose, and Year trend. IV3: Interaction between legislation change and a company's relationship with its local government (Loose × Relation) and year and company dummies. This table reports the first stage of IV estimation. All models use company fixed effects. The counterfeit entry dummy (equals one if counterfeits are discovered for a brand) and counterfeit sale quantity as a fraction of the authentic sale quantity are regressed on the set of IV, with the year trend and company fixed effects, in four separate regressions. Each column reports one regression specification. Heteroscedasticity-consistent standard errors that correct for clustering at the company level appear in parentheses.

*10% significance level.

**5% significance level.

***1% significance level.

quantity (in relative terms to authentic sale quantity) and replace the year dummies with a year trend to check robustness of results. Different columns in Table II exhibit the estimations from several specifications of this first-stage IV regression. As shown in columns (1)–(4), the legislation dummy and the interaction between Loose and Relation are highly correlated with counterfeit entry or sales, statistically significant at the 1% level. The overall Wald Chi-squared test or *F*-test for the instruments is highly significant as well. All these estimations tell a consistent and clear story that the policy shift and its interaction with the ISO relationship proxy are highly correlated with the treatment variables: counterfeit entry and counterfeit sale quantities as a share of authentic sale quantities.

To address the potential concern that the legislation-change dummy might be confounded with other macro changes that are not picked up by the year effects, I conduct robustness checks

using the fraction of the resources the QTSB devoted to the shoe industry as an alternative instrument to the legislation dummy. I discuss the estimation details in online Appendix B; all the results are similar to those presented here.

Instrumental Variable Regressions for Various Authentic Strategies and Outcomes. I estimate equations (1) and (2) simultaneously (2SLS), to test the counterfeit entry effect on each of the authentic producers' strategy proxies in σ (as defined in Section II) and on their profits and export revenues (Table III). Standard errors are clustered at the company level. Using the counterfeit sale quantity and the counterfeit entry dummy lagged by different years as alternative treatment variables, I arrive at robust results. Counterfeiter entry and sales induce most authentic producers to upgrade quality with more expensive materials and differentiate their products from counterfeits, as reflected in the significant increase in unit production costs two years later (column (1); coeff = 0.29 for entry lagged by two years, implying a 33.6% increase). Whereas most authentic companies started investing in enforcement activities and establishing licensed company stores within one year (columns (3) and (4)), advertisement costs were not significantly influenced by counterfeits (column (2)). This is plausibly due to two opposing forces: On one hand, being counterfeited could have been a form of advertisement for the brand, and on the other hand, low-quality counterfeits could have ruined the brand's reputation, forcing the authentic company to invest more in advertising. In the interviews, the brand managers commented that they trained employees in their licensed company stores to inform consumers about the differences between their authentic products and counterfeits. Authentic prices rose significantly two years after counterfeit entry (column (5); coeff = 0.37 translates into a 45% increase) due to endogenous sunk costs including quality investments, self-enforcement, the vertical integration of retail stores, and other nonprice signals. Additional price signaling strategies might have been employed and are explored in the next section. There is no significant effect of counterfeit entry on authentic profits or export revenues (columns (6) and (7)).

The hedonic regressions described in Section III and online Appendix A.1 establish the high correspondence between the unit costs and the shoe characteristics from the annual catalogs. The significant coefficients in the log cost specification as reported above therefore indicate a significant impact of counterfeit entry

TABLE III
INSTRUMENTAL VARIABLE REGRESSIONS FOR THE IMPACTS OF COUNTERFEITS ON VARIOUS AUTHENTIC COMPANY BUSINESS STRATEGIES AND OUTCOMES

Dependent variable	Cost _t (1)	Ads _t (2)	Store _t (3)	Enforce _t (4)	Price _t (5)	Profits _t (6)	Exports _t (7)
Treatment specification 1: FakeEntry _{t-1}	0.17 (0.28)	0.52 (1.07)	4.36*** (1.32)	2.73** (1.02)	0.16 (0.30)	-2.44 (1.57)	1.65 (4.83)
Treatment specification 2: FakeEntry _{t-2}	0.29** (0.11)	0.53 (0.39)	2.63* (1.62)	0.98* (0.52)	0.37*** (0.10)	0.21 (0.66)	2.68 (3.58)
Treatment specification 3: LogFakeQuantity _{t-2}	0.04** (0.02)	0.05 (0.05)	0.58*** (0.21)	0.37*** (0.10)	0.03** (0.01)	-0.11 (0.19)	0.32 (0.29)
Year and company fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N obs.	372	372	372	372	372	372	372

Note. This table reports the second stage of IV estimation. All models use year and company fixed effects. All the dependent variables are in logs. Each row indicates one treatment specification: for example, the counterfeit entry dummy Entry_{t-2} (or Entry_{t-1}) equals one if counterfeits are discovered in year t - 2 (or t - 1) for a brand. Log Fake Quantity_{t-2} is the number of counterfeit sales in year t - 2. Various authentic outcome variables are regressed on the entry dummies, in separate regressions. Column (1) reports entry effects on log authentic high-end prices, column (2) reports entry effects on log advertisement costs, (3), on log number of licensed stores, (4), on log enforcement investments, (5), on log profits, (6), on log of export revenues of the authentic company, and (7), on log cost of high-end products. All nominal terms are deflated with 1995 CPI. Heteroscedasticity-consistent standard errors that correct for clustering at the company level appear in parentheses.

*10% significance level.

**5% significance level.

*** 1% significance level.

or quantity on the authentic shoe quality upgrades. To probe into the quality changes, I analyze each aspect of the shoe characteristics pre- and post-entry, using the IV estimates on the overall quality proxy I extract from the product catalogs and rank sum tests on each characteristic as detailed in Qian (2006) and Appendix B.3. The analysis yields interesting results: The authentic producers used fancier surface and side materials and improved the shoe appearance tremendously (especially for leather shoes) after counterfeit entry. Equipment and technologies were improved; notably, these companies imported Italian production lines. There is no matching improvement in functionality, possibly due to the fact that the companies always described their high-end shoes as comfortable, versatile, having cushioning effects, etc. If functionality indeed did not change significantly in practice, then it interestingly reflects that authentic companies upgraded quality dimensions that could most directly distinguish their products from those of counterfeiters. The overall quality shifted up by fifteen percentile points after the brand experienced counterfeits (the modes of the distributions for quality ranks are approximately equal to 20).

Exploring licensed stores, I regress the log of the number of licensed stores an authentic company established on the lagged-year counterfeit entry or quantity, the log pcPPP, economic growth, the Gini coefficient, the year trend, and company fixed effects. The results demonstrate that the number of licensed stores is positively (statistically significantly at the 1% level) correlated with the lagged-year counterfeit entry or quantity and the current-year Gini coefficient. The intuition is that the prevalence of counterfeits in the market induced incumbents' countervailing responses. Original products in a licensed store are usually sold at a higher price, because building or renting a space to set up a licensed store pushes up fixed and marginal costs. This is profitable if consumers find it worthwhile to have this type of indicator to assure them of the product's authenticity. In other words, a licensed store can be considered as an information service, separating authentic products from counterfeits. Regression analysis also reveals that the number of licensed stores is positively correlated with income distribution: The higher the Gini coefficient, the more wealthy people there are who can afford luxury products or who are willing to pay more for famous brands.

Instrumental Variable Estimates to Trace Log Authentic Price Trends. Whereas the previous section tests the impacts of

counterfeit entry on various market norms, this section traces the entry effects on authentic prices over a longer time horizon. In addition, I empirically disentangle the price increase into two parts: the part due to quality improvement and the part due to signaling effects. To tease out these two parts, I include the log of unit production costs as a control variable in the second-stage IV estimation (equation (1)). As online Table A.1 shows, shoe characteristics help explain over 90% of the variations in shoe costs and 80% of the price variations. The part of the price increase due to quality improvement can be reflected by a positive coefficient on the cost variable, whereas the signaling part is likely captured by a positive coefficient on the entry dummy in the same regression. I therefore run two sets of regressions. The first set regresses the log authentic price on the instrumented counterfeit-entry dummy lagged by zero to five years, respectively, simply controlling for the year trend and company fixed effects (columns (1), (3), and (5) in Table IV). This set of regressions yields the *overall* entry effects on authentic prices in the five-year time frame. The second set of regressions adds authentic unit production costs as a control, together with the other control variables discussed in the next paragraph, to shed light on the potential price signaling effect net of quality upgrades (columns (2), (4), and (6) in Table IV).

To address the concern that prices can rise due to positive demand shifts, I control for a set of macroeconomic variables.²⁰ Price can also be correlated with a company's prestige, which I control for by including the age of the company, defined by the present year minus the incorporation year. I further control for the macroeconomic environment by using annual data on the Chinese real pcPPP, growth rate, Gini coefficient, total consumption as a share of GDP, and deflated household consumption in that year. I convert prices, deflated household consumption, and pcPPP to logarithms in order for the data distributions to be approximated better as normal distributions. Furthermore, regressions on log terms capture the rates of change in variables instead of their levels, which vary across companies. Because the macroeconomic factors are the same for all companies in each year, they are

20. In separate specifications, I also add the company's domestic sale quantities to the controls, and the results do not change much. The negative coefficient on the domestic sale quantity variable, while insignificant, provides some evidence that a shift in demand may not be a good explanation for the price increase, although it cannot entirely rule out that possibility. Positive demand shocks would logically raise both the domestic price and sale quantities and lead to a positive correlation between these two variables.

TABLE IV
 INSTRUMENTAL VARIABLES ESTIMATES FOR COUNTERFEIT EFFECTS ON AUTHENTIC
 PRICES: ENTRY DUMMY LAGGED BY 0, 2, OR 4 YEARS

Dependent variable	Log deflated prices for high-end authentic products— $\log(P_t)$					
	Current year		2-year lag		4-year lag	
	(1)	(2)	(3)	(4)	(5)	(6)
Fake entry	0.02 (0.06)	-0.01 (0.01)	0.43*** (0.13)	0.08** (0.04)	0.25** (0.12)	0.06 (0.05)
log cost		1.02*** (0.01)		0.82*** (0.05)		0.93*** (0.03)
Age		0.001** (0.000)		0.001 (0.001)		0.001* (0.000)
log(GDPpcPPP)		0.11 (0.15)		0.04 (0.21)		0.09 (0.12)
Growth		0.001 (0.001)		0.001 (0.001)		0.002 (0.005)
Gini		0.005* (0.002)		0.004** (0.002)		0.002 (0.006)
C/Y		0.000 (0.001)		0.003 (0.003)		0.002 (0.003)
log(HHC)		0.01 (0.02)		0.08 (0.08)		0.04 (0.08)
Year trend	0.00 (0.00)	-0.01 (0.01)	0.04*** (0.01)	-0.01 (0.02)	0.03*** (0.01)	0.00 (0.00)
N obs.	372	372	372	372	372	372

Note. This table reports the IV estimates of the counterfeit entry effect on the log of deflated authentic high-end prices. All models use company fixed effects. Each column represents a regression specification, with the counterfeit entry dummy defined at different lags as specified in the column header. For instance, columns (3) and (4) correspond to the $Entry_{t-2}$ dummy, which equals 1 if a counterfeit of a brand entered in year $t - 2$; log Cost is the authentic cost of high-end products in year t , proxying for its quality; age is defined as the current year minus a company's incorporation year. Real GDP per capita PPP, growth rates, consumption over income (C/Y), and household consumption (HHC) are obtained from the World Bank *World Development Indicators*. Gini coefficients are extracted from the U.N. Human Development Reports. Heteroscedasticity-consistent standard errors that correct for clustering at the company level appear in parentheses.

*10% significance level.
 **5% significance level.
 ***1% significance level.

collinear with the year dummies. I replace year dummies with the year trend in these regressions in order to preserve the interesting coefficients on these macro variables.

The coefficients in the regression specification with entry lagged by one year resemble those with current-year entry. Similarly, regression results with entry lagged by three years resemble those lagged by two years, and five-year-lag estimates resemble those lagged by four years. For brevity, Table IV presents only results with entry lagged by zero, two, and four years. The

immediate pricing impact of counterfeit entry may be negative; however, it is not statistically significant (columns (1) and (2)). This indicates that it took time for the authentic companies to respond to counterfeit entry. Entry evidently induced authentic companies to raise prices from two years on (columns (3)–(5)). Notably, prices rose by a factor of 1.5 on average after counterfeits entered, proving significant at the 5% level (column (3); coefficient = 0.43 for the log price). When including the log of unit costs (proxying for quality) in the regression, this variable explains a substantial part of the price increase (columns (4) and (6)). The results help to tease out the potential confounding effect: If the price jumps were due to a brand effect, the price of the same product, not one of higher quality (made with higher unit costs and better materials, as shown in online Appendices A and B), should have been affected.

Moreover, even after controlling for cost, counterfeit entry induced the log authentic price to rise by 8% on average, with a standard error of 3.7%, two years after entry (column (4)). One explanation for this result is price signaling effects: Prices rose above a level that could be explained by improvements in quality. However, this effect fades away when log authentic prices are regressed on the four-year-lag entry variable (column (6)). This is consistent with the predictions in Bagwell and Riordan (1991) and echoes findings in Curry and Riesz (1988) that, in the durables market, firms may first signal high quality with a price higher than the complete-information optimal price, and then decrease the price as information spreads. Results are robust when including year-fixed effects, with IV3 as specified in Table II or with controlling for the set of shoe characteristics in place of log costs (online Appendix B, Table A.8). I conduct additional robustness checks by adding the number of company stores and advertisement and enforcement expenditures (in logs) to the right-hand side of the regression model. Although company stores and advertisement expenditures are positively correlated with authentic prices and are significant at the 5% level, there is remaining predictive power on the counterfeit entry coefficient (online Table A.8). This analysis provides evidence for the presence of subtle price-signaling effects.

It is worth noting the positive and significant coefficients on the age variable in column (2). Together with the negative correlation between this age variable and the counterfeit entry dummy, this suggests that the longer an authentic brand remains on the market (greater age), the more information may be released to consumers, resulting in counterfeit entry imposing less influence

on short-run authentic prices. The role of information is again revealed.

V. THEORY FOUNDATIONS FOR THE FINDINGS

I build upon a vertical differentiation model (Gabszewicz and Thisse 1979, 1980; Shaked and Sutton 1983) with endogenous quality and other endogenous sunk costs (ESC) (Sutton 1991) to explain the effects of counterfeit entry, as observed in the empirical sections. In light of the finding that authentic producers chose different quality levels pre- and post-entry of counterfeiters, I introduce quality options for the authentic producer, who chooses quality according to its potential to yield higher profits. I first analyze price competition with a given quality (one per firm) under the Stackelberg game and then look at the *ex ante* choice of quality. I take asymmetric information into account by building on the literature of quality uncertainty. Asymmetric information is important in the context of counterfeits, as many news stories have revealed how consumers are conned into buying counterfeits.²¹ Price is the conventional signal for product quality, but Nelson (1974) points out the importance of advertisement as a form of nonprice signal. Milgrom and Roberts (1986) argue that prices are better signals for quality than nonprice signals (notably advertisements) unless repeated purchase is assumed. Despite the sophistication of these models, they only consider a monopolistic market and assume exogenous quality levels. Metrick and Zeckhauser (1999) use a simplified vertical differentiation framework to model competition under asymmetric information. However, their models are still confined to exogenous quality, and they derive equilibrium market shares in a price-pooling equilibrium, which is helpful for explaining certain sector equilibria but not applicable to most counterfeit markets. I argue that ESC can play an important role in the context of price rivalry and asymmetric information.

The stylized model as detailed in Qian (2006) predicts that the incumbent is induced to improve quality and raise prices after a new entry into the market, provided that the entrant's product quality is lower than a certain value relative to the quality

21. Chinese media reported a few years ago that a woman bought a pair of Nike shoes on sale, but only one month later they fell apart. Her happiness in catching the sale turned into indignation, and she sued the Nike branch in Shanghai. She then found out the pair she got was counterfeit.

of the incumbent's product. This can be linked to the findings by Aghion et al. (2005) that firms sometimes innovate to escape competition. However, their model does not reconcile with the fact that the authentic firms did not engage in innovation when there was already significant competition from all the other authentic producers. Innovation occurred and prices jumped only after these authentic brands were infringed upon by counterfeits. My model provides intuitive rationales. If the entrant's quality is very high relative to the highest quality an authentic producer would like to attain, then competition can still be fierce even if the incumbent upgrades quality. The incumbent may be better off engaging in limit-pricing strategies. It is only when an entrant's quality is below a certain threshold that the incumbent sees enough innovation gains to justify additional costs. This relative cost structure explains why certain sectors may protect their IPR differently or respond to entrants of varying quality levels differently.

In addition to spacing out on the quality ladder by innovating, the authentic quality upgrades also can serve as a signaling device to disentangle asymmetric information created by the entry of counterfeiters. This helps to explain the empirical findings that the sampled authentic companies mainly upgraded the shoe surface materials, pattern-press equipment and techniques, and other appearance-related features. The predictions also shed light on alternative signaling strategies. Even without a quality change, authentic producers may choose to set prices higher than the complete-information ones to signal their product's superior quality relative to that of the counterfeit. This signal is credible because counterfeiters may imitate only at the cost of losing some expert consumers, who would not buy counterfeits if their price were as high as the authentic price. In the theoretical framework, I convey this intuition when the constrained separating equilibrium prevails with the counterfeiter's Incentive Compatibility constraint binding. Under this circumstance, the constrained price is the profit-maximizing price for the authentic producer and can be considered a signaling device to separate authentic products from counterfeits. The detailed derivations in Qian (2006) clearly lay out the various parameters with price and quality dynamics.

The theoretical framework explains the use of enforcement, licensed company stores, and holograms as a means of countervailing counterfeiting. The intuition in a nutshell is as follows:

Tightened enforcement, either governmental or company-level, add to the risk of outlawing counterfeits and translate into a loss function for counterfeiters. The implementation of company stores and holograms is a nonprice signal for quality or authenticity. All these measures would widen the parameter range for the authentic producer to effectively separate herself from counterfeiters. In sum, my model enriches the set of instruments authentic producers can use to combat counterfeits, as observed in practice: quality, enforcement activities, price, vertical integration, and other signaling devices. Analyzing and abstracting from the managers' comments during the interviews, I find that the companies initially employed this set of strategies to disentangle the asymmetric information counterfeiters generated and to protect authenticity. These strategies are in essence also the ESC that helped sustain the authentic producers' competitive positions in the market, as some managers seem to have realized in retrospect.²²

All these aforementioned separating strategies push up authentic prices. The theoretical framework I propose here is, therefore, more complete in explaining the data than prior theories. Notably, Frank and Salkever (1997) conjecture that the entry of generic drugs lures away price-sensitive consumers and leaves behind a more inelastic demand curve for the brand-name drugs to opt for higher prices. However, this segmentation story cannot fully explain the empirical findings in my study. First, I observe that, unlike the generic-drug case, authentic quality rose after the entry of counterfeits. The price increases largely corresponded to the increases in costs to produce a higher quality product post-entry instead of merely to the change in demand.

22. During the interview, one company's manager said, "Starting from 1996, our company products have reduced using the wholesale market and we switched the channel to licensed retailing. We established a well-managed retail distribution system nationwide. This is one of the most effective ways to combat counterfeits, and it almost deterred counterfeiting." Another sales manager told me, "Counterfeits pushed us to establish our [licensed] stores. We have now discovered a new channel [of retailing] and we are now trying to build our personality into it." One brand-protection officer stated that "Once our licensed company stores were opened, we had an influx of customers come and purchase even at much higher prices than the old wholesale prices. Why? We later learned that many customers who bought counterfeit shoes felt very uncomfortable due to the inferior shoe materials, and some [counterfeits] even fell apart in public, which caused embarrassment. These customers undoubtedly would rather pay more to secure authentic purchases. In the end, we had higher mark-ups for our shoes and more resources to develop new models of higher quality, which certainly would charge further higher prices and bring in more profits. As the gap between our products and the counterfeits widens, customers like ours more. We call this a virtuous cycle."

Second, the segmentation model may be extended to suggest that authentic firms upgraded quality to target high-valuation consumers and gave up on consumers at the other end of the spectrum. However, if there was no asymmetric information about counterfeiting, it would be hard to understand why companies invested as much as they did, according to data, in self-enforcement and company retailing. Third, the negative associations of counterfeit sales with company age and lagged-year production costs are also difficult to resolve with models with complete information. Without asymmetric information, the more established (greater age) an authentic company was and the more higher-end products it held, the more abundant were the incentives for imitation and the larger was the low-end market to capture.²³

VI. CONCLUSION AND POLICY IMPLICATIONS

The economic impact of counterfeits is an urgent concern for business managers and policy makers. In this paper, I collect panel data on Chinese shoe companies to investigate the pricing and marketing impacts of counterfeit entry. In particular, I identify an exogenous change in government enforcement efforts to monitor footwear trademarks, occurring since 1995, and its differential impacts on counterfeit entry for branded companies with varying degrees of closeness with the government. Using the interaction between legislation change and the relationship proxy as an IV, I obtain empirical results that are robust across various specifications and consistent with theory predictions. To my knowledge, this study is the first attempt to combine theory and empirics to unveil the economics of counterfeits.

My analysis shows that counterfeit entry may exert downward pressure on prices by lowering expected quality in the short run. More importantly, however, counterfeit entry also stimulates

23. Finally, there are other notable differences between generic drugs and counterfeit products. First, the pharmaceutical market has complicated demand structures. Typically, doctors who prescribe medicine do not directly pay for it, and studies show that doctors tend to prescribe branded drugs even when generics are available. The health care system further makes drug demand inelastic. This is not the case in other industries. Second, the vast majority of Chinese consumers are very price-sensitive because their income level (in PPP terms) is lower than that of the Americans. The switch by these consumers to purchasing counterfeits thus lowers the possibility of charging a higher authentic price within the market. Third, generic drugs can be considered perfect substitutes for branded drugs in terms of functionality or quality, but this is not usually true with counterfeits. This last point goes back to the key difference between counterfeits and generic/imitative goods—the intent to deceive, which creates asymmetric information.

the original producer to offer a higher quality product at a higher price. This suggests innovation as a successful business strategy to mitigate copycat competition. In addition, counterfeit entry induces authentic companies to invest in self-enforcement activities and downstream vertical integration. I show that company-level enforcement activities and licensed company stores are ways to deter counterfeit entry or to reduce counterfeit sales. As a result of these costly differentiation strategies or ESC, authentic prices rise two and three years after counterfeit entry. It is also interesting to note empirically that companies with a worse relationship with the government experience more counterfeiting infringements. This alludes to another strategy against counterfeits, especially in countries like China: Foster a good relationship with the government.

My empirical findings have rich implications for IPR policies. Public enforcement efforts tend to outperform private ones in light of the fact that, after the loosening of government enforcement, authentic companies have to tolerate a higher level of counterfeiting even after implementing a set of business strategies against counterfeits.²⁴ The fact that authentic companies innovated after the government loosened enforcement indicates that stronger IPR is not a *necessary* condition for innovation. This finding, therefore, complements previous research on IPR, which shows that stronger IPR is not a *sufficient* condition for innovation (Scherer and Weisburst 1995; Sakakibara and Branstetter 1999; Bessen and Maskin 2000; Qian 2007). The findings point to the possibility of an optimal level of IPR protection (Gallini 1992; Qian 2007). This optimum may vary from sector to sector.

This study also lends general guidance to other possible public policy interventions that may be useful for combating counterfeits. Because both empirical findings²⁵ and theory illustrate the importance of information in ameliorating counterfeit impact, leveraging both the government's authority and the authentic companies' techniques of distinguishing product authenticity can be helpful in disseminating information and deterring counterfeits. In fact, starting from the year 2006, the Chinese government has initiated

24. The importance of government enforcement is also reflected through the fact that the seven safety sectors stayed clear of major accidents during those years when they were monitored under high priority. Speculating from this fact and the observation that the footwear industry witnessed innovation and more product variety, the reallocation of government resources in 1995 may have been wise.

25. See Section IV.B on the interpretation of company-age coefficients.

multiple television programs to broadcast new efforts and cases to combat counterfeiters and educate citizens on how to detect various counterfeits. The Chinese education system has also introduced IPR knowledge into textbooks to help the younger generation recognize that counterfeiting is illegal and shameful. These are efforts both to solve the asymmetric information problem and to eliminate the market for counterfeits in the long run.

This paper is a first step in exploring the complex impacts of counterfeits. Although the current analysis sheds light on a diverse set of business strategies and policies against counterfeiting, there may be others that are not explored here due to data limitations. Obtaining parallel and more detailed data from other sectors and countries remains an important challenge.

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REFERENCES

- Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith, and Peter Howitt, "Competition and Innovation: An Inverted U Relationship," *Quarterly Journal of Economics*, 120 (2005), 701–728.
- American Apparel and Footwear Association, *ShoeStats* (2005).
- Athey, Susan, and Armin Schmutzler, "Investment and Market Dominance," *RAND Journal of Economics*, 32 (2001), 1–26.
- Bagwell, Kyle, and M. H. Riordan, "High and Declining Prices Signal Product Quality," *American Economic Review*, 81 (1991), 224–239.
- Batra, G., Daniel Kaufmann, and Andrew H. W. Stone, *Investment Climate Around the World: Voices of the Firms from the World Business Environment Survey* (Washington, DC: World Bank Publications, 2003).
- Bessen, Jim, and Eric Maskin, "Sequential Innovation, Patents, and Imitation," Department of Economics, Massachusetts Institute of Technology Working Paper No. 00-01, 2000.
- Branstetter, Lee, Raymond Fisman, and Charles F. Foley, "Do Stronger Intellectual Property Rights Increase International Technology Transfer?" *Quarterly Journal of Economics*, 121 (2006), 321–349.
- Bresnahan, Timothy, "Empirical Methods for Industries with Market Power," in *Handbook of Industrial Organization*, Vol. II, Richard Schmalensee and Robert Willig, eds. (Amsterdam: Elsevier Science Publishers B.V., 1989).
- Curry, D. J., and P. C. Riesz, "Prices and Price/Quality Relationships: A Longitudinal Analysis," *Journal of Marketing*, 52 (1988), 36–51.
- Darby, M., and E. Karni, "Free Competition and the Optimal Amount of Fraud," *Journal of Law and Economics*, 16 (1973), 67–88.
- Ellickson, Paul, "Supermarkets as a Natural Oligopoly," Working Paper (<http://www.econ.duke.edu/paule/SupermarketsAsNO.pdf>), 2004.
- Fisman, Raymond, "Estimating the Value of Political Connections," *American Economic Review*, 91 (2001), 1095–1102.
- Frank, Richard G., and D. S. Salkever, "Generic Entry and the Pricing of Pharmaceuticals," *Journal of Economics & Management Strategy*, 6 (1997), 75–90.
- Gabszewicz, J., and J.-F. Thisse, "Price Competition, Quality and Income Disparities," *Journal of Economic Theory*, 20 (1979), 340–359.
- , "Entry (and Exit) in a Differentiated Industry," *Journal of Economic Theory*, 22 (1980), 327–338.

- Gallini, Nancy, "Patent Policy and Costly Imitation," *Rand Journal of Economics*, 23 (1992), 52–63.
- Gans, Joshua, David Hsu, and Scott Stern, "The Impact of Uncertain IP Rights on the Market for Ideas: Evidence from Patent Grant Delays," mimeo, Northwestern University, 2003.
- Jaffe, Adam, and Josh Lerner, *Innovation and Its Discontents* (Princeton, NJ: Princeton University Press, 2004).
- Khwaja, Asim I., and Atif Mian, "Do Lenders Favor Politically Connected Firms? Rent Provision in an Emerging Financial Market," *Quarterly Journal of Economics*, 120 (2005), 1371–1411.
- Kortum, Samuel, and Josh Lerner, "Stronger Protection or Technological Revolution: What Is behind the Recent Surge in Patenting?" *Carnegie-Rochester Conference Series on Public Policy*, 48 (1998), 247–304.
- Lanjouw, Jean, and Iain Cockburn, "New Pills for Poor People? Empirical Evidence after GATT," *World Development*, 29 (2001), 265–289.
- Levitt, Steve, and S. Venkatesh, "An Economic Analysis of a Drug-Selling Gang's Finances," *Quarterly Journal of Economics*, 115 (2000), 755–789.
- McCalman, Phillip, "Reaping What You Sow: An Empirical Analysis of International Patent Harmonization," *Journal of International Economics*, 55 (2001), 161–186.
- Metrick, Andrew, and Richard Zeckhauser, "Price versus Quantity: Market-Clearing Mechanisms When Consumers Are Uncertain about Quality," *Journal of Risk and Uncertainty*, 17 (1999), 215–242.
- Milgrom, Paul, and J. Roberts, "Price and Advertising Signals of Product Quality," *Journal of Political Economy*, 94 (1986), 796–821.
- Mobarak, A. M., and D. P. Purbasari, "Corrupt Protection for Sale to Firms: Evidence from Indonesia," Colorado University Working Paper, 2006.
- Moser, Petra, "How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World Fairs," NBER Working Paper 9909, 2003.
- Nelson, P., "Advertising as Information," *Journal of Political Economy*, 82 (1974), 729–754.
- Qian, Yi, "Pricing and Marketing Impacts of Entry by Counterfeiters and Imitators," Harvard University Working Paper, <http://www.nber.org/~yiqian/>, 2006.
- , "Do National Patent Laws Stimulate Domestic Innovation in a Global Patenting Environment? A Cross-Country Analysis of Pharmaceutical Patent Protection: 1978–2002," *Review of Economics and Statistics*, 89 (2007), 436–453.
- , "Are Intellectual Property Rights the Blossoming Rain?—Evidences from Innovations, Technology Transfer, and International Trade," forthcoming in *The Development Agenda: Global Intellectual Property and Developing Countries*, Neil Netanel, ed. (London: Oxford University Press, 2008).
- Qian, Yi, and Hui Xie, "Bayesian Inference in a Simultaneous Equation Model with Random Change-points," Northwestern University and University of Illinois Working Paper, 2007.
- Quality and Technology Supervision Bureau of China (also named "General Administration of Quality Supervision, Inspection and Quarantine"), *Year Books* (1991–2004).
- , *Guidelines for ISO Applications and Frequently Asked Questions* (2000).
- Sakakibara, Mariko, and Lee Branstetter, "Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Law Reforms," NBER Working Paper 7066, 1999.
- Scherer, Fred M., and S. Weisburst, "Economic Effects of Strengthening Pharmaceutical Patent Protection in Italy," *International Review of Industrial Property and Copyright Law* 26 (1995), 1009–1024.
- Shaked, A., and John Sutton, "Natural Oligopolies," *Econometrica*, 51 (1983), 1469–1483.
- Sutton, John, *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration* (Cambridge, MA: The MIT Press, 1991).
- World Customs Organization, "Counterfeiting Congress Calls for Public-Private Cooperation" (<http://www.wcoomd.org/ie/En/Press/press.html>), May 25, 2004.