ABSTRACT

China's rapid economic transformation over the past three decades has presented both opportunities and challenges to many U.S. businesses. Despite broad success in the China market, many U.S. companies have reported that two major factors—the infringement of their intellectual property rights (IPR) in China and China's indigenous innovation policies—have undermined their competitive positions. In response to a U.S. International Trade Commission (Commission) survey, many U.S. firms reported losses associated with IPR infringement in China, including losses in sales, profits, and license and royalty fees, as well as damage to brand names and product reputation. U.S. firms have reported losses associated with China's indigenous innovation policies as well, but have been mostly concerned about the future implications of these evolving policies in such areas as technical standards and preferential support to Chinese firms. In this second of two interconnected reports requested by the U.S. Senate Committee on Finance, the Commission was asked to estimate the effect of reported IPR infringement in China and China's indigenous innovation policies on the U.S. economy and employment, to the extent feasible. This report provides such estimates, on both an economy-wide and sectoral basis, using a combination of analytic tools and qualitative information.

ACRONYMS

3G	Third generation
4G	Fourth generation
AAFA	American Apparel & Footwear Association
ACAC	AVIC-1 Commercial Aircraft Co., Ltd.
ACAE	AVIC Commercial Aircraft Engine Company
AHRI	Air-Conditioning, Heating, and Refrigeration Institute
AM-CHAM	American Chamber of Commerce in China
AML	Anti-Monopoly Law
AMSC	American Superconductor
AVIC	Aviation Industry Corporation of China
BASCAP	Business Action to Stop Counterfeiting and Piracy
BEA	Bureau of Economic Analysis
BSA	Business Software Alliance
BYD	Build Your Dreams Automobile Co., Ltd.
CAAC	Civil Aviation Administration of China
CAFUC	Civil Aviation Flying University of China
CAS	Civil Aviation Supplies Holding Company
CBP	U.S. Customs and Border Protection
CCC	China Compulsory Certification
CDB	China Development Bank
CDC	Centers for Disease Control
CFM	CFM International
CGE	computable general equilibrium
COMAC	Commercial Aviation Company of China
Commerce	U.S. Department of Commerce
Commission	U.S. International Trade Commission
Committee	U.S. Senate Committee on Finance
EC	European Commission
ECAT	Emergency Committee for American Trade
EIU	Economist Intelligence Unit
EU	European Union
FDI	foreign direct investment
FTE	full-time equivalent
GAO	U.S. Government Accountability Office
GDP	gross domestic product
GE	General Electric Aviation
GM	General Motors
HNTE	high and new technology enterprise
HVACR	heating, ventilation, air-conditioning, and refrigeration
IACC	International AntiCounterfeiting Coalition
ICARHMA	International Council of Air-Conditioning, Refrigeration, and Heating Manufacturers Associations
ICC	International Chamber of Commerce
ICE	U.S. Immigration and Customs Enforcement
IDC	International Data Corporation
IFPI	International Federation of the Phonographic Industry
IFTA	Independent Film and Television Alliance
II	indigenous innovation
IIPA	International Intellectual Property Alliance
IIPI	International Intellectual Property Institute

ACRONYMS—*Continued*

INTL ITC	International Imaging Technology Council
IP	intellectual property
IPI	Institute for Policy Innovation
IPO	Intellectual Property Owners Association
IPR	intellectual property rights
ISO	International Organization for Standardization
IT	information technology
ITIC	Information Technology Industry Council
JAC	Jianghuai Automobile Co., Ltd.
JCCT	U.S.-China Joint Commission on Commerce and Trade
JV	joint venture
LCA	large civil aircraft
LTE	Long Term Evolution
MIC	Motorcycle Industry Council
MIIT	Ministry of Industry and Information Technology
MLP	Medium- to Long-Term Plan for the Development of Science and Technology
MLPS	Multi-Level Protection Scheme
MNC	multinational corporation
MOE	Ministry of Education
MOF	Ministry of Finance
MOST	Ministry of Science and Technology
MOU	memorandum of understanding
MPA	Motion Picture Association
MPAA	Motion Picture Association of America
MW	megawatts
NAICS	North American Industry Classification System
NAM	National Association of Manufacturers
NDRC	National Development and Reform Commission
NEV	new energy vehicle
NIIP	national indigenous innovation product
OECD	Organisation for Economic Co-operation and Development
OEM	original equipment manufacturer
P2P	peer-to-peer
R&D	research and development
RIMSII	Regional Input-Output Modeling System, U.S. Department of Commerce
SAC	Standardization Administration of China
SAIC	Shanghai Automotive Industry Corporation
SAR	special administrative region
SASAC	State-owned Assets Supervision and Administration Commission of the State Council
SIIA	Software & Information Industry Association
SME	small and medium-sized enterprise
SOE	state-owned enterprise
TD-SCDMA	Time Division Synchronous Code Division Multiple Access
TIA	Telecommunications Industry Association
TRAB	Trademark Review and Adjudication Board
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights (WTO)

ACRONYMS—*Continued*

UK	United Kingdom
USCBC	U.S.-China Business Council
USCIB	U.S. Council for International Business
USDOC	U.S. Department of Commerce
USITC	U.S. International Trade Commission
USITO	U.S. Information Technology Office
USPTO	U.S. Patent and Trademark Office
USTR	U.S. Trade Representative
VAT	Value-added tax
WAPI	WLAN Authentication and Privacy Infrastructure
WCDMA	Wideband Code Division Multiple Access
WFE	wholly owned foreign entities
Wi-Fi	Trademark of the Wi-Fi Alliance, referring to IEEE 802.11 wireless networking standards
WLAN	wireless local area network
WTO	World Trade Organization

CHAPTER 2
Trends and Characteristics of Chinese IPR Infringement and Indigenous Innovation Policies: External Sources

This chapter presents publicly available data and information that shed light on the trends and characteristics of Chinese IPR infringement. It begins with the presentation of seizure statistics that illustrate what is known about counterfeit trade intercepted at the U.S. border. These data, and comparable statistics from the European Union (EU) and Japan, show that China is the primary source of infringing goods seized by customs authorities. The chapter then describes the growing role of the Internet in the sale and distribution of IPR-infringing goods from China. The chapter next identifies approaches to measuring the effects of Chinese IPR infringement that provide direction for the analysis carried out in later chapters. The chapter ends with a targeted review of the literature on China's new and evolving indigenous innovation policies.

IPR Seizure Statistics

Because infringing activity is illegal and cannot be comprehensively detected, it is impossible to fully assess the true magnitude of IPR-infringing trade originating from China or any other country. However, data on IPR-related seizures in the United States and other countries shed light on the growing problem, the types of products seized, and the role of China in this illicit trade.

U.S. Seizures of Counterfeit Goods from China

U.S. Customs and Border Protection (CBP) and U.S. Immigration and Customs Enforcement (ICE) are responsible for seizing goods in the United States that are counterfeited (trademark infringing) and pirated (copyright infringing).[1] According to CBP data, seizures of counterfeit and pirated products have risen by over 360 percent, from $40.6 million in calendar year 1995 to $187.3 million in calendar year 2010 (figure 2.1.A).[2] The value of CBP seizures has increased at a much faster rate than the value of

[1]Most seizures are for trademark infringement, not copyright infringement. USITC, *China IPR and Indigenous Innovation 1,* 2010, 2-10. The statistics reflect seizures by both ICE and CBP that are aggregated and published by CBP. As noted later in this chapter, CBP statistics likely underrepresent the amount of IPR-infringing goods entering the United States, and seizures may be skewed toward types of goods that are easier to intercept. The data from 1995 to 2010 are subject to interyear variations, but provide perspective over time.

[2]CBP staff, Intellectual Property Rights Seizure Statistics, e-mail message to USITC staff, January 25, 2011. Value data are based on the domestic value of the goods as determined by adding the cost of manufacturing goods in a foreign country to the costs of shipping, insurance and customs duties to enter the United States. Unless specifically noted, CBP seizure statistics in this report are presented for calendar years.

imports in the product categories in which most seizures occurred.[3] However, since the underlying magnitude of illicit IPR-infringing trade is unknown, the implications of higher seizures remain unclear. Increased seizures could be a result of increased supply of IPR infringed goods, increased government resources to interdict these products, and/or efficiency gains that CBP and ICE may have made in detecting infringing products.[4]

China's Role in Counterfeit Goods Trade

China has grown to become the primary source of counterfeited products in the United States (figure 2.1.A). According to CBP data, Chinese-sourced products, which represented 12.5 percent of the value of total seizures in 1995, rose to 73.6 percent in 2005 before falling to 59.3 percent in 2010 (figure 2.1.B); this decline is a recent phenomenon.[5] By contrast, the number of seizures involving IPR-infringing goods from China continued its rise, from 6.0 percent of the total in calendar year 1995 to 53 percent in 2010, while the number of seizures from other countries (excluding Hong Kong) fell from 90.7 percent in 1995 to 28.2 percent in 2010 (figure 2.1.C).

Seizures of counterfeits shipped from Hong Kong, the second-highest source of U.S. IPR seizures in 2010, grew during 2005–10 as well (figure 2.1.A). Due to the size and efficiency of its port operations, Hong Kong is a popular port for the transshipment of counterfeit goods. Hong Kong officials note that because Hong Kong manufactures few products, counterfeit goods seized from Hong Kong are likely manufactured in China and other countries and simply transshipped through Hong Kong.[6] Most recently, the official statistics from Hong Kong show that the number of transboundary seizures of IPR-infringing goods from China that were destined for the United States increased by over 50 percent from January 2009 to November 2010.[7]

[3]Imports of consumer goods, computers and accessories, and electrical and telecommunications equipment grew by 150 percent during this same period. These categories include imported goods that are the most likely to be counterfeited, such as footwear, apparel, computer goods, pharmaceuticals, etc., according to CBP data. U.S. Census Bureau, FTD 900 U.S. International Trade in Goods and Services, June 20, 1996, exhibit 7; U.S. Census Bureau, FTD 900 U.S. International Trade in Goods and Services, February 11, 2011, exhibit 8.

[4]GAO, "Intellectual Property," 2010, 16.

[5]When calculated by fiscal year (FY), China accounted for about 79–81 percent of the value of seizures in FY 2006–09, before falling to 66 percent of the value of seizures in FY 2010. CBP, IPR National Targeting and Analysis Group, "Department of Homeland Security IPR Seizures," January 2011; CBP, "CBP, ICE Release Report on 2010 Counterfeit Seizures," March 16, 2011. Differences in fiscal year and calendar year data result from the number of seizures and their estimated values in the two different time periods.

[6]Government officials, interviews by USITC staff, Hong Kong, January 3, 2011.

[7]Official statistics of Hong Kong Customs and Excise, January 4, 2011.

Types of Counterfeits Seized in the United States

In 2010, counterfeit footwear from all sources was the top product seized by CBP/ICE in the United States, accounting for $38.8 million or 20.7 percent of the value of all seizures (figure 2.1.D). Seizures of both footwear and consumer electronics, the second-largest product category seized in 2010 ($34.8 million, or 18.6 percent of the value of seizures), have grown rapidly since 2005.[8] Seizures of these products supplanted wearing apparel (8.8 percent of the value of seizures) and handbags and wallets (7.5 percent of the value of seizures) as the top products seized in 2010. IPR seizures of media and pharmaceuticals are also growing in importance. Other major products seized in recent years include cigarettes, watches, computer hardware, jewelry, and toys and electronic games.

China's dominance as a source of IPR seizures is most pronounced in the top four product categories of seizures. In 2010, China's share of the value of these U.S. IPR seizures was 61.6 percent for handbags and wallets, 63.8 percent for consumer electronics, 74.5 percent for wearing apparel, and 90.2 percent for footwear (figure 2.1.E). One industry source estimates that 80 percent of the global counterfeits of its athletic shoes are made in China.[9] In contrast, the value of seizures of pharmaceutical and media products from China has been less than the value of these seizures from other countries.

Other Countries' Seizures of Counterfeits from China

Customs seizure statistics from Japan and the EU also show that goods seized for IPR violations come predominantly from China, and that their number has been increasing in recent years. China is the major source of counterfeit imports of consumer goods into these regions, particularly of footwear, apparel, and handbags. However, seizures of goods such as consumer electronics and computers sourced from China play a smaller role in these countries than in the United States.[10]

The European Commission (EC) reports IPR seizures according to the number of seizures (cases) and the number and types of intercepted articles. The EC reported in 2010 that cases involving seized goods declined between 2008 and 2009 for the first time in recent years, but such cases still remained high, given the downturn in the global economy and in EU trade.[11] In 2009, China accounted for 64.4 percent of the number of IPR-infringing articles seized in the EU.[12] The top IPR-infringing products from China, in terms of number of articles, were tobacco products, clothing and accessories, footwear, and body care items.[13]

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[8]CBP and ICE noted that a relatively large seizure ($2.3 million) of computer hardware occurred in FY 2010. CBP and ICE, *CBP, ICE, Intellectual Property Rights Fiscal 2010 Seizure Statistics—Final Report*, January 2011, 6 (released March 16, 2011).

[9]Industry representative, telephone interview by USITC staff, July 13, 2010.

[10]The types of products seized may also reflect the manner of reporting. For example, the EU reports the number of cases and articles, but no values. Japan reports the types of products seized from all sources but not for individual countries. However, in Japan, consumer electronics and computers are not among the top products seized.

[11]EC, Taxation and Customs Union, *Report on EU Customs Enforcement*, 2010, 2.

[12]Ibid.

[13]Ibid., 26–27.

Japan reported that the number of its IPR cases grew by 189 percent during 2004–08; China accounted for 81.5 percent of IPR seizure cases and 53.9 percent of the value of seized goods in 2008.[14] For Japan, the 540 percent rise in the number of cases involving seized articles from China far outpaced the increase in total seizure cases during this period.[15] Japan does not report the type of products that come from a specific country. However, the top products from all countries that were seized for IPR infringement in Japan in 2008 included handbags, which accounted for 61 percent of IPR cases, followed by key cases, watches, apparel, belts, and shoes.[16] Given the importance of China in the value and number of IPR seizures in Japan, many are likely to be sourced from China. A comparison of available data for the United States, the EU, and Japan is provided in table 2.1.

TABLE 2.1 Comparison of available IPR seizure statistics—United States, EU, and Japan

	United States (2010)	EU (2009)[a]	Japan (2008)
Reporting agency	Department of Homeland Security, Customs and Border Protection	European Commission, Taxation and Customs Union	Ministry of Finance, Customs & Tariff Bureau
Total seizures			
Value (million $)	187.3	([b])	[c]199.2
Articles (number)	([b])	117,959,258	944,000
Cases (number)	21,321	43,472	26,415
Top source of seizures	China	China	China
Chinese-sourced seizures			
Value (%)	59.3	([b])	53.9
Articles (%)	([b])	64.4	74.1
Cases (%)	52.9	([b])	81.5
Top products seized from China	Footwear, consumer electronics, wearing apparel, handbags and wallets (by value)	Tobacco products, clothing and accessories, footwear, and body care items (by number of articles)	([b])

Sources: EC, Taxation and Customs Union, *Report on EU Customs Enforcement,* 2010; Government of Japan, *IPR Protection: The Role of Japan*, 2009; CBP, IPR Seizure Statistics, e-mail message to USITC staff, January 2011; Council of Economic Advisors (CEA), *2011 Economic Report of the President*, 2011, table B110.

[a]Years in parentheses denote latest year for which data were available.
[b]Not available.
[c]20.6 billion yen converted at a rate of 103.39 yen per dollar in 2008.

[14]Government of Japan, *IPR Protection: The Role of Japan*, 2009, 21, 24, and 27. Japan reported the amount of IPR-related seizures by value for 2008 only and did not report the valuation procedure, e.g., domestic value or manufacturer suggested retail price.
[15]Ibid., 24.
[16]Government of Japan, *IPR Protection: The Role of Japan*, 2009, 22.

Factors Facilitating Counterfeiting

An important factor facilitating the growth in IPR violations has been globalization and the spread of technology that enables simple and low-cost duplication of popular products, as well as packaging and labeling.[17] As U.S. and other manufacturers moved their manufacturing operations abroad to Asia and other regions, opportunities for counterfeiting increased from the standpoint of both the production process and the import supply chain. The ability to duplicate products and packaging at low cost, coupled with opportunities to make high margins on both luxury goods and products consumed every day, makes counterfeiting an extremely attractive operation.[18] The footwear industry provides an example of how globalization and investments by multinational corporations abroad helped to expand counterfeit industries in China (box 2.1).

Most recently, a growing share of the sales and distribution of counterfeits has reportedly originated from the Internet.[19] Counterfeits are purchased online and shipped to the United States and other markets by postal and express mail services, often in relatively small quantities that are difficult to detect.[20] Seizure statistics from the United States show an increasing share of seizures from air express and postal shipments and a decline in the share of seizures from commercial cargo shipments (figure 2.1.F).[21] The EU likewise reports an increasing number of seizures from postal and air express mail shipments.[22]

[17]Masters, "Counterfeit LAN Technology," April 2010, 1.

[18]Industry representatives, interviews by USITC staff, Shanghai, January 12–14, 2011.

[19]IACC, written submission to the USTR, February 15, 2011, 13; industry representatives, interviews by USITC staff, Washington, DC, November 3, 2010, and March 1, 2011.

[20]Brener, "Enforcement of IPR: Targeting Counterfeit and Piratical Goods," July 14, 2010; government representative, telephone interview by USITC staff, July 22, 2010; government representative, interview by USITC staff, Arlington, VA, December 8, 2010; industry representative, telephone interview by USITC staff, February 8, 2011.

[21]Commercial shipments include cargo shipments via air, truck, rail, and sea. The "all other" mode of conveyance includes seizures away from ports of entry, and these also grew from 2005 to 2010. Government official, e-mail to USITC staff, February 8, 2010. Despite this delineation, CPB and ICE note that the bulk of postal and air express shipments are commercial in nature. CBP and ICE, *CBP, ICE, Intellectual Property Rights Fiscal 2010 Seizure Statistics*, January 2011, 11.

[22]EC, Taxation and Customs Union, *Report on EU Customs Enforcement*, 2010, 27.

This pattern also holds true for counterfeit goods from China. In 2000, counterfeit goods delivered through air express and postal shipments accounted for less than 3 percent of all China seizures (by value); however, by 2010, they represented 17 percent of seizures.[23] In Japan, 33 percent of the counterfeits seized in 2009 were delivered by international post, while in the first half of 2010 this figure increased to 79 percent, with 90 percent of such deliveries coming from China.[24]

Reportedly, growth in IPR-infringing products also may be attributable to the activities of organized crime groups that smuggle and distribute counterfeit merchandise for profit. According to ICE, in many cases international organized crime groups use profits from selling counterfeit goods to bankroll other criminal activities, such as drug and weapons trafficking.[25] While many of these organized crime groups do not appear to be located in China, they reportedly are utilizing the Internet and other supply chains to connect to Web sites and counterfeiting activity in China.[26]

Limitations of Seizure Data

In sum, CBP data show that IPR-infringing seizures from China have been increasing; however, more information is needed to quantify the overall extent of IPR infringement and its effects on the U.S. economy for a number of reasons. First, the CBP data most likely underrepresent the degree of IPR infringement, in part because trademarks generally must be recorded with CBP to be enforceable at the border, and most trademark owners do not take this step.[27] Only about 1 percent of active trademarks in the United States have been recorded with CBP. Moreover, most CBP seizures are of products that are readily identifiable, whereas many infringing products (e.g., semiconductors or other components) may be difficult to identify.[28]

Second, seizures are dependent on CBP and ICE enforcement practices, including tips about potential shipments, whether or not government agencies are targeting certain products, and the size of the shipments seized.[29] For example, CBP targets IPR-infringing products that not only affect innovation but also pose threats to U.S. consumers, such as counterfeit personal care items and pharmaceuticals, exploding devices, and products that could pose a threat to infrastructure.[30] Additionally, there is no information on the extent of IPR-infringing shipments that are not seized—thus knowledge of the extent of the

[23]CBP, IPR Seizure Statistics, e-mail message to USITC staff, January 25, 2011. IPR seizures of express consignments and postal service shipments from Hong Kong and other countries also increased from 2000 to 2010. IPR seizures of goods shipped by these modes increased from 12 percent of seizures to 36 percent of seizures (by value) for countries excluding China.

[24]IACC, written submission to the USTR, February 15, 2011, 15–16.

[25]CBP, "Over 4.4 Million Counterfeit Marlboro Cigarettes Seized," January 14, 2011; ICE, "ICE Seizes $1.4 Million in Counterfeit DVDs," October 20, 2009; Chen, "Smoking Dragon, Royal Charm," October 20, 2008; government official, interview by USITC staff, Arlington, VA, December 8, 2010. Industry representatives have noted, for example, close ties between organized crime and smugglers of counterfeit cigarettes. Industry representative, interview by USITC staff, Washington, DC, March 16, 2011.

[26]Government official, interview by USITC staff, Arlington, VA, December 8, 2010.

[27]USITC, *China IPR and Indigenous Innovation 1*, 2010, xvi.

[28] Ibid.

[29]Government official, interview by USITC staff, Arlington, VA, December 8, 2010. Additionally, industry sources noted that seizures of counterfeit cigarettes were high in certain years owing to broader Federal Bureau of Investigations (FBI) operations involving guns, counterfeit currency, drugs, and counterfeit cigarettes smuggled from China. Industry representative, interview by USITC staff, March 16, 2011.

[30]CBP, "Overview of IPR Enforcement," n.d. (accessed March 17, 2011).

problem is incomplete.[31] Although U.S. seizure statistics are generally considered more comprehensive than those for many countries, CBP and ICE, like comparable agencies in other countries, face resource constraints that limit the number of inspections and seizures they can carry out.[32] However, the seizure data do suggest the growth of the problem as well as China's increasing role in counterfeit trade.

Third, data on IPR-infringing seizures in the United States do not provide information about the further problem of production and counterfeit sales in China itself, which may displace U.S. exports as well as sales by U.S. companies manufacturing in China for the Chinese and other markets.[33]

IPR Infringement in China and the Role of the Internet

The growing popularity of online marketplaces presents significant opportunities and challenges for U.S. firms. With the global reach of the Internet, sellers can instantaneously reach customers around the world; however, customers also can be more easily induced to purchase counterfeit products. Unlike a street vendor who plainly operates outside of normal channels, online suppliers of counterfeits are often indistinguishable from legitimate sources. Price differences online between legitimate products and counterfeits may not be large enough to alert the consumer that the product is counterfeit rather than just a good deal. Moreover, Web sites offering infringing goods often mimic legitimate sites, from page layouts to the prominent display of brand names.[34]

Besides facilitating the movement of physical goods, the Internet also enables consumers to locate infringing digital content, such as movies and music for download and consumption. Government detection of infringing digital goods, which are delivered through decentralized computer networks and involve no physical movement of products, is enormously challenging. No U.S. government agency systematically collects or tracks data on the size or scope of digital piracy.[35]

These problems are not limited to China. Currently, the majority of Web sites offering infringing goods and digital content are hosted in the United States and Europe; the availability of reliable high-speed infrastructure is an important factor in choosing host locations.[36] The rapid growth of China's Internet population and infrastructure thus raise concerns for IP-intensive firms. China has the largest population of Internet users in the world. As of December 2010, China had an estimated 457 million Internet users (compared to approximately 223 million in the United States). Moreover, approximately 90 percent of Chinese users access the Internet through high-speed broadband

[31]USITC, *China IPR and Indigenous Innovation 1*, 2010, 2-11. The OECD also noted that customs agencies across countries have limited resources to screen all shipments for IPR-infringing goods. OECD, *The Economic Impact of Counterfeiting and Piracy*, 2008, 16.

[32]USITC, *China IPR and Indigenous Innovation 1*, 2010, 2-10.

[33]Industry representatives, interviews by USITC, Shanghai, January 12–14, 2011.

[34]Industry representative, interview by USITC staff, Washington, D.C., November 3, 2010; industry representative, telephone interview by USITC staff, February 9, 2011; GIPC, "Online Piracy and Counterfeiting Overview," March 2010, 3–4.

[35]GAO, "Intellectual Property," April 2010, 8.

[36]MarkMonitor, "Traffic Report," January 2011, 4.

interconnections, enabling them to rapidly download large files, such as movies, television shows, and video games.[37]

Counterfeiting and Piracy on the Internet

A variety of mechanisms enable the online sale of infringing physical goods and the piracy of copyrighted digital content such as music and movies. Descriptions of these mechanisms appear below, along with examples, where available, of the size and scope of such activities associated with China.

Online Marketplaces for Counterfeits

Chinese counterfeits are offered in vast quantities on online marketplace sites. Online counterfeiters in China reportedly operate through thousands of separate platforms and domain names, auction sites, and trade portals, which offer a wide variety of infringing products and provide discounts for large purchases (table 2.2).[38] Moreover, products from these Chinese marketplace sites frequently show up for sale on eBay, Amazon marketplace, Craigslist, and other sites, where unsuspecting customers may believe they have found a discounted legal product rather than a fake.[39]

TABLE 2.2 Examples of Chinese online marketplaces reportedly associated with infringing products

Alibaba.com	Made-cigarettes.com
Aliexpress.com	Olymal.com
DHgate.com	Taobao.com
Diytrade.com	Tradekey.com
Globalsources.com	Trademe.com
iOffer.com	Tradetang.com
LinkChina.com	Tradett.com
Made-in-China.com	

Sources: USTR, "Notorious Markets Review," Feb. 28, 2011; IACC, written submission to USTR, Feb. 15, 2011; Beachbody, written submission to USTR, Feb. 15, 2011; SIIA, "China Marketplace Summary," 2010; industry representative, e-mail message to USITC staff, March 22, 2011; BSA, "Software Piracy on the Internet," October 2009, 8; and IIPA, written submission to the USITC, July 9, 2010, 12.

IPR owners use notice and takedown procedures in attempting to address online infringement in China. Under these procedures, the owner sends notice of the infringing product or content to the Internet Service Provider and requests that the listing be taken down. If the service provider does so immediately, it may have a "safe harbor" from an infringement claim under applicable Chinese regulations.[40] However, when the process is not effectively structured—for example, when repeat offenders are able to simply repost

[37]International Intellectual Property Alliance (IIPA), Special 301: China, 2011, 60; IIPA, written submission to the USITC, June 3, 2010, 11.

[38]IACC, written submission to USTR, February 15, 2011, 19; SIIA, "China Marketplace Summary," 2010; BSA, "Software Piracy on the Internet," October 2009, 8; IIPA, written submission to the USITC, July 9, 2010, 12. As part of a Special Campaign to Combat IPR infringement begun in October of 2010 and continuing through June 2011, China reportedly has pursued increased enforcement activities against counterfeit and pirated materials offered online. *Xinhua News*, "China Cracks Down," April 8, 2011.

[39]SIIA, "China Marketplace Summary," 2010; industry representative, interview by USITC staff, November 3, 2010; Beachbody, written submission to USTR, Feb. 15, 2011; industry representative, telephone interview by USITC staff, February 9, 2011.

[40]Song, "A Comparative Copyright Analysis," July 2010.

TABLE 2.3 Digital piracy mechanisms with Chinese examples

Mechanisms	Definition and Chinese examples
P2P networks	P2P technology connects individual computer users to each other directly, without a central point of management or server-hosting content. Users download and install a P2P client application that enables them to search for and download files on other users' computers. Popular P2P protocols include BitTorrent. Xunlei, BTPig, Kugou or Kugoo, and other Chinese-based services provide P2P client software and an indexed platform to assist in large-scale illegal file sharing. Their activities particularly affect music, audiovisual, business and entertainment software, and digitized books and journals.
Cyberlockers	These sites allow users to copy digital media, such as music, movies, and other content, onto a site operator's server for the user to access at any time. The site generates a link to download the content, which users may stream or share with others in forums, blogs and Web sites. The movie and recording industries report that more than 100 major cyberlocker sites operate from China, including Rayfile, Namipan, and 91files.
Streaming sites	These sites enable visitors to access digital content online by streaming. Unlike cyberlockers, streaming sites do not transfer files to users. The site may also allow users to submit their own content (this is known as UGC—user-generated content). China-based TVAnts reportedly illegally streams live U.S. professional sports event, and profits from the stream by selling advertising on its media player. Packages of pay-TV channels, including the Cartoon Network, CNN, Discovery Channel, Disney Channel, ESPN, and HBO, reportedly are regularly available for streaming in China.
Deep linking	Deep linking occurs when a Web site displays a link to content other than the home page of another Web site. The music industry reports that Baidu, Sogou, Gougou, and many others offer deep links to thousands of infringing song files and obtain substantial advertising revenues from these services.

Sources: BSA, "Software Piracy on the Internet," October 2009, 8; IIPA, written submission to the USITC, July 9, 2010, 12; IIPA, written submission to the USTR, February 15, 2011; Sports Coalition, written submission to the USTR, February 18, 2010; Cable and Satellite Broadcast Association of Asia, written submission to the USTR, February 18, 2010.

Monitoring of digital piracy activities provides a sense of the size and scope of online infringement. However, this monitoring generally requires sophisticated and costly techniques; those firms that can afford to do so often hire experts. The online monitoring agency DtecNet, for example, conducts global scanning of P2P infringements of video games, movies, and TV shows for firms in these copyright industries. In 2010, it ranked China the world's second heaviest offender in terms of digital piracy (after Italy) with a total of 70.1 million downloads, of which about 66 percent were movies (46.2 million downloads), 24 percent were video games (16.8 million downloads), and 10 percent (7 million downloads) were TV shows.[46]

IPR Infringement and the Internet: Information Gaps

There are many information gaps with respect to online infringement that make it difficult to quantify the overall size and scope of the problem across industry sectors. First, countless times each day, files are exchanged and Web sites offering counterfeits are established. As a result, estimates of online activity tend to be small snapshots of the total, especially given that the activity being tracked is illegal and meant to avoid official

[46]DtecNet, "China P2P Infringements in 2010," January 7, 2011, 2.

detection. Interviews with industry representatives confirm this challenge, as all stated that they only had the ability and/or resources to track a small fraction of the infringement of their products occurring online.[47]

Second, measuring the size and scope of the problem and its effect on the U.S. economy are two substantially different tasks. Inferences about the effect of infringement on the economy often rely on assumptions about the substitution rate—the rate at which consumers who access infringing material would have bought a legitimate copy had the pirated version not been available. This rate is difficult to calculate, since it depends on predicting consumer behavior. Rates also vary by country, by demographic factors such as age or income, and by product type. As further discussed below, the calculation of substitution rates introduces substantial uncertainty into the determination of the effects on the U.S. economy of IPR infringement.

Third, the interaction between market access restrictions in China and infringement also makes it extremely difficult to identify the effects of IPR infringement on U.S. firms. Significant market access restrictions for movies, music, and other content in China directly limit the legitimate supply of these products and thereby increase the demand for pirated content, reportedly wreaking havoc on U.S. firms' business models in China.[48] The interaction between market access restrictions and piracy in the sound recording industry is explored in box 2.4.

[47]Industry representatives, telephone interviews by USITC staff, December 15, 2010–February 11, 2011.

[48]Independent film producers report, for example, that they are unable to raise money to finance the production and distribution of films in China because market access restrictions and high piracy rates undermine virtually all legitimate market opportunities, and also make it difficult to quantify the value of the lost market. Industry representative, telephone interview by USITC staff, November 3, 2010; IFTA, written comments on ITA review of government programs, October 29, 2010.

Approaches to Measuring IPR Infringement and Indigenous Innovation

This review builds upon the findings reported in the first USITC report on the empirical literature studying the costs of IPR infringement to the United States and worldwide. This section focuses on a narrower set of studies that provide direction for the analysis in later chapters and situate the approach used in this report in the broader literature. This chapter also identifies links that have been made between IPR protection and employment, and describes the limited existing literature on China's recent and rapidly evolving indigenous innovation policies.

The Costs of IPR Infringement

Studies have examined the costs of IPR infringement on various dimensions of the global economy, as well as on the United States and on other economies separately. However, no studies to date have comprehensively examined the impact of Chinese infringement on the U.S. economy, the focus of this report, nor have they used a computable general equilibrium (CGE) framework to assess the potential economic impact on one country (the United States) of better IPR protection in another (China).

Global Effects of Global Infringement

One of the most comprehensive studies of global effects from IPR infringement was published by the OECD in 2008.[49] The OECD relied on global customs seizure data to estimate the worldwide value of infringing trade (up to $250 billion for 2007) and the share of counterfeit and pirated goods in world trade (1.9 percent for 2007). As noted in the first USITC report, assumptions underlying these estimates are problematic.[50]

Most recently, Frontier Economics, working on behalf of the International Chamber of Commerce (ICC)/Business Action to Stop Counterfeiting and Piracy (BASCAP), updated the OECD analysis to include seizure data for 2008.[51] Based on this seizure data and additional analyses, the report estimates a range of $455–$650 billion in worldwide sales of counterfeit and pirated products, comprising $285–$360 billion in internationally traded infringing products; $140–$215 billion in domestically produced and consumed infringing products; and $30–$75 billion in digitally pirated products.

A number of earlier studies of the global effects of IPR infringement have been criticized by the U.S. Government Accountability Office (GAO) and researchers in the field. GAO finds, for example, that various estimates sourced to government agencies could not be traced back to an original data source or methodology.[52] Researchers identify industry

[49]OECD, *The Economic Impact of Counterfeiting and Piracy*, 2008; OECD, *Magnitude of Counterfeiting and Piracy*, 2009. This study is identified in table 1.1.

[50]USITC, *China IPR and Indigenous Innovation 1*, 2010, 2-11. Despite the drawbacks, the Commission has used the seizure statistics here for three limited ends: providing insight into what types of goods are commonly seized, discerning trends, and identifying sectors that experience IPR infringement in order to select a representative sample of IP-intensive industries for our survey.

[51]Frontier Economics, "Estimating the Global Economic and Social Impacts of Counterfeiting and Piracy," February 2011. This study is identified in table 1.1.

[52]GAO, *Intellectual Property*, 2010, 18–20.

studies that are not transparent in their sources or underlying assumptions.[53] In addition, when they can be identified, many key assumptions that drive estimates involve substitution rates and the value assigned to the counterfeits, which can range from the very low price of a fake on the street to the much higher retail price of the legitimate good.

Effects on U.S. Economy of Global Infringement

The USITC's 1988 study of foreign IPR protection examined impacts of IPR infringement (worldwide) on the entire U.S. economy.[54] Limitations of that study included a relatively small sample of respondents, the self-reported nature of the empirical loss estimates, and the difficulty in extrapolating beyond the respondents to the entire economy. For the current report, the Commission produced a larger and more representative sample of the U.S. economy, and built into the questionnaire a means of checking the validity of loss estimates reported by respondents.

Sector-Specific Studies of IPR Infringement

In examining losses in particular IPR-intensive sectors, a crucial issue is the extent to which sales of infringing products translate into lost sales of legal products. Counterfeit and pirated products are often not perceived as perfect substitutes for the legitimate versions, and even when they are, consumers would not necessarily replace cheaper infringing goods with legal items on a one-for-one basis. A 2009 study addresses the difficulties involved in estimating these parameters and discusses empirical research that has attempted to shed light on the substitutability and demand elasticity of IPR products.[55]

The literature related to the infringement of digital goods, for example, reveals a fairly wide range of substitution rates. Substitution rates generally are reported to be higher for movies than for music, with the research suggesting that infringing sales displace legal ones at rates between 45 and 67 percent.[56] However, most studies focus on Western consumers; little is known about whether the rates are similar in China. One of the few exceptions is a 2010 study that found that each unpaid movie viewing displaced only 0.14 paid viewings among the Chinese college students surveyed and approximately zero displacement among the general Internet users surveyed.[57] The music industry has been studied more extensively, with some researchers finding music substitution rates for Western consumers that range between 15 and 20 percent.[58]

Studies are not always transparent in their analysis of substitution rates. One conducted on behalf of the Motion Picture Association (MPA) by LEK Consulting estimated global

[53]Chaudhry and Zimmerman, *The Economics of Counterfeit Trade*, 2009, 11–17.

[54]USITC, Foreign Protection of Intellectual Property Rights, 1988, appendix H. This study is identified in table 1.1.

[55]Watt, "An Empirical Analysis of the Economics of Copyright," 2009, 65–99.

[56]Frontier Economics, "Estimating the Global Economic and Social Impacts of Counterfeiting and Piracy," 32, February 2011; Rob and Waldfogel, "Piracy on the Silver Screen," 2007.

[57]Bai and Waldfogel, "Movie Piracy and Sales Displacement," 2010; see also Martikainen, "Does File-Sharing Reduce DVD Sales?" 2010; Smith and Telang, "Competing with Free," 2009.

[58]Frontier Economics, "Estimating the Global Economic and Social Impacts of Counterfeiting and Piracy," 28-29, February 2011; Waldfogel, "Music File Sharing in the iTunes Era," 2009, 8 (noting a range between 0 and 30 percent).

losses to MPA members due to Internet and hard-goods piracy were $6.1 billion in 2005, with piracy rates the highest in China (over a 90 percent potential market loss), resulting in an estimated $244 million in lost revenue there.[59] However, because only a summary of the study has been publicly released, the substitution rates applied, survey methodology, and manner of calculating losses are not clear.

The Business Software Alliance (BSA) and International Data Corporation (IDC) publish annual piracy estimates for business software based on country surveys. The most recent of these found that China had an estimated 79 percent piracy rate in 2009, with the commercial value of unlicensed software in China estimated at approximately $7.6 billion.[60] The report uses the term "commercial value of pirated software" in place of the previous term "losses," recognizing that not all pirated software users would obtain a legal copy at the average market price if the pirated software were not available.

Studies of Other Countries

Two consulting firms (TERA Consultants and Frontier Economics), both working on behalf of ICC/BASCAP, published reports quantifying employment and other effects of piracy beyond the United States.[61] TERA Consultants' report estimated the effect of piracy on EU employment for the "most at risk" creative core industries and supporting noncore industries, based on Eurostat data and country-specific and industry-specific survey results.[62] The study found a total of €9.9 billion ($12.6 billion) in retail losses for the creative industries in the EU, with 186,400 direct and indirect job losses.[63] Frontier Economics studied four at-risk industries: luxury goods, food and beverage products, pharmaceuticals, and software. The study estimated that the UK government lost €4.1 billion ($5.2 billion) in taxes and higher welfare spending, while the Mexican government lost €1.4 billion ($1.8 billion), and that 380,000 and 480,000 jobs were lost due to piracy and counterfeiting in the United Kingdom and Mexico, respectively.

Statistical Studies of Infringement's Impact on U.S. Firms

As noted earlier, chapter 4 of this report provides results of an econometric analysis conducted by the Commission using publicly available data to estimate the impact of IPR infringement in China on U.S. exports, FDI, and licensing receipts. In examining potential effects of stronger IPR protection on exports, previous studies have identified two possibly offsetting impacts: a market-expansion effect and a market-power effect.[64] The market-expansion effect of stronger IPR protection suggests that exporters are concerned that their goods will be imitated or reverse-engineered in foreign markets with weak protection, limiting their market opportunities; therefore, if IPR protection were to increase in China, U.S. exports to China would increase. Conversely, improved IPR

[59]LEK, "The Cost of Movie Piracy," 2005. This study is identified in table 1.1.

[60]BSA and IDC, "Seventh Annual BSA/IDC Global Software and Piracy Study," 2010. This study is identified in table 1.1.

[61]TERA Consultants, "Building a Digital Economy," 2010; Frontier Economics, "The Impact of Counterfeiting on Governments and Consumers," 2009. These studies are identified in table 1.1.

[62]The four core industries analyzed are recorded music, film, TV series, and software. The noncore industries convey goods and services to consumers. TERA Consultants, "Building a Digital Economy," 2010, 5.

[63]Euros were evaluated at the exchange rate prevailing on August 27, 2010, which was $1.27 per euro.

[64]Smith, "Are Weak Patent Rights a Barrier to U.S. Exports?" 1999; Yang and Huang, "Do Intellectual Property Rights Matter to Taiwan's Exports?" 2009.

protection may trigger the market-power effect if exporters use the monopoly power associated with IPR protection to reduce export sales and raise prices. These effects depend, in part, on the imitative capabilities of firms in the importing country.[65]

Studies have generally found that exports increase with improved destination-country IPR protection.[66] Moreover, the literature suggests that this effect is even more pronounced when the goods exported are high-technology or patent-intensive[67] and when the importing country has strong imitative capacity, as measured by such indices as high levels of R&D or high employment of scientists and engineers in the importing country.[68] However, some research has found increased IPR protection to be negatively associated with U.S. exports, consistent with the "market power" theory explained above. In other words, firms facing less competition abroad from counterfeits may raise prices and reduce the volume of export sales, possibly reducing their total dollar value.[69]

Turning to impacts on FDI, the empirical literature finds that stronger host-country IPR protection is associated with greater inbound FDI. This is particularly true in industries with high R&D or technology intensity,[70] and for multinational corporations (MNC) that receive larger technology payments from their affiliates.[71] Different types of FDI are affected differently: stronger IPR protection tends to attract more production-oriented FDI, while countries with weaker IPR are more likely to find that FDI by MNCs is limited to marketing operations.[72] As for licensing revenues, both U.S. firms[73] and Japanese firms[74] have been shown to charge higher prices in countries with stronger IPR

[65]While conceptually these two effects exist, no previous studies have attempted to estimate their separate impacts; similarly, in the current study only their net impact will be estimated.

[66]Branstetter et al., "Intellectual Property Rights, Imitation, and Foreign Direct Investment," 2007; Smith, "Are Weak Patent Rights a Barrier to U.S. Exports?" 1999; Falvey, Foster, and Greenaway, "Trade, Imitative Ability and Intellectual Property Rights," 2009; Ivus, "Do Stronger Patent Rights Raise High-Tech Exports?" 2010; Maskus and Penubarti, "How Trade-Related Are Intellectual Property Rights?" 1995; Vichyanond, "Intellectual Property Protections and Patterns of Trade," 2009; Yang and Huang, "Do Intellectual Property Rights Matter to Taiwan's Exports?" 2009. The paper by Branstetter et al. uses the number of new goods exported to a country that has undergone patent reform as a measure of exports. Counting new goods avoids the problem that exists when using the value of exports, i.e., determining whether increases in values are due to increases in quantities exported (the market expansion effect) or increases in prices (the market power effect).

[67]Ivus, "Do Stronger Patent Rights Raise High-Tech Exports?" 2010; Vichyanond, "Intellectual Property Protections and Patterns of Trade," 2009. However, Fink and Primo Braga, 2005, find the opposite result—that stronger patent protection reduces exports in high-technology sectors.

[68]Falvey, Foster, and Greenaway, "Trade, Imitative Ability and Intellectual Property Rights," 2009; Ivus, "Do Stronger Patent Rights Raise High-Tech Exports?" 2010; Smith, "Are Weak Patent Rights a Barrier to U.S. Exports?" 1999.

[69]These include An, Maskus, and Puttitanun, "Duration of Rent Extraction and the Entry Mode Decision," 2008; Nair-Reichert and Duncan, "Patent Regimes, Host-Country Policies, and the Nature of MNE Activities," 2008 (for exports to unaffiliated parties).

[70]Nair-Reichert and Duncan, "Patent Regimes, Host-Country Policies, and the Nature of MNE Activities," 2008; Smith, "How Do Foreign Patent Rights Affect U.S. Exports, Affiliate Sales, and Licenses?" 2001.

[71]Branstetter et al., "Intellectual Property Rights, Imitation, and Foreign Direct Investment," 2007.

[72]Smarzynska Javorcik, "The Composition of Foreign Direct Investment," 2004.

[73]An, Maskus, and Puttitanun, "Duration of Rent Extraction and the Entry Mode Decision," 2008; Branstetter, Fisman, and Foley, "Do Stronger Intellectual Property Rights Increase International Technology Transfer?" 2006; Branstetter et al., "Intellectual Property Rights, Imitation, and Foreign Direct Investment," 2007; Nair-Reichert and Duncan, "Patent Regimes, Host-Country Policies, and the Nature of MNE Activities," 2008.

[74]Wakasugi and Ito, "The Effect of Stronger Intellectual Property Rights on Technology Transfer," 2009.

protection. These effects, as with exports and FDI, vary across products and are stronger for MNCs that are more reliant on patents and/or royalty and license fees.

It should be noted that an increase in FDI could substitute for exports from the United States, thereby reducing U.S. activity by the parent firm. This could happen if an MNC chooses to serve a foreign market by producing in that market rather than exporting to it. Conversely, an increase in U.S. outbound FDI could lead to more exports of the U.S. parent to its own affiliate, increasing production in the parent firm. This could happen, for example, if the production process is fragmented, so that parts or components are exported from the United States for final assembly in another country.[75] On balance, however, studies suggest that production by U.S. parents and their foreign affiliates is likely to either grow or contract together. U.S. parents with expanded affiliate sales are likely to export more to their foreign affiliates, to receive greater license and royalty payments from their foreign affiliates, and to engage in more general headquarters activities to oversee and coordinate their foreign affiliates, than are U.S. companies with little or no foreign affiliate sales.[76] This general complementarity between different kinds of MNC activity needs to be taken into account in assessing the effects of any potential change in IPR protection in China on the U.S. economy, and is discussed in chapter 4.

The Effect of IPR Infringement on Employment

The few empirical studies that have produced estimates of the U.S. employment effects of IPR infringement relate to individual economic sectors. These studies typically rely on surveys of consumer and/or commercial users from a sample of countries to estimate piracy. Associated job losses are calculated using various multipliers. While methodological concerns have been expressed about these studies, they do show considerable job losses associated with IPR infringement. For example, a BSA and IDC study of the business software sector estimates that lowering the piracy rate for PC software from 43 percent to 33 percent in the 42 countries covered by the study would result in an additional 500,000 jobs in those countries.[77]

A study commissioned by the Institute for Policy Innovation (IPI) examines economy-wide effects of piracy in the U.S. motion picture, sound recording, packaged software, and video games industries.[78] Using multipliers from the U.S. Department of Commerce's Regional Input-Output Modeling System (RIMSII), the study estimates both direct and indirect job losses due to piracy. According to this study, global piracy results in a total of 373,375 jobs lost in the United States, with the bulk of job losses representing the indirect impact of global piracy on noncopyright U.S. industries. The GAO has criticized studies using multipliers, noting they only account for a one-time change in employment and they assume no re-employment in other industries.[79]

[75]See also Branstetter, Fisman, and Foley, "Do Stronger Intellectual Property Rights Increase International Technology Transfer?" 2006.

[76]Examples of evidence of positive linkages between domestic activity and investment abroad include Desai, Foley, and Hines, "Foreign Direct Investment and Domestic Economic Activity," 2005, and Hanson, Mataloni, and Slaughter, "Expansion Abroad and the Domestic Operations of U.S. Multinational Firms," 2003. Also, Koncz, "International R&D, Technological Capability, and Productivity," 2010, finds that increased R&D in affiliates of U.S. MNCs enhances productivity in the parent company.

[77]BSA, "Piracy Impact Study," 2010.

[78]Siwek, "The True Cost of Copyright Piracy to the U.S. Economy," 2007.

[79]GAO, Intellectual Property, 2010, 23.

Patent Protection and Employment Effects

The sector-specific studies of IPR infringement mentioned above do not generally address patent infringement. However, two recent papers have explored how this might be done. One notes that uncertainty over the profitability of patents results in a loss to a firm in value and in its ability to finance future R&D activities.[80] Conversely, an increase in the returns to patented activities results in an increase in company value, thereby raising expenditures on both R&D and employment, given that the stream of returns is associated with those activities. As an example, the paper estimates that a 2 percent increase in value for firms in high-technology industries would result in increased research and investment, generating returns that would add 25,000 jobs per year. A second paper suggests that reduced value in patents and patented technology could result in firms being less willing to add employees to produce new technology, as well as to supply new plant, equipment, components, and services.[81]

Indigenous Innovation

Most observers see the January 2006 Medium- to Long-Term Plan for the Development of Science and Technology (MLP) as the founding document of China's indigenous innovation policies. One goal of this wide-ranging plan is for China to reduce its economic dependence on foreign companies and foreign technology, a goal that makes the plan relevant both to U.S. firms and to the U.S. economy. However, little research has examined the effects of those policies outside of China, or on the United States in particular.[82]

A recent study evaluates the implementation, through mid-2010, of the policies set forth in the MLP. It concludes that foreign companies have reason for concern, but that the actual implementation of the policies has fallen far short of the government's goals, for reasons including strong protests from foreign companies, foreign governments, and some voices within China.[83] The study further points out that indigenous innovation policies have not thus far stopped foreign corporations from maintaining strong market share, trade, and profitability in China. However, it notes that this encouraging pattern may not hold true for certain industries, including telecommunications and renewable energy.

Another recent report emphasizes that Chinese policies seeking to appropriate technology from foreign multinational corporations—such as local-content requirements, mandatory joint ventures, and forced technology transfer rules—are the central source of the impact of indigenous innovation policies on U.S. firms.[84] It notes that such policies have been used by other countries in the past, but that China is more aggressive about how it applies these policies and has the additional leverage of conditional access to the world's largest and fastest-growing market. A report prepared for the U.S. Chamber of Commerce similarly focuses on the global business community's concerns regarding China's

[80]Ehrlich, "Economic Benefits of Clarifying the Standard for Assessing 'Reasonable Royalty' Damages Under Patent Law," 2009.

[81]Shane, "The Likely Adverse Effects of an Apportionment-Centric System of Patent Damages," January 14, 2009.

[82]For additional information about China's indigenous innovation policies and their effects on the United States, see USITC, *China IPR and Indigenous Innovation 1,* 2010, chapter 5.

[83]Kennedy, "Indigenous Innovation," September 2010.

[84]Hout and Ghemawat, "China vs. the World," December 2010.

indigenous innovation policies.[85] It describes U.S. and other foreign companies as trapped between their business need for access to China's large, rapidly growing market and China's insistence on significant transfers of technology as the price for such market access.

By contrast, Ahrens addresses the question of how China can best encourage indigenous innovation while keeping markets open, and the role of government procurement in that process.[86] He argues that China's existing indigenous innovation policies decrease the level of competition in China, and are thus unlikely to be effective in promoting domestic innovation, since removing competition tends to reduce, not increase, firms' incentives to innovate.

This focused review of the literature shows the challenging nature of quantifying effects of indigenous innovation and IPR infringement in general and specifically on individual countries. The remainder of this report presents various approaches to the measurement of these issues, taking into account relevant methodologies employed by other researchers.

[85]McGregor, *China's Drive for "Indigenous Innovation,"* July 2010.
[86]Ahrens, "Innovation and the Visible Hand," July 2010.

CHAPTER 3
Reported Effects from IPR Infringement in China on U.S. Economy (Survey Results)

Key Findings

According to the responses to the Commission's survey, U.S. firms that reported IPR infringement in China accounted for 58.1 percent of the sales by firms in the U.S. IP-intensive economy (explained below) conducting business in China in 2009. Overall sales amounted to approximately $7.3 trillion, which corresponds to about 16.3 percent of U.S. GDP in 2009.[1] Based on the survey data, U.S. IP-intensive firms reported overall global losses of $48.2 billion (in a range of $14.2 billion to $90.5 billion) due to reported Chinese IPR infringement in 2009.[2] In addition, they spent an estimated $4.8 billion (in a range of $279.1 million to $9.4 billion) to protect themselves against Chinese IPR infringement in 2009.[3] While copyright infringement was reported to be the form of IPR infringement in China that had the most damaging economic impact on U.S. firms during 2007–09, trademark infringement in China represented the most common form of reported IPR infringement.

The top IP-related concerns for firms were stolen trade secrets; lost sales, royalties, or license fees; damage to brands or product reputation; and the costs of IPR enforcement. Firms ranked the province of Guangdong and the municipalities of Shanghai and Beijing as having both the best and the worst climates for protecting intellectual property in China, with results varying by industry sector. Firms that provided quantitative responses estimated that improved IPR protection and enforcement in China could result in as much as a 10–20 percent increase in sales, royalties, and license fees earned in China, and a 2–5 percent increase in employment in their U.S. operations. These employment gains could translate into approximately 922,588 (in a range of 254,999 to 1,590,176 new jobs) new U.S. jobs among IP-intensive firms, although some of these jobs could be the result of workers shifting from other sectors of the U.S economy.

[1]The Commission applied a weighting procedure to the questionnaire responses in order to extrapolate the results attained from individual respondents to the U.S. IP-intensive economy as a whole. See appendix E for a copy of the questionnaire and appendix F for a discussion of the survey methodology.

[2]Significant at the 80 percent level. Value data show the central value estimate as well as the lower and upper bound ranges reflecting the statistical confidence levels identified. Losses include lost sales, royalties, and license fees, in all markets. Of the $48.2 billion in total reported losses in 2009, approximately $36.6 billion (75.9 percent) was attributable to lost sales, while the remaining $11.6 billion was attributable to a combination of lost royalty and license payments as well as other unspecified losses (these components of global IPR losses were significant at the 85 percent level). Estimated losses are derived from weighted responses to the USITC questionnaire (for firms that responded in the affirmative to question 1.14) to question 2.8 and the sum of weighted responses to questions 4.5b, 5.5b, 6.6b, and 7.5b, when a firm did not respond to question 2.8. Estimated global losses are discussed in more detail below and in appendix F.

[3]Significant at the 80 percent level. Infringement expenses include (1) firms' expenses to protect against IPR infringement by Chinese entities, and (2) firms' enforcement expenses incurred attributable to infringement by Chinese entities. This value is derived from weighted responses to the USITC questionnaire (for firms that responded in the affirmative to question 1.14) to question 2.11 and the sum of weighted responses to questions 4.6b, 5.6b, 6.7b, and 7.6b, when a firm did not report expenses in question 2.11. Estimated infringement expenses are discussed in more detail below.

These findings complement the results presented in chapter 4 that use a publicly available data to assess broader economic linkages between IPR protection in China and U.S. economic activity, and analyze likely intersectoral developments in the U.S. economy if China were to improve its IPR protection and enforcement.

Survey Overview: Questionnaire and Methodology

The Commission's questionnaire surveyed the U.S. IP-intensive economy affected by IPR infringement in China and certain sectors considered to be particularly susceptible to IPR infringement.[4] For the purpose of this chapter, this subset of the economy is defined as the "IP-intensive economy." The U.S. IP-intensive economy represents U.S. sales of $7.3 trillion—approximately 16.3 percent of U.S. GDP in 2009.[5]

The questionnaire asked about the effects of IPR infringement in China on firms in the U.S. IP-intensive economy over a three year period, 2007–09, and, in some cases, for only the year 2009. Many firms that reported IPR infringement were not able to quantify these effects for the three year period. Therefore, some of the values and shares derived from these values presented in the chapter are for 2009 only, even though other data may refer to the broader three year period. As a result, data for different periods should not be compared.

Sector Selection

The Commission's survey covered firms in 24 sectors of the U.S. economy that are considered to be particularly susceptible to IPR violations in China. These sectors, as defined by their North American Industry Classification System (NAICS) codes, were chosen using quantitative data that was supplemented by the judgment of analysts, as shown in table 3.1. A high incidence of quantitative indicators—such as research and development (R&D) expenditures, investments, royalties and licensing fees, and patent filings—suggests considerable investment in and reliance upon IPR. These indicators were used to select several sectors. Several other sectors were included because their products make up a large share of the goods seized by U.S. Customs and Border Protection (CBP) for trademark infringement.[6]

For each of the 24 selected sectors shown in table 3.1, individual firms were selected from the Orbis database,[7] which contains a significant share of all firms (privately as well as publicly held) in the United States. In addition to these randomly selected firms, the largest firms within each of the 24 sectors were targeted as potentially important contributors to the survey responses. Larger firms tend to export more and are more likely to have business in China, and are therefore likely to be more affected by IPR

[4]Both the survey plan and the interpretation of the questionnaire results were conducted by the Commission, with advisory services provided by Summit Consulting.

[5]Data are for 2007; based on estimates of sectoral sales by the U.S. Census Bureau and of value added by the U.S. Bureau of Economic Analysis. The share of GDP, which is in the range of 13.9–16.3 percent, was calculated based on the value added by the 24 sectors identified as potentially affected by IPR issues, as defined in this section. These contribute approximately 10 percent to U.S. GDP. In addition, the firms targeted in the special groups (top trademark firms and U.S. firms with FDI in China) contribute an additional 4–6 percent of value added. The share of GDP thus calculated reflects the sectors and special groups thus defined. This calculation is not meant to imply that IPR issues are irrelevant to the rest of the U.S. economy, since such issues may be relevant in all sectors.

[6]See CBP, *Intellectual Property Rights Seizure Statistics: Fiscal Year 2009*, October 2009.

[7]Orbis is a database of company profile and financial information published by Bureau Van Dijk.

Two other special groups were also targeted to be included in the survey: the U.S. firms holding the top trademarks in the world, and all U.S. firms that—according to the Orbis database—had foreign direct investment (FDI) in China.[8] The Commission included these groups because they were considered likely to have a disproportionate exposure to potential IPR violations in China.[9]

The Commission mailed a total of 5,051 questionnaires to active firms, including firms in each of the 24 identified sectors and firms in the special groups.[10] While the IP-intensive sectors and special groups selected for inclusion in the survey have a relatively high probability of being directly affected by Chinese IPR infringement, the Commission recognizes that IPR violations can affect firms outside these sectors; industries that may indirectly benefit from IPR protection include retailers, traders, and transportation businesses that support the distribution of IPR-reliant goods and services.[11] However, those firms that face direct threats to the sales of their products as a result of IPR violations are considered the most likely to suffer significant losses. As a result of this decision to focus on IP-intensive firms, all results estimated from the survey are in fact reflections of only this more narrowly defined economy. In this sense, the results form a lower bound because the sample excluded firms from non-IP-intensive sectors that also may have experienced losses.

In order to extrapolate the results obtained from individual respondents to the U.S. IP-intensive economy as a whole, the Commission applied a weighting procedure to the questionnaire responses. That weighting procedure is described, along with the questionnaire methodology, in appendix F.

Firms That Experienced IPR Infringement in China

The Commission's survey results showed that in general, the firms that reported experiencing IPR infringement in China are different from those firms that did not report experiencing infringement. Firms that reported infringement were at least three times larger, and were characterized as possessing significantly higher global average sales, royalties, R&D expenditures, and employment (figure 3.1).

[8]There were just under 1,000 firms in the Orbis database that reported investment in China.

[9]This is discussed in more detail in the section "Firm Size and IPR Infringement Practices in China."

[10]Of the 5,670 questionnaires that were originally sent, 619 (10.9 percent) were returned by the Postal Service, due to business closings, changes of addresses, and name changes of businesses.

[11]Siwek, "Engines of Growth," 2005, 2.

Estimated Losses Due to Chinese IPR Infringement

U.S. firms experiencing IPR infringement in China reported total global losses of $48.2 billion (in a range of $14.2 billion to $90.5 billion)[21] in 2009 due to that infringement (table 3.2).[22] Of the $48.2 billion in total reported losses in 2009, approximately $36.6 billion (75.9 percent) was attributable to lost sales, while the remaining $11.6 billion was attributable to a combination of lost royalty and license payments as well as other unspecified losses.[23]

Losses by sector (2009). Firms experiencing IPR infringement in China in the information and other services sector reported the largest losses, estimated at $26.7 billion (in a range of $11.8 billion to $48.9 billion) in 2009, followed by firms in the high-tech and heavy manufacturing sector, with reported 2009 losses of $18.5 billion (in a range of $1.9 billion to $37.0 billion).[24]

Losses by type of infringement (2009). Firms experiencing IPR infringement in China reported significantly higher losses from copyright infringement than from other types of Chinese IPR infringement during 2007–09. Firms reported quantifiable 2009 losses from copyright infringement of $23.7 billion (in a range of $10.2 billion to $37.3 billion), and quantifiable losses from trademark infringement of $6.1 billion (in a range of $1.4 billion to $12.5 billion). Firms reported quantifiable 2009 losses of $2.4 billion for patent infringement and trade secret misappropriation combined.[25]

[21]Significant at the 80 percent level. Ranges indicate the lower and upper bounds reflecting the statistical confidence levels.

[22]Losses include lost sales, royalties, and license fees, in all markets. USITC questionnaire, weighted responses to question 2.8 plus weighted responses to questions 4.5b, 5.5b, 6.6b, and 7.5b when a firm did not report losses in question 2.8, for firms that responded in the affirmative to question 1.14. Significant at the 80 percent level.

[23]Significant at the 85 percent level.

[24]Because total worldwide losses were compiled from different questions in the Commission's survey, losses by type of IPR infringement do not add to total reported worldwide losses. Significant at the 80 percent level.

[25]Significant at the 90 percent level.

TABLE 3.2 U.S. firms experiencing IPR infringement in China: Reported losses due to Chinese IPR infringement, 2009

Losses	Survey findings	
	Point estimate	Lower and upper bounds[a]
Total reported global losses[b]	$48.2 billion[c]	$14.2 billion–$90.5 billion
Losses by sector[b]		
Information and other services	$26.7 billion	$11.8 billion–$48.9 billion
High-tech and heavy manufacturing	$18.5 billion	$1.9 billion–$37.0 billion
Chemical manufacturing	$2.0 billion	$0.4 billion–$3.6 billion
Consumer goods manufacturing	$0.8 billion	$0.5 billion–$1.1 billion
Transportation manufacturing	$144.6 million	$35.3 million–$294.7 million
Losses by type of IPR infringement[d]		
Copyright infringement	$23.7 billion	$10.2 billion–$37.3 billion
Trademark infringement	$6.1 billion	$1.4 billion–$12.5 billion
Patent infringement[e]	$1.3 billion	$0.2 billion–$2.8 billion
Misappropriation of trade secrets[e]	$1.1 billion	$0.2 billion–$2.4 billion
Unspecified[f]	$16.0 billion	$2.2 billion–$35.5 billion

Source: Staff calculations from USITC questionnaire. See appendix F for method and further details.

Note: Data are significant at the 95 percent level unless otherwise indicated. Value data show the point estimate and the lower and upper bound ranges reflecting the confidence levels. Losses by sector and losses by type of IPR infringement are compiled from different questions in the USITC questionnaire and do not add to the same total values.

[a]When the sum of unweighted values is greater than the lower bound of the confidence interval at which the estimate becomes positive, the sum of unweighted values is reported as the lower bound and the upper bound is shifted upward by the difference between the sum of unweighted values and the original lower bound.
[b]Significant at the 80 percent level. Additional information on estimated global losses is provided in appendix F.
[c]Of the $48.2 billion in total reported losses in 2009, approximately $36.6 billion (75.9 percent) was attributable to lost sales, while the remaining $11.6 billion was attributable to a combination of lost royalty and license payments as well as other unspecified losses. These components of global IPR losses were significant at the 85 percent level.
[d]Calculated using information from questions 2.8, 4.5b, 5.5b, 6.6b, and 7.5b, for firms that responded in the affirmative to question 1.14. Most firms were unable to apportion losses according to IPR infringement type. For additional information, see appendix F.
[e]Significant at the 90 percent level.
[f]Calculated as a residual (the difference between total reported global losses and loses by identified type of IPR infringement).

Losses by market (2007–09). Firms reported that 90.2 percent of their 2007–09 losses due to IPR infringement in China were the result of copyright infringement in the Chinese market (figure 3.4). As discussed in more detail in the section on "Copyright Infringement" below, firms in the information and other services sector accounted for half of the reported losses due to copyright infringement. The relatively higher losses due to copyright infringement in China may be due in part to the generally low cost of illegally replicating copyrighted works and the ease of both physical and digital distribution of infringed products.[26]

Losses by market and by type of infringement (2007–09). The locations where firms reported their greatest losses from Chinese IPR infringement varied by type of IPR. Firms reporting patent infringement stated that more than half (53.8 percent) of their losses

[26]See "Copyright Infringement" section for additional information.

firms reported that their estimates of lost sales in the Chinese and other markets, lost global profits, and losses due to Internet-based infringement were based on information from third parties. [30]

IPR Infringement Expenses and Impact of Improved IPR Protection and Enforcement

Efforts on the part of firms to counter Chinese IPR infringement could prove costly, especially to firms in the information and other services sector. Moreover, firms said improved IPR protection measures on the part of the Chinese government would have a beneficial impact on their sales, royalties, and license fees earned in China, as well as on U.S. employment.

IPR Infringement Expenses

U.S. firms that reported IPR infringement in China reported spending a total of $4.8 billion (in a range of $279.1 million to $9.4 billion) [31] to protect themselves against Chinese IPR infringement in 2009.[32] Firms in the information and other services sector reported spending the most, estimated at $2.0 billion (in a range of $36.2 million to $4.0 billion), followed by firms in the high-tech and heavy manufacturing sector at $1.1 billion (in a range of $0.1 billion to $2.1 billion) and those in the chemical manufacturing sector at $0.9 billion (in a range of $0.2 billion to $1.6 billion) (table 3.3).

TABLE 3.3 U.S. firms experiencing IPR infringement in China: Reported infringement expenses, 2009

Expenses[a]	Survey findings	
	Point estimate	Lower and upper bounds
Total reported infringement expenses[b]	$4.8 billion	$279.1 million–$9.4 billion
Expenses by sector		
Information and other services[b]	$2.0 billion	$36.2 million–$4.0 billion
High-tech and heavy manufacturing[b]	$1.1 billion	$0.1 billion–$2.1 billion
Chemical manufacturing[c]	$0.9 billion	$0.2 billion–$1.6 billion
Transportation manufacturing[d]	$0.6 billion	$2.8 million–$1.3 billion
Consumer goods manufacturing[d]	$0.1 billion	$10.4 million–$0.3 billion

Source: Staff calculations from USITC questionnaire. See appendix F for method and further details.

[a]Infringement expenses include (1) firms' expenses to protect against IPR infringement by Chinese entities, and (2) firms' enforcement expenses incurred attributable to infringement by Chinese entities. USITC questionnaire, weighted responses to question 2.11 plus weighted responses to questions 4.6b, 5.6b, 6.7b, and 7.6b when a firm did not report expenses in question 2.11, for firms that responded in the affirmative to question 1.14.
[b]Significant at the 85 percent level.
[c]Significant at the 90 percent level.
[d]Significant at the 75 percent level.

Infringement expenses varied by the type of infringement firms faced. Nearly all firms that reported material losses from copyright infringement (94.0 percent of firms) or trademark infringement (92.1 percent) in China spent money to address that infringement. However, fewer firms that reported material losses from patent

[30]USITC questionnaire, weighted responses to question 2.7, for firms that responded in the affirmative to question 1.14.
[31]Significant at the 85 percent level. Ranges indicate the lower and upper bounds reflecting the statistical confidence levels.
[32]Infringement expenses include (1) firms' expenses to protect against IPR infringement by Chinese entities, and (2) firms' enforcement expenses incurred attributable to infringement by Chinese entities. USITC questionnaire, weighted responses to question 2.11 plus weighted responses to questions 4.6b, 5.6b, 6.7b, and 7.6b when a firm did not report expenses in question 2.11, for firms that responded in the affirmative to question 1.14.

infringement (22.5 percent) and trade secret misappropriation (14.4 percent) incurred expenses to address the infringement.[33]

Potential Impact of Improved IPR Protection and Enforcement

Impact on sales

U.S. firms that reported IPR infringement in China estimated that improved IPR protection and enforcement in China would result in a 10–20 percent increase in their sales in China,[34] especially in the information and other services sector and the high-tech and heavy manufacturing sector.

Sales in China: Most firms (75.1 percent) reported that improved IPR protection and enforcement in China would result in a 10–20 percent increase in their sales in China. This was true for nearly all firms in the information and other services sector (97.9 percent) and for most firms in the high-tech and heavy manufacturing sector (71.1 percent).

Sales in the United States: Almost half of firms (47.5 percent) reported that improved IPR protection and enforcement in China would result in an increase of up to 5 percent in their sales in United States, although most firms in the consumer goods industry (85.3 percent) reported a likely increase of 5–10 percent in their U.S. sales.

Sales in other markets: More than one-third of firms (37.8 percent) reported that an increase of up to 5 percent in their sales in other markets was likely if IPR protection and enforcement in China were to improve.

Impact on royalties and license fees

Firms that reported IPR infringement in China estimated that improved IPR protection and enforcement in China would result in a 10–20 percent increase in the royalties and license fees they earned in China, especially in the information and other services sector and the chemical manufacturing sector. [35]

Royalties and license fees earned in China: Most firms (94.6 percent) estimated that improved IPR protection and enforcement in China would result in a 10–20 percent increase in the royalties and license fees they earned in China. This was particularly true for firms in the information and other services sector (reported by 98.1 percent of firms in that sector) and in the chemical manufacturing sector (reported by 93.3 percent of firms in that sector).

Royalties and license fees earned in the United States: Most firms (98.2 percent) reported that improved IPR protection and enforcement in China would result in an increase of up to 5 percent in the royalties and license fees they could earn in the United States.

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[33]USITC questionnaire, weighted responses to questions 4.6a, 5.6a, 6.7b, and 7.6a, for firms that responded in the affirmative to question 1.14.

[34]Firms that reported IPR infringement in China who indicated in question 3.4a that global unit sales would likely increase. USITC questionnaire, weighted responses to questions 3.4a and 3.4b, for firms that responded in the affirmative to question 1.14.

[35]Firms that reported IPR infringement in China who indicated in question 3.5a that global receipts of royalties and license fees would likely increase. USITC questionnaire, weighted responses to questions 3.5a and 3.5b, for firms that responded in the affirmative to question 1.14.

Royalties and license fees earned in other markets: Most firms (92.1 percent) reported a likely increase of up to 5 percent in the royalties and license fees they earned in other markets if IPR protection and enforcement in China were to improve.

Impact on U.S. employment

Improved IPR protection and enforcement in China may result in increased U.S. employment, according to the surveyed firms that reported IPR infringement. Firms estimated that improved IPR protection and enforcement in China could result in a 2–5 percent increase in their U.S. employment, especially in the information and other services sector, the consumer goods manufacturing sector, and the high-tech and heavy manufacturing sector. These employment gains could translate into as many as 922,588 (in a range of 254,999 to 1,590,176)[36] new U.S. jobs among IP-intensive firms, although some of these jobs could be the result of workers shifting among sectors of the U.S economy.[37]

Overall: Many firms (42.0 percent) reported that improved IPR protection and enforcement in China would result in an increase of 2 to 5 percent in their U.S. employment.

By sector: Most firms (73.6 percent) in the information and other services sector and more than half of firms in the consumer goods manufacturing sector (56.8 percent) reported a likely increase of up to 5 percent in their U.S. employment if IPR protection and enforcement in China were to improve. Almost all (96.5 percent) firms in the transportation manufacturing sector reported a likely increase of less than 5 percent in their U.S. employment as a result of improved IPR protection in China. However more than one-third of firms in the high-tech and heavy manufacturing sector (37.1 percent[38]) reported a likely increase of greater than 10 percent in their U.S. employment.

Outside the framework of the questionnaire, a number of individuals contacted during the course of this investigation stated that they did not see a clear link between Chinese IPR infringement and U.S. employment.[39] However, some stated that U.S. employment would be more likely to increase for firms with production in the United States[40] than for U.S. firms with production in China.[41]

Additional Losses Associated with IPR Infringement

In addition to the lost sales, royalties, and license fees from infringing Chinese products and services, more than half (56.8 percent) of firms reported that they experienced other forms of revenue losses as a result of new competition from lower-priced Chinese goods

[36]Ranges indicate the lower and upper bounds reflecting the statistical confidence levels.

[37]Chapter 4 presents a framework for understanding how intersectoral changes may lead employment to shift from one sector of the U.S. economy to others, based on improved IPR protection in China.

[38]Significant at the 90 percent level.

[39]Industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 3–7, 2011.

[40]USITC, hearing transcript, June 16, 2010, 331 (testimony of James D'Addario, D'Addario and Co., Inc.)

[41]Industry representatives, interviews by USITC staff Hong Kong and mainland China, January 3–7, 2011.

and services that are believed to be the result of IPR infringement.[42] Firms in all sectors reported lower revenue due to infringement. More than half of firms in the high-tech and heavy manufacturing sector (60.7 percent), the information and other services sector (62.5 percent), and the chemical manufacturing sector (54.4 percent) reported lower revenues as a result of infringement. Between 45 and 50 percent of firms in the consumer goods manufacturing sector (47.6 percent)[43] and the transportation manufacturing sector (46.9 percent) reported lower revenues as a result of infringement.[44]

Firms reported that IPR infringement in China resulted in lower revenues mostly because they either lowered their prices to compete with counterfeits (which some firms subsequently found to be an ineffective antipiracy strategy), sold fewer products, or some combination of the two. Of firms that identified reasons for the lower revenues, 17.4 percent[45] reported that they lowered the prices of their products or services to compete with infringing Chinese products,[46] and 15.1 percent reported that they sold fewer units in the Chinese market. A smaller but still significant share (10.1 percent)[47] of firms reported that their revenues were lower because they did not enter China's market due to concerns about IPR infringement.[48]

Survey Results: Scope of Chinese IPR Infringement

This section describes the types of IPR infringement that firms reported experiencing in China, and the leading economic activities performed by these firms. Trademark infringement was the most widely reported type of Chinese IPR violation worldwide, with firms involved in sales in China, exporting from China, and contract-based manufacturing in China the most likely to report instances of IPR infringement. Firms also identified the Chinese municipalities and provinces with the best and worst climates for IPR protection.

Types of IPR Infringement

Figure 3.5 shows the types of Chinese IPR infringement that firms reported experiencing worldwide during 2007–09. Nearly one-third (31.5 percent) of the firms reported experiencing lost sales, royalties, license fees, or other income worldwide due to trademark infringement, more than any other form of Chinese IPR infringement.[49]

[42]A total of 18.4 percent (significant at the 90 percent level) of firms that reported IPR infringement in China said their revenues were unaffected, and 15.0 percent said they did not know if their revenues had been affected by Chinese IPR infringement. The remainder of responses was accounted for by responses of "unknown" and nonresponses to the question. Respondents may have indicated more than one reason for the lower revenues associated with IPR infringement in China. USITC questionnaire, weighted responses to question 2.6, for firms that responded in the affirmative to question 1.14.

[43]Significant at the 80 percent level.

[44]USITC questionnaire, weighted responses to question 2.6.

[45]Significant at the 90 percent level.

[46]As discussed in the section "Strategies for Addressing IPR Issues," some firms reported that they subsequently found price discounting to be an ineffective strategy to combat IPR piracy.

[47]Significant at the 90 percent level.

[48]Percentages do not total to 100 percent because respondents may have indicated more than one reason for the losses due to infringement. USITC questionnaire, weighted responses to question 2.6, for firms that responded in the affirmative to question 1.14.

[49]Respondents may have indicated losses due to more than one type of infringement. USITC questionnaire, weighted responses to questions 4.1, 5.1, 6.1, and 7.1, for firms that responded in the affirmative to question 1.14. According to one source, "the trademark counterfeiting problem in China is probably the most serious in world history." USITC, hearing transcript, June 15, 2010, 35 (testimony of Daniel Chow, Ohio State University).

Almost all (91.6 percent) of the surveyed firms in the consumer goods manufacturing sector reported material losses from Chinese trademark infringement (especially the apparel manufacturing industries).[50]

A total of 15.5 percent of firms reported experiencing losses due to Chinese copyright infringement worldwide during 2009–07, with half (50.0 percent) of firms in the information and other services sector reporting such losses.[51] Overall, more firms in all sectors reported that copyright protection was "extremely important" to their business during 2007–09 than any other form of IPR protection.[52]

A total of 15.3 percent of firms reported experiencing losses due to patent infringement during 2007–09, including 43.3 percent of firms in the chemical manufacturing sector.[53] Losses due to trade secret misappropriation during 2007–09 were reported by 7.2 percent of firms, including 30.9 percent[54] of firms in the chemical manufacturing sector.[55] Additional information about losses due to each type of reported IPR infringement is provided later in this chapter.

[50]See the section "Trademark Infringement" for additional information. USITC questionnaire, weighted responses to question 5.1, for firms that responded in the affirmative to question 1.14.

[51]Respondents may have indicated losses due to more than one type of infringement. USITC questionnaire, weighted responses to question 4.1, for firms that responded in the affirmative to question 1.14. See the section on "Copyright Infringement" for additional information.

[52]USITC questionnaire, weighted responses to question 2.1, for firms that responded in the affirmative to question 1.14. According to IIPA the range of Chinese copyright infringement includes "a staggering 79% of all software installed in 2009 in China, to widespread infringement of music, films, entertainment software, books and other copyrighted materials through online and mobile networks, optical disc infringements (including the manufacture and export of high quality counterfeits and special boxed sets), wholesale and retail infringements, hard-disk loading of software onto computers, illegal camcording, unauthorized use of copyright materials in Internet cafés, unauthorized public performances, and infringements of books, journals, and other published materials." IIPA, written submission to the USITC, June 15, 2010, 4.

[53]Respondents may have indicated losses due to more than one type of infringement. USITC questionnaire, weighted responses to question 6.1, for firms that responded in the affirmative to question 1.14. See the section on "Patent Infringement" for additional information.

[54]Significant at the 85 percent level.

[55]Respondents may have indicated losses due to more than one type of infringement. USITC questionnaire, weighted responses to questions 7.1, for firms that responded in the affirmative to question 1.14. See the section on "Trade Secret Misappropriation" for additional information.

Survey Results: Top IPR Infringement Concerns and Strategies

This section describes the top concerns U.S. firms reported in the Commission's survey about IPR infringement in China. It also reports firms' views about the Chinese entities responsible for IPR infringement, and firms' strategies for addressing IPR issues in China. This section concludes with a discussion of the relationship between firm size and reported Chinese IPR infringement.

Top Concerns

Firms that reported IPR infringement in China said their top IP-related concerns during 2007–09 were stolen trade secrets;[61] lost sales, royalties, or license fees in all markets;[62] damage to brands or product reputation;[63] and the cost of IPR enforcement.[64] Almost two-thirds (64.6 percent) of firms with concerns about stolen trade secrets described themselves as "extremely concerned." More than half of firms with concerns about damage to brand/product reputation (54.7 percent) and with the cost of IPR enforcement (56.4 percent) described themselves as "extremely concerned" about each of those issues. Between 40 to 50 percent of firms with concerns about lost sales, royalties, or license fees in all markets described themselves as "extremely concerned" about such losses. Increased warranty costs related to counterfeit products ranked among firms' least pressing concerns, with one-fourth (25.5 percent) of firms providing a ranking in this category describing themselves as "not at all concerned."[65]

Chinese Entities Responsible for Infringement

The types of Chinese entities identified by the survey as responsible for IPR infringement during 2007–09 vary significantly depending on the type of IPR infringement. In many cases, firms that reported infringement also reported that "unknown entities" were a significant source of Chinese infringement.[66] The growing use of the Internet to sell counterfeit goods could explain the inability of firms to identify sources of infringing

[61]The Commission's China IPR and Indigenous Innovation 1 report discussed U.S. businesses' concerns about trade secret misappropriation in China. Almost all foreign industries in China reportedly rely on trade secrets to protect their business information, but there are few published cases in China in which U.S. or other foreign firms have asserted trade secret misappropriation. Moreover, industry representatives report that it is difficult to protect and enforce trade secrets in China. USITC, *China IPR and Indigenous Innovation 1*, 2010, 4-10 and 4-13. For further information about the impact of trade secret misappropriation see USITC, hearing transcript, June 15, 2010, 318 (testimony of Christian Murck, American Chamber of Commerce, People's Republic of China); 319 (testimony of Mark Bohannon, Software & Information Industry Association).

[62]The Commission's China IPR and Indigenous Innovation 1 report discussed the effects of lost sales, royalties, or license fees in third-country markets. USITC, *China IPR and Indigenous Innovation 1*, 2010, 6-11 to 6-12.

[63]For further information about the impact of damage to brand and product reputation, see USITC, hearing transcript, June 15, 2010, 196 (testimony of Shaun Donnelly, International Business Policy); 425–526 (testimony of James D'Addario, D'Addario and Co., Inc.).

[64]USITC questionnaire, weighted responses to question 2.3, for firms that responded in the affirmative to question 1.14.

[65]For further information about the impact of warranty costs on small businesses, see USITC, hearing transcript, June 15, 2010, 198 (testimony of Shaun Donnelly, International Business Policy).

[66]Respondents may have indicated more than one type of infringing Chinese entity. USITC questionnaire, weighted responses to question 2.4, for firms that responded in the affirmative to question 1.14.

products, as the relative anonymity afforded by the Internet makes it an attractive distribution network for people dealing in counterfeit and pirated merchandise.[67] Table 3.4 shows the leading Chinese entities identified for each specific type of IPR infringement, as well as the sectors for which the entity ranked highest.[68]

TABLE 3.4 U.S. firms experiencing IPR infringement in China: Leading Chinese entities reported to be responsible for IPR infringement, 2007–09

IPR infringement type	Leading infringing entities[a] (share of firms identifying this type of entity, for given type of IPR infringement)	Sectors for which entity ranked highest
Copyright infringement	Chinese private firms (18.5 percent)[b]	• Chemical manufacturing • High-tech and heavy manufacturing • Information and other services
	Individuals, including former employees (15.7 percent)[c]	• Consumer goods manufacturing
	Unknown entities (44.0 percent)[d]	• Information and other services • Consumer goods manufacturing
Trademark infringement	Individuals, including former employees (17.3 percent)	• Consumer goods manufacturing • Chemical manufacturing
	Unknown entities (46.4 percent)	• Consumer goods manufacturing[e]
Patent infringement	Chinese private firms (identified by 13.3 percent)[b]	• Chemical manufacturing • High-tech and heavy manufacturing • Transportation manufacturing
	Unknown entities (18.6 percent)[b]	• Chemical manufacturing • Information and other services
Trade secret misappropriation	Chinese state-owned enterprises (6.5 percent)[f]	• High-tech and heavy manufacturing
	Unknown entities (18.1 percent)[b]	• Information and other services • Chemical manufacturing

Source: USITC questionnaire, weighted responses to question 2.4, for firms that responded in the affirmative to question 1.14.

Note: Data are significant at the 95 percent level unless otherwise indicated.

[a]Respondents may have indicated more than one type of infringing entity.
[b]Significant at the 90 percent level.
[c]Significant at the 85 percent level.
[d]According to one source, copyright infringement in China occurs in many sophisticated ways that can make it difficult to identify the infringing entities, such as use of unlicensed software by businesses, duplication and sale on physical media and through online and mobile networks, and infringement of published material. IIPA, written submission to the USITC, June 3, 2010, 4.
[e]For example, one multinational company that manufactures and sells products in China stated that counterfeiters are small entrepreneurs operating at such a low volume with such inexpensive equipment that makes it difficult to identify the infringing entities. Industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 7, 2010.
[f]Significant at the 70 percent level.

[67]For additional information on Internet-based infringement, see the section "IPR Infringement in China and the Role of the Internet" in chapter 2 of this report. See also Stewart and Stewart, written submission to the USITC, July 8, 2010, 6–7.
[68]For additional information on contributors to piracy and potential infringers of trade secrets in China, see USITC, *China IPR and Indigenous Innovation 1*, 2010, 3-6 to 3-8 and 4-10 to 4-13.

Strategies for Addressing IPR Issues in China

U.S. firms that reported IPR infringement in China generally also reported that price discounting proved to be an ineffective strategy for combating Chinese IPR infringement.[69] Consequently, firms reported that they typically did not offer price discounts geared to counter infringement in China even though IPR infringers' products often were lower priced.

Characteristics of the Infringing Products

Firms that reported IPR infringement in China varied in their assessments of the ways infringing products differed from the originals. Firms most frequently characterized the allegedly infringing Chinese products as inferior in quality. Firms characterized infringing products as bait-and-switch products, exact replicas, and high-quality counterfeits much less frequently.[70]

Inferior-quality products: Nearly half of firms (49.6 percent) categorized the allegedly infringing products as moderate or low-quality products (i.e., clearly IP-infringed products, but selected consciously by consumers to save money or because such infringing products are "good enough"). Between 45–55 percent of firms in all sectors characterized the allegedly infringing Chinese products as inferior-quality products.[71]

Bait-and-switch products: Almost one-third of firms (32.2 percent) characterized the allegedly infringing products as bait-and-switch products (i.e., consumers realize the product is counterfeit only upon opening the packaging or using the product).[72] Allegedly infringing bait-and-switch products ranked particularly high for firms in the consumer goods manufacturing sector and the high-tech and heavy manufacturing sector.[73] One strategy that U.S. firms reported using to combat this type of infringement included the use of distinctive or hard-to-replicate packaging and/or the inclusion of serial numbers on the packaging along with a Web site address to allow the customer to verify that the product is legitimate.[74]

Exact replicas: More than one-fourth of firms (25.7 percent) characterized the allegedly infringing products as exact replicas (i.e., no discernable difference between the U.S firm's product/service and the infringed product/service). Infringing exact replicas ranked particularly high for firms in the chemical manufacturing sector.[75]

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[69]See appendix G for additional information on firms' strategic changes as a result of IPR infringement in China.

[70]Respondents may have indicated more than one characteristic of infringing products. USITC questionnaire, weighted responses to question 3.3, for firms that responded in the affirmative to question 1.14.

[71]Respondents may have indicated more than one characteristic of infringing products. One private sector association representative described as indirect costs of IPR infringement the "cost of the damage, the loss of value of brands and reputations as unsafe pirated and counterfeit products come onto the market." USITC, hearing transcript, June 15, 2010, 196 (testimony of Shaun Donnelly, International Business Policy).

[72]For example, the industry association that represents the U.S. toner and inkjet cartridge remanufacturing industry stated that "As the demand for these [remanufactured] printer cartridges has grown, so has the supply of illegal products. Counterfeit cartridges, poorly refilled cartridges bearing labels identical to the OEM [original equipment manufacturer] ones and packaged in identical OEM boxes, began appearing around the world." International Imaging Technology Council, written submission to USITC, July 8, 2010.

[73]Respondents may have indicated more than one characteristic of infringing products.

[74]USITC, hearing transcript, June 16, 2010, 335 (testimony of James D'Addario, D'Addario & Co., Inc.).

[75]Respondents may have indicated more than one characteristic of infringing products.

High-quality counterfeits: Less than 10 percent of firms characterized the allegedly infringing products as high-quality or high-price substitutes or counterfeits such that consumers may not realize they are buying illegal products. High-quality counterfeits ranked particularly high nevertheless for firms in the transportation manufacturing and the information and other services sectors.[76]

Price Discounting Practices

Divergent views were expressed on price discounting practices. Only 27.6 percent of firms that reported IPR infringement reported that they generally discount their prices, relative to U.S. prices, for comparable products in China.[77] Almost three-quarters of those firms discounting (73.6 percent) stated that they offered discounts of 10 percent or greater in the Chinese market; however, the majority (59.3 percent) reported that the discount was not associated with competition from allegedly infringed products.[78] These survey findings most likely indicate that firms were engaged in differential pricing—offering lower prices in China to account for relatively lower Chinese incomes—rather than discounting prices to compete with counterfeit products.[79]

Although a number of firms that reported IPR infringement in China also reported that at some point they discounted prices, many also seemed to find that price discounting was not an effective strategy to combat piracy. One source stated, "I don't think that there is a business model in the world that can compete with a [pirated] price where the marginal cost of production [such as with digital copyright piracy] is almost nothing."[80] One U.S. firm reported that even lowering its Chinese distributors' net prices by 30 percent[81] was of limited effectiveness in the light of Chinese tariffs and China's undervalued currency.[82] Moreover, lowering prices on the genuine products meant that "the price disparity [between the genuine and the counterfeit articles] isn't quite as much so it's even more confusing for the [Chinese] consumer."[83]

Most firms that reported IPR infringement in China also reported that Chinese IPR infringers did not discount the prices of infringing products relative to the prices of legitimate products in China. According to one source, Chinese infringers appear to be becoming increasingly sophisticated in their pricing strategies, often pricing their counterfeit products at near world price levels to deceive potential customers into thinking that they had merely received good deals on non-infringing products.[84] Just one-fifth of U.S. firms (21.2 percent) reported that Chinese IPR infringers discounted their

[76]Respondents may have indicated more than one characteristic of infringing products.

[77]USITC questionnaire, weighted responses to question 3.1, for firms that responded in the affirmative to question 1.14. The Commission notes that in response to question 2.6 (see the discussion "Reasons for Lower Revenues"), 17.4 percent of firms cited lowering prices to compete with infringing Chinese products as one reason for their lower revenues. As questions 2.6 and 3.1 were two fundamentally different questions, the resulting statistics are not contradictory.

[78]USITC questionnaire, weighted responses to question 3.1, for firms that responded in the affirmative to question 1.14.

[79]For example, one trade association representative representing firms in the information and other services sector reported that the members of that association generally practice differential pricing in selected markets. That source stated that differential pricing was more a strategy to take into account China's significantly lower per capita income compared to that of the United States, rather than a strategy to counter IPR infringement. USITC, hearing transcript, June 15, 2010, 458 (testimony of Michael Schlesinger, IIPA).

[80]USITC, hearing transcript, June 15, 2010, 459 (testimony of Michael Schlesinger, IIPA).

[81]Ibid., 335 (testimony of James D'Addario, D'Addario and Co., Inc.).

[82]D'Addario, written submission to the USITC, May 24, 2010.

[83]USITC, hearing transcript, June 15, 2010, 368 (testimony of James D'Addario, D'Addario and Co., Inc.).

[84]Industry representative, interview by USITC staff, Washington, DC, November 3, 2010.

prices.[85] Among these firms, more than one-third of firms in the information and other services sector (37.5 percent) [86] and one-fourth of firms in the high-tech and heavy manufacturing sector (26.1 percent)[87] reported that Chinese IPR infringers discounted the prices of their infringing products. Overall, U.S. firms reporting Chinese price discounts for infringing products estimated those discounts to average 67.3 percent of the price charged for legitimate products in China. Firms in the information and other services sector reported the steepest average price discount, 94.5 percent, and firms in the high-tech and heavy manufacturing sector reported an average price discount of 46.3 percent.[88]

Survey Results: Type of IPR Infringement

This section describes the Commission's survey results for specific types of Chinese IPR infringement—copyright infringement, trademark infringement, patent infringement, and misappropriation of trade secrets. As stated above, the firms covered in this survey are those in the U.S. IP-intensive economy that have business in China and reported Chinese IPR infringement. Table 3.5 shows that more firms that had experienced IPR infringement in China (31.5 percent) reported material losses due to Chinese trademark infringement than any other type of IPR infringement.[89]

Copyright Infringement

Copyrights generally encourage creative endeavors by prohibiting original works from being copied without the creator's permission. Those works are varied and include literary and artistic works, as well as computer programs.[90] Costs associated with copyrighted works generally include a fixed cost to author the work and a variable cost to make copies.[91] That fixed cost—whether to write a new software operating system, or to produce and film a major motion picture—can be high, and sales, transmissions, broadcasts, or licensing of copies are what firms usually rely upon to recoup those fixed costs. Copyright infringement, sometimes referred to as copyright piracy, inhibits a firm's capacity to recoup those fixed costs.

[85]USITC questionnaire, weighted responses to question 3.2, for firms that responded in the affirmative to question 3.2.

[86]Data for information and other services sector significant at the 80 percent level. USITC questionnaire, weighted responses to question 3.2, for firms that responded in the affirmative to question 3.2.

[87]Data for information and other services sector significant at the 90 percent level. USITC questionnaire, weighted responses to question 3.2, for firms that responded in the affirmative to question 3.2.

[88]USITC questionnaire, weighted responses to question 3.2, for firms that responded in the affirmative to question 3.2.

[89]Losses include material sales or profit losses anywhere in the world. USITC questionnaire, weighted responses to questions 4.1, 5.1, 6.1, and 7.1, for firms that responded in the affirmative to question 1.14. Percentages do not add to 100 percent because respondents may have reported more than one kind of loss.

[90]Berne Convention for the Protection of Literary and Artistic Works, art. 2; TRIPS art. 10; 17 U.S.C. §§ 101–102.

[91]Landes and Posner, *The Economic Structure of Intellectual Property Law*, 2003, 37.

Losses Due to Chinese Copyright Infringement

Firms estimated losses due to reported Chinese copyright infringement of $23.7 billion (in the range of $10.2 billion to $37.3 billion) during 2009 (table 3.2). Material sales or profit losses worldwide from Chinese copyright infringement during 2007–09 were reported by 15.5 percent[95] of firms that reported IPR infringement in China (table 3.6).[96] More firms reported losses in the Chinese market due to copyright infringement than to other forms of IPR infringement (table 3.5 and figure 3.4). Perhaps because of the generally low cost of illegally replicating copyrighted works and the ease of distribution (whether by physical or digital means), piracy of copyrighted works resulted in substantial losses during 2007–09, as noted earlier. Firms that experienced copyright infringement in China averaged a loss-to-sales ratio of 6.4 percent in 2009, the highest among all forms of IPR protection (table 3.6).

TABLE 3.6 U.S. firms experiencing IPR infringement in China: Copyright infringement, survey results (percent)

Description	Survey results
Loss-to-sales ratio (losses/sales), 2009	6.4
Share of firms that experienced material sales or profit losses anywhere in the world due to copyright infringement in China during 2007–09	[a]15.5
Share of firms that reported losses and could differentiate market where losses occurred	98.9
Percent of 2007–09 losses in:	
• Chinese market	90.2
• U.S. market	0.9
• Other markets	8.9
Share of firms that reported losses and could not differentiate market where losses Occurred	[b]1.1
Share of firms that incurred expenses to address the infringement of firms' copyrights in China	94.0
Share of firms that experienced the following U.S. employment effects as a result of copyright infringement in China:[c]	
• U.S. employment decreased	[c]8.9
• U.S. employment increased	[a]0.1
• No change in U.S. employment	91.1

Source: USITC questionnaire, weighted response data.

Note: Significant at the 95 percent level unless otherwise indicated. Weighted responses to questions in section 4 of the questionnaire for firms responding in the affirmative to question 1.14, unless otherwise indicated. Percentages may not add to 100 due to rounding or because respondents may have made multiple selections or given more than one response for certain questions.

[a]Significant at the 90 percent level.
[b]Significant at the 70 percent level.
[c]For firms responding in the affirmative to question 4.1.

Firms in the information and other services sector were most commonly affected by copyright losses, with half (50.0 percent)[97] of all such firms reporting material losses. A total of 7.6 percent[98] of firms in the high-tech and heavy manufacturing sector also

[95]Significant at the 90 percent level.
[96]USITC questionnaire, weighted responses to question 4.1 for firms that responded in the affirmative to question 1.14. Respondents may have indicated losses due to more than one type of infringement.
[97]Significant at the 90 percent level.
[98]Significant at the 75 percent level.

reported such losses;[99] these may be attributable to piracy of a variety of different types of works, including semiconductor maskworks [100] proprietary software used in manufacturing, software installed on consumer electronics such as smart phones, and Internet content used to support product sales.[101]

Half (49.5 percent) of all firms that reported experiencing violations of copyrights in China also reported they incurred sales or profit losses during 2007–09, at least in part as a result of copyright infringement. Again, this was most prevalent in the information and other services sector, where 79.2 percent of firms experienced losses.[102] Most firms reporting copyright infringement losses (98.9 percent) during 2007–09 were able to identify the markets where their losses occurred; 90.2 percent of those losses occurred in China (table 3.6).[103]

Part of the problem for many of the copyright industries (such as music, movies, and book publishing) is the market access limitation that they face in China. For example, China severely limits the number of new foreign films that can be introduced in that market each year, making legitimate sales of products by foreign film companies nearly impossible.[104] It is believed that the longer infringement remains pervasive in China, the harder it becomes for companies to sell legitimate products at profitable rates. According to one publisher, the prevalence of piracy establishes a price point for their product that prices the original out of the market, rendering Chinese retailers unwilling to purchase legitimate foreign-source products in meaningful quantities.[105]

Scope of Copyright Infringement

Copyright infringement has had a significant impact on firms in the information and other services sector. Half of the firms in this sector (50.0 percent)[106] reported that they had reason to believe that one or more of their copyrighted works were infringed in China during 2007–09.[107] Half of the firms in this sector (50.0 percent)[108] also reported lost sales, royalties, license fees, or other income in China or in markets outside of China as a result of copyright infringement during 2007–09.[109] In addition to the more common

[99]USITC questionnaire, weighted responses to question 4.1, for firms responding in the affirmative to question 1.14.

[100]Some survey respondents identified losses due to the infringement of their layout designs for integrated circuits in response to the survey questions on copyright infringement.

[101]USITC questionnaire, survey respondents.

[102]The high-tech and heavy manufacturing, chemical manufacturing, and transportation manufacturing industries also felt the effects, with 58.2, 19.7 and 13.3 percent, respectively, of firms reporting losses from copyright infringement. USITC questionnaire, weighted responses to question 4.1, for firms responding in the affirmative to question 1.14.

[103]USITC questionnaire, weighted responses to question 4.5b, for firms responding in the affirmative to question 1.14.

[104]Market restrictions affecting the motion picture industry include the maintenance of a quota of only 20 films for which revenue sharing of the box office receipts between the producers and the importer and distributor is possible; the inability to import and distribute films except through the two main Chinese film companies; a screen-time quota; a restriction on market access for foreign satellite programming; television broadcast quotas; blackout periods for films; local print requirements; and import duties. All of these, according to the IIPA, close off the market for U.S.-produced films and programming. IIPA, written submission to the USITC, June 3, 2010, 12.

[105]USITC questionnaire, survey respondent.

[106]Significant at the 90 percent level.

[107]USITC questionnaire, weighted responses to question 4.3a, for firms that responded in the affirmative to question 1.14.

[108]Significant at the 85 percent level.

[109]USITC questionnaire, weighted responses to question 4.5a, for firms that responded in the affirmative to question 1.14.

methods of copyright piracy—illegal downloads and physical reproduction of infringed material—firms reported substantial losses from under-licensing. In such cases a Chinese company may purchase a single-user license or subscription to a database or information service and then distribute it throughout the organization. This practice puts firms that pay for such services legitimately at a competitive disadvantage with their Chinese counterparts, as the subscriptions can be costly.[110] More broadly, illegal downloads of business software by Chinese entities can put foreign firms that purchase software legally—which can represent significant investments for U.S. firms in their operations—at a disadvantage relative to Chinese firms that did not make similar investments yet sell the same products or services in direct competition.[111] These issues are addressed further in chapter 4.

Firms that reported IPR infringement in China have registered thousands of copyrights, with almost all (98.6 percent) pending or in force in the United States. Of those registered copyrights in the United States, most (96.5 percent) are held by companies in the information and other services sector.[112] By law, copyrights do not have to be registered in China in order to receive protection, but some companies choose to do so in an effort to secure enhanced protection or to facilitate the enforcement process. From the survey, it appears that many firms do not pursue enforcement actions.[113] This is reportedly due to the associated costs and unsatisfactory outcomes in administrative and court proceedings.[114]

Impact of Copyright Infringement

Firms that reported IPR infringement generally said that the pace of copyright infringement in China remained steady during 2007–09, and a minority of firms indicated that copyright infringement had increased. The reported effects of infringement went well beyond lost sales, in some cases affecting employment and innovation. The U.S. employment effects of copyright infringement are uncertain. When asked to provide data on employment changes resulting from infringement losses, most firms were unable to produce an estimate, and those that did largely reported no change.[115] However, anecdotal reports suggest that the effects, while difficult to quantify, are likely more pervasive than data would suggest. According to one company, losses resulting from piracy in China affect not only them, but also their subsidiaries and distributors, who may experience slower growth and employment constraints.[116]

Firms that reported copyright infringement in China generally did not report scaling back on R&D expenses as a result of material losses during 2007–09.[117] This may be related, in part, to the fact that copyrighted works may not be as R&D intensive as other IPR-protected works, though it is likely also because these firms do not tend to classify their activities—for example, money spent in promoting a new artist—as R&D in the sense of pursuing new knowledge through research. However, firms with copyright issues often expend considerable resources developing new products and material. Moreover, some

[110]Industry representative, telephone interview by USITC staff, December 2010.
[111]Business Software Alliance, written submission to USITC, June 3, 2010, 2.
[112]USITC questionnaire, weighted responses to question 4.2.
[113]USITC questionnaire, weighted responses to question 4.4a, for firms that responded in the affirmative to question 1.14.
[114]USITC questionnaire, survey respondents.
[115]USITC questionnaire, weighted responses to question 4.8.
[116]USITC questionnaire, survey respondent.
[117]USITC questionnaire, weighted responses to question 4.9.

firms reported increased research spending to develop more sophisticated technological protection measures and other means of protecting their works from piracy.[118]

Copyright Infringement and Enforcement Challenges

The majority of firms that reported copyright infringement in China said they did not pursue legal action because the penalties for parties found liable were reported to be too low to act as a deterrent or because the costs of doing so were thought to be too high given the minimal penalties.[119] However, 94.0 percent of firms that reported material losses from copyright violations in 2007–09 incurred some expenses to address infringement,[120] and 31.8 percent[121] of these firms pursued enforcement proceedings.[122] Ultimately, however, nearly all firms that pursued enforcement proceedings were dissatisfied with the outcome,[123] and such experiences are likely to provide disincentives for firms to further engage in such proceedings. Some companies have attempted to pursue criminal proceedings against known offenders, but report that Chinese government officials are reluctant to initiate them and often refuse to transfer cases to the agency responsible for undertaking criminal proceedings.[124]

In the face of these challenges, many companies elect to fight piracy largely on their own—for example by monitoring Internet distribution channels of infringing material and sending cease and desist letters to violators. One company reported working with PayPal and other legitimate payment processors to cut off the ability of consumers to purchase pirated products from unauthorized Web sites. However, as noted earlier, this approach has been likened to a game of whack-a-mole, with distributors reemerging online under a different name—sometimes within hours of shutting down the original site (see box 2.2).[125]

Digital Copyright Piracy

While anecdotal information suggests that copyright infringement through illegal Internet downloads is on the rise, it remains difficult to quantify the effects of such reported activity. Based on the questionnaire responses, it appears that most companies are not able to accurately assess losses from digital infringement versus those from physical infringement. However, one industry representative reported that digital piracy overtook physical piracy in 2008 as the predominant method of copyright infringement in China.[126] Further, there is a strong sentiment across many segments of the information industry that digital piracy is one of the most pressing issues that firms are facing, with P2P, deeplinking sites, and other illegal file-sharing sites having a significant negative effect on profitability. These issues are discussed in more detail in chapter 2 of this report.

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[118]USITC questionnaire, survey respondent.

[119]Industry representative, interview by USITC staff, Hong Kong, China, January 3, 2011.

[120]USITC questionnaire, weighted responses to question 4.6a, for firms that responded in the affirmative to question 4.1.

[121]Significant at the 80 percent level.

[122]USITC questionnaire, weighted responses to question 4.4a, for firms that responded in the affirmative to question 1.14.

[123]USITC questionnaire, weighted responses to question 4.4d, for firms that responded in the affirmative to question 1.14.

[124]Survey response. Further, it is reported that firms with infringement issues often elect not to pursue action because their position in the market and the business climate may be such that making waves could cause them greater long-term damage. Industry representative, telephone interview with USITC staff, Washington, DC, December 17, 2010.

[125]Industry representative, interview by USITC staff, Washington, DC, November 3, 2010.

[126]Ibid.

Trademark Infringement

Trademarks generally protect the right to use a distinctive mark or name to identify and distinguish a product, service, or firm.[127] Trademarks enable a consumer to purchase products or services from brands that the consumer believes to be reliable or desirable.[128] Firms spend substantial sums on product quality, service, and advertising in order to establish the reputation of their brands.[129] A trademark infringer can cause a trademark owner to lose sales when the infringer competes in the marketplace with the trademark owner, deceiving consumers as to the source of goods or services offered. Beyond lost sales, poor-quality counterfeits undermine the investments made by brand owners in the quality and reputation of their products and can give rise to health and safety concerns, as well as to wrongful product warranty and liability claims. Brands are no less important to small firms; there are more than 1.6 million active certificates of federal trademark registration in the United States.[130]

Counterfeiting in China is reported to be a significant problem affecting a wide cross-section of companies, as virtually any good or service with a trademark can be and is counterfeited there.[131] The majority of companies reported that counterfeiting continues to grow in China, and most companies experiencing material losses in sales or profits due to trademark infringement also pursued enforcement proceedings to address these losses.

Losses Due to Trademark Infringement

Firms estimated losses due to reported Chinese trademark infringement of $6.1 billion (in the range of $1.4 billion to $12.5 billion) during 2009 (table 3.2). Nearly one-third of firms that reported IPR infringement in China (31.5 percent) also reported material sales or profit losses worldwide from Chinese trademark infringement during 2007–09,[132] meaning that more firms reported worldwide losses due to trademark infringement than to other forms of Chinese IPR infringement (table 3.5).[133] Most firms reporting trademark infringement losses (83.3 percent) were able to identify the markets where their losses occurred; the largest losses were reported in the Chinese market (37.7 percent), followed by the U.S. market (32.3 percent) and all other markets (30.1 percent).[134] However, almost one-fifth of firms (16.7 percent) could not identify the markets where their losses occurred (table 3.7). The growing use of the Internet to sell counterfeit goods may contribute to the large share of losses that could not be attributed to specific markets.[135]

The sector with the largest share of firms that reported losses related to trademark infringement (90.8 percent) is the consumer goods manufacturing sector, while companies in the high-tech and heavy manufacturing sector registered the largest

[127] *See* TRIPS art. 15 ¶ 1. For more information on the definition of trademarks, see USITC, *China: Intellectual Property Infringement*, 2010, 1-5.

[128] Landes and Posner, *The Economic Structure of Intellectual Property Law*, 2003, 167–68.

[129] Ibid., 168.

[130] USITC, *China IPR and Indigenous Innovation 1*, 2010, 3-24.

[131] Ibid., 3-15, 3-16.

[132] USITC questionnaire, weighted responses to question 5.1, for firms that responded in the affirmative to question 1.14. Respondents may have indicated losses due to more than one type of infringement.

[133] As noted earlier, while more firms reported losses *in the Chinese market* due to copyright infringement than to other forms of IPR infringement, more firms reported *worldwide* losses due to trademark infringement than to other forms of Chinese IPR infringement.

[134] USITC questionnaire, weighted responses to question 5.5b, for firms that responded in the affirmative to question 1.14.

[135] For more information on IPR infringement and the Internet, see chapter 2.

losses—nearly 70 percent of total reported losses.[136] Some industry representatives estimated that their sales have been one-third lower because of Chinese counterfeiting.[137] Almost none of the firms experiencing trademark infringement could quantify the extent to which trademark infringement in China has damaged, diluted, or tarnished the value of their trademarks, but identified these costs as significant.

TABLE 3.7 U.S. firms experiencing IPR infringement in China: Trademark infringement, survey results (percent)

Description	Survey results
Loss-to-sales ratio (losses/sales), 2009	0.8
Share of firms that experienced material sales or profit losses anywhere in the world due to trademark infringement in China during 2007–09	31.5
Share of firms that reported losses and could differentiate market where losses occurred	83.3
Percent of 2007–09 losses in:	
• Chinese market	37.7
• U.S. market	32.3
• Other markets	30.1
Share of firms that reported losses and could not differentiate market where losses occurred	[a]16.7
Share of firms that incurred expenses to address the infringement of firms' trademarks in China[b]	92.1
Share of firms that experienced the following U.S. employment effects as a result of trademark infringement in China:	
• U.S. employment decreased	[a]8.6
• U.S. employment increased	0.1
• No change in U.S. employment	91.3

Source: USITC questionnaire, weighted response data.

Note: Significant at the 95 percent level unless otherwise indicated. Weighted responses to questions in section 5 of the questionnaire for firms responding in the affirmative to question 1.14, unless otherwise indicated. Percentages may not add to 100 due to rounding or because respondents may have made multiple selections or given more than one response for certain questions.

[a]Significant at the 80 percent level.
[b]For firms responding in the affirmative to question 5.1.

Scope of Trademark Infringement

Trademark infringement was most pervasive among consumer goods manufacturers, as almost all of them (91.6 percent) reported such problems. Trademark infringement in China was also common among chemical manufacturers, as 33.0 percent of them identified trademark infringement losses in China.[138] Box 3.4 reports industry comments and concerns about trademark infringement in China.

[136]Significant at the 75 percent level. USITC questionnaire, weighted responses to question 5.5, for firms that responded in the affirmative to question 1.14. Respondents may have indicated losses due to more than one type of infringement.

[137]Industry representative, interview by USITC staff, Hong Kong and mainland China, January 3–7, 2011; iindustry representative, interview by USITC staff, Shanghai, January 10–14, 2011.

[138]Significant at the 90 percent level. USITC questionnaire, weighted responses to question 5.1, for firms that responded in the affirmative to question 1.14.

BOX 3.4 Company comments regarding trademark registration in China

Companies identified a variety of concerns about trademark registration in China during field interviews and in questionnaire responses. Some of those concerns are summarized below.

Trademark registration backlog. According to one industry representative, a large backlog of trademark registrations in China prevents timely registration of all of a firm's trademarks. One company official estimated that it takes on average 18 months to 2 years to register a Chinese trademark, which provides a significant amount of time for counterfeiting to take place. This is a particular problem for products with a short life cycle, such as toys. In addition, according to other industry representatives, Chinese trademark authorities grant virtually all applications to register a trademark, including those that violate existing trademarks.

Trademarks with similar names. Many registered trademarks are very similar to those already registered, and may include misspellings, or a slightly different company name. According to one company official, foreign companies in China are particularly vulnerable to having their Chinese company name (which is often a Chinese translation or transliteration of the company's English trademark) registered by Chinese companies or individuals as their own trademark. On the other hand, a Chinese provincial high court recently upheld a lower court decision in favor of French cosmetics brand L'Oreal in its case against a Chinese company using the trademark "L'Oiyir."

Trademarks registered in different product classes. Other company representatives noted that third parties register the identical trademark but apply it to their own goods by registering the mark in product classes or subclasses that are different from the company's typical product classes. Industry representatives noted that it is extremely difficult to enforce rights vis-à-vis infringers in unrelated business categories (product classes) and even unrelated subclasses within the same class. To address these concerns, a number of companies reported increasing their "trademark scope" by registering their trademarks in more business categories and subclasses, regardless of the product.

Trademark "squatting." Other industry officials are concerned about trademark "squatting," which refers to the act of registering another party's brand name as your own. China has a "first-to-register" system that requires no evidence of prior use or ownership, leaving registration of popular foreign marks open to third parties. These third parties (squatters) may then bring an infringement action or seek payment from the true brand owner.

Sources: Survey respondents; industry officials, interviews with USITC staff, Hong Kong and mainland China, January 3–7, 2011, and Shanghai, China, January 10–14, 2011; U.S. government official, telephone interview by USITC staff, February 1, 2011; "Desist Order on 'L'Oreal' Labeling for Local Firms," *China Daily*, January 19, 2011; "China's IP Journey," *WIPO Magazine*, December 2010.

The large share of firms reporting material losses in the consumer goods manufacturing sector was accounted for by the apparel manufacturing subsector, in which nearly all firms (99.7 percent) reported material losses. This was followed by the breweries, wineries, and distilleries (50.7 percent) and footwear (44.0 percent) subsectors. Nearly all firms (96.7 percent) in the pesticide, fertilizer, and other agricultural chemical manufacturing subsector of the chemical manufacturing sector also reported losses. In the information and other services sector, nearly all firms (99.4 percent) in the motion picture and video industries subsector reported material losses, followed by the sound recording (64.0 percent) and software publishers (35.1 percent) subsectors. Finally, in the high-tech and heavy manufacturing sector, significant shares of firms in the following subsectors reported material losses: miscellaneous manufacturing (41.2 percent), medical equipment and supplies manufacturing (41.0 percent), and semiconductor and other electronic component manufacturing (32.7 percent).[139]

Firms that reported IPR infringement had many fewer trademarks registered in China than in the United States. The number of trademarks recorded with U.S. Customs and

[139]USITC questionnaire, weighted responses to question 5.1, for firms that responded in the affirmative to question 1.14.

China Customs was significantly smaller than the number of trademarks registered.[140] The smaller number of trademarks pending or in force in China than in the United States can be partly attributed to a lack of awareness among SMEs that a U.S. trademark does not offer full protection in China and other markets.[141]

Impact of Trademark Infringement

Although the majority of firms (51.0 percent) reported that they could not determine the trend in trademark infringement in China during 2007–09, 41.0 percent of firms indicated that trademark infringement increased during 2007–09;[142] this was particularly true of firms in the chemical manufacturing and information services sectors. According to industry representatives, Chinese counterfeiting is growing each year as it spreads across China, affects a broader range of products, and involves a growing number of markets.[143] For example, as enforcement improved in Guangzhou, a major coastal counterfeiting center in southeast China, counterfeiters reportedly moved inland.[144] Similarly, as a brand owner "gets better at dealing with fakes," the counterfeiters move on to new brands.[145] Internet-based trade in counterfeits is also proliferating and remains particularly hard to police.[146] The growth of small-scale so-called "living room" counterfeiters, who can move quickly to avoid detection, and the lack of penalties against retailers who sell counterfeits, have also led to a spread in counterfeit activity.[147]

A much smaller share of firms (7.7 percent)[148] reported that trademark infringement was stable during 2007–09,[149] including some in the pharmaceuticals and electrical equipment, appliance, and component manufacturing subsectors. One company representative mentioned that in sectors with potential food safety problems the trend may be stabilizing, as Chinese authorities assess more stringent penalties when health or safety issues are involved.[150] Very few companies said that trademark infringement decreased from 2007 to 2009 (0.2 percent),[151] with most of those responses coming from firms in the high-tech and heavy manufacturing sector. One company that reported a decrease in trademark infringement between 2007 and 2009 reported it "decreased due to the global economy and not because of better enforcement by China."[152]

The majority of companies (91.3 percent) reported that trademark infringement in China did not affect the number of U.S. employees they hired during 2007–09.[153] A much

[140]USITC questionnaire, weighted responses to question 5.2. U.S. Customs can seize counterfeit imports. China Customs can seize both counterfeit imports and counterfeit exports. For further information, see USITC, *China: Intellectual Property Infringement*, 2010, 1-14.

[141]A 2005 U.S. Patent and Trademark Office study found that 85 percent of SMEs who export do not realize their U.S. trademarks and patents do not protect them overseas. Stopfakes.gov, "Do You Have a Plan to Protect Your Products from Intellectual Property Theft in China?" n.d.

[142]USITC questionnaire, weighted responses to question 5.8.

[143]USITC questionnaire, survey respondent; industry representative, interviews by USITC staff, Shanghai, China, January 10–14, 2011.

[144]Industry representative, interviews by USITC staff, Shanghai, China, January 10–14, 2011.

[145]Ibid.

[146]For more information, see chapter 2 of this report.

[147]Industry representatives, interviews by USITC staff, Shanghai, China, January 10–14, 2011. For more information on the factors facilitating the growth of counterfeiting, see chapter 2 of this report. Chapter 2 also includes an in-depth discussion of the rise of counterfeiting in the footwear industry (box 2.1)

[148]Significant at the 85 percent interval.

[149]USITC questionnaire, weighted responses to question 5.8.

[150]Industry representative, interview by USITC staff, Shanghai, China, January 10–14, 2011.

[151]Significant at the 85 percent level.

[152]USITC questionnaire, survey respondent.

[153]USITC questionnaire, weighted responses to question 5.9.

smaller share of firms (8.6 percent)[154] said that trademark infringement caused a decrease in the firm's employment of U.S. workers. Only a few companies reported an increase in the number of U.S. workers during 2007–09 because of trademark infringement; generally, these were employees dedicated to enforcement efforts. The impact of any improvements in trademark protections in China on U.S. employees reportedly would depend on whether there was U.S. production. Firms with U.S. production indicated that U.S. employment would be higher if IPR protection improved.[155] By contrast, according to several firms that manufacture in China, even if IPR protection improved in China, the number of U.S. employees at their companies would not change. Instead, firms stated that jobs in China could grow.[156] These companies were of the opinion that production in China will not return to the United States, because China offers lower production costs and a faster-growing market. One company official estimated annual growth of 25–35 percent in the Chinese market in his product line over the past few years.[157]

Nearly all firms (86.1 percent) said that trademark infringement in China had no effect on U.S.-based R&D expenditures during 2007–09.[158] Several company officials noted that their U.S. R&D is not growing because the U.S. market is not growing; instead they conduct R&D in China focused on developing products for the large and growing Chinese market.[159] Among firms with trademark issues, R&D expenditures as a share of global sales were lower in China (0.1 percent) than in the United States (4.1 percent) or the world (6.5 percent). Although companies showed more willingness to invest in R&D in China for products intended for sale in China (the share of R&D expenditures in China to sales in China was 3.2 percent), this share was still lower than the share of U.S. R&D expenditures to U.S. sales (9.6 percent).

Trademark Infringement and Enforcement Challenges

Of the firms that reported material losses in sales or profits from trademark infringement in China during 2007–09, nearly all (92.1 percent) also incurred expenses to address the infringement.[160] These expenses averaged $50,459 per firm and accounted for less than 0.05 percent of their global sales. Total expenses were highest in the high-tech and heavy manufacturing sector, followed by the transportation manufacturing sector, particularly the motor vehicle equipment manufacturing subsector. Individual companies responding to the survey reported expenditures to address trademark infringement as high as $21 million during 2007–09, and typically noted that their estimates were substantially underestimated because they could not quantify personnel costs and many other related expenses.[161]

To address reported infringement, 92.1 percent of firms with material trademark losses said they pursued enforcement proceedings during 2007–09.[162] Administrative

[154]Significant at the 80 percent level.

[155]USITC, hearing transcript, June 15–16, 2010, 331 (testimony of James D'Addario, D'Addario and Co., Inc.).

[156]Industry representative, interview by USITC staff, Hong Kong and mainland China, January 3–7, 2011; industry representatives, interviews by USITC staff, Shanghai, China, January 10–14, 2011.

[157]Industry representative, interview by USITC staff, Shanghai, China, January 10–14, 2011.

[158]USITC questionnaire, weighted responses to question 5.10.

[159]Industry representative, interviews by USITC staff, Shanghai, China, January 10–14, 2011.

[160]USITC questionnaire, weighted responses to question 5.6a, for firms that responded in the affirmative to question 5.1.

[161]USITC questionnaire, survey respondents.

[162]USITC questionnaire, weighted responses to question 5.4a, for firms that responded in the affirmative to question 1.14.

proceedings were the type of proceeding most frequently pursued, accounting for 99.1 percent of all reported proceedings, followed much further behind by civil and criminal cases. Dissatisfaction with the outcome of proceedings was reported by the vast majority of firms pursuing administrative, civil, and criminal cases, 90.4 percent, 97.8 percent, and 98.4 percent, respectively.

Administrative proceedings remain the most popular because they are generally faster and less expensive than the other options,[163] but many industry representatives claimed that the remedies were too weak. For example, one U.S. firm that manufactures music strings and accessories stated that a Chinese factory was fined just $3,500 for counterfeiting 100,000 packages of guitar strings.[164] The limited remedies likely dissuade this and other firms from pursuing legal recourse. (See box 3.5 for more company comments on Chinese enforcement proceedings.) Firms reported an aggregate $3.4 million in monetary relief from legal proceedings related to trademark infringement in China during 2007–09, which represented less than 0.5 percent of total losses reported by firms from trademark infringement.

[163]USITC, *China IPR and Indigenous Innovation 1*, 2010, 1-8.

[164]USITC, hearing transcript, June 15–16, 2010, 371 (testimony of James D'Addario, D'Addario and Co., Inc.). According to the company, the average retail price for a set of counterfeit strings is 15–20 RMB ($2.22–$2.95) while an authentic set of D'Addario strings sells for about 35 RMB ($5.17).

Patents are of special importance to industries with significant R&D expenditures, including pharmaceuticals, agricultural chemicals, and biotechnology.[167] For example, the pharmaceutical sector reportedly expended over $65 billion in R&D in 2009, reinvesting about 16 percent of global sales in R&D.[168] Reportedly only 1 of about 5,000 products researched is approved for marketing each year and, as of 2005, the cost of bringing a pharmaceutical to market was estimated to be as high as $1 billion.[169] Patents, which can make it possible for firms to recoup some of this substantial investment, thus have been characterized as a pharmaceutical company's "main asset."[170] Similarly, some small firms, including startups, find patent holdings to be necessary to attract venture and other capital.[171]

Losses Due to Patent Infringement

Firms estimated losses due to reported Chinese patent infringement of $1.3 billion (in the range of $0.2 billion to $2.8 billion) during 2009 (table 3.2). Material sales or profit losses worldwide from Chinese patent infringement were reported by 15.3 percent of firms (table 3.8). The chemical manufacturing sector was the sector with the largest share (43.3 percent) of firms that reported losses related to patent infringement.[172]

TABLE 3.8 U.S. firms experiencing IPR infringement in China: Patent infringement, survey results (percent)

Description	Survey results
Loss-to-sales ratio (losses/sales), 2009	0.6
Share of firms that experienced material sales or profit losses anywhere in the world due to patent infringement in China during 2007–09	15.3
Share of firms that reported losses and could differentiate market where losses occurred	24.8
Percent of 2007–09 losses in:	
• Chinese market	53.8
• U.S. market	9.8
• Other markets	36.4
Share of firms that reported losses and could not differentiate market where losses occurred	[a]75.2
Share of firms that incurred expenses to address the infringement of firms' patents in China[b]	22.5
Share of firms that experienced the following U.S. employment effects as a result of patent infringement in China:	
• U.S. employment decreased	[a]7.9
• U.S. employment increased	[c]0.0
• No change in U.S. employment	92.1

Source: USITC questionnaire, weighted response data.

Note: Significant at the 95 percent level unless otherwise indicated. Weighted responses to questions in section 6 of the questionnaire for firms responding in the affirmative to question 1.14, unless otherwise indicated. Percentages may not add to 100 due to rounding or because respondents may have made multiple selections or given more than one response for certain questions.

[a]Significant at the 70 percent level.
[b]For firms responding in the affirmative to question 6.1.
[c]Significant at the 90 percent level.

[167]See, e.g., Maskus, *Intellectual Property Rights in the Global Economy* 200, 52; Landes and Posner, *The Economic Structure of Intellectual Property Law*, 2003, 316; USITC questionnaire responses; industry representative, telephone interviews by USITC staff, October–November 2010 and January 2011.
[168]PhRMA, "Pharmaceutical Industry Profile 2010: Key Facts."
[169]DiMasi and Grabowski, "The Cost of Biopharmaceutical R&D: Is Biotech Different?" 2007.
[170]Industry representatives, interviews by USITC staff, Shanghai, China, January 10–14, 2011.
[171]Graham, et al., *High Technology Entrepreneurs*, 2010, 1255, 1288–89.
[172]USITC questionnaire, weighted responses to question 6.1, for firms that responded in the affirmative to question 1.14 . Respondents may have indicated losses due to more than one type of infringement.

Of the firms reporting losses due to Chinese patent infringement in 2007–09, most (75.2 percent) were not able to identify the markets where their losses occurred. Firms that could differentiate their losses by market (24.8 percent) estimated that the Chinese market accounted for 53.8 percent of the losses, and the U.S. market accounted for 9.8 percent of the losses. Third-country markets accounted for 36.4 percent of the losses.[173] As an example of the importance of losses resulting from the reported Chinese patent infringement in third-country markets, a U.S. chemical company reported that it lost 50 percent of the Malaysian market for one of its brand-name products because of Chinese shipments of a similar product to Malaysia. The brand-name product and process were patented in China; the potentially-infringing Chinese product was said to be produced by a state-owned entity in China.[174]

The share of firms reporting patent infringement (15.3 percent) was significantly lower than the share reporting trademark infringement (30.5 percent) during 2007–09.[175] Industry sources attributed the lower reporting of patent infringement to several factors: (1) some U.S. companies focus on pursuing proceedings against trademark violations in China rather than known cases of patent infringement because trademark proceedings cost less and are considered easier to present; (2) it is likely that many patent-intensive U.S. firms, such as those in the chemical manufacturing sector, maintain trade secrets rather than patents in China to avoid disclosure of proprietary data when the patent is published; (3) trademark infringement may be more common because infringers compete with the original products largely on the basis of price differences, and the high costs involved with replicating patented processes or products can reduce infringers' price-competitiveness; and (4) the relative ease of detecting trademark infringement because a trademark is evident on the face of the infringing product or its packaging, whereas detailed study of the alleged infringing product or its manufacturing process may be required to detect patent infringement.[176]

Firms that reported losses related to patent infringement in China estimated an average share of losses to sales of less than 1.0 percent.[177] These losses were concentrated among large, U.S.-based companies with global sales of over $400,000 per employee.[178] In general, firms citing losses from Chinese patent infringement maintained a significantly higher ratio of R&D expenditures to global sales in 2009 (7.1 percent) than those who did not have such losses (about 2.6 percent).

[173]USITC questionnaire, weighted responses to question 6.6b for firms that responded in the affirmative to question 1.14.

[174]Industry representative, interview by USITC staff, Washington, DC, February 16, 2011.

[175]USITC questionnaire, weighted responses to questions 5.1 and 6.1, for firms that responded in the affirmative to question 1.14. Respondents may have indicated losses due to more than one type of infringement.

[176]Industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 3–7, 2010. See also USITC, *China: Intellectual Property Infringement*, 2010, 4-6.

[177]The share of losses to sales for companies citing Chinese patent infringement was much lower than the share reported by firms affected by copyright piracy.

[178]For many U.S. affiliates of foreign firms, their parent companies hold the patent rights, maintain sales in China, and/or enforce IPR protection, thereby potentially reducing the direct impact of Chinese patent infringement of the U.S. affiliates' products on the U.S. economy and jobs. Questionnaire responses; industry officials, telephone interviews by USITC staff, October–November 2010 and January 2011.

Scope of Patent Infringement

Firms citing patent infringement losses in China reported many more patents pending or in force in the United States than in China.[179] Sources stated that foreign companies tend to file fewer Chinese patents, mainly because of concern about the lack of enforcement.[180]

Firms in the high-tech and heavy manufacturing sector accounted for the majority of reported U.S. and Chinese patents, 72.8 percent and 53.7 percent, respectively. U.S. industry representatives stated that they were increasingly changing their strategies and patenting as many products and processes as possible, with many expanding their patent portfolio to include filing utility patents in China.[181] They also noted that companies increasingly are filing utility and invention patents simultaneously; the utility patent, which is likely to be approved fairly quickly, then can act as a preliminary level of protection until the invention patent is granted.[182]

Impact of Patent Infringement

Although the majority of firms (57.9 percent) reported that they could not determine the trend in patent infringement in China during 2007–09, substantially more reported that infringement increased (24.0 percent)[183] than decreased (less than 1 percent).[184]
Almost all firms (92.1 percent) reported that patent infringement in China did not affect the number of U.S. employees they hired during 2007–09.[185]

Firms were more likely to feel that Chinese patent infringement had caused changes in their U.S.-based R&D expenditures. While more than half (55.8 percent) of firms with R&D activities in the United States reported no effect in this regard, almost one-third (31.9 percent) stated that Chinese patent infringement had caused a reduction in U.S.-based R&D expenditures. No firms reported an increase in U.S.-based R&D.[186] Several companies stated that the amounts they spent on patent enforcement could otherwise have been spent on R&D.[187]

[179]USITC questionnaire, weighted responses to question 6.2, for patents pending or in force as of December 31, 2009. In addition, respondents reported very few patents recorded with Chinese customs authorities. Unlike in the United States, China customs permits the recordation of patents, which customs authorities may consult in connection with their detection of infringing goods at the border. USITC, *China IPR and Indigenous Innovation 1*, 2010, 2010, 1-5.

[180]Industry representatives, interviews by USITC staff, Shanghai, China, January 10–14, 2011.

[181]Industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 3–14, 2011. As discussed in the first report, utility patents (also called "petty patents") are not substantively examined before being granted and are largely held by Chinese entities. The United States does not offer utility patents. USITC, *China IPR and Indigenous Innovation 1*, 2010, 1-6.

[182]Industry representatives, interviews by USITC staff, Shanghai, China, January 10–14, 2011. See also USITC, *China IPR and Indigenous Innovation 1*, 2010, 4-2.

[183]Significant at the 90 percent level.

[184]USITC questionnaire, weighted responses to question 6.8.

[185]USITC questionnaire, weighted responses to question 6.9a.

[186]USITC questionnaire, weighted responses to question 6.10a.

[187]Industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 3–7, 2011.

Patent Infringement and Enforcement Challenges

Almost one-fourth (22.5 percent) of firms reported incurring expenditures to address Chinese patent infringement.[188] Although the chemical sector accounted for the largest number of firms reporting such expenses (73.4 percent), companies in the high-tech and heavy manufacturing sector reported the largest expenditures—over three quarters of the total (77.7 percent). The average enforcement expenditures for the other sectors were significantly lower.

Anecdotal statements about patent infringement cases in China cite issues such as evidentiary and administrative hurdles, smaller awards than expected, protectionism, and a perception of bias against foreign firms, as reasons for not pursuing cases.[189] Companies stated that it is hard to get cases to court for several reasons, including evidentiary challenges.[190] However, some industry representatives reported that the Chinese patent enforcement and litigation systems are improving.[191]

Trade Secret Misappropriation

A trade secret is technical or business information that is generally unknown to anyone outside the firm and brings economic advantage to the owner over competitors, and for which the owner has adopted measures to maintain its confidentiality. Almost all industries reportedly rely on trade secrets as one way to protect their valuable business information in China.[192] Some companies maintain trade secrets in place of patents to limit the disclosure of proprietary data.[193] Although all sectors are susceptible to trade secret misappropriation, the sectors from the IP-intensive economy that reported being the most affected were the chemical manufacturing sector, the consumer goods manufacturing sector, and the high-tech and heavy manufacturing sector.

Firms experiencing IPR infringement that reported trade secret misappropriation in China during 2007–09 had notably larger operations than those that did not mention trade secret misappropriation as a problem. Firms reporting trade secret misappropriation had an average sales-to-employee ratio three times higher than that of firms that did not report trade secret misappropriation.

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[188]USITC questionnaire, weighted responses to question 6.7, for firms that responded in the affirmative to question 6.1.

[189]Industry representative, interviews by USITC staff, Hong Kong and mainland China, January 3–14, 2011. Also, USITC, *China IPR and Indigenous Innovation 1*, 2010, 4-6.

[190]Industry representatives, interviews by USITC staff, Hong Kong and Mainland China, January 3–7, 2011. According to testimony before the Commission, the number of Chinese IPR litigation cases filed in 2009 increased by 25 percent to 30,626 cases. Most involved Chinese enterprises suing other Chinese enterprises. Only 4,400 of these cases, however, addressed patents. USITC, hearing transcript, June 15, 2010, 12 (testimony of Lee Branstetter, Carnegie Mellon University).

[191]Industry representatives, interviews by USITC staff, Shanghai, China, January 10–14, 2010.

[192]Industry representative, telephone interview by USITC staff, July 22, 2010; industry representatives, interviews by USITC staff, Beijing, China, September 8, 2010. The OECD notes that food and beverage companies may particularly rely on trade secrets to protect their proprietary recipes. OECD, *The Economic Impact of Counterfeiting and Piracy*, 2008, 328.

[193]USITC, hearing transcript, June 16, 2010, 385 (testimony of James D'Addario, D'Addario and Co., Inc.); industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 3–7, 2011.

Losses Due to Trade Secret Misappropriation

Firms estimated losses due to reported Chinese trade secret misappropriation of $1.1 billion (in the range of $0.2 billion to $2.4 billion) during 2009 (table 3.2). Material sales or profit losses worldwide from Chinese misappropriation of trade secrets during 2007–09 were reported by 7.2 percent[194] of firms experiencing IPR infringement in China (table 3.9).[195] This was most prevalent in the chemical manufacturing sector, in which 30.9 percent[196] of firms reported losses due to trade secret misappropriation. The high-tech and heavy manufacturing sector and the transportation sector also reported losses as a result of Chinese trade secret misappropriation.[197]

TABLE 3.9 U.S. firms experiencing IPR infringement in China: Trade secret misappropriation, survey results (percent)

Description	Survey response
Loss-to-sales ratio (losses/sales),[a] 2009	0.4
Share of firms that experienced material sales or profit losses anywhere in the world due to trade secret misappropriation in China during 2007–09[a]	[b]7.2
Share of firms that reported losses and could differentiate market where losses occurred	72.6
Percent of 2007–09 losses in:	
• Chinese market	5.7
• U.S. market	47.9
• Other markets	46.4
Share of firms that reported losses and could not differentiate market where losses occurred	[c]7.4
Share of firms that incurred expenses to address the misappropriation of firms' trade secrets in China	[d]14.4
Share of firms that experienced the following U.S. employment effects as a result of trade secret misappropriation in China:	
• U.S. employment decreased	[d]12.9
• U.S. employment increased	[e]0.0
• No change in U.S. employment	87.1

Source: USITC questionnaire, weighted response data.

Note: Significant at the 95 percent level unless otherwise indicated. Weighted responses to questions in section 7 of the questionnaire for firms responding in the affirmative to question 7.1, unless otherwise indicated. Percentages may not add to 100 due to rounding or because respondents may have made multiple selections or given more than one response for certain questions.

[a]For firms responding in the affirmative to question 1.14.
[b]Significant at the 85 percent level.
[c]Significant at the 70 percent level.
[d]Significant at the 75 percent level.
[e]Significant at the 85 percent level.

As mentioned earlier, some chemical manufacturing companies reported that they maintained trade secrets in place of patents to limit disclosure of proprietary data; this strategy makes them more susceptible to trade secret misappropriation.[198] Firms in the

[194]Significant at the 85 percent level.
[195]USITC questionnaire, weighted responses to question 7.1, for firms that responded in the affirmative to question 1.14. Respondents may have indicated losses due to more than one type of infringement.
[196]Significant at the 85 percent level.
[197]USITC questionnaire, weighted responses to question 7.1, for firms that responded in the affirmative to question 1.14. Respondents may have indicated losses due to more than one type of infringement.
[198]Industry representatives, interviews by USITC staff, Hong Kong and mainland China, January 3–7, 2011; industry representative, telephone interview by USITC staff, February 18, 2011; USITC, hearing transcript, June 16, 2010, 385 (testimony of James D'Addario, D'Addario and Co., Inc.).

pharmaceutical subsector (part of the chemical manufacturing sector) and in other chemical manufacturing subsectors reported the largest losses in sales, royalties, license fees, or other income from Chinese trade secret misappropriation during 2007–09. Within the high-tech and heavy manufacturing sector, firms in two subsectors—machinery manufacturing and semiconductor and other electronic component manufacturing—reported the largest losses.

The majority of firms that reported IPR infringement in China said that most of their losses from trade secret misappropriation occurred outside the Chinese market, with a large portion of the losses occurring in the U.S. market (47.9 percent) and third-country markets (46.4 percent).[199] It is also possible that the ease of rapid dissemination of trade secrets via mobile telecommunications devices also may contribute to trade secret losses occurring outside of China.[200]

Scope of Trade Secret Misappropriation

A total of 17.2 percent of firms experiencing IPR infringement in China, and almost all (98.0 percent) firms that experienced trade secret misappropriation in China, reported taking steps to maintain proprietary trade secrets as part of their Chinese operations during 2007–09,[201] including using nondisclosure agreements and tightening internal control over operations.[202] The chemical manufacturing sector—particularly the pharmaceutical and medicine manufacturing subsector—had the highest number of firms that reported taking measures to maintain proprietary trade secrets in China. Numerous companies in the consumer goods manufacturing sector also reported taking steps to preserve proprietary trade secrets in China. However, more than 85.0 percent of the firms that took steps to maintain proprietary trade secrets as part of their operations in China reported that the steps were not effective.[203] Protecting trade secrets was characterized by firms as being difficult.[204] The chemical manufacturing sector and the high-tech and heavy manufacturing sector reported experiencing the most problems when trying to maintain proprietary trade secrets in China.

The majority of firms that reported trade secret misappropriation in China also reported that the most common avenue of misappropriation in China is current or former employees; these employees may take the information to new employers or use it to start a new rival company, sometimes even despite nondisclosure agreements.[205] Most of the firms experiencing IPR infringement in China who reported having to disclose confidential data stated that to their knowledge, their confidential data had not been disclosed to persons outside the regulatory agency.[206]

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[199]USITC questionnaire, weighted response to question 7.5b.

[200]Industry representative, interview by USITC staff, Washington, DC, November 3, 2010.

[201]USITC questionnaire, weighted response to question 7.2a, for firms that responded in the affirmative to question 7.1.

[202]Industry representatives, interviews by USITC staff in Hong Kong and mainland China, January 3–7, 2011; USITC.

[203]USITC questionnaire, weighted response to question 7.2b.

[204]Industry representatives, interviews by USITC staff in Hong Kong and mainland China, January 3–7, 2011.

[205]Industry representatives, interview by USITC staff, Washington, DC, July 15, 2010; industry representatives, interviews by USITC staff, Shanghai, China, September 15, 2010; Pagnattarro, "The Google Challenge," 2007, 625–32.

[206]USITC questionnaire, weighted response to question 7.10, for firms that responded in the affirmative to question 7.1.

Impact of Trade Secret Misappropriation

About half (52.7 percent) of firms that reported experiencing trade secret misappropriation in China also reported that misappropriation became a bigger problem during 2007–09. More firms in the chemical manufacturing sector and the information and other services sector reported that trade secret misappropriation became a bigger problem during the period. Very few firms reported that trade secret misappropriation became a smaller problem.[207]

Most (87.1 percent) of firms reported no change in employment in the United States from 2007-09 as a result of trade secret misappropriation. A smaller share (12.9 percent) reported that employment decreased, particularly firms in the chemical manufacturing sector. Some firms in the high-tech and heavy manufacturing sector also reported a decrease in U.S. employment. Very few firms reported an increase in U.S. employment as a result of trade secret misappropriation in China, presumably dedicated to IPR enforcement.[208] On the other hand, most firms (85.4 percent) reported no changes in R&D expenditures in the United States as a result of trade secret infringement in China during 2007–09.[209]

Trade Secret Infringement and Enforcement Challenges

A large portion of firms experiencing trade secret misappropriation in China (60.0 percent) reported not having incurred expenses to address the misappropriation.[210] Some firms reported that not only are the procedural requirements for bringing suit significant, but that it is challenging to come up with the written evidence that Chinese law requires to prove that the misappropriation occurred.[211] Nevertheless, a few firms in the high-tech and heavy manufacturing sector reported having incurred enforcement expenses.

Only 0.6 percent[212] of those firms that reported material losses due to trade secret misappropriation during 2007–09 stated that they had pursued any trade secret misappropriation proceedings in China.[213] Trade secret cases are still relatively rare in Chinese courts; not only is trade secret misappropriation difficult to prove in China, but also it may be that trade secret owners are taking proceedings outside of China to obtain more effective relief for trade secret misappropriation.[214]

[207]USITC questionnaire, weighted response to question 7.7, for firms that responded in the affirmative to question 7.1.

[208]USITC questionnaire, weighted response to question 7.8., for firms that responded in the affirmative to question 7.1

[209]USITC questionnaire, weighted response to question 7.9., for firms that responded in the affirmative to question 7.1

[210]USITC questionnaire, weighted response to question 7.6, for firms that responded in the affirmative to question 7.1.

[211]Industry representative, telephone interview by USITC staff, July 9, 2010; industry representatives, interview by USITC staff, Washington, DC, November 3, 2010.

[212]Significant at the 90 percent level.

[213]USITC questionnaire, weighted response to question 7.4, for firms that responded in the affirmative to question 7.1.

[214]USITC, *China IPR and Indigenous Innovation 1*, 2010, 4-5.

CHAPTER 4
Potential Effects of the Improvement of IPR Protection in China on the U.S. Economy

Overview

The questionnaire results presented in chapter 3 helped the Commission assess the effects of IPR infringement in China as reported by U.S. IP-intensive firms. These results permit the evaluation of firms' perspectives and provide a detailed look at those sectors the Commission considered to be IP-intensive. The results outlined in this chapter complement the findings discussed in chapter 3. The results here are derived from the use of two types of quantitative analysis that trace the effects of better IPR protection in China on the U.S. economy, and serve as a measurable proxy for the economic effects associated with IPR infringement in China on the U.S. economy.

The first stage of the analysis builds on data showing that U.S. exports are higher to countries that protect IP-intensive goods. Applying econometric techniques[1] to publicly available data, this chapter shows how a substantial improvement in IPR protection in China is likely to be associated with increased U.S. exports to China. Export data are examined for all traded sectors in the U.S. economy, and the effects of different levels of IPR protection across countries that trade with the United States are analyzed. Because the data show that U.S. IP-intensive exports are higher to those countries with high levels of IPR protection, the United States would, by extension, export more to China if China matched the level of IPR protection provided by other countries. Estimates of the size of these potential increases in U.S. exports to China are derived from the econometric model.

Based on these data, as well as other results concerning increases in capital costs in China, the second stage of this analysis employs a general equilibrium analysis to simulate the potential effects of those higher exports on both the U.S. economy generally and on specific industry sectors. Unlike the more narrow scope of the questionnaire or the econometric analysis, the use of general equilibrium analysis helps evaluate the interconnected effects of an improvement in IPR protection in China on all parts of the U.S. economy. In particular, this form of analysis permits the evaluation not only of the improvements and benefits to the U.S. economy resulting from changes in IPR protection in China, but also of potential tradeoffs across sectors, and between producers and consumers. Such tradeoffs might include the increased price of labor and capital, as IP-intensive businesses expand and compete for available resources with other sectors of the economy.

The results of this simulation analysis illustrate possible consequences of certain changes to IPR protection in China, but they are not forecasts or predictions. They do not account fully for all components of IPR protection measures, such as anti-counterfeiting enforcement. Nor do they account for possible changes in technology, in consumer

[1]An econometric analysis uses mathematical and statistical methods to derive economic implications from observed data.

preferences, or the overall macroeconomic environment. The simulations are best viewed as an attempt to illustrate certain effects on the U.S. economy of IP-related changes in U.S. exports to China, and of changes in the cost of IP-related capital (specifically, software and computers) in China, under the alternative assumptions of fixed and flexible supplies of labor and capital. Under the assumption of fixed supplies of these factors, if changes in IPR protection lead to the demand for more output, and hence more labor and capital, the prices of these factors will have to rise to allow reallocation across sectors of the fixed resources. Under the alternative, prices of labor and capital will not change, but additional resources will be drawn into the economy, allowing it to expand.

Most of the results presented in this chapter are taken from simulations assuming a fixed supply of capital and labor, but certain results (primarily those concerning employment effects) that assume a fully flexible supply of capital and labor are also presented. More complete results for both are provided in appendix H. Following an initial presentation of the results is a description of the methodology and scope of the underlying analysis. To the Commission's knowledge, the combination of statistical and simulation methods employed here has not been used before to explore the effects of changes in IPR protection in China on the U.S. economy. In key places throughout this chapter, important assumptions and caveats are identified to assist the reader's interpretation of the results. It should be noted that the analysis does not address the speed with which changes to IPR protection in China may be implemented, nor the speed with which the effects of those changes may be felt by the U.S. economy.

Key Findings

The Commission's economic analysis suggests that an improvement in IPR protection in China would likely lead to an improvement in several key U.S. macroeconomic indicators, including an overall increase in U.S. output, wages paid to workers, and profits. Gains would likely vary by sector, with several IP-intensive sectors expanding at the expense of other sectors. Transactions between the United States and China could likely increase in three areas: U.S. exports of goods; U.S. exports of services, including the payment of license and royalty fees to U.S. firms; and sales by affiliates of U.S. multinational companies (MNCs) in China. The economy-wide increases in U.S. exports of goods and services could be associated with increases in both U.S. and Chinese economic welfare. Sector-level results indicate a potential shift in U.S. economic activity toward sectors that rely on robust IPR protection. Increases in U.S. goods and services exports would likely be associated with increases in U.S. employment and output in several services sectors and in the IP-intensive publishing and software goods sector. Recreational services, which include motion picture production and sound recording, business services, and education and related services, as well as the manufacturing sector that includes software, paper products, and publishing, would each be expected to benefit.[2] These sectors include several of the sectors identified as part of the IP economy for the survey. The electronics equipment industry could face counteracting forces that on balance could yield small positive gains in output and employment. By contrast, some less IP-intensive manufacturing sectors may see a decline in output as a result of improved IPR protection in China, as more resources are allocated towards more IP-intensive sectors within the United States.

[2]These calculations are based on an improvement in IPR protection in China and do not take into account the potential effect of improved market access for U.S. firms in the recreational services sector. Market access restrictions in China significantly reduce the baseline of U.S. exports in this sector. *See USITC, China IPR and Indigenous Innovation 1*, 2010, and chapter 2 of this report.

Simulated Economy-Wide Effects

The Commission identified and examined two channels through which improvements in IPR protection in China could lead to economy-wide effects in the United States. First, increased exports of technology-intensive products to China could affect U.S. economic activity both directly, by increasing output of U.S. exporting sectors, and indirectly, through their effects on the economies of China and third countries. Second, under stronger IPR protection, firms in China could face higher capital costs, since they would pay higher prices for legitimate software and, to a lesser extent, for legitimate computers.[3] The simulations presented in table 4.1 below are based on the interactions of these two channels.

The main findings are summarized in table 4.1.[4] The simulation analysis was based on the assumption that China's level of IPR protection would rise to that of the United States. The simulation indicates that the positive effects on U.S. welfare could be approximately $6.7 billion.[5] A large share of these gains in U.S. welfare arise from changes in prices: U.S. exporters to China could receive higher prices for their goods, while prices of some U.S. imports from China, such as electronics equipment, could fall due to the expanded supply of exports from China that follows from China's increased production. As discussed below, the economic effects of terminating counterfeit production in China have not been modeled, due to the unavailability of reliable data. The presumed effect would be to contract the supply of counterfeit production in China. China's welfare would expand greatly, mainly because of the large productivity gains in China associated with that country's increased ability to absorb imports from the United States and other countries. Such productivity gains may be expected to result from more securely protected IPR.

[3]The possibility of such an effect was raised during the Commission's public hearing for this study. USITC, hearing transcript, June 15, 2010, 206 (testimony of Robert Holleyman, Business Software Alliance). Both software and computers make up a significant portion of capital stock in many sectors.

[4]Table 4.1 provides both low-end and high-end estimates, in addition to the central estimate. The estimates in the text refer to central estimates. The ranges have been included to provide some indication of the degree of uncertainty involved with respect to the strength of the relationship between IPR protection and trade behavior. Further discussion of the ranges is found in a subsequent part of the chapter.

[5]"Welfare" is a measure of the overall effect of a change in policy or in the economic environment, the amount by which the economy is better (or worse) off as a result of the change. The increase in U.S. welfare is a result of increases in exports and the cost of capital in China, and does not take into account the effect on the U.S. economy of the considerable increase in sales by U.S. affiliates in China. More generally, the estimates and simulations presented throughout this chapter are subject to a number of caveats which are described in a subsequent section of the chapter.

TABLE 4.1 Simulated and estimated changes in the U.S. economy resulting from improved IPR protection in China

	2009 Initial value	Change					
		Central estimate		Lower-bound estimate[e]		Upper-bound estimate[e]	
	Million $	Million $	Percent	Million $	Percent	Million $	Percent
Simulated Effects:							
U.S. economic welfare[a]	11,849,428	6,709	0.1	1,874	0.0	11,167	0.1
U.S. labor compensation	8,004,200	33,117	0.4	33,689	0.4	42,119	1.0
U.S. profits (as reflected by returns to capital)[b]	3,034,266	12,253	0.4	12,588	0.4	15,667	0.5
China's economic welfare [a]	2,334,789	86,401	3.7	25,556	1.1	155,059	6.6
Estimated Effects:							
Net income of affiliates[c]	8,515	3,509	41.2	3,296	38.7	3,721	43.7
U.S. exports of goods to China	65,121	9,444	14.5	781	1.2	18,106	27.8
U.S. exports of services to China, other than royalties and license fees	13,480	8,947	66.4	2,507	18.6	15,387	114.2
U.S. receipts of royalties and license fees from China	2,179	2,960	135.9	1,821	83.6	4,099	188.1
Sales of affiliates of U.S. MNCs in China	171,733[d]	87,756	51.1	86,552	50.4	88,959	51.8

Source: USITC staff calculations.

Note: See appendix H for methods.

[a]Percentage changes in welfare are expressed as percentages of GDP, which is given as the initial value.
[b]Domestic profits.
[c]Profits of U.S. firms in China.
[d]Initial value is for 2008, the most recent year for which data are available.
[e]Lower-bound and upper-bound refer to the confidence interval bounds, obtained using statistical methods. See appendix H .

Simulated total labor compensation in the United States would rise by about $33 billion. This labor compensation simulation is produced under an assumption that the economy is at a constant level of employment and capital utilization, which could be seen as a reflection of tight markets for labor and capital. Thus, expansions in one sector would require that labor and other resources be drawn from other sectors, but the overall amount of employment (or unemployment) would not change. Wages would adjust to market conditions, increasing in the case of higher labor demand.

However, at the time of this writing, the United States is emerging from the recession of 2008–09 and still faces relatively high levels of unemployment. Reflecting such a situation, an alternative version of the analysis operates under the assumption that adjustments to the demand for labor and capital are manifested through increases in the supply of these resources without increasing their cost (i.e., wages and interest rates). A simulation under this alternative assumption, of a flexible labor supply, indicates an increase in total labor compensation of $166 billion. This translates into an additional 2.1 million jobs, or a 1.6 percent increase.[6] In this case, all adjustments to changing labor market conditions would take place via the increased supply of labor while wages would remain fixed for all sectors. Under a flexible labor supply assumption, U.S. welfare could increase by $185.2 billion and U.S. profits could increase by $62.1 billion.

[6]As a share of total nonfarm employment, 2009. Census data.

The simulation analysis currently used by the Commission, which both explicitly represents China and the rest of the world, assumes that adjustments in the labor market will be made either through wages (the fixed labor supply assumption, reflecting tight labor markets) or through employment levels (the flexible labor supply assumption, reflecting a labor market with some excess supply), but not both. The actual effect is expected to lie between the two cases, with a combination of both wage and employment adjustment, and would depend upon the overall tightness of the labor market at the time of full policy implementation.[7]

Domestic profits earned by U.S. firms in the United States would increase under the simulation by an estimated $12.2 billion as a result of improved IPR protection in China. Profits of U.S. affiliates operating in China (denoted as net income by the U.S. Bureau of Economic Analysis) would increase by approximately $3.5 billion as a result of expanded operation of such affiliates.

U.S. transactions with China would respond to changes in IPR enforcement in a manner broadly consistent with the economics of IPR protection as it applies to the decisions of MNCs.[8] U.S. receipts of royalties and license fees would likely be most responsive (in percentage terms) to improvements in IPR protection in China, followed by foreign direct investment (FDI) (as measured by U.S. affiliate sales); U.S. exports of goods would be the least responsive. Since many license and royalty fees represent payments for technology, they are likely to be strongly affected by improved IPR protection as this would enhance the enforceability of contracts underlying the payment of licenses and royalties. Similarly, since FDI is driven by the efforts of MNCs to profit from their ownership of firm-specific assets, such as technologies, patents, trademarks, copyrights, trade secrets, and business methods, improved IPR protection is an important part of the business environment underlying MNCs' decision to invest.

The results concerning merchandise exports are nuanced. Exports of many goods may be enhanced by stronger IPR protection, particularly intra-firm goods exports associated with FDI. Exporters may likewise be more likely to ship technology-intensive goods to markets with improved IPR protection, since better practices may mitigate concerns about reverse engineering. However, exports are also subject to potentially countervailing influences. For example, exporters may take advantage of the monopoly power potentially associated with strong IPR protection to reduce the quantity of exports to a market in which they hold IPR in order to charge higher prices in those markets.[9]

Simulated Sectoral Effects

Table 4.2 presents simulated effects of stronger IPR protection in China on the U.S. economy for key IP-intensive sectors, including both goods and services sectors.[10] As noted, the effects vary considerably among sectors. Moreover, the interactions of the two channels mentioned earlier—increased exports to China and the increase in capital costs

[7]In addition, the "tightness" of labor markets is likely to vary by sector, perhaps with less flexible labor supplies among high-skilled workers or those in high-IP intensive industries.

[8]See USITC, *China IPR and Indigenous Innovation 1*, 6-8 to 6-11; Smith, "How Do Foreign Patent Rights Affect U.S. Exports, Affiliate Sales, and Licenses?" 2001, 414–18; and the literature review in chapter 2.

[9]See USITC, *China IPR and Indigenous Innovation 1*, 6-9 to 6-11, and the literature review in chapter 2.

[10]The results are presented for the combined effects of increased exports and higher software costs. For a decomposition of the effects of increased U.S. exports and increased Chinese capital costs for selected U.S. manufacturing sectors, see appendix H.

arising from higher prices for software and computers—are in some cases complex; the effects of one channel counteract those of the other.

Sectors can be sorted into two groups, according to their response to the policy change. These groups are the services sectors and general manufacturing sectors. Manufacturing sectors include those, such as electronincs, engaged in what is often termed "processing trade." The effects of the policy change under the fixed employment (tight labor market) assumption are presented first in order to demonstrate the effects of reallocation of resources across sectors. This is followed by a section on employment effects under a scenario reflecting an excess labor supply (higher unemployment). In table 4.2, reported changes in exports to China are derived from the econometric analysis and used as inputs to the simulation model, to generate effects at the economy and sector levels.

As shown in table 4.2, services sectors as well as the publishing and software sector experience an increase in imports from China in response to an increase in U.S. exports to that country. This is largely due to the effect that the increase in U.S. exports to China has on productivity there; China becomes more productive, and able to increase its own exports. Furthermore, increased production in the United States helps to increase demand for imports. For many manufacturing sectors, the increase in capital costs imposed on China's manufacturing as a result of the higher prices for software and computers imposes limits on China's ability to export.

TABLE 4.2 Highlighted sectors under combined exports and capital cost channels

	Change in U.S. exports to China[a]		Change in U.S. imports from China		Change in U.S. employment	
	Million $	Percent[b]	Million $	Percent[b]	Thousand employees	Percent[b]
Services, software, and publishing						
Software, paper products, and publishing	1,641	75.8	624	39.5	6	0.4
Business services	1,757	129.0	164	31.9	11	0.1
Recreational services, etc.	1,503	129.0	92	25.1	17	0.2
Education and public services	2,754	126.0	144	26.5	26	0.1
Manufacturing						
Electronic equipment	2,405	36.5	–257	–0.3	([c])	0.0
Motor vehicles and parts	171	22.6	846	13.1	([b])	–0.1

Source: USITC staff calculations.

Note: See appendix H for method.

[a]U.S. exports include both exports of goods and services, including some license fees and royalties attributed to manufacturing sectors. In this simulation, U.S. exports to China for most sectors are imposed as an exogenous policy shock.
[b]Percent change is relative to the baseline scenario of no policy change.
[c]Less than 500 employees.

Table 4.3 details the results for the two channels, providing estimates of potential effects using only the increased export channel ("exports only") and estimates of potential effects using both the increased export channel and increased prices of software and computers channel ("exports and capital cost").

TABLE 4.3 Simulation model changes in U.S. exports, imports, output, and employment, by selected sectors

	Percentage change[a]					
	U.S exports		U.S. imports			
	to China	to World	from China	from World	U.S. Output	U.S. Employment
Software, publishing, etc.						
Exports only scenario	75.8	7.7	32.1	0.8	0.4	0.4
Exports and capital cost scenario	75.8	7.4	39.5	1.4	0.4	0.4
Electronic equipment						
Exports only scenario	36.5	–1.8	12.2	1.0	–2.1	–2.1
Exports and capital cost scenario	36.5	1.3	–0.3	0.8	0.0	0.0
Motor vehicles and parts						
Exports only scenario	22.6	0.1	12.2	0.1	0.0	0.0
Exports and capital cost scenario	22.6	–0.1	13.1	0.5	–0.1	–0.1

Source: USITC staff calculations. In this simulation, U.S. exports to China for most sectors are imposed as an exogenous policy shock based on the econometric analysis described in this chapter. They are the same whether or not capital costs are modeled.

[a]Percent change is relative to the baseline scenario of no policy change.

Services sectors and software, paper products, and publishing sector

In the case of services sectors, as well as the goods sector that includes software, paper products, and publishing, the United States is almost exclusively a net exporter to China, since China has little export capacity in these categories. Thus, improved IPR protection would allow U.S. exports to expand, directly promoting increases in U.S. output and employment. As an illustrative example, the software, paper products, and publishing sector would experience a 0.4 percent gain in output and a similar gain in employment. This result would be driven by the improved global competitiveness of U.S. firms, as demonstrated by the increase in U.S. exports to the world, which would grow by 7.4 percent. China is not a major exporter in this sector, so despite some increases in efficiency, China's contribution in this sector to global supply would not be expected to grow dramatically.

Chinese processing trade and other manufactured goods

For certain manufacturing sectors, such as the electronics equipment sector, China's current pattern of trade entails importing intermediate inputs from a wide variety of sources in order to export downstream products. In these sectors, given higher U.S. exports to China, Chinese producers would use U.S. intermediate goods exports as inputs in their production processes and then export the finished goods back to the United States and to the rest of the world.[11] The effect of the higher exports only channel, taken alone, would thus be to strengthen China's competitiveness in these sectors, leading to a reduction in output in these sectors in the United States (table 4.3). The increase in the prices of software and computers resulting from improved practices has the potential to improve the competitiveness of U.S. firms by raising costs for firms in China, thereby raising output and employment in the United States. The electronics equipment sector, as presented in table 4.3, illustrates these counterbalancing effects. Although the net effect

[11]The improvement in IPR protection in China is expected to lead to an increase in productivity throughout the Chinese economy. This would enable China to absorb the increased imports implied by the econometric analysis, in line with the productivity and trade patterns of countries with high levels of IPR protections. The simulation analysis allows increased absorption of IP-intensive goods and services into China through a productivity increase by China's economy. See appendix H for details.

on employment and output of the two channels is close to zero, this result masks the opposing effects of the two channels.

Although exports to China in the electronic equipment sector, as affected by the higher exports channel, could increase considerably (36.5 percent), electronics equipment imports from China could increase as well, by 12.2 percent. The reason, as mentioned above, is that China would make use of the increased imports to produce other electronic goods more efficiently and then re-export them. As a result, the trade deficit in the electronics equipment sector could expand.[12] At the same time, U.S. exports to the rest of the world could decline by 1.8 percent, indicating a shrinking of demand from the rest of the world as China's exports are substituted for U.S. exports.

However, under the influence of increased capital costs for software and computers, U.S. output could expand over time back to its original level, so that the net effect of the two channels is close to zero under the scenario presented.[13] Higher capital costs in China result in a gain in U.S. price-competitiveness. Because electronics equipment goods are software intensive, their cost of production in China could rise substantially.[14] Electronics produced in the United States would be purchased as a substitute for the now more costly goods made in China. As a result of the combined scenario, imports from China could decline from the original baseline by 0.3 percent. In addition, the United States would gain market share, as its exports to the rest of the world could increase by 1.3 percent over the baseline.

In the case of many manufacturing sectors with high concentrations of intermediate inputs from China, the effect of the combined scenario is to reduce U.S. output and employment. One source of this effect is the increase in costs imposed on the production of intermediate goods in China. The increased cost of software and computers in China's capital stock due to improved IPR protection would, as noted above, result in fewer price-competitive goods exported by China. To the extent that a U.S. firm relies on low-cost goods from China, this reduces the U.S. firm's competitiveness on the world market, and in some cases it may lose market share to firms in the rest of the world, as well as domestically. Chinese firms, by contrast, experience productivity gains associated with importing more high-technology intermediate inputs, which enhance those firms' competitiveness, as well as higher capital costs, which reduce their competitiveness. Both the importance of intermediate goods as inputs into Chinese production and the importance of software in the Chinese capital stock vary from sector to sector. Thus, the way in which these effects affect the pattern of trade and output in the United States, China, and third markets would vary from sector to sector in complex ways.

[12]Since the baseline total for U.S. electronics exports to China is much smaller than the baseline total for U.S. electronics imports from China, the dollar value of the increased imports would be much higher than the dollar value of the increased exports.

[13]Although the net effect under the two channels assumed by these simulations is close to zero, the underlying counterbalancing mechanisms of the two channels means that a small change in assumptions may yield either a positive or negative effect on output of electronics. If laws against software piracy are enforced more rigorously than general IPR protection measures, a positive effect on output would be expected.

[14]See appendix H for a description of the determination of the software intensity of industry sectors.

Sectoral effects under flexible labor supply conditions

As noted, the simulated contractions in IP-intensive U.S. manufacturing may be mitigated if the labor market is not facing tight conditions. For example, U.S. sectors modeled as showing decreases in output and employment under tight labor conditions would show either less of a decrease in output and employment, or small expansions under conditions of excess labor.[15]

Each of the illustrative sectors discussed above could experience an increase in employment if the labor market is not facing tight conditions. For example, the motor vehicles and parts sector could see employment increase by 1.8 percent (equivalent to 12,000 full-time equivalent workers or FTEs) rather than decreasing by 0.1 percent. The electronics equipment sector could see employment increase by 0.9 percent (4,000 FTEs) rather than a zero net effect. The software, paper products, and publishing sector could see a 2.0 percent (33,000 FTEs) increase in employment, rather than a 0.4 percent increase under the assumption that reflects tight labor markets.[16]

Economic Analysis: Detailed Methodology and Scope

This section discusses the methodology used to generate the results just described, along with the methodology's scope and limitations. The section that follows presents the econometric results in fuller form and also gives more details about the simulation modeling framework.

Methodology

Using the analytical framework presented in the Commission's first report, the Commission has generated estimates of the effects of improved IPR protection in China on the U.S. economy and U.S. jobs, including on a sectoral basis, as well as potential effects on sales, profits, royalties, and license fees of U.S. firms globally. A schematic presentation of the analytical framework is presented in figure 4.1. As a first step, two sets of econometric estimates were generated. One set examines the effects of improved IPR protection on U.S. exports of goods and services, including U.S. receipts of license fees and royalty payments. This set of results is presented in a subsequent section of this chapter, and is also used in a subsequent analytical step as discussed below. A second set of econometric estimates examines the effect of improved IPR protection on the operations of U.S. MNCs, including effects on sales, net income, employment, exports and imports, and R&D. This latter set of estimates is presented as a stand-alone result and not used in the subsequent analysis.[17]

[15]The model used in the economic analysis is geared toward the analysis of sectoral effects, including the reallocation of labor and capital as a result of policy changes.

[16]The full sectoral comparisons are in appendix tables H.8–H.9.

[17]These results were not used as inputs into the subsequent analysis, because the model used is not equipped to deal directly with MNCs and their dual presence in the U.S. and foreign markets.

components ($1.9 billion, or an increase of 39.9 percent); aerospace products and parts ($1.0 billion, or 19.3 percent); resin, synthetic rubber, and artificial and synthetic fibers and filament ($685 million, or 17.3 percent); basic chemicals ($586 million, or 17.3 percent); and navigational, measuring, electro-medical, and control instruments ($594 million, or 22.0 percent). In general, when IPR protection improves, goods sectors with high R&D investment are estimated to increase their exports more than sectors with relatively low R&D investment. Because the estimate of the impact of IPR protection on trade takes into account the possibility that more R&D-intensive industries may have a greater responsiveness of exports to improvements in IPR protection, increases in trade have been estimated for manufacturing only, since the available sectoral R&D data for sectors that export goods pertain almost exclusively to manufacturing.[28]

TABLE 4.4 Estimated increases in U.S. goods exports to China as a result of improved IPR protection

	2009 Initial value	Estimated increase	
Sector	Million $	Million $	Percent
Semiconductors and other electronic components	4,870	1,940	39.9
Aerospace products and parts	5,313	1,024	19.3
Resin, synthetic rubber, artificial, synthetic fibers, and filaments	3,960	685	17.3
Basic chemicals	3,389	586	17.3
Navigational, measuring, electro-medical, and control instruments	2,699	594	22.0
Other general purpose machinery	1,861	356	19.1
Meat products and meat packaging products	1,424	233	16.4
Agriculture and construction machinery	1,298	249	19.1
Pulp, paper, and paperboard mill products	1,351	227	16.8
Nonferrous metal (except aluminum) and processing	1,356	213	15.8
Computer equipment	1,034	221	21.4
Engines, turbines, and power transmission equipment	1,025	196	19.1
Motor vehicles and parts	995	198	19.9
Pharmaceuticals and medicines	645	236	36.5
Communications equipment	632	211	33.4
Industrial machinery	795	152	19.1
Other fabricated metal products	809	139	17.2
Motor vehicle parts	747	148	19.9
Other chemical products and preparations	775	134	17.3
Iron and steel and ferroalloy	720	114	15.8
All other sectors[a]	29,425	1,591	5.4
Total	65,121	9,444	14.5

Source: USITC staff calculations.

Note: See appendix H for methodology.

[a]"All other sectors" includes agricultural and other nonmanufactured goods for which intellectual property effects were not estimated.

Estimated Services Exports

The effect of improvements in IPR protection in China was also estimated for services trade. The approach was similar to that used for goods trade, with slight modifications reflecting the availability of data. Notably, information about R&D by sector was not available for the sectors being analyzed. As before, the estimates assume an improvement in IPR protection in China to the level of IPR protection in the United States.

[28]See appendix H for details.

Table 4.5 reports effects on services exports. The overall increase, excluding royalties and licensing fees, is estimated to be $8.9 billion, an increase of 66.4 percent over the baseline for services exports of $13.5 billion in 2009.

TABLE 4.5 Estimated increases in U.S. exports to China as a result of improved IPR protection in China

	2009 Initial value	Estimated increase	
Sector	Million $	Million $	Percent
Services	13,480	8,947	66.4
Business, professional, and technical services	3,714	4,327	116.5
Travel, passenger fares, and other transportation	5,407	1,760	32.6
Other services	4,359	2,861	65.6
Royalties and license fees	2,179	2,960	135.9[a]
Food	49	67	135.9[a]
Chemicals	439	597	135.9[a]
Primary and fabricated metals	12	17	135.9[a]
Machinery	44	59	135.9[a]
Computers and electrical products	194	263	135.9[a]
Electrical equipment, appliances and components	29	39	135.9[a]
Transport equipment	69	93	135.9[a]
Other manufacturing	104	141	135.9[a]
Books, records, and tapes	2	3	135.9[a]
Software	737	1,001	135.9[a]
Broadcasting	23	31	135.9[a]
Wholesale trade	249	339	135.9[a]
Finance insurance and real estate	3	4	135.9[a]
Professional services	27	36	135.9[a]
Other industries	200	272	135.9[a]

Source: USITC staff calculations. Initial values are calibrated within the model.

Note: See appendix H for methodology.

[a]For royalties and license fees, the total percentage change has also been applied to individual sectors.

Royalties and licensing fees are most affected in percentage terms by changes in IPR protection; this is to be expected, as they are derived directly from the protection of IPR. Estimated increases were $3.0 billion. Business, professional, and technical services are also affected, with exports estimated to increase by $4.3 billion. Transportation and other services are least affected.[29] These results accord well with a reasonable understanding of the relative importance of IPR protection in each of these areas.

Estimated Royalties and License Fees

Royalties and licensing fees are unique in that they pertain to a variety of sectors rather than representing a single sector. Their estimated effects can be identified with the affected sectors according to the level of royalties and licensing fees received by each of these sectors. The lower half of table 4.5 reports the estimated allocation of U.S. receipts of licensing and royalty fees across sectors under the assumption that royalties and licensing fees will respond similarly to changes in IPR protection regardless of the industry. Significantly, software makes up the largest share—nearly one-third—of the total, with estimated increases in exports of $1.0 billion. Other strongly affected sectors

[29]"Other services" includes finance, insurance, telecommunications services, and educational services.

include chemicals ($0.6 billion), wholesale trade ($0.3 billion), and computers and electrical products ($0.3 billion).

The estimates of increased U.S. goods, services, and royalties and licensing fees exports to China presented in tables 4.4 and 4.5 are incorporated as inputs into the simulation exercise, to generate U.S. welfare effects, effects on the returns to labor and capital, and other sectoral effects.

Estimated Effects on the Activities of U.S. Majority-Owned Affiliates in China

Estimates of the effects of improved IPR protection by China on sales and other activities of U.S. majority-owned affiliates ("affiliates") in China appear in table 4.6. Sales of affiliates[30] of U.S. MNCs in China would increase by an estimated $88 billion (or by 51 percent) as a result of improved IPR protection in China. Most of these sales would likely be sales to China's domestic market, consistent with the historical pattern of U.S. FDI in China.[31] These estimates are relatively large compared to the estimates of increased U.S. goods exports presented above, since sales of U.S. affiliates in China are approximately three times as large as U.S. goods exports to China. U.S. exports to affiliates in China would increase by an estimated $2.1 billion (or by 61.7 percent). These estimates are small relative to the estimates of increases in total U.S. exports to China just presented; U.S. exports to U.S. affiliates in China accounted for only 5.5 percent of total U.S. exports to China in 2008.[32] The estimates were generated by methods comparable to those used for U.S. exports, as described above.

TABLE 4.6 Estimated effects of improving IPR protection in China on activities of U.S. majority-owned affiliates in China

	2008 Initial value	Estimated increase	
Variable	Million $	Million $	Percent
Affiliate sales	171,733	87,756	51.1
U.S. exports to affiliates	3,452	2,127	61.7
U.S. imports from affiliates	5,241	4,805	91.7
Net income of affiliates	8,515	3,509	41.2
R&D performed by affiliates	663	149	22.5
	Thousand employees	Thousand employees	Percent
Employment in U.S affiliates in China	774	38	4.9

Source: USITC staff calculations.

Note: See appendix H for methodology.

[30]Sales of U.S. majority-owned affiliates in China accounted for 76.5 percent of all sales of U.S. nonbank affiliates in China in 2008 (Commerce/BEA data and USITC staff calculations). Data for majority-owned affiliates are used in this report because these data are substantially more detailed than data for all U.S. nonbank affiliates.

[31]In 2008, the most recent year for which data are available, sales by U.S. majority-owned affiliates in China were distributed as follows: 75.3 percent to the local Chinese market, 8.6 percent to the United States, and 16.0 percent to third countries. Commerce/BEA, table III.F.2 , USITC staff estimates.

[32]Commerce/BEA and Census data; USITC staff calculations.

U.S. imports from U.S. affiliates in China would increase by an estimated $4.8 billion, or 92 percent over the baseline. Net income for U.S. affiliates in China would increase by an estimated $3.5 billion (41 percent). These increases in net income would be the primary source of increased profits for U.S. firms globally. R&D in affiliates is estimated to increase by $149 million (23 percent). Employment in Chinese affiliates of U.S. firms is estimated to increase by 38,000 employees (5 percent).

The estimates with respect to U.S. affiliate activity in table 4.6 are presented as stand-alone estimates: they are not incorporated in the simulation of economy-wide effects presented below. This is because the simulation modeling techniques used to calculate economy-wide effects do not currently include a role for MNCs. However, two published analyses of the relationship between U.S. parent activity and U.S. affiliate activity suggest that employment in U.S. parents is likely to increase with increases in U.S. affiliate activity. According to one of these analyses, an increase in U.S. affiliate employment of 1 percent is associated with an increase in parent employment of about 0.2 percent.[33] According to the other, a 1.0 percent increase in U.S. affiliate sales is associated with an increase in U.S. parent employment of about 0.02 percent.[34] In other words, U.S. affiliate activity abroad is often a complement to, rather than a substitute for, the activity of parent companies in the United States.

These estimates, together with the estimates presented above of the response of U.S. affiliate employment and U.S. affiliate sales in China to improvements in IPR protection in China, suggest that the expansion of U.S. affiliates in China would be associated with an increase in employment in U.S. parent companies of MNCs of 8,200 – 9,400 jobs.[35] This estimate is not directly comparable with the employment effects presented in the economy-wide simulation analysis above, which assumes fixed aggregate employment and is designed to simulate shifts in U.S. employment across sectors. It does, however, suggest that an analysis fully incorporating the effects of IPR improvement on foreign affiliates of U.S. MNCs would show additional increases in U.S. output and incomes above those presented in the simulation modeling below.

Effects of Reducing China's Exports of Counterfeit Goods

Improved IPR protection in China would also lead to a reduction in the production and export of counterfeit goods in China. The effects on the U.S. economy of a reduction in Chinese counterfeiting may be substantial. Again, the Commission has not undertaken estimates or simulations of the indirect effects of Chinese production and exports of counterfeit goods, because of the speculative nature of existing estimates of current levels of counterfeit production and trade associated with China.

To estimate the impact of reducing China's production and export of counterfeit goods, it would be necessary to have—at a minimum—an estimate of China's current exports of such goods. The OECD has produced a widely cited estimate that the total value of trade in counterfeit products in the world was as much as $250 billion for 2007, of which a substantial share is believed to be Chinese exports.[36] This figure is inferred from data on

[33]Desai, Foley, and Hines, "Foreign Direct Investment and Domestic Economic Activity," 2005, table 2, equation 4.

[34]Hanson, Mataloni, and Slaughter, "Expansion Abroad and the Domestic Operations of U.S. Multinational Firms," 2003, table 4.

[35]See appendix H for details. The higher estimate is associated with Hanson, Mataloni, and Slaughter (2005), and the lower one, with Desai, Foley, and Hines (2003).

[36]OECD, "The Economic Impact of Counterfeiting and Piracy," 2008. See also the literature review in the present study.

seizures of IPR-infringing goods by customs officials in various countries. Customs seizure data only represent infringing goods actually intercepted. The rate of interception of goods is subject to a number of factors, such as the active involvement of rights holders, which vary by country and sector, and the enforcement priorities of customs authorities. Most importantly, to infer the unknown value of goods not seized, and thus entering into commerce, from the observed value of goods seized requires multiplying the seizure data by a very large factor, which is inherently unverifiable and subject to substantial error.[37] It would be even more speculative to use such an estimate of global infringing exports to derive specific values for bilateral and sectoral China trade, such as would be required for the type of analysis performed above.

Some observations can nonetheless be made on the potential effects of reducing China's counterfeit production and exports, based on general economic principles. Since counterfeit goods compete with noncounterfeit ones, they normally exert downward pressure on the prices of genuine goods. The prices of genuine goods would likely rise under a scenario of improved Chinese IPR protection, which would benefit producers of such goods but impose a price penalty on consumers purchasing the goods. On the other hand, since counterfeits are often of inferior quality to genuine goods, a reduction in counterfeiting would be expected to lead to improvements in the average quality of products in frequently counterfeited sectors. This potential improvement in product quality could offset the increase in prices paid by consumers, although comparisons between price and quality effects on consumers are inherently difficult to make.

Many of the legitimate versions of the most frequently counterfeited types of goods are often imported into the U.S. market rather than produced in the United States—for example, handbags and shoes from Italy and watches from Switzerland. For such goods, the benefits of a reduction in counterfeiting might be experienced more by producers in these countries than by producers in the United States.

[37]USITC, *China IPR and Indigenous Innovation 1*, 6-13.

CHAPTER 5
The Effects of China's Indigenous Innovation Policies on the U.S. Economy

In 2006, China introduced a number of indigenous innovation policies aimed at increasing the level of scientific and technological innovation originating within the country and expanding the Chinese share of the added value embodied in the goods produced in China's factories. Such policies may make it more difficult for U.S. firms to compete in China's fast-growing market, either through exports or through local production in China, thus adversely affecting the U.S. economy and U.S. employment. Indigenous innovation policies may also help Chinese companies to compete in global markets outside of China, including in the United States, raising concerns that Chinese policies may reduce U.S. firms' access to a level playing field worldwide. This chapter identifies to the extent feasible the reported, actual, and potential effects of China's indigenous innovation policies on the U.S. economy and U.S. employment. To describe the size and scope of reported effects on the U.S. economy, the chapter relies upon U.S. firms' responses to the Commission's questionnaire. In addition, industry case studies have been used to examine actual and potential effects resulting from those policies.

Key Findings

The Commission's questionnaire sought data and information from U.S. firms on the reported effects of indigenous innovation policies. Questionnaire results show the following:

Firms that have reported concerns with indigenous innovation in China account for 67.2 percent of the sales and 29.0 percent of the total number of firms in the U.S. IP-intensive economy conducting business in China in 2009. The firms that have reported concerns are relatively large; they have higher average sales, research and development (R&D) expenditures, royalty and license fee income, and employment than firms that have not reported concerns with indigenous innovation.[1] The largest shares of firms reporting concerns related to indigenous innovation policies were in the high-tech and heavy manufacturing sector and the chemical manufacturing sector.[2]

The top policy areas in which firms identified existing problems are (1) preferential support provided to Chinese firms in the form of tax incentives, subsidies, and preferential lending; and (2) Chinese-specific technical standards. Preferential support for Chinese firms was identified as the greatest future problem for U.S. respondent firms.[3]

[1]The Commission applied a weighting procedure to the questionnaire responses in order to extrapolate the results attained from individual respondents to the U.S. IP-intensive economy as a whole. See appendix E for a copy of the questionnaire and appendix F for a discussion of the survey methodology.

[2]As discussed in chapter 3, the Commission has defined five sectors into which 24 subsectors have been grouped: consumer goods manufacturing; high-tech and heavy manufacturing; chemical manufacturing; transportation manufacturing; and information industries and miscellaneous services.

[3]Government procurement is another policy area of concern identified by industry representatives with respect to indigenous innovation. See Ferrantino, Wang, and Yinug, "Chinese Imports of Indigenous Innovation Products," USITC working paper, forthcoming, for a discussion of one attempt to assess the effects of indigenous innovation policies related to government procurement on Chinese high-tech imports from the United States and the world.

These policy areas were also identified in the case studies presented below. In particular, the subsidies and incentives provided Chinese firms are significant concerns for foreign wind power and automotive companies in China, and telecommunications equipment firms have raised concerns about preferential lending to Chinese firms and Chinese-specific technical standards.

Indigenous innovation policies are relatively new and evolving; only a small percentage of U.S. IP-intensive firms that conduct business in China reported that they had already experienced material losses due to such policies in 2009. Going forward, most firms either are unsure how their revenues will be affected by indigenous innovation or anticipate that their revenues will fall.

The case studies examine the effects of indigenous innovation policies on U.S. firms in five specific industries: wind energy, telecommunications equipment, software, automobiles, and civil aircraft and parts. The first three industries were specifically targeted by China as focus areas for its indigenous innovation product accreditation policies and associated government procurement preferences. The auto and aircraft and parts industries are R&D- and capital-intensive, and thus were considered likely to be affected by indigenous innovation policies. Most of the industries selected are important to U.S. exports and the U.S. economy more generally. The case studies identify the indigenous innovation-related policies of most concern to U.S. firms in each sector and the actual and potential economic effects of these policies. Major findings are highlighted in table 5.1.

TABLE 5.1 Key findings: Effects of China's indigenous innovation policies for selected U.S. industries

Industry	Key indigenous innovation and industrial policies identified	Actual and potential effects of such policies
Wind energy equipment	Government procurement preferences	There has been a significant decline in foreign firms' participation in the Chinese market in the last five years
	Local-content requirements	
	R&D incentives and support	Government procurement opportunities are highly restricted; no foreign firm has won a National Development and Reform Commission tender since 2005
		Competition from heavily supported Chinese firms has increased in third-country markets
Telecommunications equipment (mobile handsets)	Development of Time Division Synchronous Code Division Multiple Access (TD-SCDMA) standard to reduce reliance on foreign technologies and royalty payments	There has been a significant decline in foreign firms' market share in China in the last five years
	Preferential lending and generous lines of credit to promote Chinese companies in third-country markets	Significant firm resources are devoted to supporting multiple product lines to accommodate China's indigenous standards
		Foreign firms attempting to comply with regulatory requirements must often delay market entry
		Creation of "national champion" Chinese firms alters the competitive landscape
Software	Introduction of Multi-Level Protection Scheme (MLPS) and China Compulsory Certification (CCC) software security standards	Foreign firms are prohibited from competing for software contracts in industries deemed critical to Chinese security
	Government procurement preferences	Foreign firms are required to disclose encryption codes and other key intellectual property to compete
		Government procurement is potentially restricted at the central government level; it is already restricted at the provincial level in many provinces
Automotive industry	Mandatory joint-venture requirements	Government incentives are available only to domestic firms, making it more difficult for foreign firms to compete in the Chinese market
	Encouragement of technology transfer	
	R&D incentives and support for R&D limited to Chinese firms	Joint-venture and technology transfer rules limit company flexibility and raise the possibility of loss of intellectual property
	Local-content requirements	
	Government procurement preferences	Government procurement preferences may limit market for fleet sales
Civil aircraft and parts	Possible mandatory joint-venture requirements	Potential effects depend on China's success in acquiring and using foreign civil aviation technology
	Technology transfer requirements and incentives	

Source: Summarizes the case studies presented later in this chapter.

Note: The case studies discuss firms producing goods, not services, in each industry.

Indigenous Innovation Policies

Most analysts date the start of China's emphasis on indigenous innovation to the January 2006 Medium- to Long-Term Plan for the Development of Science and Technology (MLP).[4] The MLP defines three components of indigenous innovation: (1) genuinely original innovation, (2) integrated innovation, defined as fusing together existing technologies in new ways, and (3) reinnovation, or assimilating and improving upon imported technologies.[5] The third component can be seen as a form of technology transfer policy, a particularly important issue for foreign firms in China's automotive and aviation sectors. The MLP also identified several specific innovation targets for China to achieve by 2020, including increasing investment in R&D, limiting dependence on imported technology, increasing patents granted to Chinese citizens, and ensuring that Chinese-authored scientific papers are extensively cited around the world.[6]

Observers have sharp differences as to the appropriate definition of indigenous innovation, a question that is addressed in the Commission's survey. Some define indigenous innovation narrowly, as policies directly related to the draft National Indigenous Innovation Product (NIIP) catalog and associated government procurement decisions.[7] Others use a more expansive definition that encompasses aspects of Chinese industrial policies beyond government procurement, including issues related to technical standards, technology transfer policies, preferential lending, and others.[8] The Commission's first report relied on a more expansive definition (box 5.1). Consequently, this report's analysis of the effects of indigenous innovation policies will encompass government procurement, technical standards, technology transfer, and other policies as identified by respondents to the Commission's questionnaire and in the case studies as pertinent to China's indigenous innovation strategy.

[4]Indigenous innovation policies are outlined in more detail in the Commission's first report. USITC, *China IPR and Indigenous Innovation 1*, 2010, chapter 5.

[5]Cao, Suttmeier, and Simon, "China's 15-year Science and Technology Plan," December 2006, 40.

[6]Ibid., 38; McGregor, *China's Drive for "Indigenous Innovation,"* July 2010, 14–15.

[7]Industry representatives, interviews with USITC staff, Shanghai, January 11–12, 2011.

[8]McGregor, *China's Drive for "Indigenous innovation,"* July 2010; USITC, hearing transcript, Washington, DC, June 15, 2010, 168–69 (testimony of Jeremie Waterman, U.S. Chamber of Commerce); Hearing transcript, Washington, DC, June 15, 2010, 213–14 (testimony of Mark Bohannon, Software & Information Industry Association); industry representative, interview by USITC staff, Shanghai, January 10, 2011; industry representatives, interviews by USITC staff, Beijing, September 8, 2010.

rate, notwithstanding its "high-tech" status. Preferential lending policies—for example, low-cost financing provided by the Chinese government to Chinese firms—also reportedly place U.S. firms at a comparative disadvantage with Chinese firms competing in the same industry.[16]

The questionnaire asked firms more detailed questions about Chinese-specific technical standards. Of firms that reported their products or services encounter Chinese-specific technical standards that conflict with widely accepted global standards, most said that they were not given the opportunity to take part in the standard-setting process or were only allowed to participate with observer status.[17] In addition, most of those firms said that they expect Chinese-specific standards to damage their competiveness in the Chinese market, and a relatively high share also expect negative effects on their competiveness in third-country markets.[18]

The top policy areas in which firms identified future problems are subsidies and tax incentives. Subsidies and tax incentives overlap as policy areas that are current and future concerns. Going forward, firms may be focused on such policies that lend preferential support to Chinese companies because of the resulting difficulty for U.S. firms to compete with the prices of Chinese goods.[19]

Concerns about Indigenous Innovation Policies by Sector

The share of firms reporting concerns related to indigenous innovation policies was highest in high-tech and heavy manufacturing and chemical manufacturing sectors, as shown in figure 5.4; both these sectors are R&D- and patent-intensive. Firms in the chemical manufacturing sector, in particular those reporting losses due to indigenous innovation, consistently indicated problems with the tax incentives available to their Chinese competitors. By contrast, firms with reported losses due to indigenous innovation in the high-tech and heavy manufacturing sector identified problems ranging from preferential support to Chinese companies to the development of national technical standards. Table 5.2 illustrates the reported level of concern regarding indigenous innovation policies, by sector and NAICS category.

[16]Industry representative, interviews with USITC staff, Washington, DC, July 2 and 15, 2010.

[17]Specifically, of firms answering the question regarding the standard-setting process, 0.2 percent reported being offered the opportunity to participate in the process; 53.3 percent were offered the opportunity, but only with observer status; and 46.5 percent (significant at the 90 percent level) of firms were not offered the opportunity.

[18]Of firms answering the question regarding competitive effects, while 63.3 percent of firms indicate they expect such standards to damage competiveness in China, 36.7 percent (significant at the 90 percent level) of firms indicated they don't expect those effects (USITC questionnaire, weighted response to question 8.6a, for those firms that responded in the affirmative to question 8.2). Further, 44.7 percent (significant at the 90 percent level) of firms expect such standards to also damage competiveness in markets outside of China, while 55.3 percent of firms do not expect those effects (USITC questionnaire, weighted response to question 8.6b).

[19]USITC questionnaire, survey respondent.

TABLE 5.2 Indigenous innovation: concerns by sector (percent of firms concerned)

Sector	NAICS category[a]	NAICS code	Percent
Consumer goods manufacturing	Breweries, wineries, and distilleries[e]	31212–31214	3.2
	Tobacco manufacturing[f]	3122	4.4
	Footwear manufacturing & other leather & allied product manufacturing[c]	3162, 3169	11.3
	Apparel manufacturing[c]	315	14.3
	Watch, clock, and part manufacturing[c]	334518	14.2
	Jewelry and silverware manufacturing	33991	0.0
	Game, toy, and children's vehicle manufacturing[c]	33993	9.2
Chemical manufacturing	Pesticide, fertilizer, and other agricultural chemical manufacturing	3253	14.5
	Pharmaceutical and medicine manufacturing	3254	9.8
	Other chemical manufacturing[d]	325 (ex 3253, 3254)	3.1
High-tech and heavy manufacturing	Machinery manufacturing	333	16.1
	Semiconductor and other electronic component manufacturing[e]	334413	10.6
	Other computer and electronic product manufacturing	334 (ex 334413, 334518)	10.0
	Electrical equipment, appliance, and component manufacturing	335	16.7
	Medical equipment and supplies manufacturing	3391	18.3
	Research and development[c]	5417	4.8
Transportation manufacturing	Motor vehicle equipment manufacturing	3361–3363	7.6
	Aerospace product and parts manufacturing[b]	3364	8.3
Information and other services	Newspaper, periodical, book, and directory publishers[f]	5111	3.2
	Software publishers	5112	40.1
	Motion picture and video industries	5121	7.8
	Sound recording industries	5122	[g]
	Internet publishing and broadcasting and web search portals	51913	57.9
	Computer systems design and related services	5415	6.5

Sources: Compiled from Commission questionnaire responses.

[a]North American Industry Classification System (NAICS). http://www.census.gov/eos/www/naics/.
[b]Significant at the 90 percent level.
[c]Significant at the 85 percent level.
[d]Significant at the 75 percent level.
[e]Significant at the 70 percent level.
[f]Not statistically different than zero.
[g]Too few responses in subsector to estimate a share of firms.

Actual and Potential Effects of China's Indigenous Innovation Policies on Selected U.S. Industries

The case studies presented below provide information on the actual and potential effects of China's indigenous innovation policies for five selected industries: wind energy, telecommunications equipment, software, automotive, and civil aircraft and parts.

Wind Energy

Overview

The Chinese government has used indigenous innovation and other policies to develop its wind energy industry in recent years. These policies have included local-content requirements, support for R&D by Chinese firms, and government procurement rules that favor domestic firms. This case study focuses on China's policies toward utility-scale wind power, the renewable energy segment with the largest current market in China. Although broad Chinese government support for development of the wind power industry could potentially create market opportunities for U.S. firms, China's market has become increasingly dominated by Chinese-owned firms, and opportunities for U.S. and other foreign firms have contracted. Moreover, while the effects of these policies on the U.S. economy and U.S. jobs may be relatively small, since U.S. and other foreign-based firms conduct much of their manufacturing in China, the effects on business opportunities for U.S. wind turbine manufacturers may be significant. Similarly, although U.S. companies that supply component parts to Chinese wind turbine manufacturers could potentially benefit as Chinese companies expand, as of early 2011 most Chinese manufacturers appear to source the vast majority of their components from other Chinese companies.

U.S. Participation in China's Wind Energy Market and Industry

China has been rapidly building wind farms in recent years, and in 2010 became the world leader in installed wind power capacity, ahead of the United States, with 44,733 megawatts (MW) installed, of which 18,923 MW were installed during 2010 alone.[22] In 2009, at least 14,000 MW of new wind projects were built in China, a 130 percent increase over 2008 and a tenfold increase in installed wind power over four years.[23] Most of this demand for wind turbines has been met by Chinese domestic manufacturers, particularly Sinovel, Goldwind, and Dongfang.[24]

China's wind power market is split into national concession contracts larger than 50 MW and small provincial concessions, with foreign firms completely excluded from competing for all national concession contracts. National contracts make up the bulk of the market and are awarded through the government procurement process by the National Development and Reform Commission (NDRC).[25] No foreign firm has won an NDRC concession tender since 2005.[26] U.S. and other foreign companies that are active in China's wind power industry, including world leaders Gamesa (Spain), Vestas (Denmark), and GE (United States), primarily participate in the much smaller market for wind power concessions awarded by provincial governments (contracts that are generally less than 50 MW). Even for wind turbine projects developed by those companies, however, most components are being supplied by Chinese companies or manufactured in

[22]Global Wind Energy Council, "China Adds 18.9 GW of New Wind Power Capacity in 2010," News release, April 6, 2011. By contrast, U.S. wind installations increased from 2,462 MW in 2006 to 10,010 MW in 2009, then declined to 5,116 MS in 2010. American Wind Energy Association (AWEA), *U.S. Wind Industry Annual Market Report, Year Ending 2009*, 2010, 5; AWEA, "U.S. Wind Industry Continues Growth," News Release, April 7, 2011.

[23]Zindler, Statement to the U.S.-China Economic and Security Review Commission, July 14, 2010, 7.

[24]Ibid.

[25]Industry representatives, interviews with USITC staff, Washington, DC, July 15, 2010, and Beijing, September 8, 2010; Dewey & LeBoeuf, March 2010, 53.

[26]The NDRC tenders comprise China's entire wind power market for projects larger than 50 MW. Industry representatives, interviews with USITC staff, Washington, DC, July 15, 2010, and Beijing, September 8, 2010; Dewey & LeBoeuf, March 2010, 53.

China, due to local-content requirements that were in place from 2005 through 2009.[27] In addition to investing in production facilities in China, wind energy companies based in the United States and elsewhere are increasingly locating their R&D activities in China to take advantage of the manufacturing infrastructure and to be close to the ultimate demand location for their products; reportedly it makes economic and business sense to conduct R&D close to other parts of the value chain.[28]

U.S. wind energy firms are also participating in the Chinese market by licensing key technologies and selling wind turbine components to Chinese companies. For example, American Superconductor (AMSC), based in Massachusetts, recently announced that it has licensed its patented wind turbine technology for 2MW, 3MW, and 5MW turbines to six Chinese companies, and expects to continue to grow its licensed market share in China.[29] In July 2010, Timken Co. won a $26 million contract to supply wind turbine parts and services to China's Goldwind. The contract calls for Timken to supply engineering support, advanced bearings, and services for Goldwind's 1.5 MW and 2.5 MW turbines. The two companies also will collaborate on future wind turbine developments.[30]

Chinese Laws and Policies Related to Wind Energy

China has established policies over a number of years that aim to increase domestic production of wind energy equipment and overall use of wind power in China (table 5.3). In the renewable energy arena, the Chinese government has imposed local-content requirements; provided R&D funding, tax incentives, and other benefits available only to domestic manufacturers; set ambitious clean energy deployment targets; and established procurement policies to develop its domestic market and related infrastructure. In addition, local and provincial governments in China offer clean energy companies free land, tax breaks, and other incentives to facilitate regional networks of investors, manufacturers, suppliers, universities, and other actors that can work together to scale up renewable energy projects in a given region.[31]Government procurement is an important factor in China's wind power market, as most wind farms are funded through government contracts. Government procurement preferences for indigenous renewable energy products, if enforced according to draft policies circulated for comment in 2010, are viewed as likely to significantly undermine market opportunities for U.S. firms.[32]

[27]Industry representatives, interviews with USITC staff, Washington, DC, July 15, 2010, and Beijing, September 8, 2010; Dewey & LeBoeuf, March 2010, 53.

[28]Wong, Statement to the U.S.-China Economic and Security Review Commission, July 14, 2010, 19.

[29]AMSC technology powers approximately 10 percent of wind turbines worldwide. American Semiconductor, "AMSC Licenses Multiple Wind Turbine Designs," January 11, 2011.

[30]Timken Co., **"**Timken Wins US$26 Million Wind Energy Contract Supplying Goldwind," July 28, 2010.

[31]Swezey, statement to the U.S.-China Economic and Security Review Commission, July 14, 2010.

[32]Dewey & LeBoeuf, "China's Promotion of the Renewable Electric Power Equipment Industry," March 2010, 17.

TABLE 5.3 Principal Chinese laws related to wind energy

Law	Date	Description
Ride the Wind Program	1997	Encouraged SOEs to establish joint ventures with foreign companies to manufacture wind turbines in China. Joint-venture partners were chosen on the condition of technology transfer, and received Chinese government support. The program started with a 20 percent local-content requirement that was scheduled to rise to 80 percent. This program has been terminated.
NDRC Notice of Requirements for the Administration of Wind Power Construction (Notice 1204)	2005	Established a 70 percent local-content requirement for wind turbines. The level of local-content above the minimum standard was a key criterion in awarding the winning bid. As of July 2005, wind power stations that did not meet the 70 percent local-content requirement would not be allowed to be built in China (even for non-NDRC concession projects). Local-content requirements were removed in November 2009.
Renewable Energy Law	2005	Includes dates by which utilities' share of total electric power from renewables must meet certain targets, requires utilities to pay reasonable on-grid prices to renewable power producers; and ensures that higher prices paid to producers of renewable energy are shared by all electricity customers.
MLP Guidelines, including "low cost, mass development, and utilization of renewable energy"	2006	Gives priority to R&D related to large-scale wind power generation equipment and technologies, among other renewable technologies. The guidelines promote several policy tools, including fiscal and tax policies to promote R&D and enhance innovation capabilities, government procurement focused on promoting indigenous innovation products, and absorption of imported technologies.
Several Opinions of the State Council on Expediting the Rejuvenation of the Equipment Manufacturing Industry	July 2006	Among other classes of equipment, "high-power wind power generation units" are designated as "key." One strategy for the government would be to support indigenous innovation projects. In approving construction projects, the state should consider domestic production of key technological equipment. Import tax exemptions for complete sets of foreign-made equipment would be cancelled, but domestic firms could continue to enjoy import tax exemptions for key foreign-made parts. In May 2009, a further State Council plan on equipment manufacturing again identified wind power equipment such as frequency conversion control systems, bearings, and carboform blades as targets of financial support for indigenous innovation equipment.
Medium- and Long-Term Development Plan for Renewable Energy in China	September 2007	One objective in the plan is that by 2020, local manufacturing of renewable energy equipment should be based primarily on indigenous innovation, meaning that the relevant intellectual property should be wholly-owned by enterprises organized under the laws of China. The Plan does not give further detail about how to achieve this goal.
Special Fund for Wind Power Manufacturing	August 2008	Provides funding to promote wind power-focused R&D activities by Chinese-owned wind power manufacturing companies. Applicants for funding must have Chinese-owned IPR, provide complete technical specifications to the Chinese government, and manufacture wind power equipment in China. As of February 2011, the fund is the subject of WTO consultations between the United States and China.
Chinese Government stimulus package	November 2008	Boosted renewable energy spending and required that domestic products be given preference in the distribution of $7 billion in stimulus money for new wind power concessions.
Interim Measures for Offshore Wind Power Development and Construction	January 2010	Requires that companies undertaking offshore wind farm investment projects must have foreign ownership of no more than 49 percent.

Sources: Government of China, Ministry of Finance, "Announcement on Issuing the Management Regulations on Special Fund for Wind Power Manufacturing Sector in China," August 11, 2008; Lewis, "A Review of the Potential International Trade Implications," n.d.; USTR, "United States Requests WTO Dispute Settlement Consultations," December 22, 2010; USTR, "China," April 2011; ACORE and Chinese Renewable Energy Industries Association (CREIA), "US-China Quarterly Market Review," October, 2010; Dewey & LeBoeuf, "China's Promotion of the Renewable Electric Power Equipment Industry," March 2010; NDRC, "Medium- and Long-Term Development Plan for Renewable Energy," September 2007; *Windpowermonthly.com*, Article 3.2(3), "Relaxing the Rules of Supply," October 2010.

One particular concern identified by foreign companies in China's wind energy sector has been the high (70 percent) local-content requirement (NDRC Notice 1204, 2005) that China has imposed on contracts for wind energy equipment (see table 5.3).[33] This requirement effectively forced foreign companies to set up manufacturing centers in China, bringing many of their component suppliers with them and likely reducing U.S. exports of components. However, wind turbine manufacturers usually prefer to establish manufacturing facilities close to the site of greatest demand, as transport costs for finished wind turbines are high, so local-content requirements may not be the determining factor for the manufacturing location for the turbine. Some of these foreign-owned manufacturing facilities were structured as joint ventures, which also brought benefits to China in the form of technology transfer.[34]

China removed local-content requirements on wind turbines in November 2009 and confirmed that wind power equipment produced by foreign companies operating in China would be treated as domestic content. By that point, local-content requirements were arguably no longer needed, since low-priced Chinese suppliers were plentiful in the market.[35] However, U.S. industry and labor representatives contend that many local-content requirements are still in place, implicitly or explicitly, or that China still offers significant incentives, including grants, loans, and tax subsidies, that are contingent on use of local products.[36] In December 2010, the United States filed a complaint against China under the WTO Dispute Settlement Understanding, alleging improper subsidies to China's wind power industry in violation of China's WTO obligations (box 5.3).[37]

By 2010, wind turbine manufacturers were able to source their complete supply chains in China, and most wind turbines sold in China, whether by Chinese or foreign firms, easily exceed the 70 percent local-content threshold. Manufacturers report significant pressure to source from China, both to win government contracts and to reduce costs as much as possible in a time of excess supply, which is partly due to the entry of new Chinese manufacturers into the market.[38] Increased Chinese production also has led to oversupply of turbines in the market, bringing down prices in China.[39]

[33]The high local-content requirement is one factor leading to China's development of a complete domestic wind power industrial chain, but other factors, such as government funding of R&D and demonstration projects, may have been equally important. Windpowermonthly.com, "Relaxing the Rules of Supply," October 2010, 9; Dewey & LeBoeuf, March 2010, 52.

[34]Bloomberg New Energy Finance, "Joined at the Hip," May 17, 2010, 9.

[35]Dewey & LeBoeuf, March 2010, 58; USTR, "21st U.S.-China Joint Commission on Commerce and Trade," December 15, 2010; Bradsher, "To Conquer Wind Power, China Writes the Rules," December 14, 2010.

[36]United Steelworkers, "United Steelworkers' Section 301 Petition Demonstrates China's Green Technology Practices Violate WTO Rules," par. 2 and 3; industry representative, telephone interview by USITC staff, February 4, 2011.

[37]The United States requested consultations with China in the matter, and the EU and Japan subsequently requested to join the consultations. WTO, Dispute DS419, China—Measures Concerning Wind Power Equipment, Summary of Dispute.

[38]*Wind Power Monthly*, "Relaxing the Rules of Supply," October 2010, 9–11; industry representative, telephone interview by USITC staff, February 4, 2011.

[39]When leading Chinese wind turbine manufacturers began mass production and sales in 2006, turbines were typically priced between 15 and 20 percent below equipment from non-Chinese companies. The price gap between Chinese and foreign turbines had widened to over 27 percent as of early 2010. Bloomberg New Energy Finance, "Joined at the Hip: The US-China Clean Energy Relationship," May 17, 2010, 9.

106.5 MW project is expected to cost between $150 million and $200 million, and the project is expected to use approximately 60 percent U.S. content.[50]

It appears that the Chinese industry's growing capacity and market share are due in large part to indigenous innovation-related policies. Foreign firms have limited access to the government procurement market, which accounts for all of the largest wind farm projects in China. This situation sharply limits the prospects for U.S.-based wind energy companies in China.[51] Chinese joint-venture companies that are majority foreign-owned reportedly are not considered to be domestic companies in the concession process, largely excluding foreign firms that have invested in local production in China.[52] However, concessions for wind power projects below 50 MW are controlled by local or provincial governments, not the NDRC. These projects are reportedly more open to bidding by non-Chinese firms, which have been competitive in this smaller market.[53]

In a step forward for foreign firms, the 2010 JCCT Agreement included a provision that China will permit foreign wind power companies to use their experience from outside of China to demonstrate competence when bidding on projects within China. Previously, this was not the case; foreign enterprises were judged only on their prior experience in China in qualifying for large-scale wind power projects.[54] China further agreed that foreign firms will be able to submit documentation based on existing installed wind power projects outside China in order to demonstrate technical requirements for eligibility to supply large-scale wind power projects in China.[55]

Aside from indigenous innovation policies, other aspects of Chinese renewable energy policies, including feed-in tariffs and aggressive targets for installed capacity, have encouraged the wind energy industry's development in China.[56] China's long-term policy commitment to renewable energy permits investors to better predict market conditions over 10 years or more, thus facilitating investment from both foreign and domestic firms.

Telecommunications Equipment

Overview

One of the most visible manifestations of Chinese indigenous innovation aspirations in the telecommunications equipment industry has been the development of a homegrown

[50]Goldwind estimates that the project, its second in the United States, will create more than 100 construction and permanent jobs in the United States. *North American Wind Power*, "Goldwind to Sell Power from Shady Oaks to ComEd," December 21, 2010; Bloomberg New Energy Finance, "Xinjiang Goldwind Science & Technology Co.," December 21, 2010.

[51]Industry representatives, interviews with USITC staff, Washington, DC, July 15, 2010, and Beijing, September 8, 2010; Dewey & LeBoeuf, March 2010, 53.

[52]Moreover, information provided by firms based outside of China indicates that the bidding process favors Chinese products that are allegedly less efficient, and that the process relies exclusively on initial turbine prices, excluding consideration of factors such as long-term performance or maintenance costs. Industry representative, telephone interview with USITC staff, July 15, 2010.

[53]Industry representatives, interviews with USITC staff, Washington, DC, July 15, 2010, and Beijing, September 8, 2010; Dewey & Le Boeuf, March 2010, 52–56.

[54]U.S. Trade Representative, "21st U.S.-China Joint Commission on Commerce and Trade," December 15, 2010; USTR, *2010 Report to Congress on China's WTO Compliance*, December 2010, 7, 20.

[55]USTR, *2010 Report to Congress on China's WTO Compliance*, December 2010, 41–42.

[56]Also, as of 2010, the income and value-added tax rates for wind farms were half of the rates applicable to other power projects, at 15 percent and 8.5 percent, respectively. Bloomberg New Energy Finance, "Joined at the Hip: The US-China Clean Energy Relationship," May 17, 2010, 5–7.

standard for third generation (3G) mobile technology, which affects the global players in both the networking infrastructure and wireless handset components of the industry. This case study focuses on handset makers, as this is where U.S. involvement in the Chinese industry is concentrated.[57] Chinese indigenous innovation policies, including the setting of 3G standards, have enhanced the technological expertise of Chinese companies involved in the mobile telecommunications industry and facilitated their global expansion. These policies have also acted as roadblocks to U.S. wireless handset makers' access to the Chinese market, affecting product development costs and time to market. Although it is difficult to quantify a direct impact on U.S. jobs, Chinese wireless handset makers have altered the global competitive landscape and become rivals of their U.S. counterparts in markets around the world.

U.S. Participation in China's Wireless Handset Industry

China is critical for U.S. handset makers as both a market and a production base. China had 850 million mobile phone subscribers in 2010, up from 393 million in 2005, making it the largest market in the world and one of the fastest growing.[58] A decade ago, foreign multinationals dominated the Chinese handset market, accounting for nearly 90 percent of China's handset industry sales.[59] As of 2010, the market share in China held by foreign handset makers, including U.S.-based Motorola and Apple, had fallen to approximately 50 percent.[60] U.S. companies' market share in China has declined dramatically over the last five years, reflecting both a global trend for U.S. handset makers as they compete with leading multinationals like Nokia, Samsung, and LG, and the rise of domestic manufacturers in China.[61] The dominant Chinese handset firms are ZTE and Huawei, joined by dozens of small manufacturers of lower-tier phones, some of whom are engaged in the illegitimate activities popularly referred to as "shanzhai" (box 5.4).[62]

[57]Another important part of the U.S. telecommunications equipment industry consists of wired network infrastructure companies that produce Internet switches, routers, and optical transport equipment. These companies, which include Cisco, Juniper, and Ciena, are also affected by China's indigenous innovation policies and face competition from some of the same Chinese companies (Huawei and ZTE in particular) that are dominant in the wireless handset industry segment.

[58]TIA, *ICT Market Review*, 2011, 5–124.

[59]Wuzhou, "China's Burgeoning Mobile Phone Industry," September 2003.

[60]Other U.S.-based producers of wireless handsets include HP, which acquired Palm in 2010, and Dell. Both companies are smaller players than Motorola and Apple.

[61]The U.S. leader in China, Motorola, saw its mobile phone market share decline from 23 percent in 2006 to 2 percent in 2010. This can be contrasted with growing sales of smartphones, the fastest growing segment of the mobile phone market in China—an area of strength for U.S. companies like Apple, with offerings such as the iPhone. Chao, "Motorola Makes China Push," August 31, 2010.

[62]USITC, "Wireless Handsets," March 2010, 22.

Box 5.4 China's shanzhai mobile phone market

Shanzhai phones are believed to be an important force in China's mobile handset market, reportedly taking market share from global brands as well as Chinese mobile phone producers. According to industry reports, shanzhai phones may include blatant counterfeiting and production of knockoffs, as well as phones of varying quality that are sold at a substantial discount because taxes, regulatory fees, and safety inspections are avoided. Gray market phones, which are legitimate phones sold through unauthorized channels, are also sometimes associated with the market for shanzhai phones.

Shanzhai phones can be difficult to distinguish from legitimate low-cost handset production and are sometimes conflated with unbranded, "white box" cellular phones, which may be legally manufactured by contract and then branded by the carrier. This was an early development strategy of Huawei and ZTE, which produced unbranded phones, often exporting them to developing countries and establishing relationships with carriers. Though estimates vary and statistics often lump together black market shanzhai phones with unbranded white box phones, industry analysts estimate they account for 20 to 38 percent of mobile phone sales in China in 2009.

The availability of total chipset solutions from Taiwanese chipmaker MediaTek and software available from several sources has lowered the barriers to entry for manufacturers, who can now buy the "brains" of the cell phone and create simple designs around the chipset. These small local manufacturers have benefited from the delays in the launch of 3G networks and of specific branded phones, such as the iPhone. The delays give small manufacturers a chance to develop their own products that can serve as substitutes for brand-name mobile phones at a fraction of the cost.

Sources: Barboza, "In China, Knockoff Cellphones Are a Hit," *New York Times*, April 28, 2009; *Economist*, "Silent Mode," October 16, 2008; Sandstrom, "Sales of Unbranded Chinese Phones Surge," *Wall Street Journal*, November 10, 2010; Richburg, "'Gray Market' Is Red Hot in China," *Washington Post*, August 8, 2010; AmCham South China, "Business Environment in China," March 2010.

U.S. wireless handset companies participate in China primarily through FDI and contracting production to Chinese manufacturing firms, with negligible U.S. exports of handsets to China.[63] These manufacturing operations serve as a base for U.S. companies to meet global demand, with a good portion of the handsets produced in China destined for the U.S. and other markets.[64] Some U.S. companies involved in the wireless handset industry, along with other major multinational mobile handset producers, have also invested in R&D in China.[65]

The United States is also a major supplier of technology for essential components to handset makers in China, including domestic Chinese companies.[66] U.S. companies like Qualcomm are the global leaders in the license and manufacture of semiconductor chipsets that form the highest value component in mobile handsets and constitute the integral technology enabling wireless connectivity in accordance with a particular wireless standard. These companies typically license patents to manufacturers of wireless equipment and collect royalties on wireless handsets containing their technology.[67]

[63]U.S. exports of handsets to China were $16 million in 2009, compared to $13 billion in U.S. imports of handsets from China. Compiled from official statistics of the U.S. Department of Commerce.

[64]China has grown as a manufacturing base, from producing 245.9 million mobile phone handsets in 2003 to producing more than 700 million in 2010, representing around 60 percent of global production. IBISWorld, "Mobile Communications and Terminal Equipment Manufacturing in China," September 8, 2010.

[65]IBISWorld, "Mobile Communications and Terminal Equipment Manufacturing in China," September 8, 2010, 29; USITC questionnaire, survey respondents.

[66]U.S. firms like Qualcomm, Broadcom, Interdigital, Texas Instruments, Infineon (owned by Intel), Marvell, and Icera are global leaders in the development of wireless technology.

[67]Datamonitor, "Qualcomm Incorporated," May 7, 2010, 4.

Chinese Policies and Practices

Telecommunications has been identified as a sector of strategic importance in China's MLP, and the 11th Five-Year Plan for High-Technology Industries (2006–10) targeted "new generation broadband wireless mobile communications networks" as one of its 16 megaprojects. Next-generation mobile technology is again targeted in available drafts of the forthcoming 12th Five-Year Plan (2010–15).[68]

An important objective of China's indigenous innovation aspirations is the development of products incorporating Chinese intellectual property and Chinese-developed standards.[69] China's work in the targeted telecommunications sector, particularly through its development of a homegrown 3G standard for wireless communications networks, is helping it to achieve these indigenous innovation goals. It is also moving China toward the specific targets laid out in the MLP of limiting dependence on imported foreign technology, increasing investment in R&D, and increasing the number of patents granted to Chinese citizens.

The Chinese government spearheaded the development of the TD-SCDMA 3G wireless standard in an effort to reduce reliance on foreign technologies and the corresponding costs to Chinese manufacturers in the form of royalties and license fees.[70] In addition to reducing dependence on foreign technology in a sector important for economic development and national security, it has been suggested that development of the Chinese standard would improve China's bargaining position in future licensing arrangements, as China would be armed with its own patents.[71] The work that went into developing TD-SCDMA may have increased awareness of the importance of patenting core technologies and helped Chinese firms to develop expertise in the standards-setting process. The experience also likely upgraded Chinese companies' technical knowledge of wireless networks, setting the stage for them to take a more prominent role in developing Long Term Evolution (LTE), the fourth generation of mobile technology.[72]

Although China's Ministry of Industry and Information Technology (MIIT) invested heavily in TD-SCDMA and asked Datang, an SOE, to lead the project, reports indicate that the majority of essential patents underlying TD-SCDMA are foreign owned.[73] Nevertheless, the standard was prioritized as the unique Chinese homegrown standard, resulting in delayed access for Chinese mobile phone users to the most modern, internationally available technology for several years, while work continued on TD-SCDMA. When 3G mobile phone networks in China were launched in 2009, the license

[68]*APCO Worldwide*, "China's 12th Five-Year Plan," December 10, 2010.

[69]Suttmeier, Yao, and Tan, "Standards of Power," June 2006, 12.

[70]Time Division Synchronous Code Division Multiple Access (TD-SCDMA) was approved as an international 3G standard by the International Telecommunications Union in 1999. The other two international 3G standards are CDMA2000, the standard based on U.S. intellectual property, and WCDMA, the standard backed by the EU. Both were relatively mature when they were accepted by the ITU and had industry backing, whereas much of the work on TD-SCDMA began after its acceptance as an international standard. The policy of promoting indigenous innovation has been credited as a dominant factor in the ultimate adoption of the TD-SCDMA standard in China. Gao, "Understanding Key Features of the TD-SCDMA Adoption Process," October 14, 2009. For discussion of China's promotion of domestic standards as a tool to promote indigenous innovation, see USITC, *China Intellectual Property Infringement*, 2010, chapter 5.

[71]Ernst, "Indigenous Innovation and Globalization," November 15, 2010.

[72]China Mobile has been working on the time division version of LTE and has plans to launch seven commercial trial networks by mid-2012. Jingting, "Trials planned for TD-LTE," *China Daily*, March 8, 2011.

[73]Ernst, " Indigenous Innovation and Globalization," November 15, 2010; Yan, "3G Standard Setting Policy," 2007.

for the Chinese TD-SCDMA technology was assigned to the largest of China's three carriers, China Mobile, which accounts for more than two-thirds of the country's wireless subscribers,[74] despite the company's reported reluctance to exclusively deploy the Chinese technology.[75] The directed way in which spectrum has been allocated and network licenses assigned has raised questions of technology neutrality, with China apparently "picking winners" rather than allowing telecom carriers to choose technology based on the best interests of their company and customers. U.S. handset makers and chipset providers wishing to tap into China Mobile's vast pool of wireless customers must therefore develop technology compatible with the TD-SCDMA standard.

The Chinese government continued to support TD-SCDMA by prioritizing the standard in China's stimulus plan, designating its eligibility for government procurement preferences, and increasing its spectrum allocation.[76] China Mobile reportedly signed strategic cooperation agreements with 31 local governments in 2009 who pledged to support TD-SCDMA development on land use, frequency resources, and construction of wireless cities.[77] China Mobile invested $100 million in an R&D fund and set up cooperative agreements with handset makers and integrated circuit designers to help facilitate development of wireless handsets to be used on TD-SCDMA networks. In addition, according to sources, the wireless provider has been subsidizing the cost of TD-SCDMA wireless handsets to lower the cost for their customers and compete against 3G services offered by the two other Chinese carriers operating on the rival international 3G standards.[78]

Preferential lending and generous lines of credit reportedly also provide critical support for the global expansion of China's telecom industry.[79] This credit may have played a role in enabling Chinese firms to offer generous financing terms and low prices in third-country markets.[80] For example, Huawei's line of credit from the China Development Bank (CDB) was extended to $30 billion in 2009; ZTE received $15 billion from the CDB and another $10 billion from the Chinese Export-Import Bank the same year.[81] These financing packages reportedly are offered on highly favorable, nonmarket terms.[82]

Table 5.4 identifies significant policies and practices that uniquely impact the telecommunications industry in China as well as broader policies related to indigenous innovation that may also affect U.S. companies involved in the Chinese mobile phone manufacturing industry.

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[74]Ramsay, "China's Mobile Subs Reach 842M," January 20, 2011.

[75]Ernst, " Indigenous Innovation and Globalization," November 15, 2010, 72; Gao, "Understanding Key Features of the TD-SCDMA Adoption Process," 2009, 8–9.

[76]USTR, "China," April 2011, 78.

[77]China Mobile Limited, *2009 Annual Report*, n.d. (accessed March 30, 2011), 28.

[78]C114, "China Mobile to Subsidize TD-SCDMA Terminal Users," June 23, 2010; Clark, "China Mobile to triple handset subsidies," October 15, 2009.

[79]Dalton, "EU Finds China Gives Aid to Huawei, ZTE," February 3, 2011; Waterman, written testimony to the USITC, June 15, 2010, 25.

[80]For example, ZTE has deployed a commercial TD-SCDMA network in Ghana, and commercial trial TD-SCDMA networks have been built in South Korea, Hong Kong, Italy, Canada, and Romania. China Mobile owns Pakistani telecom operator CMPak, making it a likely candidate for TD-SCDMA as well. Lennighan, "Global Markets to Embrace China's TD-SCDMA," March 31, 2009.

[81]Le Maistre, "Huawei, ZTE Strike New Funding Deals," June 11, 2009.

[82]A recent European Commission investigation points to the enormous size of these lines of credit compared to annual sales. For example, ZTE received access to $25 billion, compared with its $8 billion annual revenue in 2009. Dalton, "EU Finds China Gives Aid to Huawei, ZTE," February 3, 2011.

TABLE 5.4 Selected Chinese policies and practices related to mobile communications and indigenous innovation

Policies	Date	Description
TD-SCDMA 3G wireless standard	2009	International standard developed and promoted by the Chinese. Phones operating on China's largest network with China Mobile must comport with this unique standard.
WAPI WLAN security standard	2009	China's Ministry of Industry and Information Technology (MIIT) requires that mobile phones sold in China that support the internationally prevalent Wi-Fi must also be enabled with the Chinese standard WLAN Authentication and Privacy Infrastructure (WAPI).
Subsidies for TD-SCDMA handset users	2009	China Mobile provided approximately $1.8 billion in subsidies to its 3.4 million TD-SCDMA users in 2009, with plans to provide up to $4.6 billion in 2010, dependent on the number of new subscribers. China Mobile also invested a total of $200 million in an R&D fund in 2009 and 2010 to encourage handset makers to design around China's unique standard.
Proposed Regulations for the Administration of the Formulation and Revision of the Patent-Involving National Standards	2009	These rules could obligate a patent holder whose patent is part of a national standard to grant a royalty-free license for its use, or be subject to compulsory licensing that would force the patent holder to license its technology with royalties substantially below the market rate.
China's stimulus package	2008	Of the $56 billion of stimulus funding reserved for domestic innovation, $15 billion was allocated to the development of the TD-SCDMA standard, demonstrating the standard's relative importance in achieving China's innovation goals.

Sources: USTR, *2011 Technical Barriers Report*, March 2011; C114, "China Mobile to Subsidize TD-SCDMA Terminal Users," June 23, 2010; Wang, "Subsidies to Boost China's 3G Handset Market," 2010; China Mobile Limited, *2009 Annual Report*, n.d. (accessed March 30, 2011); USITC, *China: Effects of Intellectual Property Infringement,* 2010, chap. 5; Freshfields Bruckhaus Deringer, "Patents and Standards-setting in China," 2010; Ernst, "Indigenous innovation and Globalization," 2010.

Effects of Indigenous Innovation Policies on U.S. Firms and the U.S. Economy

Understanding the effects of indigenous innovation policies on U.S. telecommunication firms and the U.S. economy is complicated by the sheer size and potential of the Chinese market. While participation in the Chinese telecommunications equipment industry presents unequaled opportunities for growth, indigenous innovation policies effectively require foreign companies to participate in the market on Chinese terms, or not at all. While U.S. firms are actively negotiating agreements to license their intellectual property to Chinese firms, developing new technology to meet Chinese standards, and waiting to be granted licenses to operate on the networks, indigenous innovation policies provide domestic Chinese enterprises with safe havens from competition while they develop their own expertise and market share.

Effects on U.S. firms

China's promotion of Chinese-specific technical standards was the most common existing and future problem cited in questionnaire responses among telecommunications equipment companies reporting material losses due to China's indigenous innovation policies.[83] A particular concern that arises over China's deployment of a third wireless

[83]USITC questionnaire, telecommunications equipment companies' responses to question 8.3.

standard (TD-SCDMA) in the face of two existing international standards[84] is that companies will have to expend resources altering existing technology or creating new technology to support bifurcated product lines. For example, Motorola has released a new 3G smartphone in three versions, one for each of the distinct standards used by China's mobile carriers.[85] This affects planning for R&D, design for new products, and time to market for companies wanting to participate in the Chinese market.[86] Yet due to the sheer size of China's market, there is a significant opportunity cost for not participating.[87] In order to continue its growth in China, Apple may need to consider similar actions. The iPhone currently operates only on the WCDMA network operated by China Unicom. To reach the larger base of China Mobile customers, Apple would have to create a new model that can operate on China's TD-SCDMA standard.[88] Domestic Chinese competitors are expected to continue to develop their own smartphone products, including Chinese-specific online "app" stores that may further entrench domestic technology.[89]

U.S. companies also face delays in trying to meet China's regulatory and licensing requirements needed to sell their products in the Chinese market. The iPhone's official release in China was reportedly delayed by more than two years because of negotiations with the telecommunications carriers and the Chinese government, which requested the phone be manufactured without a Wi-Fi receiver.[90] The long delay helped to jumpstart both a gray market for iPhones brought into the country[91] and the production of highly sophisticated counterfeits, which were often Wi-Fi enabled or incorporated other novelties, such as the ability to accommodate dual SIM cards.[92] The latter is characteristic of the shanzhai phenomenon in China (box 5.4).[93]

China also has been criticized for approaching standards setting with the aim of advantaging domestic firms and circumventing royalties and license fees otherwise owed to non-Chinese companies.[94] In the case of TD-SCDMA, despite being labeled the home-grown Chinese national standard, it is unclear exactly what percentage of the core intellectual property is owned by Chinese companies. Consequently, it is difficult to assess the extent to which this reduces Chinese dependence on foreign technologies and their royalty and licensing obligations. In terms of the impact on U.S. IP-holding firms,

[84]The two existing 3G standards are WCDMA, developed and widely used in Europe, Asia, and throughout the world; and CDMA2000, the standard developed in the United States where it is one of the leading 3G technologies, as well as in Canada, Japan, and South Korea.

[85]Chao, "Motorola Makes China Push," August 31, 2010.

[86]The imposition of unique standards requires companies to alter design and functionality for a particular market at great expense, both monetarily and with respect to the pace of innovation, according to a USITC questionnaire respondent.

[87]Industry representatives, interviews by USITC staff, Beijing, September 8, 2010, and July 30, 2010; USITC, Hearing transcript, June 15, 2010, 241 (testimony of John Neuffer, Information Technology Industry Council).

[88]Creating phones to operate on different 3G standards is something Apple has been reluctant to do even in the U.S. domestic market. *C114*, "Is China the iPhone's Next Growth Engine?" November 29, 2010.

[89]Bourdreau, "Apple's Familiar Domination Elusive in China," November 25, 2010; Lifei, "China Mobile Ophone Hopes," September 1, 2009; *Business Week*, "China Unicom to Sell Its Own Smartphone by Year-End," November 18, 2010.

[90]At the time, Chinese regulators required handsets to use the domestically developed WAPI security protocol, an alternative to the internationally accepted Wi-Fi standard.

[91]Estimates report that as many as 1.5 million iPhones were in use in China prior to its official launch. In the first six months after the launch, official sales numbered 800,000 compared with 2.5 million handsets sold through the gray market. Chao, Luk, and Back, "Sales of iPhones in China Set Under 3-Year Accord," August 31, 2009; Richburg, "'Gray Market' Is Red Hot," August 8, 2009.

[92]Chao, Luk, and Back, "Sales of iPhones in China Set under 3-Year Accord," August 31, 2009.

[93]Zhu and Shi, "Shanzhai Manufacturing," 2010.

[94]Industry representatives, interviews by USITC staff, Washington, DC, July 30, 2010.

the Chinese government's decision to mandate the adoption of TD-SCDMA effectively reduced the royalties that could have accrued from other internationally accepted 3G standards. However, the patents involved in the three 3G standards often build upon one another, meaning some of the core intellectual property is overlapping. If the proposed regulation by the Standardization Administration of China (SAC) on patents in national standards (see table 5.4) were to be enforced, it could have a significant impact on U.S. IP holders, who would have to grant licenses royalty-free or at substantially reduced rates.[95]

In keeping with the MLP, the two major Chinese mobile phone makers have increased their patent applications and involvement in standards-setting activities, and both have been heavily involved in developing the technology for fourth generation mobile networks. Some industry analysts claim that the emergence of fourth generation mobile technology, LTE, is causing "a major reshuffle in the distribution of IPR wealth."[96] Chinese and other Asian firms may hold a much larger share of the global LTE patents than they did of earlier technologies, which have been largely dominated by Western firms.[97] ZTE for instance, claims to hold 7 percent of the essential LTE patents and expects to extend that to 10 percent by 2012.[98]

The effects of China's proposed government procurement rules on U.S.-based handset manufacturers, as embodied in the expected NIIP catalog, will not be known until final regulations are released. U.S. mobile phone manufacturers conduct a relatively small portion of their business with official Chinese government ministries, so the direct effects are not expected to be significant. U.S. companies report higher sales to SOEs, as the three mobile carriers in China are majority state-owned.[99] While some observers are concerned that SOEs will follow the government procurement rules that apply to government ministries, it is too early to tell whether that will be the case.[100]

Effects on the U.S. economy

Chinese indigenous innovation policies have helped to introduce a new competitive force in the global mobile phone industry. While this change has had indirect impacts on the U.S. economy as U.S. firms manage increased competition, the direct impact on jobs and exports is unclear. Some industry representatives point to China's indigenous innovation policies as contributing to the success of "national champion" companies like Huawei and ZTE, which have altered the competitive landscape of the global telecommunications equipment industry. With the help of billions of dollars in government funding and loans, and the reprieve from competition afforded by national standards, these homegrown companies have not only risen to the top of the Chinese market, but have aggressively expanded abroad, with handset sales overseas generating upwards of 70 percent of their total handset revenues in 2010.[101] ZTE broke into the top five global handset producers for the first time in 2010 (table 5.5).[102] Chinese companies have also been making forays

[95]Freshfields Bruckhaus Deringer, "Patents and Standards-Setting in China," March 2010; USTR, *2010 Technical Barriers Report*, 2010, 75.

[96]Mansfield, "LTE Is Changing the Landscape of IPR Wealth," May 18, 2010.

[97]Ibid.

[98]ZTE Corporate Website, "ZTE Holds 235 Essential LTE Patents," January 11, 2011.

[99]Industry representatives, interviews by USITC staff, Beijing, September 8, 2010.

[100]These concerns extend to industries beyond telecommunications. USITC, Hearing transcript, June 15, 2010, 58 (testimony of Calman Cohen, Emergency Committee for American Trade).

[101]Fletcher, "Huawei 2010 Handset Contract Sales," January 7, 2011; Fletcher, "ZTE Shifts Focus," September 22, 2010; Le Maistre, "Huawei, ZTE Strike New Funding Deals," June 11, 2009.

[102]Data on shipments from IDC, reported by Samson, "China's ZTE Outselling Apple," January 28, 2011.

into the U.S. market, starting with lower-valued, pay-as-you-go phones and moving up the value chain by offering more sophisticated phones and teaming with larger operators.[103] Chinese mobile handset companies now compete with U.S. companies at home and globally.

TABLE 5.5 Top five global mobile phone vendors in 2010

Vendor	2009 unit shipments (millions)	2010 unit shipments (millions)	2009–10 percent change	2010 market share (percent)
1. Nokia	431.8	453.0	4.9	32.6
2. Samsung	227.2	280.2	23.3	20.2
3. LG Electronics	117.9	116.7	-1.0	8.4
4. ZTE	26.7	51.8	94.0	3.7
5. Apple	25.1	47.5	89.2	3.4
Others (Including RIM, Sony Ericsson, and Motorola)	342.9	439.4	28.1	31.6

Source: IDC, as reported in Fierce Wireless, "The Global Handset and Smartphone Market in the Fourth Quarter of 2010," January 28, 2011.

However, it is impossible to attribute U.S. telecommunications trade and employment trends directly to Chinese indigenous innovation policies. U.S. imports of telecommunications equipment from China have been growing for over a decade, outstripping exports every year since 1999. Since then, the U.S. trade deficit in telecommunications equipment has grown from $2.4 billion in 1999 to $60.5 billion in 2010.[104] Chinese mobile phone firms have also invested in the U.S. market, primarily by setting up R&D and sales centers. Huawei currently employs over 1,000 U.S. workers and plans to create several hundred more jobs, while ZTE has announced plans to add more than 2,000 U.S. jobs to an undisclosed base over the next several years.[105]

Some industry representatives have expressed concern that China's mandating of domestic standards discourages the procurement of imported products, causing U.S. companies to reduce investment and manufacturing in the United States, and thus affecting U.S. jobs.[106] However, most manufacturing of mobile handsets is already taking place outside the United States, primarily in China; manufacturing employment in the U.S. telecommunications equipment industry has been declining for the last decade.[107] Another potential concern is that indigenous innovation policies might encourage U.S. mobile handset makers to increasingly shift R&D activities to China, which could result in U.S. job losses.

[103]Kharif, "China's ZTE Expands in U.S.," August 20, 2010.

[104]Compiled from official statistics of the U.S. Department of Commerce.

[105]Pomfret, "History of Telecom Company," October 8, 2010; Huawei Corporate Web site, "Huawei Expands North American Headquarters in Plano, Texas," October 1, 2010; Kharif, "China's ZTE Expands in U.S.," August 20, 2010.

[106]TIA, written testimony to the USITC, July 7, 2010.

[107]U.S. domestic employment in the communications equipment industry (NAICS 3342, a category that includes additional, related industries) stood at 119,500 in 2009, a 50 percent decline from 236,900 jobs in 2001.

Software

Overview

Software companies provide goods and services that enable users to perform tasks using hardware (such as computers or mobile phones).[108] Industry representatives have stated that certain implemented technical standards are having negative effects on U.S. firms' ability to fully participate in the Chinese software market. Draft Chinese government procurement rules have potentially significant negative commercial implications for U.S. software firms, if implemented. Quantifying the overall effect of Chinese software indigenous innovation policies on the broader U.S. economy and on U.S. jobs is currently not feasible, given that these policies are either relatively new or in the process of being developed.

U.S. Participation in China's Software Industry

Many U.S. software companies are active in the Chinese market and are seeking to increase their market share as Chinese enterprises increase their consumption of business software.[109] The three largest software companies in the world—Microsoft, Oracle, and IBM—are headquartered in the United States, and all three have made substantial investments in China. U.S. software companies often choose to form strategic partnerships[110] with Chinese software firms in order to jointly develop products for the local market and better serve Chinese customers.[111]

Chinese Laws and Policies

Two components of China's indigenous innovation policies—technical standards and government procurement—explicitly target software (see table 5.6).[112] Software has also been singled out in some broader policy directives.[113]

[108]Although the industry includes both business and entertainment software, this section will focus on the U.S. business software sector, which has expressed substantial concern over the potential negative effects of Chinese indigenous innovation policies.

[109]Gregory, Nollen, and Tenev, *New Industries from New Places*, 2009; IBISWorld, "Software Services in China," June 14, 2010, 8.

[110]Strategic partnerships may refer to joint ventures, but may also include other types of strategic alliances between software companies, due to the nature of the software industry.

[111]IBISWorld, "Software Services in China," June 14, 2010, 8. See, for example, Microsoft's partnership with state-owned CS&S, among other partnerships. See also Gregory, Nollen, and Tenev, *New Industries from New Places*, 2009, 107.

[112]Questionnaire responses from U.S. firms with operations in this sector also reported concerns in these areas.

[113]The January 2006 MLP, which some consider the beginning of China's indigenous innovation policies, includes software as one of the 13 engineering priority "megaprojects" that are singled out for special attention and funding. See Cao, Suttmeier, and Simon, "China's 15-year Science and Technology Plan," December 2006, 40–43. The 11th Five-Year Plan for High-Technology Industries (2006–10) further describes all 16 megaprojects. For details on the software megaproject, see McGregor, *China's Drive for "Indigenous Innovation,"* 2010, 40. According to some industry representatives, it is difficult to link software's inclusion in the megaprojects list to any concrete activities on the ground, though there may be an effect on a broader level. Industry representatives, telephone interview by USITC staff, January 31, 2011.

TABLE 5.6 Principal Chinese policies related to software

Policy	Date	Description
China Compulsory Certification (CCC) rules affecting 13 IT security products	2002, revised 2009	Certification process requiring testing and certification for certain IT products (including antispam software and operating systems) that are imported to and marketed in China. Requires covered goods be submitted to designated certification bodies affiliated with the Chinese government for certification. The principal concern of foreign firms is the risk that proprietary intellectual property could be stolen. The CCC also increases the costs and time needed to bring new products to market.
Multi-Level Protection Scheme (MLPS)	June 2007	Only recently being enforced, this set of rules governs security technology designed to protect sensitive information. The MLPS is a security framework that categorizes software information systems into five levels of increasing sensitivity. Products from the top three levels may be supplied only by Chinese-owned firms with core technology and key components based on Chinese intellectual property. The principal concern of foreign software firms is the risk of being shut out of certain Chinese markets in levels three and above, which include software for the banking, energy, telecommunications, education, and transportation industries.
Government Procurement Law	2002; revised draft issued in 2010	Provides preferences for domestic companies in government procurement. The revised draft implementing regulations, released in April 2010, target software as one of six high-technology sectors of focus. The principal concern of foreign firms is the risk of being shut out of the Chinese government procurement market for software.

Sources: U.S. Information Technology Office, "China's Multi-Level Protection Scheme," September 2010, 3; TIA, written submission to the USTR and the USDOC, June 12, 2009; USCIB, written submission to USDOC, National Institute of Standards and Technology (NIST), September 22, 2010, 5; Stewart and Stewart, written submission to the USITC, July 8, 2010, 27–28.

Technical standards

New rules under the CCC program require that foreign firms seeking to import and market 13 categories of information security IT products in China, including anti-spam software and operating systems, have designated certification bodies affiliated with the Chinese government inspect and certify their products.[114] The rules are based on Chinese security standards and not on an international standard such as ISO or the Common Criteria (a recognized international standard for computer security certification).[115] The principal concern of foreign software firms regarding the rules is the risk that proprietary intellectual property could be compromised. The rules also increase the costs and the time to bring new products to market. China implemented the rules in May 2009 despite the concerns raised by the United States, other countries, and U.S. industry representatives.[116] Due to international pressure, the Chinese government revised the rules later in 2009 to apply only to products sold to government agencies, but did not eliminate them entirely.[117]

In 2007, the Chinese government issued a measure known as the MLPS, which also raises industry concerns. The MLPS applies mandatory security requirements to the

[114]USCIB, written submission to USDOC, National Institute of Standards and Technology (NIST), September 22, 2010, 5; U.S. Information Technology Office (USITO), "China's Multi-Level Protection Scheme," September 2010, 3.

[115]USCIB, written submission to USDOC, NIST, September 22, 2010, 5.

[116]USTR, "TBT Report," March, 2011, 65; USTR, "Statement from U.S. Trade Representative Ron Kirk," May 4, 2009; USCIB, written submission to USDOC, NIST, September 22, 2010, 5.

[117]USTR, "TBT Report," March, 2011, 65; USTR, "Fact Sheet: U.S.-China Joint Commission," October 29, 2009.

development, administration, and use of information technology products. A cornerstone of the MLPS is a security framework that categorizes software information systems into five levels of increasing sensitivity.[118] For systems rated in level three and above, several requirements apply, including that the product developer and manufacturer must be a Chinese company owned by Chinese citizens, and that core technology and key components of products must be based on Chinese IP.[119] These requirements apply to systems used in several broad sectors, including banking, energy, telecommunications, education, and transportation, which in effect would eliminate foreign participation in these markets. The MLPS also requires that encryption products obtain government approval for use and cannot be imported without authorization.[120]

Government procurement

Government procurement is an important market[121] for U.S. software companies, and is likely to become more important as China implements its new commitments requiring all government agencies to purchase legal software.[122] As indicated above, China's 2002 Government Procurement Law and subsequent implementing policies give priority to "local" goods and services, with software explicitly mentioned.[123] China's 2006 policy on national accreditation for indigenous innovation products provided that accredited indigenous innovation products would be given preferential treatment in government procurement, and draft policies released in a 2009 circular (Circular 618) identified software as one of the focus areas of the forthcoming NIIP catalog.[124] The revision to the circular released in April 2010 softens some key requirements, but still targets software as one of six high-technology sectors of focus for preferential government procurement policies.

In addition to national procurement policies, a number of provincial governments have released indigenous innovation product catalogs that list preferred products for government agency and SOE procurement. According to the U.S.-China Business Council (USCBC), as of February 2011, provincial and municipal governments had released at least 61 indigenous innovation product catalogs.[125] A review of the publicly

[118]TIA, written submission to the USTR and the USDOC, June 12, 2009.

[119]USITO, "China's Multi-Level Protection Scheme," September 2010, 4; USCIB, written submission to USDOC, NIST, September 22, 2010, 5.

[120]USITO, "China's Multi-Level Protection Scheme," September 2010, 5; USCIB, written submission to USDOC, NIST, September 22, 2010, 5–6.

[121]The Chinese government procurement market for software was estimated to be 16 percent of the total Chinese software market in 2010 based on revenue. IBISWorld, "Software Services in China," June 14, 2010, 8.

[122]According to a fact sheet published by the White House, China made the following commitment regarding software in connection with the January 2011 U.S.-China summit meeting: "to assess and ensure its government's use of legal software, by, among other measures, 1) allocating government budget funding for legal software purchases, 2) auditing the use of legal software and publishing the results of those audits, and 3) promoting the use of licensed software in private companies and in SOEs through software asset management programs." White House, "Fact Sheet: U.S.-China Economic Issues," January 19, 2011.

[123]For a summary of the central government's laws and policies regarding government procurement, see USITC, *China: IPR Infringement and Indigenous Innovation 1*, 2010, table 5.1.

[124]Stewart and Stewart, written testimony to the USITC, July 8, 2010, 27–28.

[125]USCBC, "Provincial and Local Indigenous Innovation Product Catalogues," February 2011, 1.

released catalogs listed by USCBC confirms that product catalogs from the following provinces contain software products: Beijing, Fujian, Hubei, Jiangsu, Jiangxi, and Sichuan.[126]

Effects of Indigenous Innovation Policies on U.S. Firms and U.S. Economy

According to U.S. industry representatives, the Chinese policies of most concern to U.S. software firms are the new CCC rules and the MLPS, because they are currently in effect. The government procurement policies were in draft form as of January 2011 and implementing regulations were not yet in place yet, and therefore are a more long-term or potential concern.[127] Though the effects of the CCC rules and MLPS on U.S. software firms cannot yet be systematically measured, some industry representatives believe that these policies are already having negative effects on U.S. firms' ability to fully participate in the Chinese software market.[128]

The CCC rules and the MLPS raise several concerns among U.S. software industry firms. The prime concern regarding the CCC rules is that the process of obtaining CCC certification requires software firms to disclose encryption secrets and other propriety information to the Chinese government through the designated certification bodies, thereby potentially imperiling their proprietary IP.[129] U.S. software firms are also concerned that these regulations increase the cost of participating in the Chinese market by requiring them to develop one set of products for the Chinese market and another for non-Chinese markets, motivating firms to consider withdrawing from or refraining from entering the Chinese market altogether.[130] The added cost to U.S. firms to develop a distinct product for the Chinese market places them at a disadvantage vis-à-vis Chinese firms, which are currently not participating in foreign markets (including the U.S. market) to the same degree as U.S. firms and therefore do not incur this equivalent cost.[131]

U.S. industry groups have also voiced several concerns about the MLPS. Of prime concern is the requirement that information security products used for systems categorized in level three and above contain no foreign IP. This requirement, industry representatives assert, puts market access restrictions on foreign firms while shielding Chinese domestic firms from foreign competition.[132] In addition, some point out that several sectors that are classified in level three, such as banking, energy, telecommunications, transportation, and education, are not overtly national security in

[126]Based on a review of product catalogs available at Chinese provincial government Web sites found in USCBC, "Issues Brief: China's Domestic Innovation and Procurement Policies," May 2010, 9–10. Indications are that most, if not all, products listed in the reviewed catalogs are produced by domestic Chinese firms.

[127]Industry representative, interview by USITC staff, Washington, DC, January 31, 2011; industry representatives, telephone interview by USITC staff, January 31, 2011.

[128]Industry representatives, telephone interview by USITC staff, January 31, 2011; USITO, "China's Multi-Level Protection Scheme," September 2010, 3.

[129]Industry representative, interview by USITC staff, Washington, DC, January 31, 2011; industry representatives, telephone interview by USITC staff, January 31, 2011; Owen, "Standards in China," January–February 2010.

[130]USTR, "China," 2010, 51; USITC, Hearing transcript, June 15, 2010 (testimony of John Neuffer, Information Technology Industry Council).

[131]Industry representatives, telephone interview by USITC staff, January 31, 2011.

[132]USITO, "China's Multi-Level Protection Scheme," September 2010, 6–7; industry representatives, telephone interview by USITC staff, January 31, 2011; McGregor, *China's Drive for "Indigenous Innovation,"* 2010, 31; McDonald, "China Sets up New Battle over Computer Security," August 25, 2010.

nature, but because of their MLPS classification must nevertheless refrain from using information security systems that contain foreign IP.[133]

Besides concerns over market access, some have expressed concern that MLPS rules also allow for potential disclosure of proprietary information, which can compromise the security of the cryptographic technology disclosed.[134] MLPS rules, which are outside the Common Criteria, give the Chinese government significant authority in encryption issues. For example, MLPS rules allow the agency in charge of enforcing encryption standards to exercise full control over any cryptographic technology used in MLPS systems, conduct unannounced cryptographic inspections on any system level, and require that a significant share of cryptographic source code be handed over to Chinese authorities.[135] In addition, MLPS requirements stipulate that Chinese labs must conduct encryption testing and post-market factory inspections and that encryption testing requires the sharing of source code encryption keys.[136]

Though considered less of an immediate concern than such technical standards issues, China's government procurement laws also pose significant potential problems to the U.S. software industry, according to U.S. industry representatives.[137] In general, U.S. software firms' main concern, which is similar to that voiced by representatives of other sectors and industries, is that these laws would further perpetuate a policy of import substitution by creating preferences for Chinese domestic firms in the government procurement market, thereby effectively denying U.S. software firms access to this segment of the market.[138]

Finally, U.S. software firms expressed concern that these policies appear to operate in concert to boost the Chinese industry at the expense of foreign firms. Often described by U.S. industry representatives as a "web" of indigenous innovation policies,[139] this structure might entail technical standards such as the new CCC rules and MLPS working to force technology transfer (as well as adding costs to foreign firms operating in China), which would accelerate Chinese software firms' development, while government procurement laws create an exclusive market for these firms to sell their products without foreign competition.[140] As with concerns over some individual indigenous innovation

[133]Industry representatives, interview by USITC staff, Beijing, September 8, 2010. It has been pointed out that this seeming contradiction may stem from the fact that MLPS rules broadly define national security to include "national competitiveness and the strength of the economy, science and technology." See Ernst and Martin, *The Common Criteria for Information Technology Security Evaluation*, January 2010, 10.

[134]USITO, "China's Multi-Level Protection Scheme," September 2010, 6–7; McMillan, "China Policy Could Force Foreign Security Firms Out," August 26, 2010.

[135]Ernst and Martin, "The Common Criteria for Information Technology Security Evaluation," January 2010, 10.

[136]Ibid., 8.

[137]BSA, written submission to the USITC, June 3, 2010, 5–6; IIPA, written submission to the USITC, July 9, 2010, 32–33; TIA, written submission to the USTR and the USDOC, June 12, 2009; USITO, comments to MOST, May 10, 2010, 1–5. Some U.S. software industry representatives point to the Chinese government's development of these procurement laws as particularly worrisome, while also acknowledging that their biggest concern is not current harm but rather the potential negative effects. Industry representatives, interview by USITC staff, Washington, DC, June 2, 2010.

[138]USITO, comments to MOST, May 10, 2010, 1–5; USITC, Hearing transcript, June 15, 2010 (testimony of Robert W. Holleyman, Business Software Alliance).

[139]USITC, Hearing transcript, June 15, 2010 (testimony of Jeremy Waterman, U.S. Chamber of Commerce; Robert W. Holleyman, Business Software Alliance; and Mark Bohannon, Software Information Industry Association). For further discussion of this point, see USITC, *China: IPR Infringement and Indigenous Innovation 1,* 2010.

[140]Industry representatives, telephone interview by USITC staff, January 31, 2011.

software policies, however, concern over the interaction of these policies is based mainly on their potential effects rather than on actual or reported effects as of early 2011.

Automotive Industry

Overview

The Chinese government's focus on developing the automotive industry predates the 2006 emphasis on indigenous innovation. Since 2004, the Chinese government's plan for the automotive industry has focused on increasing the level of Chinese intellectual property in vehicles manufactured in China. More recently, Chinese auto policy has particularly targeted "new energy vehicles" (NEVs) such as electric or hybrid cars, investing billions of RMB in R&D and incentives to increase production and sales of NEVs. The evolving nature of indigenous innovation policies, uncertainty as to whether state and local governments or even SOEs will adopt indigenous innovation rules, and the difficulty in differentiating the effects of indigenous innovation from previously existing Chinese automotive industry policies all make it difficult to assess the current and potential impact of indigenous innovation policies on the U.S. economy and U.S. jobs in this sector. In general, though, U.S. companies appear to have continued to expand production of vehicles in China.[141] Chinese government policies related to innovation, combined with manufacturers' interests in producing vehicles in their fastest-growing market, create incentives for U.S. auto firms to increase production of vehicles through their Chinese joint ventures. Indigenous innovation policies could, however, undermine U.S. firms' competitiveness or sales if their products do not qualify to be included in government procurement catalogs or to receive other government incentives.

U.S. Participation in China's Automotive Industry and Market[142]

The Chinese automotive market is the biggest in the world, with over 17 million units sold in 2009 and over 18 million units in 2010.[143] In 2010, U.S. automotive market sales totaled 11.5 million.[144] With the world's largest population, a growing middle class, and a relatively low ratio of cars to people, automotive market sales in China are likely to rise even further.[145] U.S.-based manufacturers participate in the Chinese automotive market through both exports and FDI. Generally, they export small numbers of large SUVs and expensive cars from North America, and produce large numbers of smaller, less expensive vehicles in China.[146] From 2005 to 2009, the United States exported an average of over 44,000 cars per year to China.[147] These exports included vehicles from Ford, General Motors (GM), and Chrysler, as well as units from Mercedes and BMW plants in the southeastern United States.

The Chinese government requires investment by foreign auto companies in domestic production via joint ventures because it hopes to exchange domestic market access for

[141]ISI Emerging Markets, CEIC database (accessed November 5, 2010).

[142]This discussion focuses on cars and light trucks.

[143]China Association of Automobile Manufacturers, "China Automobile Production Increase," January 21, 2011.

[144]*Ward's Automotive Reports,* "Light Vehicle Sales Segmentation: 4th Quarter 2010," January 17, 2010.

[145]Reuters, "Chinese Auto Sales Growth Seen Near 2010 Rate," March 11, 2011.

[146]These less expensive vehicles are often manufactured at the joint venture's assembly plant (or plants). IBISWorld, "Automobile Manufacturing in China," February 25, 2010, 15.

[147]GTIS, Global Trade Atlas Database (accessed November 3, 2010).

Chinese Laws and Policies Related to the Auto Industry

China's automotive policy since the 1980s has been focused on developing its domestic auto industry. The explicit policy goal of developing automotive products with domestic Chinese intellectual property was first announced in the 2004 Policy on Development of the Automotive Industry (table 5.7). China's previous auto sector policies did not directly address IP, but emphasized the development of domestic capabilities in China's automotive sector through a variety of policies including local-content requirements, incentives to perform R&D in China, and strong encouragement for Western firms to agree to transfer technology in exchange for access to an effective joint-venture partner.

In 2004, the Chinese government released its Policy on Development of the Automotive Industry, which included the goal of creating indigenous intellectual property several years before the MLP was introduced. The policy encourages manufacturers to improve R&D and technical innovation and "actively develop products with China's own IP." It also supports the establishment of new R&D facilities through tax incentives, encourages international cooperation, and affirms that foreign automakers are restricted to minority ownership in no more than two passenger vehicle assembly joint ventures.[155] The 2009 Automotive Adjustment and Revitalization Plan encourages mergers and reorganizations of large-scale automobile enterprises, as well as the creation of independent brands, both for export and for domestic sales.[156] The plan also announced further government support for NEVs.[157] NEVs are also an important part of the 12th Five-Year Plan (box 5.5).

[155]Government of China, SDRC, Automobile Industry Development Policy No. 8, 2006.

[156]Government of China, SDRC, Automobile and Steel Industries Adjustment and Revitalization Plan, September 2009; *People's Daily Online*, "China May Curb Overcapacity of Automotive Industry," September 6, 2010.

[157]Government of China, SDRC, Automobile and Steel Industries Adjustment and Revitalization Plan, September 2009.

TABLE 5.7 Auto industry policies related to indigenous innovation

Law	Date	Description
Informal auto development policy	1980s	The central government used high tariffs and import quotas to protect the domestic market, and limited foreign firms' involvement in joint ventures.
Formal Policy on Development of the Automotive Industry	1994	The policy encouraged production increases for automakers and introduced the goal of reducing the number of Chinese car companies to six. On joint ventures, the policy formalized ownership limits on foreign firms, but also required specific types and quality of investment from the foreign firms (e.g., creation of an R&D center and transfer of technology of at least the 1990 level).
Policy on Development of the Automotive Industry (2004)	2004	Under the policy, the government supported establishment of R&D facilities through preferential tax policies and added the goal of creating indigenous IP. The policy continued a focus on restructuring the industry and maintained restrictions on foreign ownership of joint ventures.
11th Five-Year Plan	2006–10	Under the plan, the government's two principal goals for the auto industry were to increase domestic quality and production and to strengthen independent brands.
Automotive Readjustment and Revitalization Plan	2009	The plan contained several policies related to indigenous innovation. First, it continued support for independent Chinese innovation in the auto industry, making available RMB 10 billion in special funds for NEVs and technological innovation. It also announced plans to subsidize NEVs. The government additionally announced support for vehicle manufacturers to create their own brands and a base for exports of vehicles.
12th Five-Year Plan	2011–15	Includes a goal of consolidating the Chinese automotive industry, and another goal of selling 1 million NEVs in China by 2015.

Sources: Sims Gallagher, *China Shifts Gears*, 2006; Government of China, "Formal Policy on Development of Automotive Industry," 1994; Government of China, State Development and Reform Commission, "Automobile Industry Development Policy No. 8," 2006; Government of China, "Automobile and Steel Industries Adjustment and Revitalization Plan," September 2009; *APCO Worldwide,* "China's 12th Five Year Plan," December 10, 2010, 4, 8.

SAIC engineers in technology and systems development, jointly develop NEVs, permit SAIC participation in GM's global vehicle development process, and allow SAIC to share access to additional GM technology related to vehicle and powertrain application.[161]

Other companies reportedly have refused to transfer their best technology in exchange for market access. One reason cited has been the relatively low royalty rates offered by Chinese companies for access to new technology.[162] China's 2004 fuel efficiency standard was reportedly introduced in response to some foreign companies' refusal to transfer new efficiency technology, with the goal of giving Chinese joint-venture partners the leverage to negotiate with their foreign counterparts for the use of the most advanced new technology on vehicles assembled in China.[163]

Chinese government fleet purchases make up 6 percent of passenger vehicle sales, so government procurement may be an important market for foreign firms.[164] Currently, transportation is not a focus area identified for the NIIP catalog.[165] However, NEVs are considered green technology, which is a focus of indigenous innovation. Among the local and provisional government product catalogs, only Shanghai's includes transportation products.[166]

Effect of Indigenous Innovation Policies on U.S. Firms and the U.S. Economy

The effects of Chinese indigenous innovation policies on U.S. firms and the U.S. economy are difficult to isolate, due in part to other Chinese auto industry policies.[167] The status of joint-venture products that incorporate Chinese intellectual property is also uncertain with regard to government procurement catalogs or other types of incentives. Currently, the impact of China's indigenous innovation policies on foreign-invested joint ventures is unknown, though the creation of China-specific brands by these joint ventures is reportedly a response to indigenous innovation requirements.[168] Indigenous innovation policies could also affect U.S. automotive industry revenue in China through decreased sales or loss of competitiveness if U.S. firms are unable to qualify for incentives offered to domestic firms. Similarly, the impact of indigenous innovation policies on the U.S. economy or U.S. jobs in this sector is unclear, as most foreign firms selling large numbers of vehicles in China already produce vehicles and conduct R&D there.[169] However, according to a recent Chamber of Commerce survey, U.S. companies in the automotive sector (in a tie with the energy industry) were the group most concerned that indigenous innovation policies could have a negative impact on their business.[170] On the

[161]General Motors Company, "Amendment No. 8 to SEC Form S-1," November 16, 2010, 66.

[162]Reportedly, the Chinese government typically offers a maximum royalty rate of 4.5–6.0 percent for autos and auto parts. Moga, "Tech Transfer Turning Point?" *China Business Review*, September–October 2010, 31.

[163]Oliver et al., "China's Fuel Economy Standards for Passenger Vehicles," March 2009, 7.

[164]IBISWorld, "Automobile Manufacturing in China," February 25, 2010, 9.

[165]USCBC, "The US-China Business Council Comments," May 10, 2010, 19.

[166]The Shanghai catalog lists the Roewe 550 and 750 as NIIPs. Roewe is an SAIC brand that is separate from its joint ventures with GM. Government of Shanghai, Shanghai indigenous innovation Product Catalog 1, August 21, 2009.

[167]Thun, Changing Lanes in China, 2006, 55.

[168]Creating China-specific brands may also be based on marketing efforts not related to indigenous innovation policies. Waldmeir, "Beijing Presses Carmakers to Share Technology," February 18, 2011.

[169]Neither Chinese nor foreign-invested companies in China currently manufacture vehicles in China for export to the United States, though a number have stated plans to do so in the future. Wang, "BYD's Electric Car Dream in the U.S. Sparks Concerns," January 12, 2011.

[170]American Chamber of Commerce in Shanghai, *China Business Report 2010–2011*, January 2011, 21.

other hand, in response to the Commission's questionnaire, firms from the motor vehicles and parts sector were not as concerned about indigenous innovation as firms from a number of other sectors (table 5.2).

Industry experts hold differing views on the development and implementation of indigenous innovation policies in the near term and how these policies will affect foreign-invested joint ventures in China. Chinese government officials have stated that foreign invested enterprises (such as joint ventures) will receive national treatment under these indigenous innovation policies.[171] If they are eligible for NIIP status, foreign-invested joint ventures may choose to create unique vehicle designs in China in order to qualify.[172] As of January 2011, government policies use NIIP status only for government procurement catalogs.

Some U.S. business groups in China have expressed concerns that the government will use policies such as R&D incentives, local-content requirements, or technology transfer requirements to encourage foreign companies to incorporate more Chinese intellectual property in their products.[173] Lack of access to incentives would make foreign-invested joint ventures less competitive in the Chinese market. Sales to government agencies may also be affected.[174] A sizeable portion of sales (16 percent) come from businesses, many of which are SOEs.[175] It remains unclear whether SOEs will adhere to government procurement regulations once they are implemented, even if they are not explicitly required to do so.[176] If government procurement catalogs were to include passenger vehicles, it would likely affect more than the 6 percent of the market that is officially classified as government fleet purchases. Although precise data are not available, government and business fleet purchases likely include at least some vehicles designed outside of China that would not meet the criteria for government purchase under the NIIP.[177]

Civil Aircraft and Aircraft Parts

Overview

China's aircraft and parts industries have been targeted for development by the central government's two most recent five-year plans, both of which predate the introduction of indigenous innovation policies under the 2006 MLP. However, the government's long-standing focus on developing the industries through technology, facilitated by joint ventures, is in line with the MLP's indigenous innovation goals. Compared with the wind power and automotive industries, Chinese aircraft companies have been less successful in acquiring significant market share, either in China or abroad. This is primarily because of the high level of technological expertise needed to compete in the civil aircraft industry, especially given the requirements for meeting international aviation standards.[178] It remains to be seen whether China will be able to successfully compete in the global

[171] *Xinhua News,* "China's Investment Environment Improving amid 'Growing Pains,'" September 9, 2010; *Xinhua News,* "Full Text of Chinese Premier Wen Jiabao's Speech," September 13, 2010.

[172] USCBC, Issues Brief: China's Domestic Innovation and Procurement Policies, May 2010, 5.

[173] Hout and Ghemawat, "China vs. the World," December 2010, 97.

[174] IBISWorld, "Automobile Manufacturing in China," February 25, 2010, 9.

[175] Ibid. Information on the share of motor vehicles purchased by SOEs is not available.

[176] USITC, Hearing transcript, Washington, DC, June 15, 2010, 53 (testimony of Calman Cohen, Emergency Committee for American Trade).

[177] Tong Hao, "Audi Speeds Past Rivals," June 25, 2009.

[178] Airbus (France), Boeing (U.S.), Canadair (Canada), and Embraer (Brazil) have acquired the necessary skills to manufacture and market passenger transport aircraft successfully throughout the world.

aviation market in the future. For now, China's plan to develop the C919, an indigenous large civil aircraft (LCA), and a regional jet, the ARJ21, rely heavily on aircraft systems provided by U.S. and other foreign companies through joint ventures in China.

U.S. Participation in China's Aircraft and Aircraft Parts Industry

The U.S. aerospace industry is the largest manufactured goods exporter in the United States. It produces aircraft, spacecraft, and associated parts to supply the majority of the world's aerospace needs. During 2000–09, China became an increasingly important market, with dramatic increases in imports of U.S. aircraft (337.8 percent) and engines (1,350.8 percent) and a more modest increase in aircraft parts (45.4 percent).[179] China does not currently produce LCA. Its civil aircraft programs under development rely on foreign inputs, including engines, avionics, and aircraft systems. U.S. suppliers account for about 40 percent of the parts and systems on China's ARJ21 regional aircraft,[180] and could see a significant increase in market share if the aforementioned civil aircraft programs are successful. The C919's entry into service is scheduled for 2016; the ARJ21's for year-end 2011.[181]

To enhance its ability to meet domestic needs, China has restructured its aerospace industry, segregating the civil portion from other branches, and invited global participation in its civil industry. Major international aerospace suppliers, including some from the United States, have sought out joint ventures in China to participate in this developing industry (table 5.8). Chinese firms in the industry, most of them state-owned, see technology transfer as one important goal of such joint ventures. U.S. firms reportedly carefully negotiate technology transfer agreements, aware of the possibilities for additional "unplanned technology transfer" (through theft of IP). Foreign companies aim to manage such transfers within their joint ventures while maintaining control of their core technologies.[182]

The market for aircraft in China is driven by growing air transport demand, and the parts market is driven by both replacement needs and China's two new civil aircraft programs. China has opted to purchase major systems, such as the avionics, engines, and flight

[179]GTIS, Global Trade Atlas, December 2, 2010, data for HS 8802, HS 8411, and HS 8803.
[180]Chadha, "China Lays Plans for ARJ21-900," February 19, 2008.
[181]GE Aviation, "LEAP-X1C Launched on New C919 Aircraft," November 16, 2010; *Aviation Week*, "ARJ21 Wing Problems Drive Program," November 15, 2010.
[182]Industry representative, interview with USITC staff, Shanghai, January 13, 2011.

TABLE 5.8 Major U.S. companies supporting China's aircraft industry

U.S. Companies	Product	Chinese customer/partner/relationship
General Electric Co., through its joint venture with Snecma (Safran Group), i.e., CFM International	Aircraft engines	Commercial Aviation Company of China (COMAC): engine customer Final engine assembly and test facility established in China with AVIC Commercial Aircraft Engine Company (ACAE)
General Electric Co.	China Training School	Joint venture with the Civil Aviation Administration of China (CAAC), Civil Aviation Supplies Holding Company (CAS), Civil Aviation Flying University of China (CAFUC), CFM International (CFM), GE Aviation (GE), and Snecma (Safran group): partner in training engine mechanics
General Electric Co.	Aircraft avionics	AVIC Systems of China (joint venture)
Goodrich Hella Aerospace Lighting Systems	Major portion of the lighting system on its new ARJ21	COMAC: Purchase systems
Hamilton Sundstrand, div. United Technologies, Inc.	Electrical power generation and distribution systems	COMAC: Purchase systems
Honeywell, Inc.	Auxiliary power unit, model 131-9[C9C]	AVIC Harbin Dongan Engine (Group) Corp.
Nexcelle, div. of Safran-GE	Engine nacelle & thrust reversers	COMAC, AVIC Aircraft Corp: engine customer
Parker Aerospace, div. Parker Hannifin Corp.	Provides primary fly-by-wire flight control actuation system, and fuel, inserting, and hydraulic systems for the C919	China Aviation Industry Systems Co.: Customer for C919 program
	Joint development and in-country support of Parker's hydraulic and fuel systems	AVIC Systems
Rockwell-Collins, Inc.	Avionics	AVIC 1 Commercial Aircraft Company

Source: Corporate Web sites.

control systems, from foreign suppliers, rather than using domestically designed components for these two programs; there are no globally recognized and supported domestic producers of such systems.[183] Such initial reliance on imports may also allow Chinese companies to direct their R&D funds to developing their domestic capabilities in new areas such as aero- and fluid dynamics and materials research while China's aerospace industry assimilates existing foreign technologies to become more self-sufficient.

Major U.S.-based aircraft parts firms with a presence in China include several large manufacturing companies (table 5.8). These firms typically form joint ventures with Chinese counterparts in order to obtain business in China; in at least one case, a foreign company was instructed that in order to bid on certain projects, a joint venture with a

[183]China may opt to export its civil aircraft. Incorporating Western technologies into their aircraft allows Chinese aircraft to be more readily serviced worldwide by existing mechanics and service organizations.

Chinese partner was required.[184] Reportedly, COMAC, China's aviation original equipment manufacturer (OEM), "has made it explicitly clear that foreign bidders on the C919 program are expected to form joint ventures with Chinese partners, especially in high-technology areas such as advanced materials and flight control systems, where Chinese technology is lagging."[185]

The commercial incentives to enter into such ventures may be significant. The ARJ21 regional jet program and the C919 LCA program are among the few new aircraft programs in development worldwide. In China and elsewhere, winning a position on a new program almost ensures a revenue stream for several decades for the supplier. Firms therefore may be willing to accept joint ventures or technology transfer agreements that would not reflect their first preferences.

If Chinese firms successfully build engines and aircraft systems to foreign standards, and implement international standards for systems interrelatedness and certification, they may begin manufacturing indigenously designed components and engines for domestic and international OEMs.[186] This may take 10–20 years, but according to one source, it is not an impossible outcome of Chinese companies' joint ventures, technology transfer agreements, and generally close working relationships with foreign firms.[187]

Chinese Laws and Policies

China has implemented a variety of policies to develop its civil aircraft industry (table 5.9). The most important ones are the direct guidance given by the central government through China's recent five-year plans. China's 10th Five-Year Plan (2001–05) called for the promotion of science and technology, specifically emphasized high-technology research, and specified that efforts should be concentrated on making breakthroughs in key fields, including aerospace and aviation.[188] This plan classified civil aircraft as one of the five newly emerging industries to be developed. As a result, the AVIC-1 Commercial Aircraft Co., Ltd. (ACAC) was formed in 2002 with the express goal of producing a regional jet aircraft.[189] The 11th Five-Year Plan (2006–10) sought to build on earlier government direction and China's lessons learned in design, management, and support of its ARJ21 regional jet. This plan specifically stated the central government's goal of producing LCA, helicopters, and general aviation aircraft, with the aim of improving China's knowledge and skill base.

[184]Industry representative, interview with USITC staff, Shanghai, January 13, 2011.

[185]Cliff, Ohlandt, and Yang, *Ready for Takeoff*, 43, 2011.

[186]Erickson, "Seizing the Highest Ground: China's Aerospace Development and Its Larger Implications," 2004.

[187]According to industry sources, China hopes to parlay technology transferred through licensed manufacturing into development and production of an indigenous domestic jetliner. In the aircraft production field, as in other areas, China will attempt first to manufacture under license through joint ventures, but then to take advantage of the resulting technology transfer to reverse engineer aircraft and ultimately—through investment in R&D—to produce its own. Industry representative, interview with USITC staff, Shanghai, January 13, 2011. See also Cliff, Ohlandt, and Yang, *Ready for Takeoff*, 116, 2011 (noting rapid progress in China's ability to supply civilian aircraft components but substantial remaining capability gaps).

[188]Government of China, MOST, *National Hightech R&D Program (863 Program)*, undated Web site.

[189]AVIC-1 Commercial Aircraft Company, "About ACAC," n.d. (accessed December 2, 2010).

TABLE 5.9 Policies promoting civil aircraft development in China

Policy	Date enacted	Relation to civil aircraft development
China's 10th Five-Year Plan (2001–05): civil aircraft classified as one of the five newly emerging industries	2001	Specified planned breakthroughs in high-tech fields, including aircraft
Guiding Opinion on Promoting the Adjustment of State-Owned Capital and the Reorganization of State-Owned Enterprises	December 2006	Civil aviation was considered a strategic industry, one in which the Chinese government should own at least a 50 percent interest
China's 11th Five Year Plan (2006–10): aircraft one of China's 16 major development plans	2006	Directed Chinese companies to produce large civil and general aviation aircraft, and helicopters
The Guiding Principles of Program for Mid-to-Long Term Scientific and Technological Development (2006–20) [MLP]	February 2006	Identified large aircraft production as a megaproject
Catalog of Encouraged Foreign Investment Industries, Decree of the State Development and Reform Commission, No. 57	November 2007	Encouraged foreign direct investment in China's aerospace industry
2008 National Intellectual Property Strategy	2008	Key industry sectors where China should concentrate on obtaining strategic patents are given in paragraph 16, including aeronautics and astronautics
China's 12th Five Year Plan (2011–15): New materials development	2011	Reportedly will encourage development of new composite materials for aerospace

Sources: www.interlinkChina.com, "Implementation of the 10th Five-Year Plan 2001–2005," n.d.; China Economic Net, "China's Aviation Industry Aims High," November 6, 2006; Naughton, "China's State Sector," May 24, 2007; GlobalSecurity.org, "Civil Aircraft Programs," n.d.; Cao, Suttmeier, and Simon, "China's 15-Year Science and Technology Plan," December 2006; Friedmann, "China: China´s National IP Strategy 2008," September 15, 2008; Ministry of Commerce, Catalog of Encouraged Foreign Investment Industries, May 2010; Zeebiz.com, "China's 12th Five Year Plan: Prospects on Major Industries," December 11, 2010.

The MLP has also been an important policy promoting China's aircraft sector; LCA is noted as a particular area for development.[190] According to a December 2006 directive issued by the State-owned Assets Supervision and Administration Commission of the State Council (SASAC),[191] civil aviation is considered to be a strategic industry, and thus each Chinese company is subject to substantial (at least 50 percent) government control.[192] Nevertheless, the central government has offered a minority share of corporatized SOEs for private sector ownership (foreign or domestic) through the sale of public stock, acknowledging the benefit of attracting a diversity of skills to Chinese aircraft companies.[193]

[190]Levin Institute, "Industrial Innovation in China," July 2006, Appendix, 113.

[191]USITC, China: Description of Selected Government Practices and Policies, December 2007.

[192]One exception to this rule is the Airbus final assembly line opened in 2008 in Tianjin, a joint venture with Tianjin Free Trade Zone (TJFTZ) and China Aviation Industry Corporation (AVIC). Airbus has a 51 percent stake in this venture. Airbus Industries, SAS, "Airbus Final Assembly Line China Achieves 2009 Target," Press release, December 17, 2009.

[193]China.org, "Premier on 10th Five Year Plan for National Economic and Social Development (indigenous innovation)," n.d. (accessed February 14, 2011).

Effects of Indigenous Innovation Policies on U.S. Firms and the U.S. Economy

China has been attempting to build an LCA since the 1980s, but has not been successful. Chinese policies have largely shaped the current manufacturing landscape, defined in part by joint ventures with foreign companies. In the auto and wind power industries, such policies have led to increasing market share for Chinese firms. In aviation, however, Chinese firms have found the technological hurdles more difficult to surmount.

As of February 2011, it does not appear that China's announced indigenous innovation policies have directly impacted U.S.-based firms in the aircraft and aircraft parts manufacturing industries in China. For example, there is no government procurement or technical standards policy favoring indigenous Chinese aerospace products, likely because of the dearth of such products. The policies do, however, complement the goal of existing aircraft industry policies, which are designed to advance China's domestic aircraft industry. It is possible that indigenous innovation policies will have a greater impact on China's aerospace industry in the future. Such potential impact depends on whether China is able to acquire or develop the necessary technology for OEM aircraft production, either through technology transfer from Western companies or through aerospace R&D conducted in China. Further, China's ability to profit from technology transfer depends on Chinese firms' ability to transform lessons learned from joint ventures with foreign aerospace entities into concrete products and services.

U.S. companies participating in joint ventures with Chinese aerospace companies are aware of the inherent risks of such ventures, primarily the risk of losing control of their proprietary intellectual property and technology. However, they consider this risk as the price of participating in China's market.[194] How each foreign company manages its risk depends on the company involved, but all attempt to limit their exposure to unintended technology transfer.

[194]Industry representative, interview with USITC staff, Shanghai, January 13, 2011.

APPENDIX A
REQUEST LETTER