



Supporting Online Material for

China's Innovation Landscape

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OVERVIEW

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1. FURTHER NOTES: CHINA'S PATENT SYSTEM AND POLICY

The patent system of the People's Republic of China (PRC) was introduced following the Open Door Policy of Deng Xiaoping in 1978. An important objective of the Open Door Policy was to bring in foreign science and technology to modernize China's industry (S1). To facilitate the transfer of scientific and technological know-how into the country and to increase the protection of foreign and domestic intellectual property rights, the Chinese Patent Office (CPO), later renamed the State Intellectual Property Office (SIPO), was created in January 1980. China joined the World Intellectual Property Organization (WIPO) in June 1980 and acceded to the Paris Convention for the Protection of Industrial Property in November 1984 before becoming an official member in March 1985. The original version of the Patent Law of China was adopted in March 1984 and came into force in April 1985 (S2).

China's Patent Law has been amended three times – in 1992, 2000, and most recently in 2008. The 1992 amendment increased the duration of patent protection (from 17 years to 20 years from date of filing) and incorporated the full legal protection of pharmaceutical and chemical inventions, and microbiological products and processes (S3). The goal was to promote investment in pharmaceutical and biotechnology research and development and enhance the importation of pharmaceutical and biochemical products. The 2000 amendment brought the patent law into compliance with the Trade-Related Aspects of Intellectual Property Rights Agreement ("TRIPS") (S4, S5). It gave owners of patents new substantive rights (e.g., rights of “offer for sale”). In 2001, further enhancements simplified patent application procedures and improved administrative and judicial enforcement and protection (S4, S5). The third amendment in 2008, which went into effect in 2009, enhanced patentability standards, in particular novelty, improved on design patents, and clarified patent joint-ownership rights, among other modifications (S6). These measures could improve China’s relatively weak intellectual property protection environment and better align its patent law with international standards in the global economy.

Since 1985, China has witnessed a rapid growth of patent applications. The number of patents applied and granted across all sectors and regions has substantially increased by an average annual rate of about 15% (applied) and 13% (granted) from application year 1985 to 2006. In addition to the enhanced patent system and procedures to facilitate the development and transfer of science and technology in China, the Chinese government has been attempting to improve R&D capabilities in other ways that may have impacted the number of patents applied for and granted. For example, the government designated in 1979 the Special Economic Zones (SEZs) in the coastal cities of Shenzhen, Zhuhai, Shantou and Xiamen (S7), with preferential economic policies such as special tax incentives for foreign investment and greater independence on international trade activities to attract foreign direct investments (FDI) into these regions. In 1984, the Open Port Cities were introduced which later became the Economic and Trade Development Zones (ETDZs) in 1985 (S8). By offering tax incentives and tax breaks, the ETDZs served as magnets for foreign investments in important scientific and technological industries, such as electronics and computing (S9). By 1995, there were thirteen Free Trade Zones (FTZs) in operation under the High-Technology Industry Parks or Development Zones (HTDZs) (S9). These were specially designated regions with no tariffs on a large number of

exported and imported goods to attract research and development facilities into the industrial and science parks. These zones were also accessibly located in most provinces of China except for Qinghai and the autonomous regions of Tibet and Ningxia. These government policies may have helped the coastal regions such as Zhuhai and Shenzhen that attracted early FDI to develop into major economic and social hubs (S7). While the Eighth Five-Year Plan (1991 to 1995) started to stimulate and coordinate development of coastal, central and interior regions (S10), a goal of the Ninth Five-Year Plan (1996 to 2000) was to continue regional modernization and economic development by moving more FDI into the interior regions (S11). These significant policy measures could have accounted for some of the observed diffusion of innovative capacities (of firms and research institutes) from the coastal areas into the central and interior regions in the analysis.

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S11. L. Pan, The 9th Five-Year Plan (1996-2000). Official Web Portal, Government of China, April, 2006; (http://www.gov.cn/english/2006-04/05/content_245690.htm).

2. DATA SOURCE

The data set analyzed in the paper can be purchased from the SIPO Intellectual Property Publishing House. For details, see: http://www.sipo.gov.cn/sipo_English/service/

3. SUPPLEMENTARY FIGURES

Figure S1. SIPO patents granted in all patent classes by assignee sector for grant year 1986 to 2006. (Number of patents, $N = 1,119,089$)

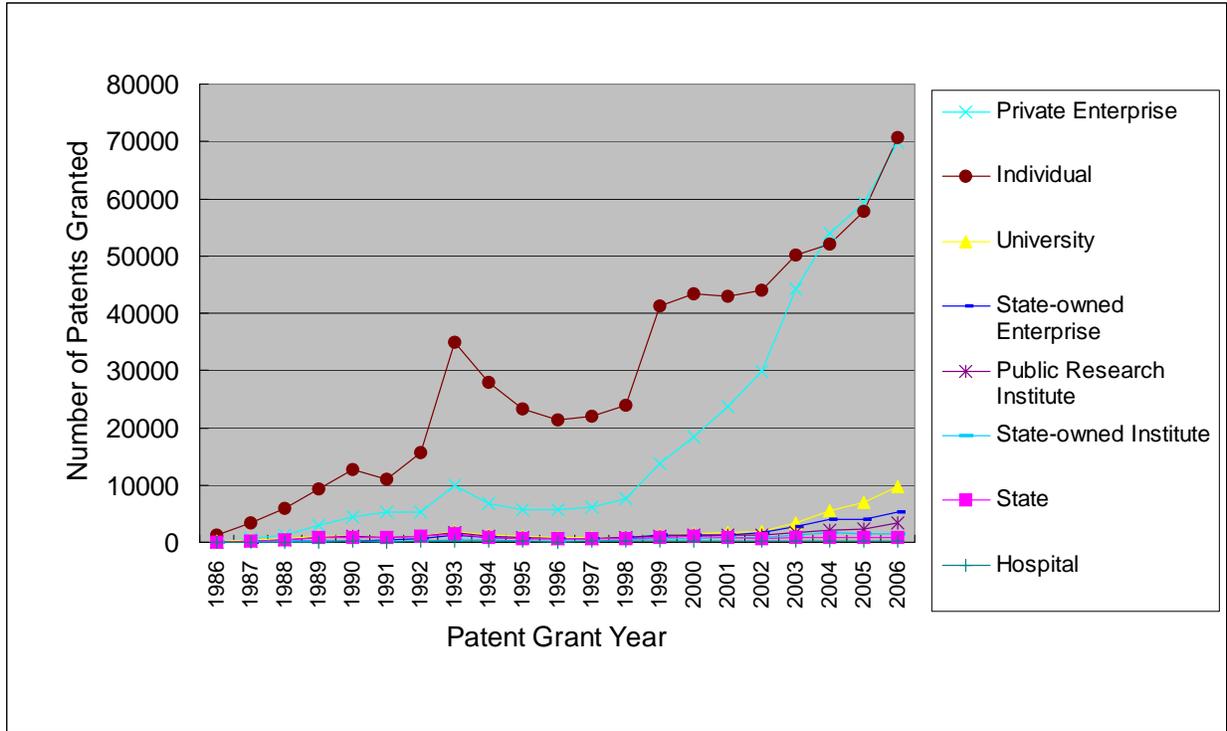


Figure S2. SIPO patents granted in 12 major science and technology classes for grant years 1986 to 2006. (Number of patents, $N = 209,471$)

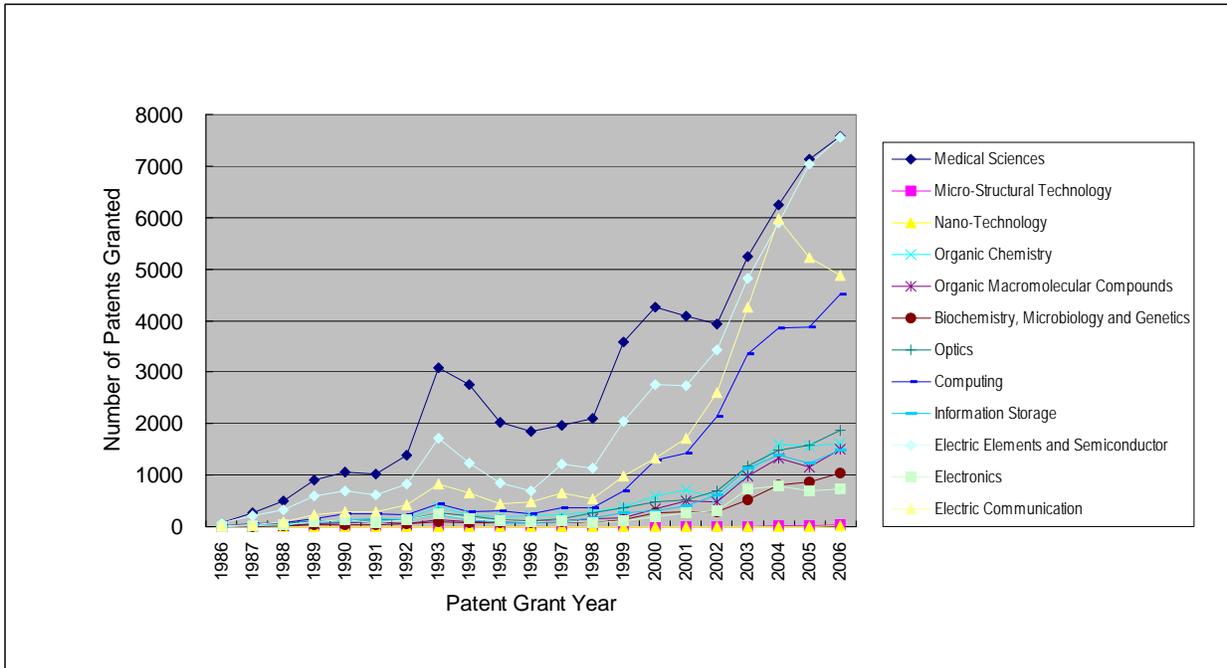


Figure S3. SIPO patents granted in 12 major science and technology classes by assignee country for grant years 1986 to 2006. (Number of patents, $N = 209,471$)

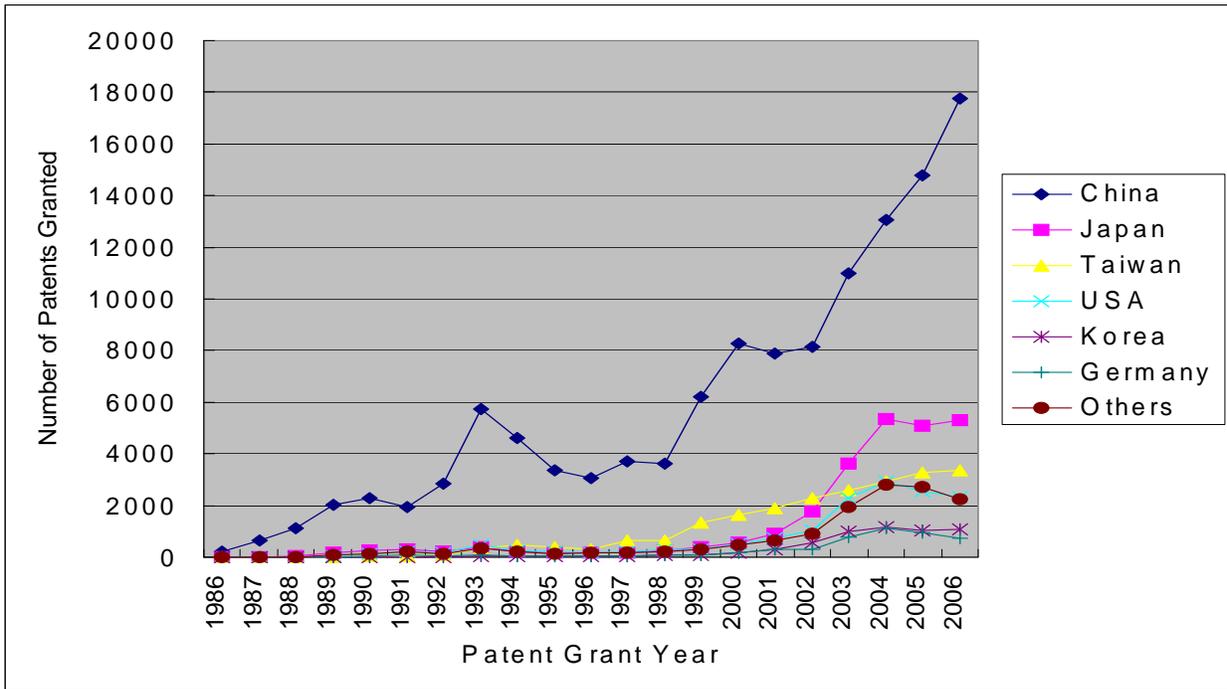
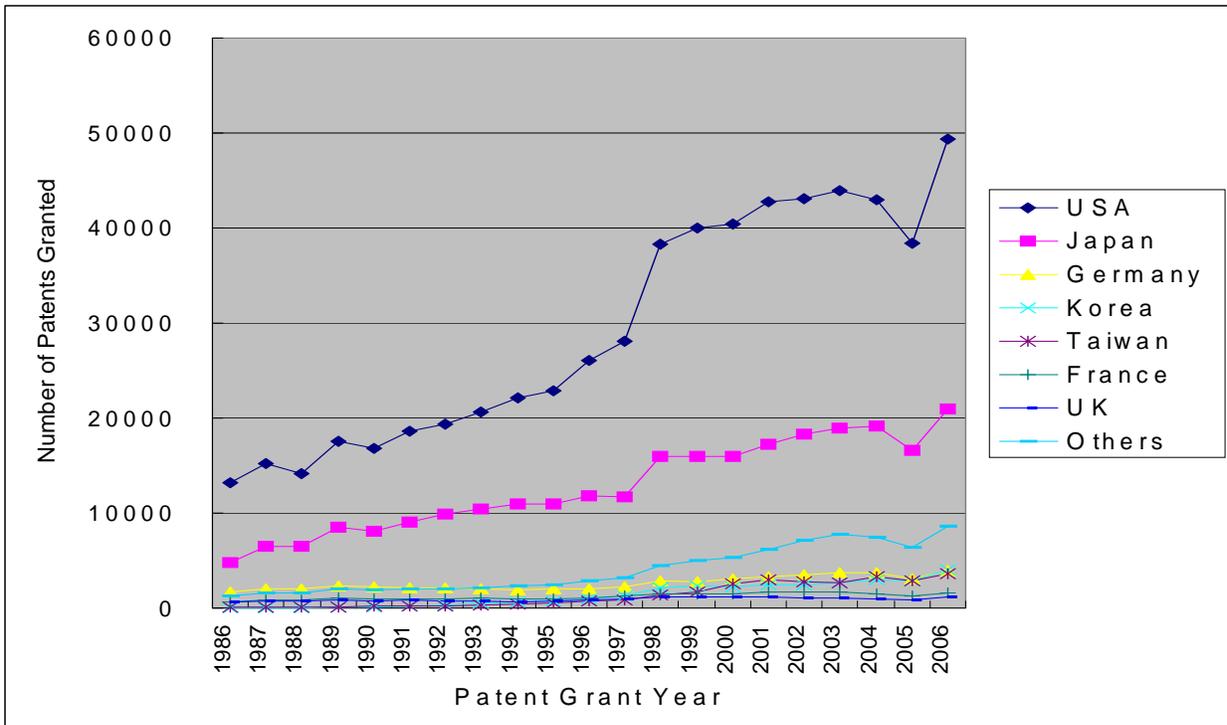


Figure S4. USPTO patents granted in 12 major science and technology classes by assignee country for grant years 1986 to 2006. (Number of patents, $N = 1,122,538$)



Source: OECD Statistics on Science, Technology and Patents: Patents Statistics (<http://stats.oecd.org/index.aspx>)

4. SUPPLEMENTARY TABLES

Table S1. Definition of the eight patent assignee sectors.

Assignee Sector	Definition
Private enterprise	For-profit companies, firms or factories affiliated with an officially registered business or enterprise
Individual	Individual inventor(s)
University	Universities, colleges or educational institutions
State-owned (or -run) enterprise	For-profit companies, firms or factories (affiliated with an officially registered business or enterprise) owned or run by the central or state government, e.g., military products, some telecommunications, transportation, energy, heavy industries or regulated financial and securities firms
Public research institute	Non-profit research institutes, organizations and laboratories
State-owned (or -run) institutes	Non-profit research institutes, organizations and laboratories owned or run by the central or state government, e.g., Chinese Academy of Sciences or Chinese Textile Academy
State	Central or state government agencies, bureaus, ministries, armies, administrations and councils
Hospital	Hospitals or clinics

Note: State-owned (or -run) enterprises are primarily documented under the State-owned Assets Supervision and Administration Commission of the State Council; (<http://www.sasac.gov.cn/n1180/n1226/n2425/index.html>).

Table S2. International patent classification (IPC) codes and description of 12 major science and technology classes.

A 61	Medical or veterinary science; hygiene
B 81	Microstructural technology
B 82	Nanotechnology
C 07	Organic chemistry (such compounds as the oxides, sulfides, or oxysulfides of carbon, cyanogen, phosgene, hydrocyanic acid or salts thereof C25B7/00)
C 08	Organic macromolecular compounds; their preparation or chemical working-up; compositions based thereon (manufacture or treatment of artificial threads, fibres, bristles or ribbons D01)
C 12	Biochemistry; beer; spirits; wine; vinegar; microbiology; enzymology; mutation or genetic engineering
G 02	Optics (making optical elements or apparatus C03C)
G 06	Computing; calculating; counting (score computers for games B43K29/08)
G 11	Information storage
H 01	Basic electric elements (includes semiconductor and devices)
H 03	Basic electronic circuitry
H 04	Electric communication technique

Source: Obtained from the World Intellectual Property Organization (WIPO) IPC codes (<http://www.wipo.int/classifications/ipc/en/>).

Table S3. Number of patents granted by SIPO in 12 major science and technology classes for grant years 1986 to 2006.

Patent Grant Year	Medical Sciences (A61)	Micro-Structural Tech (B81)	Nano-Tech (B82)	Organic Chemistry (C07)	Organic Compounds (C08)	Biochemistry, Microbiology or Genetics (C12)	Optics (G02)	Computing (G06)	Information Storage (G11)	Electric Elements (H01)	Electronics (H03)	Electric Communi-cation (H04)	Total for 12 Classes	Percent of SIPO Patents across all classes
1986	75	0	0	2	2	1	16	21	3	83	6	10	219	12.03
1987	262	0	0	5	14	4	22	58	29	212	24	46	676	13.09
1988	505	0	0	17	18	23	61	71	41	324	34	88	1182	12.97
1989	900	0	0	53	53	37	123	152	103	588	92	225	2326	14.74
1990	1063	0	0	77	76	41	123	254	141	697	135	285	2892	13.88
1991	1015	0	0	109	98	46	126	243	159	612	86	280	2774	14.30
1992	1389	0	0	160	62	48	143	225	125	830	136	420	3538	14.03
1993	3079	0	0	376	132	100	262	440	233	1714	256	837	7429	14.29
1994	2759	0	0	238	88	74	211	293	130	1236	148	648	5825	14.86
1995	2027	0	0	193	90	80	139	311	78	846	110	451	4325	13.27
1996	1851	0	0	220	120	77	124	253	72	687	93	477	3974	13.22
1997	1963	0	0	236	124	87	151	359	90	1210	114	653	4987	15.90
1998	2092	0	0	291	153	75	272	373	172	1142	75	543	5188	14.64
1999	3587	0	0	387	171	130	367	692	265	2051	111	984	8745	14.52
2000	4265	0	0	598	350	274	481	1298	301	2749	200	1323	11839	17.41
2001	4089	1	0	723	493	298	519	1417	408	2735	263	1719	12665	17.39
2002	3932	1	1	561	474	292	685	2140	618	3425	308	2606	15043	18.71
2003	5234	2	1	1000	986	526	1171	3363	1129	4829	732	4255	23228	22.24
2004	6239	11	7	1609	1329	803	1494	3864	1379	5896	782	5975	29388	24.38
2005	7128	27	8	1562	1164	865	1576	3876	1232	7027	697	5230	30392	22.87
2006	7577	39	25	1628	1512	1033	1867	4515	1486	7552	724	4878	32836	20.30
Total	61031	81	42	10045	7509	4914	9933	24218	8194	46445	5126	31933	209471	18.72

Note: If a patent falls under more than one IPC class, the fraction of each science or technology class to which this patent had been classified under was calculated. For example, if a patent is classified under classes A61, B81, B82 and C07, each of these four classes is weighted as 0.25. The numbers presented in the table above have been rounded up to the nearest whole number.

Table S4. Number of patents granted by USPTO in 12 major science and technology classes for grant years 1986 to 2006.

Patent Grant Year	Medical Sciences (A61)	Micro-Structural Tech (B81)	Nano-Tech (B82)	Organic Chemistry (C07)	Organic Compounds (C08)	Biochemistry, Microbiology or Genetics (C12)	Optics (G02)	Computing (G06)	Information Storage (G11)	Electric Elements (H01)	Electronics (H03)	Electric Communication (H04)	Total for 12 Classes	Percent of USPTO patents across all classes
1986	4112	3	1	3304	2355	405	967	1224	1451	4700	1383	2334	22240	31.37
1987	4962	13	10	3498	2603	572	1445	1622	1967	5884	1478	3001	27054	32.59
1988	4691	3	0	3394	2602	565	1598	1700	1890	5564	1308	2705	26021	33.38
1989	6313	6	0	4218	3073	714	1786	2406	2424	6630	1557	3451	32577	34.10
1990	6171	2	0	4275	3035	786	1708	2203	1881	6459	1425	3175	31121	34.43
1991	6709	6	1	4329	3549	823	1911	2376	2236	7107	1645	3397	34089	35.31
1992	6835	4	1	4537	3688	1014	2019	2791	2271	7235	1696	3657	35749	36.67
1993	6993	10	1	4986	3771	1156	1985	3322	2581	7454	1508	4010	37776	38.40
1994	7622	13	2	4216	3528	1078	1897	3960	2963	8199	1778	4839	40097	39.41
1995	7800	21	3	4472	3035	1129	1871	4559	3042	8297	1976	5279	41483	40.91
1996	8608	28	4	4592	2993	1507	2228	5846	3401	8707	2009	6383	46307	42.26
1997	10026	34	4	5414	2907	1967	2371	6105	3540	9130	1926	5977	49401	44.11
1998	12939	43	4	6048	3282	2915	3324	9853	5028	12234	2680	9443	67793	45.96
1999	13143	51	6	5802	3273	3026	3148	9968	5063	14379	2772	9892	70523	45.94
2000	12865	70	6	5388	3308	2676	3380	9552	5249	16421	3010	10244	72170	45.83
2001	13492	99	12	5669	3612	3073	3794	10240	5419	18634	3312	10520	77874	46.89
2002	13499	136	9	5961	3706	2787	4076	10217	5584	19473	3483	11125	80056	47.84
2003	14034	204	14	5200	3484	2532	4700	11100	5745	19958	3574	11930	82473	48.79
2004	11057	258	16	4451	3146	2158	5208	12140	6013	20274	3679	13592	81993	49.91
2005	9259	210	16	3963	2230	1879	4881	11527	5229	17629	3356	12314	72494	50.44
2006	10452	18	7	4757	2520	2839	5268	21630	5732	19069	4400	16556	93248	53.70
Total	191582	1232	120	98475	65700	35602	59561	144341	78710	243437	49956	153823	1122538	43.55

Note: If a patent falls under more than one IPC class, the fraction of each science or technology class to which this patent had been classified under was calculated. For example, if a patent is classified under classes A61, B81, B82 and C07, each of these four classes is weighted as 0.25. The numbers presented in the table above have been rounded up to the nearest whole number.

Source: Extracted from OECD Statistics on Science, Technology and Patents: Patents Statistics (<http://stats.oecd.org/index.aspx>).