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# **PRC Outward Investment in the U.S. and Europe: A Model of R&D Acquisition**

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## I. INTRODUCTION TO PRC OUTWARD INVESTMENT

Maintaining international competitiveness in the current international environment requires rapid scientific and technological innovations. As the flow of foreign direct investment and venture capital continues to expand across the world, the pressures to create quicker and more efficient ways to extract the benefits of technological innovation may lead to more creative methods for its acquisition. This is especially true for countries like the People's Republic of China (PRC) which on the one hand, is rich in foreign reserves and on the other hand, short in operational research and development designed to alter its external sector from one that is based on cheap labor to one that is based on innovation and higher value added.<sup>1</sup>

Despite the fact that PRC outward FDI (OFDI) is by world standards very small, it has significantly expanded and focused its attention to the acquisition of technology, once it adopted its “going global” program.<sup>2</sup> The PRC's OFDI went from \$9.9 billion in 2005 to \$77.2 billion in 2012, and in the first 6 months of 2013 PRC's OFDI was \$42.6 billion.<sup>3</sup> This impressive growth is a reflection of (a) the PRC's adoption of its National Development and Reform Commission (NDRC) and (b) the Export-Import Bank of China (EIBC) jointly issued directive to encourage overseas

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<sup>1</sup> The original texts of all of the PRC policy statements with respect to their long-term plans in the area of OFDI can be found in International Institute for Sustainable Development *Chinese Outward Investment: An emerging policy framework: A Compilation of primary sources*, 2012.

<sup>2</sup> Data on PRC OFDI are taken from both the Heritage Foundation and the MOFCOM.

<sup>3</sup> MOFCOM, *2012 Statistical Bulletin of Chinese Outward Foreign Direct Investment* (Beijing: Aug 2013), and Heritage Foundation.

investment in four specific areas: “(1) resource exploration projects to mitigate the domestic shortage of natural resources; (2) projects that promote the export of domestic technologies, products, equipment and labor; (3) overseas R&D [research and development] centers to utilize internationally advanced technologies, managerial skills and professionals; and (4) [mergers and acquisitions] that could enhance the international competitiveness of Chinese enterprises and accelerate their entry into foreign markets.”<sup>4</sup>

The driver for this OFDI is the State not the private market. In 2012, official PRC statistics list total PRC OFDI at \$ 87.8 billion, of which the majority originated from centrally-controlled state-owned enterprises (SOEs). While private enterprises role in OFDI is rising, it is still a minority participant of the total OFDI flows.<sup>5</sup> PRC (SOE) firms operating in the USA and Europe are encouraged to participate in merger and acquisitions (M&A) or to acquire 100% ownership of foreign companies through which they can absorb state-of-the-art technologies and thus “leapfrog” several stages of development and upgrades.<sup>6</sup> While this could be viewed as intra-firm behavior, it is not. It represents PRC SOE activity and not PRC private TNC M&A activity.

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<sup>4</sup> UNCTAD, *World Investment Report 2013: Global Value Chains – Investment and Trade for Development* (New York: United Nations Press, 2013). China moved up from the sixth to the third largest investor in 2012, after the United States and Japan. In 2012 China was one of the main drivers of OFDI and is expected to continue in this role.

<sup>5</sup> MOFCOM, 2012. *Statistical Bulletin of China's Outward Foreign Direct Investment* (Beijing: 2013). The Heritage foundation estimates that over 90% of Chinese OFDI by value is State Owned Enterprise (SOE) investments. According to MOFCOM official statistics, by the end of 2011, SOE's represented 66.2% of the country's OFDI stock. In non-financial sectors, OFDI stock from SOEs was \$60.17 billion, accounting for 77% of the total. Much of the data confusion arises from MOFCOM use of Hong Kong as the final destination of Chinese OFDI. Furthermore, there is confusion about the concept of SOE. MOFCOM attributes the OFDI to 中央企业 (*zhongyang qiye*), or “central enterprise,” which refers specifically to SOEs under the direct control of the central government, as opposed to the more generic 国有企业 (*guoyou qiye*), which simply means “state-owned enterprise.”

<sup>6</sup> For instance, in 1988, the Shougang (Capital) Iron and Steel Corp. purchased 70 percent of the California-based Mesta Engineering and Design Inc. and thus obtained access to the company's high-tech design capability in steel-rolling and casting equipment. See, Chang-hong Pei and Wang Lei, “Chinese Corporate Investment in the United States,” *China and World Economy* 5 (May 2001), Chinese Academy of Social Sciences.

[http://old.iwep.org.cn/wec/english/articles/2001\\_05/5peichanghong.htm](http://old.iwep.org.cn/wec/english/articles/2001_05/5peichanghong.htm). Another example is Lenovo's purchase of IBM's personal computer division in 2005. With this purchase Lenovo was able to gain managerial and commercial experience in the international PC market, making Lenovo the number 2 global supplier of PC's and other computer equipment.

Given that the official data presented by the PRC highlights the important role of its SOE in its OFDI activity, we accept their position that the majority of OFDI is done by State actors. A time series of PRC cross-border M&A activity (in millions of US dollars) is presented in Table 1. It is noteworthy that by 2012, the value of Chinese cross-border M&A was equivalent to 25% of total Developed country and 15% of total World cross-border M&A investments.

The PRC's role in OFDI is predominantly in the form of non-financial transnational corporations (TNC) M&A's. Table 2 presents the top non-financial TNC ranked by foreign assets in 2011. The UNCTD ranks this data by the Transnationality Index (TNI), which is calculated as the average of the foreign assets to total assets, foreign sales to total sales and foreign employment to total employment. The list of TNCs includes what is often referred to as the "bargain hunters." In many cases these bargain hunters are in search of "bargains" which represent undervalued or troubled "brands." In acquiring these companies the PRC does not have to spend decades building up "brand" recognition. For example, Nanjing Automotive acquired British car manufacturer MG Rover's brand in 2005. Geely Automotive, one of the PRC's biggest automotive companies, acquired Ford Motor's Volvo unit in 2010 in a \$1.8 billion deal.<sup>7</sup> Furthermore, since these TNCs control virtually all intellectual property in the PRC and account for 85 percent of the PRC's technology exports, the PRC's determination to have its overseas firms undertake overseas acquisitions as a route to enhanced research and development would be a rational choice.

According to the OECD (2008) the main economic drivers of economic growth include "the absolute growth of R&D and innovation related activities." They stress that in the 21<sup>st</sup> century one should find great competition in the scientific and technological fields; significant globalization of

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<sup>7</sup> Not all PRC efforts have proven successful. In 2010, Sprint Nextel Corp. excluded Chinese telecommunications-equipment makers Huawei and ZTE from a contract worth billions of dollars largely because of national security concerns about the two companies' ties to the Chinese government and military, and the security implications of integrating their equipment into critical U.S. telecommunications infrastructure. Joann S. Lublin and Shayndi Raice, "Security Fears Kill Chinese Bid in U.S.," *Wall Street Journal*, November 5, 2010.

<http://online.wsj.com/article/SB10001424052748704353504575596611547810220.html>.

R&D; more performance of R&D in the services sector and a growing focus on non-technological innovation; widespread policy shifts towards fiscal incentives for R&D; and enhanced internationalization and mobility of highly skilled people, including greater participation of women in the HRST (human resources for science and technology) labor force across almost all countries. The leadership of the PRC are aware of this and are therefore on the ‘fast track’ to encourage their overseas firms to acquire more and more foreign firms.<sup>8</sup>

In 2012 Chinese M&A deals greater than \$1 billion consisted of 20 large SOE transactions which are listed in Table 3. The ranking represents a subset of the top 200 M&A deals listed by UNCTAD.<sup>9</sup> The data represents a small subset of the total of 316 M&A’s completed by the PRC in 2012. The majority of these acquisitions represent far smaller sums of money. The industries represented by China’s major acquisitions range from mining industries, oil extracting industries, telecom companies, environmental sciences and technology companies, to banking services and life insurance companies. The acquiring Chinese partners are large SOEs with sufficient capital to complete these transactions. These are not intra-firm transaction as one would expect in a market economy context, but rather acquisitions by China’s SOE TNCs.<sup>10</sup>

Chinese participation in Greenfield projects in 2012 is at the level of 8 percent of total developed country Greenfield investments and consisting of 438 individual projects, primarily in Africa and Latin America. Most of these projects are equally large scale. A prominent example of these kinds of infrastructure projects includes a \$1.5 billion telecom transaction between China’s ZTE and Ethiopia. The PRC managed to acquire this infrastructure project in 2006 by offering a \$1.5 billion in low-interest financing, funded by China’s state-owned banks. When faced by a World Bank complaint that Ethiopia granted ZTE monopoly rights, Ethiopia invited ZTE’s Chinese rival, Huawei to bid on a subsequent project. Under a 2013 project priced at \$1.6 billion, funded by a low-interest

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<sup>8</sup> See footnote 1 above.

<sup>9</sup> See UNCTAD. *World Investment Report, 2013*, Appendix Table 17.

<sup>10</sup> A similar profile in the financial sector is not currently available.

loan from China's state-owned banks, Ethiopia has accepted Huawei in its telecom sector, thus creating a duopoly controlling this vital sector. Between 1995 and 2012 the Chinese state-owned Export-Import Bank and the China Development Bank provided approximately \$50 billion in low interest financing for projects in Africa. During the same period the US state-owned Export-Import Bank has offered approximately \$12 billion in low-interest financing for projects in Africa.<sup>11</sup>

If we focus strictly on Chinese state-owned TNC M&A activity we have a very simple transaction between the State actor and the foreign firm representing the asset that is intended to be acquired. One can begin by introducing the assumption that both parties have asymmetric information on the value of the asset. Part of the asymmetry may arise from the expected positive spillover effect in the local economy after acquisition. In effect the asset to be acquired has two value components, (1) immediate value; and (2) long-term value arising from the positive spillover. The sequence of this two party transaction can look as follows:

- 1) The State after incurring a search cost of ( $\delta$ ) calculates the value of the spillover effect to be ( $\Omega$ ) which is greater than the expected profitability ( $\pi$ ) of the acquired firm;<sup>12</sup> The value of the asset to the State would be:

$$V = (\pi + \Omega) - \delta \quad \text{where} \quad \Omega > \pi \quad (1)$$

- 2) The State offers the target company a purchase package ( $\gamma$ ) which is composed of two components, the value of shares [ $v(\rho)$ ] purchased where  $0 \leq \rho \leq 1$  and a share of the profits of the acquired firm if 100% of the shares are not sold  $\pi(1 - \rho)$ . The latter possibility will include a cost to the targeted company of operating in the PRC. This may be viewed as the cost associated with a performance clause ( $\phi$ ) for a defined period of time or indefinitely equaling [ $\beta(\phi)$ ].

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<sup>11</sup> "Telecom Deal by China's ZTE, Huawei in Ethiopia Faces Criticism," *WSJ*, January 6, 2014.

<sup>12</sup> The spillover effects are assumed to be occurring over a number of periods.

$$\text{Overall the offer would be } \gamma = [\nu(\rho)] + [\pi(1 - \rho)] - \beta(\phi) \quad (2)$$

- 3) The target company observe the purchase package ( $\gamma$ ) but not ( $V$ ).
- 4) If the target company rejects the offer then its payoff is its expected profits ( $\pi$ ) from its normal activities while the State payoff is zero. If the target company accept the State's offer its payoff will be  $\gamma = [\nu(\rho)] + [\pi(1 - \rho)] - \beta(\phi)$  and the government gets  $V = (\pi + \Omega) - \delta - \gamma$ .

Under the scenarios we have outlined above the PRC TNC in its M&A activity is betting on the fact that not only is  $\Omega > \pi$  but that  $(\pi + \Omega) > (\delta + \gamma)$ . The empirical literature on the generic issue of “spillover effects” of TNC activity is mixed. We presume that there must be sufficient positive “spillover” effects to justify the large sums of OFDI by PRC state-owned TNCs in their M&A activities. The empirical literature attempting to explain PRC state-owned TNC activities is inconclusive and without much theoretical underpinnings. (Bowman, Gilligan and O'Brien, 2013 and Szamoszegi, 2012; Li, 2012). We attempt to fill this gap by presenting, in Section II, a reasonable theoretical explanation of PRC OFDI in search for “spillover effects” in a two country model with firms distinguished by their ability to innovate.

## **II. INNOVATION VIA M&A OR IMMIGRATION OF SKILLED S&E WORKERS?**

Consider a world with two countries with two legal enforceable intellectual property (IPR) environments where an entrepreneur can innovate — that with a well-established common law legal structure  $C^L$  that enforces IPR rules and that of a transition economy  $C^T$  with a ‘work in progress’ legal enforcement of IPR. The State actor  $S^T$  in the transition economy  $C^T$  is attempting to acquire

“spillover” effects attached to innovative R&D.<sup>13</sup> The model is divided into two stages, the first stage concerns the problem of inducing “in-country innovation” in the State dominated economy with questionable IPR enforcement and the second stage focuses on the economic argument for foreign acquisition of the “spillover effects” either through M&A or by acquiring the skilled labor.

The transition economy is populated by  $j$  risk-neutral firms with a strong and powerful State actor that will both create and invest in its enterprises  $E_S^{j,T}$  (where S=State and T=transition economy legal structure). The two major distinguishing factors separating transition economy firms and their market counterparts revolves around their ability to acquire an initial wealth,  $W^{j,T}$  at capital costs substantially lower than their competition in the market economy and their ability to successfully innovate in the context of a ‘work in progress’ legal enforcement of IPR.

In order to consider the options available to  $E_S^{j,T}$  we begin by focusing on the decision to innovate.

### *The Decision to Innovate via Immigration*

There are two firms one located in  $C^L$  and the other in  $C^T$ . Assume, initially that both firms have constant marginal costs  $c$ . In period 1, they can endeavor to initiate an innovation that reduces their marginal costs by  $x_i$ ,  $i$  representing either a firm in L or T environments. For simplicity assume that research R&D investment has diminishing returns and that the R&D expenditure function is quadratic (Qiu, 1997), such that:

$$V(x_i) = \frac{\sigma x_i^2}{2} \text{ where } \sigma > 0 \quad (3)$$

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<sup>13</sup> The record of PRC acquisitions up to 2012 (presented in Tables 1 to 3) supports the idea that  $S^T$  is attempting to fill the gap in new innovations created by  $C^T$  — the ‘work in progress’ legal enforcement of IPR.



where the parameter  $\sigma$  measures the efficiency or productivity of the R&D technology.

In order to innovate, each firm has to hire scientists and engineers (S&Es). Once the decision to innovate is made, the next question is the cost of that skilled human capital. In a multi-country context where there is a free flow of skilled labor one can postulate that  $C^L$  and  $C^T$  environment firms compete on a regular basis for skilled human capital, and that competition is captured fully in terms of wage competition.<sup>14</sup> One can presume a framework where firm  $i$  in  $C^T$  offers wages  $w_{i,T}^{j,L}$  ( $i \neq j$ ) for firm  $j$ 's S&Es and  $w_{i,T}^{i,T}$  for their own S&Es. Assuming competitive markets a scientist or engineer from firm  $j$  will switch locations from  $C^L$  to  $C^T$  if  $w_{i,T}^{j,L} > w_{j,L}^{j,L}$ , otherwise he or she continues to work for firm  $j$ . To attract S&Es from firm  $j$ , firm  $i$  needs to offer a wage which is higher than  $w_{j,L}^{j,L}$  by some  $\tau$ .

The wage differential  $\tau$  offered by firm  $i$  in  $C^T$  must reflect the differential human capital skills and additional expected performance of  $i$ . While some of this information is known, the full differential in performance can only be determined with some degree of certainty only after the wage contract is offered and the employee comes on board. If a S&E moves to firm  $i$  in  $C^T$  this firm obtains an immediate cost reduction equal to  $x_j$  accounted for the technical hire and by the knowledge spillover  $\Omega$  from knowledge while employed in firm  $j$  in  $C^L$ , so its marginal production costs will be:

$$c_i^T = c - x_i - \Omega x_j \quad (4)$$

where the parameter  $\Omega \in [0,1]$  captures the extent of spillovers. The reduction in costs reflected in equation (4) arises because of the assumption that the required human capital to reduce production cost is completely transferable to other firms. Furthermore, we assume that the cost reductions are

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<sup>14</sup> We assume that the transition economy has reduced or eliminated any restrictions in their policies with respect to foreign skilled labor.

complementary. Hence, if a firm can motivate a S&E of the competing firms to move, he or she will be able to replicate the original cost reduction in his new firm. For the sake of completeness one can also assume that knowledge can be duplicated within the firm losing its valued scientist or engineer. If firm  $i$  in  $C^T$  loses a S&E to its local  $C^T$  competitors after investing at least the wage differential  $\tau$ , we assume that it has already internalized the cost savings so that its costs remain,  $c - x_i$ .

The value to firm  $i$  in  $C^T$  of attracting foreign skilled workers becomes apparent when we introduce competition between firm  $i$  in  $C^T$  and firm  $j$  in  $C^L$ . For simplicity, assume that the two firms produce homogeneous goods. The inverse market demand schedule of the consuming countries is given by:

$$p = \alpha - \beta(q_i^T + q_j^L); \quad i \neq j; \quad \alpha > 0 \quad (5)$$

where  $q_i^T$  is the quantity of firm  $i$ 's (in  $C^T$ ) production. [The homogeneity assumption can be easily transformed by letting  $q_j^L = \gamma q_j^L$  where the degree of product differentiation decreases with the parameter  $\gamma$ ]

Let  $\pi_i^T$  represent firm  $i$ 's profits excluding the cost of innovation, then given the firms decisions to undertake R&D,

$$\pi_i^T = p_i^T q_i^T - (c - x_i - \Omega x_j) q_i^T \quad (6)$$

The two firms choose output to maximize their respective market profits and the resulting Cournot-Nash equilibrium would be:

$$q_i^* = \frac{1}{4 - \gamma^2} [(\alpha - c)(2 - \gamma) + (2 - \Omega\gamma)x_i + (2\Omega - \gamma)x_j] \quad (7)$$

## *The Decision to Acquire R&D*

As an alternative strategy to importing skilled S&E workers firm  $i$  in  $C^T$  can begin the process of acquiring via M&A the research firms relevant to its production. Whitney and Gaisford (1999) have suggested that firm  $i$  in  $C^T$  may be able to acquire the R&D generating firm itself. Incorporating this assumption bring the current discussion closer to the strategic trade policy models of Brander and Spencer (1985), Dixit (1984). Eaton and Grossman (1986). Dixit and Kyle (1985), Branson and Klevorick (1986), Grossman (1986), Gal-Or (1985) and Vives (1984).

As noted above let  $\Omega$  denote the “spillover effect” or in terms of the acquisition the probability that firm  $i$ 's agents in  $C^T$  successfully penetrate firm  $j$  in  $C^L$  new technology. The probability that firm  $i$  will fail to penetrate firm  $j$  is  $1 - \Omega$ , and the probability where firm  $i$  is successful is simply  $\Omega$ . Given that the marginal cost attainable with previous generation technology is  $c - x_i$  and the marginal cost reduction attributable to the new technology post spillover is  $\Omega x_j$ , firm  $j$  would maintain its superior position as long as firm  $i$  is prevented from accessing the R&D. Firm  $j$  produces more than firm  $i$  and earns higher profits because its cost advantages remain intact when firm  $i$ 's corporate incursion is unsuccessful. Following Qiu (1977) we assume that  $\alpha - (c - x_i) - \Omega x_j$  is strictly positive such that firm  $i$  continues to produce even if its attempt to acquire the R&D is unsuccessful. Once firm  $i$  manages to succeed in its acquisition of the R&D the symmetry assumption will guarantee that in both firms, profits, outputs and costs will be identical. All the potential outcomes in this Cournot-Nash Duopoly R&D acquisition model are presented in Table 4. A successful bid to penetrate firm  $j$  by firm  $i$ , would increase firm  $i$ 's Nash equilibrium output by  $\frac{2\Omega x_j}{3\beta}$  and its profits by  $\frac{4\Omega x_j (\alpha - x_i)}{9\beta}$ , reduce firm  $j$ 's Nash-equilibrium output by  $\frac{\Omega x_j}{3\beta}$  and its profits by

$\frac{2\Omega x_j(\alpha - x_i + (\frac{3}{2})x_j)}{9\beta}$  and increase industry output by  $\frac{\Omega x_j}{3\beta}$  and consumer surplus by

$$\frac{2\Omega x_j(\alpha - x_i + (\frac{3}{4})\Omega x_j)}{9\beta}.$$

### III MICRO DATA ON THE PRC PATH TO ACQUIRE FOREIGN R&D

Employment of foreigner experts in China has been on the rise since 2001. While small in numbers, relative to the Chinese labor market, its significance is that it is predominantly in economics, technology and management; education, science, culture and public health. On the demand side the definition of “foreign expert” in economy, technology and management experts includes engineers, senior technicians and managerial staff members. In the past 20 years, the number of invited foreign experts has added up to over 2 million, from more than 50 countries and territories. Currently, over 240 thousand foreign experts are invited to work in China.<sup>15</sup> There is no data on their distribution by industry and no figure for the ones engaging in S&E activities.

If R&D is an expensive endeavor with enormous risks to investors and in the case of the PRC to the State, there is a strong incentive to acquire proven innovation in the market economies. But the real “bargains” are in R&D operations that have not yet proven their true market value.

The best publically available micro data on PRC outward M&A activity is provided by the Heritage Foundation. In Table 5 we present the data for M&A activities by PRC TNCs worth \$100 million or more between 2005 and 2013. These deals represent about 25% of all the successful M&A deals in 2011. Of equal note are the list of troubled M&A deals presented in Table 6. All of these deals are in the technology area.

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<sup>15</sup> China’s Ministry of Human Resources and Social Security, *The 2011 Human Resource and Social Security Development in China Bulletin*, 2014

In order to empirically test the theoretical justifications for PRC TNC overseas activities requires a much richer data set than we can access publically today. Irrespective of this data constraint, the theoretical construct we present here is a reasonable explanation of the activities by the PRC TNCs in overseas markets.

<b>Table 1</b>			
<b>Value of Chinese Cross-Border M&amp;As, as Compared to the World and Developed Economies, 1990-2012</b>			
<b>(Millions of dollars)</b>			
<b>Year</b>	<b>China Total (PRC plus Hong Kong)</b>	<b>World</b>	<b>Developed economies</b>
1990	1,841	98,903	87,188
1991	947	21,094	14,624
1992	2,317	48,106	36,658
1993	1,700	43,623	34,845
1994	2,041	91,769	79,062
1995	1,436	112,527	102,004
1996	1,628	142,557	124,863
1997	5,636	180,751	163,205
1998	6,355	406,427	372,286
1999	7,235	630,807	592,794
2000	37,397	905,214	828,662
2001	1,209	429,374	388,605
2002	18,799	248,446	201,729
2003	1,380	182,874	138,180
2004	2,752	227,221	166,974
2005	11,848	462,253	359,551
2006	20,092	625,320	497,324
2007	-10,262	1,022,725	841,714
2008	36,893	706,543	568,041
2009	28,951	249,732	160,785
2010	44,384	344,029	223,726
2011	49,506	555,173	428,075
2012	45,126	308,055	175,555

Source: UNCTAD, *World Investment Report*, 2013.

Table 2

The top non-financial TNCs from China, ranked by foreign assets, 2011 <sup>a</sup>

(Millions of dollars and number of employees)

Ranking by:					Assets		Sales		Employment		TNI <sup>b</sup> (Per cent)
Foreign assets	TNI <sup>b</sup>	Corporation	Home economy	Industry <sup>c</sup>	Foreign	Total	Foreign	Total	Foreign <sup>d</sup>	Total	
1	18	Hutchison Whampoa Limited	Hong Kong, China	Diversified	77 291	92 788	23 477	30 023	206 986	250 000	81.4
2	90	CITIC Group	China	Diversified	71 512	514 847	9 923	51 659	30 806	140 028	18.4
5	61	China Ocean Shipping (Group) Company	China	Transport and storage	40 435	52 230	19 454	29 579	7 355	130 000	49.6
10	89	China National Offshore Oil Corp	China	Petroleum expl./ref./distr	29 802	112 887	19 786	75 518	3 367	98 750	18.7
17	45	Jardine Matheson Holdings Ltd	Hong Kong, China	Diversified	21 486	58 297	28 291	37 967	217 556	330 000	59.1
21	5	Noble Group Ltd	Hong Kong, China	Wholesale trade	17 761	19 943	80 732	80 732	13 477	14 000	95.1
24	100	China National Petroleum Corporation	China	Petroleum expl./ref./distr	16 954	475 700	8 671	326 790	31 442	1 668 072	2.7
32	60	CLP Holdings Ltd	Hong Kong, China	Utilities (Electricity, gas and water)	14 217	27 595	7 697	11 772	2 057	6 316	49.8
34	70	Sinochem Group	China	Petroleum expl./ref./distr	13 112	40 563	54 861	70 994	7 994	47 022	42.2
36	2	First Pacific Company Ltd	Hong Kong, China	Electrical & electronic equipment	12 500	12 612	5 684	5 684	73 542	73 582	99.7
37	71	New World Development Ltd	Hong Kong, China	Diversified	12 200	29 437	2 273	4 230	14 123	45 000	42.2
40	14	China Resources Enterprises Ltd	Hong Kong, China	Petroleum expl./ref./distr	11 606	14 635	13 020	14 153	190 000	200 000	88.8
41	93	Sun Hung Kai Properties Ltd	Hong Kong, China	Other services	11 466	53 088	720	8 046	6 242	35 000	16.1
46	11	Li & Fung Ltd	Hong Kong, China	Wholesale trade	10 228	10 920	18 900	20 030	25 106	29 624	90.9

48	8	Shangri-La Asia Ltd	Hong Kong, China	Other consumer services	9 598	9 973	1 647	1 912	27 552	28 900	92.6
51	64	Lenovo Group Ltd	China	Electrical & electronic equipment	9 103	15 861	17 179	29 574	6 238	27 000	46.2
56	34	The Hong Kong and China Gas Co. Ltd	Hong Kong, China	Electricity, gas and water	7 738	10 957	1 606	2 881	1 369	1 938	65.7
58	99	China Mobile (Hong Kong) Limited	China	Telecommunications	7 483	149 653	4 084	81 674		175 336	3.3
60	69	Swire Pacific Ltd	Hong Kong, China	Business services	7 234	37 688	2 633	4 662	37 672	73 867	42.2
66	10	Yue Yuen Industrial Holdings Ltd	Hong Kong, China	Other consumer goods	6 342	6 473	5 529	7 045	451 399	460 000	91.5
73	96	Sinopec - China Petrochemical Corporation	China	Petroleum expl./ref./distr.	5 568	179 813	86 305	387 595	1 000	377 235	8.5
77	83	Power Assets Holdings Ltd	Hong Kong, China	Electricity, gas and water	4 931	12 199		1 311	752	1 861	26.9
79	9	Shenzhen International Holdings Ltd	Hong Kong, China	Construction	4 525	5 138	717	717	4 165	4 729	92.0
80	3	Galaxy Entertainment Group Ltd	Hong Kong, China	Other consumer services	4 519	4 606	5 172	5 291	14 386	15 000	97.3
81	94	China Minmetals Corp	China	Metal and metal products	4 512	36 227	8 673	54 194	7 990	146 000	11.3
85	6	Guangdong Investment Ltd	Hong Kong, China	Diversified	4 213	4 485	884	920	4 062	4 295	94.9
90	7	Road King Infrastructure Ltd	Hong Kong, China	Transport and storage	3 678	4 086	878	878	1 671	1 832	93.7
91	1	Lee & Man Paper Manufacturing Ltd	Hong Kong, China	Wood and paper products	3 436	3 444	1 892	1 892	7 682	7 700	99.8
92	12	Esprit Holdings Ltd	Hong Kong, China	Other consumer goods	3 381	3 473	4 268	4 344	10 857	14 100	90.9
94	81	ZTE Corp	China	Other consumer goods	3 219	16 934	7 228	13 342	21 069	89 786	32.2
98	98	China Railway Construction Corporation Ltd	China	Construction	3 076	66 453	2 579	68 575	23 602	241 621	6.1



100	41	TPV Technology Limited	China	Wholesale trade	2 972	5 257	7 803	11 040	17 183	29 516	61.8
<i>Source: UNCTAD. World Investment Report, 2013.</i>											
<sup>a</sup> All data are based on the companies' annual reports unless otherwise stated; corresponds to the financial year from 1 April 2011 to 31 March 2012.											
<sup>b</sup> TNI, the Transnationality Index, is calculated as the average of the following three ratios: foreign assets to total assets, foreign sales to total sales and foreign employment to total employment.											
<sup>c</sup> Industry classification for companies follows the United States Standard Industrial Classification as used by the United States Securities and Exchange Commission (SEC).											
<sup>d</sup> In a number of cases foreign employment data were calculated by applying the share of foreign employment in total employment of the previous year to total employment of 2011.											
<sup>e</sup> In lieu of 2011 figures, 2010 data have been used.											

Table 3

## Cross-border M&amp;A deals worth over \$1 billion completed in 2012 by China

Rank	Value (\$ billion)	Acquired company	Host economy <sup>a</sup>	Industry of the acquired company	Ultimate acquired company	Ultimate host economy	Industry of the ultimate acquired company	Acquiring company	Home economy <sup>a</sup>	Industry of the acquiring company	Ultimate acquiring company	Ultimate home economy	Industry of the ultimate acquiring company	Shares acquired (Percentage)
20	4.8	Petrogal Brasil Ltda	Brazil	Crude petroleum and natural gas	Galp Energia SGPS SA	Portugal	Crude petroleum and natural gas	Sinopec International Petroleum Exploration & Production Corp	China	Investors, nec	Sinopec Group	China	Crude petroleum and natural gas	30
32	3.5	Energias de Portugal SA (EDP)	Portugal	Electric services	EDP	Portugal	Electric services	China Three Gorges International (Europe) SA	Luxembourg	Investors, nec	China Three Gorges Corp	China	Electric services	21.35
46	3.0	MGN Gas Networks (UK) Ltd	United Kingdom	Natural gas transmission	MGN Gas Networks (UK) Ltd	United Kingdom	Natural gas transmission	Investor Group	Hong Kong, China	Investors, nec	Investor Group	Hong Kong, China	Investors, nec	100
55	2.6	AMC Entertainment Holdings Inc	United States	Motion picture theaters, except drive-in	AMC Entertainment Holdings Inc	United States	Motion picture theaters, except drive-in	Dalian Wanda Group Corp Ltd	China	Operators of nonresidential buildings	Dalian Wanda Group Corp Ltd	China	Operators of nonresidential buildings	100
57	2.5	Devon Energy Corp-Shale Oil & Gas Assets (5)	United States	Crude petroleum and natural gas	Devon Energy Corp	United States	Crude petroleum and natural gas	Sinopec International Petroleum Exploration & Production Corp	China	Investors, nec	Sinopec Group	China	Crude petroleum and natural gas	33.33
62	2.3	Swire Properties Ltd	Hong Kong, China	Land subdividers and developers, except cemeteries	John Swire & Sons Ltd	United Kingdom	Deep sea foreign transportation of freight	Shareholders	Hong Kong, China	Investors, nec	Shareholders	Hong Kong, China	Investors, nec	18
73	2.2	LME Holdings Ltd	United Kingdom	Security and commodity	LME Holdings Ltd	United Kingdom	Security and commodity	HKEx Investment (UK) Ltd	United Kingdom	Investors, nec	HKEX	Hong Kong, China	Security and commodity exchanges	100

				city exchanges			city exchanges							
86	2.0	Unicom New Horizon Telecommunications Co Ltd	China	Radiotelephone communications	China United Network	China	Telephone communications, except radiotelephone	China United Network Communications Corp Ltd	China	Telephone communications, except radiotelephone	China Unicom(Hong Kong)Ltd	Hong Kong, China	Telephone communications, except radiotelephone	100
87	1.9	Weetabix Ltd	United Kingdom	Cereal breakfast foods	Lion Capital LLP	United Kingdom	Investors, nec	Bright Food(Group) Co Ltd	China	Noncommercial research organizations	Bright Food(Group)Co Ltd	China	Noncommercial research organizations	60
103	1.7	ING Management Holdings (Malaysia)Sdn Bhd	Malaysia	Life insurance	ING Groep NV	Netherlands	Life insurance	American International Assurance Co Ltd	Hong Kong, China	Life insurance	American Intl Assurance Group	Hong Kong, China	Life insurance	100
113	1.6	Lasalle Investment Management KK-Property Portfolio	Japan	General warehousing and storage	Jones Lang LaSalle Inc	United States	Real estate agents and managers	Investor Group	China	Investors, nec	Investor Group	China	Investors, nec	100
118	1.5	Gloucester Coal Ltd	Australia	Bituminous coal and lignite surface mining	Noble Group Ltd	Hong Kong, China	Grain and field beans	Yancoal Australia Pty Ltd	Australia	Bituminous coal and lignite surface mining	Yan Kuang Group Co Ltd	China	Bituminous coal and lignite surface mining	100
122	1.5	Talisman Energy(UK)Ltd	United Kingdom	Crude petroleum and natural gas	Talisman Energy Inc	Canada	Crude petroleum and natural gas	Sinopec International Petroleum Exploration & Production Corp	China	Investors, nec	Sinopec Group	China	Crude petroleum and natural gas	49
130	1.4	China Unicom (Hong Kong)Ltd	Hong Kong, China	Telephone communications, except	China Unicom (Hong Kong)Ltd	Hong Kong, China	Telephone communications, except radiotelephone	China United Network Communications Group Co Ltd	China	Telephone communications, except radiotelephone	China United Network	China	Telephone communications, except radiotelephone	4.56

				radiotel ephone										
136	1.4	Tower Top Develop ment Ltd	China	Operat ors of nonresi dential building s	Yuexiu Propert y Co Ltd	Hong Kong, China	Land subdivid ers and develop ers , except cemeteries	Yuexiu REIT 2012 Co Ltd	Hong Kong, China	Real estate investment trusts	Yuexiu Real Estate Investment	Hong Kong, China	Real estate investment trusts	99.99
138	1.3	Australi a Pacific LNG Pty Ltd	Australia	Crude petrole um and natural gas	Conoco Phillips Co	United States	Crude petroleum and natural gas	China Petrochemica l Corp {Sinopec Group}	China	Crude petroleum and natural gas	Sinopec Group	China	Crude petroleum and natural gas	10
147	1.3	Anvil Mining NL	Australia	Copper ores	Anvil Mining NL	Australia	Copper ores	MMG Malachite Ltd	Hong Kong, China	Nonferrous die- castings, except aluminum	China Minmetals Corp	China	Nondurable goods, nec	100
148	1.3	Extract Resourc es Ltd	Australia	Uraniu m- radium- vanadiu m ores	Extract Resour ces Ltd	Australia	Uranium- radium- vanadium ores	Taurus Minerals Ltd	Hong Kong, China	Investors, nec	Peoples Republic of China	China	National government	57.26
179	1.1	Kyobo Life Insuran ce Co Ltd	Korea, Republic of	Life insuran ce	Kyobo Life Insuran ce Co Ltd	Korea, Republic of	Life insurance	Investor Group	Hong Kong, China	Investors, nec	Investor Group	Hong Kong, China	Investors, nec	24
194	1.0	Grande Cache Coal Corp	Canada	Bitumin ous coal undergr ound mining	Grande Cache Coal Corp	Canada	Bituminou s coal undergrou nd mining	1629835 Alberta Ltd SPV	Canada	Investment offices, nec	Winsway Coking Coal Hldg Ltd	Hong Kong, China	Coal and other minerals and ores	100
195	1.0	Kalahar i Mineral s PLC	United Kingdom	Uraniu m- radium- vanadiu m ores	Kalahar i Mineral s PLC	United Kingdom	Uranium- radium- vanadium ores	China Guangdong Nuclear Power Holding Co Ltd	China	Electric services	Peoples Republic of China	China	National government	100

**Table 4**

Potential outcomes in a Cournot-Nash Duopoly R&D acquisition model		
Description	Firm $C_i^T$ <u>does not</u> receive the cost saving technology from firm $C_j^L$	Firm $C_i^T$ <u>does</u> receive the cost saving technology from firm $C_j^L$
Firm $C_i^T$ 's MC	$c - x_i$	$c - x_i - \Omega x_j$
Firm $C_j^L$ 's MC	$c - x_i - \Omega x_j$	$c - x_i - \Omega x_j$
Firm $C_i^T$ 's Output	$\frac{(\alpha - x_i - \Omega x_j)}{3\beta}$	$\frac{(\alpha - x_i + \Omega x_j)}{3\beta}$
Firm $C_j^L$ 's Output	$\frac{(\alpha - x_i - 2\Omega x_j)}{3\beta}$	$\frac{(\alpha - x_i + \Omega x_j)}{3\beta}$
Firm $C_i^T$ 's Profit	$\frac{(\alpha - x_i - \Omega x_j)^2}{9\beta}$	$\frac{(\alpha - x_i + \Omega x_j)^2}{9\beta}$
Firm $C_j^L$ 's Profit	$\frac{(\alpha - x_i - 2\Omega x_j)^2}{9\beta}$	$\frac{(\alpha - x_i + \Omega x_j)^2}{9\beta}$
Consumer Surplus	$\frac{2(\alpha - x_i + 0.5\Omega x_j)^2}{9\beta}$	$\frac{2(\alpha - x_i + \Omega x_j)^2}{9\beta}$

**Table 5**

**Cross-Border M&A deals in Technology worth more than \$100 million between 2005 and 2013**

Year	Investor	Millions	Share Size	Partner/Target	Sector	Subsector	Country
2013	Fosun	\$240	96%	Alma Lasers	Technology		Israel
2013	CDH	\$110	10%	Mobile World	Technology	Telecom	Vietnam
2013	Mindray Medical	\$110	100%	ZONARE Systems	Technology		USA
2013	Shanghai Micro Port Scientific	\$290		Wright Medical	Technology		USA
2013	Tencent	\$350	6%	Activision	Technology		USA
2013	Huawei	\$200			Technology	Telecom	Britain
2012	Huawei	\$1,500			Technology	Telecom	Hungary
2012	CIC	\$490	7%	Eutelsat	Technology	Telecom	France
2012	Tencent	\$330	40%	Epic Games	Technology		USA
2012	Lenovo	\$150		Digibras	Technology		Brazil
2012	Huawei	\$150			Technology	Telecom	India
2012	Xinwei	\$300			Technology	Telecom	Nicaragua
2012	BGI	\$120	100%	Complete Genomics	Technology		USA
2011	Lenovo	\$180	51%	NEC	Technology		Japan
2011	China Unicom	\$500	1%	Telefonica	Technology	Telecom	Spain
2011	Tencent	\$400	84%	Riot Games	Technology		USA
2011	ZTE	\$200			Technology	Telecom	Brazil
2011	Lenovo	\$670	82%	Medion	Technology		Germany
2011	Huawei	\$130			Technology	Telecom	Italy
2010	Tencent	\$300	10%	Digital Sky Technologies	Technology		Russia
2010	Shanda Games	\$100	100%	Eyedentity Games	Technology		S. Korea
2010	Sinochem	\$270	50%	DSM	Technology	Medical	Netherlands
2009	Unicom	\$1,000	1%	Telefonica	Technology	Telecom	Spain
2009	China Mobile	\$500			Technology	Telecom	Pakistan

2008	Wuxi PharmaTech	\$160	100%	AppTec Lab Services	Technology		USA
2008	Mindray Medical	\$200		Datascope	Technology		USA
2007	China Mobile	\$280	89%	Paktel	Technology	Telecom	Pakistan
2007	China Mobile	\$180	11%	Paktel	Technology	Telecom	Pakistan
2005	Lenovo	\$1,740		IBM	Technology		USA

**Source: Heritage Foundation**

Table 6

**Cross-Border Incomplete and Troubled M&A deals in Technology worth more than \$100 million between 2005 and 2013**

Year	Investor	Millions	Share	Partner	Sector	Subsector	Country
2013	China Mobile	\$600	12	Fareastone	Technology	Telecom	Taiwan
2010	Huawei	\$480		2Wire	Technology	Telecom	USA
2010	Huawei	\$1,300		Motorola	Technology	Telecom	USA
2010	Huawei and ZTE	\$5,000		Sprint	Technology	Telecom	USA
2008	ZTE	\$300			Technology	Telecom	Philippines
2008	Huawei	\$600	17%	3Com	Technology	Telecom	USA
2008	Great Wall	\$300	43%	Iomega	Technology		USA
2006	China Mobile	\$5,300		Millicom	Technology	Telecom	Luxembourg

Source: Heritage Foundation



## REFERENCES

- Bowman, Megan, George Gilligan and Justin Obrien “China: Investing in the World” *Center for International Finance and Regulation Working Paper*, 2013.
- Brander, James A., and Spencer, Barbara J., “Export Subsidies and International Market Share Rivalry,” *Journal of International Economics*, February, 1985, 83- 100
- Branson; William H. and Klevorick Alvin K., “Strategic Behavior and Trade Policy,” in Paul Krugman, ed., *Strategic Trade Policy and the New International Economics*, Cambridge, MA: MIT Press, 1986.
- China’s Ministry of Human Resources and Social Security, *The 2011 Human Resource and Social Security Development in China Bulletin*, 2014
- Dixit, Avinash, “International Trade Policy for Oligopolistic Industries,” *Economic Journal*,” 1984 Supplement, 1-16.
- Dixit, Avinash K., and Kyle, Albert S., “The Use of Protection and Subsidies for Entry Promotion and Deterrence,” *American Economics Review*, March 1985, 139-152.
- Eaton, Jonathan, and Grossman, Gene M., “Optimal Trade and Industrial Policy Under Oligopoly,” *Quarterly Journal of Economics*, May 1986, 383-406.
- Gal-Or, Esther, “Information Sharing in Oligopoly,” *Econometrica*, March 1985, 329-343.
- Grossman, Gene M., “Strategic Export Promotion: A Critique,” in Paul Krugman, ed., *Strategic Trade Policy and the New International Economics*, Cambridge, MA: MIT Press, 1986.
- Heritage Foundation. *The China Global Investment Tracker*. 2014
- The International Institute for Sustainable Development *Chinese Outward Investment: An emerging policy framework A Compilation of primary sources*. 2012
- Li, Tong. “Institutional Factors Matter: Perspectives on China’s Outward Direct Investment,” December 2012. Milken Institute.
- Lublin, Joann S. and Shayndi Raice, “Security Fears Kill Chinese Bid in U.S.,” *Wall Street Journal*, November 5, 2010.  
<http://online.wsj.com/article/SB10001424052748704353504575596611547810220.html>.
- MOFCOM. *2012 Statistical Bulletin of Chinese Outward Foreign Direct Investment*. Beijing, Aug 2013.
- OECD, *OECD Science, Technology and Industry Outlook*, 2008. Paris.

Pei, Chang-hong and Wang Lei, “Chinese Corporate Investment in the United States,” *China and World Economy* 5 (May 2001), Chinese Academy of Social Sciences.

[http://old.invep.org.cn/wec/english/articles/2001\\_05/5peichanghong.htm](http://old.invep.org.cn/wec/english/articles/2001_05/5peichanghong.htm).

Qiu, Larry D. “On the Dynamic Efficiency of Bertrand and Cournot Equilibria,” *Journal of Economic Theory*. 75, 213-229 (1977).

Szamosszegi, Andrew. “An Analysis of Chinese Investments in the U.S. Economy,” October 2012. Washington: Capital Trade FDI Study.

Vives, Xavier, “Duopoly Information Equilibrium,” *Journal of Economic Theory*, October 1984,71-94.

UNCTAD, *World Investment Report 2013: Global Value Chains – Investment and Trade for Development* (New York: United Nations Press, 2013).