China’s competitiveness in international trade: 
The impact of innovation and human capital – 
Review of empirical literature

Günter Heiduk and Agnieszka McCabe

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Wojciech Bieńkowski

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Introduction

The literature on China’s competitiveness in international trade focusing on the impact of innovation and human capital differs in many ways from comparable studies of other countries:

- “Competitiveness of China” reflects the illusion that the sources of competitiveness are geographically equally distributed. In fact, these sources are regionally, even locally clustered leaving large parts of the country unfit for competition. Therefore, empirical studies on regions’, provinces’ or cities’ competitiveness in international trade suggest an accurate enough access to its determinants.

- “Innovation” has to be interpreted as broadly as possible. More so than in other countries, the gradual economic transformation without any political transformation is already in itself an innovative institutional pattern. Furthermore, in view of the pre-1978 socialist command economy, China’s current opening-up policy distinguishes itself by innovative features.

- In case of China, “human capital” - usually resulting from on the spot educational investment in human resources, thus creating unique competences and finally yielding additional output - seems to feature some special characteristics such as extremely fast learning when working in China in a foreign invested environment. Furthermore, the large community of Chinese expatriates seems to contribute considerably to China’s international competitiveness. Last but not least, there are good reasons to consider China’s technological history (invention of compass, gunpowder, papermaking, printing) as “sunk investment” in today’s entrepreneurial spirit which characterizes many Chinese.

- A general problem facing empirical studies on China refers to the access, reliability and transparency of data and statistics. Furthermore, original field research is not even a generally accepted research method. Until recently quantitative studies on trade related issues had been rather rare. The situation improved since an increasing number of Chinese researchers is trained (and often occupied) in foreign universities/research institutes.

- Last but not least it has to be mentioned that many non-Chinese researchers (and politicians) attribute China’s competitiveness in export to the artificially undervalued Renminbi, even after an appreciation of approx. 25% since March 2005. It is argued that the undervalued Renminbi benefits primarily the labor-intensive manufacturing industries in China.
I. The Changing Pattern of China’s Competitiveness in International Trade

When organizing the empirical literature on China’s competitiveness in international trade since the middle of the 19th century, the following phases become visible:

- Phase I (1860-1920) Making use of historical country-based location and ownership advantages which result partly from natural resources (tea), partly from innovative products – and therefore specialized human capital – (silk, porcelain)

- Phase II (1920-1945) Breakdown of China’s competitiveness in the wake of the Chinese Civil War, the Japanese occupation and the Pacific War

  Mainly because of external reasons (“unequal treaties”) between 1860 and 1949 China missed the chance to follow the path of modern western-style industrialization

- Phase III (1949-1977) Nationalization of the economy; state trade; no incentives for state-owned enterprises to be internationally competitive; degrading, even destroying China’s former competitive advantages; very limited quantitative information on China’s foreign trade; starting with exports of textile yarns, fabrics and clothing with increasing share in China’s total exports (building up low-skill labor intensive competitive advantage)

- Phase IV (1978-2000) Achieving mature competitiveness in low-skill labor intensive products; opening up to foreign direct investment; establishing special economic development zones as institutional innovation; benefiting from technological and organizational innovations in leading industries in highly developed economies (fragmentation of production processes, offshoring, outsourcing); gaining gradually competitive advantage in production processing and manufacturing parts and components (transferred “borrowed ownership advantage” from abroad)

- Phase V (2001-) Gradual development of specialized competitive advantages in high-tech industries by offering incentives to foreign R&D investments; investment in higher education; aiming to extend parts and components production into full-fledged high-tech production processes

With respect to innovation and human capital as determinants of China’s competitiveness in international trade, the following stylized characteristics could be extracted from the above mentioned observations:
<table>
<thead>
<tr>
<th>Table 1</th>
<th>China’s Innovation- and HC-based Competitiveness in International Trade in Selected Periods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitiveness</td>
<td></td>
</tr>
<tr>
<td>- Final Products</td>
<td>Silk, Porcelain</td>
</tr>
<tr>
<td>- Production Processes</td>
<td></td>
</tr>
<tr>
<td>Determinants</td>
<td></td>
</tr>
<tr>
<td>- Domestic Ownership + Location Advantages</td>
<td>Traditional, but innovative and human capital-intensive techniques</td>
</tr>
<tr>
<td>- Foreign (imported) Ownership Advantages</td>
<td></td>
</tr>
<tr>
<td>Enabler</td>
<td></td>
</tr>
<tr>
<td>- Domestic</td>
<td>Institutional innovation: Opening and expansion of domestic ports</td>
</tr>
<tr>
<td>- Foreign</td>
<td>Intermediary: <em>Entrepôt</em> Hong Kong</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: HC stands for Human Capital.*
II. Data

Figure 1  China’s Share in World GDP, 1978-2010


Figure 2  China’s Trade, 1980-2009 ((billions US-$, growth rate)

Source: http://www.starmass.com/china_review/imports_exports/top_importing_provinces.htm
The sharply increasing export/GDP ratio suggests that China’s export dependency is increasing and its growth is mainly export-led. Especially in case of China this ratio is misleading. Firstly, the overall gross industrial output also increased as a share of GDP.
leaving the share of exports on the overall gross industrial output relatively unchanged.
Secondly, the upgrading of China’s exports from labor-intensive products (e.g. textiles, shoes) to technology-intensive products (e.g. consumer electronics) drastically reduced the domestic content and increased the imported content of the export production. These changes reduce the growth effect, even if exports grow significantly.¹ The comparison between China’s growth rate of GDP and its growth rate of exports suggests a weak correlation implying that China’s growth is very much domestic led.

Figure 5    China’s Top 5 Trade Partners, 2010 (billion US$)

Source: Garrity, 2011, p. 77.

Figure 6    Share of selected product groups on China’s total exports, 1952-1964, 1982-2000


---
Table 2  Shares of ten categories of goods on total exports, 1980–2001 (per cent)

<table>
<thead>
<tr>
<th>Year</th>
<th>1-5</th>
<th>6-10</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>50.30</td>
<td>16.47</td>
<td>0.43</td>
<td>9.44</td>
<td>23.62</td>
<td>0.33</td>
</tr>
<tr>
<td>1981</td>
<td>46.57</td>
<td>13.29</td>
<td>0.27</td>
<td>8.85</td>
<td>23.76</td>
<td>0.40</td>
</tr>
<tr>
<td>1982</td>
<td>45.02</td>
<td>13.03</td>
<td>0.43</td>
<td>7.41</td>
<td>23.81</td>
<td>0.35</td>
</tr>
<tr>
<td>1983</td>
<td>43.28</td>
<td>12.84</td>
<td>0.47</td>
<td>8.51</td>
<td>20.99</td>
<td>0.47</td>
</tr>
<tr>
<td>1984</td>
<td>45.66</td>
<td>12.36</td>
<td>0.42</td>
<td>9.26</td>
<td>23.06</td>
<td>0.55</td>
</tr>
<tr>
<td>1985</td>
<td>50.56</td>
<td>13.90</td>
<td>0.38</td>
<td>9.70</td>
<td>26.08</td>
<td>0.49</td>
</tr>
<tr>
<td>1986</td>
<td>36.43</td>
<td>14.38</td>
<td>0.38</td>
<td>9.40</td>
<td>11.90</td>
<td>0.37</td>
</tr>
<tr>
<td>1987</td>
<td>33.55</td>
<td>12.12</td>
<td>0.44</td>
<td>9.26</td>
<td>11.52</td>
<td>0.21</td>
</tr>
<tr>
<td>1988</td>
<td>30.32</td>
<td>12.40</td>
<td>0.49</td>
<td>8.96</td>
<td>8.31</td>
<td>0.16</td>
</tr>
<tr>
<td>1989</td>
<td>28.70</td>
<td>11.70</td>
<td>0.60</td>
<td>8.02</td>
<td>8.22</td>
<td>0.16</td>
</tr>
<tr>
<td>1990</td>
<td>25.59</td>
<td>10.64</td>
<td>0.55</td>
<td>5.70</td>
<td>8.43</td>
<td>0.26</td>
</tr>
<tr>
<td>1991</td>
<td>22.47</td>
<td>10.06</td>
<td>0.74</td>
<td>4.85</td>
<td>6.62</td>
<td>0.21</td>
</tr>
<tr>
<td>1992</td>
<td>20.02</td>
<td>9.78</td>
<td>0.85</td>
<td>3.70</td>
<td>5.53</td>
<td>0.16</td>
</tr>
<tr>
<td>1993</td>
<td>18.17</td>
<td>9.15</td>
<td>0.98</td>
<td>3.33</td>
<td>4.48</td>
<td>0.22</td>
</tr>
<tr>
<td>1994</td>
<td>16.29</td>
<td>8.28</td>
<td>0.83</td>
<td>3.41</td>
<td>3.36</td>
<td>0.41</td>
</tr>
<tr>
<td>1995</td>
<td>14.44</td>
<td>6.69</td>
<td>0.92</td>
<td>2.94</td>
<td>3.58</td>
<td>0.31</td>
</tr>
<tr>
<td>1996</td>
<td>14.52</td>
<td>6.77</td>
<td>0.89</td>
<td>2.68</td>
<td>3.93</td>
<td>0.25</td>
</tr>
<tr>
<td>1997</td>
<td>13.10</td>
<td>6.05</td>
<td>0.57</td>
<td>2.30</td>
<td>3.82</td>
<td>0.35</td>
</tr>
<tr>
<td>1998</td>
<td>11.15</td>
<td>5.72</td>
<td>0.53</td>
<td>1.92</td>
<td>2.82</td>
<td>0.17</td>
</tr>
<tr>
<td>1999</td>
<td>10.23</td>
<td>5.36</td>
<td>0.40</td>
<td>2.01</td>
<td>2.39</td>
<td>0.07</td>
</tr>
<tr>
<td>2000</td>
<td>10.22</td>
<td>4.93</td>
<td>0.30</td>
<td>1.79</td>
<td>3.15</td>
<td>0.05</td>
</tr>
<tr>
<td>2001</td>
<td>9.90</td>
<td>4.80</td>
<td>0.33</td>
<td>1.57</td>
<td>3.16</td>
<td>0.04</td>
</tr>
</tbody>
</table>


Source: Calculated by the authors according to data in State Statistical Bureau, China Statistical Yearbook, various years.

Source: Zhang and Zhang, 2005, p. 212.

Table 3  Dynamic RCAs, 1970–2003 (annual per cent change in country exports/annual per cent change in world exports)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1.11</td>
<td>2.19</td>
<td>2.14</td>
<td>2.24</td>
<td>3.66</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>1.11</td>
<td>2.57</td>
<td>1.84</td>
<td>0.65</td>
<td>0.67</td>
</tr>
<tr>
<td>Memo: China + HK</td>
<td>2.22</td>
<td>2.36</td>
<td>1.96</td>
<td>1.46</td>
<td>2.49</td>
</tr>
<tr>
<td>S. Korea</td>
<td>1.66</td>
<td>2.33</td>
<td>1.60</td>
<td>1.40</td>
<td>0.78</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.01</td>
<td>1.73</td>
<td>2.27</td>
<td>1.23</td>
<td>0.07</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.93</td>
<td>0.62</td>
<td>1.89</td>
<td>3.58</td>
<td>-0.51</td>
</tr>
<tr>
<td>Thailand</td>
<td>1.20</td>
<td>2.25</td>
<td>2.19</td>
<td>0.82</td>
<td>1.04</td>
</tr>
<tr>
<td>Singapore</td>
<td>1.34</td>
<td>1.78</td>
<td>1.98</td>
<td>0.67</td>
<td>0.28</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1.68</td>
<td>0.03</td>
<td>1.40</td>
<td>1.36</td>
<td>-0.11</td>
</tr>
<tr>
<td>Taiwan</td>
<td>1.42</td>
<td>2.39</td>
<td>0.94</td>
<td>1.23</td>
<td>-0.60</td>
</tr>
<tr>
<td>Japan</td>
<td>1.03</td>
<td>1.40</td>
<td>1.06</td>
<td>0.34</td>
<td>-0.10</td>
</tr>
<tr>
<td>US</td>
<td>0.89</td>
<td>0.99</td>
<td>0.97</td>
<td>1.26</td>
<td>-0.49</td>
</tr>
</tbody>
</table>


The drastic change on China’s export structure is most visible in the increase in machinery industry (category 8 in table 2). “The absolute value of goods exported in this category in 2001 was 51.8 times that in 1980.”

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2 Zhang and Zhang, 2005, p. 211.
The decreasing trend in processing trade and since 2005 sharply increasing trend in conventional products (which are to a large extent final products) suggest a new phase in China’s competitiveness. The still high but no more growing share of foreign invested enterprises, the decreasing share of state-owned enterprises and the increasing share of domestic private enterprises on China’s exports indicate that China’s private business sector is gradually gaining international competitiveness. There are good reasons to assume that innovation and a growing pool of high skilled labor are the driving forces behind these changes.

Empirical studies on China’s two-way trade in the capital goods sector show evidence for the shift in China’s trade in final products and intermediate products. The decomposition of the capital goods sector (machinery and transport equipment) into final goods and intermediate goods indicates that China is to an increasing degree not only an exporter of manufactured parts and components but also an attractive location for producing high-tech products.\(^3\) “As the 2nd largest manufacturing exporter with 10.4% world market share in 2008, China ranks as the largest capital goods … exporter with a total value of US$ 565 billion accounting for 16.9% of world total, and the 2nd largest capital goods importer with a total value of US$ 446.1 billion accounting for 13.4% of world total. This phenomenon seems to be puzzling if China has been traditionally taken as a labor abundant country which is supposed to export less capital intensive products. Furthermore, China is not only a final products producer but

\(^3\) See e.g. Institute for Manufacturing, 2007; http://www.airbus.com/company/worldwide-presence/airbus-in-china/
also an intermediates exporter. For capital goods final products … alone, China is no question the largest exporter with 20.2% world market share and at the same time, the 2nd largest final products importer accounting for 10.2% of world total. For capital goods intermediates …, China is both the largest exporter and the largest importer. Its total export of capital goods intermediates mounted to US$ 201 billion and total import to US$ 265.4 billion.\textsuperscript{4} A simple indicator that demonstrates China’s still low competitiveness in high-tech exports is the negative contribution of high-tech industries and mid high-tech industries to the trade balance: Together, both industries contribute a negative share of around 20 per cent to the trade balance in total manufacturing trade.\textsuperscript{5}

\textbf{China’s “real” export dependency}

As already mentioned the extraordinary high share of exports in China’s output which is atypical for a large country has to be corrected by imported inputs used in the production of exports. The prevailing methods deliver different results. The concept of vertical specialization\textsuperscript{6} underestimates the share of foreign value-added in exports because it is ignoring tariff-/tax-favored processing trade. The necessary assumption that the intensity in the use of imports is the same for production for exports and production for domestic sales does not apply to China. The “non-competitive” input-output model\textsuperscript{7} allows to separate imported and domestically produced input. In China’s exports to the USA the direct domestic value-added content accounted for 20 percent in 1991.\textsuperscript{8} By using a disaggregated input-output model, a recent study\textsuperscript{9} estimates for the period 1997-2006 a slightly fluctuating share of foreign value-added in Chinese manufactured exports at around 50 percent. The domestic value-added in processing exports is low (between 18-26 percent) and high in normal exports (between 88-95 per cent). In 13 industries China’s exports exhibit less than 50 percent domestic value-added; these are sophisticated products such as computers (4 percent), telecommunication equipment (15 percent). In 2002, they accounted for nearly 44 percent of China’s manufacturing exports. The domestic value-added in labor-intensive industries (e.g. toys, sports products) ranges between 51-65 per cent. This group accounted for 22 percent of China’s total manufacturing exports in 2002. The remaining industries’ domestic value-added is over two thirds (e.g. apparel) but they accounted for only one third of China’s

\textsuperscript{4} Zhu, 2009, p. 5.  
\textsuperscript{5} Sachwald, 2006, p. 10.  
\textsuperscript{6} Hummels, Ishii, Yi, 2001.  
\textsuperscript{7} Chen et al, 2004; Lau et al. 2007.  
\textsuperscript{8} Chen, 2007, p. 4.  
\textsuperscript{9} Koopmann et al, 2008.
manufacturing exports.\textsuperscript{10} Estimations of the value-added in exports by firm ownership confirm the expectation that wholly foreign owned enterprises exhibit the lowest share of domestic value-added (33 percent in 2002 and 28 percent in 2006), followed by Sino-foreign joint venture companies (about 45 percent in 2001 and 2006). This share reached approximately 70 per cent in state-owned enterprises. With over 80 percent, Chinese private enterprises exhibit the highest share of domestic-value added in their exports.\textsuperscript{11}

The impressive development path of China’s exports might give cause to the assumption that its export competitiveness has crowding-out effects on industries in and exports of other countries. A just published study estimates that “China’s opening lowered the share of labour-intensive manufacturing in the sum of labour-intensive manufacturing and primary output in other countries by between 1 and 3.3 percentage points, and the corresponding export share by between 1.5 and 5 percentage points.”\textsuperscript{12} Countries in East Asia that are open to trade and produce similar products to those made in China, are most affected. But on average, the impact of China’s competitiveness on the broad sectoral structures of other countries is fairly small.

III. Enablers of China’s competitiveness in international trade

III.1 The role of ports and Hong Kong

“Until the year 1840, China’s international trade was limited to only a handful of local firms in a single port, Canton (Guangzhou). That did not sit well with Western countries who wanted to import more and more silk and porcelain from China in exchange for Western goods. Trade liberalisation came swiftly in the form of British gunboats. After defeat in the Opium War (1840-42), China was forced to open its economy to foreign trade at a large number of so-called treaty ports. Soon after, China’s foreign trade started growing rapidly. By the 1920s, China’s share in world trade reached a level so high that it was topped only in the 1990s, after China’s foreign trade had taken off again.”\textsuperscript{13} The rise of China’s trade in the second half of the 19\textsuperscript{th} century is strongly connected with trade liberalization. With the rising number of open ports, China’s imports increased rapidly.

\textsuperscript{10} For detailed data in 83 industries see Koopmann et al, 2008, p. 25-26.
\textsuperscript{11} Ibid, p. 27.
\textsuperscript{12} Wood and Mayer, 2011. p. 346.
\textsuperscript{13} Keller, Li, Shiue, 2010.
The British colony Hong Kong played an important role as an intermediary, not only in imports but also in exports. In the last 35 years of the 19th century Hong Kong’s share in China’s exports increased with a time lag to China’s imports through the *entrepôt* Hong Kong (Figure 1). After the gradual decline in the first half of the 20th century Hong Kong recaptured its leading role as China’s trade intermediary after the opening up started at the end of 1970s. In the 1990s Hong Kong’s share in China’s trade reached around 50% (Feenstra and Hanson, 2004). The revival of Hong Kong as well as ports in China such as Shanghai and Tianjin suggests that intangible, innovative trading knowledge outlasted China’s autarky period. Hardware and software logistics considerably matters in international trade. China’s current competitiveness in international trade is strongly supported by Hong Kong’s role in the past as China’s *entrepôt*. 

Source: Keller, Li, Shiue, 2010, p. 47.
III.2 Developing the hinterland of ports: Activating entrepreneurial spirit

It is not surprising that the hinterland of China’s ports developed into engines of China’s trade-led growth, first and foremost Guangdong Province (Figure 12). “Coastal provinces dominated China’s export production during the 1990s and continue to contribute almost 70% of the country’s total exports…Guandong alone accounted for 40% of all exports in 1998, but since then other coastal provinces have caught up. This is reflected in the sharply increasing trade openness of Shanghai, Jiangsu or Zhejiang.”

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“The proportion of Guangdong’s share in China’s total exports has been gradually decreasing since 2001 from 39% to 30% in 2007. This drop has been offset by the uprising portion in Jiangsu’s share in China’s total exports from 12% in 2001 to 17% in 2007. One of the reasons for such a phenomenon is due to the decrease in the amount of textile and garments sector. While garment exports in Guangdong keep slipping, the garment industry has flourished in Jiangsu and Zhejiang provinces.” Recent studies on the impact of the financial crisis on economic performance of Guandong Province found that the excessive dependence on labor-intensive exports leads to negative effects. “The lack of technological innovation industries to restrict the industry upgrading, thus seriously constraining the competitiveness of enterprises.” This leads to the conclusion that transformation from “Made in China” to “Create in China” is a must for sustaining China’s export competitiveness.

### III.3 Institutional innovation: Systemic transformation

In his state-of-the-art analysis of China’s transformation in the 1980s/1990s, Barry Naughton payed special attention to the opening up of China’s borders. The institutional innovation of gradually replacing the socialist command economy with a more market-oriented economy

15 http://www.starmass.com/china_review/imports_exports/top_importing_provinces.htm
18 Naughton, 2007, part V.
was from the beginning “launched in tandem with a renewed commitment to fostering economic growth. The twin challenges of underdevelopment and transition were interwoven at all stages of the transition process.”

Differently to other countries China’s first period of transformation from 1978 to the early 1990s was primarily aimed at creating growth, not radical institutional changes. In the post-1992 period institutional changes accelerated and stabilized an even higher growth path. Three factors merged together and fueled growth allowing to extensively exploit the high potential of China’s comparative advantages. Firstly, high savings were channeled into upgrading human and physical capital. Secondly, market incentives led to improvements in the efficiency of the allocation of human and physical capital. These incentives, thirdly, contributed to revival of traditional Chinese virtues such as entrepreneurship and commercial skills. According to Naughton’s conclusion China’s positive factor shaping its economic future is the slow but steady improvement of its human resources.

III.4 Policy innovation: “Invite-in-strategy” and “trade ownership strategy” of the 1980s/1990s

“The world is open and the experience has proved that carrying out construction of socialism with the state door closed can not be successful, and the development of China is inseparable from the world.”

China’s opening up at the end of the 1970 didn’t start with a “big bang”. In fact, the experiment with a new framework for trade was carried out on a local basis. In 1978 Hong Kong firms were for the first time allowed to sign export processing contracts with Chinese firms in the Guangdong Province. Soon after that, four Special Economic Zones were set up in Guangdong Province and Fujian Province. Products could be imported duty-free if these were used as inputs into export products. Together with the strong support from the provincial and local authorities in facilitating trade, the two provinces developed in less than two decades into the world’s most important manufacturing hub.

The “Coastal Development Strategy” finally led to a dual trade regime by separating “export-promotion trade” that was exempted from the extremely restrictive administrative trade controls from “ordinary trade” that was channeled through the state-run foreign trade

20 This part refer closely to Heiduk and Holslag, 2010.
companies. Parallel to the export promotion policy foreign investments in the Export Processing Zones and the Special Economic Zones were not only allowed, but pro-actively attracted by granting a package of monetary incentives. The main feature of China’s invite-in strategy in the 1980s and 1990s has been the active government promotion of FDI inflows by a bundle of policy measures. In two decades the contracted FDI inflows have grown from about US$ 1.5 billion to more than US$ 40 billion. In 2008 China celebrated “30 year utilization of foreign capital” with a FDI stock of US$ 92.4 billion [www.fdi.gov.cn]. More than 50% is counted as inflows from Hong Kong.

The success of the foreign companies (mainly from Hong Kong and Taiwan) spread over to other parts of China after being allowed investing all over the Middle Kingdom. Since the middle of the 1980s numerous reforms gradually liberalized China’s trade. 15 years after formally applying to rejoin the GATT, China became the 143rd member of the WTO in December 2001.

The opening up policy aimed firstly at attracting foreign investment and technology, and allocating it according to a regional development strategy (“invite-in strategy”). Secondly, the emergence of Chinese MNEs that are able to successfully enter the global market by exports and OFDI was promoted by enhancing R&D and investments in human capital (“trade ownership strategy”). The former brought the concept of Special Economic Zones (SEZ) to perfection. However, China’s export competitiveness was (and partly still is) highly regionally/locally concentrated. The initial concentration of SEZs in the Southeast was a clear sign of China’s interest in strengthening the links with Hong Kong, Taiwan, Macao, the Chinese overseas diasporas, and last but not least with the leading industrialized countries. The fear that the domestic enterprises will be marginalized by exporters were the driving force to motivate and support R&D import. Gaining trade ownership requires secure and reasonably priced input factors, especially energy, raw materials and human resources. Trade ownership of supply channels and control of foreign natural resources are both an absolute priority of Chinese policy since the middle of the first decade of the 21st century. It goes without saying that this cannot be successfully managed across all industries. Trade ownership is therefore closely connected with a strategic industrial policy true to the motto “developing and protecting national champions”. It does not surprise that production subsidies
and firm’s export performance are positively correlated. Firm characteristics such as high capital intensity play a more prominent role than the organizational form of the enterprises.\textsuperscript{22}

The causality between China’s export boom and its policy strategies need further research: “The extent to which China’s sophisticated export basket has been a direct consequence of its unorthodox policy regime is not clear. But it is not too much of a stretch to imagine that China’s industrial structure has indeed been shaped by policies of promotion and protection, just as in the cases of earlier East Asian tigers.”\textsuperscript{23}

\textbf{IV. Innovation import via IFDI, SEZ, and international competitiveness}

In the case of China the legalization of foreign ownership could be regarded as an institutional innovation.\textsuperscript{24} But foreign ownership itself is an important source of innovation via the transfer of competencies, technology and know-how of the parent companies which is often coupled with learning experience of producing for exports.\textsuperscript{25} An increasing number of studies confirm the positive relation between foreign ownership, innovation (in a broad sense) and export behavior.\textsuperscript{26} Location not only in terms of geography but also in terms of government created Special Economic Zones (SEZ) serve as a promoter of foreign ownership-based export competitiveness.

The literature dealing with the effects of IFDI in China is divided into two strands of interest, namely growth- and export-oriented studies. A controversial debate characterizes the former debate.\textsuperscript{27} On the optimistic side it is argued that IFDI has a significant beneficial impact on the Chinese economy when the ratio of IFDI to industrial output rises.\textsuperscript{28} A study on four Asian countries (including China) provides an estimate that one US dollar of FDI adds 3.27 US dollars to the GDP of each of the four countries.\textsuperscript{29} Pessimistic results are based on evidence that IFDI crowds out domestic investment.\textsuperscript{30} More optimistic than pessimistic is the result that IFDI complement domestic investment.\textsuperscript{31} Studies dealing with the effect of IFDI on China’s exports suggest altogether positive results. IFDI contribute significantly to China’s

\textsuperscript{22} Girma, Gong and Görg, 2009.
\textsuperscript{23} Rodrik, 2006, p. 5.
\textsuperscript{24} Huang, 2001.
\textsuperscript{25} Wignaraja, 2008, p. 2.
\textsuperscript{26} See e.g. Du and Girma, 2008; Greenaway et al suggest that joint ventures perform better than wholly foreign owned firms.
\textsuperscript{27} Tang, Selvanathan and Selvanathan, 2008, p. 1292.
\textsuperscript{28} Shan, 2002.
\textsuperscript{29} Dondety and Mohanty, 2007.
\textsuperscript{30} Huang, 2003.
\textsuperscript{31} Tang, Selvanathan and Selvanathan, 2008, p. 1307.
export boom (figure 13), obviously to a higher degree than domestic capital. At least in the first 20 years after the opening up the labor-intensive industries benefit more than anticipated.\textsuperscript{32}

**Figure 13**  
Foreign Invested Enterprise (FIEs) and China’s Exports, 1980-2004


IFDI has also positive effects on China’s imports.\textsuperscript{33} When analyzing specific industrial sectors it turns out that IFDI effects on exports vary by industry. FDI in non labor-intensive industries are more efficient in stimulating exports than those in labor-intensive ones.\textsuperscript{34}

Cross-country studies show that the positive IFDI effects on GDP, exports and imports are stronger in China than in other developing countries. This seems to be attributed firstly to the successful transfer of technology (which includes learning-by-doing), secondly to innovative policy measures, and thirdly to the foreign investors who often belong to the rich Chinese Diaspora. The literature pays special attention to the first and second reasons. The empirical evidence shows that in the 1990s technology transfer through IFDI was fairly limited but at the level expected given China’s developing country status and technological capacities.\textsuperscript{35}

With the emergence of China as the manufacturer of the world its exports of the foreign

\textsuperscript{32} Zhang, 2005, p. 10.

\textsuperscript{33} Dondeti and Mohanty, 2007, p. 13.

\textsuperscript{34} GU et al, 2008.

\textsuperscript{35} Young and Lan, 1997.
affiliates had been technologically upgraded by imported technologies which were partly embedded into IFDI and partly embedded into intra-firm imports of semi-finished products. The impact on local production and the diffusion of technology to China’s domestic industry seem to be limited, at least until the middle of the first decade of the 21st century. The rapid technological upgrading of China’s exports in last decade resulted to a large extent from the reorganization of production in Asia. China is benefiting from the triangular trade pattern: “firms in advanced Asian economies use China as an export base and instead of exporting finished goods to the US and Europe, now export intermediate goods to their affiliates in China.” Therefore, high-tech exports from Japan and Korea shifted to China.

As mentioned before, China’s competitiveness emerged predominantly from IFDI in SEZ which are regionally concentrated (figure 14). SEZ is an umbrella term for zones with different aims (e.g. high-tech zones) and different levels (state-level, provincial, municipal zones) and different promotion policies ranging from special labor regulations, export promotion measures, less bureaucratic controls to preferential tax status. Besides preferences granted from all levels of government the export competitiveness also results from cheap labor. The openness to the world markets requires a certain degree of isolation to the domestic economy in order to keep the centrally planning system intact. Therefore, the freedom of action of these enclaves’ administration is relatively limited.

While Chinese politicians celebrated the four original SEZs as a success story of the opening up policy, critical aspects are reviewed in the academic literature. The uneven distribution of the gains of foreign investments is contributing significantly to the regional income disparities. Guangdong, Zhejiang, Shanghai and Fujian provinces absorb by far the largest part of FDI. In the middle of the 1990s around 90% of FDI inflows were concentrated in the coastal areas, clearly led by Guangdong Province. Most foreign investors used China to a large extent as a location for outsourcing labor-intensive parts of the production chain. Especially at the beginning of the opening-up, labor-intensive parts and components production did not contribute to developing a “deep” production structure. There are some doubts regarding the contribution of the SEZs to the regional growth of the coastal provinces. It is still difficult to quantify the regional growth effects because of the enclave character of the SEZs and the statistical and methodological problems of analyzing spill-over effects. In the first phase of the opening-up Chinese firms invested in the SEZs which did not contribute

to the desired upgrading effects in modern technologies. The high concentration of FDI in light industrial production and assembly with low value-added effects led to a relatively unilateral, vulnerable industrial structure. Especially the rise of Shenzhen was accompanied with exploding real estate prices, corruption, social problems, trade deficits, smuggling, environmental problems. This caused controversial discussions on the justification of the SEZs in the mid 1980s and resulted in their re-evaluation leading to a shift towards High-tech Development Zones.

There are still doubts whether the SEZs could tap the full potential of economic efficiency because of their political and economic restrictions to function as market-oriented institutions within a centrally planned economic system, however as a matter of fact, thanks to Shenzhen – the first SEZ - Guangdong Province climbed from rank 6 in terms of GDP in 1978 to rank 1 in 1995 contributing nearly 10% to China’s GDP and around 40% to China’s exports.  

Figure 14 China’s Special Economic Zones, 2010

![China’s Special Economic Zones, 2010](image)

Source: Zeng, 2011, p. 11.

Recently, controversial discussions arose regarding the contribution of SEZs to the technological upgrading in China. On the one hand foreign funded firms are mostly more technology intensive than domestic enterprises. On the other hand there are arguments that

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38 Heiduk and Holslag, 2010, p. 16-20.
this IFDI promoting SEZ concept did not contribute to improving indigenous competitiveness.\textsuperscript{39} It is argued that on average the level of technology embodied in IFDI has been only two years ahead of the Chinese technology. A study on the electronic industry finds significant productivity depression rather than positive spillover effects on domestic enterprises.\textsuperscript{40}

World Bank’s 2011 study evaluates the SEZs as follows “In 2006, the five initial SEZs accounted for 5 percent of China’s total real GDP, 22 percent of total merchandise exports, and 9 percent of total FDI inflows. At the same time, the 54 national ETDZs (Economic and Technological Development Zones) accounted for 5 percent of total GDP, 15 percent of exports, and 22 percent of total FDI inflows.”\textsuperscript{41} All SEZs together accounted for 11.1 percent of China’s total GDP and 29.8 percent of exports. SEZs attract a considerable part of IFDI. The study estimates that in 2007 about 46 percent of China’s total utilized FDI were allocated to the major national-level SEZs. The outstanding role of the High-tech Industrial Development Zones (HIDZ) is manifested by the following data: “In 2007, the 54 HIDZs hosted about half the national high-tech firms and science and technology incubators. They registered some 50,000 invention patents in total, more than 70 percent of which were registered by domestic firms…they also hosted 1.2 million R&D personnel and accounted for 33 percent of the national high-tech output…In 2002, their expenditures on R&D accounted for 2.4 percent of China’s total R&D expenditures.”\textsuperscript{42} In Shenzhen it is to be expected that R&D spending will reach 4 percent of its GDP in 2010; the high-tech sector is expected to grow at an average of 20 percent over the next few years.

\textbf{V. Innovation, R&D and international competitiveness}

The growing share of high-tech products in China’s total exports (figure 15) hides the considerable lack of home grown technological and innovative capabilities. Even in Chinese exporting enterprises the technology is mostly non-Chinese. Empirical studies on the high-tech content of Chinese enterprises show that at the beginning of the last decade only 10\% of China’s exports were based on own technology.\textsuperscript{43} Accumulating the domestic R&D capital

\textsuperscript{39} Fu and Gao, 2007, p. 26.
\textsuperscript{40} Ibid, p. 27; Hu and Jefferson, 2002.
\textsuperscript{41} Zeng, 2011, p. 13.
\textsuperscript{43} Zhang, 2008.
stock is now at the top of China’s development strategy. Growing domestic R&D capabilities will increase the ability to successfully absorb foreign technologies.\textsuperscript{44}

\textbf{Figure 15}  \hspace{1em} \textit{China’s High-Tech Exports, 1995-2009 (billion US$)}

Source: Xing, 2011, p. 3.

As China’s development path is moving upward, there is a growing need for innovation to keep its growth sustainable. The efforts of establishing and improving the national innovation system resulted so far in numerous policy activities with different results. While the R&D spending (in 2005 sixth rank worldwide, second rank in total numbers of researchers since 2000) and the quantitative measurable output (3 percent on global patent applications with doubling of the number of patents every two years) have grown rapidly, the innovation performance is lagging behind.\textsuperscript{45} This is attributed to the slow growth of capabilities for making productive use of input factors; especially the access of human resources is a crucial factor.

\textbf{Figure 16}  \hspace{1em} \textit{Gross domestic R&D expenditure of selected countries, 1998, 2003, 2008 (per cent of GDP)}


\textsuperscript{44} Yu and Yu, 2006.

\textsuperscript{45} OECD, 2008, p. 16.
Other limitations result from insufficient framework conditions such as weak enforcement of intellectual property rights. Despite the intensive efforts to develop and functionally improve high-tech clusters the gap between basic research and applied technology development is still wide. From an outside point of view China’s national innovation system “appears as an ‘archipelago’, a very large number of ‘innovative islands’, with synergies inefficiently developed between them, limiting spillovers beyond them. Spreading the culture and means of innovation beyond the fences of S&T parks and incubators by promoting more market-based innovative clusters and networks should now be an important objective.”

Despite the increase in R&D spending, China’s R&D intensity is far below that of industrialized countries, especially in high-tech industries (table 4). “This holds also for high-tech export industries, which lack a large R&D base in China and continue to rely heavily on foreign-sourced technology embodied in FDI and imported inputs. For this segment, the share of value-added devoted to R&D was only one-tenth of that in the United States in 2005. Indeed the R&D intensity of Chinese high-tech firms is lower than that of medium-technology form in the OECD.” In 2007, China’s R&D intensity amounted to 1.5 per cent compared to 2.7 per cent of the USA and 3.4 per cent of Japan.

46 OECD, 2008, p. 17.
Table 4  R&D intensity of Chinese companies by level of technology

<table>
<thead>
<tr>
<th></th>
<th>OECD</th>
<th>United States</th>
<th>Japan</th>
<th>Europe</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2005</td>
<td>2005</td>
<td>2007</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-tech companies</td>
<td>30.2</td>
<td>36.3</td>
<td>25.2</td>
<td>24.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Medium-tech companies</td>
<td>10.1</td>
<td>10.3</td>
<td>14.6</td>
<td>0.4</td>
<td>2.7</td>
</tr>
<tr>
<td>Low-tech companies</td>
<td>0.5</td>
<td>0.7</td>
<td>0.6</td>
<td>0.4</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: OECD, STAN R&D Database and National Bureau of Statistics Microdatabase.

Nowadays, China’s high-tech industry is to an increasing extent challenged by other competitors, e.g. Taiwan, while educational level is approximately that of the Taiwanese workforce in the 1970s.\(^49\) According to a survey conducted in 2004-2006, 53 percent of large enterprises, 86 per cent of the medium-sized and 96 per cent of the small did not have continuous R&D activities. The relatively high number of international patent applications hid the fact that they are concentrated among a few leading Chinese MNEs (e.g. Huawei) who face a large number of technologically backward enterprises. One of the main reasons results from the former government-led model of innovation which set neither incentives nor autonomy for state-owned enterprises to innovate. Despite the fact that nowadays SOEs’ share in China’s R&D expenditures climbed up to approximately one third, the output in innovation is still modest. Private enterprises’ share is around 10 per cent of the SOEs’ share, but the output (measured by patent applications per million R&D expenditures or patents per 100 scientists/engineers) is almost two times higher. Furthermore, the incomplete transformation to the market system results rather in barriers than in incentives to engage in innovation and technological progress. A World Bank survey showed that the fast growing SMEs’ capacity to innovate or to absorb new technologies is often very limited. “On the overall question of constraints, the survey results indicated that innovative activities of SMEs are frustrated by a shortage of talents, an inability to use external opportunities and resources, difficulties in getting access to quality innovation services, and a lack of capital.”\(^50\) Last but not least the institutional infrastructure for a venture capital industry is not yet fully developed.

\(^{49}\) Zhang et al, 2009, p. xvi.

\(^{50}\) Ibid, p. xviii.
As already mentioned, China’s high-tech exports are dominated by foreign MNCs. After China’s accession to the WTO the R&D facilities of foreign MNCs expanded rapidly (figure 18). It is obvious that the increasing exports of foreign MNCs’ high-tech products are related to their increasing R&D in China. The foreign MNCs’ strategy sharply contrasts with the Chinese high-tech firms: “Many claim that China’s high-tech companies do not tend to view the technological innovation as the key competitiveness.”

Figure 18    Foreign R&D Labs in China, 1985 – 2007

VI. Human capital investment and international competitiveness

At the end of the 1990s, China’s GDP per capita was only about 13% of the world average (measured in PPP about 63% of the world average), but the percentage of its population that had a primary and secondary education was much higher than that of the world average. The reallocation of labor from agriculture to the industrial sector has considerably contributed to the aggregate productivity growth. With just under 40 percent the labor force in agriculture is still high. Barriers (e.g. hukou system) hinder internal migration and lead to a reservoir of

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51 See also Xing, 2011.
52 Yang, 2010, p. 3.
53 Zhang and Zhang, 2005, p. 220.
54 OECD, 2010, p. 28.
labor that at least partially could be upgraded by higher education. Despite significant investment in universities, the access for school graduates from rural areas is still limited. The impressive rise of the number of new entrants into universities (60 percent between 2003 and 2008) has to be put into the context of large differences between universities regarding the quality of teaching. Furthermore, the high demand for university graduates in the public sector, in general management and in education is constraining the allocation of massive human resources to the high-tech sectors.\textsuperscript{55}

Besides direct public investment in the education sector, Chinese government has launched reforms that brought significant contextual changes to the human resource function and human resource management practices in Chinese enterprises. These studies do not divide the observed enterprises into export-oriented and domestically active enterprises. But it is to be expected that the results are valid for export-oriented firms.

Field studies investigating the implications for human resource management practices in all organizational types of enterprises suggest an emerging strategic role of the human resource function, with evidence of participation in strategic decision-making and a continuing emphasis on the competencies (i.e., qualifications and work experience) of human resource managers.\textsuperscript{56} Regression analyses showed that organizational strategy and organizational ownership, in contrast with earlier research, were not found to be strong predictors of human resource management practices. The changing business environment in China and participation of the human resource function in strategic decision-making were the strongest predictors of human resource management practices. Overall, a strategic role of the human resource function and implementation of ‘Western’ practices are becoming more prevalent in China, although the legacy of traditional practices endures and new challenges are emerging. A more recent study of these authors found some evidence for a positive relationship between the degree of strategic integration of human resource management with firm performance.\textsuperscript{57}

The latter is also positively correlated with entrepreneurial orientation (propensity by a company’s top management to take calculated risks, be innovative, and demonstrate strategic pro-activeness) and acquisitive learning (learning new competencies and knowledge externally). The former has a higher performance impact than the latter. This result supports other studies showing that firms obtain a sustainable competitive advantage by investing in

\textsuperscript{56} Zhu et al, 2005.
\textsuperscript{57} Zhu et al, 2007.
the development of internal capabilities.\textsuperscript{58} This holds especially for Chinese high-tech firms. Human resource management focusing on employee training, immaterial innovation and process control contribute significantly to innovation and firm performance.\textsuperscript{59} The impact on exports is not investigated.

A recently published\textsuperscript{60} study focuses on the relationship between IFDI, human capital and innovation taking up this topic from two former studies which focus on Argentina and Portugal.\textsuperscript{61} In case of China, a number of studies examined the effect of IFDI on human capital concluding that labor quality is an important factor in attracting FDI.\textsuperscript{62} Contrary to the aforementioned results for Argentina and Portugal, there is no evidence in China that IFDI has a positive influence on human capital in domestic firms. But the study found statistically solid evidence “sustaining that, in indirect terms, by means of investment in innovative activities, FDI has a positive impact on the general human capital (i.e., formal education) of large, innovative firms located in China.”\textsuperscript{63}

From a macroeconomic point of view the impressive increase in all components of human capital in the science and technology sector cannot hide the fact that the main bottleneck in China’s technological competitiveness seems to be the result of shortages in specialized human resources.

Comparisons between the impact of human capital and physical capital on China’s growth show that both promote growth but investment in innovation and private investment are found to be particularly important; higher education plays a prominent role.\textsuperscript{64}

\textbf{VII. China’s industrial competitiveness and exports: An overall view}

There is a common understanding in the literature that industrial competitiveness in the global market is the result of five drivers: skills, technological efforts, IFDI, royals and technical payments abroad and infrastructure.\textsuperscript{65} Based on multiple regression estimations for the period 1988-1998 the findings suggest that domestic R&D, access to foreign technology through FDI

\begin{footnotesize}
\textsuperscript{58} Zhao et al, 2011.
\textsuperscript{59} Li, Zhao and Liu, 2006.
\textsuperscript{60} Shu and Teixeira, 2010.
\textsuperscript{61} Narula and Marin, 2003; Tavares and Teixeira, 2005.
\textsuperscript{62} See e.g. Sun et al, 2002.
\textsuperscript{63} Shu and Teixeira, 2010, p. 19.
\textsuperscript{64} Ding and Knight, 2011.
\textsuperscript{65} Zhao and Zhang, 2007, p. 6.
\end{footnotesize}
and licensing have a powerful influence on China’s industrial performance.\textsuperscript{66} China was on the top of the list of export winners in low-tech, medium-tech and even high-tech manufacturing in 1985-2000. The share of medium- and high-tech exports in total manufacturing exports rose from 4\% to 37\%. Improvements in skills resulting from the increasing number of tertiary students enrolled in technical subjects places China on the top of developing countries. This result is confirmed by other studies. Especially after 2001 the share of high-tech manufacturers in total trade has increased. High-tech parts and components were imported, assembled and exported as finished high-tech goods.\textsuperscript{57}

Only few studies do not share the optimistic view of praising China’s competitiveness in the global market. It is argued that “apart from low-cost production made almost exclusively for foreign firms, neither the private nor the state sector of China’s economy is particularly competitive.”\textsuperscript{68} Apart from institutional, cultural and macroeconomic barriers the undeveloped innovation capabilities were hold responsible for the backwardness of China’s competitiveness.\textsuperscript{69} “For the most part Chinese firms are not exporting high technology themselves…Perhaps only 15\% of the value-added of China’s electronic and IT exports comes from Chinese firms while the rest is imported.”\textsuperscript{70} Impediments to innovation include a low level of R&D, overly rigid organizational hierarchies, intellectual property issues, and problems with resource allocation and responsibility. These results may have limited validity because they are based on a small sample of firms in China’s coastal provinces.

A study on China’s competitiveness in manufacturing had been at its peak from the late 1980s to the mid 1990s and lost ground since then.\textsuperscript{71} By measuring the real effect exchange rate through a unit-labor-cost based method, the positive and negative effects are higher compared to the usual industrial-price-based methods.

One of the most popular indicators used for measuring competitiveness is the productivity, divided into labor productivity, capital productivity and total factor productivity. In the period from 1993 to 2002 the fastest increasing labor productivity occurred in heavily export-oriented industries (electronics and telecommunications equipment industry and processing industry in timber, bamboo, cane, and palm fibre).\textsuperscript{72} It may surprise that China’s capital

\textsuperscript{66} Ibid, p. 11.
\textsuperscript{67} Nataraj and Tandon, 2011.
\textsuperscript{68} Wang et al, 2008, p. 4; Ahlstrom et al, 2006.
\textsuperscript{69} See e.g. Zeng and Williamson, 2007.
\textsuperscript{70} Wang et al, 2008, p. 6.
\textsuperscript{71} Dullien, 2005.
\textsuperscript{72} Zhang and Zhang, 2005, p. 15.
productivity has been falling over time. The considerable accumulation of capital was accompanied by new technologies and new production equipment which in turn contributed to the increasing labor productivity. The relatively high growth in total factor productivity in most industries originated from institutional transformation (chapter III.3), opening up policies (chapter III.4) and the special human capital structure (chapter V). The role of FDI with respect to industrial productivity and growth is emphasized in a recently published study: “The estimates suggest that FDI has positive direct and spillovers effect on China’s industrial productivity level and growth, and the contribution of FDI to productivity is enhanced by its interaction with China’s human capital. While labor-intensive industries benefit more from FDI direct effects, capital-intensive industries gain more from FDI spillover effects.”

Recently published literature emphasizes two limits of China’s industrial competitiveness, namely the rising trade conflicts and the rising labor costs. A study on China’s garment industry predicts that in the low-end market sector of this industry, Chinese producers will be forced to move their production to western part of China or even to low-cost locations in Southeast Asian countries. China can only sustain its position as the “tailor to the world” by specializing on higher-end products that about all require sophisticated technologies.

The majority of empirical studies on China’s competitiveness focus on costs including domestic wages, material costs, productivity, exchange rates. Furthermore, IFDI - not only seen as capital accumulation but also as transfer of technology and skills - play an important explanatory role. As shown in table 3, China’s competitiveness – measured by the dynamic RCAs trend – improved considerably since the 1970s. It is generally accepted that there is no monocausal explanation. From a dynamic point of view the shift of Chinese production toward more advanced products with technological content is notable. The discussion on what is next after the “Global Factory Model” goes in the direction of “Industrial Upgrading”. A study on China’s IT industry stresses the necessity to balance the domestic and international orientation. At the core are specific innovative capabilities which combine soft entrepreneurial and management capabilities with hard R&D. Only few Chinese enterprises in the IT industry can achieve technological leadership. It is recommended to follow a less

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73 Zhao and Zhang, 2010, p. 656.
74 Ramasamy and Yeung, 2008, p. 126.
75 See e.g. Sinnakkannu, J. and Nassir, A. (2006). This study does not agree with the dominating tenor of the literature that the Renminbi is substantially undervalued. Hence it follows that China’s export competitiveness is based on other factors.
76 Adams, Gangnes, Shachmurove, 2006, p. 120.
77 Ernst, 2007.
costly and risky “technological diversification strategy”, but it needs improvements in soft capabilities. The most promising way to acquire these capabilities is the progressive integration into the global innovation network of foreign universities, research institutions, consulting firms, and informal peer group networks of overseas Chinese researchers, engineers, managers. \(^\text{78}\)

As mentioned before, China’s export basket differs considerably from countries with similar income per capita. Besides its traditional export products which fit into the Heckscher-Ohlin explanation of trade, China exports also high-tech products which compete with products of high-income countries. It is argued that in low-income countries usually the uncertainty about the costs of investments discourage the early entry into new industries. \(^\text{79}\) The production and export of high-productivity goods is therefore too low. Measured by an indicator (developed by Hausmann and Rodrik, 2003) China’s export profile in 1992 was associated with an income level that is more than six times higher than its per capita GDP at the time and dropped to half at the beginning of the 21st century. \(^\text{80}\) This allows to conclude that the skill content of China’s exports is likely to be much higher than its endowment may imply. The correlation with the stock of human capital is indeed positive, but weak. Another study presented an opposite result: In 1990, the actual share of skill-intensive exports was lower compared to a predicted ratio. \(^\text{81}\)

**VIII. China’s ICT equipment exports: A Ricardian paradox?**

When it comes to studies on China’s exports of high-tech products, its ICT industry serves as a prime example. In 2004, China outpaced the USA as the largest exporter in ICT products. \(^\text{82}\) The bulk of these exports consist of electronic consumer goods, computers and telecommunication equipment. But China’s competitiveness in electronic components and instruments is weak. Main importer of China’s ICT equipment is the USA whereas main exporters of electronic components to China are Japan and Korea. This trade pattern suggests that China serves as an assembly location where final products are exported to the most attractive markets. Evidence provides the share of ICT exports by ownership structure of the manufacturer: In 2003, more than 90 per cent of China’s exports of computers and IT equipment are assembled in foreign affiliates. China’s international competitiveness in ICT

\[^{78}\text{Ibid, p. 459.}\]
\[^{79}\text{Hausmann and Rodrik, 2003.}\]
\[^{80}\text{Rodrik, 2006, p. 7.}\]
\[^{81}\text{Wood, 1991.}\]
\[^{82}\text{Sachwald, 2006, p. 4.}\]
equipment stems rather from low-cost assembling than from homegrown technology. Foreign technology is embodied in foreign multinationals’ investment in China. In 2003, foreign funded enterprises generated an export surplus of 16.58 billion US$ whereas the domestic funded enterprises generated a deficit of 6.68 billion US$.\(^{83}\)

A study comparing the Taiwanese and Chinese emergence of the integrated circuit industry found that China has largely remained in the assembly and test activities, whereas their counterparts in Taiwan have upgraded strongly to wafer fabrication, designing and R&D activities.\(^{84}\) Anyhow, China’s share in world exports of integrated circuits rose from 1.7 per cent in 1990 to 5.9 per cent in 2005. The bulk of these exports are still resulting from low-end assembly operations. Chinese firms are often not able to make successful use of foreign technology which they acquired through licenses. Human capital seems to be crucial bottleneck. Chinese government tries to copy Taiwan’s and Korea’s policy to attract back its talents from abroad.

The Ricardian model of international trade which predicts that China’s exports are characterized by high labor intensity does not contradict with China’s fast growing exports in ICT equipment. China’s export competitiveness in this industry is “borrowed” from mainly Japanese, Korean and Taiwanese multinationals at the price of technological backwardness and fast growing regional/local disparities. If the recently starting trend of establishing R&D labs by foreign multinationals will continue\(^{85}\), then it is to be expected that these disparities will grow.

IX. **Resume**

When compared to studies of the competitiveness of international trade in other countries, the literature on China has to cope with special difficulties such as availability, reliability, transparency of data and statistics as well as restrictions in primary field research.

China’s competitiveness is still based on a relatively fragile fundament, namely because of the mismatch of economic and political reform, the geographical divide between competitive and non-competitive regions, the divide by sectors and the high dependence on foreign energy and natural resources.

\(^{83}\) Ning, 2007, p. 570.
\(^{84}\) Rasiah et al, 2010, p. 238.
Institutional and policy innovations paved the way for China’s competitiveness. Foreign enterprises seem to benefit to a larger extent from these innovations than domestic enterprises. China’s competitiveness is therefore rather foreign grown via IFDI and embodied technologies than home grown.

China’s competitiveness on the global markets needs a stronger innovative component. In order to achieve sustainability of its export competitiveness and to make full domestic use of technological upgrading, China has to improve the efficiency of its national innovation system and to increase the quantity and quality of its human capital. Empirical studies covering the last five years are rare and partly not accessible at the moment.

It seems that in recent years the interest in studying the determinants of China’s competitiveness in international trade is declining. It is partly replaced by a growing interest in China’s import and energy/raw materials-securing strategy. Furthermore, domestic developments such as inflation, regional inequality, environmental damages are attracting the interest of the research community at an increasing pace.

The survey does not claim to cover the whole range and all facets of the literature related to China’s competitiveness in international trade based on innovation and human capital. Especially most of the growing empirical studies in Chinese language are not included into this survey.
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