Cambridge Journal of Economics 2013, **37,** 791–818
doi:10.1093/cje/bes058
Advance Access publication 6 November 2012

Why has China succeeded? And why it will continue to do so

Jesus Felipe, Utsav Kumar, Norio Usui and Arnelyn Abdon*

The key factor underlying China's fast development during the last 50 years is its ability to master and accumulate new and more complex capabilities, reflected in the increase in *diversification* and *sophistication* of its export basket. This accumulation was policy induced and not the result of the market, and began before 1979. During the last 50 years, China has acquired revealed comparative advantage in the export of both labour-intensive products (following its factor abundance) and sophisticated products, although the latter does not mean that there was leapfrogging. China is exceptionally well positioned (especially taking into account its income per capita) to continue learning and gaining revealed comparative advantage in the export of more sophisticated products. Given adequate policies, carefully thought-out and implemented reforms and skilful management of constraints and risks, China has the potential to continue thriving. This does not mean, however, that high growth will continue indefinitely.

Key words: China, Capabilities, Diversification, Export-led growth, Leapfrogging, Sophistication
JEL classifications: O20, O25, O53

1. Introduction

There is a vast literature trying to explain China's very high gross domestic product (GDP) growth rate and poverty reduction since it started its transition to the market system in 1979.[1] Three key stylised facts underlie China's high output growth rates: (i) its high growth rates of capital accumulation, driven by high investment–output ratios;

Manuscript received 14 April 2011; final version received 23 July 2012.
Address for correspondence: Jesus Felipe, Asian Development Bank, Manila, Philippines; email: jfelipe@adb.org

* Asian Development Bank. Jesus Felipe is also research associate with the Cambridge Centre for Economic & Public Policy, University of Cambridge, UK; the Centre of Full Employment and Equity, University of Newcastle, Australia; the Center for Full Employment and Price Stability, University of Missouri-Kansas City, USA; and the Levy Economics Institute of Bard College, New York. We are grateful to Ha-Joon Chang, Justin Lin and Thomas Rawski for their very useful comments. Two referees of this journal also provided very helpful suggestions. The usual disclaimer applies. This paper represents the views of the authors and not those of the Asian Development Bank, those of its Executive Directors or of the member countries that they represent.

[1] Average GDP growth rate for 1960–2007 was 7.82%, and 6.21% in per capita terms. For 1980–2007 the rates were 9.93% and 8.74%, respectively.

(ii) a marked outward orientation through export-led growth policies (Felipe *et al.*, 2008);[2] and (iii) the pursuit of industrialisation (in particular the production and export of manufactures), a key ingredient for fast growth and development (Rodrik, 2006A). China's miracle is that it has been able to sustain this process for three decades.[3]

In this paper we try to gain insight into China's development by analysing the evolution of its export basket since the 1960s, in particular how it has become more diversified and how it has shifted to products with higher income content. We argue that while reforms after 1979 were important because they opened the economy and provided incentives for the private sector to develop, they could not have succeeded without acknowledging the stock of capabilities that existed in the country. We show that as far back as the 1960s, China's productive structure was quite complex already and this set the basis for the country's future high growth. Reforms towards a market system since the 1980s have been key to China's development. However, we stress the path-dependent nature of development and emphasise the significant knowledge that had been accumulated before the reforms started.

The historical experience of the advanced economies and that of Asian countries such as South Korea indicates that development entails a shift from dependence on agricultural activities (especially on farming) into reliance on modern industrial and service sectors. This shift is referred to as structural transformation and is what leads to fast and sustained growth. In other words, becoming a developed country requires achieving sustained growth for a period of decades. In general, the only way to do this is through significant structural transformation.[4]

More precisely, structural transformation is the process by which countries change what they produce and how they do it, as well as how they move from low-productivity and low-wage activities to high-productivity and high-wage activities. Structural transformation has three components: (i) shifts in the output structure, from activities of relatively low productivity into high-productivity activities; (ii) shifts in the employment structure, typically a decline in the share

[2] Also, some growth accounting studies have documented that total factor productivity growth has been relatively high. On the contributions of factor accumulation and total factor productivity growth to overall growth, see, e.g., Tsui *et al.* (1995), Borensztein and Ostry (1996), Hu and Khan (1997), Young (2000), Felipe and McCombie (2002), Heytens and Zebregs (2003), Blanchard and Giavazzi (2005) and Islam *et al.* (2006). Chow (1993) and Felipe and McCombie (2011) discuss the pre-reform period.

[3] See the recent work by Storm and Naastepad (2005) and Lee and Mathews (2010). They emphasise different aspects of East Asia's (China included) development, in particular the drive towards industrialisation, the emphasis on capability building, export orientation, industrial targeting and sequential upgrading. All of them are part of China's story.

[4] This is a point forcefully emphasised by Chang (2010) in his critique of some recent interpretations of development as poverty reduction.

[5] The share of agriculture in total GDP has declined significantly, from about 60% during 1952–70, to slightly over 10% in recent years. However, agriculture is still the largest employer in the economy (still over 40% of total employment). Felipe (2010, pp. 123–7, 154) concludes that most of the growth in overall labor productivity in China during 1987–2002 was due to the growth in labor productivity within industry. The contributions of labor productivity growth within agriculture and within services were minimal. Likewise, the contribution of labor relocation from agriculture into industry to overall labor productivity growth was negative due to the decline in the employment share in industry during this period, while the contribution of labor relocation from agriculture into services was significant due to the large increase in the share of employment in services. Overall, the growth in labor productivity in industry plus the effect of relocation of labor from agriculture into services accounts for over 80% of overall labor productivity growth during this period.

of employment in agriculture;[5] and (iii) upgrading and diversification of the production and export baskets. It is not obvious how this process happens, except that in all successful cases there has been some form of government intervention. In the case of China, this process did not start taking place on a major scale until after the Communist Revolution.

Along these lines, Hausmann *et al.* (2007), Hidalgo *et al.* (2007), Hidalgo (2009) and Hidalgo and Hausmann (2009) have argued recently that growth and development are the result of structural transformation and, crucial in their story, they have shown that not all products carry the same consequences for a country's development.[6] The reality is that developing countries face serious problems when they try to become competitive in a new product, when they try to enter a new market and when they try to shift production and exports towards more sophisticated products. Hausmann *et al.* (2007) show that the specific set of products that a country exports has important consequences for the pattern of development. Empirically, a measure of the sophistication of a country's export basket proves to be a good predictor of future growth: controlling for initial income, countries with a more sophisticated export basket (also initially) grow faster. On these grounds, Hidalgo *et al.* (2007) argue that development has to be understood as the process of accumulating more complex sets of capabilities and of finding paths that create incentives for those capabilities to be accumulated and used. The implication is that a growth miracle sustained for several decades must involve the continual introduction of new goods, not merely continual learning on a fixed set of goods. To analyse development and structural transformation from this perspective, Hidalgo *et al.* (2007) have developed a new analytical tool called the *product space*.

In this paper, we study how China has progressed since the early 1960s as a result of learning and accumulating the capabilities necessary to produce and export new and more sophisticated products. China's high growth rates during the last five decades, the result of massive investment (reaching 40%–50% of GDP) and successful integration into the world economy through trade, only make sense in a context of high assimilation and absorption capabilities, increasing the capacity to employ new methods of production and new inputs and significant upgrading (Abramovitz, 1986; Nelson and Pack, 1999).[7]

We focus on two aspects: (i) the sophistication of China's export basket; and (ii) the number of products in which China has acquired a revealed comparative advantage (RCA; diversification). Sophistication and diversification capture different aspects of how countries progress. The first captures the ability to export products produced and exported by the rich countries to the extent that, in general, they embody higher productivity, wages and income per capita. The second factor captures the ability to become competitive in a wider range of products, measured by the number of products exported with RCA. The rationale that underlies our analysis is that technical progress and structural change evolve together (technical progress induces structural change and vice versa; they jointly lead to growth), and underlying both is the

[6] Certainly, these claims are not new. The importance of industrialisation was highlighted by Nicholas Kaldor (1967) and others (on this see Felipe *et al.*, 2009). The major contribution of this recent literature is the methods of analysis developed (e.g. the product space) and the emphasis on building capabilities.

[7] The success of China's industrial development is a point also stressed by scholars such as Brandt *et al.* (2008). Our analysis uses a different methodology.

mastering of new capabilities. We look at these two issues at the level of 779 products exported.[8]

The rest of the paper is structured as follows. Section 2 provides an analysis of the sophistication and diversification of China's export basket. In Section 3 we discuss whether China's success has been due to comparative advantage or industrial policy. Section 4 provides an analysis of China's future export opportunities. Section 5 summarises the main findings and draws some policy implications.

2. Export sophistication and product diversification

Following Hausmann *et al.* (2007), we first calculate the level of sophistication of a product (PRODY) as a weighted average of the GDP per capita of the countries that export the product in question.[9] This is calculated individually for each product. PRODY provides a measure of the income content of a product. It is, therefore, not an engineering notion. For example, a chair will have a high level of sophistication if it is exported by a large group of developed countries. This will simply mean that consumers in other countries are willing to pay a high price for the chair and, therefore, the chair will be most likely a product with high income elasticity. Then we calculate the level of sophistication of a country's export basket (EXPY) as the weighted average of the level of sophistication of the products that it exports (i.e. of the different PRODY).[10]

Figure 1 shows the EXPY index for China and a group of comparator countries, as well as for some developed countries. The figure indicates that in the early 1960s, when China was still one of the poorest economies in the world, EXPY was about $10,000. By 2006, China's export basket had achieved a relatively high level of sophistication, $16,757, comparable to that of Japan in 1970–75, Spain, Italy and Singapore in 1985–90, and Korea in 1990–95; and it has already overtaken Portugal. In Asia, only Japan, Singapore, Korea and Malaysia are ahead of China today.

[8] We use Standard International Trade Classification (SITC) (rev. 2) four-digit level data. Data for the period 1962–76 were downloaded from the National Bureau of Economic Research web site (http://www.nber.org/data/). See Feenstra *et al.* (2005) for details. Data for 1977–2006 were downloaded from the United Nations Commodity Trade Statistics web site (http://comtrade.un.org/).

[9] Algebraically: $PRODY_i = \sum_c \left[\frac{xval_{ci} \Big/ \sum_i xval_{ci}}{\sum_c \left(xval_{ci} \Big/ \sum_i xval_{ci} \right)} \right] \times GDPPC_c$, where $xval_{ci}$ is the value of country c's exports of commodity i and $GDPPC_c$ is country c's per capita GDP. GDPPC is from World Development Indicators and is measured in 2005 purchasing power parity (PPP$). Therefore, the unit of PRODY is PPP$. We have calculated PRODY for the 779 products in our analysis. The product with the highest sophistication level is 'furnace burners', with an index of almost $40,000. The product with the lowest level is 'tin ores', with an index of $955.

[10] Algebraically: $EXPY_c = \sum_i \left(\frac{xval_{ci}}{\sum_i xval_{ci}} \times PRODY_i \right)$. Like PRODY, EXPY is measured in 2005 PPP$.

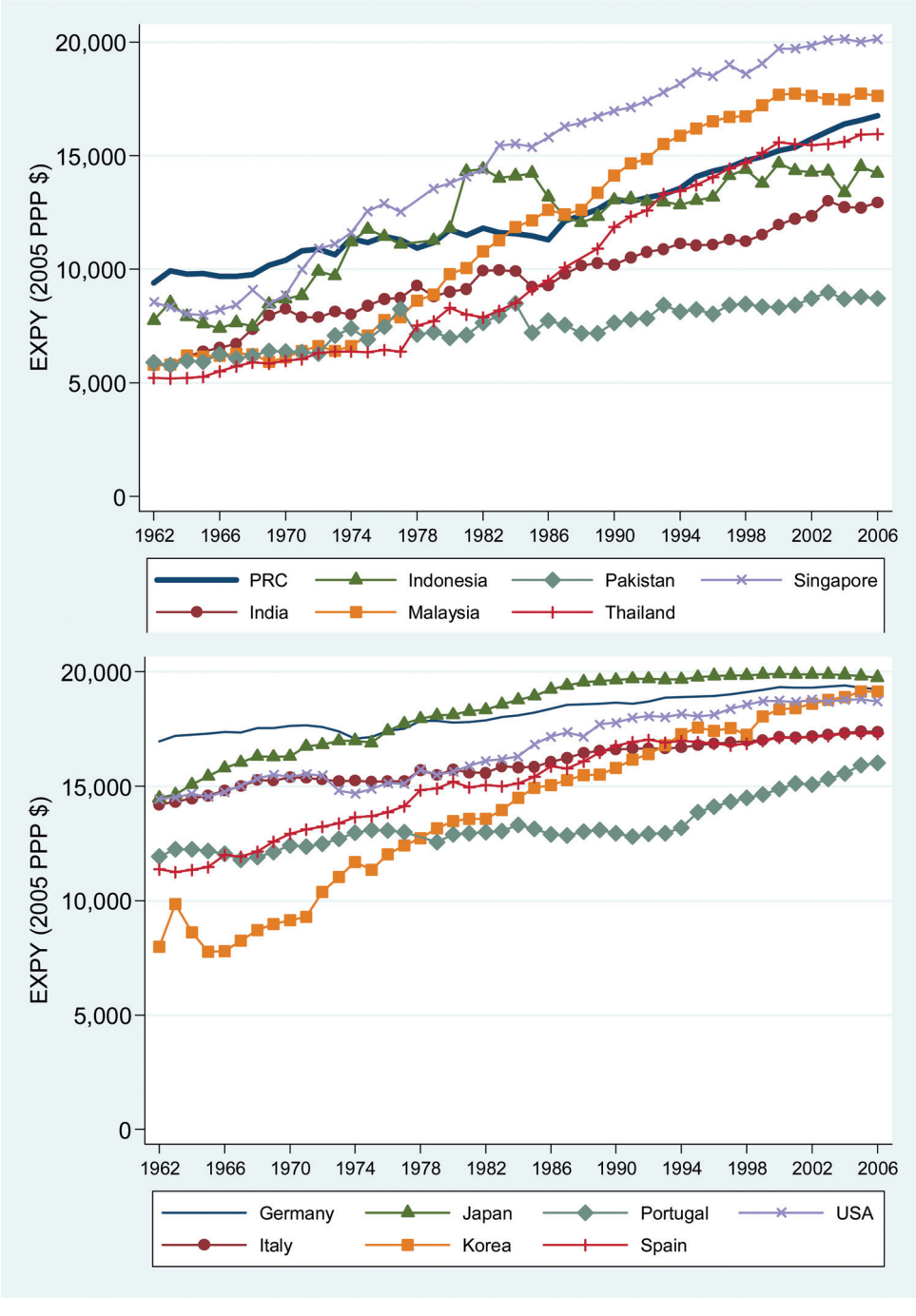


Fig. 1. *Level of sophistication of the export basket (EXPY).*
Source: Authors' calculations.

Figure 2 decomposes the level of EXPY into the contribution of Leamer's (1984) categories (see Appendix Table A1). The figure indicates that while in the 1960s animal and capital-intensive products contributed the most to the level of EXPY, by 2006 the largest contributor to EXPY was machinery.

Figure 3 shows the relationship between export sophistication (EXPY) and GDP per capita in 2006. The graph reveals that China's export package is very sophisticated given its income per capita.[11] Felipe (2010, Table 10.4) estimates that a 10% increase in EXPY at the beginning of the period raises growth by about half a percentage point. In our view, those who criticise today the role of export-led growth in China's policy miss the point that the true driver of growth has been the superb increase in the sophistication of its export basket.

Diversification is measured by the absolute number of products that a country exports with RCA.[12] This is shown in Figure 4, which indicates that in the early 1960s China already exported a significant number of products with RCA: 105 (out of a total of 779 in the analysis), well ahead of Korea, which exported only 41 products with RCA (and Brazil only 45). By 2006, China exported 269 products with RCA, marginally below the number of products exported with RCA by Italy and Spain (among the most diversified countries in the world) and above countries like Japan (192 products) and Korea (135 products). Since the 1960s, the number of products that China exported with RCA has increased very fast. For example, between 1975 and 1980, China gained RCA in 88 new products, and between 1985 and 1990 in another 68.[13]

To gain insight into the products that China exports, we have split them into Leamer's (1984) categories. They are shown in Table 1. The most sophisticated products are machinery (with an average PRODY of $19,549), chemicals (with an average

[11] Observers such as Xing (2011), have argued that Chinese exports are not as sophisticated once imports of components are taken into account. Even if the value-added component of China's exports was small (suppose that most exports were simple assembly work), it does not mean that China does not gain anything. Quite the opposite, we believe that during the last 40 years there has been a significant use and enhancement of the country's capabilities. These capabilities, depending on what they are, can be redeployed for the production of other products that require similar capabilities. Marvasi (2010) finds that China's exports are quite import dependent and that its imports are more sophisticated than its exports, a finding that we have corroborated. We certainly agree with this, but at the same time we would argue that most other developing countries cannot do what China does today. Even China's mere assembly and packaging of many products requires many different kind of capabilities to come together to make the supply chain work—something that most other developing countries only wish they had. Lack of one or more skills could potentially disrupt the whole supply chain, as argued by Kremer (1993) in his 'O-Ring Theory of Economic Development'. In other words, China's imports and exports require a level of capabilities that many other countries do not possess.

[12] The index of RCA is the ratio of the export share of a given product in the country's export basket to the same share at worldwide level (Balassa, 1965). Algebraically:

$$RCA_{ci} = \frac{xval_{ci} \Big/ \sum_i xval_{ci}}{\sum_c xval_{ci} \Big/ \sum_i \sum_c xval_{ci}}$$

. A country is said to have RCA in the export of a commodity if this index is greater than 1. The index of RCA can be a problematic indicator, especially if used for comparison of different products. For example, a country very well endowed with a specific natural resource can have an RCA in the thousands. However, the highest RCA in automobiles is about 2.

[13] These figures are the net gain, since China also lost RCA in some products during the periods considered. The net gain is the difference between the number of (new) products in which China acquired RCA and the number of (old) products in which China lost RCA.

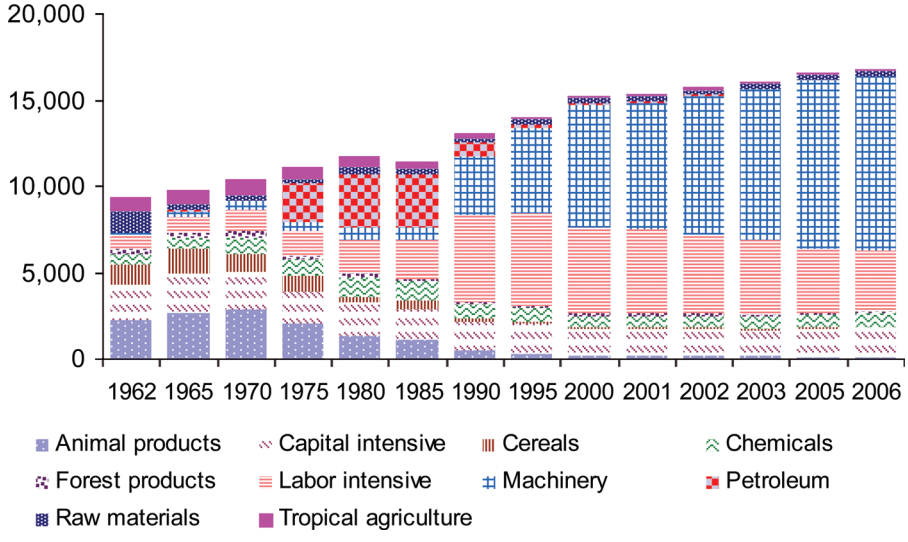


Fig. 2. *China: EXPY by Leamer's classification.*
Source: Authors' calculations.

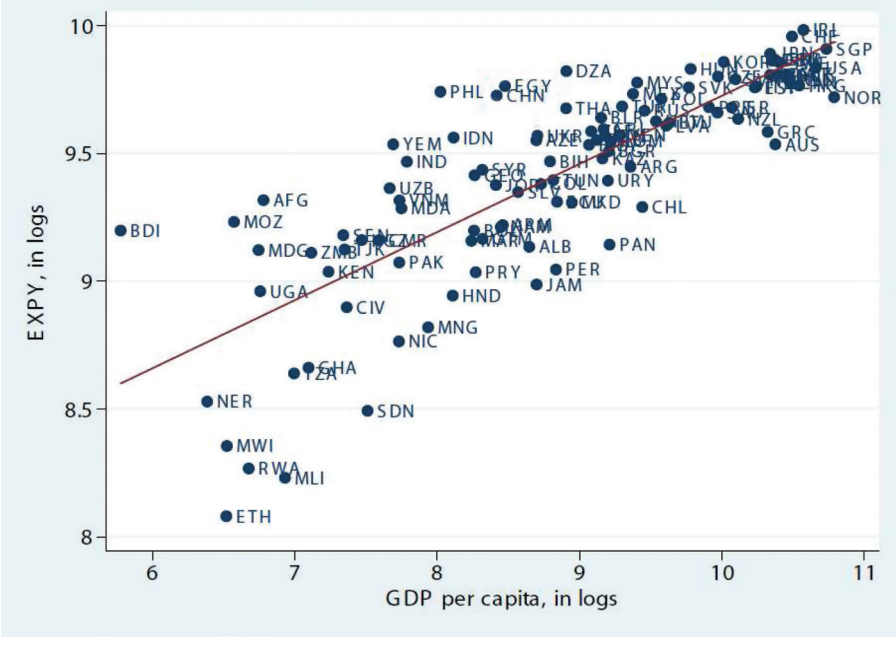


Fig. 3. *Export sophistication (EXPY) and GDP per capita, 2006.*
Source: Authors' calculations.

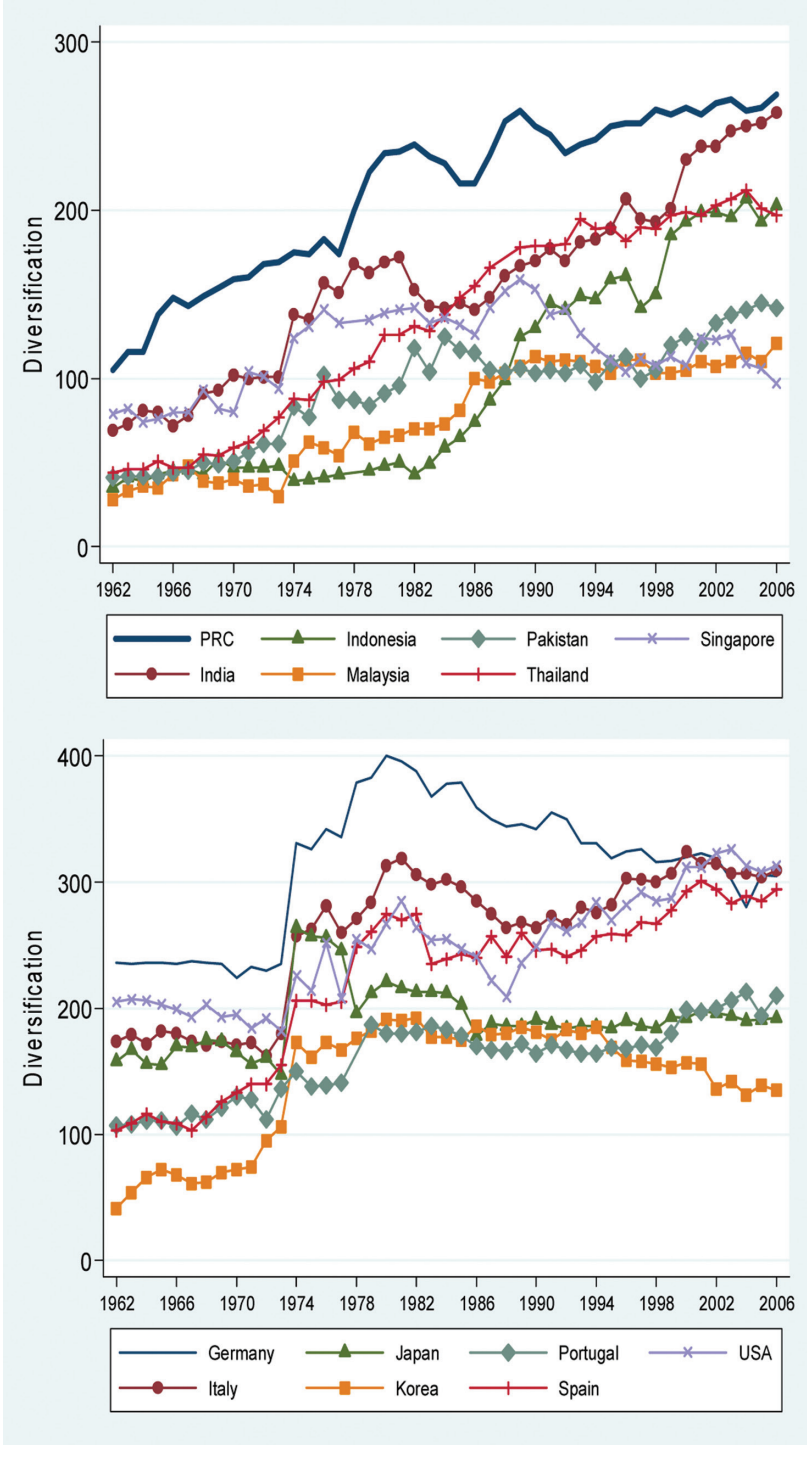


Fig. 4. *Diversification of the export basket.*
Note: There is a jump in 1973–74 that results from the oil price shock.
Source: Authors' calculations.

Table 1. *Export diversification according to Leamer's classification*

	1962	1965	1970	1975	1980	1985	1990	1995	2000	2005	2006
Petroleum	0	1	1	1	7	5	2	1	2	2	2
Raw materials	9	8	7	10	13	15	17	16	17	12	14
Forest products	3	6	5	4	6	4	4	5	8	7	7
Tropical agriculture	15	22	25	23	22	20	15	16	15	11	10
Animal products	18	24	22	28	30	23	21	19	18	10	10
Cereals	13	19	24	21	25	33	28	15	15	10	10
Labour-intensive	18	22	32	36	54	47	61	62	66	71	69
Capital-intensive (excluding metals)	15	14	15	21	31	34	37	37	39	45	47
Core commodities											
Metal products	7	7	10	9	14	10	19	20	21	20	23
Machinery	1	4	7	8	6	6	22	36	42	54	57
Chemicals	6	11	11	13	26	19	24	23	18	19	20
Total	105	138	159	174	234	216	250	250	261	261	269

Note: Metal products include iron and steel and manufactures of metals.
Source: Authors' calculations.

PRODY of $18,507) and metal products (with an average PRODY of $15,804). These are referred to as 'core' commodities. These three categories contain a total of 325 commodities (181 machinery, 95 chemicals and 49 metal products) out of the total 779, with an average sophistication level of $18,705 (the average sophistication level of the remaining commodities is $11,794).

Table 1 shows that China's progression has been impressive. In 1962, out of the 105 products exported with RCA, only 14 (or 13% of the total) were highly sophisticated, or 'core', products: six chemicals (three of which were products with a level of sophistication above $20,000; one of the other three, pyrotechnic articles, was exported with a very high RCA, 12.06. See footnote 12 for definition of RCA), seven metals and one machinery. The bulk of products that China exported with RCA was shared equally between tropical agriculture, animal products, cereals, labour-intensive and capital-intensive.[14]

By 2006, the number of total products exported with RCA had increased to 269, out of which 100 were core products (37% of the total). Of the three core categories, metal products has seen a steady increase, while the number of chemicals increased until about 1980 and then declined slightly. Naturally, there have been important shifts within metals and chemicals. Within the former, China has lost its RCA in the least sophisticated metals, where it had RCA in 1962, and has gained RCA in metal products that have significantly higher PRODY values.

[14] In 1962, Korea and Brazil exported fewer core products with RCA than China, seven and three, respectively.

Table 2. *Top 20 countries according to the number of core commodities exported with RCA, 2006*

	No. of products exported with RCA > 1	Average PRODY of products exported with RCA > 1	'Core' products	Average PRODY of 'core' products	GDP per capita 2006 (2005 PPP$)	Share of 'core' commodities (%)
Germany	305	18,155	195	19,707	32,334	63.9
USA	313	16,197	168	19,489	42,672	53.7
Italy	309	16,015	151	19,297	28,478	48.9
France	303	15,971	140	18,656	31,131	46.2
Japan	192	19,063	139	19,925	31,041	72.4
Austria	235	17,239	131	19,305	34,520	55.7
Netherlands	278	15,720	125	19,343	35,789	45.0
Switzerland	191	18,248	124	20,444	36,702	64.9
United Kingdom	215	17,345	121	19,871	32,941	56.3
Czech Republic	255	16,042	119	18,279	21,674	46.7
Spain	294	14,930	116	18,257	27,960	39.5
Sweden	197	18,238	113	19,751	33,432	57.4
Slovenia	214	16,185	104	18,549	24,766	48.6
China	**269**	**13,323**	**100**	**17,136**	**4,524**	**37.2**
Belgium	259	15,255	100	18,901	32,729	38.6
Denmark	227	16,017	95	19,945	34,440	41.9
Finland	163	17,671	94	18,922	32,056	57.7
Poland	256	14,404	91	16,682	14,648	35.5
India	258	12,124	88	17,557	2,416	34.1
Slovakia	193	15,379	86	17,368	17,535	44.6
Note:						
Korea (rank = 22)	135	16,974	81	18,986	23,884	60.0
Brazil (rank = 23)	195	13,290	81	16,881	8,745	41.5
Russian Federation (rank = 41)	113	14,054	53	15,296	12,797	46.9

Source: Authors' calculations.

There are two important observations to make. The first is that China still exports a high number of labour-intensive products with RCA, a total of 69 (the largest group). Second, the most remarkable change has taken place within machinery: from one single product exported with RCA in 1962 (railway and tramway freight not mechanically propelled, PRODY = $10,663, RCA = 2.32) to 57 in 2006. China lost its RCA in transport equipment for railway and tramway freight, but has gained RCA in equipment for ships and boats. Moreover, it has already gained RCA in most telecommunication and electronics equipment, as well as in a number of industrial and office equipment items.[15] The unweighted average PRODY of the core products exported by China with RCA has increased from $14,741 in 1962 to $16,307 in 1980.[16]

[15] Rodrik (2006B) also examines the evolution of China's exports and argues that even though labor-intensive products have always been an integral part of China's exports, its current export basket also contains a variety of sophisticated products. Our analysis corroborates this point.

[16] The weighted (by the export shares) averages are $7,893 in 1962, $8,096 in 1980 and $14,888 in 2006. This shows a clear shift to products with higher PRODY within the core.

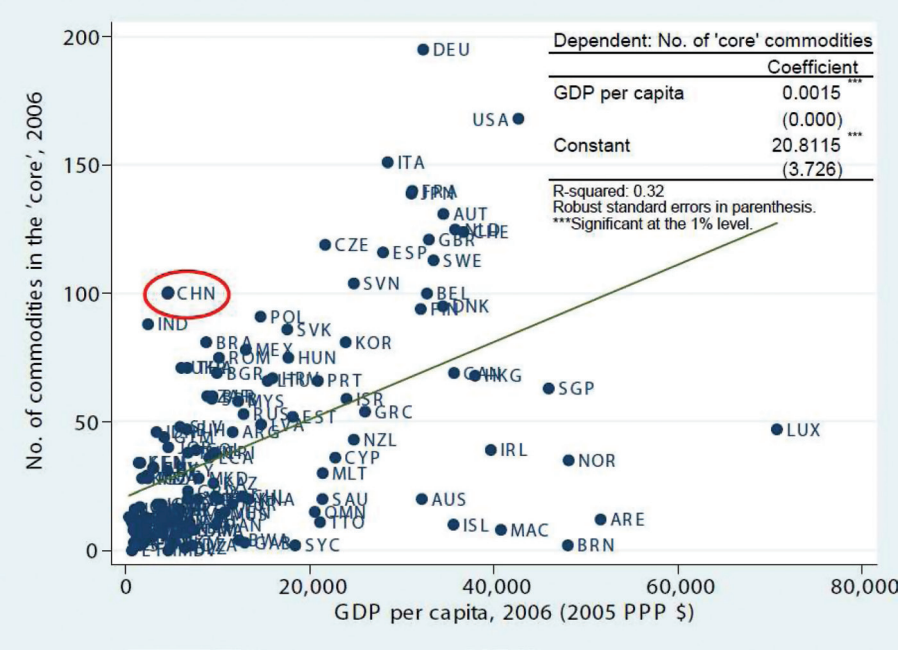


Fig. 5. *Number of 'core' commodities and GDP per capita, 2006.*
Source: Authors' calculations.

A comparison of China with other countries is truly revealing. Table 2 shows the number of products exported with RCA and the unweighted average level of sophistication (PRODY) of these products, the number of core products exported with RCA (the ordering of the countries is based on this variable) and the unweighted average level of sophistication (PRODY) of these products, GDP per capita of the country, and the share of the number of core products exported with RCA in the total number of products exported with RCA. As it could be expected, all these countries are developed (see Figure 5), with the exceptions of China and India, ahead, of, for example, Brazil and Russia (China is also ahead of South Korea). These countries are shown at the bottom of the table. See the analysis in Felipe *et al.* (2010A, 2010B).

What does China export today? Table 3 shows the export shares of the top 20 products (exported with a share of at least 1%), their level of sophistication (PRODY) and the RCA index. The table reveals the following: (i) about half of these products have a sophistication level of about $20,000; (ii) the products with the highest export share in China's total exports are 'parts and accessories for machines', with a share of 4.68%, and 'peripheral units', with a share of 4.11%; and (iii) the products with the highest RCA are 'children's toys' (RCA = 5.01), 'digital data processing machines' (RCA = 4.49) and 'travel goods' (RCA = 4.41).

Finally, we have also analysed the extent to which the products that China exports are unique or not. Figure 6 plots the number of products exported with RCA against

Table 3. *Top 20 exports, 2006*

Code	Commodity	Leamer's Classification	PRODY	Export Share (%)	RCA
7599	Parts, nes of and accessories for machines of headings 7512 and 752	Machinery	20,505	4.68	2.24
7525	Peripheral units, including control and adapting units	Machinery	19,438	4.11	3.07
8942	Children's toys, indoor games, etc.	Labour-intensive	19,086	3.61	5.01
7643	Television, radio broadcasting; transmitters, etc.	Machinery	22,238	3.50	1.91
7649	Parts, nes of and accessories for apparatus falling in heading 76	Machinery	21,053	3.47	2.29
7522	Complete digital data processing machines	Machinery	18,606	3.07	4.49
8510	Footwear	Labour-intensive	9,997	2.83	3.77
7638	Other sound recording and reproducer, nes; video recorders	Machinery	19,579	2.58	3.81
7764	Electronic microcircuits	Machinery	20,984	2.36	0.84
8310	Travel goods, handbags, etc. of leather, plastics, textile, others	Labour-intensive	12,957	1.54	4.41
7641	Electrical line telephonic and telegraphic apparatus	Machinery	20,649	1.50	2.91
8219	Other furniture and parts thereof, nes	Labour-intensive	13,763	1.36	2.33
8439	Women's, girls', infants' outer-wear, textile, not knitted or crocheted; other outer garments of textile fabrics, not knitted or crocheted	Labour-intensive	8,522	1.33	3.36
7788	Other electrical machinery and equipment, nes	Machinery	16,447	1.31	1.55
7611	Television receivers, colour	Machinery	15,755	1.29	1.81
7721	Switches, relays, fuses, etc.; switchboards and control panels, nes	Machinery	16,544	1.26	1.06
7712	Other electric power machinery, parts, nes	Machinery	20,237	1.23	2.86
8451	Outerwear knitted or crocheted, not elastic nor rubberised; jerseys, pullovers, slipovers, cardigans, etc.	Labour-intensive	8,045	1.20	3.37
8459	Outerwear knitted or crocheted, not elastic nor rubberised; other, clothing accessories, non-elastic, knitted or crocheted	Labour-intensive	8,085	1.12	3.21
8710	Optical instruments and apparatus	Machinery	21,226	1.08	2.75

Source: Authors' calculations.

an index of standardness of the products exported.[17] A lower value of standardness indicates that the products exported are more unique (i.e. exported by fewer countries). The best positioned countries are those in the fourth quadrant (high diversification and more unique products), while the worst are those in the second quadrant (low diversification and standard products).[18] Figure 6 indicates that China is in the fourth quadrant, together with most of the developed countries. In Asia, only Japan, Singapore, Korea, Malaysia and Hong Kong export more unique products than China, but all of them export fewer products with RCA. Figure 7 shows the relationship between standardness and GDP per capita in 2006. The figure shows that, given its income per capita, China has a highly unique export package.

3. Comparative advantage or industrial policy?

Hidalgo *et al.* (2007) argue that the production (and export) of different products requires different and very specific capabilities (resources—both human and physical knowledge of markets, legal system, institutions, etc.). For example, the capabilities required to successfully export oranges are very different from those required to export furniture. What differentiates these capabilities is that some of them can be easily redeployed into the production and export of many other products. This is the case of, for example, heavy machinery or transportation. However, there are many other products that require very specific capabilities that cannot be easily redeployed. This is the case of natural resources, such as oil.

Hidalgo *et al.*'s (2007) recently developed concept of product space encapsulates these ideas. The product space uses network theory to produce a graphical representation of all the products exported in the world. The rationale is that if two goods need the same capabilities, a country should show a higher probability of having RCA in both.

The product space is highly heterogeneous. Some peripheral products are only weakly connected to other products. Some groupings appear among these peripheral goods, such as petroleum products, seafood products, garments and raw materials. These products provide countries with a nature-based RCA. In the centre of the network is a core of closely connected products, mainly machinery, chemicals and capital-intensive (metal) products. Nature does not provide an advantage in these products. When acquired, it is man-made. The heterogeneous structure of the product space has important implications for structural change. Products in the periphery are less sophisticated and with a lower income elasticity of demand for exports than those in the core. That is, not all products are the same qualitatively as carriers of economic development. If a country produces goods in a dense part of the product space, then structural transformation is much easier because the set of acquired capabilities

[17] Specifically, standardness is the average ubiquity of commodities exported with RCA for each country c and is calculated as: $\frac{1}{\text{diversification}_c}\sum_i \text{ubiquity}_{ic}$, where diversification is the number of products exported by country c with RCA and ubiquity of commodity i is the number of countries exporting commodity i with RCA (Hidalgo and Hausmann, 2009).

[18] The negative relationship between both variables remains when we use the number of core commodities or the percentage of core commodities (out of the total number of commodities exported with RCA) instead of standardness.

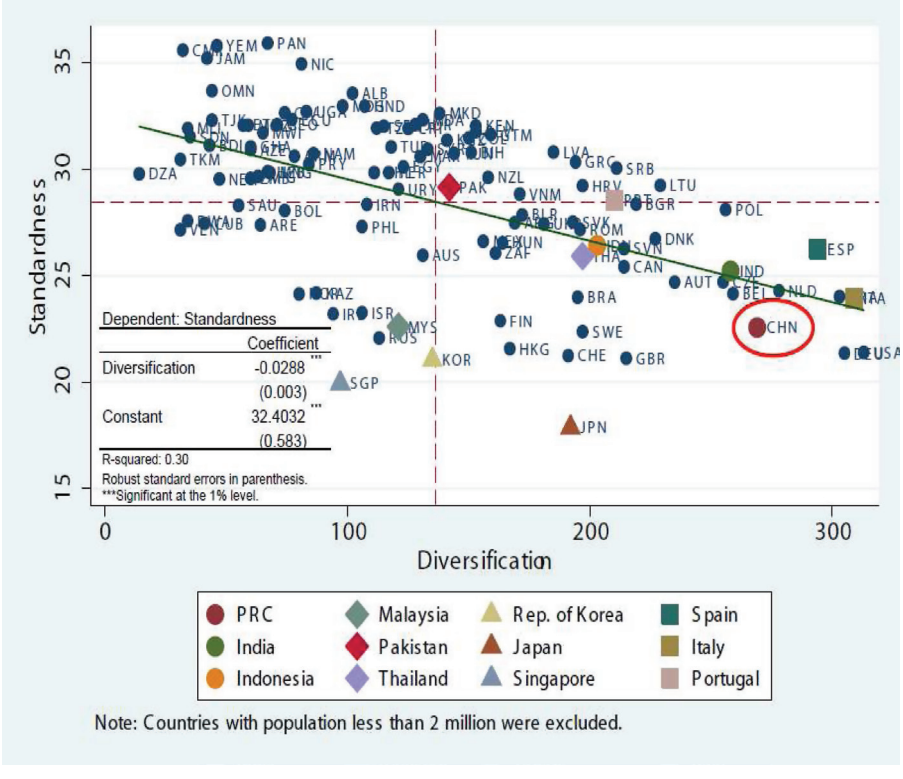


Fig. 6. *Diversification and standardness, 2006.*
Source: Authors' calculations.

can be easily redeployed to the production of other nearby products. However, if a country specialises in the peripheral products, this redeployment is more challenging, as no other set of products requires similar capabilities. The conclusion is that a country's position in the product space signals its capacity for structural transformation. China's orientation and position in the product space can be understood by looking at Table 1.[19]

In 1980, at the start of reforms, China already exported a total of 234 products with RCA, with 46 in the core (of which 40 were metals and chemicals) and 11 out of the latter had a sophistication level of $20,000 or above.[20] And certainly China had set a very strong presence in the garments (labour-intensive) and textiles (capital-intensive) clusters. Arguably, the most remarkable change probably occurred between 1985 and 1990, when China got into electronics (grouped under machinery in Leamer's classification). As Table 1 indicates, in 1980 and 1985, China had RCA in the export of only

[19] For a visual representation of China's orientation in the product space, the reader is referred to the working paper version of this article (Felipe *et al.*, 2010).

[20] In 1962, out of the 14 products in the core exported with RCA, only three had a level of sophistication of $20,000 or above. In 1970 the number of products in the core exported with RCA and with a level of sophistication above $20,000 had increased to eight (including 'rails and railway track construction materials', at $30,678), then to 19 in 1995 and to 29 in 2006 (see Table 1).

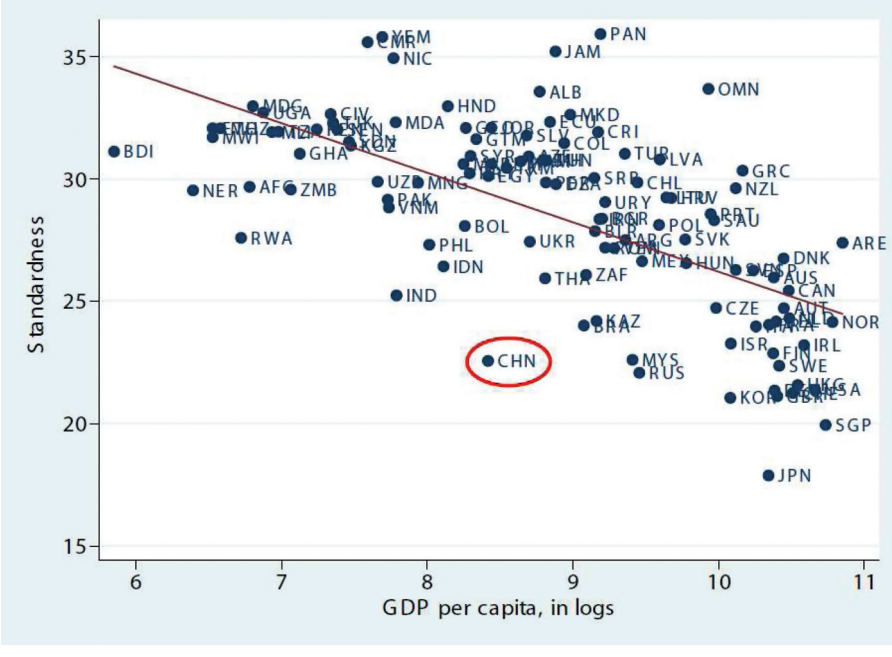


Fig. 7. *Standardness and GDP per capita, 2006.*
Source: Authors' calculations.

six machinery products. Between 1990 and 2006, the number of machinery products exported with RCA increased to a total of 57.

Table 1 shows that China continues to export with RCA a significant number of products in the labour-intensive category (a total of 69 products in 2006). However, it also reveals that the number of core products China exports with RCA is quite impressive. In our view, the only way to understand this is by acknowledging China's increasing capacity to master and accumulate capabilities and the role played by industrial policy (Table 4).[21,22] China started setting up export-processing zones as a key strategy to learn from foreign firms in the advanced countries when these restructured their global production networks (Zhang and Song, 2000) and this way accumulated

[21] There is still a debate going on about the usefulness of industrial policy. The fact is that Western developed countries used industrial policy since the fifteenth century to protect and develop the manufacturing sector. See the detailed analyses in Chang (2002) and Reinert (2007) and the debate between Lin and Chang (2009). In our view, it is impossible to understand how rich countries got rich without being aware that they heavily protected their industries when they were taking off. China is doing nothing different. It is simply replicating what many other countries, including the USA, did (e.g. set industry standards, regulations, buy-local policies, procurements, patent laws advantageous to domestic producers, etc.) to build their own industries.

[22] In recent work, Rawski (2010) argues that China's success is the result of a historical process that endowed Chinese workers with strong organisation and economic capabilities. These capabilities are legacies accumulated over decades and centuries prior to the establishment of the People's Republic in 1949. Specifically, he argues that the 'accelerated growth during the post-1978 reform era rests on a long-term historical accumulation of skills and capabilities that extend far beyond the typical complement of human assets available to low-income nations' (Rawski, 2010, p. 6).

capabilities.[23] The landmark foreign direct investment (FDI) legislation was the Equity Joint Venture Law of 1979 (Table 5). The result is that, today, the vast bulk of Chinese exports are produced by foreign multinationals.[24] The law was historic in that it signified a reversal of the political stance against economic opening and in that it laid the foundation for the foreign investments that have emerged since 1979. In 1986, the State Council released a document entitled 'Regulations to Encourage Foreign Investments' to shift the FDI regime from 'permitting' to 'encouraging' FDI. The regulations allowed export-oriented and technologically advanced foreign firms to enjoy various benefits relating to taxes, credit, input charges, labour management, export rights and foreign exchange requirements. Foreign investors were required to enter joint ventures with domestic firms for technology transfer (Yueh, 2009).[25] China was able to bargain effectively with foreign investors because of the leverage of its large market size.[26]

Also, the jump into the electronics cluster in the 1990s (driven by foreign firms) was the result of participation in global value chains (Felipe, 2010, pp. 249–52). The evidence, consistent with the discussion in this paper, is that China has done a great deal of impressive catching up through mechanisms such as 'original equipment manufacturer', 'original design manufacturer' and 'original brand manufacturer'. This shift into electronics was possible only because China had previously acquired the capabilities necessary to assemble and export these goods. While socialist controls and regulations inhibited private enterprise, the positive legacy is that they provided a solid foundation for the forthcoming growth, e.g. wide access to education and health, highly egalitarian land distribution, increased female labour force participation, a system of economic regional decentralisation and a very active government that promoted technological development.[27]

[23] This took place after the currency realignment following the Plaza Accord (1985), which led to a significant appreciation of the yen.

[24] Manova and Zhang (2009) decomposed Chinese exports in 2005 by ownership type as follows: foreign-owned, 50.4%; joint ventures, 26.3%; private domestic, 13.1%; and state-owned, 10.3%.

[25] Observers, such as Gilboy (2004), argue that China continues to rely heavily on foreign-invested enterprises for transfer of technology and that these foreign firms account for a large share of China's exports. While this is true, Rodrik (2006B, p. 19) notes that 'Domestic firms play a significant role in China. In fact, 100% foreign-owned firms are a rarity among the leading players in the industry. Most of the significant firms tend to be joint ventures between foreign firms and domestic (mostly state-owned) entities.' Our interpretation is that, FDI (joint venture or wholly owned) has allowed to transfer technology and capabilities that are redeployed for the production and export of other products. The key to China's growth is not who (foreign, domestic or joint-venture entities) will produce more sophisticated products, but whether China will be able to jump on to more sophisticated, higher-income products. Of course, this will require some institutional changes to protect intellectual property, to encourage domestic research and development, and venture capital, which will require the development of capital markets.

[26] We have to add the role played by the undervaluation of the yuan: in the words of Rodrik (2010), 'a kind of industrial policy'. See also Rodrik (1986) and Polterovich and Popov (2004).

[27] Bardhan (2008, p.1) argues that there are three important myths about how globalisation has stimulated China's (and India's) recent rapid growth. The standard argument, he claims, is that 'decades of socialist controls and regulations stifled enterprise in India and China and led them to a dead end. A mix of market reforms and global integration finally unleashed their entrepreneurial energies. As these giants shook off their "socialist slumber", they entered the "flattened" playing field of global capitalism. The result has been high economic growth in both countries and correspondingly large declines in poverty.' Regarding China, he argues that the country had already achieved growth rates of about 9% per annum between 1978 and 1993, higher than those of the successful East Asian countries between 1960 and 1980. Regarding poverty, about two-thirds of the decline in extremely poor people between 1981 and 2004 had taken place by the mid-1980s. This large decline was probably related to domestic factors and not to global competition. These factors included (i) a significant increase in agricultural productivity following decollectivisation, (ii) a land reform programme and (iii) increased farm procurement prices.

Table 4. *China's industrial policy.*

State ownership	Was extremely high as a result of Communist takeover, but thousands of state enterprises have been privatised or shut down as the economy underwent massive market restructuring
Subsidised credit	Still significant subsidised credit through state-owned banks, directed at state enterprises
Tax incentives	Strongly biased towards foreign investment and high technology
Tariff and non-tariff protection	Levels have come down significantly with World Trade Organization (WTO) entry, but still significant non-tariff barriers
Foreign direct investment (FDI) targeting	Initially there was very strong control on FDI. Then, policy changed strategically: country opened up and favoured cutting-edge investment in key areas; foreign firms have come to use China both as an export platform, low-cost manufacturing hub and for its large domestic market; the government has been effective at creating strong competition among foreign firms and induced them to bring best technologies
Local content requirements	Important mechanism to develop backward linkages succeeded because of capabilities of domestic firms
Intellectual property rights	Weak until required to update as part of WTO accession in 2001; enforcement is weak and is likely to become a very controversial issue in future in relations with developed countries
Government procurement	Important mechanism to develop national firms in many areas; effective use of national standards to support competitiveness of indigenous firms
Promoting large domestic firms	Multiple instruments used to create world-class indigenous (public and private) companies to compete with multinational corporations domestically and eventually abroad

Source: Dahlman (2009, p. 307).

What lies behind this progression? In the product space model, development is a path-dependent process. There is no growth trajectory that acts as a 'centre of gravity' towards which the economy is inexorably and inevitably drawn. Long-term growth and development depend on a succession of short- and medium-term developments along a historical adjustment path. During the 1960s and 1970s, China had already made inroads into the core of the product space. This was part of China's industrialisation drive since the 1950s. It was deliberate and policy induced, a stated objective of Chinese policy makers (Wilcox *et al.*, 1962, pp. 80–100; Wang and Li, 1995). Using data for 2000, Felipe and Estrada (2008) estimate that China's actual manufacturing sector as a share of GDP in 2000 (34.5%) was about seven percentage points above what a regression of this share on income per capita (and its square), population and openness predicted (27.5%). This is consistent with the old notion that manufacturing is the 'engine of growth' embedded in *Kaldor's first law* (Kaldor, 1967; Felipe *et al.*, 2009; see also Rodrik, 2006A) and with the fact that growth accelerations are associated with structural changes in the form of increases in the share of manufacturing (Hausmann *et al.*, 2006).

The heavy industrial expansion and huge capital construction projects undertaken during the 1950s (employing labour-using and capital-saving methods), together with the speedy introduction of modern technology (assistance from the Soviet Union), led to very significant increases in industrial production, electric power and steel

Table 5. *Major foreign direct investment (FDI) laws after 1978*

Laws and regulations	Key components
Equity Joint Venture Law (1979)	Laid down the foundation for successive laws on FDI, including income tax and labour management
Wholly Foreign-owned Enterprises Law (1986) andSino-Foreign Cooperative Joint Venture Law (1988)	Developed a legal infrastructure governing the three main forms of foreign-invested enterprises (FIEs)—equity joint ventures, cooperative joint ventures and wholly foreign-owned—and devising favourable policy treatments for FDI
Regulations to Encourage Foreign Investments (1986)	Shifted FDI policy from 'permitting' to 'encouraging' FDI; separated FIEs into two categories—those qualifying for favourable treatments (export-oriented and technology-advanced FIEs) and those qualifying for normal treatment; and qualified FIEs enjoyed benefits related to taxes, credit access, input charges, labour management, export rights and foreign exchange balance requirements
Provisional Regulations for Guiding the Direction of Foreign Investment (1995, revised 1997)	Laid out a positive and negative list of economic sectors and official intentions of investment priorities; FDI-involved projects are divided into four categories—encouraged, allowed, restricted and prohibited

Source: Authors.

output (Wilcox *et al.*, 1962, p. 92, Table 5). We insist that we do not argue that the industrial policies before market reforms were introduced were completely successful. Without any doubt, they led to a lot of waste, miscalculations, low-quality products, poor planning and inefficiencies. It is likely that the capabilities created were not well utilised and scarce resources were wasted under ambitious government policies. Our point is that the reason why in 1980 China could export 234 commodities with RCA (46 of them in the core) is that during the previous decades it had mastered and accumulated a large number of capabilities and know-how. Only this way could Chinese entrepreneurs respond to the market incentives created by the market reforms. For decades, China protected its industry and slowly allowed it to graduate to the international market. Moreover, China's trade as far back as the 1950s was 'an absolutely crucial element (necessary, but not sufficient) in its headlong modernisation. Imported machinery and equipment, embodying modern technology, contributes an output-raising potential that substantially outweighs short-run costs … Without trade many years of painful technological growth would be required' (Wilcox *et al.*, 1962, pp. 90–1).[28]

Can this fast process be equated with what is referred to in the literature as leapfrogging, i.e. the idea that some stages of development can be bypassed (supported by government-led industrial policy) in an attempt to move faster up the development

[28] Felipe (2010, pp. 127–30) argues that for countries lagging behind the technological frontier, endogenous technical progress is partly dependent on the acquisition and mastery of more advanced production techniques from the leader countries, which, in turn, depends on the country's capabilities. If technology is sector specific, its diffusion from the more to the less advanced countries will be faster the higher the degree of structural similarity between them.

ladder? Our view is that leapfrogging is not supported by careful empirical and firm-level research (Hobday, 1995).[29] Case studies suggest that firms acquire technology through a costly, difficult and incremental learning process. The notions of learning and capability accumulation contradict the idea of leapfrogging. China's firms did not leapfrog from one vintage of technology to another. On the contrary, firms engaged (and still are) in a painstaking and cumulative process of technological learning. The route to advanced electronics and information technology has been a long, difficult learning process, driven by the manufacture of goods for export. Moreover, as shown in Table 1, of the 269 products that China exported with RCA in 2006, the largest category was labour-intensive products (a total of 69, or 25% of the total).

Given that in 1950 China was a very poor and backward economy, our interpretation of this evidence is that the country's progress during the next three decades was remarkable and difficult to square with the conclusion that growth had been essentially due to factor accumulation and that technical progress had been absent (see Chow, 1993; Felipe and McCombie, 2002, 2011). Our view of China's development is consistent with the key characteristic of development embedded in the product space, namely, that it is path dependent. For developing countries to move fast in the product space and reach the core, they often need to defy their comparative advantage as determined by their factor abundance. China's impressive progression and growth after the introduction of market reforms cannot be understood without factoring in the capabilities that had been developed and accumulated over the three decades under the planning system and prior to the introduction of market reforms. Without these capabilities, entrepreneurs could not respond to the incentives created by the market reforms.[30] As we noted above, these policies misallocated some resources, but this does not mean that economic performance was poor. The conclusion is that if China had not proceeded this way, today it would be a much poorer country.[31]

4. China's 'open forest'

Another complementary way of analysing how China has progressed during the last 40 years is to look at the country's (future) export opportunity set at different points in time. Hausmann and Klinger (2006) provide a measure of a country's export

[29] Kim (1997) described Hyundai's efforts to produce a car after it had purchased the foreign equipment, hired expatriate consultants and signed licensing agreements with foreign firms as follows: 'Despite the training and consulting services of experts, Hyundai engineers repeated trials and errors for fourteen months before creating the first prototype. But the engine block broke into pieces at its first test. New prototype engines appeared almost every week, only to break in testing. No one on the team could figure out why the prototypes kept breaking down, casting serious doubts even among Hyundai management on its capability to develop a competitive engine. The team had to scrap eleven more broken prototypes before one survived the test. There were 2,888 engine design changes … Ninety-seven test engines were made before Hyundai refined its natural aspiration and turbocharger engines … In addition, more than 200 transmissions and 150 test vehicles were created before Hyundai perfected them in 1992' (Kim, 1997, p. 129). This is far from the notion of leapfrogging.

[30] We have to add that despite the erroneous agricultural policies that precipitated the famine of 1960–61 and again slowed agriculture during the 'Cultural Revolution' of 1966–67, China's progress in agriculture during 1962–2000 was remarkable (Lin, 1998).

[31] Rodrik (2006B, p. 5) argues that although it is hard to determine the extent to which the sophistication of China's export basket is due to its unorthodox policy regime, it is 'not too much of a stretch to imagine that China's industrial structure has been shaped by policies of promotion and protection, just as in the cases of earlier East Asian Tigers'.

structure that captures the flexibility of an economy to adapt to external shocks and encapsulates the potential for further structural change. This measure, which they call *open forest*, is a weighted average of the *sophistication* of all potential export goods of a country (i.e. those goods not yet exported with RCA), where the weight is the *density* or distance between each of these goods and those currently exported with RCA. *Density* (distance) in this context is not a physical concept; rather, it measures how close (far) a commodity not exported with RCA is to the country's export basket. It is a proxy for the probability that a country can successfully export a 'new' product (i.e. that it acquires RCA in it) given its current set of capabilities.[32] Open forest captures the (expected) value of the goods that the country could potentially export, i.e. the products that it currently does not export with RCA. This value, therefore, depends on how far the goods not exported with RCA are from the goods exported with RCA (i.e. distance, or the probability that the country can export them) and on how sophisticated the good not exported with RCA are.

We have calculated *open forest* for China and for a group of comparator countries since the 1960s. This is shown in Figure 8. China's open forest in 1962 was $1,003 (in thousands, 2005 PPP$). It ranked twenty-first in the world. By 2006 its open forest had increased to $2,414, the ninth largest in the world.[33]

As we argued in the previous section, this phenomenal progression is the result of path dependency. Once China had set a foot into the core, it could diversify and upgrade its export basket quickly. In other words, once the country gained RCA in some sophisticated products in the core, it became easier to 'move around'. These products are 'close' to many other sophisticated products (e.g. other types of machinery or chemicals) in the sense that there is a high probability that China can export them successfully (i.e. that it can acquire RCA), because they use capabilities that are similar to the ones that the country already possesses.

What about those commodities located 'far' from the current basket (i.e. high distance and, hence, low probability that China acquires RCA in them)? These products tend to be unsophisticated (e.g. natural resources and some agricultural products) and therefore contribute little to open forest. Therefore, even though China has gained

[32] Algebraically: $Open\_Forest_c = \sum_j \left[\frac{\sum_i \phi_{ij} x_{ci}}{\sum_i \phi_{ij}} (1 - x_{cj}) PRODY_j \right]$, where $\omega_{cj} = \frac{\sum_i \phi_{ij} x_{ci}}{\sum_i \phi_{ij}}$ is the density and $x_{ci,cj} = \begin{cases} 1 \text{ if } \mathrm{RCA}_{i,j} \geq 1 \text{ for country } c \\ 0 \text{ if } \mathrm{RCA}_{i,j} < 1 \text{ for country } c \end{cases}$; ϕ_{ij} denotes the proximity or probability that the country will shift resources into good j, given that it exports good i; $PRODY_j$ is a measure of the sophistication of product j (not exported with RCA); and $\omega_{cj} PRODY_j$ is the expected value (in terms of the sophistication of exports) of exporting good j. First, we calculate the number of products which China currently exports with RCA (i.e. RCA > 1). Second, we calculate the sophistication of all products. Third, we calculate the distance between the current export basket (i.e. the products that China currently exports with RCA) and each of the products not currently exported with RCA. Fourth, we compute open forest as the sum of the multiplications *density* times *sophistication* (for the products not exported with RCA).

[33] The 10 largest open forest values in 2006 were (in thousands, 2005 PPP$): Poland, $2,618; Spain, $2,551; India, $2,548; Lithuania, $2,501; Czech Republic, $2,499; Italy, $2,462; Denmark, $2,436; Bulgaria, $2,435; China, $2,414; and Belgium, $2,401. See Felipe et al. (2010).

RCA in the export of 269 products, still many of the products that it does not export with RCA are highly sophisticated and in the core (there are 325 core products and China exports 100 of them with RCA), and the probability of exporting them is high. Hence, China's high open forest.

Finally, we have estimated a regression of open forest on income per capita (and its square), the investment–output ratio and the number of export destinations using data for 105 countries for 2006. The curved line in Figure 9 provides the expected value of open forest given income per capita; to draw it, we fix the investment–output ratio and the number of export destinations at the sample averages, 22.7% and 132, respectively. The results indicate that China's expected (i.e. predicted by the regression) open forest ($2,107,000), given the values of the three right-hand-side variables, is below the actual one ($2,414,000). This reinforces the conclusion that China's future is bright.

How can China acquire RCA in some of these products? China needs to develop and carefully implement a set of policies that allow its firms to take advantage of the huge potential warranted by their privileged position in the product space. Given the success achieved during the last 50 years, policy makers need to measure well the *amount* of intervention that they exert and think more about the *quality* of these interventions. For example, at this point, China does not need to take strategic bets, i.e. to try to gain RCA in products that require capabilities that China has not acquired yet. The country needs first to develop the necessary capabilities to successfully export these products. Likewise, support to new activities (e.g. the provision of specific public inputs, tax breaks and subsidies) has to be guided by very clear sunset clauses and performance benchmarks, and policy makers have to learn to identify sectors that have no future as quickly as possible and, hence, to stop supporting them.

5. Conclusions: what lies ahead and what China should do

In this paper we have discussed China's impressive performance since the 1960s as a result of its capacity to accumulate and master capabilities. China's increasing capabilities are reflected in the number of products exported with RCA (degree of diversification) and in the increasing sophistication of its export basket.

The analysis indicates that by 1962, China had acquired RCA in the export of 105 products (out of 779 in our analysis), although only 14 were 'core' products (metals, chemicals and machinery) with a significant level of sophistication. By 1980, when transition started, China had already attained RCA in the export of a significant number of products, a total of 234 (of which 46 were core products, mostly chemicals and metals), and it already had a relatively high index of export sophistication (given its income level). Despite the hardship imposed by the Great Leap Forward, the Cultural Revolution and all the inefficiencies of the planning system, it is difficult to square these gains, which had to entail significant structural transformation of the Chinese economy as well as mastering of a significant number of capabilities, with lack of technical progress (however broadly defined). Our analysis indicates that the government's priority industries did not necessarily go against China's factor abundance, as the country has gained RCA in the export of both labour-intensive and sophisticated products. This strategy has paid off, as there is no doubt that a country with an inefficient industrial sector is better off than one with a weak or no industrial sector at

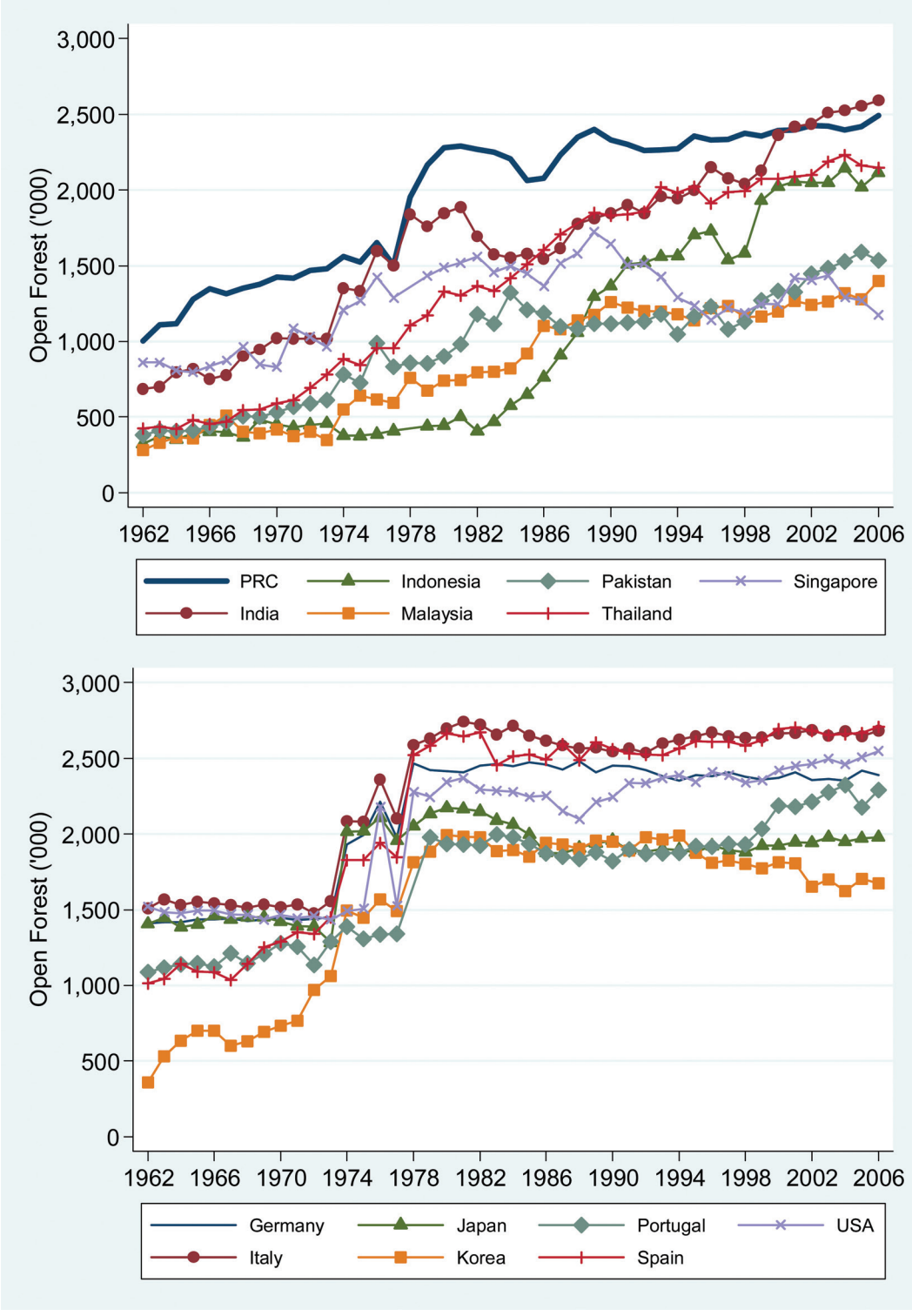
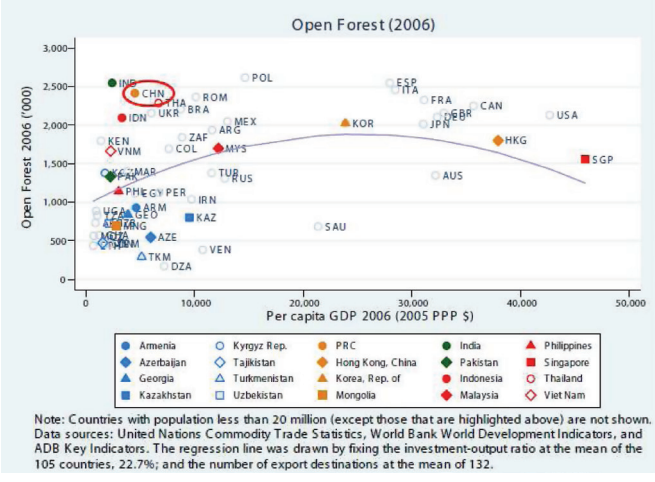


Fig. 8. *Trend in open forest.*
Source: Authors' calculations.



Note: Countries with population less than 20 million (except those that are highlighted above) are not shown. Data sources: United Nations Commodity Trade Statistics, World Bank World Development Indicators, and ADB Key Indicators. The regression line was drawn by fixing the investment-output ratio at the mean of the 105 countries, 22.7%; and the number of export destinations at the mean of 132.

Dependent: Open Forest	Coefficient
GDP per capita	0.073263 ***
	(0.015)
GDP per capita^2	-0.000001 ***
	(0.000)
Investment-output ratio	25.80148 ***
	(8.424)
No. of export destinations	10.70858 ***
	(2.674)
Constant	-1037.917 ***
	(363.929)

R-squared: 0.53
Robust standard errors in parenthesis.
***Significant at the 1% level.

Fig. 9. *Opportunities for economic transformation: open forest, 2006.*
Source: Authors' calculations.

all.[34] This evolution helps explain the shift that occurred during the late 1980s, when China truly set foot into the core of the product space and, in particular, into electronics and machinery. By 1990 the number of core products exported with RCA had reached 65.

By 2006, China's export basket was highly sophisticated and one of the most diversified in the world: it exported 269 products with RCA, of which 100 were core products. No other developing country can match China's spectacular performance. We have argued that this was the result of industrial policies that allowed the accumulation of product-specific capabilities. In our view, if in 1950 China had tried to go 'the other way', probably today it would be a much poorer country.

A measure of the future export opportunities reveals that China is extremely well positioned to continue performing very well. From a policy perspective, this analysis, together with that on sophistication and diversification, indicates that Chinese policy makers should not feel pressure and rush to undertake major interventions and reforms, as the country has achieved a relatively high level of sophistication and diversification in its export basket, as well as a very large potential export opportunity set. In simple terms, 'let it be'.[35] As Felipe *et al.* (2010C) show, over two-thirds of the products that China exports with RCA are products well connected in the product space.[36] So far, an unorthodox and gradualist development path, based on implementing well-focused

[34] Some may disagree with this statement. Certainly, we are not supporting the creation of white elephants and we are not saying that *anything goes* for the sake of creating an industrial sector. What we argue is that it has long been understood that having an industrial sector leads higher real wages (than having no industrial sector at all). The consequence is that, if inefficient, the sector should be reformed to make it more efficient, rather than close it down.

[35] This is an expression used by Hausmann and Klinger (2008).

[36] Although one-third of the total number of products that China exports with RCA fall into the low-sophistication category. For this reason, Felipe *et al.* (2010C) classify China as part of the group of countries in the 'middle product' trap.

reforms in key areas (Rodrik, 2006C) while rejecting many of the so-called Washington Consensus reforms, has served China very well. While the country will have to implement many reforms (e.g. labour and capital markets and the development of services) in the coming decades, something that policy makers know well, a cautious pace is still the route to follow in the medium term. The private sector could be invited to this process through, for example, sectoral round tables, deliberation and investment advisory councils and public–private venture funds. In the words of Brandt et al. (2008, p. 570): 'Chinese experience shows that despite their undoubted benefits, neither privatisation of enterprise ownership nor extensive deregulation, full price flexibility, rule of law, and other widely recommended institutional changes must necessarily precede a broad-gauged advance of manufacturing capabilities.'

Moreover, the more China becomes a market economy, the more it will have to pay attention to market failures. Two market failures in particular are rampant in developing countries: (i) information externalities incurred in discovering the cost structure of an economy, i.e. discovery of the new activities that can be exported profitably;[37] and (ii) coordination externalities in the presence of scale economies.[38] However, as it advances in its quest to become more a market-oriented economy, the role of the state should be to create a climate of collaboration with the private sector more than to provide subsidies. In our view, China needs to devise an optimal combination of *horizontal* and *vertical* policy instruments.[39] The objective of the first type of policies is to resolve economy-wide market failures that affect broad sectors of the economy (e.g. provide subsidies to innovation and relax financial constraints for small and medium enterprises (SMEs), while the second aim at developing new RCAs by promoting specific new activities. To increase the possibility of success, China's government needs to tailor policies and tools to each sector and then implement these policies in close collaboration with the private sector, which needs to be nurtured. Therefore, the spectrum of interventions is relatively large, ranging from a hands-off approach (e.g. simply creating the necessary market institutions) to acting as a central operator in a sector. Experience shows that coordination with the private sector increases the chances of policy success.

China is implementing policies to achieve a 'harmonious society' (Felipe, 2010, pp. 1–6). Chinese policy makers have realised that solving problems such as unemployment and underemployment, a deteriorating environment or increasing inequalities, will determine how well the country does in the next decades (Wen, 2009). Perhaps policy makers should think less in terms of a growth target and more in terms of employment creation (and unemployment/underemployment reduction) and structural transformation targets. Growth will be a by-product.[40] Development is a

[37] Information externalities derive from the fact that searching for a new product is an activity with great social value, one that is but poorly rewarded. If entrepreneurs fail in their attempts, they will have to bear all the search costs. However, if they succeed, other producers/exporters will quickly learn and follow them. In this case there is a *clear* case for the government to subsidise investments (to the initial investor) in *new, non-traditional activities* and not in activities already established.

[38] Coordination externalities derive from the fact that many projects require simultaneous investments in order to be profitable. for example, hotels will not be built unless the government provides good public infrastructure, but the government will not build infrastructure unless the private sector builds the hotels. Relaxing coordination failures often does not require subsidies to the private sector.

[39] We do not want to overstretch the distinction between horizontal and vertical industrial policies, as often it is difficult to differentiate both. On this, see Chang (2009).

[40] See Felipe *et al.* (2012) for growth forecasts.

path-dependent process and China has acquired tremendous knowledge and competency that will allow it to continue thriving in the next decade. This does not mean, however, that growth rates of 10% and above will remain forever, as China faces a number of constraints and risks.

Analysing China in the year 2030, the miracle of the previous 20 years will not be, most likely, that annual growth remained at 10%; rather, it *should be* that in 2010 its policy makers understood well the country's potential, together with the constraints and risks that it faced and, most importantly, that they successfully implemented a series of reforms that allowed the country to continue transforming.

Bibliography

Abramovitz, M. 1986. Catching-up, forging ahead and falling behind, *Journal of Economic History*, vol. 46, 386–406

Balassa, B. 1965. Trade liberalization and revealed comparative advantage, *Manchester School of Economics and Social Studies*, vol. 33, 99–123

Bardhan, P. 2008. What makes a miracle. Some myths about the rise of China and India, *Boston Review*, January–February, http://emlab.berkeley.edu/users/webfac/bardhan/boston.pdf, date last accessed 14 January 2011

Blanchard, O. and Giavazzi, F. 2005. 'Rebalancing Growth in China: A Three-Handed Approach', MIT Department of Economics Working Paper no. 05-32

Borensztein, E. and Ostry, J. D. 1996. Accounting for China's economic performance, *American Economic Review, Papers and Proceedings*, vol. 86, no. 2, 224–8

Brandt, L., Rawski, T. G. and Sutton, J. 2008. China's industrial development, in Brandt, L. and Rawski, T. G. (eds), *China's Great Transformation*, Cambridge, UK, Cambridge University Press, 569–632

Chang, H.-J. 2002. *Kicking Away the Development Ladder*, London, Anthem Press

Chang, H.-J. 2010. *Hamlet* without the Prince of Denmark: how development has disappeared from today's 'development' discourse, in Khan, S. and Christiansen, J. (eds), *Towards New Developmentalism: Markets as Means rather than Master*, Abingdon, Routledge, 47–58

Chang, H.-J. 2009. Industrial Policy: Can we go Beyond an Unproductive Confrontation? paper presented at the Annual World Bank Conference on Development Economics, 30 September, Seoul, http://siteresources.worldbank.org/EXTABCDE/Resources/7455676-1288210792683/Ha-Joon-Chang.pdf, date last accessed 14 January 2011

Chow, G. C. 1993. Capital formation and economic growth in China, *Quarterly Journal of Economics*, vol. 108, 809–42

Dahlman, C. 2009. Growth and development in China and India: The Role of Industrial and Innovation Policy in Rapid Catch-up, in Cimoli, M., Dosi, G. and Stiglitz, J. E. (eds), *Industrial Policy and Development: The Political Economy of Capability Accumulation*, London, Oxford University Press, 303–35

Feenstra, R., Lipsey, R., Deng, H., Ma, A. and Mo, H. 2005. 'World Trade Flows: 1962–2000', National Bureau of Economic Research Working Paper no. 11040

Felipe, J. 2010. *Inclusive Growth, Full Employment and Structural Change: Implications and Policies for Developing Asia*, 2nd edn, London, Anthem Press

Felipe, J. and Estrada, G. 2008. Benchmarking developing Asia's manufacturing sector, *International Journal of Development Issues*, vol. 7, no. 2, 97–119

Felipe, J., Kumar, U. and Abdon, A. 2010A. 'Exports, Capabilities, and Industrial Policy in India', Levy Economics Institute of Bard College Working Paper no. 638

Felipe, J., Kumar, U. and Abdon, A. 2010B. 'As you Sow so shall you Reap: From Capabilities to Opportunities', Levy Economics Institute of Bard College Working Paper no. 613

Felipe, J., Kumar, U. and Abdon, A. 2010C. 'How Rich Countries became Rich and Why Poor Countries Remain Poor: It's the Economic Structure … Duh!' Levy Economics Institute of Bard College Working Paper no. 644

Felipe, J., Kumar, U. and Abdon, A. 2012. Using capabilities to project growth 2010–2030, *Journal of the Japanese and International Economies*, vol. 26, 153–66

Felipe, J., Kumar, U., Usui, N. and Abdon, A. 2010. 'Why has China Succeeded? And Why it will Continue to Do So', Levy Economics Institute of Bard College Working Paper no. 611
Felipe, J., Laviña, E. and Fan, E. X. 2008. The diverging patterns of profitability, investment and growth of China and India, 1980–2003, *World Development*, vol. 36, no. 5, 741–74
Felipe, J., León-Ledesma, M., Lanzafame, M. and Estrada, G. 2009. Sectoral engines of growth in developing Asia: stylized facts and implications, *Malaysian Journal of Economic Studies*, vol. 46, no. 2, 107–33
Felipe, J. and McCombie, J. S. L. 2002. Productivity in China before and after 1978 revisited, *Zagreb International Review of Economics and Business*, vol. 5, no. 1, 17–43
Felipe, J. and McCombie, J. S. L. 2011. Some caveats modeling technical progress and investment: the case of China, *Journal of International Commerce, Economics and Policy*, vol. 2, no. 2, 305–24
Gilboy, G. J. 2004. The myth behind China's miracle, *Foreign Affairs*, vol. 84, no. 3, 33–48
Hausmann, R., Hwang, J. and Rodrik, D. 2007. What you export matters, *Journal of Economic Growth*, vol. 12, no. 1, 1–15
Hausmann, R. and Klinger, B. 2006. 'Structural Transformation and Patterns of Comparative Advantage', Center for International Development Working Paper no. 128
Hausmann, R. and Klinger, B. 2008. 'Achieving Export-led Growth in Colombia', Center for International Development Working Paper no. 182
Hausmann, R., Pritchett, L. and Rodrik, D. 2006. Growth accelerations, *Journal of Economic Growth*, vol. 10, 303–29
Heytens, P. and Zebregs, H. 2003. How fast can China grow? in Tseng, W. and Rodlauer, M. (eds), *China Competing in the Global Economy*, Washington, DC, International Monetary Fund, 8–29
Hidalgo, C. 2009. 'The Dynamics of Economic Complexity and the Product Space over a 42-Year Period', Center for International Development Working Paper no. 189
Hidalgo, C. and Hausmann, R. 2009. The building blocks of economic complexity, *Proceedings of the National Academy of Sciences*, vol. 106, no. 26, 10570–5
Hidalgo, C., Klinger, B., Barabasi, A. L. and Hausmann, R. 2007. The product space conditions the development of nations, *Science*, vol. 317, 482–7
Hobday, M. 1995. *Innovation in East Asia*, Cheltenham, Edward Elgar
Hu, Z. F. and Khan, M. S. 1997. Why is China growing so fast? *International Monetary Fund Staff Papers*, vol. 44, no. 1, 103–31
Islam, N., Dai, E. and Sakamoto, H. 2006. Sources of growth, in Wu, Y. (ed.), *Economic Growth, Transition and Globalization in China*, Northampton, Edward Elgar, 13–60
Kaldor, N. 1967. *Strategic Factors in Economic Development*, Ithaca, Cornell University Press
Kim, L. 1997. *From Imitation to Innovation: Dynamics of Korea's Technological Learning*, Boston, Harvard Business School Press
Kremer, M. 1993. The O-ring theory of economic development, *Quarterly Journal of Economics*, vol. 108, 551–75
Leamer, E. 1984. *Sources of International Comparative Advantage: Theory and Evidence*, Cambridge, MA, MIT Press
Lee, K. and Mathews, J. A. 2010. From Washington Consensus to BeST Consensus for world development, *Asian Pacific Economic Literature*, vol. 24, no. 1, 86–103
Lin, J. 1998. *How did China Feed Itself in the Past? How will China Feed Itself in the Future?* Second Distinguished Economist Lecture delivered at the International Maize and Wheat Improvement Center, Mexico, http://apps.cimmyt.org/english/docs/special_publ/del/2del/2distecon_text.htm, date last accessed 14 January 2011
Lin, J. and Chang, H.-J. 2009. Should industrial policy in developing countries conform to comparative advantage or defy it? A debate between Justin Lin and Ha-Joon Chang, *Development Policy Review*, vol. 27, no. 5, 1–20
Manova, K. and Zhang, Z. 2009. China's Exporters and Importers: Firms, Products, and Trade Partners, National Bureau of Economic Research Working Paper no. 15249
Marvasi, E. 2010. *China's Exports: What Products are Sophisticated?* Manlio Masi Foundation and University of Rome Tor Vergata, mimeo
Nelson, R. R. and Pack, H. 1999. The Asian growth miracle and modern growth theory, *Economic Journal*, vol. 109, no. 457, 416–36
Polterovich, V. and Popov, V. 2004. Accumulation of foreign exchange reserves and long term economic growth, in Tabata, S. and Iwashita, A. (eds), *Eurasia's Integration into the World Economy*, Sapporo, Slavic Research Center, Hokkaido University, 161–198

Rawski, T. 2010. 'Human Resources and China's Long Economic Boom', University of Pittsburgh, 12 December, http://www.ewi-ssl.pitt.edu/econ/files/faculty/papers/110608_pub_RawskiThomas_Rawski%20Human%20Resources%20Revised%20Dec%2012%202010.pdf (date last accessed 14 January 2011)
Reinert, E. 2007. *How Rich Countries Got Rich … And Why Poor Countries Stay Poor*, London, Constable
Rodrik, D. 1986. Disequilibrium exchange rates as industrialization policy, *Journal of Development Economics*, vol. 23, no. 1, 89–106
Rodrik, D. 2006A. 'Industrial Development: Stylized Facts and Policies', John F. Kennedy School of Government, Harvard University, http://www.hks.harvard.edu/fs/drodrik/Research%20papers/industrial%20development.pdf (date last accessed 14 January 2011)
Rodrik, D. 2006B. 'What's so Special about China's Exports?', National Bureau of Economic Research Working Paper no. 11947
Rodrik, D. 2006C. 'Goodbye Washington Consensus, Hello Washington Confusion?' The John F. Kennedy School of Government, Harvard University, http://www.hks.harvard.edu/fs/drodrik/Research%20papers/Lessons%20of%20the%201990s%20review%20_JEL_.pdf (date last accessed 14 January 2011)
Rodrik, D. 2010. Making room for China in the world economy, *American Economic Review*, vol. 100, no. 2, 89–93
Storm, S. and Naastepad, C.W. M. 2005. Strategic factors in economic development: East Asian industrialization 1950–2003, *Development and Change*, vol. 36, no. 6, 1059–94
Tsui, K.-Y., Hsueh, T.-T. and Rawski, T. G. 1995. *Productivity, Efficiency and Reform in China's Economy*, Hong Kong, Chinese University of Hong Kong
Wang, H. and Li, S. 1995. *Industrialization and Economic Reform in China*, Beijing, New World Press
Wen, J. 2009. Report on the Work of the Government, paper presented at the Third Session of the Eleventh National People's Congress, 5 March, Beijing
Wilcox, C., Weatherford, W. D. and Hunter, H. 1962. *Economies of the World Today: Their Organization, Development, and Performance*, New York and Burlingame, Harcourt, Brace & World
Xing, Y. 2011. 'China's High-tech Exports: Myth and Reality', National Graduate Institute for Policy Studies Discussion Paper no. 11-05
Young, A. 2000. 'Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period', National Bureau of Economic Research Working Paper no. 7856
Yueh, L. Y. 2009. Perspectives on China's economic growth: prospects and wider impact, in Dinello, N. and Shaoguang, W. (eds), *China and India and Beyond: Development Drivers and Limitations*, Cheltenham, Edward Elgar, 3–22
Zhang, K. H. and Song, S. 2000. Promoting exports: the role of inward FDI in China, *China Economic Review*, vol. 11, 385–96

Appendix

Table A1 *Leamer's classification and SITC rev. 2 (two-digit level)*

1. Petroleum		7. Labour-intensive	
Petroleum and petroleum products	33	Non-metallic mineral	66
		Furniture	82
2. Raw materials		Travel goods, handbags	83
Crude fertiliser and crude minerals	27	Articles of apparel	84
Metalliferous ores	28	Footwear	85
Coal	32	Miscellaneous manufacture	89
Gas	34	Postal packages, not classified	91
Electric current	35	Special transactions, not classified	93
Non-ferrous metals	68	Coin (other than gold coin)	96
Gold, non-monetary	97		
		8. Capital-intensive	

3. Forest products	
Cork and wood	24
Pulp and waste paper	25
Cork and wood	63
Paper	64
4. Tropical agriculture	
Vegetables and fruit	05
Sugar	06
Coffee	07
Beverages	11
Crude rubber	23
5. Animal products	
Live animals	00
Meat	01
Dairy products	02
Fish	03
Hides, skins	21
Crude animal and vegetable materials	29
Animal and vegetable oils and fats	43
Animals, live (nes)	94
6. Cereals	
Cereals	04
Feeds	08
Miscellaneous edible products	09
Tobacco	12
Oil seeds	22
Textile fibres	26
Animal oils and fats	41
Fixed vegetable oils and fats	42
Leather	61
Rubber	62
Textile yarn, fabrics	65
Iron and steel	67
Manufactures of metals, not elsewhere specified (nes) Sanitary fixtures and fittings, nes	69 81
9. Machinery	
Power generating	71
Specialised for particular industries	72
Metalworking	73
General industrial	74
Office and data processing	75
Telecommunications	76
Electrical	77
Road vehicles	78
Other transport equipment	79
Professional and scientific instruments	87
Photographic equipment	88
Armoured vehicles, firearms and ammunition	95
10. Chemicals	
Organic	51
Inorganic	52
Dyeing and tanning	53
Medicinal and pharmaceutical	54
Oils and perfume	55
Fertilisers	56
Explosives	57
Artificial resins and plastic	58
Chemical materials, nes	59