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Working Paper

Measuring the competitive threat from China

WIDER Research Paper, No. 2008/11

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Suggested Citation: Jenkins, Rhys (2008) : Measuring the competitive threat from China, WIDER Research Paper, No. 2008/11, ISBN 978-92-9230-053-1, The United Nations University World Institute for Development Economics Research (UNU-WIDER), Helsinki

This Version is available at:

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Economics Research

Research Paper No. 2008/11

Measuring the Competitive Threat from China

Rhys Jenkins*

February 2008

Abstract

In recent years there has been a growing literature that analyses the threat which Chinese exports pose to the exports of other developing countries. The paper provides a critique of the standard measures of export similarity which have been used to estimate the threat from China in these studies. Two alternative indices, the static and the dynamic index of competitive threat, are developed and estimated for 18 developing countries and compared with estimates for the standard measures. It is shown that the latter tend to underestimate the extent to which countries are threatened by China. They also distort both the rankings of countries according to the extent to which they face competition from China and the direction of change in the competitive threat over time.

Keywords: China, competition, export similarity, exports, trade

JEL classification: F12, O24

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This study has been prepared within the UNU-WIDER project on the Southern Engines of Global Growth.

UNU-WIDER acknowledges the financial contributions to the research programme by the governments of Denmark (Royal Ministry of Foreign Affairs), Finland (Ministry for Foreign Affairs), Norway (Royal Ministry of Foreign Affairs), Sweden (Swedish International Development Cooperation Agency—Sida) and the United Kingdom (Department for International Development).

ISSN 1810-2611

ISBN 978-92-9230-053-1

Acknowledgements

Some of the ideas in this paper are the result of discussions with Chris Edwards and John Thoburn. I am grateful to them and to two anonymous referees for their comments.

Acronyms

CC	coefficient of conformity
DICT	dynamic index of competitive threat
ESI	export similarity index
GSP	GATT's general system of preferences
ICT	index of competitive threat
RCA	revealed comparative advantage
SICT	static index of competitive threat

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Typescript prepared by Liisa Roponen at UNU-WIDER

The views expressed in this publication are those of the author(s). Publication does not imply endorsement by the Institute or the United Nations University, nor by the programme/project sponsors, of any of the views expressed.

1 Introduction

China's rapid growth and increased openness over the past quarter century have led to it emerging as a key player in the global economy in the early twenty-first century. GDP has grown at over 9 per cent per annum since 1980 so that China is now the world's fourth largest economy at market exchange rates. Its share of world trade has risen over the same period from less than 1 per cent in 1980 to over 6.5 per cent in 2005 making it the third largest trading economy. Although China's growth performance is not that different to Japan's and the Asian newly industrializing countries' at similar stages of their development, what does make China potentially more significant in terms of its impact on the world economy in future is the sheer size of the country.

What will be the effect of China's increased global significance on the rest of the world? China has over the past decade accounted for about 13 per cent of world economic growth (Winters and Yusuf 2007: table 1.1) and its rapid growth has been an important source of additional demand for exporters. This is particularly true for primary commodity exporters, including a number of African and Latin American countries, who have benefited from both increased volumes of exports to China and improvements in their terms of trade as a result of increased commodity prices (UNCTAD 2005: ch. 2; IMF 2006: ch. 5).

There is, however, a downside to the global expansion of China for some developing countries, with concern being expressed about the impact that Chinese competition is having on their exports. The problems are particularly acute for countries which developed significant textile and garment exports under the MFA's quota system. With the end of the MFA they are exposed to direct competition from China which they may be poorly placed to meet. Reports are already coming in of plant closures in countries as far apart as Bangladesh, El Salvador and Lesotho (see McGhie, Kwatra and Davison 2004 on Bangladesh; Thompson 2005 on Central America; Peta 2005 on Lesotho).

Nor are the problems confined to countries that have specialized in unskilled labour-intensive manufactures. As Chinese industry becomes more technologically sophisticated, its range of exports is broadening and also posing a threat to middle-income exporters of more capital- or skill-intensive products such as Mexico and Malaysia. Chinese exports of some agricultural products are also on the rise, for example, with Chinese apples affecting markets for countries such as Chile and South Africa.

As awareness spread of the potential significance of Chinese competition for the exports of other developing countries, a number of academic papers and reports tried to evaluate the threat and to identify the countries which were most affected. These studies base their conclusions on a variety of indicators used to estimate the seriousness of the competitive threat from China. What they all have in common is that they measure the similarity between the export structure of the affected country and that of China, on the grounds that the greater the similarity, the more likely a country is to be negatively affected by Chinese competition. They also assume that an increase in the index over time represents increased competition while a fall implies greater complementarity between the trade structure of China and the affected country.

This paper will argue that there are serious limitations to the measures that have been used which make them potentially misleading indicators of the severity of the

competitive threat to different countries and of changes in competition over time. The remainder of the paper is set out as follows. The next section presents the main indices that have been used in the recent literature on the impact of China on other developing countries and a summary of the main findings of such studies. Section 3 presents an analytical critique of these indices as measures of the competitive threat posed by China. Section 4 then develops two alternative measures, the *static index of competitive threat* (SICT) and the *dynamic index of competitive threat* (DICT) which it is argued give a more direct picture of the competition which a developing country faces from China and presents estimates of these indices for 18 developing countries. Section 5 then compares these estimates with the traditional measures of export similarity to show that the latter underestimate the threat posed by China to other developing countries' exports, particularly in the case of small, relatively specialized exporters. In Section 6 the argument is extended to show that these new measures give a better indication of changes in the degree of competition which a country faces over time than the conventional indices. Finally, Section 7 summarizes the main methodological advantages of the new measures and suggests ways in which they may prove useful in policy analysis.

2 Previous studies of Chinese competition

Two main kinds of indicators have been used in the literature to measure the competitive threat which China poses to exports from other developing countries. The first is Finger and Kreinin's *export similarity index* and related indicators such as the *coefficient of specialization* and the *coefficient of conformity*. The second are correlations either between the product structures of two countries' exports or their patterns of *revealed comparative advantage*. This section briefly describes these indicators and the studies on Chinese competition which have used them.

2.1 The export similarity index and related measures

The best known measure is the *export similarity index* (ESI) which was first presented by Finger and Kreinin (1979) as a means of measuring the similarity of the exports of any two countries to a third market. The index is derived from the share of each product in each country's total exports and is defined as the sum of the smaller value for each product.

$$ESI = 100 * \sum_i \text{MIN}(x_{i1}, x_{i2}) \quad (1)$$

where x is the share of a commodity in exports, i is the product and 1 and 2 are the two countries for which the index is being calculated. The value of the index ranges from 0 where there is no overlap between the products the two countries export and 100 when they have identical export structures.

The ESI has been used by the Inter-American Development Bank to analyse the degree to which China competes with the exports of the Latin American countries and a sample of Asian economies (IDB 2004: table 5.6). It has also been used by Wu and Chen (2004) to analyse competition between China, Taiwan, South Korea and ASEAN, by Schott (2004) for a large number of countries in Latin America and the Caribbean, Asia

and the OECD, by Calderon (2006) for Latin America and by Jenkins and Edwards (2006) and Goldstein et al. (2006: table 14) in studies of China's impact on Sub-Saharan Africa.

Another index which has been applied in the literature on China is a modified form of the coefficient of specialization (Blazquez-Lidoy, Rodriguez and Santiso 2006). The standard format used in the economic geography literature is given as $\sum |x_{i1} - x_{i2}|$ which has a range from 0 when export structures are identical to 2 when they are totally dissimilar. In order to obtain a measure with a range from 0 to 100 the modified coefficient is calculated as

$$CS = 100 * (1 - \frac{1}{2} \sum |x_{i1} - x_{i2}|) \quad (2)$$

In fact this modified coefficient of specialization is identical to the ESI and will not therefore be considered separately.¹

An alternative measure also used by Blazquez-Lidoy, Rodriguez and Santiso (2006) is the coefficient of conformity (CC) which is based on the product of the market shares of the two countries rather than the differences between them.

$$CC = 100 * (\sum_i x_{i1} x_{i2}) / \sqrt{(\sum_i x_{i1}^2 \sum_i x_{i2}^2)} \quad (3)$$

As with the ESI and the coefficient of specialization, this index can vary between 0 when two countries have no exports in common and 100 when they have identical export structures. The denominator in this coefficient is the product of the Herfindhal Index of commodity concentration of exports for the two countries. Blazquez-Lidoy, Rodriguez and Santiso (2006) find a high correlation between the coefficients of conformity and specialization (ESI) and also use a composite measure which is the arithmetic average of the two indices.

The most complex index which has been used in the recent literature on China is the index of trade competition adopted by Meller and Contreras (2003).

$$ITC = 100 * \sum_i \{ (X_{i1} + X_{i2}) / (\sum_i X_{i1} + \sum_i X_{i2}) \} * \{ 1 - (|x_{i1} - x_{i2}|) / (x_{i1} + x_{i2}) \} \quad (4)$$

Where X_i represents the value of exports of product i and x_i is again the share of product i in the country's total exports. The first term measures the share of product i in the total exports of the two countries (i.e., the significance of the product) while the second is a modified coefficient of specialization (normalized by the share of product i in total trade). Once more, the index has a range from 0 when there is no overlap of exports to 100 when the two countries have identical export structures.

¹ The equivalence of the ESI and the CS can be shown as follows. If $x_{i1} = x_{i2} \pm a_i$, the minimum value of x_i will be $x_{i1} - a_i$ when $x_{i1} > x_{i2}$ and x_{i1} when $x_{i1} < x_{i2}$. Then $\sum_{i=1}^n \text{MIN}(x_{i1}, x_{i2}) = \sum_{i=1}^n x_{i1} - \sum_{i=1}^M a_i$, where $1 \dots M$ are those products where $x_{i1} > x_{i2}$. Since $\sum_{i=1}^n x_{i1} = 1$ and $\sum_{i=1}^M a_i = \frac{1}{2} \sum_{i=1}^n a_i$, this reduces to: $1 - \frac{1}{2} \sum_{i=1}^n |x_{i1} - x_{i2}|$ which is the ESI.

2.2 Correlation measures

An alternative to the ESI and related measures based on differences between export shares or the product of export shares is to estimate the correlation between the trade patterns of two countries. The correlation between product shares in exports has been quite widely used in the literature on competition from China. Some studies use correlation coefficients while others use rank correlations. In both cases the value of the index ranges from +1 for countries with an identical export structure to -1 where the structures are totally dissimilar. Studies which have adopted this approach include Lall and Albaladejo (2004) and Ianchovichina, Suthiwart-Narueput and Zhao (2003) on East Asia; Lall and Weiss (2004), Moreira (2004) and Meller and Contreras (2003) on Latin America; and Jenkins and Edwards (2004) on eighteen countries in Asia, Africa and Latin America.

An alternative to correlating export shares between two countries is to use the correlation between their *revealed comparative advantage* (RCA) by product. The most common RCA index is the Balassa measure:

$$RCA = x_{i1}/x_{iw} \quad (5)$$

where x_{i1} is the share of product i in the exports of country 1 and x_{iw} is the share of product i in total world exports. Shafaeddin (2004) uses rank correlations between the RCA of China and other countries by product to identify those countries which face most competition from China. Lederman, Olarreaga and Rubiano (2006) use an alternative RCA index developed by Vollrath (1991) to estimate competition between China and Latin America

2.3 Findings of previous studies

In contrast to the popular perception of the ‘Chinese threat’, most of these studies find that China’s impact on other developing countries’ exports to third markets is relatively limited with the competitive threat being confined to relatively few, mainly Asian, countries.

While there is general agreement that the countries facing most competition from China are in Asia, there are differences regarding which countries are most at risk. Some studies have concluded that the Asian countries most threatened by Chinese competition are the more advanced East Asian countries (Meller and Contreras 2003; Schott 2004), while others see a greater threat to countries in South Asia which have specialized in labour-intensive manufactures and have not been able to upgrade their exports (Shafaeddin 2004).

For other regions of the developing world, competition from China in third markets is not seen as a major problem. Blazquez-Lidoy, Rodriguez and Santiso (2006: 19) note that, ‘In general terms the results suggest that there is no trade competition between China and Latin America’ and that ‘this competition is even decreasing rather than increasing over the recent period of time’. A recent World Bank study similarly concludes that ‘Latin America and the Caribbean’s trade specialization pattern is becoming more complementary to the specialization pattern of China’ (Lederman,

Olarreaga and Rubiano 2006: 16), echoing the earlier findings of Lall and Weiss (2005).² Only Mexico is generally seen as an exception within Latin America.

Even more than in Latin America, Africa is seen as largely unaffected by Chinese competition in third markets because of its limited development of manufactured exports. An OECD report finds very little overlap between exports from China and Africa, with the partial exception of South Africa (Goldstein et al. 2006: table 14). A recent World Bank report on the impact of China on Sub-Saharan Africa does not even analyse this aspect preferring to concentrate on direct trade and investment links (Broadman 2007).

3 A critique of the conventional indicators

Although these indicators have been widely used to identify the countries which are most threatened by Chinese exports and whether competition from China is increasing or diminishing over time, neither the ESI-type measures nor correlations between export indicators provide a good measure of Chinese competition.

3.1 ESI type measures

The *export similarity index* was first introduced by Finger and Kreinin (1979) to analyse the impacts of trade policies, particularly the concessions granted to developing countries under the general system of preferences (GSP) and the effects of tariff reductions under GATT, on developing country exports. They argue that because the structure of developing countries' exports differed from those of developed countries, they benefited relatively little from GATT reductions in tariffs which were concentrated on products exported by developed countries, and that the GSP did not lead to trade diversion from developed to developing countries.

In this context a measure of the similarity in export structures between different countries is an appropriate indicator. The studies referred to in the previous section use the ESI to address a quite different question, namely the degree to which China competes in third markets with different countries and how this is changing over time. It might appear at first sight that the similarity of export structures between two countries is an appropriate measure of the degree of competition but on more careful consideration, this turns out not to be the case.

Indices which measure the similarity between the exports of two countries by definition return a single value between a pair of countries. The exports of country A are as similar/dissimilar to those of country B, as those of country B are to those of country A. When the ESI is interpreted as an index of competition between two countries, then this implies that the competitive threat of country A to country B is the same as the competitive threat posed by country B to country A. Replace A by China and B by Honduras and the absurdity of this position becomes evident. No index which implies

² 'The direct threat to exports to third country markets appears small: Latin American and the Caribbean's (LAC's) trade structure is largely complementary to that of China' (Lall and Weiss 2005: 163).

that Honduras is as much a competitive threat to China's export markets as China is for Honduran exports is credible.

The basic point here is that the ESI and related indices are measures of the similarity between the *composition* of the exports of the two countries being compared. This is underlined by Finger and Kreinin in their original article introducing the ESI when they write that,

Since the index is intended to compare only patterns of exports across product categories, it should not be influenced by the relative sizes or scales of total exports. To remove the scale effect, the exports of, say *a* must be rescaled so that they are equal in total to those of *b*. (Finger and Kreinin 1979: 906)

The removal of the scale effect is reflected in the use of the share of each product in total exports, rather than the value of exports in the indices discussed in the previous section.³

This enables Finger and Kreinin and the other authors to calculate a single value to measure the similarity between the exports of any pair of countries. One can think of the similarity between the exports of two countries as the share of exports which are common to both countries expressed as a proportion of their combined exports. However, from the point of view of a country concerned about the competition it faces from China, what is relevant is the proportion of its own exports made up of products that compete with Chinese exports. The share of these products in China's exports is of no relevance to it. It is quite possible that where the competing country is a small exporter, common products make up a substantial share of its own exports while only accounting for a small proportion of total Chinese exports. Appendix I presents this argument in diagrammatic form.

The same argument can apply even if the value of exports of the two countries is similar but one country is much more specialized in those products which overlap. Again the overlapping set of exports represents a much greater proportion of the exports of the more specialized country than for the diversified exporter. In practice small exporters are likely to be more specialized than large ones so that the size and diversification effects are likely to reinforce each other.

China's exports in 2002 were almost US\$300 billion, far more than those of any of the other countries included in this study. It exports almost twice as much in value terms as the second largest exporter, Mexico, and over 600 times as much as the smallest exporters (Ethiopia and Uganda) (see Statistical Appendix: Table A1). Table A1 also shows that China's exports are more diversified than those of the other countries apart from Brazil, and considerably more diversified than those of the smaller exporters. An index which gives a single value for a pair of countries cannot possibly represent both the threat which China poses to Ethiopia's exports and the threat from Ethiopia for China's exports.

³ The only partial exception to this is the ITC where the first term of the equation does include absolute values of exports.

The implication of this is that the conventional indices are likely to underestimate the threat which China poses for smaller, less diversified exporters, relative to larger, more diversified ones. In fact where China is compared to a much smaller exporter, the conventional indices are a better measure of the threat that the smaller country poses to China's exports than of the threat posed by China. It is intuitively obvious that a single index which is a weighted measure of the significance of the overlap between the exports of the two countries will be dominated by the larger exporter.

ESI-type indicators are not only misleading in terms of ranking the competitive threat to different countries but also fail to provide an appropriate measure of changes in the competitive threat faced by a particular country over time. This again derives partly from the way in which the index only measures the similarity in the composition of exports between two countries. If over time the composition of exports in both countries remains unchanged, then the ESI does not change. Increased competition is implicitly equated with a convergence of export structures. However a major factor in the increase in competition from China in world markets is the extremely rapid growth of Chinese exports (and consequent increase in China's share of world exports) over time. Because ESI-type indicators only take into account the shares of different products in total exports, they do not reflect the overall growth of exports which is a key feature of the competitive threat from China.

If China's export growth is associated with a diversification of its exports through expansion into new products not produced by its competitor, then the ESI falls. However this does not necessarily mean a reduction in competition in those products in which it previously competed. Indeed it may well be increasing its share in world markets for existing products as well, so that the picture obtained from the ESI suggests the opposite of what is really happening.

3.2 Correlation measures

The basic criticism made of ESI-type indicators, that the indices provide a single value for any pair of countries, applies equally to those measures based on correlations between export shares or RCAs. Again what is being measured is the similarity between the composition of exports of the two countries rather than a meaningful indicator of the degree of competition between them. As with the ESI-type measures, the use of export shares or relative measures such as revealed comparative advantage, abstracts from the effect of differences in the size of exports between the two countries.

There are some additional problems posed by the use of correlation coefficients. Where a country is highly specialized in a small number of exports, most observations will have a value of zero which will generate a very low correlation with the exports of a larger, more diversified exporter. It may also make the results highly dependent on a few outliers. This is particularly true where the Balassa version of the RCA is used since it has no upper limit and for small, highly specialized exporters, this leads to very high RCAs for the products which they export.⁴

⁴ In practice studies using RCAs have either used rank correlations (Shafaeddin 2004) or an alternative RCA measure which does have an upper limit (Lederman, Olarreaga and Rubiano 2006).

A further limitation of the correlation measures, even compared to ESI-type indicators, is that they do not provide an easy way of identifying the key industries in which two countries compete. The ESI can be decomposed so that the contribution of each product or group of products, to the overall index can be calculated. This is not possible in the case of correlation measures.

Over time, correlation measures, like the ESI-type measures, can only indicate whether the composition of exports of two countries are converging or diverging. They do not provide an appropriate way of assessing whether competition between the two countries has intensified or reduced over a period.

4 Alternative measures of the competitive threat from China

4.1 The static and the dynamic index of competitive threat

The extent to which a country faces a competitive threat from China depends not on the overall similarity of its export structure to that of China, but rather on the proportion of its total exports accounted for by products in which China is globally competitive. A country which has a high share of its exports in such products is threatened by Chinese competition even if the products concerned account for a relatively small share of China's total exports so that the ESI would be relatively low. The higher the share of a country's exports made up of such products, the greater the extent of the threat from China. Thus the *index of competitive threat* (ICT) can be defined simply as:

$$ICT = 100 * \sum_i x_{i1} \quad (6)$$

where $i = 1 \dots m$, which includes all products in which China is globally competitive.

It remains then to identify those products in which China is a significant global competitor. There are a number of different ways in which this might be done. The standard approach in the literature to identifying products in which a country is internationally competitive is to use RCA. There are a number of different RCA measures but here we will only consider the Balassa RCA. All those 3-digit SITC products in which China has an $RCA > 1$ were considered to be under competitive threat from China. The proportion of other countries' exports that are accounted for by such products can then be calculated. This gives a static indicator of the extent to which a country's exports are likely to be under threat from China. This will be referred to as the *static index of competitive threat* (SICT).

An alternative approach is to identify those products where China's exports are growing more rapidly than world trade as those in which other countries' exports are facing a threat. This is somewhat similar to the approach used by Lall and Albaladejo (2004) who look at changes in world market shares of China and other countries. They explicitly relate their notion of 'competitive threat' to the business literature in which relative market share is a commonly used measure.

The approach adopted here selects all products for which China's exports grew faster than world exports between 1990 and 2002. In order to avoid including products in which China's share of world exports was small and therefore the likely effect of

competition on other exporters limited, products where China's share of world exports was less than 2 per cent in 2002 were excluded.⁵ Again the share of these products in each country's total exports was calculated. This we will call the *dynamic index of competitive threat* (DICT).⁶

These two indices are consistent with a common sense understanding of the extent of the competitive threat which a country faces from China in its export markets. They also clearly distinguishes between the competitive threat which a country faces from China and that which China faces, since the latter is measured by the proportion of Chinese exports accounted for by products in which the other country is globally competitive. Although the new indicators do not explicitly take into account the scale of a country's exports in estimating the competitive threat (except indirectly in so far as scale is correlated with diversification of exports), they avoid the bias which exists in traditional measures as a result of using a single indicator of export similarity.

3.2 Empirical estimates of the SICT and DICT

The two new indicators, the static and the dynamic index of competitive threat, were estimated using data on the exports of China and 18 developing countries, six each from Asia, Africa and Latin America, available from Jenkins and Edwards (2004).⁷ Although not a random selection of developing countries, the 18 represent a range of countries in terms of region, size, level of development, scale and diversification of exports (see Statistical Appendix, Table A1 for a listing of the countries and some key indicators).

Export data were obtained for the world, China and each of the 18 countries from Statistics Canada's *World Trade Analyzer* (WTA) for 1996 and 2002. This is based on UN COMTRADE data which has been reanalyzed to create a consistent set of trade statistics between countries. Since many of the previous studies have used the standard international trade classification at the 3-digit level to study China's export competition, this was the classification used here. It should be noted that the measured degree of competitive threat will depend on the level of disaggregation of the data, both in terms of products (2, 3, 4 digit SITC for example) and markets (world, major regions, individual countries). It is possible that China and other developing countries export different products within the same 3-digit SITC classification, so that more disaggregated data would result in a lower estimate of the share of exports which face competition from China and this *caveat* should be borne in mind.⁸

⁵ The choice of a 2 per cent cut off point for the share of China's exports in the world market is somewhat arbitrary. Sensitivity analysis however showed that setting the share at either half or double this level would not change the proportion of China's exports that were regarded as posing a competitive threat by very much.

⁶ A similar measure was previously used by the author in Jenkins and Edwards (2004, 2006).

⁷ We are grateful to the UK Department for International Development which commissioned Jenkins and Edwards (2004).

⁸ Important though this may be in empirical work, it applies to all the indices discussed and therefore does not affect the central argument of this paper that the main indicators that have been used in the literature are inherently inappropriate irrespective of the level of aggregation of the data to which they are applied.

Table 1
Share of exports under threat, 2002

	SICT	DICT	China's SICT
Bangladesh	97	92	23
Cambodia	95	97	17
India	43	54	35
Indonesia	42	55	42
Pakistan	82	92	27
Vietnam	60	61	30
Cameroon	3	23	3
Ethiopia	27	26	3
Mozambique	17	67	4
Nigeria	2	2	2
South Africa	33	47	17
Uganda	34	41	4
Bolivia	17	21	5
Brazil	23	39	15
Honduras	34	49	12
Mexico	49	64	52
Nicaragua	26	30	7
Peru	23	39	13

Note: Columns (1) and (2) represent the share of the listed country's total exports which are under threat from China. Column (3) represents the share of China's exports which are under threat from the listed country.

Source: Own elaboration from WTA data.

The first two columns of Table 1 show the SICT and the DICT which China represents for each of the 18 countries. Those countries for which China represents the most severe threat, with over 80 per cent of exports accounted for by products in which China is internationally competitive, were Bangladesh, Cambodia and Pakistan. At the other extreme, Nigeria and Cameroon had virtually no exports that competed with China, not surprisingly given the significance of oil exports for both countries. It is worth noting, however, that in contrast to the commonly held view, an important share of other African countries' exports are of products which compete with China, as are those of several Latin American countries. Although not on the same scale as in Asia, between a quarter and a half of exports of a number of countries in these regions face Chinese competition.

The third column of Table 1 shows the proportion of China's exports accounted for by products in which each of the 18 countries has a revealed comparative advantage ($Balassa\ RCA > 1$).⁹ Thus whereas 97 per cent of Bangladesh's exports are of products in which China has an $RCA > 1$, only 23 per cent of China's exports are of products in which Bangladesh has an $RCA > 1$. The only country, of the 18, in which the share of its exports accounted for by products in which China is globally competitive is less than the share of China's exports in which it has a comparative advantage, is Mexico. The very large differences for most countries between the values in columns (1) and (3) underline the point made earlier that a single index measuring the similarity of export structures cannot adequately capture both the notion of the competitive threat posed by China to another country's exports and the threat which that country poses to China's exports.

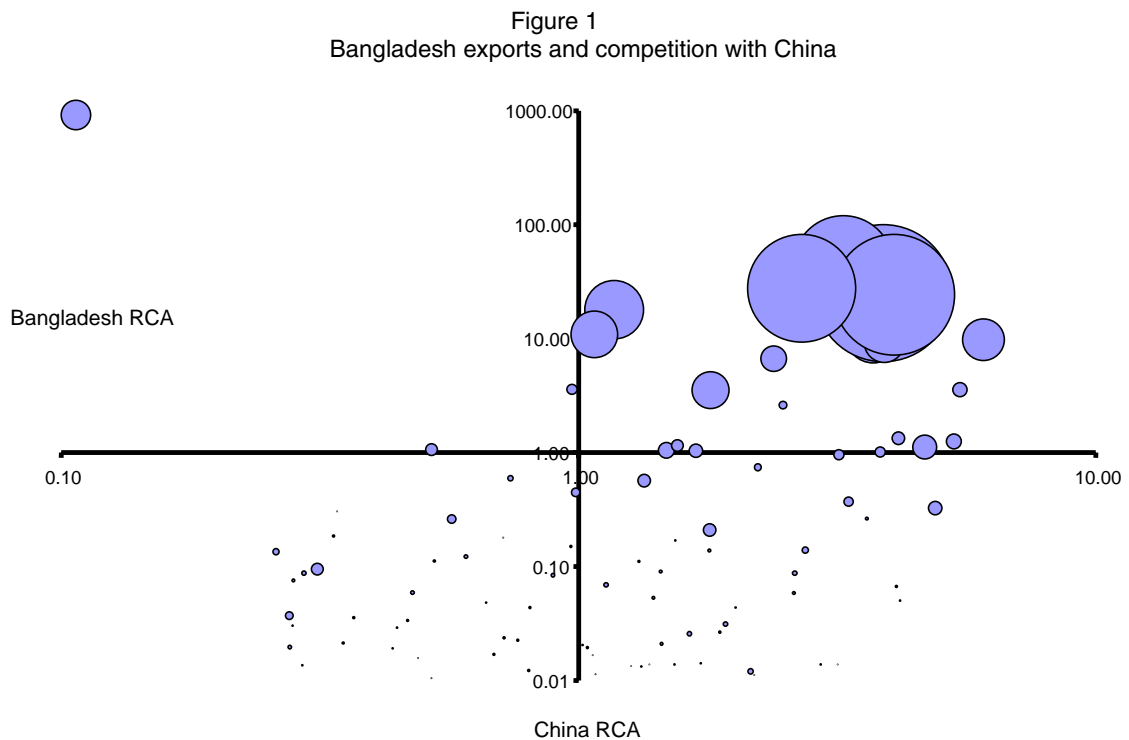
⁹ This is the SICT for China with respect to the competitive threat posed by each of the 18 countries.

3.3 Diagrammatic presentation

The proposed static measure of the competitive threat posed by China can be illustrated visually by comparing the values of RCA for China and its competitor.¹⁰ A bubble diagram can show four quadrants according to whether China and its competitor have RCAs greater than or less than one. The size of the bubble can also be used to indicate the value of exports of each product by the threatened country. Figure 1 illustrates this for the case of Bangladesh.

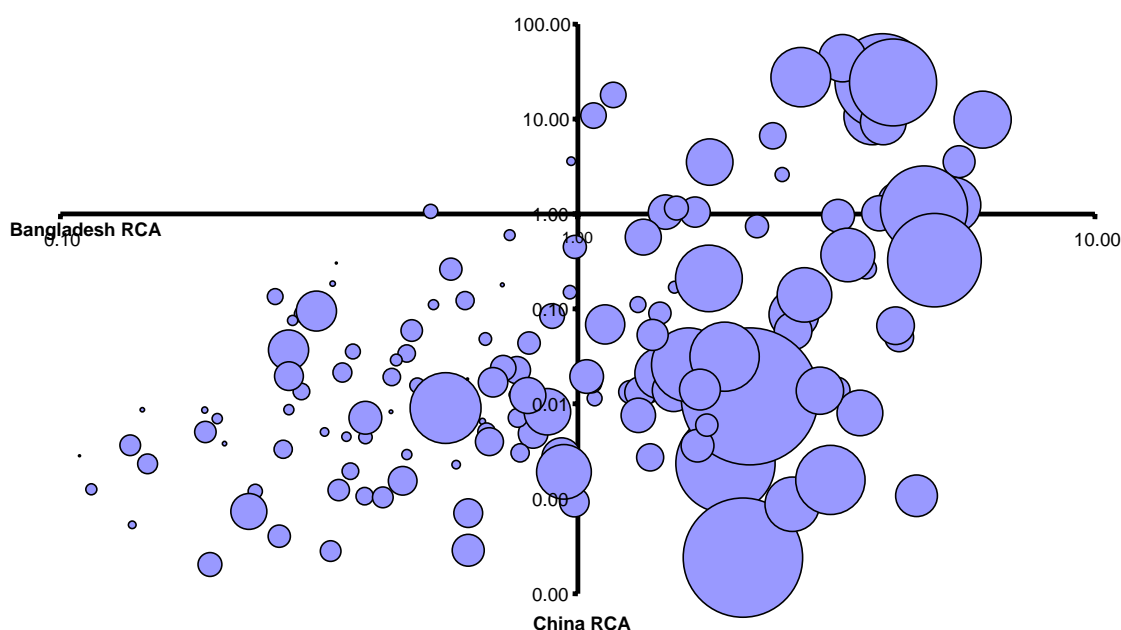
What is immediately apparent is the extent to which Bangladesh's exports are concentrated in the north-east quadrant of the diagram, indicating that they are products in which China also has a revealed comparative advantage. The diagram also highlights the degree to which Bangladesh's exports are concentrated in a relatively small number of products (a small number of large bubbles). It is clear that Bangladesh is highly threatened by competition from China.

Figure 2 provides a similar picture but this time the bubbles represent the value of China's exports of products according to combinations of RCA in Bangladesh and China. This shows that the largest proportion of China's exports is in the south-east quadrant of the diagram i.e. products in which Bangladesh does not have a comparative advantage. As mentioned above, less than a quarter of the value of China's exports is of products in which Bangladesh is globally competitive.



¹⁰ A similar visual presentation could be provided for the DICT but for reasons of space this has not been done here.

Figure 2
Chinese exports and competition with Bangladesh



5 Comparing measures of the competitive threat from China

Having estimated the new indices of competitive threat and shown how they provide different estimates for the threat from and to China for other countries, these indices will be compared with the results obtained using traditional indicators. In order to do this on a systematic basis, the same data for China and 18 developing countries were used to estimate a range of different measures (see Statistical Appendix, Table A2 for a listing of the countries and the values for each indicator).

Two issues can be addressed in looking at the relationship between the new indices and those used in previous studies. First, do they give a consistent ranking of countries in terms of the degree of competition which they face from China? Second, do they give approximately similar estimates of the level of competition from China faced by a particular country?

Table 2
Rank correlations between indices for 18 countries, 2002

	SICT	DICT
X share	0.73	0.78
Rank RCA	0.75	0.62
ESI	0.63	0.54
CC	0.79	0.73
ITC	0.50	0.34
SICT	1	0.80

Source: Statistical Appendix, Table A1.

To analyse the first question, Spearman rank correlation coefficients were calculated between the two indicators and each of the conventional indices. The results are presented in Table 2.

It is worth noting that the two new measures introduced here are highly correlated with each other. However, they are not so well correlated with some of the earlier indicators that have been used, especially the ITC and the ESI. The correlation between the DICT and the ITC is insignificant and the correlation between the DICT and the ESI is only significant at the 5 per cent level as is that between the SICT and ITC.¹¹

Inspection of the data reveals that there are some important changes in the ranking of countries according to the index which is adopted. Most striking is the rise of Bangladesh and Cambodia which emerge as the countries most threatened by China according to the two new indices, whereas they appear to be in the middle of the range of countries according to the ESI and the ITC. Mexico on the other hand, which is the country most threatened by China according to all the traditional indices apart from the correlation between RCA ranks falls to fifth place on both the new indices. Similarly Indonesia, which is the second most exposed country according to the ESI, coefficient of conformity and the ITC, falls to seventh or eighth place in terms of the two new indicators. Since Mexico and Indonesia are relatively large, diversified exporters, while Bangladesh and Cambodia are much smaller, highly specialized exporters (see Statistical Appendix, Table A1), this confirms the bias identified earlier in the discussion of the limitations of the traditional indicators.

These correlations only relate to consistency in the *ranking* of different countries according to the threat from China. They say nothing about the absolute level of this threat for particular countries and how far the measures accurately capture this. In order to test for consistency in this narrower sense, regressions were run for the pairs of indices. If the various indices returned consistent absolute values for the threat of competition from China, then the resulting linear regression should have an intercept not significantly different from zero and a slope not significantly different from 1.¹²

These throw further doubt on the consistency of the traditional measures and the new indices introduced in the last section. Both the ESI and the ITC are very poorly correlated with the SICT and the DICT and the regression coefficient is not significantly different from zero at the 5 per cent level (see Table 3). Furthermore, for all the regressions the slope of the regression line was significantly less than unity, indicating

¹¹ Critical values for the Spearman rank correlation coefficient with 18 observations are 0.564 at the 1 per cent level and 0.399 at the 5 per cent level.

¹² One issue here is that whereas the ESI, coefficient of conformity and ITC are measured on a scale of 0-100, the export share and rank RCA are correlation coefficients taking a value between -1 and 1. A first step is to rescale the ESI and related measures from 0-100 to 0-1. It was decided not to rescale the correlation coefficients because it was observed that although theoretically these could take a value of -1, the lowest observed value was in fact -0.1. The inclusion of a constant term in the regressions was used to capture the fact that the different measures might not have a common origin.

that the traditional indices tended to underestimate the extent to which Chinese exports competed with those of the other 18 countries compared with the new measures.¹³

In summary, therefore, the traditional indices that have been used in measuring the competitive threat from China underestimate the absolute extent to which a country's exports are threatened by China. They also introduce systematic biases into the ranking of countries by inflating the threat to larger, more diversified exporters, relative to smaller exporters with a narrower range of exports.

Table 3
Relationship between different Indicators

	SICT			DICT		
	Slope	Intercept	R ²	Slope	Intercept	R ²
X Share	0.47** (0.10)	-0.08 (0.05)	0.57	0.50** (0.12)	-0.14* (0.06)	0.53
Rank RCA	0.49** (0.11)	-0.07 (0.05)	0.55	0.51** (0.12)	-0.13 (0.07)	0.51
ESI	0.22** (0.12)	0.14* (0.06)	0.16	0.25** (0.13)	0.10 (0.07)	0.18
CC	0.43** (0.11)	0.03 (0.05)	0.51	0.45** (0.12)	-0.03 (0.06)	0.48
ITC	0.14** (0.14)	0.16* (0.07)	0.06	0.17** (0.15)	0.13 (0.08)	0.08

Notes: Standard error of the slope coefficient in brackets;

* significantly different from zero at 5 per cent; ** significantly different from 1 at 5 per cent level.

Source: As for Table 2.

6 Changes in the competitive threat from China over time

In addition to comparing the level of threat from China to the exports of different countries at a point in time, the various indices have also been used to look at changes over time. If the structure of exports of China and its competitors are becoming increasingly similar then it is assumed that the threat posed by China is increasing, while divergence of export structures would indicate a diminution of the threat. Given the emergence of China as a global player in recent years, it would be expected that many countries would have faced an increased competitive threat. Some countries that specialize in primary commodities in which China is not internationally competitive would be relatively unaffected, but for other countries China would present an increased challenge.

In order to see how far the various measures reflect this, the different indices were calculated for 1996 for each country and then compared with the previously calculated indices for 2002 (Statistical Appendix, Table A3). The first surprise from the data is the relatively small number of cases in which the index increased for the traditional measures. Taking those cases in which the index increased by more than 2, on a scale

¹³ In most cases the hypothesis that the constant term was zero could not be rejected. In this case a slope coefficient of less than 1 implies that on average the value of the traditional index is less than the value of the new index with which it is being compared.

from 0 to 100 (or 0.02 for the correlation coefficients), as facing a significant increase in competition from China, the number varied from three in the case of the correlation between RCAs to five for the coefficient of conformity (see Table 4). For each of these indicators, more countries faced less competition from China in 2002 compared to 1996, than faced increased competition.

The last two rows of Table 4, which show our alternative indices, present a rather different picture. Almost half of the eighteen countries are now seen to face increasing competitive pressure from China and only five or six have seen competition fall.

Looking at the changes in the indices for individual countries reveals some further interesting results (see Statistical Appendix, Table A3). The only country which appears to face increased competition on all the indices is Mexico. Bangladesh, where the share of exports facing competition from China increased between 1996 and 2002, is less threatened in 2002 than in 1996 according to all the conventional indices apart from the rank RCA, while Cambodia, the country where the share of exports competing with China increased most over the period, shows a reduction in both the ESI and the ITC. Ethiopia, where the proportion of exports accounted for by products which compete with China also increased, shows no significant change in any of the conventional indices.

Looking at changes over time in the indices, therefore, raises further doubts as to whether the traditional measures of export similarity are a useful way of measuring the competitive threat from China to other developing country exporters.

Table 4
Numbers of countries in which competition from China increased or fell, 1996-2002

	Increased competition	Little change	Reduced competition
Correlation of X share	4	6	8
Correlation of RCA	3	3	12
ESI	4	7	7
Coefficient of conformity	5	4	9
Coefficient of ITC	4	6	8
SICT	8	5	5
DICT	9	4	5

Note: Competition is considered to have increased if the relevant index rose by more than 2 (0.02 in the case of the correlation coefficients) and to have reduced if it fell by more than 2.

Source: Statistical Appendix, Table A3.

7 Conclusion

This paper has shown that the main indices which have been used as measures of the competitive threat from China are inherently flawed. The principal reason for this is that the indices measure the similarity between the export structures of China and its competitors. Where China's exports are much larger and more diversified than those of its competitor, these indices tend to underestimate the extent to which the competitor's exports are threatened. This leads to distortions in both the rankings of countries according to the extent to which they face competition from China and the direction of change in the competitive threat over time.

The paper has also developed two alternative indices to measure the extent of Chinese competition, the *static* and the *dynamic index of competitive threat*. These have several advantages over the indices used in previous studies. First and foremost, they distinguish between the threat which China poses to another country from the threat that the other country poses to China, rather than conflating them into one measure. Second, they are not biased by differences in the value of exports from the two countries concerned, or by differences in the commodity concentration of their exports. Third, since they measure the proportion of a country's exports accounted for by products in which China is internationally competitive, the meaning of a particular value of the index is easy to understand, which is not the case with some of the other indices. Fourth, they identify very clearly the key products for which a country faces competition from China. Finally, they are relatively economical in terms of data requirements and complexity of calculation once RCAs and changes in world market shares for China have been obtained.

By providing a more realistic measure of the extent to which countries face competition from China, these indicators can inform national policy. Where there is a substantial threat to exports, this provides added urgency to the need to promote competitiveness or to find market niches less exposed to Chinese competition. This is facilitated by the ease with which products that are most threatened can be identified. This can be refined by using more disaggregated data both at product and market levels. At the global level, the paper suggests that the disruption to the trade of developing countries caused by the emergence of China is likely to be far greater than has been recognized up to now. This implies that there may be a greater need for adjustment measures or preferential trading arrangements to limit the negative impacts on other developing regions.

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Appendix I: A diagrammatic illustration of the problems of a single indicator of export similarity¹⁴

Intuitively one can think of the ESI and similar indices diagrammatically as representing the overlap between the two countries' sets of exports.

Figure I.1 represents the two countries' exports as circles. The two circles are drawn of equal size to illustrate Finger and Kreinin's point that exports should be rescaled so that they are equal in total for the two countries. In part A there are no goods which are exported by both countries so that the two sets do not overlap and the various indices of export similarity have a value of zero. In part B there is significant overlap and so the index takes a value between zero and 100. Where, as in the figure, the overlap is half of each country's exports, then the various indices will be around 50.¹⁵ Part C represents the situation in which the structure of exports for the two countries is identical so that the circles overlap completely. This is the situation where the index is 100.

This diagrammatic presentation helps to clarify a fundamental flaw in using the ESI as a measure of competition between China and other countries. Figure I.1 illustrates a situation in which the two countries are symmetrical in that the level of exports are set to be equal and therefore the overlap between the two sets of exports is the same for both countries, giving a single value for the index.

Figure I.1

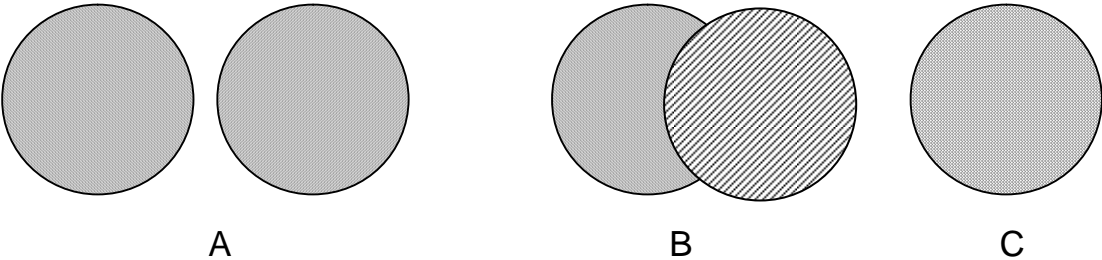
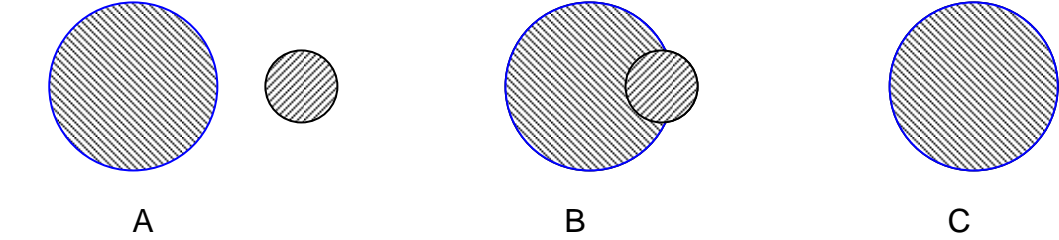


Figure I.2



¹⁴ I am indebted to John Thoburn for suggesting this diagrammatic presentation.

Figure I.2 illustrates a situation in which differences in the scale of exports between the two countries are explicitly recognized by drawing the circles proportionate to the value of their exports. As before A, B and C represent different levels of overlap between the exports of the two countries. A will again be a situation in which there is no similarity between the countries' exports and the index will be zero. In parts B and C, the implications of differences in scale can be seen. In B the overlap represents about 5 per cent of the exports of the larger country but 50 per cent of the exports of the smaller, while in C all the exports of the smaller country compete with those of the larger country, but these only represent 10 per cent of the latter's exports. It is clear that a single value index cannot represent the competitive threat faced by both countries.

Although the above discussion is presented in terms of export similarity type indices, the criticism applies equally to measures based on correlations between export share or RCAs. In this case Figure I.1 above can be re-interpreted so that part A represents a situation in which $r^2 = 0$ and part C is where $r^2 = 1$ (see Gujarati 2003: 82).

¹⁵ This is an approximation since the exact value of the index will depend on the share of the individual products exported by both countries in the total exports of each country.

Statistical appendix

Appendix Table A1
Basic indicators for 18 countries, 2002

	GDP per capita (constant 2000 US\$)	Exports (\$mn.)	Export concentration*
China	1106.0	299,221	0.154
Bangladesh	372.7	6,442	0.388
Cambodia	305.9	1,909	0.456
India	480.0	56,255	0.186
Indonesia	844.3	61,264	0.181
Pakistan	532.0	10,550	0.273
Vietnam	255.0	16,847	0.285
Cameroon	708.7	1,825	0.525
Ethiopia	126.0	496	0.417
Mozambique	247.4	940	0.585
Nigeria	357.8	18,628	0.788
South Africa	3121.6	26,982	0.167
Uganda	443.7	488	0.343
Bolivia	1010.4	1,400	0.303
Brazil	3473.4	63,604	0.148
Honduras	932.2	1,820	0.253
Mexico	5853.0	169,650	0.186
Nicaragua	791.0	694	0.237
Peru	2085.4	7,791	0.293

Note: * Herfindhal Index of commodity concentration of exports.
Source: World Bank (WDI) for the GDP per capita; WTA for exports.

Appendix Table A2
Measures of Chinese competition for 18 countries, 2002

	X share	Rank RCA	ESI	CC	ITC	SICT	DICT
Bangladesh	0.34	0.40	21	37	15	97	92
Cambodia	0.37	0.23	18	39	11	95	97
India	0.10	0.27	40	24	40	43	54
Indonesia	0.32	0.35	47	43	52	42	55
Pakistan	0.23	0.28	32	31	27	82	92
Vietnam	0.26	0.46	38	33	39	60	61
Cameroon	-0.02	-0.05	6	3	6	3	23
Ethiopia	-0.05	0.08	6	2	6	27	26
Mozambique	-0.01	0.04	6	4	6	17	67
Nigeria	-0.01	-0.10	4	3	3	2	2
South Africa	0.03	-0.02	31	20	33	33	47
Uganda	-0.05	-0.08	9	4	9	34	41
Bolivia	-0.05	-0.07	13	5	14	17	21
Brazil	0.07	-0.03	32	25	33	23	39
Honduras	0.00	-0.01	17	11	16	34	49
Mexico	0.49	0.29	54	57	55	49	64
Nicaragua	-0.06	-0.06	17	7	17	26	30
Peru	-0.02	0.18	19	8	19	23	39

Note: The first two columns of the table show correlation coefficients between the variable for China and the listed country. The remaining columns show indices which can vary from 0 to 100.

Source: Own elaboration from WTA data.

Appendix Table A3
Change in measures of competition from China, 1996-2002

	X share	Rank RCA	ESI	CC	ITC	SICT	DICT
Bangladesh	-0.15	0.02	-6	-13	-6	9	7
Cambodia	0.11	0.07	-6	6	-12	48	32
India	-0.10	-0.11	-5	-11	-5	-4	-3
Indonesia	0.00	-0.08	2	0	4	3	1
Pakistan	-0.11	-0.10	-1	-9	-2	2	2
Vietnam	-0.21	-0.02	-2	-18	-0	4	3
Cameroon	-0.09	-0.03	-4	-11	-3	-2	4
Ethiopia	0.01	-0.00	-0	1	-1	19	8
Mozambique	0.00	0.07	-5	-2	-6	-28	47
Nigeria	-0.14	-0.05	-1	-12	-0	1	0
South Africa	0.05	-0.03	-0	3	1	-0	-2
Uganda	-0.00	-0.10	6	4	6	24	29
Bolivia	-0.01	-0.15	-3	-5	-2	-6	-7
Brazil	0.04	-0.08	-2	0	-1	-4	-4
Honduras	0.02	-0.07	0	4	-2	11	15
Mexico	0.20	0.08	7	16	8	14	6
Nicaragua	-0.02	-0.13	4	-2	7	-10	-10
Peru	-0.02	-0.01	-3	-4	-2	-2	-4

Source: Own elaboration from WTA data.