The sophistication of exports: Is China special?

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A B S T R A C T

Recent studies have found that China is “special” in exporting highly sophisticated goods not comparable with its income level. In this paper we identify two measurement biases that account for this “China is special” observation. First, product quality has not been fully considered in the measurement of sophistication, which has caused an overestimation of the sophistication of China’s exports. Second, the average income of China has been used to measure the export capability of China, which has caused an underestimation of China’s capability of exporting sophisticated goods. After correcting the two measurement biases, China appears much less as an outlier in the cross-country comparison of the sophistication of exports.

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1. Introduction

China has achieved spectacular growth in export volume in the past three decades. Equally impressive is China’s rapid upgrade of its export structure. Table 1 reports data on China’s 14 manufacturing industries ranked by R&D intensity. In 1992, “Textiles, apparel, leather and footwear”, the least R&D-intensive industry, accounted for 44.5% of China’s manufacturing exports to the world. By 2005, this industry’s export share fell to 18.8%. Taking its place are two R&D-intensive industries, “Electrical machinery; radio, television and communication equipment” and “Machinery and equipment; office, accounting and computing machinery”, which represented 42.5% of China’s manufacturing exports to the world in 2005.

An even more startling feature of China’s exports, identified by Rodrik (2006) and Schott (2008), is that the measured sophistication of China’s exports far exceeds what would be expected from its stage of development. Fig. 1 illustrates the relative export sophistication of 141 countries in 1996 (based on data of exports to the U.S.). In both graphs, the vertical axis shows the measured export sophistication of a country (EXPY and ESI are two export sophistication indices, which we will discuss in Section 2), and the horizontal axis shows a country’s per capita GDP (PCGDP). The graphs reveal a positive relationship between the export sophistication index and PCGDP, with China (CHN) as a clear outlier above the trend line. This exceptionally high level of export sophistication for China was considered by Rodrik (2006) as “special”.

Fig. 1 shows that China’s outlier status is determined by the values of two parameters: the relatively high level of China’s export sophistication and the relatively low level of China’s PCGDP. One would naturally ask: are these two parameters properly measured? The sophistication indices used by Rodrik (2006) and Schott (2008) are constructed from product-level trade data. Schott (2004) found that even with the most detailed product classification (HS 10-digit), the product varieties from different
countries are highly heterogeneous despite being in the same product category. For the same HS10 product exported to the U.S., the prices vary considerably across the exporting countries. Schott (2008) viewed this price difference within the same product category as reflecting “within-product sophistication”. He found that while China’s across-product export sophistication (measured by EXPY or ESI) is exceptionally high, its within-product export sophistication turns out to be exceptionally low. In other words, although many of China’s exported goods belong to sophisticated categories, they may well be the low-quality varieties. Without considering the product quality dimension, one would overestimate the sophistication of China’s exports.

Theoretically speaking, the sophistication of a country’s export structure is determined by the country’s technology and capital endowment in producing the exports. To the extent that PCGDP measures a country’s export capability, it can serve as the single variable in predicting the country’s export sophistication. However, for countries with high regional heterogeneity, the overall PCGDP is a poor measure of export capability. China’s coastal provinces, which account for over 90% of China’s exports, have an average PCGDP level 1.5 to 2 times that of China’s overall PCGDP. Without taking this into account, one would underestimate the export capability against which the relative export sophistication is evaluated.

The purpose of this paper is to evaluate the parameters that establish the “China is special” observation. Our main finding is that China’s exports appear “special” because the sophistication measures do not fully consider product quality and because China’s overall PCGDP understimates the development level of its exporting regions. Although both factors have been mentioned in previous studies (e.g. Schott, 2008), this paper makes a distinctive contribution in providing a systematic evaluation of their individual and combined effects. We find that China’s outlier status is reduced after introducing product-quality or PCGDP adjustments to the analysis, but the individual effect of each is not large enough to reject the “China is special” hypothesis. However, the combined effect of the two adjustments makes China no longer an outlier in the cross-country comparison of export sophistication. Our finding is useful in the context of the debate on the nature of China’s exports. Rodrik (2006) considered China’s outlier status as evidence that China’s export experience was neither “a simple story of specialization according to comparative advantage,” nor “a straightforward story of export growth achieved through trade openness and free market forces.” Our finding shows however that China’s outlier status can be explained by economic fundamentals if the relevant variables are properly measured.

While this paper focuses on the measurement issues in the evaluation of China’s export sophistication, a number of recent papers have explored the reasons behind the high sophistication of China’s exports. Wang and Wei (2010) find that improvements in human capital and government policies in the form of tax-favored high-tech zones have been key determinants of China’s rising export sophistication. Van Assche and Gangnes (2010) argue that the high sophistication of China’s exports may simply be a result of the high sophistication of imported inputs in the processing trade. Using a sophistication index based on production data, they find no evidence that China’s electronics production activities are exceptionally sophisticated. Amiti and Freund (2010) also argue that the observed high sophistication of China’s exports might be a result of processing trade. Their computation shows that the skill content of China’s total exports increased significantly from 1992 to 2005, but little increase was found when processing exports were excluded from total exports. Besides processing trade, foreign firms are also considered a major force behind the rise of China’s export sophistication. Xu and Lu (2009) find that foreign firms from advanced countries have contributed significantly to the increase of the sophistication of China’s exports.

The remainder of the paper is organized as follows. In Section 2 we discuss the export sophistication measures and replicate the “China is special” result. In Section 3 we introduce the product quality dimension to the measurement of export sophistication, and evaluate the sensitivity of the measured export sophistication of China to the product quality adjustment. In Section 4 we discuss the measurement of a country’s capability of exporting sophisticated goods and consider regional heterogeneity. In Section 5 we conclude. We provide a description of our data in Appendix A.
2. The sophistication of China’s exports

2.1. Measurement

The sophistication of a country’s exports is measured by two indices in the recent literature. The first one is an “income content index” constructed by Rodrik (2006) and Hausmann, Hwang and Rodrik (2007).\footnote{Similar indices have been constructed by Michaely (1984) and Lall, Weiss and Zhang (2006).} This index, denoted by EXPY, measures the sophistication of country c’s exports as

$$
EXPY_c = \sum_{j \in I} s_{ic} PRODY_i
$$

Fig. 1. Export sophistication relative to income, 1996.
where PRODY is the sophistication of good i, I is the set of goods country c exports, and \( s_{ci} \) is the share of good i in country c's total export value. Thus a country's export sophistication is the weighted average of the sophistication of all its exported goods. For good i, its sophistication is measured by

\[
PRODY_i = \sum_{j \in I} \left( \frac{S_{ij}}{\sum_{n \in C} Y_j} \right)
\]

(2)

where \( Y_j \) is the income level (real GDP per capita) of country j. According to Eq. (2), the sophistication of good i is given by the weighted average of the income levels of all countries in set C that export the good, where the weight variable \( (s_{ij}/\sum s_{in}) \) reflects the importance of good i in country j's exports relative to all the other countries that export the good. A good is considered more sophisticated if it is exported more intensively by high-income countries, and a good is considered less sophisticated if it is exported more intensively by low-income countries. Thus the sophistication of a country's exports is revealed by the "income content" of the exports.

The second measure, Export Similarity Index (ESI), computes the overlap of a country's exports with that of a set of advanced countries: 3

\[
ESI_{cd} = \sum_{i \in I} \min(s_{ci}, S_{id})
\]

(3)

In Eq. (3), ESI\(_{cd}\) is the similarity between country c's export bundle and country d's export bundle. Denoting \( d \) as the set of OECD countries, ESI\(_{cd}\) reveals the sophistication of country c's exports measured against OECD exports.

2.2. The "China is special" result

Two recent studies (Rodrik, 2006; Schott, 2008) examined the relationship between a country's export sophistication (EXPY or ESI) and its PCGDP. Both studies found a positive relationship between EXPY/ESI and PCGDP, and China stands out as an outlier with its EXPY/ESI significantly higher than the level predicted by its PCGDP.

The results of Rodrik (2006) and Schott (2008) may be replicated using the following regression equation: 4

\[
\log(\text{EXPY}_{ct}/\text{ESI}_{ct}) = \alpha + \beta \log(\text{PCGDP}_{ct}) + \gamma \text{CHN} + \epsilon_{ct}
\]

(4)

where CHN is a dummy variable for China and \( \epsilon \) is an error term. The regression is performed on a sample of 141 countries in the period 1992–2005. Table 2 reports the results. In regressions (2.1) and (2.3), the estimated coefficients of CHN are positive and statistically significant at the 1% level, implying that China is a positive outlier in export sophistication relative to countries with similar PCGDP. In regressions (2.2) and (2.4), the effect of CHN is estimated for three sub-periods (1992–1995, 1996–2000, and 2001–2005). The results show that the estimated coefficients of CHN remain positive and statistically significant at the 1% level, and the point estimates show a declining trend over time, as was also noted by Rodrik (2006).

To get a more concrete idea about how "special" China is, we display in Table 3 the group of ten countries at PCGDP levels similar to China's. The table shows that in 1992, China's EXPY (7356) and ESI (0.104) were both significantly higher than the group average (4250; 0.019); India also appears to have been an outlier (7358; 0.059). In 2004, China moved up to a group of countries with higher PCGDP. Again, China's EXPY (12,524) and ESI (0.161) were both significantly higher than the group average (7225; 0.037); Venezuela also appears to have been "special" (10,985; 0.076).

The examples of India and Venezuela indicate that China was not the only outlier in the cross-country relationship between EXPY/ESI and PCGDP. It is also clear from Fig. 1 that in 1996 India (IND) and Mexico (MEX) looked as special as China. Fig. 1 shows that there were also outliers below the fitted line, such as Hong Kong (HKG). Thus there could be many "Country X is special" results. Notice that a country's outlier status in Fig. 1 was established on the values of two parameters: the sophistication index and PCGDP. In the next two sections, we evaluate these two key parameters.

3. The quality of China's exports

We first evaluate the sophistication measures. Conceptually, neither EXPY nor ESI necessarily reflect the sophistication of a country's exports. For example, a rich country might export a high-PRODY good because of its natural resources. 5 On the other hand, a poor country might export a high-PRODY good because of the multinational firms that export it from the country. With

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4 Rodrik (2006) does not specify this regression equation explicitly, but his argument is derived from such a regression equation. Rodrik (2006, p. 6) states that "Fig. 3 shows the scatter plot of EXPY against per-capita GDP for 1992. The correlation coefficient is 0.83. But countries do not lie neatly alongside the regression line... China's exports were associated with an income level that is more than six times higher than China's per-capita GDP at the time." Schott (2008) specifies the same equation (p. 26, Eq. (3)).

5 For example, "Dungeness crabmeat, prepared, frozen" (HS = 1,605,104,015) was exported mainly by Canada and its PRODY level is computed to be around 20,000.
global offshoring, it is also rather possible that a country exports a highly sophisticated final good after processing imported intermediate goods that are already of high sophistication.

Despite the noise in the EXPI/ESI measures, evidence shows that the indices do reflect the technology content of exports to a certain degree. Table 4 reports the estimated correlations between PRODY and R&D intensity for 2-digit ISIC industries of OECD countries, for which the data is available.\(^6\) The estimated correlations are all positive, and only three resource-intensive industries (fuel, rubber, and basic metals) show estimates that are statistically insignificant. We also computed correlations at the country level and found that both EXPY and ESI are positively correlated with R&D-GDP ratio.\(^7\) Thus we conclude that EXPY and ESI are imperfect but useful measures of export sophistication.

3.1. The quality of exports

The indices of EXPY and ESI, however, do not capture one important dimension of export sophistication, i.e., that product quality varies across countries. As documented by Schott (2004), even at the most disaggregated product-level data of international trade statistics (10-digit HS code), the price of the same product differs considerably based on country of origin. Table 5 shows an example. In 1996, there were 26 countries exporting “Line telephone sets with cordless handsets” (HS = 8,517,110,000) to the U.S. market and the average price was $49. Among major exporters, China exported 11.3 million sets at an average price of $44, the Philippines exported 9.2 million sets at $38, Malaysia exported 5.5 million sets at $55, and Japan exported 463,274 sets at $117. Schott (2008) pointed out that such price differences signal product-quality differences, and he defined the sophistication related to product quality as “within-product sophistication” in contrast to the “across-product sophistication” measured by EXPY/ESI.

\[^6\] We use industry average R&D intensity of previous five years as industry R&D variable for current year, and compute its correlation with average PRODY of the corresponding industry.

\[^7\] Using the R&D-GDP ratio averaged over 1996–2004 as the R&D variable for 2005, we find that its correlations with the EXPY and ESI indices in 2005 are 0.72 and 0.46 respectively in a sample of 90 countries. Both correlation estimates are statistically significant at the 1% level.
To measure the within-product quality difference, we construct the following relative-price index:

\[ q_{ic} = \frac{\sum_{n \in C_i} \mu_{in} p_{in}}{\sum_{n \in C_i} \mu_{in} p_{in}} \]  

Equation (5)

In Eq. (5), \( p_{ic} \) is the price of good \( i \) exported by country \( c \). The denominator is the weighted average of the prices of good \( i \) exported by all countries, the weight \( \mu_{in} \) being country \( n \)'s export share of good \( i \) in all countries' exports of good \( i \), which reflects the relative importance of country \( n \) in exporting good \( i \).

It is documented in Schott (2004) that for the same product, there is a positive correlation between the price of a country’s exports and its PCGDP. Fig. 2 shows the case of “Line telephone sets with cordless handsets.” We may infer from this positive correlation the within-product quality difference, which is the focus of this study.
relationship between price and PCGDP that rich countries generally export products of higher quality, and poor countries generally export products of lower quality. Interestingly, Schott (2008) found that China is again an outlier in this cross-country relationship: the average price of Chinese exports is significantly lower than the level predicted by its PCGDP. We can replicate this result by running the following regression:

$$\log(q_{ict}) = \alpha_{it} + \beta \log(\text{PCGDP}_{ct}) + \gamma \text{CHN} + \varepsilon_{ict}$$  \hspace{1cm} (6)$$

In Eq. (6), $\alpha_{it}$ is a product-year fixed effect that controls for unobserved product-year characteristics. Table 6 reports the results. In regression (6.1), the estimated coefficient of CHN is negative and statistically significant at the 1% level. In regression (6.2), the effect of CHN is estimated for three sub-periods. The estimated coefficients of CHN in the three sub-periods are all negative and statistically significant at the 1% level, and their absolute values show an increasing trend over time.

### 3.2. Quality-adjusted measure of sophistication

The finding that the prices of China’s exports are exceptionally low is important to the evaluation of China’s export sophistication. If price signals quality, then EXPY/ESI overestimates the export sophistication of China.

**Table 6**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>log PCGDP</td>
<td>0.369 (8.83)***</td>
<td>0.371 (8.84)***</td>
</tr>
<tr>
<td>CHN</td>
<td>−0.380 (8.59)***</td>
<td>−0.204 (4.19)***</td>
</tr>
<tr>
<td>CHN (1996–2000)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHN (2001–2005)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>−3.520 (9.57)***</td>
<td>−3.540 (9.58)***</td>
</tr>
<tr>
<td>Product-year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>2,607,879</td>
<td>2,607,879</td>
</tr>
<tr>
<td>$R^2$-squared</td>
<td>0.26</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Notes: the dependent variable is log $q$. Robust standard errors adjusted for clustering at the country level. Absolute values of $t$ statistics are in parentheses.

*** Significant at 1%.
How do we incorporate product quality in the measurement of sophistication? We propose to introduce a quality multiplier that adjusts the PRODY index. PRODY measures the average sophistication of a good without considering within-product quality differences. We define the following quality-adjusted index of sophistication:

\[
QPRODY_{ic} = (q_{ic})^\theta \times PRODY_i
\]

In Eq. (7), \((q_{ic})^\theta\) is the quality multiplier, where \(\theta\) is a parameter that measures the degree of quality adjustment. When there is no quality adjustment \((\theta = 0)\), \(QPRODY_{ic} = PRODY_i\). The usefulness of this index is that it recognizes the relatively high sophistication of a high-quality variety (e.g., men's cotton shirts made in Italy, \(q = 2.91\) in 2001) that belongs to a product category of low sophistication (\(HS = 6,105,100,010\), "Men's shirts of cotton, knit", \(PRODY = 3323\) in 2001), and the relatively low sophistication of a low-quality variety (e.g. video projectors made in China, \(q = 0.15\) in 2001) that belongs to a product category of high sophistication (\(HS = 8,528,304,000\), "Video projectors, CLR, non-hi def", \(PRODY = 25093\) in 2001).

### 3.3 Sensitivity of China's export sophistication to quality adjustment

To see the importance of quality adjustment in evaluating China's export sophistication, we perform a sensitivity test using the following regression equation:

\[
\log(QEXPY_{ct}) = \alpha_t + \beta \log(PCGDP_{ct}) + \gamma_1 CHN + \gamma_2 IND + \gamma_3 MEX + \gamma_4 HKG + \varepsilon_{ct}
\]

where QEXPY_{ct} is the weighted average of the quality-adjusted sophistication of all the goods exported by country \(c\) in time \(t\). IND, MEX and HKG are dummy variables for India, Mexico and Hong Kong, respectively.

Table 7 reports the results. We experiment with seven different values of \(\theta\). In regression (7.1), the dependent variable is EXPY \((\theta = 0)\). The result shows that China, India and Mexico all have EXPY levels significantly higher than the predicted levels (so they are all "special"), while Hong Kong has an EXPY level significantly lower than the predicted level. As the value of \(\theta\) increases (i.e., as more quality adjustment is introduced to the sophistication measure), the estimated coefficients of CHN, IND and MEX all fall steadily, but the one of CHN falls faster than the ones of IND and MEX. Indeed, when \(\theta = 2/3\), China is no longer an outlier in terms of the statistical significance of the China dummy, while India and Mexico remain outliers. Notice that Hong Kong becomes

### Table 7

Regressions of QEXPY with different degrees of quality adjustment.

<table>
<thead>
<tr>
<th>(\theta)</th>
<th>(7.1)</th>
<th>(7.2)</th>
<th>(7.3)</th>
<th>(7.4)</th>
<th>(7.5)</th>
<th>(7.6)</th>
<th>(7.7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\theta = 0)</td>
<td>(\theta = 1/5)</td>
<td>(\theta = 1/3)</td>
<td>(\theta = 1/2)</td>
<td>(\theta = 2/3)</td>
<td>(\theta = 3/4)</td>
<td>(\theta = 1)</td>
<td></td>
</tr>
<tr>
<td>log PCGDP</td>
<td>0.548 (89.32)***</td>
<td>0.548 (86.22)***</td>
<td>0.547 (81.56)***</td>
<td>0.546 (73.75)***</td>
<td>0.545 (64.94)***</td>
<td>0.544 (60.52)***</td>
<td>0.542 (48.28)***</td>
</tr>
<tr>
<td>CHN</td>
<td>0.566 (6.84)***</td>
<td>0.455 (5.31)***</td>
<td>0.381 (4.21)***</td>
<td>0.285 (2.85)***</td>
<td>0.183 (1.62)***</td>
<td>0.128 (1.06)***</td>
<td>0.056 (0.37)***</td>
</tr>
<tr>
<td>IND</td>
<td>0.652 (7.87)***</td>
<td>0.570 (6.65)***</td>
<td>0.514 (5.68)***</td>
<td>0.442 (4.43)***</td>
<td>0.367 (3.24)***</td>
<td>0.328 (2.70)***</td>
<td>0.205 (1.35)***</td>
</tr>
<tr>
<td>MEX</td>
<td>0.376 (4.45)***</td>
<td>0.341 (3.98)***</td>
<td>0.315 (3.48)***</td>
<td>0.275 (2.75)***</td>
<td>0.226 (2.00)***</td>
<td>0.197 (1.63)***</td>
<td>0.086 (0.57)***</td>
</tr>
<tr>
<td>HKG</td>
<td>0.460</td>
<td>0.505</td>
<td>0.533</td>
<td>0.568</td>
<td>0.606</td>
<td>0.627</td>
<td>0.702***</td>
</tr>
<tr>
<td>Constant</td>
<td>4.163 (79.64)***</td>
<td>4.147 (76.66)***</td>
<td>4.148 (72.60)***</td>
<td>4.166 (66.04)***</td>
<td>4.204 (58.83)***</td>
<td>4.231 (55.25)***</td>
<td>4.338 (45.34)***</td>
</tr>
<tr>
<td>Year fixed effects</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.81</td>
<td>0.80</td>
<td>0.78</td>
<td>0.75</td>
<td>0.70</td>
<td>0.67</td>
<td>0.56</td>
</tr>
</tbody>
</table>

Notes: The dependent variable is QEXPY. Absolute values of t statistics are in parentheses.

**Significant at 5%.

***Significant at 1%.
increasingly an outlier as $\theta$ increases, which is consistent with the fact that a large portion of Hong Kong’s exports come from mainland China so Hong Kong’s export sophistication is adjusted downward after considering the quality of its exports.

What is a proper value of $\theta$? Table 8 shows the size of the quality multiplier ($q^\theta$) at different values of $\theta$. For example, an adjustment of $\theta = 1/2$ implies the following effects: for a product at the 1st percentile of the $q$ distribution, $QPRODY = 0.14 \times PRODY$; for a product at the 99th percentile of the $q$ distribution, $QPRODY = 6.46 \times PRODY$. There is no theoretically “correct” value of $\theta$. However, we can rule out $\theta = 0$ since it ignores entirely the quality dimension of sophistication. We may also rule out $\theta = 1$ since it seems to introduce too much quality adjustment, making $QPRODY$ only 2% of $PRODY$ for the products at the 1st percentile of the $q$ distribution, and 42 times $PRODY$ for the products at the 99th percentile of the $q$ distribution. We observe from Table 7 that the threshold value of $\theta$ for China is $2/3$ above which the estimated coefficient of CHN is statistically insignificant. In our subsequent analysis, we choose $\theta = 1/2$ as the benchmark value of the quality adjustment parameter. As Table 7 shows, with this moderate quality adjustment, China, India and Mexico remain outliers in the cross-country relationship between export sophistication (measured by QEXPY) and PCGDP.

It is worth pointing out that irrespective of the value of $\theta$, our results show that the “China is special” observation is sensitive to the quality adjustment of the sophistication index. Thus our results establish the importance of the quality dimension in evaluating the sophistication of China’s exports.

4. Regional heterogeneity

So far we have used China’s overall PCGDP as a measure of its capability to export sophisticated goods. This measure ignores, however, the considerable heterogeneity among Chinese regions and the fact that most of China’s exports are from its more developed coastal provinces. Table 9 displays some key statistics of China’s provinces in 2004. The second column shows the ratio of provincial PCGDP to China’s PCGDP; the numbers reveal that the income level of the richest region (Shanghai) was 13 times that of the poorest region (Guizhou) in 2004. The third column shows provincial export shares. The top-nine exporting provinces

---

Table 9

<table>
<thead>
<tr>
<th>Province</th>
<th>Provincial PCGDP to China’s PCGDP</th>
<th>Provincial export share</th>
<th>Provincial FDI share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shanghai</td>
<td>4.48</td>
<td>0.12</td>
<td>0.10</td>
</tr>
<tr>
<td>Beijing</td>
<td>3.00</td>
<td>0.03</td>
<td>0.04</td>
</tr>
<tr>
<td>Tianjin</td>
<td>2.56</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Zhejiang</td>
<td>1.94</td>
<td>0.10</td>
<td>0.09</td>
</tr>
<tr>
<td>Jiangsu</td>
<td>1.68</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Guangdong</td>
<td>1.60</td>
<td>0.32</td>
<td>0.17</td>
</tr>
<tr>
<td>Fujian</td>
<td>1.40</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Shandong</td>
<td>1.37</td>
<td>0.06</td>
<td>0.14</td>
</tr>
<tr>
<td>Liaoning</td>
<td>1.32</td>
<td>0.03</td>
<td>0.09</td>
</tr>
<tr>
<td>Heilongjiang</td>
<td>1.13</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Hebei</td>
<td>1.05</td>
<td>0.02</td>
<td>0.01</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>0.92</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Xinjiang</td>
<td>0.91</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Jilin</td>
<td>0.89</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Hubei</td>
<td>0.85</td>
<td>0.00</td>
<td>0.00</td>
</tr>
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<td>Chongqing</td>
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Source: China’s Statistical Yearbook, 2005. PCGDP denotes per capita GDP.

* Municipality directly under the central government (equivalent to province).
accounted for 90% of China’s total export value in 2004. Notice that the top exporting provinces are the ones with high income levels (second column) and high shares of foreign direct investment (last column). It is evident that China’s overall GDP significantly underestimates the capital and technology capacity possessed by China’s major export regions.10

To account for the high income heterogeneity of Chinese provinces and the uneven distribution of exports across the provinces, we construct the following income variable that uses provincial export shares as weights:

$$PCGDP_e = \sum_{r \in R} s_r PCGDP_r$$  \hspace{1cm} (10)$$

In Eq. (10), $R$ denotes the set of export regions, $PCGDP_r$ is the per capita GDP level of region $r$, and $s_r$ is the export share of region $r$. Table 10 reports the results from the computation. The numbers show that China’s $PCGDP_e$ is significantly higher than China’s overall $PCGDP$, and the gap has increased steadily from 1992 to 2005.11

The income differences between exporting regions and non-exporting regions exist in all countries. Defining $\lambda_c$ as the ratio of country $c$’s export-region-weighted $PCGDP$ to the country’s overall $PCGDP$, we have

$$PCGDP_{ec} = \lambda_c PCGDP_e$$  \hspace{1cm} (11)$$

We consider $PCGDP_{ec}$ as a better indicator of a country’s capacity to export sophisticated goods than $PCGDP_e$. The problem, however, is that we do not have data to compute $\lambda_c$ for all countries. Still, we can gain useful insights by doing some experiments. It seems reasonable to assume that the degree of regional heterogeneity is relatively low in high-income countries and relatively high in middle- and low-income countries. In our first experiment, we assume $\lambda_c = 1.2$ for high-income countries and $\lambda_c = 1.4$ for middle- and low-income countries except China. With this assumption, we compute $PCGDP_{ec}$ for all countries except China and denote it as $PCGDPCP$. For China, we use $PCGDP_{ec}$ from Eq. (10) as its $PCGDP_{ec}$.

The first two regressions of Table 11 show the effects of this adjustment of the income variable. In regression (11.1), the income variable is $PCGDP$. In regression (11.2), the income variable is $PCGDPCP$. We see that after introducing the adjustment for regional income differences, the estimated coefficient of CHN remains positive and statistically significant, but the size of its point estimate falls to 0.422 from 0.566.

Regression (11.3) of Table 11 shows the results of replacing $EXPY$ with the quality-adjusted sophistication measure ($QEXPY$) as the dependent variable. We see that after introducing the quality adjustment in the measurement of export sophistication, the estimated coefficient of CHN remains positive and statistically significant, but the size of its point estimate falls to 0.285 from 0.566 in regression (11.1).

In regression (11.4), we introduce both the quality adjustment and the $PCGDPCP$ adjustment. The results show that the estimated coefficient of CHN falls to 0.142 and is statistically insignificant. From this benchmark experiment, we see that China disappears as an outlier in the cross-country comparison of the sophistication of exports once the measurement of sophistication considers product quality and the measurement of a country’s export capability considers regional heterogeneity.

We experimented with a number of plausible assumptions on $\lambda_c$ to see the sensitivity of the results of regression (11.4). We report in regression (11.5) one of the experiments in which $\lambda_c = 1.6$ is assumed for all middle- and low-income countries including China’s $PCGDP$ (Table 9).

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10 Schott (2008) noted the importance of considering the inter-regional relative endowment disparities within China, but did not incorporate them in his regression analysis.

11 Note that $PCGDPCP$ may overestimate the income level of China’s export regions. First, the exports of the coastal provinces may contain goods produced by the inland provinces that are shipped to the coastal provinces prior to being shipped abroad. Second, the reported income level of coastal provinces may not reflect the income level of migrant workers. These measurement biases do not affect our main results as shown by the regression results under different assumptions on China’s $PCGDP$ (Table 9).
China, and $\lambda_c = 1.2$ is assumed for high-income countries. The results show that the estimated coefficient of CHN is 0.199 and is statistically significant at the 10% level. This and other experiments confirm that the outlier status of China is considerably reduced (if not completely removed) once the export sophistication and export capability of countries are properly measured. Notice that the estimated coefficients on IND and MEX remain positive, sizable and statistically significant in regressions (11.4) and (11.5). This suggests that the measurement biases are a more significant factor in accounting for the outlier status of China than that of India and Mexico.12

5. Conclusion

China’s rapid upgrade in export structure has attracted much attention recently. Two influential papers by Rodrik (2006) and Schott (2008) found that China is “special” in exporting highly sophisticated goods that are not comparable with its development level. In this paper, we provide an evaluation of the two key parameters that establish the outlier status of China in cross-country comparisons, namely the export sophistication index and the country’s development level. We find that it was the improper measurement of the two parameters that led to the “China is special” result. First, product quality has not been fully considered in the sophistication measurement which has caused an overestimation of China’s export sophistication. Second, the average income of the whole country has been used to measure export capacity, which has caused an underestimation of the capacity of China’s coastal regions to export sophisticated goods. We show that China is much less “special” in the cross-country comparison of export sophistication once these two measurement biases are corrected.

In assessing the impact of product quality on the “China is special” result, we develop a quality-adjusted measure of sophistication. Our experiments show that China’s measured export sophistication is particularly sensitive to product quality in comparison with other developing countries, notably India and Mexico. We argue that a country’s overall PCGDP is a poor measure of its endowment and technology capacity to export sophisticated goods, as exporting regions within the country are usually more developed than non-exporting regions. Our experiments show that the consideration of regional heterogeneity is one of the keys to a proper evaluation of China’s export sophistication.

Our study has examined the “China is special” result from the angle of measurement biases. As discussed in the introduction of the paper, several recent studies have started to explore the reasons behind China’s increasingly sophisticated export structure, and have examined the roles of foreign direct investment, processing trade, and certain government policies. Our results on China, India and Mexico suggest that different countries may have different reasons to be “special” in a cross-country comparison of export sophistication. Further research based on micro-level data of individual countries should be useful in this research area.

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12 Table 11 shows that Hong Kong is a downward-biased outlier in all the regressions. This finding is not surprising as a large portion of Hong Kong’s manufacturing exports are from mainland China.
References


