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Comment Galina Hale

Zhi Wang and Shang-Jin Wei present us with a thorough and convincing study of the growing sophistication of Chinese exports in recent years and of the forces behind this trend. We learn that improvements in human capital and tax incentives for high-tech zones are responsible for the expansion

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of China's export into more sophisticated categories, while sophistication within categories is driven by a combination of processing trade, foreign direct investment (FDI), and, again, tax incentives for high-tech zones.

These results are important for two reasons. First, rising sophistication of Chinese exports means that even high-income countries will experience competitive pressure from Chinese producers, so understanding its sources will help us evaluate potential shifts in the global division of labor in the future. More specifically, the distributional effects of U.S. imports from China (which in 2008 contributed over 16 percent to U.S. total imports) depend crucially on what types of goods the United States is importing from China. Second, this study contributes to our understanding of China's economic growth. In particular, it suggests that, at least in its export sector, China is following the stages of the East Asian growth miracle—beginning with labor-intensive goods, increasing capital intensity as wealth accumulates and labor becomes more expensive, turning to high-tech goods as technology develops and human capital accumulates, and finally developing into a niche producer of cutting-edge research and development (R&D) intensive goods and services.

The analysis is conducted on two levels. On the first level, the authors study the overlap in Harmonized System (HS) six-digit categories of manufactured goods exported by China and by G3 economies (the United States, Japan, and the European Union)—the larger the overlap, the more sophisticated the structure of Chinese exports. To do so, they construct an export dissimilarity index (EDI) in the spirit of Finger and Kreinin's (1979) export similarity index (ESI) and study the trends and the determinants of these indexes across China's provinces and cities. On the second level, the authors study the unit prices of each of these six-digit categories to investigate the potential increase in sophistication and quality of goods *within* each category.

We learn, as expected, that the similarity of Chinese exports to G3 exports grew at a steady pace between 1996 and 2006. This increase in sophistication is most pronounced among privately owned companies, the share of which has been steadily growing during the period under consideration. The authors are careful to conduct their analysis for firms with different ownerships separately and find that the results do indeed vary by ownership type.

For geographical differences in export sophistication growth, they consider the following possible explanations: processing export, the presence of a high-tech zone, skilled labor, output, and the presence of FDI. Almost all of their results come from differences in the *dynamics* of EDI and explanatory variables across cities because city and year fixed effects are included. The role of cross-city differences may be read from table 2A.8, where city fixed effects are excluded. As expected, the same factors that appear important in the main specification are also responsible for cross-city differences in export sophistication.

The results are summarized well in the paper. I now focus on the difference of the results across different ownership types and on some interpretations I don't necessarily agree with. The reader should keep in mind that city fixed effects absorb all time-invariant differences across cities, while year fixed effects absorb all trends common to all cities. The discussion in the paper occasionally slips into cross-city interpretation (especially in the conclusion), which is not really a problem given that cross-city differences are, in fact, driven by the same factors.

The authors find that in the full sample EDI becomes smaller, that is, exports become more sophisticated, when the share of exports from export processing zones (EPZs) and high-tech zones increases, when the share of population with a university degree increases, and when cities become richer in terms of gross metropolitan product (GMP) per capita.

Although GMP per capita is potentially endogenous (presumably, more sophisticated exports are also more valuable and, thus, increase GMP per capita) and should probably be lagged, I believe it is an important control variable and needs to be included. I disagree, however, with its interpretation as a measure of human capital accumulation in the city—it might be a measure of physical capital accumulation in the city or of changing industrial composition of the city's output, which, again, would be simultaneously determined with more sophisticated exports. I believe the other proxy—share of university students in nonagricultural population—is less likely to be endogenous and is a better proxy for human capital accumulation. In fact, it seems to have an independent effect in the same direction as the per capita GMP: an increase in the share of university students is associated with growing sophistication of the export structure, even controlling for GMP.

Given that processing trade is a large share of Chinese exports, it is very important to include relevant controls. The authors did a great job of controlling for both EPZs and processing trade outside such zones. They find that processing trade is, in fact, in less sophisticated product categories—the larger the share of processing trade, the less sophisticated the exports, ceteris paribus. This effect is driven entirely by state-owned and collective firms, as it is not present for other ownership sectors and is small and not robustly significant for the full sample.

The importance of high-tech zones is also driven by state-owned and collective firms, which is not surprising because it shows a direct effect of the government's policies designed to upgrade the production structure in state-owned enterprises through high-tech zones, R&D subsidies, and links with research centers. Private firms do not enjoy such support.

The authors seem to find consistently that the presence of FDI does not have any effect on the sophistication of Chinese exports. While foreign-invested firms themselves appear to produce more sophisticated product lines (see columns [3] and [4] in table 2.10), there do not seem to be any spillovers, nor do the preceding factors affect the export sophistication of

foreign-owned firms. To me, this effect is not surprising: Hale and Long (2008) find that the presence of FDI in a given city and industry increases competition for skilled labor, which may offset any potential positive spillovers from FDI. Hale and Long (2009) also find that spillovers from FDI to total factor or labor productivity do not seem to be present in China, which is consistent with the Wang and Wei results.

Turning to the analysis of unit values, which proxy for the sophistication of exports within each HS six-digit category, I am disappointed that the authors chose a different regression specification. In particular, they chose to include city by year fixed effects, rather than city and year fixed effects separately. While this allows them to focus more squarely on the role of processing trade and high-tech zones, it no longer allows them to test for the effect of human capital accumulation as in previous regressions because the explanatory variable does not vary within city-year. Moreover, it makes results difficult to compare with the preceding analysis. For instance, the authors find that a higher share of processing trade increases the unit values of exports, which is different from the effect of processing trade on EDI. However, we cannot definitively say that the effects differ because the regression specification is not the same.

Overall, the paper presents a very informative and thorough analysis of an issue that is both important and understudied in the literature so far. Any trade economist or macroeconomist who studies Chinese exports needs to keep in mind that massive structural and compositional changes take place in the background and cannot be ignored. Wang and Wei provide an important contribution to our understanding of the sophisticated nature of Chinese economic growth and of geographical differences in Chinese export growth patterns.

My understanding of the results is that the growing sophistication of Chinese exports mostly appears to be driven by government policies targeting the development of high-tech industries and higher education. Going forward, therefore, if one can expect such policies to continue, one should also expect the sophistication of Chinese exports and their competitive pressure on high-income countries to be growing as well.

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