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An Empirical Analysis for Over-Sophisticated Export and Regional Economic Growth

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Abstract

This paper investigates the hypothesis of export sophistication-led growth in the case of China. Using a panel data covering Chinese provinces and the period between 2003 and 2008, this paper examines whether regional exports with higher sophistication help to increase rates of regional growth. The empirical results reveal a positive relationship between export sophistication and growth in China. And the relationship is found to be driven by the export of coastal provinces.

Keywords

Export Sophistication, Over-Sophisticated Export, Regional Growth, Panel Data, China

1. Introduction

Empirical testing of the export-led growth hypothesis has a long pedigree. Earlier studies focus on the effect of aggregated export scale, based on cross-country data or one-country data. And the effect of aggregated export scale on growth is empirically proved in most researches [1]-[4]. In recent years, guided by the development of international trade theory, empirical studies in this line have been diverted to examine specific factors, conditions, channels or mechanisms by which export leads to growth. Hereinto, Hausmann and Rodrik [5] construct an indicator EXPY that measures the productivity level associated with a country's export basket. They found that China ended up with an export basket that was significantly more sophisticated than what would be normally expected for a country at its income level. They suggest that this more sophisticated basket has been an important determinant of China's rapid growth. Subsequently, Schott [6] also provides evidence that China exports more products in line with OECD countries than expected given its level of development. Using cross-country data, Hausman, Huang and Rodrik [5] examine the effect of export sophistication on economic growth.

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The empirical results suggest that more sophisticated export induces rapid growth. But as pointed out by Shan and Sun [1], cross-country studies implicitly assume a common economic structure and similar production technologies across countries. Results indicated by significant coefficients may therefore be highly misleading. Therefore, different methods and data need to be used for more robust results. This paper enriches research in this line by examining the effect of productivity level reflected in regional export package on local economic growth in the case of China.

In this paper, the indicator PEXPY is defined to capture productivity level associated with a Chinese province's export basket. With export values of 1245 products of 70 counties and 31 Chinese provinces 2002-2007, PEXPY is calculated. Analysis shows that most provinces do have an export basket that is more sophisticated than what would be normally expected for a province at its income level. Next, I test the hypothesis that higher export sophistication causes regional economic growth with panel data of 31 provinces 2002-2007. The empirical results support promotion effect of higher export sophistication on economic growth. The hypothesis is also tested with sub-samples of inland and coastal provinces respectively. The effect of export sophistication to economic growth is only found in coastal provinces.

This paper is organized as follows. Section 2 describes the data and specification. The empirical results are discussed in Section 3. Section 4 concludes the paper.

2. Provincial Export Productivity Level

Indicator PEXPY

Hausmann and Rodrik construct an indicator EXPY that measures the productivity level associated with a country's export basket. Here I define indicator PEXPY for measuring a province's export sophistication as

$$\text{EXPY}_j = \sum_i \text{PRODY}_i \cdot s_{ij}$$

where PRODY_i is a proxy for the benchmark level of productivity of each particular export commodity i. Using it as weights I can measure the average export sophistication of province j. PRODY_i is calculated according to Hausmann, Hwang and Rodrik [5].

$$\text{PRODY}_i = \sum_c \frac{S_{ic}}{\sum_c S_{ic}} Y_c$$

where S_{ic} is the value-share of the commodity i in the country c's overall export basket and Y_c is the PPP adjusted GDP per capita expressed in 2000 constant terms for country c. It's necessary to note that s_{ij} is the value-share of the commodity i in the Chinese province j's overall export basket here. In doing so, EXPY could be used to measure product sophistication of any geographic scope's export according to the definition of j.

3. Data and Methodology

3.1. Methodology

For study of one country, more econometric studies use time-series data to investigate the causal relationship between exports and growth by means of Granger-type causality tests. A handful of scholars use panel data, such as An and Iyigun [7]. Although Granger tests are available in this study, panel data analysis provides more regional information. So following An and Iyigun [7], Our empirical estimates of the effect of the export sophistication on economic growth is obtained by estimating the following equation with panel data[1]:

$$g_{j,t} = \beta_0 + G_{j,t-1} + I_{j,t-1} + H_{j,t-1} + EI_{j,t-1} + \text{PEXPY}_{j,t-1} + \alpha_j + u_{jt} \quad (1)$$

Here time dummy is controlled and fixed-effects model is adopted. The variables in Equation (1) are defined as follows: $g_{j,t}$ is the average growth rate of province j's per-capita GDP; $G_{j,t-1}$ the province j's per-capita income at the beginning of each period (in logs); $I_{j,t-1}$ the investment to GPP ratio; $H_{j,t-1}$ the percentage of "primary and secondary school complete" in the population aged 15 or above. $EI_{j,t-1}$ the export value to GPP

[1]An and Iyigun [7] is a cross-national study for export skill content on growth. Here we dropped regressors describing regional characteristic difference among countries.

ratio. $PEXPY_{j,t-1}$ in logs is a proxy for commodities sophistication of Chinese provinces' export. Presently, index EXPY has been designed to measure average commodities sophistication/quality for a country' export in study of previous studies [6] [8].

3.2. Data

The first dataset includes regional information on 31 provinces that constitute Mainland China. Original data is compiled from three series public publications of National Bureau of Statistics of China: China's Statistical Yearbook, China Population Statistic Yearbook and China Industry Economy Statistical Yearbook. The information includes nominal per capita GPP 2002-2008 in RMB Yuan, provincial consumer price index (CPI), fixed asset investment 2003-2007, GPP in 100 million RMB Yuan, population aged 15 or above, population with primary schooling and secondary schooling as highest education respectively, and export commercial value in 10 million RMB Yuan. The real per capita GDP growth rate from 2003 to 2008 is dependent variable. Prior to calculation for growth rate; the yearly levels have been adjusted to reflect 2000 constant prices using provincial CPI.

The second dataset includes the data of the United Nations Commodity Trade Statistics Database (COMTRADE) obtained through the WITS platform to construct proxy of $PRODY_i$. Under the HS2002 classification there are 1245 products at the 4-digit level. For purposes of consistency the analysis is confined to countries that reported information for every year between 2002 and 2007 and for which data on GDP per capita were available from the World Development Indicators. This left us with 70 countries representing around 50 percent of total trade.

The third dataset of Chinese provincial export value 2002-2007 under the HS2002 classification at the 4-digit level is obtained from Customs of the People's Republic of China to calculate index $PEXPY_j$. **Table 1** presents the summary statistics of our sample and **Table 2** reports the Correlation matrix.

4. Results

There are several potential econometric problems in this estimation need to be addressed. First, to alleviate multicollinearity, I exclude the regressors that are highly correlated with the regressors in the model. As shown by **Table 2**, multicollinearity is no longer a concern with weakly correlated regressors. Second, the empirical analysis is based on data for China's 31 provinces and autonomous regions over the years 2003 to 2008. The small sample size necessarily calls for cautious analysis of the results. Therefore, I here use the robust variance estimator to improve the overall estimate's small-sample properties. Third, it's necessary to address the possible endogeneity of explanatory variables. And I use Fixed-Effects Anderson-Hsiao IV Regression for robust result.

The results are shown by **Table 3**. Fixed-effects analysis is used with the robust variance estimator adopted to

Table 1. Descriptive statistics.

Variable	Obs.	Mean	S.D.	Min	Max
Growth	186	0.163	0.056	−0.058	0.452
Original PC GPP (log)	186	9.428	0.612	8.061	11.097
Export Sophistication	186	9.686	0.256	9.118	10.339
Investment	186	0.476	0.124	0.263	0.825
Human Capital	186	0.552	0.129	0.076	0.730
Export Intensity	186	0.156	0.214	0.000	0.949

Table 2. Correlation matrix.

	Growth	Original PC GPP	Export Sophistication	Investment	Human Capital
Original PC GPP	−0.1527				
Export Sophistication	0.1173	0.4791			
Investment	0.3092	−0.0948	0.2439		
Human Capital	0.0737	0.4621	0.1017	−0.5110	
Export Intensity	−0.1348	0.6893	0.2971	−0.2652	0.3177

Table 3. Fixed effects regression result.

	All Samples		Inland Provinces		Coastal Provinces	
	(1)	(2)	(1)	(2)	(1)	(2)
Export Sophistication	0.124** (0.010)	0.122** (0.008)	0.085 (0.098)	0.096* (0.041)	0.311* (0.029)	0.292* (0.039)
Original PC GPP	−0.077 (0.059)	−0.088* (0.036)	−0.037 (0.359)	−0.059 (0.181)	−0.305** (0.016)	−0.295** (0.016)
Investment	0.203*** (0.001)	0.209*** (0.001)	0.183** (0.019)	0.191** (0.015)	0.279** (0.008)	0.283** (0.009)
Export Intensity	−0.098 (0.070)	−0.093 (0.068)	0.055 (0.799)	0.080 (0.715)	−0.015 (0.785)	−0.013 (0.823)
Human Capital	0.304* (0.048)		0.213 (0.255)		0.794** (0.013)	
Primary Education		0.430* (0.029)		0.345 (0.178)		0.844** (0.025)
Secondary Education		−0.144 (0.682)		−0.244 (0.603)		0.630 (0.146)
R^2	0.37	0.39	0.44	0.45	0.40	0.41
Obs.	186	186	120	120	66	66

The Fixed-Effects analysis is reported with the robust variance estimator calculated. Province-specific and time-specific fixed effects estimate. P-Value in parentheses. The symbols *, **, and ***denote significance at the 10%, 5% and 1% levels, respectively. Province-specific and time-specific fixed effects estimate.

improve the overall estimate's small-sample properties. Column 1 of **Table 3** reports the results of the fixed-effects model using all samples. Column 2 and 3 report the results using the sample of inland provinces and coast al provinces respectively. Specification (1) is a parsimonious specification in which I include original per-capita GPP, investment ratio, export intensity and human capital as independent variables. Specification (2) uses primary education and secondary education instead of aggregated human capital measure.

The coefficient of average export sophistication is 0.12 in specification (1), statistically significant in the four specifications using all samples, and 0.31 in specification using coastal provinces, also statistically significant in spite of the lowered significant level. However, it is insignificant in 3 specifications using inland samples. This result suggests that higher export sophistication is an important factor that explains the Chinese economic performance in recent years. The export sophistication-led growth hypothesis can be empirically supported with cross-provincial dataset of China. This result is consistent with Hausman, Huang and Rodrik [5] in spite of using different methodology and dataset. The basic economic theory underlying this is simple: exporter operates products with high productivity means more profit, which attracts more local entrants. Learning effect from imitating or creation by entrants leads to the development of regional economy.

Besides, in China, the huge regional discrepancy still exists currently according to our results: 1% increase in export commodities' sophistication will lead to 0.31% economic growth in coastal provinces. But such causal relationship is not found in inland provinces. Therefore, the export sophistication-led growth method exists only in the east developed regions. According to the study of Xu and Lu [9], level of export sophistication is positively related to the share of wholly foreign owned enterprises from developed countries and the share of processing export of foreign-invested enterprises. Coastal provinces are typical habitat for foreign enterprises with high-tech and upgraded processing export which maybe the origin of regional economic growth. For this conjecture further studies are needed for cautious conclusion.

For robust validity, I test export sophistication on regional growth using fixed-effects Anderson-Hsiao IV Regression and the result is reported in **Table 4**. As shown by **Table 4**, the results are totally consistent with above.

In addition, the other control variables that we include have expected effects on economic growth, except export intensity: ceteris paribus, regions with higher investment level grew faster, while those that were rich initially tended to grow more slowly. It is especially obvious for coastal developed provinces. The coefficients on proxy of human capital are positive and significant for specifications of all samples and coastal provinces, but not for inland provinces, which is consistent with the notion that a province with more skilled labor tends to export commodities with higher sophistication and possibly induces learning effects contributing to economic

Table 4. Fixed-Effects Anderson–Hsiao IV Regression result.

Variable	All Samples		Inland Provinces		Coastal Provinces	
	(1)	(2)	(1)	(2)	(1)	(2)
Export sophistication	0.126*** (0.004)	0.123*** (0.004)	0.087 (0.089)	0.099 (0.055)	0.311*** (0.001)	0.292** (0.007)
Original PC GPP	−0.084** (0.024)	−0.096** (0.011)	−0.042 (0.324)	−0.065 0.158)	−0.305*** (0.001)	−0.295*** (0.002)
investment	0.216*** (0.000)	0.223*** (0.000)	0.191** (0.008)	0.201*** 0.005)	0.279** (0.006)	0.283** (0.006)
Export intensity	−0.098 (0.068)	−0.093 (0.082)	0.019 (0.931)	0.041 0.850)	−0.015 (0.808)	−0.013 (0.842)
Human capital	0.353** (0.016)		0.245 (0.182)		0.794*** (0.004)	
Primary education		0.485*** (0.003)		0.384 0.071)		0.844** (0.006)
Secondary education		−0.106 (0.709)		−0.222 0.585)		0.630 0.181)
R^2	0.3791	0.3942	0.4368	0.4471	0.4028	0.4053
χ^2	3041.03 (9)	3098.85 (10)	2010.93 (9)	2027.28 (10)	1120.33 (9)	1100.77 (10)
Obs.	185	185	119	119	66	66

The Fixed-Effects Anderson-Hsiao IV analysis is reported for robust validity. Province-specific and time-specific fixed effects estimate. P-Value in parentheses. The symbols *, **, and ***denote significance at the 10%, 5% and 1% levels, respectively.

growth. This result is consistent with Wang and Wei [10]. The coefficients of export intensity are statistically insignificant. This result suggests that export scale be not a significative drive for economic growth, when compared with export sophistication. Additionally, our results show that primary educated population prompts economic growth instead of the secondary educated. It is puzzled and needs to be further studied.

5. Conclusion

Using a panel dataset covering 31 Chinese regions and the period between 2003 and 2008, I examine whether exports with higher quality help to sustain higher rates of economic growth. After controlling for differences in the initial levels of per-capita income, investment level, human capital, as well as export intensity, I find that higher export sophistication induces economic growth of China. It is an important factor that explains the Chinese coastal provinces' economic performance, but not for inland provinces. I think this result correctly reports the relationship between export sophistication and Chinese economic growth in recent years, and it further shows huge discrepancy between Chinese inland and coastal provinces.

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