An Empirical Study on Impact of China’s Outward Foreign Direct Investment on Export Commodity Structure Optimization

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Abstract: In order to explore whether outward foreign direct investment (OFDI) upgrades the home country’s export commodity structure, the paper constructed the Vector Auto Regression (VAR) model to study the impact of China's OFDI on export commodity structure. The results show that OFDI does optimize the export commodity structure of China, which provides the empirical basis for government decision-makers to make trade policies and strategy.

Introduction

With the development of economic globalization, and scientific and technological progress as well as the deepening of the international division of labor, each country continues to increase the efforts of foreign investment. Since the reform and opening up, China embarked on the road of foreign direct investment, while attracting a large number of foreign direct investments and intensively development of foreign trade. Despite a late start, China’s OFDI develops rapidly. Figure 1 shows the change in China’s OFDI flow and stock from 1982 to 2012.

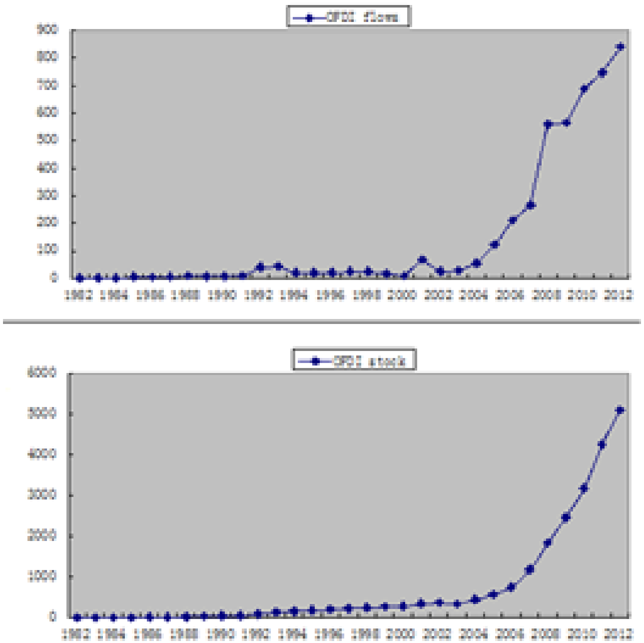

Fig. 1 China’s OFDI flow and stock during 1982 and 2012 (hundred million USD)
Resources: UNCTAD

International trade and outward foreign direct investment (OFDI) are the main channels for a country's integration into the economic globalization, so what the mutual relationship between the two is and how to coordinate them in order to promote economic development of a country or region have become key issues for the government and economists to be solved. This paper is organized as follows: Existing literature is introduced in Section 2. In Section 3, how China's OFDI influence export commodity structure is described. Section 4 is the conclusion.

Theoretical Background

So far, there is no general agreement on the relationship of OFDI and export trade. The relevant theoretical researches present three perspectives: alternative effect, complementary effect and contingency effect [1]. As to the alternative effect, Mundell (1957) mathematically modeled cross-border capital flows in a Heckscher-Ohlin framework, Buckley and Casson (1976) commented the theory of internalization, Dunning (1978) raised an eclectic paradigm and continued to update the theory. As to the complementary effect, Kojima (1973rasied marginal industry expansion theory, Tolentino (1993) and Cantwell (1994) put forward the technological innovation. Further evidence is in favor of contingency effect [2]. The determinants in the relationship of OFDI and export trade are: the level of international investment(Bergsten et al,1980),the cooperation between trade and non-trade elements(Markuson and Svenson,1985),the market-oriented OFDI or the productivity-oriented OFDI(Gray,1998),the vertical investment or horizontal investment(Head and Ries,2001),short-term or long-term effect of investment(Blonigen,2001),the degree of industrial classification(Svenson,2004),industrial structure, domestic investment, balance of payments, advance in technology, the political decision-making in the home country (Kokko,2006).

Most of these studies focus on the relationship between OFDI and foreign trade, whether OFDI can enhance the home country's structure of export products or not is not enough.

The Empirical Analysis

Data and Descriptive Statistics

Model variables include:

A.The proportion of China's foreign direct investment (stock) in GDP recorded as RIG represents the relative size of foreign direct investment and reflects the level of openness of China's economy.

Table 1 RIG during 1982 and 2012

year	OFDI (hundred million USD)	GDP (hundred million USD)	RIG (OFDI/GDP)	year	OFDI (hundred million USD)	GDP (hundred million USD)	RIG (OFDI/GDP)
1982	0.44	2953.7	0.0001	1998	250.78	10451.99	0.0240
1983	1.37	3146.37	0.0004	1999	268.53	11007.76	0.0244
1984	2.71	3173.52	0.0009	2000	277.68	11928.36	0.0233
1985	9	3090.83	0.0029	2001	346.54	13172.3	0.0263
1986	13.5	3043.48	0.0044	2002	371.72	14555.54	0.0255
1987	19.95	3298.51	0.0060	2003	332.22	16507.7	0.0201
1988	28.45	4134.39	0.0069	2004	447.77	19427.81	0.0230
1989	36.25	4597.82	0.0079	2005	572.06	22836.71	0.0251
1990	44.55	4044.94	0.0110	2006	750.26	27872.54	0.0269
1991	53.68	4241.17	0.0127	2007	1179.11	34943.51	0.0338
1992	93.68	4998.59	0.0187	2008	1839.71	45318.31	0.0406
1993	137.68	6410.69	0.0215	2009	2457.55	50694.7	0.0485
1994	157.68	5826.53	0.0271	2010	3172.11	59514.62	0.0533
1995	177.68	7569.6	0.0235	2011	4247.81	72037.84	0.0590
1996	198.82	8920.14	0.0223	2012	5090.01	80943.62	0.0629
1997	224.44	9850.46	0.0228				

Resources: Calculated from data obtained from UNCTAD

B. Chinese export commodities trade competitiveness index (abbreviated: TC) represents the performance of export products in the international market. Furthermore, according to the standard international trade classification (SITC), the Chinese export goods in SITC0-4 are regarded as resource-intensive products, SITC6, 8, 9 regrade as labor-intensive products, SITC5, 7 regraded as

capital and technology intensive products, the trade competitiveness indexes of the three sorts are recorded as TCR, TCL, and TCK.
According to trade competitiveness index (TC) formula:

$$TC_i = (E_i - I_i)/(E_I + I_i)$$

Where E_i is the total exports of product i, I_i is the total imports of the product i. If the trade competitiveness index is positive, it means that the country is a net supplier of i, production efficiency of this product is higher than the international level. The more TC closes to 1, the stronger the international competitiveness of the sort of products; otherwise weaker.
Calculated TCR,TCL,TCK, as shown in Table 2.

Table 2 TCR, TCK, and TCL during 1982 and 2012

year	TCR	TCK	TCL	year	TCR	TCK	TCL
1982	0.1366	-0.4281	0.2807	1998	-0.0566	-0.1197	0.4364
1983	0.2471	-0.4873	0.0929	1999	-0.1476	-0.1492	0.3997
1984	0.3924	-0.6015	0.0285	2000	-0.2947	-0.1266	0.3932
1985	0.4467	-0.8135	0.0159	2001	-0.2692	-0.1248	0.3829
1986	0.3323	-0.7582	0.0142	2002	-0.2664	-0.1060	0.3780
1987	0.3135	-0.6629	0.1425	2003	-0.3528	-0.0767	0.3326
1988	0.1972	-0.6403	0.1724	2004	-0.4861	-0.0386	0.3452
1989	0.1539	-0.5691	0.1685	2005	-0.5015	0.0262	0.3857
1990	0.1444	-0.4320	0.2969	2006	-0.5591	0.0601	0.4430
1991	0.1169	-0.4495	0.3001	2007	-0.5961	0.1014	0.4581
1992	0.1239	-0.4148	0.3391	2008	-0.6459	0.1459	0.4830
1993	0.0795	-0.4666	0.2234	2009	-0.6423	0.1130	0.4249
1994	0.0890	-0.3866	0.3462	2010	-0.6831	0.1077	0.4094
1995	-0.0639	-0.2666	0.3941	2011	-0.7147	0.1121	0.4092
1996	-0.0742	-0.2450	0.3540	2012	-0.7266	0.1286	0.4249
1997	-0.0888	-0.1439	0.4313				

Resources: Calculated from data obtained from UNCTAD

Unit Root Test

Time series analysis require the relevant time series to be stationary, otherwise may lead to "spurious regression"[3]. This paper uses unit root test model to judge the stationary of each time series. The Augmented Dickey and Fulled(ADF)test model is used for each variable unit root test. In order to eliminate the phenomenon of heteroscedasticity, the variables are transformed using natural log function and recorded as LNRIG.ADF unit root test results for each variable are shown in Table 3.

Table 3 ADF Text Result for Each Variable

Variables	Selection (C,T,K)	ADFVaule	Mackinnon critical value at1%level	Mackinnon critical value at5%level	Mackinno critical value at10%level	Result
TCR	(C,T,3)	-5.1907	-4.2967	-3.5684	-3.2184	Stationary***
TCK	(C,T,3)	-3.5162	-4.2967	-3.5684	-3.2184	Stationary*
TCL	(C,T,3)	-2.8453	-4.2967	-3.5684	-3.2184	Non-stationary*
LNRIG	(C,T,3)	-6.8775	-4.2967	-3.5684	-3.2184	Stationary***
D(TCR)	(C,0,4)	-6.2328	-3.6793	-2.9678	-2.6230	Stationary***
D(TCK)	(C,0,4)	-3.9133	-3.6793	-2.9678	-2.6230	Stationary***
D(TCL)	(C,0,4)	-6.1836	-3.6793	-2.9678	-2.6230	Stationary***
D(LNRIG)	(C,0,4)	-3.5940	-3.6793	-2.9678	-2.6230	Stationary**

Note: Selection(C,T,K),C means constant means trends means different lagging order; D indicates differences;*、**、***represent the Mackinnon critical value at 10%,5%,1% significant level respectively.

Test results as shown in Table 3 indicate that the ADF values of only one series of TCL is bigger than the critical value at any certain significant level, showing that there is root unit and it's not stationary. But the ADF test values of all the first order differential variable sequence D (TCR), D (TCK), D (TCL), D (LNRIG) are smaller than the critical value at any certain significant level, showing that there are not root units and they're stationary. Thus, we're sure that variables under test are the first-order difference stationary series, so that cointegration test can be carried out.

Vector Auto-regression (VAR) Model

The key of VAR is to select the suitable lag order number of variables. Calculating LR, FPE, AIC, SC and HQ of four indexes named TCR, TCK, TCL and LNRIG respectively through Eviews 6.0 in order to judge the optimal lag order number, the calculations are in Table 4.According to Table 4, only LR and AIC select 1 as the lag order, the other criterion all select 3, so VAR (3) model is established.

Table 4 the selection of VAR optimal lag order

Lag	LogL	LR	FPE	AIC	SC	HQ
0	78.93825	NA	5.57e-08	-5.352732	-5.162417	-5.294551
1	183.5237	171.8190*	1.01e-10	-11.68027	-10.72869*	-11.38936
2	201.9891	25.06011	9.16e-11	-11.85636	-10.14353	-11.33273
3	222.5838	22.06575	8.17e-11*	-12.18455*	-9.710460	-11.42820*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The next step is to examine whether the model satisfies the stability condition of VAR model. According to the root AR diagram method, if inverse roots of AR characteristic polynomial are less than 1(locate in the unit circle), the model is stable [4]. From the Figure 2, we can find that all the inverse roots of AR characteristic polynomial are inside the unit circle. So 3 is regarded as the suitable lag order.

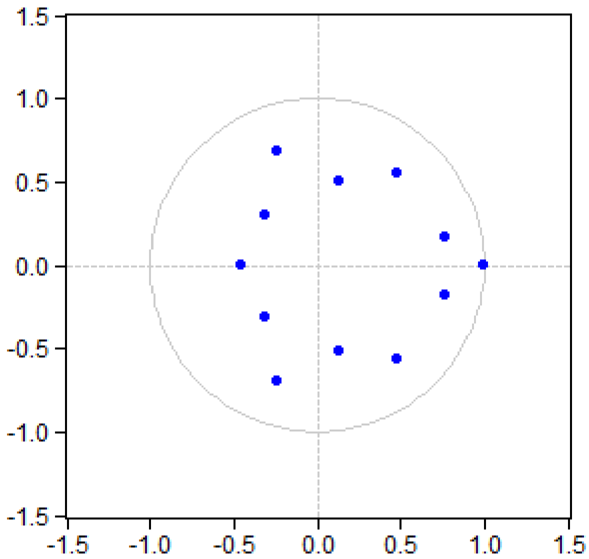

Fig. 2 Inverse Roots of AR Characteristic Polynomial

Cointegration Test

The cointegration test proposed by Johansen(1988,1991) and Johansen and Juselius(1990) is carried out to test the long-term stable relationship between China's OFDI and the structure of export products.Cointegration test results, as shown in table 5, indicate that there is one and only one cointegration equation existing between TCR and LNRIG and that there is one and only one cointegration equation existing between TCK and LNRIG, between TCL and LNRIG respectively,too. The cointegration vector of TCR and LNRIG is (1, -0.2033), and that of TCK and LNRIG is (1, 0.3666), for the TCL and LNRIG is (1, 0.1405).Vector Error Correction estimates can be done accordingly between TCR and LNRIG,between TCK and LNRIG,between TCL and LNRIG respectively as shown in Table 6.

Table 5 VAR (3)Johansen Cointegration Test

Hypo No. of CE(s)	Eigenvalue	Trace Statistics	5%Critical Value	Prob**
None*	0.7394	65.3965	47.8561	0.0005
At most 1	0.4860	27.7062	29.7971	0.0855
At most 2	0.2698	9.0707	15.4948	0.3589
At most 3	0.0095	0.2664	3.8415	0.6057

Note:*denotes rejection of the hypothesis at the 5% level

Table 6 Vector Error Correction Estimates

	Explanatory variables			
Explained variable	TCR	TCK	TCL	LNRIG
TCR	0	-1.6419	2.2532	-0.2033
TCK	-1.0416	0	-2.5001	0.3666
TCL	1.5294	-1.7290	0	0.1405
LNRIG	-0.5678	0.2833	0.1638	0

Conclusion

In the article, we adopt VAR model in econometrics to study the relationship between China’s OFDI and the structure of export products. With reference to the empirical analysis we obtain the following results: China’s OFDI dose promote export of capital and technology-intensive products and labor-intensive products, but impose restrictions to the export of resource-intensive products. Specifically, with an increase of one percentage point in foreign direct investment, competition index of resource-intensive products exports fall 0.2033%,and that of capital and technology-intensive products exports rise by 0.3666 percent, and that of labor-intensive products exports rise by 0.1405 %. The empirical study from the perspective of trade competitiveness found that China's OFDI improve the trade competitiveness of labor-intensive products and capital and technology-intensive products, but have a negative role in trade and competitiveness of resource-intensive products. The combined impact of OFDI on the trade competitiveness of these three products shows that it promotes China's export commodity optimization.

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