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DOES COMPARATIVE ADVANTAGE EXPLAIN EXPORT PATTERNS IN CHINA?

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Abstract

Revealed comparative advantage indices are calculated for China (1980-2000 period) and the Chinese provinces (1990-1998 period) and then incorporated into a reduced form export equation. The results of China's export patterns show that China has moved from a heavy industry-oriented development strategy to a comparative advantage one, with, however, marked differences among provinces. The econometric results show that this shift had a significant impact on the exports, besides the effects of real effective exchange rate, world demand, and domestic supply.

JEL classification: F14; F31; O53

Keywords: Comparative advantage; Exchange rate; Export patterns; China

Résumé

Les indices de l'avantage comparatif sont calculés pour la Chine (1980-2000 périodes) et les provinces chinoises (1990-1998 périodes) et ensuite intégrées à l'équation réduite de l'exportation. Les résultats montrent que la politique de l'exportation chinoise est passée de la stratégie du développement de l'industrie lourde à celle de l'avantage comparatif avec, cependant, de fortes différences entre les provinces. Les résultats économétriques montrent que, en dehors des effets du taux de change effectif réel, de la demande mondiale et de l'offre domestique, ce changement a eu un impact significatif sur les exportations.

JEL classification: F14; F31; O53

Mots clés: Avantage comparatif; Taux de change; Modèle de l'exportation; Chine

Introduction

Since the liberalization of the foreign trade system and the exchange rate regime beginning in the end of 1978, China has experienced a remarkable export development. China's annual export growth averaged 13.6 percent from 1980 to 2000, which is far higher than the 5.9 percent average for the world during the same period. The share of China in total world exports expanded from 0.96 percent in 1980 to 3.9 percent in 2000, which contributed to making China the seventh largest international exporter, following the U.S., Germany, Japan, France, the U.K., and Canada. The growth of Chinese manufactured exports was even higher (18.8 percent on average during 1980 to 2000). This has led to a profound change in the structure of China's exports, with the share of exported manufactured goods in total exports increasing from 50 % in 1979 to 90% in 2000. However, export performance is quite different for each province. The annual growth rate of real exports from 1990 to 1998 averaged 60.4 % and –2.0% respectively for Xinjiang and Heilongjiang provinces. The difference is also striking for manufactured goods (growth rates on average are respectively 78.3% and 7.6% for the same period and the same provinces). This shift in export patterns seems to be more congruent with the country's factor endowments based comparative advantage.

In order to explain the growth of exports, a reduced form export equation is traditionally used. The equation takes first into account demand-side factors such as the growth of overseas markets and relative prices (Goldstein & Khan 1978, 1985; Cerra, 1999), and is then extended to incorporate supply-side factors (Krause, 1987; Helkie & Hooper 1988; Muscatelli & Stevenson 1995 and Hua, 1996;).

The principle of comparative advantage, which arises from differences in technology and in factor proportions[1], was originally developed to explain the underlying reasons for

[1] Technology can be considered as an input, 'knowledge capital', as in endogenous growth model.

international trade and to predict the trade pattern resulting from changes in factor endowments. According to this principle, a country should export the products which use its abundant factor intensively and import the goods which use its scarce factor intensively. As a labor abundant underdeveloped country, China has a potential competitive power in world markets for labor-intensive products. The rationale underlying the comparative advantage principle is that the latter will determine export performance under the assumption of uniformity of tastes within the region (Balassa, 1965).

Moreover, the economic reforms and open-door policies of China allowed its economy to move from a heavy industry-oriented development strategy in a capital-scarce economy to a comparative advantage strategy in a labor intensive economy (Lin, Cai & Li, 1996).[2] This shift has resulted in a better exploitation of China's comparative advantage in labor-intensive manufacturing, which supported the country's export promotion strategy in the last two decades.

In a competitive market economy, the revealed comparative advantage in the export composition is consistent with the economy's factor-endowments based comparative advantage, and evolves along with economic development. In a transition economy such as China, the shift of comparative advantage in export composition is accelerated due to a better resource reallocation. It is thus reasonable to suppose that the comparative advantage strategy favors the growth of exports.

The objective of this paper is to assess empirically whether China's export patterns have become more congruent with the country's factor-endowments based comparative advantage, using a "revealed" comparative advantage index, and to test econometrically whether comparative advantages account for the rapid development of Chinese exports. This paper is divided into four sections. In section I, we analyze the comparative advantage based on the revealed comparative advantage index, with the latter being calculated for both China (1980-2000 period) and Chinese provinces (1990-1998 period). Reasons why the comparative advantage indices could be considered as complementary variables in the export function are discussed in section II. A reduced export equation that incorporates comparative advantage indices is presented in section III. We present the econometric results in section IV before the conclusion.

1. The revealed comparative advantage of China

1.1. Secular trends in revealed comparative advantage

The export-share revealed comparative advantage (RCA) index developed by Balassa (1965) is the one which is most frequently used in many studies. Simply stated, the revealed comparative advantage of country *j* in the trade of product *i* is measured by the item's share in the country's exports relative to its share in world trade. That is, if X_{ij} is the value of country *j*'s exports of product *i*, and X_{tj} is the country's total exports, then its revealed comparative advantage index is:

$$RCA_{ij} = (X_{ij}/X_{tj})/(X_{iw}/X_{tw}) \qquad (1)$$

Where the *w* subscripts refer to world totals. The index RCA_{ij} has a relatively simple interpretation. If it takes a value of less than 1 (which indicates that the share of product *i* in country *j*'s exports is less than the corresponding world share), this implies that the country has a revealed comparative *disadvantage* in the product. Similarly, a RCA index greater than 1 implies that the country has a revealed comparative *advantage* in the product.

Table 1 displays China's revealed comparative advantage indices by broad (one-digit SITC) product categories for the years from 1980 to 2000. One-digit SITC includes processed foods (SITC 0), beverages and tobacco (SITC 1), crude materials (SITC 2), refined fuels

[2]The upgrading of comparative advantage in NIEs (Hong Kong SAR, Korea, Singapore, and Taiwan province) from labor-intensive industry to capital-intensive industry in 1980s gave China a sound opportunity to explore its

(SITC 3), animal and vegetable oils (SITC 4), chemicals (SITC 5), manufactured materials (SITC 6), machinery and equipment (SITC 7), and finished manufactures (SITC 8). The SITC 0-4 categories comprise primary products, and the SITC 5-8 categories comprise manufactures. According to factor proportions, products in SITC 0-4 are mainly resource-intensive, products in SITC 6 and 8 are mainly labor-intensive, products in SITC 5 are mainly technology-intensive and/or capital-intensive, products in SITC 7 are mainly capital-intensive and labor-intensive. The data are originated from China's Customs General Administration, Statistics Canada, China's Customs Statistics, and International Trade Statistics Yearbook of the United Nations. These aggregated RCA indices indicate that China has moved from a position of comparative advantage in both resource-intensive and labor-intensive products at the beginning of 1980s, to one of comparative advantage in labor-intensive products only in the 1990s.

In the 1980s, China had a revealed comparative advantage in processed foods (SITC 0), crude materials (SITC 2), manufactured materials (SITC 6) and finished manufactures (SITC 8), with the former two and the latter two industries consisting largely of resource-intensive and labor-intensive products, respectively. The RCA indices exceeded one for refined fuels (SITC 3) from 1983 to 1989, a period during which the country's export policy for crude oil mainly aimed at increasing foreign exchange earnings.

In the 1990s, paralleling the spurge in foreign direct investments, the share of processing trade in China's exports substantially increased. Meanwhile, China's revealed comparative advantage had concentrated in labor-intensive goods. In 1990 and 1991, among the four kinds of products for which RCA indices were greater than 1, two were resource-intensive primary products and the other two were labor-intensive manufactures. In 1992, 1993, and 1994, among primary products, only processed foods (SITC 0) had RCA indices

comparative advantage (Yeats, 1991; Dowling, 2000).

greater than 1. From 1995 onwards, only the two labor-intensive products had RCA indices greater than 1. The RCA index of finished manufactures (SITC 8) increased significantly from 1.89 in 1980 to 2.63 in 2000.

As shown in Table 1, China's RCA indices for machinery and transport (SITC 7) are very low, which is probably due to China's relatively low level of industrialization and lack of access to technology, given that the items included in this SITC category rank among the most capital-intensive with respect to their production processes. It is worth to note, however, that the machinery and transport RCA index experienced the greatest increase, rising from 0.11 in 1980 to 0.81 in 2000.

Table 2 made a comparison of the top 10 products with strongest revealed comparative advantage between 1980 and 1997 at three-digit SITC level. Among the top 10 products with strongest revealed comparative advantage in 1980, 7 belonged to resource-intensive products (in SITC 0-4) and 3 belonged to labor-intensive products (in SITC 6 and 8). On the contrary, in 1997, only 3 belonged to resource-intensive products (in SITC 0-4) and 7 belonged to labor-intensive products (in SITC 6 and 8). The clothing (SITC 846-848), footwear (SITC 851), travel goods (SITC 831), and toys (SITC 894), which belonged to low-skill labor-intensive products, became the main export products of China.

Table 3 presents the proportion of the products which have RCA (at three-digit SITC lever) in each highly aggregated group in 1980, 1990, and 1997. From 1980 to 1997, the shares of primary products and Chemicals whose RCA indices are above 1 *decreased* from 44% to 38%t, and from 33% to 14%, respectively. On the contrary, during the same period, the shares of Finished manufactures, Manufactured materials, and Machinery and equipment whose RCA indices are above 1 *increased* from 63% to 78%, from 39% to 55%, and from 2% to 20%, respectively. Although the highly aggregated machinery and equipment category (one-digit SITC) is generally regarded as capital-intensive, some sub-groups within this category comprise labor-intensive commodities. China has gained a pretty strong comparative advantage in those sub-groups, such as household equipment (SITC 775), radio (SITC 762), motorcycle (SITC 785), and trailer (SITC 786), with RCA indices of 2.38, 4.46, 3.17 and 3.97 in 1997, respectively.

The above statistics showed that China's exports have enhanced the revealed comparative advantage in labor-intensive products and some capital-intensive products, while decreased the revealed comparative advantage in both resource- and technology-intensive products.

1.2. Comparative advantage disparity among the Chinese provinces

A striking feature of China's economic development in recent years is that not only per capita GDP and real income have significantly increased but also the income gap among provinces has obviously widened (Chen & Fleisher, 1996; Jian, Sachs, & Warner, 1996). Many studies contend that reform measures and policy shifts, the pattern of FDI, the concentration of State-owned enterprises (SOEs), an so on (Tsui, 1996; Jian, Sachs, & Warner, 1996; Dayal-Gulati & Husain 2000; Aziz, 2001) may have significant impacts on interprovincial inequalities. However, few papers consider the differences in export strategy of governments across provinces. Needless to say that export plays a very important role in economic growth. In 2000, the ratio of exports to GDP for China stood at about 23 percent. An economy that fails to implement a continuous restructuring of its production and export activities along with the shifts in comparative advantage may drop out of world markets, fall into stagnation, and degenerate into another failure case. The role of local governments may be crucial not only at the beginning stage of catch-up, but also at the transitional phase of catch-up. The following part will examine the differences in export composition among provinces, based on calculated values of revealed comparative advantages, in order to identify what kind of export strategy each province is pursuing.

Table 4 displays RCA indices, real export value, averaged annual growth rate of real export value during 1990 to 1998, terms of trade, export unit value index, and import unit value index by provinces in 1998.[3] The regional average refers to the middle-term average, not to the arithmetic average. It shows that RCA patterns greatly differ among provinces, though the differences in factor proportions compared to the rest of world are small.

In 1998, the provinces such as Shaanxi, Jiangsu, Gansu, Fujian, Henan, Guangxi, Hubei, Anhui, Inner Mongolia, Jiangxi, Hebei, Hunan, Sichuan, Yunnan, Qinghai, Ningxia, and Hainan have their comparative advantage indices in chemicals superior to 1. All the Chinese provinces except Guizhou have their remarkable revealed comparative advantage indices in manufactured materials and finished manufactures superior to 1, while they have all their noticeable revealed comparative *disadvantage* in machinery and equipment inferior to 1, except Tianjin.

In terms of export value in 1998, the top 10 provinces/cities were Guangdong, Jiangsu, Shanghai, Zhejiang, Shandong, Xinjiang, Fujian, Liaoning, Beijing, and Tianjin. Among them, 9 had no revealed comparative advantage in chemicals (SITC 5), and all had a revealed comparative advantage in finished manufactures (SITC 8). The 10 provinces (excluding Tibet) that ranked lowest were Qinghai, Ningxia, Guizhou, Gansu, Inner Mongolia, Hainan, Yunnan, Shaanxi, Jilin, and Jiangxi, 9 had revealed comparative advantage in chemicals (SITC 5), and 7 had no revealed comparative advantage in finished manufactures (SITC 8).

The provincial averaged data show that the top 10 provinces had RCA only in labor-intensive products (SITC 6 & 8), but no RCA in other products, while the bottom 10 provinces had RCA in resource-intensive products (SITC 0-4), labor-intensive products

[3] The five primary products groups (SITC 0-4) are combined into one group, whose RCA index is denoted by RCA_{04}.

(SITC 6), as well technology- and capital-intensive products (SITC 5). The averaged export value of the top 10 provinces was US$11.15 billion, which is much higher than the US$0.57 billion averaged export value of the bottom 10 provinces. The growth rate of exports of the top 10 provinces was 19.1 percent on average during 1990-1998, while that of the bottom 10 provinces was lower, at only 10.3 percent. The term of trade index of the top 10 provinces was 102.2, which is better than in the previous year. For the bottom 10 provinces, the term of trade index was 98.9 which is worse than in the previous year.

The above statistics clearly indicate that the top 10 provinces are exporting mainly labor-intensive products which mirrors their factor-endowments based comparative advantage, while the bottom 10 provinces are not. Chemicals (SITC 5) are usually technology-intensive and/or capital-intensive products and, obviously, the provinces of China have neither absolute advantage nor comparative advantage in this industry. Remarkably, most of the bottom 10 provinces are exporting a great proportion of products (SITC 5) which use their scarce factor intensively, while they do not exhibit any revealed comparative advantage in products (SITC 8) which use their abundant factor intensively. Therefore, if a province exports products on the basis of its comparative advantage, then it will export more goods and its exports enjoy a competitive power and a quicker increase. In face of the Asian financial crisis during 1997-98, the terms of trade of the provinces which better exploited its comparative advantage could improve, whereas the terms of trade of the other provinces worsened.

2. Comparative advantage, a complementary variable in the export function of China?

The principle of comparative advantage, which arises from differences in factor proportions, was originally developed by Heckscher and Ohlin (known as HO theory) to explain the underlying reasons for international trade and predict the pattern of trade between countries, based on the characteristics of the countries. Countries with, say, large amounts of land and minerals (such as Australia) can be expected to export agricultural goods and commodities, while highly populated countries (such as China) might be expected to export labor-intensive manufactured goods. The HO theory predicts that when countries move towards free trade, they will experience an increase in aggregate efficiency as well as in export volumes. The rationale behind comparative advantages is that the latter will determine the export performance under the assumption of uniformity of tastes within the region (Balassa, 1965).

Comparative advantage is a concept defined in terms of autarkic relative prices. As pretrade data are not observable in the real world, the assessment of comparative advantage has to be conducted in an indirect way by resorting to various indices. The export-share RCA index is the most frequently used in the literature. The RCA index primarily allows to quantify the commodity-specific degree of comparative advantage, to rank countries by the degree of comparative advantage, and to distinguish between countries that enjoy comparative advantage in some commodities and those that do not (Ballance, Forster & Murray, 1987). More importantly, revealed comparative advantage can be employed to analyze shifts in comparative advantage, trade patterns, and structure adjustment in individual industries, countries and/or regions (e.g., Rana, 1990; Chow & Kellman, 1993). Traditionally, labor, capital, and natural resource are regarded as the underlying factors in production. As technology is playing a more important role in determining the product cost, it can also be considered as an input ('knowledge capital'), as stated in endogenous growth models (Dollar, 1993).

Much of the early research pertaining to the RCA index focused on OECD countries (e.g., Balassa, 1965, 1979). Related studies aimed at identifying the industries that had comparative advantage in individual countries and drawing some link between trade and economic growth. In more recent studies, the focus has shifted to Asia Pacific region. The so-called "*flying geese*" theory is tested in numerous studies, which consider the shifts in comparative advantage from Japan to the rest of Asia and from NIEs to other less developed Asian countries (e.g., Dowing, 2000). To evaluate the dynamics of comparative advantage in the region, one uses the Spearman rank correlation coefficients between changes in RCA vectors for the recipient countries/groups of countries (the NIEs and ASEAN4) and the corresponding RCA changes in the "source" country/groups of countries such as Japan and the NIEs for a certain period.

Lee (1995) applied RCA to analyze the determinants of industrialization in Korea. He found that starting at the early stage of Korean industrialization, heavy or medium-industry products rapidly gained RCA and he therefore argued that Korea gained competitive in these industries through an anti-neoclassical political behavior.

Lin, Cai, and Li (1996) introduced the principle of comparative advantage into development economics and argued that the comparative advantage strategy is the best option for economic growth, even if in an autarky economy. Because different goods require different combinations of factor inputs, each economy should choose the most advantageous industrial structure based on its resource endowments. The structure of factor endowments and the relative abundance of factors of production in an economy depend both on the natural endowments of that economy and on its stage of economic development. At an earlier stage of development, capital is usually the scarce factor. The economy has a comparative advantage in land- and labor-intensive products, i.e. agricultural and mineral products. As capital accumulation and increase in the labor force reach a certain level, and as land becomes relatively scarce, labor-intensive manufacturing industries become the economy's comparative advantage. As capital accumulates further along with economic development, labor cost gradually increases, capital becomes the relatively abundant factor of production, and capital- and technology-intensive industries become the economy's comparative advantage. So every economy has its own comparative advantage, regardless of its stage of economic development, and the comparative advantage will shift dynamically with changes in its endowment structure. Adopting the comparative advantage strategy implies that, through the introduction of a competitive market system and the opening of the economy, the relative scarcity of factors of production in the economy is revealed to domestic producers through relative prices, which in turn induce them to engage in activities that fully exploit the economy's comparative advantages. The economy will thus become more competitive and will grow quickly.

In practice, developing economies, which have, like many South American countries as well as Asian countries like India or the Philippines, opted for a leap forward strategy, have suffered from inefficiency and unsatisfactory economic performance. On the contrary, all economies, such as the NIEs, that have relied on market mechanisms to exploit their own comparative advantage, are operating efficiently and have achieved rapid economic growth.

In the past two decades, the development of the Chinese economy differed from that of most other developing economies and developed countries. The most significant characteristic of China is that it is a transition economy, which gradually moves from a planning economy to a market economy. Due to the trade distortions induced by the former planning system, the "revealed" comparative advantage in export composition was inconsistent with the country's factor-endowments comparative advantage. Since the late 1970s, the government of China has undertaken wide-ranging reforms that have steadily reduced the role of planning and increased the importance of market forces. These policies and reform measures coupled with vigorous FDI activities, contributed to making China's RCA more congruent with its factor endowments based comparative advantage. Therefore, the shift in comparative advantage in China's export composition is not only the result of a change in factor proportions but it is also attributable to the industry structure adjustment and the resource reallocation involved in the transition process. This shift was also facilitated as the NIE's comparative advantage moved from labor-intensive industry to capital-intensive industry in 1980s. The relative rapid change in the export composition reflects a better use of the country's comparative advantage, which supported export growth.[4]

In addition to a transition economy, China is still a developing country. Most of China's trading partners consist of developed countries and NIEs. The shares of the developed countries and the NIEs in China's exports by destinations in 2000 were 56.3% and 26.7% respectively, and China is quite different from these trading partners with respect to factor proportions. Hence, the export pattern of China could be explained by referring to the comparative advantage theory rather than by resorting to the "new" theories of international trade, which, by invoking increasing returns to scale in production and consumers' demand for variety in consumption (Krugman, 1980; Helpman & Krugman, 1985), may explain why much of the trade between industrial countries involves two-way flows of finished manufactured goods.

It flows from the above analysis that the better use of comparative advantages could not only account for the fast economic growth but also for the rapid export expansion in China. During the transition process, the industry structure adjustment and resource reallocation contribute to bring the RCA in export composition more in line with the factor-endowments comparative advantage, which favors export growth. Thus, the RCA index can be added as a complementary variable into an export equation.

3. Comparative advantage - augmented export equation of China

[4] If trade is based on factor proportions comparative advantage and these change slowly, then the trade composition would be highly persistent (Gagnon & Rose, 1995).

In order to explain exports, a reduced form export equation is traditionally used, assuming market equilibrium between demand and supply. This reduced form has the advantage to avoid simultaneous equation bias that may arise from estimating solely a demand or a supply function (Goldstein & Khan, 1978). The equation takes first into account demand-side factors such as the growth of the overseas markets and relative prices (Goldstein & Khan 1978, 1985; Cerra, 1999), and is then extended to include supply-side factors such as the production capacity (Krause, 1987; Helkie & Hooper 1988; Muscatelli & Stevenson 1995 and Hua, 1996). In this paper, we introduced other supply-side factors, namely, the comparative advantage indices of labor intensive sectors. The introduction of these indices allows us to capture China's economic shift effect from a heavy industry-oriented development strategy to a labor-intensive comparative advantage one during the studied period.

We first present the export demand equation and the export supply equation. We suppose that actual exports correspond to an equilibrium market, in order to derive the reduced form export equation.

The export demand equation for China is a function of the relative price of exports, defined as the ratio of world export price to the export price of China, and a scale variable which represents the world demand for China's exported goods. The world demand is represented by the real GDP of the country's foreign trade partners. Thus, the export demand equation is written in logarithm form as:

$$\ln(x_t^d) = a_0 + a_1 \ln(p_{xt}^w / (p_{xt}^c * n_t)) + a_2 \ln(gdp_t^w) \qquad (2)$$

Where, x^d is the world real demand value for China's exported goods;

p_x^w is the world export price expressed in foreign currencies of China's trade partners;

p_x^c is the export price of China expressed in domestic currency, i.e. Yuans ;

n indicates the nominal effective exchange rate of Yuans vis-à-vis the foreign currencies of China's trade partners; i.e. an increase represents here an appreciation.

gdp^w is a proxy of the world real income, represented by the real GDP of China's foreign trading partners.

An increase in relative prices is expected to induce an increase in export demand $(a_1 > 0)$; export demand is also expected to increase as the world's real income rises $(a_2 > 0)$.

The export supply equation is specified as a function of the ratio of export prices to local prices for alternative goods, real GDP, which indicates the capacity of China to produce for the export market. As the Chinese provinces have been differently implicated in the heavy industry-oriented development strategy in 1970s, the shift of their economic structure towards a comparative advantage one should be much easily for those provinces which have less heavy industry sector, and inversely. Thus, it is reasonable to introduce two comparative advantage indices which represent respectively the comparative advantages in the sector of technology- and capital-intensive products and in the sector of labor-intensive products. As processing industries have been strongly developed in China, it is interesting to distinguish the traditional labor-intensive products from the products originated from processing industries. Thus, three revealed comparative advantage indices, respectively in chemicals (RCA_5), in Manufactured materials and Finished manufactures (RCA_{68}) and in Machinery / equipment (RCA_7), are introduced. Thus, the export supply equation can be expressed in logarithm form as:

$$\ln(x_t^s) = b_0 + b_1 \ln(p_{xt}^c / p_{dt}^c) + b_2 \ln(gdp_t^c) + b_3 rca_{5t} + b_4 rca_{68t} + b_5 rca_{7t} \quad (3)$$

Where x^s is the real supply export value;

p_d^c means the consumer price index of China ;

gdp^c represents real GDP of China;

rca_j represents the comparative advantage index for industry j for China, with j =5, 68 and 7, respectively.[5]

An increase in export prices relative to local prices is assumed to increase the quantity of exports supplied (i.e. b_1>0). Export supply is expected to increase as China's real GDP rises (i.e. $b_2 > 0$). The exports should increase if the production structure of China corresponds to its comparative advantage.

Since the group of SITC 5 consists largely of technology-intensive products in which there is an absolute disadvantage for each province of China, one can expect a negative relationship between the RCA index for this group and export supply. Manufactured materials in group SITC 6 and finished manufactures in group SITC 8 comprises mainly labor-intensive products, such as textile, clothing, footwear, travel goods and so on in which China has comparative advantage, so the related RCA index should have a substantially positive correlation with export supply. Although machinery and equipment in group SITC 7 are usually treated as capital-intensive products, many household electric products such as television, washing machine, refrigerator, and air condition have shifted their production process to become labor-intensive. Thus, the relationship between the RCA index for this group and export supply is expected to be positive rather than negative.

Assuming that the actual level of exports represents an equilibrium condition, then we can use $x^d = x^s = x$ to solve equations (2) and (3) simultaneously for x and p_{ix}^c,

$$\ln x = c_0 + c_1 \ln e_t + c_2 \ln gdp_t^w + c_3 \ln gdp_t^c + c_4 rca_{5t} + c_5 rca_{68t} + c_6 rca_{7t} \qquad (4)$$

[5] The 68 refers to SITC 6 and 8, not SITC 68.

e represents the real effective exchange rate of Yuans in terms of foreign currencies; i.e. an increase represents here a real appreciation, with $e = n * \frac{p_d^c}{p_x^w}$.

$$c_0 = \frac{a_0 b_1 + a_1 b_0}{a_1 + b_1};\ c_1 = \frac{-a_1 b_1}{a_1 + b_1};\ c_2 = \frac{a_2 b_1}{a_1 + b_1};\ c_3 = \frac{a_1 b_2}{a_1 + b_1};$$

$$c_4 = \frac{a_1 b_3}{a_1 + b_1};\ c_5 = \frac{a_1 b_4}{a_1 + b_1};\ c_6 = \frac{a_1 b_5}{a_1 + b_1}$$

Where, the signs of the coefficients c_1 and c_4 are expected to be negative, and the signs of other coefficients, c_2 c_3 c_5 and c_6 are expected to be positive.

Thus, China's exports are a function of the real effective exchange rate, the world's real income, China's production capacity and its comparative advantage in different industry sectors.

The equation 4 is thus transformed into the equation 5 for estimating the panel data of the Chinese provinces.

$$\ln x_{it} = c_0 + c_1 \ln e_{it} + c_2 \ln gdp_{it}^w + c_3 \ln gdp_{it}^c + c_4 rca_{5it} c_5 rca_{68it} + c_6 rca_{7it} + m_{it} + e_{it} \quad (5)$$

with u_{it} and ε_i represent respectively individual effect and error term.

Given the role played by the exports in the economic growth[6], the endogeneity of the growth variable is likely. In order to choose the pertinent econometric method to estimate the equations (4) and (5), Davison-MacKinnon test of exogeneity is employed, completed by Sargan's over-identification test. This last test allows us to know if the instrumental variables employed in TSLS regressions are pertinent. Then, for equation (5), the LM-test statistic of Breusch-Pagan is used to test the OLS specification (without specific effects) against the specification with individual effects. In the case of the existence of individual effects, the Hausman-test is employed to know which specification (fixed or random effects) is proffered

[6] The export-led growth hypothesis is often tested in many papers, despite that the results are not uniform.

to.

The panel procedure has the advantage of allowing the impact of comparative advantage indices on the exports to be different according to resources donation of the provinces according to our assumption. In order to capture the specificity of the provinces which have their comparative advantages respectively in chemicals (RCA_5), in Manufactured materials and Finished manufactures (RCA_{68}) and in Machinery / equipment (RCA_7), these three comparative advantages are respectively multiplied by three dummy variables (μ_5, μ_{68} and μ_7), which take the value 1 for the 15 top highest indices on average of RCA_5, RCA_{68} and RCA_7 and 0 for the other provinces. This enables us to shed light on the differential impact of the comparative advantages, with respect to resources donation. The dummy variable μ_5 which has the value 1 concerns Jiangsu, Anhui, Jiangxi, Hubei, Hunan, Guangxi, Hainan, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, and Ningxia. The dummy variable μ_{68} which has the value 1 concerns Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Henan, Hubei, Hunan, Guangdong, Hainan, Shaanxi, Gangsu, Ningxia and Xingjiang, The dummy variable μ_7 which has the value 1 concerns Beijing, Tianjin, Liaoning, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Fujian, Hubei, Guangdong, Sichuan, Guizhou, Yunnan, and Shaanxi.

4. Econometric results

Equation 4 is estimated using the time series for China for the 1980-1998 period, while equation 5 is estimated on yearly panel data for 29 Chinese provinces for the 1990-1998 period. Despite the official total export data are available at the province level for the period prior to 1990, the more detailed export data by products and by provinces, which are necessary to calculate the revealed comparative advantage indices, are not officially published. They can be obtained however from China's Customs General Administration and

Statistics Canada, and these only from 1990. Thus, we are constraint to estimate our model for 1990s. The econometric results should be better if the estimation began in 1980s. In fact, the shift of economic structure from the heavy industry-oriented development strategy to a labor-intensive comparative advantage one has been partially realized in 1980s.

The dependent variables are respectively the real export value of China as a whole (equation 4), the real export value of each province (equation 5) and the real export of manufactured goods of each province (equation 5).

The real export value of China is calculated as its nominal value deflated by world unit value index of exports. The real export value of each province is defined by its nominal value divided by the export unit value index. Export data are obtained from China's Customs General Administration. The provincial export unit value of exports are from China's Customs General Administration, according to 4-digit Standard International Trade Classification (SITC), given by province of export, countries of purchase, unit of quantity, value, and quantity. It is first calculated for each product as the ratio of its export value to its quantity for each year. Products which are not exported in the previous year, are excluded, as well as those whose price indices are either higher than 150% or lower than 50% relative to the previous year. Second, the export unit value index is computed for each province as the weighted geometric average of the export unit value index for each product, taking first the previous year as the base year (= 100), and then 1990 as the unique base year. The ratio of export value of each product relative to the total export value of each province is used for the weighting.

The real effective exchange rate of exports is calculated as the weighted geometric average of real exchange rate indices of the Renminbi relative to the currencies of China's or each province's main trading partners. To calculate the real exchange rate, consumer prices are used for China, each province of China, as well as for its trading partners; exchange rate are computed as the weighted average of the two exchange rates simultaneously used in China with the weighting of the two rates being based on the retention rate of exports. The official exchange rate and the importance of trade between China and its main trade partners are provided by the IMF International financial statistics, and Direction of trade (various issues) respectively. The internal settlement rate is calculated in Guillaumont Jeanneney and Hua (1996), as well as the retention rate of exports; while the free market rates of the Renminbi are from World Bank (1994) and China monthly statistics (various issues). All variables are converted into indices (100=1990) and expressed in logarithms.

The above calculated real effective exchange rate for exports takes into account the double exchange rate regime from 1981 to 1993, and thus better reflects the exchange rate policy of China (Guillaumont Jeanneney & Hua, 1996, 2001). It provides a better indicator of the competitivity of China's exports in the world market. In fact, the principal objective of the exchange rate policy during this period was to encourage exports by introducing a system of foreign exchange retention as well as a swap rate, that was more depreciated compared to the official one. The system of foreign exchange retention, which has been progressively expanded, allowed enterprises to use part of the foreign exchange earnings derived from exports to finance their own imports or to sell them at a higher rate. Previously, foreign exchange earnings had to be entirely remitted to the central government. Until their unification in January 1994, the differential between the two rates has fluctuated between 10% and 70%. Both rates have strongly depreciated. In contrast, the unified exchange rate, now subject to a controlled floating regime, only slightly depreciated (compared to the dollar) in 1994, and has slightly appreciated since then.

The real GDP of China and of each province was calculated as its nominal value deflated by its deflator (base 100=1990). The GDP and its deflator are originated from the Comprehensive Statistical Data and Materials on 50 Years of New China. The real GDP of partner countries corresponds to the weighted geometric average of their GDP expressed in 1990 dollars. The weighting is identical to that used to calculate the real effective exchange rates. The real GDPs are taken from the World Bank *World Development Indicators.*

Table 5 presents the econometric tests and results for the real exports of China as a whole on the one hand, and for the total real exports and the manufactured export goods of the Chinese provinces on the other hand. The instrumental variables of domestic GDP applied in Davidson-Mackinnon test of exogeneity are fixed asset share relative to GDP, foreign direct investment share relative to GDP, employment, infrastructure calculated as the number of telephone sets relative to population, and education corresponding to the proportions of the population having received up at least to secondary level. The pertinence of these instrumental variables is confirmed by the results of Sargan's over-identification test. The domestic GDP proved to be exogenous in the total real export function of China as a whole, and to be endogenous in the export function of the Chinese provinces. These results seem to say that a strong economic growth is necessary in the long term to keep a high export growth; inversely, the famous export-led growth hypothesis should be valuable in a shorter term. We thus interpreted the estimation results by OLS for China, and the results by TSLS for the Chinese provinces.

We also applied Breusch and Pagan Lagrangian multiplier test and Hausman specification test for the yearly panel data of the Chinese provinces to examine whether our model entailed specific effects with respect to the individual dimension (within with individual effects). The LM-test statistic of Breusch-Pagan is highly significant at the 1% level for all regressions. The results suggest the presence of specific effects, which leads us to reject the OLS specification without specific effects. Then, the results of the Hausman-test do not allow us to reject a specification with fixed effects.

According to the results of the above econometric results, the regression 1 by OLS estimation is better for explaining the real export function for China as a whole for the period from 1980 to 1998. The regression 6 and 11 by TSLS with fixed effect are convenient respectively to the estimation of the Chinese provinces' exports and manufactured exports.

In all the retained regressions (1, 6 and 11), as expected, the coefficients of the real effective exchange rate are negative and statistically significant at the level of 5 %. That means that a depreciation of the real effective exchange rate may induce an increase in exports. The difference in the coefficients means that the Chinese economy becomes more a market one in 1990s. In all these regressions, the coefficients of the world real income variables are not statistically significant. The coefficients of domestic production capacity variables have all positive signs and turn out to be highly significant at the level of 1%. This shows that the promptly growing capacity of supply has indeed promoted export volumes and that the Chinese export performance is a supply phenomenon.

The coefficients of RCA_5 indices are negative, but only statistically significant for province panel data. Chemicals (SITC 5) consist of mainly technology- and capital-intensive products in which China has no comparative advantage at all. Therefore, reducing the production and exports of this kind of products and transferring the factors to other industries may increase total export volumes.

All the coefficients of RCA_{68} indices are positive, and statistically significant. Finished manufactures (SITC 8) and manufactured materials (SITC 6) consist mainly of labor-intensive products, such as textile, clothing, footwear, travel goods etc., in which China has a clear comparative advantage. These two industries account for US$128.8 billion (51.7 percent) in China's export volumes in 2000.

All the coefficients of RCA_7 indices have positive signs and are statistically significant for provincial panel data. The machinery and equipment industry (SITC 7) consists mainly of capital-intensive products in which China seems to have little comparative advantage. There are three reasons why the estimated coefficients are very significant and positive. First, economic globalization makes it possible to shift the production process (using labor intensively) of certain capital-intensive products to developing countries. Second, the product cycle theory suggests that capital-intensive products may become more labor-intensive when technology becomes mature and standardized. Third, the machinery and equipment is the largest group and made up of a broad range of products including some labor-intensive goods.

In fact, the SITC 7 product category ranks second in terms of export volumes in 2000. Two features were distinctive of China's exports in the 1990s, namely, the much faster growth of processing trade and the growing dependence of exports on foreign-invested enterprises (FIEs). Processing industries cover domestic companies, joint-ventures or wholly owned foreign companies that assemble and/or process imported materials for re-export at a later date. Customs statistics show that 55.2 percent of China's exports consisted of processed goods in 2000. Meanwhile, commodities originating from FIEs accounted for no less than 47.9 percent of total exports, and for 70.6 percent of total processing exports.

A large number of offshore producers have been attracted to China in order to take advantage of China's comparative advantage in low-cost labor and get the more labor-intensive parts of the manufacturing process produced in China. This involved a continuous process of imports of large volumes of components, materials and intermediate goods, followed by their re-export as finished or semi-finished products, most of which belong to the SITC 7 category. Therefore, the rapid growth of exports of machinery and electric products, which are based on processing and promoted by FIEs, is congruent with China's comparative advantage.

Finally, the coefficients of RCA_5 and RCA_7 become statistically insignificant when the interaction terms between RCA_5 and μ_5 and between RCA_7 and μ_7 are introduced. As the interaction terms are statistically significant, the provinces which have higher factor endowments in RCA_5 have a negative impact of their comparative disadvantages on their exports (regression 7), as well as their manufactured goods (regression 12); while those which have higher factor endowments in RCA_7 have a positive impact of their comparative advantages. However, the coefficient of RCA_{68} is still statistically significant when its interaction term is introduced. This means that that all the Chinese provinces have their comparative advantages in labor-intensive products.

Conclusions

The objective of this paper was to assess statistically whether China's export pattern is consistent with the comparative advantage principle, and further, to analyze econometrically the impact of the comparative advantage strategy on exports. Several conclusions can be drawn from this study. First, revealed comparative advantage indices clearly show that, along with the gradual liberalization of external trade restrictions and exchange controls, China's general export patterns have shifted from distortion towards greater compliance with the principle of comparative advantage. Second, there are important differences in export patterns across Chinese provinces. The provinces whose export patterns are congruent with the comparative advantage principal exported more goods and their exports increased quickly. Third, regression results suggest that the responsiveness of exports to the real effective exchange rate has become more significant as a result of policy changes. Real exchange rate has thus played a greater role in determining exports. Fourth, only domestic supply has substantial positive impacts on exports, i.e. exports are still a supply phenomenon in China. Finally and especially, comparative advantages turn out to explain the export patterns of China during the economic transition process.

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Table 1: The revealed comparative advantage indices of China's exports

Year	Processed foods (SITC0)	Beverages and tobacco (SITC1)	Crude materials (SITC2)	Refined fuels (SITC3)	animal and vegetable oils (SITC4)	Chemicals (SITC5)	Manufactured materials (SITC6)	machinery and equipment (SITC7)	Finished manufactures (SITC8)
1980	1.718	0.490	1.415	0.893	0.525	0.823	1.270	0.114	1.891
1981	1.539	0.422	1.598	0.889	0.851	0.820	1.441	0.123	1.979
1982	1.495	0.478	1.343	0.977	0.560	0.707	1.281	0.107	1.972
1983	1.469	0.510	1.550	1.004	0.817	0.710	1.286	0.110	2.064
1984	1.534	0.488	1.668	1.270	0.738	0.693	1.379	0.206	2.033
1985	1.937	0.463	2.008	1.786	0.789	0.687	1.240	0.101	1.483
1986	2.078	0.474	2.145	1.304	0.995	0.791	1.500	0.129	1.765
1987	1.877	0.540	2.098	1.357	0.628	0.767	1.675	0.158	1.665
1988	1.578	0.493	1.610	1.128	0.362	0.667	1.344	0.358	2.009
1989	1.792	0.689	1.761	1.171	0.470	0.825	1.458	0.247	2.013
1990	1.464	0.479	1.226	0.833	0.637	0.698	1.259	0.488	2.258
1991	1.360	0.610	1.145	0.728	0.528	0.605	1.268	0.528	2.394
1992	1.282	0.670	0.920	0.698	0.412	0.573	1.213	0.414	2.899
1993	1.221	0.812	0.872	0.597	0.575	0.551	1.153	0.437	3.031
1994	1.131	0.684	0.850	0.544	0.855	0.551	1.218	0.458	3.009
1995	0.939	0.827	0.724	0.545	0.598	0.642	1.347	0.535	2.824
1996	0.965	0.785	0.716	0.472	0.552	0.639	1.255	0.591	2.916
1997	0.933	0.529	0.636	0.507	0.774	0.615	1.285	0.605	2.962
1998	0.894	0.496	0.547	0.414	0.328	0.592	1.174	0.670	2.900
1999	0.830	0.370	0.575	0.350	0.133	0.561	1.137	0.740	2.824
2000	0.763	0.279	0.512	0.462	0.092	0.512	1.137	0.813	2.628

Note: The indices for years of 1998-2000 are estimated on basis of the composition of world export in 1997-98.

Data source: data for 1980-1997 are calculated from Statistic Canada, and data for 1998-2000 are from *China's Customs Statistics* (1998-2000) and *International Trade Statistics Yearbook* (1998).

Table 2: The 10 three-digit SITC products of China's exports ranked the 10 highest RCA indices in 1980 and 1997

1980					1997				
Rank	Name	SITC	RCA	Share	Rank	Name	SITC	RCA	Share
1	Silk	261	76.66	1.17	1	Silk	261	18.21	0.17
2	Crude animal materials	291	16.56	1.42	2	Briquettes; coke	323	10.03	0.43
3	Tea and mate	074	11.69	1.18	3	Article of apparel & clothing	848	7.21	1.77
4	Jute	264	11.19	0.12	4	Pottery	666	6.88	0.74
5	Made-up articles of textile	658	10.85	3.15	5	Travel goods	831	6.38	1.82
6	Oils seeds and oleaginous fruit	223	9.18	0.50	6	Footwear	851	5.61	4.47
7	Vegetable, roots & tubers	056	9.01	1.44	7	Crude animal materials	291	5.57	0.37
8	Cotton fabrics	652	8.86	3.61	8	Clothing accessories of textile fabrics	847	5.47	0.81
9	Clothing accessories of textile fabrics	847	7.99	0.82	9	Under garments	846	5.27	3.13
10	Eggs and yolks	025	7.30	0.39	10	Toys, games and sporting goods	894	5.24	4.31

Data source: calculated from Statistic Canada.

Table 3: The shares of China's export products with RCA at three-digit SITC lever in each group in 1980, 1990, and 1997

Year	Primary products (SITC 0-4)	Chemicals (SITC 5)	Manufactured materials (SITC 6)	machinery and equipment (SITC 7)	Finished manufactures (SITC 8)	Whole products (SITC 0-8)
1980	35 / 80	7 / 21	19 / 49	1 / 44	17 / 27	79 / 221
1990	34 / 80	7 / 21	22 / 49	6 / 44	14 / 27	83 / 221
1997	31 / 80	3 / 21	27 / 49	9 / 44	21 / 27	91 / 221

Data source: calculated from Statistic Canada.

Table 4: Several economic indicators and revealed comparative advantage indices of exports by provinces (1998)

Provinces	Real export value (Billion USD)	1990-98 real export growth rate	Terms of trade	Export unit value	Import unit value	RCA in Primary products	RCA in Chemicals	RCA in Manufactured materials	RCA in Machinery / equipment	RCA in Finished manufactures
Guangdong	76.52	16.00	98.10	95.56	97.45	0.28	0.58	0.90	0.66	3.49
Jiangsu	15.93	23.20	103.60	92.71	89.50	0.35	1.01	1.26	0.68	2.61
Shanghai	15.64	14.20	101.50	93.49	92.08	0.31	0.84	1.21	0.75	2.62
Zhejiang	11.58	22.10	108.40	92.98	85.77	0.63	0.87	1.16	0.35	3.45
Shandong	11.22	14.90	103.50	92.25	89.14	1.33	0.68	1.53	0.28	2.42
Xinjiang	11.08	60.40	98.60	92.96	94.27	0.39	0.50	3.02	0.09	2.72
Fujian	10.46	26.00	103.20	91.53	88.73	0.71	0.98	1.00	0.39	3.32
Liaoning	7.60	5.50	97.60	88.88	91.10	1.16	0.67	1.28	0.76	1.43
Beijing	6.41	32.30	102.40	92.46	90.32	0.84	0.86	1.41	0.75	1.64
Tianjin	5.46	15.20	102.00	92.16	90.38	0.48	0.72	0.89	1.10	1.76
Above 10	*11.15*	*19.05*	*102.20*	*92.59*	*90.35*	*0.55*	*0.78*	*1.23*	*0.67*	*2.61*
Hebei	2.60	6.40	94.80	90.54	95.47	1.32	1.67	2.01	0.26	1.21
Heilongjiang	1.99	-2.00	98.50	91.73	93.10	4.05	0.28	0.45	0.16	0.50
Shanxi	1.71	16.50	97.40	91.90	94.34	3.97	0.57	1.02	0.04	0.13
Sichuan	1.69	6.90	99.80	94.26	94.42	1.36	1.96	1.64	0.47	0.72
Guangxi	1.60	10.30	99.60	90.25	90.59	0.98	1.53	1.93	0.18	2.12
Hubei	1.60	7.70	95.20	91.53	96.13	0.71	1.39	1.93	0.30	2.24
Anhui	1.51	12.70	108.40	91.48	84.41	1.01	1.17	1.94	0.23	2.19
Hunan	1.32	6.10	103.50	92.28	89.17	1.06	1.71	2.65	0.16	1.12
Henan	1.31	5.30	103.70	94.36	91.03	1.16	1.07	2.62	0.14	1.54
Jiangxi	1.11	8.40	98.40	90.57	92.06	1.95	1.33	1.09	0.08	2.20
Jilin	1.09	-0.70	91.30	91.50	100.20	2.67	0.81	1.24	0.21	0.99
Shaanxi	1.09	14.20	96.10	86.69	90.21	0.82	1.00	2.66	0.51	0.87
Yunnan	1.01	12.10	98.30	92.60	94.19	2.04	2.12	1.61	0.23	0.44
Hainan	0.63	4.50	103.90	88.69	85.39	1.57	3.06	1.04	0.12	1.41
Inner Mongolia	0.51	7.60	94.80	88.29	93.16	2.10	1.35	1.70	0.06	1.33
Gansu	0.46	12.90	99.40	83.54	84.01	1.25	1.28	3.25	0.19	0.40
Guizhou	0.43	13.50	99.70	93.52	93.80	3.03	1.67	1.12	0.15	0.17
Ningxia	0.24	15.90	121.20	95.17	78.52	1.23	2.42	2.73	0.03	0.68
Qinghai	0.12	4.90	102.90	92.81	90.22	1.89	2.13	2.38	0.02	0.41
Above 10	*0.57*	*10.25*	*98.90*	*91.04*	*91.14*	*1.92*	*1.51*	*1.65*	*0.13*	*0.77*

Data Source: Calculated from data of China's Customs General Administration.

Table 5: The export determinants of China: the impact of RCA

	Total real exports of China		Total real exports of the Chinese provinces					Real manufactured exports of the Chinese provinces				
Method	OLS	TSLS	OLS	Fixed effect	TSLS	TSLS/ fixed effect	TSLS/ fixed effect	OLS	Fixed effect	TSLS	TSLS/ fixed effect	TSLS/ fixed effect
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Domestic GDP	1.03***	1.02***	0.87***	0.83***	0.79***	0.75***	0.69***	0.86***	0.83***	0.78***	0.75***	0.69***
	(8.38)	(7.81)	(17.2)	(15.3)	(15.04)	(13.4)	(12.6)	(16.9)	(15.2)	(14.8)	(13.28)	(12.5)
World's GDP	0.11	0.12	-0.08	-0.10	-0.06	-0.10	-0.17	-0.09	-0.11	-0.08	-0.10	-0.18
	(0.96)	(0.99)	(-0.87)	(-1.14)	(-0.70)	(-1.06)	(-1.02)	(-1.07)	(-1.24)	(-0.90)	(-1.16)	(-1.02)
Real effective exchange rate	-0.16**	-0.16**	-0.41	-0.84*	-0.42	-0.97**	-1.08***	-0.45	-0.84*	-0.47	-0.98**	-1.08***
	(-2.46)	(-2.36)	(-1.46)	(-1.84)	(-1.49)	(-2.12)	(-2.46)	(-1.60)	(-1.84)	(-1.63)	(-2.12)	(2.04)
RCA in Chemical (RCA_5)	-036	-0.36	-0.79***	-0.88***	-0.82***	-0.93***	-0.20	-0.66***	-0.73***	-0.69***	-0.77***	-0.04
	(-1.46)	(-1.46)	(-8.13)	(-8.25)	(-8.37)	(-8.62)	(-1.00)	(-6.74)	(-6.76)	(-7.00)	(7.14)	(-0.21)
RCA in Manufactured materials and Finished manufactures (RCA_{68})	0.45***	0.45***	0.53***	0.50***	0.55***	0.51***	0.46***	0.97***	0.95***	0.99***	0.96***	0.93***
	(3.42)	(3.41)	(6.46)	(5.90)	(6.70)	(6.02)	(3.54)	(11.7)	(11.1)	(11.96)	(11.2)	(7.02)
RCA in Machinery / equipment (RCA_7)	0.27	0.28	2.57***	2.50***	2.70***	2.60***	0.32	3.21***	3.27***	3.34***	3.27***	1.06
	(1.49)	(1.51)	(9.76)	(9.01)	(10.17)	(9.32)	(0.48)	(12.1)	(11.3)	(12.5)	(11.6)	(1.56)
$RCA_{5*}\mu_5$							-0.54***					-0.54***
							(-4.28)					(-4.26)
$RCA_{68*}\mu_{68}$							0.09					0.08
							(1.44)					(1.26)
$RCA_{7*}\mu_7$							1.94***					1.88***
							(3.72)					(3.57)
Constant	-26***	-26***	-0.14	2.74	0.59	4.07	6.44***	-1.05	1.40	-0.31	2.80	5.04**
	(-10.9)	(-10.8)	(-0.09)	(1.13)	(0.36)	(1.65)	(2.64)	(-0.64)	(0.57)	(-0.9)	(1.13)	(2.05)
R^2 adjusted	0.99	0.99	0.76	0.76	0.77	0.77	0.80	0.79	0.79	0.80	0.80	0.82
Breusch and Pagan LM test			273					260				
Hausman specification test			35					32				
Davidson-MacKinnon test of exogeneity[a]		0.82			0.00	0.00	0.00			0.00	0.00	0.00
Sargan's over-identification test[a]		0.50			1.00	1.00	1.00			1.00	1.00	1.00
Observations	19	19	261	261	261	261	261	261	261	261	261	261

Note: - t corrected for heteroskedasticity by the White process. *** = significant at the 1 % level; ** = significant at the 5 % level; * = significant at the 10 % level.
- [a]: P value.