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COMPETITION AND EXPORT PERFORMANCE IN JAPAN

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ABSTRACT

The primary objective of this paper is to re-examine the relationship between domestic competition and economic performance in Japan. Specifically, it compares two opposing views: (1) Sakakibara and Porter (2001) who state that the intensity of domestic competition or rivalry is the main determinant of Japanese export success, and; (2) Uriu (1996) who argues that concentrated industries possess more economic alternatives (e.g., flexible labor and capital inputs, diversification, ability to shift excess capacity overseas, etc.) for adjustment and growth than fragmented industries. Using Sakakibara and Porter's original dataset as well as statistics from the Japan Industrial Productivity database, the local competition-export performance relationship is tested on two subsets (homogeneous good industry vs. heterogeneous good industry). Applying the method of principal components to correct for multicollinearity, I find that the key measure of competition, the concentration ratio, is positively and significantly related with industry exports, contrary to Sakakibara and Porter.

Key words: *Competition, concentration ratio, exports.*
JEL Classification: L11

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1. Introduction

According to the World Economic Forum's (WEF) *Global Competitiveness Report 2004-05*, Japan ranks 9th overall among a group of 104 countries in terms of the Growth Competitiveness Index (GCI) and ranks 8th based on the Business Competitiveness Index (BCI). The WEF defines "competitiveness" as a country's ability to sustain high growth rates in per capita GDP. The two major composite indexes, GCI and BCI, represent and measure the macroeconomic bases (macroeconomic environment, public institutions, and technology) and microeconomic sources (firm operations and strategy, and quality of the national business environment) of economic prosperity[1]. Based on earlier reports, Japan's situation has steadily improved since 2000 when its rankings were 20 and 14 for GCI and BCI, respectively. Japan's high ranking is attributed to improvements in technology and strong domestic firms despite problems in its national business environment.

The concept of competitiveness and its determinants continues to be controversial. Porter and colleagues have examined the case of Japan extensively. Using world export share as a measure of global competitiveness, Porter, Takeuchi, and Sakakibara (2000), Sakakibara and Porter (2001), and Porter and Sakakibara (2004) show, via industry case studies and statistical analysis, that:

> Our results were unequivocal: the intensity of local rivalry was by far the dominant factor explaining the international success of Japanese industries. Conversely, the presence of trade protection or the existence of a cartel worked against international competitiveness. Traditional comparative advantage variables, such as capital and labor intensity, had a weak or nonexistent relationship with export share. The size of the home market was also insignificant, suggesting that economies of scale per se is not an important factor in determining competitiveness. (PTS, 2000, p. 112)

The causal relationship between local competition and export performance is not unambiguous however[2]. Cortes (2005), testing the same industry panel dataset employed by Sakakibara and Porter and adjusting for simultaneity, finds that export share leads to more rivalry among domestic Japanese firms, urging them to be more efficient and productive. In other country studies, the results are also conflicting as demonstrated by Kim and Marion (1997) who provide empirical support for Porter's hypothesis that the degree of domestic competition positively affects exports in the U.S. food sector, and Hamilton (1997) who shows that New Zealand industries which are more concentrated (less competitive) are also more successful internationally. More recently, in a study of seven countries, Hollis (2003) finds that the higher the domestic industrial concentration, the lower the country's net exports.

The objectives of this study are two-fold: (1) to discuss the current state of competition and market structure in Japan using standard measures of concentration ratios; and (2) to re-examine the local

[1]See Porter's (2004-5) explanation of the components of BCI.
[2]See Odagiri (1992) for more discussion.

competition-export performance relationship for Japan by employing a new database (Japan Industrial Productivity data 1970-98) and Uriu's (1996) framework. Analysis will focus on the mid-1990s when the economy was stagnant and various factors such as deregulation, foreign direct investment and antitrust enforcement were contributing to the increased level of competition in Japan.

The remainder of the paper is organized as follows. Section 2 discusses the levels and trends of industrial concentration in Japan from 1975 to 2002. Section 3 presents Porter's diamond theory in general and the domestic competition-growth relationship in particular. It also examines the empirical problems associated with earlier Porter studies and discusses an alternative view by Uriu. Section 4 tests the Porter hypothesis using the method of principal components analysis on a cross-section of Japanese industries from the Japan Industrial Productivity database. The empirical tests will also be applied on earlier data provided by Sakakibara and Porter. The last section concludes with a summary and conclusions.

2. Trends in Concentration of Japanese Industries

In earlier studies, Cortes (1998, 2002) shows that the structure of Japanese markets, as measured by standard 4-firm concentration ratios and Herfindahl indexes (based on data from the Japan Fair Trade Commission (JFTC)), became increasingly concentrated in the 1980s and 1990s. Japanese manufacturing and service industries classified according to the level of 4-firm concentration ratio (CR4) for several years are presented in Table 1.[3]

Table 1. Percentage of Industries Classified According to CR4 Levels, 1975-2002

	1975	1980	1985	1990	1995	2000	2002
CR4:							
0-20%	0.8	0.7	0.0	0.0	0.0	0.0	0.3
21-40%	6.3	4.7	5.0	2.5	2.3	2.7	3.7
41-60%	18.9	18.2	15.6	16.8	5.1	13.6	9.8
61-80%	31.5	30.4	31.3	28.2	34.1	28.4	29.0
81-100%	42.5	45.9	48.0	52.5	58.5	55.3	57.2
Mean	74.8%	75.7%	76.8%	78.2%	81.6%	79.6%	80.4%
Std. Deviation	0.201	0.198	0.195	0.179	0.15	0.169	0.174
Total No. of Sectors	127	148	179	202	217	331	348

Source: Author's calculations from JFTC data.

Between 1975 and 2002, the total number of industries with CR4 above 60 percent more than tripled from 94 to 300. Percentage-wise, sectors characterized by oligopolistic firms or dominant firms accounted for 74% of industries in 1975 to 86% in 2002. On the other hand, the percentage of

[3] CR4 is the sum of the market shares of the top four firms within an industry.

industries with concentration below 40 percent fell from 7% to 4% over the period. The average 4-firm concentration level in Japan persists at a high level of approximately 80%.

A major limitation of concentration ratios is that they do not take into account imports. The effect of imports on concentration depends on the response of domestic firms. Import competition may lead to acquisitions, mergers, or exit of domestic firms, thereby raising concentration. On the other hand, foreign competition may push domestic firms to be more efficient and productive, thus reducing concentration. The JFTC provides concentration data adjusted for import penetration. Based on these figures, the average industrial CR4 went down from 86 percent in 1975 to 76 percent in 2002[4].

3. Methodology

Porter's "diamond theory" provides four main sources (shown diagrammatically as a diamond) of a country's or industry's competitive advantage: (1) factor or input conditions such as skilled labor, physical capital, and scientific and technological infrastructure; (2) demand conditions or the nature of local customers; (3) related and supporting industries such as local suppliers and clusters; and (4) firm strategy and rivalry[5]. Porter argues that domestic competition or rivalry is the most significant determinant of success in the international marketplace. In their studies of the Japanese case, Sakakibara and Porter (2004) contend that "…where Japan's economy has had healthy competition, it has also experienced strong productivity, innovation and international success" (page 41). In an earlier 2001 study, they find that: (a) local rivalry (as measured by fluctuations in market shares of leading competitors) is the most dominant factor that explains the international success of Japanese firms; (b) trade barriers negatively affect international competitiveness while legal cartels have no effect; (c) traditional comparative advantage variables such as capital and labor intensity have little or no relationship with export share, and; (d) the size of the home market is insignificant, suggesting that economies of scale are not important in determining competitiveness.

An opposite view is presented by Uriu (1996) who argues that concentrated industries possess more economic alternatives (e.g., flexible labor and capital inputs, diversification, ability to shift excess capacity overseas, etc.) for adjustment and growth than fragmented industries. He studies various "troubled" Japanese industries and finds that industry structure (measured by concentration ratio and labor supply) determines how firms react to economic distress. Unlike concentrated industries that have more choices or options, fragmented industries experience more bankruptcies and thus are more inclined to seek trade protection and other political solutions.

This paper focuses on the domestic competition-trade performance relationship and tests these two competing hypotheses. The base model to be estimated here is

$$\text{Competitiveness} = b_0 + b_1\text{Rivalry} + b_2\text{FE} + b_3\text{Size} + b_4\text{Protection} + e \quad (1)$$

[4]Odagiri criticizes such data as "…biased towards concentrated industries because of JFTC's interest in these industries." (1992, p. 205)

[5]Porter, Takeuchi, and Sakakibara (2000), pp. 103-104.

where:

- Competitiveness is defined as an industry's export share;
- Rivalry is the intensity of domestic competition as measured by the 4-firm concentration ratio;
- FE refers to factor endowments such as unskilled and skilled labor intensity and physical capital intensity;
- Size is market size or scale economies;
- Protection refers to trade barriers or *keiretsu* affiliation;
- e is an error term.

For comparative purposes, model (1) above follows that of Sakakibara and Porter (hereafter called S&P). This study, however, differs from that of S&P in several ways. First, the key explanatory variable of interest in this study is the top 4-firm concentration ratio (excluding public establishments); S&P emphasize market share instability instead of concentration as a measure of domestic rivalry. There are two reasons for using concentration as the main variable in this study: (a) contrary to their expectations, S&P found a strong positive correlation between concentration and the market share instability variable, and; (b) the use of the concentration ratio facilitates the comparison between the two datasets employed here. Second, the competition-export relationship is tested on two different datasets, S&P's data (a sample of 77 industries for the 1973-90 period) and Japan Industrial Productivity (JIP) data (56 manufacturing sectors for the 1992-2000 period).[6] The JIP database was compiled by researchers from Hitotsubashi University, Keio University, and other institutions in conjunction with the Economic and Social Research Institute of the Japanese government. It includes cross-industry data on various resources, input-output tables, research & development, trade and investment, etc. (see Fukao, et al (2004)). Third, the model is estimated for sub-samples of the dataset to account for homogeneous good industries and differentiated good industries, following Kim and Marion (1997). Finally, the model is tested and corrected for empirical problems such as simultaneity and heteroscedasticity; the technique of principal components analysis is applied to adjust for multicollinearity.

The traditional Hecksher-Ohlin resource endowments are expected to have a positive relationship with trade performance. Porter contends that the impact of market size or scale economies has become ambiguous as a result of globalization of markets. However, Uriu argues that the larger the labor force, the greater the costs of adjustment in response to economic problems, thereby negatively affecting industry performance[7]. The protection of domestic firms via *keiretsu* groupings or cartels is expected to have a negative relation with trade performance, following S&P.

[6] Sakakibara and Porter's data set consists of 46 industrial goods sectors and 31 consumer goods sectors; the Japan Industrial Productivity data is more aggregate at the 3-digit industrial classification level.
[7]The use of the industry labor force is similar to S&P's scale index.

4. Analysis of Results

The objective of this paper is to test the competition-trade performance as hypothesized by Porter and others. The main contribution is to address and examine whether Sakakibara and Porter's findings are spurious results arising from empirical problems of endogeneity, collinearity of some independent variables, and heteroscedasticity. The first step is to re-estimate S&P's base model of export performance using their original dataset. However, instead of using market share instability, the analysis here focuses on the 4-firm concentration ratio as the measure of the intensity of local competition and as the key determinant of export share. Consistent with theoretical expectations, Cortes (2005) and Doi (2001) find that market share instability and concentration are significantly and negatively related with each other. On the other hand, S&P find that high concentration is positively correlated with market share fluctuations. Given the strong correlation between concentration and market instability and to enable comparative tests of two different data sets, this study uses concentration ratio as the variable representing domestic rivalry.

Applying ordinary least squares (OLS) regression on the base model (1) above using S&P's cross-sectional data, the results are:

$$\begin{array}{l} \text{Exportshare} = 0.09 + 1.24\text{C4} - 68.16\text{Labor} + 0.61\text{HCAP} - 0.10\text{PCAP} \\ \qquad\qquad\quad (0.88)\ \ (1.24)\ \ \ (-1.33)\qquad (1.72)^{*}\qquad (-2.18)^{**} \end{array}$$

$$\begin{array}{l} - 0.38\text{Barriers72} - 0.44\text{MES} \\ \quad (-2.28)^{**}\qquad\ (-1.18) \end{array}$$

Adjusted R-squared: 0.09
Number of observations: 77
Note: t-statistics in parentheses; **significant at 5% level; *significant at 10%.

Factor conditions as represented by skilled labor (HCAP) and physical capital intensity (PCAP) as well as trade barriers (Barriers72) are significantly related with export performance. HCAP and Barriers72 have the expected signs; the unexpected negative sign of the capital intensity variable may be indicative of the Leontief paradox (Sakakibara and Porter do not provide any explanation for the PCAP result). The concentration variable C4 has a positive sign (contrary to S&P's expectation) and is statistically insignificant. The minimum efficient scale variable (MES), representing scale economies, is also insignificant. Overall, the explanatory power of the estimated model is very low. The result of applying the White test indicates no heteroscedasticity. To check for the potential simultaneity between exports and concentration, two-stage least squares (TSLS) technique is applied to the model with the following instrumental variables for explaining concentration (advertising intensity, research intensity, industry growth and variations, and cartel variables). The TSLS results are generally similar to those of the OLS estimation, albeit with a lower adjusted R-squared.

To check for multicollinearity, an examination of the correlation matrix as well as auxiliary regressions of the independent variables reveal strong collinearity among the factor endowments

variables (Labor, HCAP, and PCAP) and trade barriers (Barriers72).[8] To correct for this, the principal components technique is employed. This method combines and transforms correlated explanatory variables into a few factors called principal components. These components account for a large proportion of the total variation of the original explanatory variables and can then be used as independent variables in the regression (see Johnston (1972), pp. 322-331). In this approach, the explanatory variables of interest – concentration and scale economies – along with the relevant number of principal components are used to explain the dependent variable, trade performance. The principal component analysis is further applied to two industry groups representing homogeneous goods and differentiated goods. The results of employing principal components method on S&P's industry data are presented in Table 2.

Table 2. Principal Components Analysis Using S&P Data; Exports is Dependent Variable

Explanatory Variable	Full Sample	Homogeneous Goods Sectors	Heterogeneous Goods Sectors
Constant	0.08	0.04	0.26
	(0.97)	(0.46)	(1.63)
Concentration Ratio	0.12	0.26	-0.28
	(1.04)	(2.23)*	(-1.29)
MES	-0.43	-1.12	0.96
	(-1.14)	(-2.56)**	(1.80)*
Principal Component 1	-0.003	0.03	-0.002
	(-0.21)	(2.30)*	(-0.11)
Principal Component 2	-0.03	-0.01	0.04
	(-1.74)*	(-0.45)	(1.86)*
Principal Component 3	0.05	-0.02	0.07
	(2.53)**	(-1.12)	(1.87)*
Adjusted R-squared	0.07	0.21	0.26
No. of Observations	77	48	29

Note: T-statistics in parentheses. *Significant at 10% level; **5%; ***1%.

Each principal component is a linear combination of four correlated explanatory variables, Labor, HCAP, PCAP, and Barriers72. For the full sample, three principal components were estimated and accounted for 90 percent of the variance of the set of four variables. The results are qualitatively similar to those found by S&P, i.e., factor conditions and trade barriers are significant determinants of export share while concentration and scale economies are not.

The main contention in this study is that Sakakibara and Porter (2001) did not take into account the multicollinearity problem and the competitive advantage differences among Japanese industries arising from product type and technology. Following Kim and Marion (1997), the data set is divided into a homogeneous product group and a heterogeneous/differentiated product group based on advertising-sales ratio. The homogeneous good industries are those sectors whose advertising expenditures are less

[8]Gujarati (1999) discusses these tests of multicollinearity (pp.322-326).

than one percent of sales; differentiated good industries are those which spend equal or more than one percent of sales.[9] Table 2 shows that the key variables of concentration and scale economies are now statistically significant, contrary to S&P. More importantly, concentration has a positive influence on the export performance particularly of homogeneous good industries.

For comparative purposes, the same methodology is applied to another and more recent cross-industry dataset called the Japan Industrial Productivity database. The number of manufacturing sectors (56) is smaller than that of S&P since the data refer to 3-digit industries. The dependent variable, export share, refers to values in 2000 while the explanatory variables have values for earlier years, thereby resolving any issues of simultaneity and direction of causation. The standard empirical tests for heteroscedasticity, endogeneity, and multicollinearity are conducted. The results are similar to those using the S&P dataset. The results of principal components analysis on the JIP data (full sample and two subsets) are in Table 3 below.

Table 3. Principal Components Analysis Using JIP Data; Export Share is Dependent

Explanatory Variable	Full Sample	Homogeneous Goods Industries	Heterogeneous Goods Industries
Constant	-15.93	28.78	-18.77
	(-0.73)	(0.98)	(-0.68)
Concentration Ratio	0.47	0.48	0.57
	(2.93)***	(1.84)*	(2.89)***
Log (number of workers)	1.58	-1.97	1.51
	(0.92)	(-0.86)	(0.68)
Principal Component 1	3.92	3.02	5.09
	(2.70)***	(1.72)	(2.49)**
Principal Component 2	3.48	0.59	2.59
	(2.43)**	(0.37)	(1.28)
Principal Component 3	1.31	11.43	-2.16
	(0.73)	(5.48)***	(-1.03)
Adjusted R-squared	0.20	0.55	0.22
No. of Observations	56	25	31

Note: T-statistics in parentheses. *Significant at 10% level; **5%; ***1%.

The explanatory variables of factor conditions (skilled labor intensity, land input per worker, and capital per worker) and entry barrier (measured by a dummy variable for Japanese industries regulated in the past) are combined to form principal components. Along with these components, concentration and labor force (a proxy variable for scale economies) are included in the regression to test the competing hypotheses of Porter and Uriu. The results indicate that domestic concentration has a

[9] Following Gujarati, auxiliary or subsidiary regressions also find multicollinearity in the homogeneous goods and heterogeneous goods sub-samples. The correlated explanatory variables (Labor, HCAP, PCAP, Barriers72) are combined to form principal components to distinguish them from the key variables of concentration and scale economies.

positive and significant impact on trade performance, all other things held constant. This concentration effect is present both in homogeneous good industries and in differentiated, advertising-intensive sectors. This main finding of a direct relationship between concentration and exports is contrary to Porter's competition-trade performance hypothesis and more in line with that of Uriu.

As supplementary tests of the robustness of the main findings, other explanatory variables are introduced sequentially in the model. Only the results related to the heterogeneous good industries using JIP data are reported in Table 4. First, foreign competition in the form of imports or inward foreign direct investment is insignificant and is not a good substitute for domestic concentration/competition in explaining a country's exports. Similarly, the proportion of Japanese firms belonging to a horizontal or vertical *keiretsu* group does not have a statistically significant effect on trade performance (consistent with S&P). Sakakibara and Porter maintain that the effect of the *keiretsu* is already captured by their market instability variable (S&P, p. 319). A stronger and more reasonable explanation, however, is the weakening of *keiretsu* affiliations resulting from the prolonged recession and the revived anti-monopoly policies and enforcement of the Japan Fair Trade Commission. Advertising intensity influences exports, albeit negatively indicating that such expenditures do not spill over to other countries (consistent with Kim and Marion). The other industry trait, research and development, has the expected positive sign but is insignificant. Finally, in all these regressions, the key measure of domestic competition, the top 4-firm concentration ratio, is positively and significantly associated with export performance[10].

[10]The results for homogeneous good industries are insignificant for all independent variables (including CR4) except the principal component that represents factor conditions and regulation variables.

Table 4. Results Explaining Export Share for Heterogeneous Good Industries (JIP Data)

Independent Variable	Model with Import Share	With inward FDI	With *Keiretsu*	With Advertising	With Research
Constant	-4.33	-3.82	-4.46	2.65	-2.91
	(-0.87)	(-0.80)	(-0.79)	(0.50)	(-0.63)
CR4	0.62	0.60	0.62	0.65	0.47
	(3.21)***	(3.07)***	(3.16)***	(3.60)***	(2.11)**
Principal Component1	4.99	5.62	5.23	5.23	3.83
	(2.47)**	(2.75)**	(2.53)**	(2.81)**	(1.73)*
Import Share	0.11				
	(0.64)				
Inward FDI		0.60			
		(0.74)			
Vertical *Keiretsu*			1.37		
			(0.17)		
Horizontal *Keiretsu*			2.47		
			(0.44)		
Advertising Intensity				-11.92	
				(-2.04)*	
Research Intensity					58.39
					(1.33)
Adjusted R-squared	0.22	0.22	0.19	0.31	0.26

Note: Number of observations = 31. T-statistics in parentheses. *Significant at 10% level; **5%; ***1%.

5. Summary and Conclusions

There is a large and growing literature on the determinants of export performance. The intention here is not to add to the literature but to focus primarily on the nature of competition or market structure as a causal factor. Porter and others contend that the degree of competition or rivalry among domestic firms is the most dominant determinant of a nation's international success. In the case of Japan, Sakakibara and Porter use changes in the market shares of an industry's top firms as a measure of the intensity of local competition and find that this variable is significantly and directly related with export performance. In this study, I focus on the concentration ratio for several reasons. First, as S&P found, concentration is highly correlated with market share instability. Second, concentration data are available in both the S&P and JIP datasets, thereby making comparative analysis feasible. Finally, despite its limitations, the concentration ratio serves as a useful and important factor in merger and competition policy considerations. In this study, I re-examined the competition-export relationship using the standard measure of competition, the 4-firm concentration ratio, as the key variable of interest. I tested two competing hypotheses: (1) Porter's hypothesis that industries with low concentration (i.e., more competitive or possess higher instability) will have higher exports; and (2) Uriu's argument that more concentrated industries have greater capabilities and resources to be successful domestically and globally. Employing two comparative industry datasets for Japan (S&P and JIP) and applying principal components analysis to overcome the problem of multicollinearity, I

found that concentration has a direct and significant impact on export performance, consistent with Uriu. As Uriu points out, more concentrated industries and their respective leading firms have particular strengths and advantages such as access to larger and more flexible inputs, and a greater ability to diversify and to move excess domestic capacity and resources overseas via direct investment. Thus, the higher the industry concentration, the more successful the firms are in the global arena. Moreover, this relationship is stronger for heterogeneous good industries. Other important determinants of exports include factor endowments, government regulation, and advertising intensity. On the other hand, market size or scale economies, *keiretsu* affiliation, and foreign import and investment penetration are not significantly associated with industrial competitiveness.

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