Winner-Take-All Contention of Innovation under Globalization: A Simulation Analysis and East Asia's Empirics

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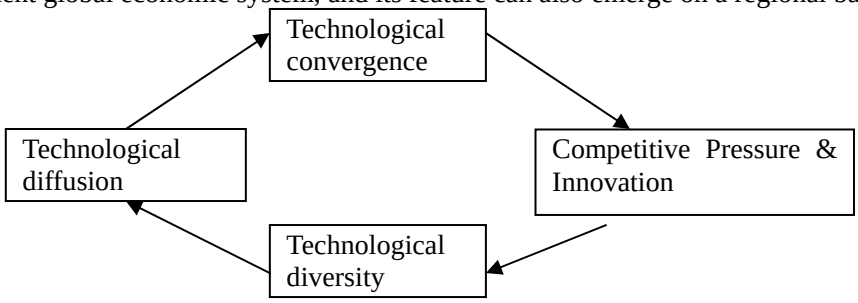
This study sets out to examine both theoretically and empirically how innovation enhances export competitiveness. That export volume becomes enhanced as more productivity-enhancing innovation can be captured by the exporting economy is the basic viewpoint of this study.

1. The Role of Knowledge in Industrialization

From Schumpeter's (1961) perspective, knowledge creation can be characterized by continuous creation and subsequent diffusion of newer technologies on the basis of the exporters' existing capital stock.

2. "Disequilibrium view" of innovation

Otani (2003) propounds the concept of "globalization cycle", within the empirical context of economic interdependence and under the theoretical purview of evolutionary theory. According to Otani, the dynamic aspect of economic globalization can be schematically presented as in Figure 1: the continuous cycle of technological innovation and its diffusion is the defining feature of the interdependent global economic system, and its feature can also emerge on a regional basis.



Source: Adapted from Otani (2003), Figure 1.

Figure 1. Globalization Cycle

3. Theoretical analysis of innovation

We highlight the possibility of concentration of innovative activities in a small group of "winner" economies, which leads to the larger shares of leading economies' exports share in innovation-active sectors than those in technologically mature sectors. Drawing on Nelson and Winter (1982), this section makes a simulation-based theoretical argument that those industrial fields with either rapid rate of innovation or slow technological diffusion arising from either inherent engineering specification or intellectual property rights (IPRs) protection exhibit the "winner-take-all" character: A large-scale exporter with state-of-the-art capital stock would build further upon its existing productive facility and hence facilitate the next round of innovative industrial operation, resulting in a larger export share than in the case of mature or standardized industrial sectors with little scope for further technological upgrading.

4. Some empirical evidence

Empirical export data corroborates this theoretical prediction on the world's cross-sectional basis: Table 1 shows a linear-regression results of rank (horizontal axis) – size (vertical axis) distribution for the world by commodity sector. The Table seems to support the hypothesis that the stronger "winner-take-all" property is observed for apparently more technology-intensive export commodities, exemplified most by the electronics and machinery products. A focus upon East Asia (not presented in this summary paper) has revealed the region's increasing resort to technology-intensive commodity sectors.

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East Asia has basically been capturing the fruit of innovation from outside the region, through the conduct of attracting foreign direct investment undertaken by multinational firms. In spite of the region's status as a net importer of technology in the "upstream" part of the economic process, its export performance as the most "downstream" part of the economic process has been outstanding, especially in the said technology-intensive sectors.

With respect to the welfare implication of the cycle of innovation and imitation, existing literature studying the impact of IPR protection on the rate of technological development[1] points out that a large demand difference between developed "North" and developing "South" could serve as deterrent against potential IPR infringement, since such conducts in the developing South would discourage innovators in the North from incurring R&D costs for fear of potential free-riding by the South. In other words, a high level of IPR protection and observance in the South would encourage innovation in the North. On the other hand, an enhanced level of IPR protection is said to suppress economic growth in the South due to expensive imitation costs (Grossman and Helpman, 1991).

Under the circumstance of what could be termed "non-strategic" R&D investment, i.e., the investment being made anyway *irrespective of* the rival's behavior (the innovator's behavior for the imitator and vice versa), an increased pace of innovation and imitation between North and South –as a result of East Asian economic integration involving both developed and developing economies, for example— could accelerate the pace of "globalization cycle" which is discussed in the former part of this paper. Considering the overall gains from innovation, therefore, acceleration of the full cycle of innovation and imitation might be a desirable option.

5. Conclusions and prospects for future research

The knowledge-creation aspect of economic activity can be viewed as "dynamic" as opposed to "static" within the standard framework of trade analysis. While the importance of the former has long been recognized, however, theoretical sophistication has tended to focus on the latter. This paper has studied technological innovation with an emphasis on its "dynamic" evolutionary property: technological breakthrough takes place discontinuously yet on the basis of existing industrial operation. The important feature of the theoretical modeling addressed in this study is that once innovation has been made, it becomes more probable for the innovative producer to make further innovation. East Asia's empirical data seems to support this increasing-returns-to-scale feature of innovation for innovation-active sectors. Regarding prospects for future research direction, formulation of innovation in its generic form could stress the "heterogeneity" of innovating and imitating agents. Empirically, the contentious argument of whether or not "winner-take-all" innovation process is welfare-enhancing for East Asia as well as the global society remains so, yet non-strategic or "single-minded" engineering effort in pursuit of further innovation would in principle be desirable for the whole society.

References:

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[1] See, for instance, Diwan and Rodrik (1991).

Table 1. Linear-regression results of rank-size distribution for the world's exports (across all countries) by commodity, 1976, 1985, 1995 and 2003

Commodity sector	Item	1976	1985	1995	2003	Simple average of slope
Electrical	Slope	-4.3 (-17.29)	-3.56 (-16.63)	-3.81 (-24.05)	-3.83 (-20.77)	-3.88
	Intercept	3.44 (11.40)	4.34 (13.12)	5.04 (18.45)	5.31 (16.61)	
	Adj R squared	0.90	0.77	0.82	0.77	
	No. of obs.	35	82	126	129	
Machinery	Slope	-4.28 (-15.27)	-3.54 (-1854)	-3.68 (-25.95)	-3.65 (-24.47)	-3.79
	Intercept	3.63 (10.69)	4.45 (15.00)	4.87 (19.90)	5.07 (19.56)	
	Adj R squared	0.87	0.81	0.84	0.82	
	No. of obs.	36	83	126	129	
Transportation	Slope	-4.23 (-15.08)	-3.54 (-19.69)	-3.67 (-23.96)	-3.61 (-23.30)	-3.76
	Intercept	3.28 (9.56)	4.24 (15.25)	4.83 (18.27)	4.86 (18.12)	
	Adj R squared	0.86	0.83	0.82	0.81	
	No. of obs.	37	82	127	128	
Pottery	Slope	-4.07 (-11.76)	-3.64 (-12.98)	-3.65 (-18.31)	-3.36 (-16.28)	-3.68
	Intercept	4.01 (9.39)	4.87 (11.14)	5.17 (14.97)	4.98 (13.90)	
	Adj R squared	0.79	0.67	0.73	0.67	
	No. of obs.	38	84	127	129	
Metal	Slope	-4.44 (-11.02)	-3.14 (-13.53)	-3.52 (-17.77)	-3.30 (-17.00)	-3.60
	Intercept	3.91 (7.92)	4.35 (12.11)	5.13 (14.93)	4.97 (14.72)	
	Adj R squared	0.77	0.69	0.71	0.69	
	No. of obs.	37	82	128	130	
Chemical	Slope	-4.11 (-11.68)	-3.03 (-14.95)	n.a.	-3.57 (-16.82)	-3.57
	Intercept	3.86 (8.97)	4.16 (13.13)		5.18 (13.99)	
	Adj R squared	0.79	0.73		0.68	
	No. of obs.	37	85		131	
Wood and Paper	Slope	-4.14 (-12.80)	-3.10 (-15.99)	-3.44 (-1925)	-3.33 (-16.42)	-3.50
	Intercept	3.89 (9.67)	4.07 (13.47)	4.85 (15.72)	4.91 (13.95)	
	Adj R squared	0.81	0.75	0.75	0.68	
	No. of obs.	39	85	126	129	
Others	Slope	-3.96 (-13.99)	-3.16 (-15.81)	-3.10 (-20.30)	-3.14 (-18.59)	-3.34
	Intercept	3.71 (10.71)	4.38 (14.00)	4.45 (16.86)	4.65 (15.85)	
	Adj R squared	0.84	0.75	0.76	0.73	
	No. of obs.	37	85	128	130	
Mining	Slope	-4.05 (-8.61)	-2.96 (-10.36)	-3.15 (-15.10)	-3.09 (-14.31)	-3.31
	Intercept	3.41 (5.83)	4.38 (9.84)	4.78 (13.20)	4.78 (12.75)	
	Adj R squared	0.66	0.56	0.64	0.61	
	No. of obs.	39	84	128	129	
Light	Slope	-3.44 (-12.83)	-3.07 (-13.87)	-3.22 (-19.56)	-3.10 (-18.54)	-3.21
	Intercept	3.88 (11.53)	4.13 (11.96)	4.63 (16.25)	4.50 (15.55)	
	Adj R squared	0.81	0.69	0.75	0.73	
	No. of obs.	40	85	128	128	
Food	Slope	-3.39 (-7.95)	-2.51 (-12.92)	-2.80 (-16.86)	-2.61 (-14.46)	-2.83
	Intercept	4.06 (7.72)	3.73 (12.23)	4.25 (14.78)	4.10 (13.07)	
	Adj R squared	0.63	0.66	0.69	0.62	
	No. of obs.	38	86	128	130	
Textiles	Slope	-3.30 (-10.95)	-2.51 (-9.57)	-2.35 (-13.32)	-2.37 (-11.72)	-2.63
	Intercept	3.55 (9.56)	4.24 (10.34)	4.30 (14.05)	4.40 (12.50)	
	Adj R squared	0.76	0.52	0.58	0.51	
	No. of obs.	38	85	128	130	
Agriculture	Slope	-2.28 (-10.62)	-2.21 (-13.55)	-2.29 (-21.76)	-2.39 (-16.05)	-2.29
	Intercept	3.11 (11.57)	3.45 (13.38)	3.70 (20.23)	3.91 (15.11)	
	Adj R squared	0.51	0.67	0.79	0.66	
	No. of obs.	40	89	130	131	

Notes: Commodity sectors in the rows are listed in the descending order (in magnitude) of the simple average.

The numbers in parentheses are t-statistics.

Source: Authors' calculation on the basis of the United Nations' trade statistics, UNCOMTRADE.