

Do foreign authors strengthen South Korea's national research system? National and international dynamics in Korea's Triple Helix of scientific co-authorship relations

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Keywords: University-Industry-Government-Overseas actors, co-authorship, South Korea

Submitted for presentation to the 8th International *Triple Helix* Conference (*Triple Helix VIII*) to be held from 20 to 22 October 2010 in Madrid, Spain

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With globalization accelerating, a nation's competitiveness in terms of its knowledge base increasingly depends on international dimensions. In an age of globally networked research, national institutions can no longer be considered as unique components of an international system of research, technology, and innovation. Exchanges more and more often take place across national borders. Hitherto, the Triple Helix (TH) perspective of university-industry-government (UIG) relations has been particularly useful for examining how effectively institutional actors in a national science system work together across institutional boundaries, and the consequential status of the interaction-based knowledge infrastructure in a national research system (Etzkowitz & Leydesdorff, 2000).

The most salient development witnessed these days regarding TH indicators is the role of international co-authorship relations. The significance of these foreign authors in the formal literature as covered by the *Science Citation Index* (SCI) lies in their ability to mediate between traditional knowledge holders and knowledge seekers in the national system. In a recent study, Leydesdorff & Sun (2009) found that foreign authors have been emerging as arguably the most important mediator in the national innovation system of Japan.

This paper traces the underlying patterns of collaborations between Korean researchers and their international partners, using longitudinal data obtained from the SCI. More specifically, the paper investigates the connection between Korean institutional actors (university, government, and industry) and international co-authorship relations. A network-based system indicator is used to measure the evolving network of co-authorship relations among national and international actors of the TH in South Korea.

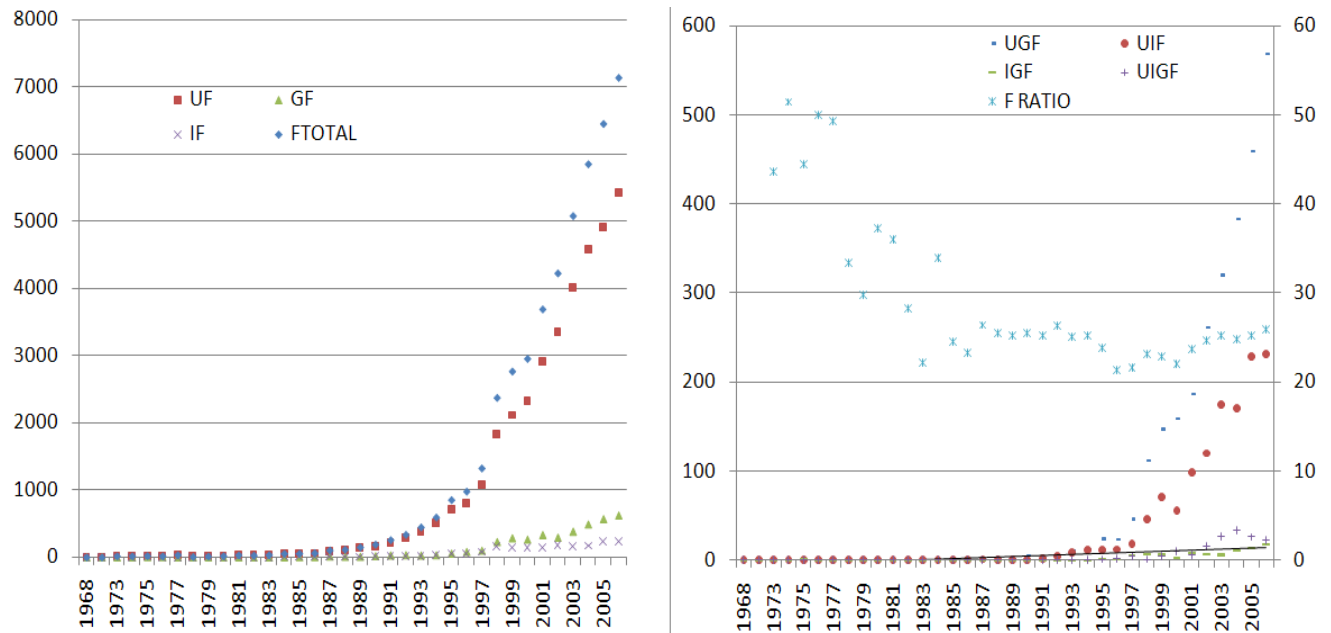
### **Development of the Korean Science System and the Role of Overseas Actors**

Since the early stages of the development of the Korean science system in the 1950s and 1960s, overseas institutions (particularly those in the US) have been critical in providing highly-qualified training for Korean researchers. During this period, as with other public science systems in developing countries, the main roles of the Korean science system were limited to education of standardized industrial labor and to technical support for industry, rather than implementation of scientific research (Kwon, 2009). Due to various government policy efforts, the university system expanded in the 1980s, and academic research was revitalized in the 1990s. Therefore, international actors have emerged as important research collaborators for Korean academics, as well as for other domestic actors (i.e. scientists in public research institutes and industries). Recently, the government has strongly encouraged high-quality cooperative research at the international level through WCU (World Class University) and WCI (World Class Institute) programs inviting prestigious international scholars.

Figure 1 shows the longitudinal trend of publications of domestic actors, overseas actors, and domestic actors with foreign actors. During the last several decades, Korean universities have been a major collaborator for overseas actors in terms of scientific publication, as shown in the Figure.

As high-quality academic research was encouraged in the late 1990s, the publications with overseas actors increased steadily. In particular, after a decrease in the mid-1990s (Kim, 2005), the share of papers co-authored with overseas actors grew from 21% in 1996 to 26% in 2006.

Figure 1: Number of publications by domestic actors with foreign actors in Korea



## Results

Figure 2 demonstrates the results for the national TH system without considering international relations. The longitudinal trend shows the reduction of uncertainty among academic, public, and industrial research actors in the Korean publication system between 1970 and 1990. Interestingly enough, mutual information among the three institutional agencies was relatively stable during the early 1990s, but decreased during the last ten years. (For a detailed investigation of the national TH system in Korea, see Park, So, and Leydesdorff, 2009)

Figure 2: Mutual information in trilateral domestic TH relations in Korea

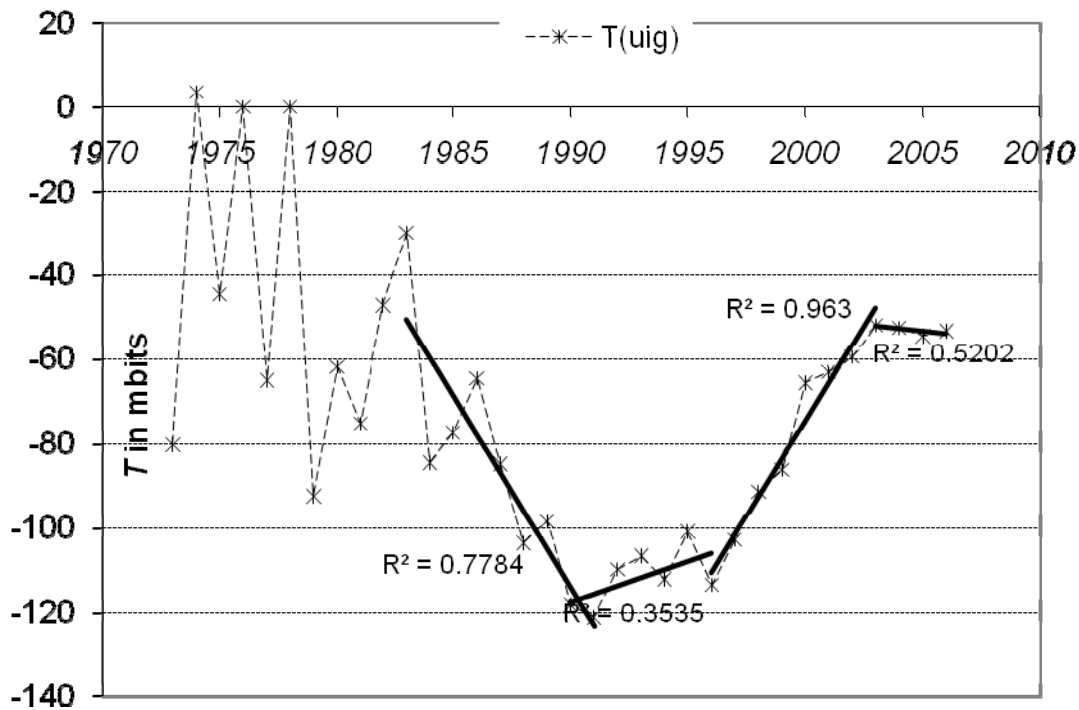


Figure 3 extends this analysis with regard to the international dimension. It shows a very noticeable result in the different TH dynamics in Korea due to the addition of the new important nodes, that is foreign authors. The trend line shows that mutual information in bilateral relations between university and foreign sectors has been in rapidly increasing since 1990. Government-foreign research collaboration ( $T_{gf}$ ) is the second strongest, followed by industry-foreign relations ( $T_{if}$ ) in the last decade.

Figure 3: Mutual relations between university, industry, government, and overseas actors in the domain of articles with Korean addresses

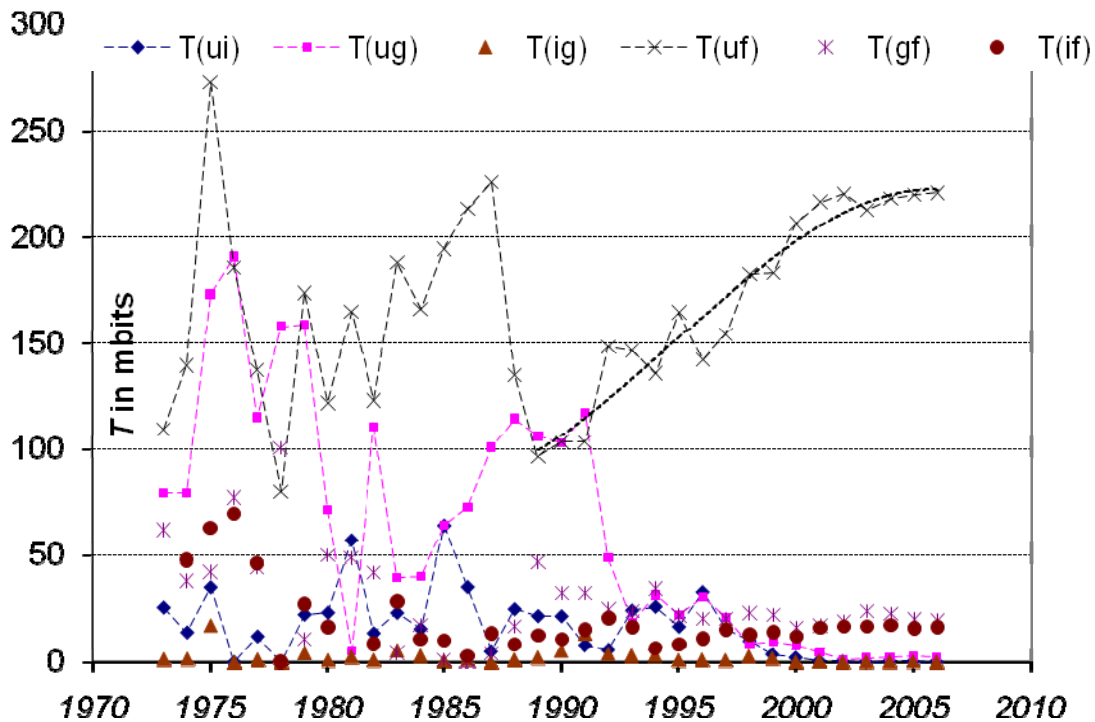
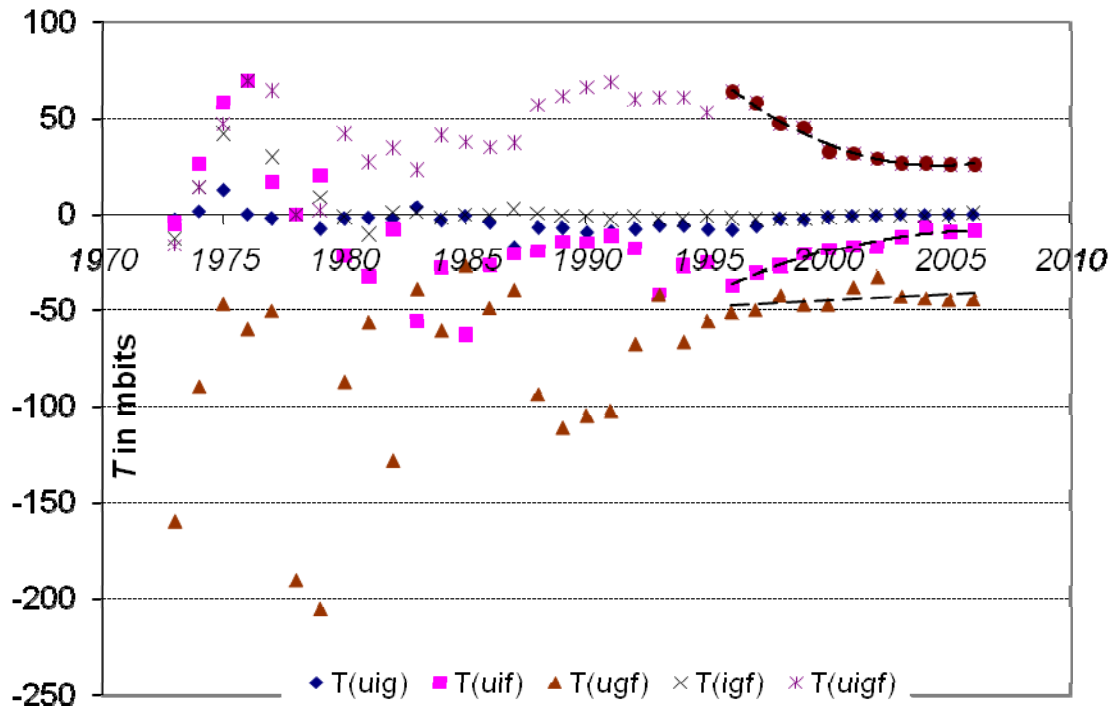


Figure 4 shows the longitudinal trend of three- and four-dimensional indicators. An interesting path among the three and four institutional spheres has emerged. First, the TH dynamics of UIGF relations in either three or four dimensions varied considerably until the mid-1980s. Next, mutual information among the four agencies ( $T_{uigt}$ ) began to increase in 1987, but remained increasingly stable during the 1990s. However, there was some reduction of uncertainty among academic, public, industrial, and foreign research actors in the Korean publication system during the mid-1990s. Overall, the system has been stable since 2001. Only university-industry-foreign collaborations eroded in the period. This is not due to bilateral relations (UF and IF), which both increased, but is because the synergy between the international relations of industry and academia can no longer be harvested from these relations at the national level.

Figure 4: The mutual information in three and four dimensions among Korean articles



### Conclusion

The Korean government has sought to strengthen the national research system in order to narrow the wide gap separating it from Western countries in the short term. However, the government has comparatively neglected public interventions in fostering knowledge-based innovation capacities across the country. The significance of international authors in the national TH system is growing due to changes in the knowledge environment. The interdependencies of complex technological changes and advances in scientific disciplines are rapidly increasing, and a competitive advantage can be secured through cooperative partnerships. The findings of this research show that the effectiveness of national research capability can be boosted beyond the three national helices by including international relations into the perspective, and new developments can be driven at the network level.

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