Session 2 (Parallel)

Basic Research Investments for Promoting Innovation

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We observe that as a country's technology level approaches the world technology frontier, it tends to rely more on technology creation than adoption, and invest more in basic research than applied or development research. The distinction between basic research and applied or development research activities is important in designing an optimal R&D policy for technological progress. As defined by Aghion and Howitt (1996), basic research produces fundamental knowledge, which by itself may not be useful but which opens up windows of opportunity, whereas development research is to generate secondary knowledge, which will allow those opportunities to be realized.

A recent paper by Kim, Ha, and Lee (2006) presents a formal theoretical model in which technological progress is more positively correlated with basic research activities for technology creation, as one country's technology gap to the technology frontier is narrower. It presents empirical evidence supporting the model's prediction, using the data on three East Asian economies including Japan, South Korea, and Taiwan, such that the interaction between R&D input structure and distance to technological frontier has a significant impact on total factor productivity (TFP) growth. It implies that, as a TFP level of an economy approaches the world frontier level, basic research becomes relatively more important, and an increase in the share of basic R&D in total R&D expenditure has a significantly positive effect on TFP growth rate.

In this regard, relative weakness of basic research is a key problem for an economy such as South Korea which is now in the development stage that needs to rely more on the innovation of its own technologies than the imitation or adaptation of existing technologies. Korea performs well above average among OECD countries in terms of R&D expenditures. Korea spent approximately 2.9 percent of GDP in 2004. However, the share of basic research expenditures in total R&D is only 15.3% in 2004, while applied and development research constitute 21.2% and 63.5% respectively.

A critical question is raised on what are the effective policies that can help achieve an optimal structure of R&D investments along its development path. Education policies would be most important. Highly-trained skilled workers with at least tertiary education are critical for innovation. Technology creation is a relatively more skill-intensive activity than adoption. Vandenbussche, Aghion, and Meghir (2004) provide evidence from 19 OECD countries between 1960 and 2000 that, as a country moves closer to the technology fron-

tier, tertiary level education becomes increasingly more important for growth than primary and secondary education. Kim, Ha, and Lee (2006) also show that the quality of tertiary education has a significantly positive effect on the productivity of R&D in Korea. Efficient educational and research frameworks that can supply highly-skilled human resources for basic research activities and thereby technology innovation, would be most important especially for an economy that approaches the world frontier technology level.

Financial market policies are also very important to encourage innovative activities by firms and research institutions. A well-developed financial system helps foster innovation activities by reducing the cost of external finance for innovative firms. Due to information asymmetry and uncertainty, private financial markets cannot achieve the socially optimal level of the financing for innovation. Hence, it is often required that the government directly support public and private research institutes as well as colleges and universities to promote research activities, especially in the area of basic and fundamental technologies. In general, the government must strive to improve the financial market system to provide long-term financial resources for innovators. The government may provide direct financial support to stimulate private-sector innovative activities, especially innovative small and medium firms, via tax incentives or direct financial subsides. For instance, Korea performs well in terms of business R&D as a share of GDP, but most of R&D is performed by large firms (OECD, 2005). Korea needs to improve direct funding programs for small-sized innovative firms and venture capital market for entrepreneurial individuals that undertake high-risk innovations.