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From Imitator to Innovator: How Do Firms Grow in Developing Countries?

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This project investigates the appropriate industrial policies for different stages of development, specifically focusing on two ways to improve technologies: adopting existing technologies from foreign firms and innovating new technologies. By digitising and analysing historical technology transfer and patent data from South Korea, we find that productivity gains and their spillover from adoption are larger at the early stages of development but diminish as the country develops. Therefore, the optimal policy needs to start by subsidising adoption and shift to innovation. Evaluating South Korea's actual policy, which transitioned from adoption to innovation subsidies, we find it significantly increased welfare. Furthermore, our results suggest that it was optimal to switch from adoption to innovation subsidy when South Korea's GDP reached approximately half that of the frontier country's GDP.

Introduction

Policymakers in numerous developing countries commonly utilise subsidies as a strategy to boost productivity and spur economic growth. They usually face a choice between two key strategies: nurturing homegrown innovation to develop their own technologies or encouraging the adoption of advanced technologies from foreign sources. However, due to limited government budgets, it's crucial to allocate these resources effectively between these two strategies. Consequently, to formulate effective technology policies, understanding the comparative benefits and costs of adopting foreign technologies versus developing indigenous innovations is essential, especially as these may vary at different stages of a country's development. This paper delves into how both the adoption of foreign technology and domestic innovation contribute to overall economic growth, and it explores the implications of these strategies for policy at various stages of economic development.

Policy context

Our study focuses on South Korea (hereafter referred to as Korea) during the period from the 1970s to the 1990s, a time frame that serves as an excellent case study for two main reasons. Firstly, Korea is renowned not just for its significant long-term economic growth but also for its remarkable transformation into one of the world's leading innovative nations. Secondly, during this era of change, the Korean government actively implemented subsidy policies aimed at closing the technological gap with more advanced countries. These policies initially focused on subsidising the adoption of foreign technologies, but as Korea began to catch up, the focus shifted towards encouraging domestic innovation. This context provides a unique opportunity for our research to examine how Korean firms adapted their technology sourcing strategies as the country transitioned

from a developing to a developed economy, and to assess the impact of technology policies that evolved in response to different stages of economic development.

Results and Policy Impact

Using this data, we document two novel facts about technology adoption that motivate our model. First, when the productivity of Korean firms lags behind that of foreign firms, production gains from adoption are larger than those from innovation, but adoption fees are less expensive. Second, we find that non-adopting firms started to cite more patents from foreign firms that sold technology to Korean firms, which suggests knowledge spillover from adoption.

Inspired by these findings, we build a growth model, focusing on how companies can boost their productivity. In this model, firms have two options: they can either adopt technology from foreign companies or innovate themselves. In the model, when domestic companies are far behind foreign companies in terms of productivity, adopting foreign technology leads to bigger productivity gains. Interestingly, the cost of adopting technology is lower when the productivity gap is larger, due to less competition.

Moreover, both adoption and innovation lead to knowledge spillover among domestic companies, aligning with our second key observation. This phenomenon opens up the opportunity for government subsidies to significantly improve the overall economic welfare. The effectiveness of these subsidies is closely linked to the degree of productivity enhancement achieved through either adoption or innovation. When domestic companies are substantially less advanced, the initial benefits of adopting foreign technology tend to surpass those derived from innovation. Yet, as these companies evolve and narrow the productivity gap, the relative advantage of adopting foreign technology diminishes. This shift indicates that the impact of government subsidies on adoption or innovation should be dynamically adjusted in accordance with the prevailing productivity differences.

We estimate our model using the collected data and conduct three quantitative exercises. First, we decompose growth between adoption and innovation by examining counterfactual scenarios in which we isolate either adoption or innovation. Our findings show that in 1973, adoption contributed to 73% of productivity growth. However, by 2022, its contribution had dramatically dropped to just 6%. As Korean firms became more competitive, the relative benefits of adopting foreign technology lessened, prompting a shift towards more innovation-based growth strategies, resulting in a decrease in reliance on technology adoption.

In our second exercise, we assessed the technology policy adopted by the Korean government starting in 1973. This policy initially encouraged the adoption of foreign technology through tax credits. Over time, however, there was a gradual shift: the government reduced the rate of subsidies for adoption while increasing support for domestic innovation, after the introduction of the R&D subsidy program in 1982. We analysed the impact of this actual policy by comparing it with three hypothetical scenarios: eliminating both types of subsidies, providing subsidies exclusively for adoption, and offering subsidies solely for innovation. Our findings indicate that the real policy

implemented by the government, which varied subsidies based on the state of development, increased overall economic welfare by 4.84% compared to not providing any subsidies. This approach proved more beneficial for welfare than either focusing only on adoption (which resulted in a 3.69% increase) or solely on innovation (yielding a 3.28% increase in welfare).

In the final part of our study, we investigated what the optimal subsidy policy might look like. We focused on a scenario where the government could choose each year to subsidise either the adoption of foreign technology or domestic innovation. A crucial decision in this approach was determining the right timing to switch from offering subsidies for adoption to those for innovation, with the goal of maximising overall economic welfare. According to our model, the most effective policy would start with a substantial adoption subsidy of 55% and then shift to an innovation subsidy of 51% in 1985 – a point at which Korea's GDP reached 55% of Japan's GDP. Implementing this strategy would lead to a 6.42% increase in welfare, which is notably higher than the improvement observed under the actual policy implemented by the Korean government.

Moving forward

Our study draws on data from South Korea, beginning in 1970, a time when the country was evolving from a low-income to a middle-income status. We believe our insights could be highly beneficial for policymakers in low-income countries, especially those who are crafting long-term technology policies. However, it's important to note that the quantitative results of such policies may vary depending on country-specific factors. The parameters that influenced South Korea's growth could differ in other contexts. Thus, if similar data on technology adoption and innovation are available from other countries, our analytical framework could be applied to understand their unique situations.

Additionally, the success of technology policies often hinges on the presence of supporting infrastructure. In the case of South Korea, a relatively higher education level compared to other low-income countries at the time likely played a role in the effectiveness of its technology policies. Future research into the impact of education policies on technology adoption and innovation would be valuable.

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