Are Technologies Appropriate for Developing Country Skills? Evidence from Vietnamese Manufacturing

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Background and Motivation

The persistent productivity gap between developing and advanced economies remains one of the central challenges in development economics. The "appropriate technology" hypothesis provides a convincing theoretical explanation for this gap: technologies developed in capital- and skill-abundant advanced economies are inherently designed for factor endowments that differ substantially from those in developing countries (Acemoglu and Zilibotti, 2001). When these technologies are adopted in settings where capital and skills are scarce, they may yield lower productivity gains, potentially locking developing countries into a lower growth trajectory even when technology diffusion is complete. The hypothesis suggests that productivity depends on differences in endowments between where technologies are developed and where they are used.

Despite its theoretical appeal and policy relevance, the appropriate technology hypothesis has seen limited empirical testing, especially at the firm level. For example, the more convincing evidence is from agricultural crop diffusion (Moscona and Sastry, 2025). This gap in the literature stems primarily from data constraints. Standard customs data do not capture machinery that is domestically produced or imported indirectly via intermediaries, while typical firm surveys lack information on the country of origin of adopted technologies. Understanding whether "inappropriate" technology adoption constitutes a major barrier to productivity growth is crucial for industrial and innovation policy in developing countries, as it calls into question the simple prescription of adopting technologies from the global frontier. To our knowledge, this paper represents one of the first tests of the appropriate technology hypothesis using firm-level data.

Data and Methodology

This paper addresses the empirical gap by exploiting a novel representative firm-level panel dataset covering Vietnamese manufacturing firms from 2009 to 2017. The data are derived from the Viet Nam statistical office enterprise survey data and contain measures of manufacturing firms' performance, worker skills and information on firm technology use.

The data contain a unique feature: they identify the country of origin for each firm's primary (most intensively used) manufacturing technology. This allows us to directly compare the differences in endowments between each firm and the source country of their technology, overcoming the limitations of both customs records and standard firm surveys.

We use these data to construct firm-level measures of the potential "inappropriateness" of their technology, defined as the absolute difference between a firm's initial skill intensity (measured by the educational attainment of its workforce in 2009) and the skill abundance of the country from which it sources technology. In other words, "inappropriateness" reflects the skill mismatch between the firm and its technology source.

This period is also well suited for the analysis because it coincides with large-scale tariff liberalization in Viet Nam, which we use to generate quasi-experimental variation in firm technology sourcing patterns. The Vietnamese data include a text description of the imported technologies. We can then link the product information to the tariff schedule by using an LLM-based API to classify each technology into six-digit HS codes based on its description, a method that has been shown to perform reliably (Marra de Artiñano, Riottini Depetris and Volpe Martincus, 2026). We manually check a random sample of entries to ensure the reliability of the match. Tariffs fell particularly strongly for more skill-abundant countries, which we use to predict changes in the potential "inappropriateness" of firm technology.

The first step of our empirical strategy is to establish the relationship between tariff reductions over this period and firm technology sourcing patterns. We do this by constructing an industry-year Bartik (shift-share) measure that weights country-product tariff rates by each industry's baseline import shares of technologies across HS6 products and origin countries. We then use this tariff-induced variation to predict changes in skill mismatch between the firm and their technology source (i.e. "inappropriateness") and examine the resulting impact on firm productivity.

Results and Next Steps

Our data show extensive switching in the countries from which Vietnamese manufacturing firms source imported technologies during the period of tariff liberalization. A large share of this switching is toward suppliers located in high-income countries. In particular, firms increasingly source technologies from Japan, Taiwan, South Korea, Germany, Italy, and the United States, which together account for over 80 percent of all switches. Given that these economies are substantially more skill-abundant than Viet Nam, this pattern suggests an increase in potential mismatch between firms' workforce skills and the technologies they adopt.

Consistent with this hypothesis, we find that tariff reductions are larger for more skill-abundant countries and thus these reductions, as captured by declines in our Bartik instrument, lead firms to source technologies from more skill abundant countries. There is a strong and statistically significant relationship between tariff reductions and greater skill mismatch. Importantly, this effect is driven by increases in positive mismatch, that is, firms shifting toward sourcing technologies from countries that are more skill-abundant than their own workforce: a 10 percentage-point decline in tariff exposure increases positive mismatch by about 0.03 standard deviations.

We then investigate the productivity consequences of rising mismatch, which we interpret as lower technology appropriateness. To address the endogeneity of mismatch, since more productive firms may be more likely to upgrade and source from high-skill countries and unobserved factors may jointly affect productivity, sourcing decisions, and workforce composition, we use our Bartik measure as an instrument. This allows us to isolate variation in mismatch driven by tariff-induced changes in technology sourcing and to estimate how productivity gains vary when firms adopt technologies that are more or less mismatched to their workforce. Preliminary results suggest that firms with smaller technological mismatches are more productive (whether measured by labor productivity or TFP), albeit the evidence is significant only at the 10 percent level. We find stronger evidence, significant at the 1 percent level, that firms with smaller technological mismatches pay higher wages. We do not find significant effects for capital investment or employment.

Our next step is to test the robustness of these results, and examine other dimensions of appropriateness, including mismatch in the capital intensity of a firm and its technology source.

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