Will Automation Technology Shift the Patterns of World Apparel Production and Trade?

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Background:
Since apparel manufacturing traditionally is highly labor-intensive, most apparel are produced by developing countries today, where labor is an abundant production factor (Dickerson, 1999). However, with the advancement of automation technologies, such as Sewbots, firms soon may also be able to use machines to make garments (Nayak and Padhye, 2017). This pioneering study intends to explore how the adoption of automation technology will shift the patterns of world apparel production and trade. While it is a common perception that automation could favor apparel manufacturing in the developed economies but put developing countries at a disadvantage, there is a lack of solid evidence and systematic evaluation (Saki, 2016; Le, 2018). Findings of the study will fulfill the research gap and shed new light on the future big landscape of the apparel industry in the new automation era, which particularly matters to the hundreds of millions of workers currently employed by the apparel sector.

Literature review:
Theoretically, the adoption of automation technology will increase the elasticity of substitution between capital and labor in the apparel sector, meaning a firm can more easily substitute capital (i.e., machines) for labor in making apparel as the relative price of the two production factors changes (Krugman, 2008). Further, according to the Rybczynski theorem, an increase in the quantity of one production factor will lead to an absolute increase in the production of the good that uses that production factor intensively (Leamer, 1984). This suggests that should apparel manufacturing can be largely automated (i.e., becomes capital-intensive), capital-abundant developed countries could increase apparel production domestically in replace of imports from developing countries. With that, this study proposes that: H1: Automation technology will increase apparel production in the developed countries. H2: Automation technology will reduce apparel exports from developing countries to developed countries. Additionally, the decrease of apparel exports to the developed countries may affect the production of apparel in the developing countries negatively. With that, this study proposes that: H3: Automation technology will reduce apparel production in the developing countries.

Methods and data:
The computable general equilibrium (CGE) model developed by the Global Trade Analysis Project (GTAP) was adopted in this study to test the hypotheses. Compared with a single-equation econometric model, the GTAP CGE model has the advantage of capturing the input-output relationship between the T&A industry and other sectors in the setting of an open global economy and generate more robust results (Adams, 2005). Data of the analysis came from the latest GTAP9 database, which includes trade, and production data of 57 sectors in 140 countries in 2015 as the base year (Aguiar, Angel, Narayanan & McDougall, 2016). For the purpose of the
study, we estimated the following three scenarios: Scenario 1 (the capital-labor elasticity of substitution (ES) in the apparel sector increases from 1.3 in the base level to 5); Scenario 2 (the value of ES in the apparel sector increases to 10); and Scenario 3 (the value of ES in the apparel sector further increases to 20). The higher the value of ES, the easier capital (i.e., machines) can be used to replace labor in making apparel. The three scenarios also assume that developed countries (including the United States, the European Union (EU) and Japan) will increase their capital supply by 10% from the base year level (i.e., the new investments made to purchase machines in making apparel). Comparing the results of these three scenarios can indicate the overall impact of automation technology on the pattern of apparel production and trade.

Results and discussion:

First, results of the CGE model estimation support H1 that automation technology will increase apparel production in the capital-abundant United States, Japan and EU (Table 1). Notably, developed countries will enjoy the biggest increase in apparel production in Scenario 3 when capital can most easily substitute labor in apparel manufacturing. Second, results show that when developed countries can make more apparel domestically thanks to the automation technology, they will import less apparel from developing countries correspondingly (H2 is supported). Likewise, because of the decrease in export, leading apparel exporters in the developing world, including China, Vietnam, Bangladesh, India and ASEAN members, will suffer a decline in their apparel production (H3 is supported). Particularly, developing countries will suffer the most decline when capital can most easily substitute labor in apparel manufacturing (i.e., Scenario 3).

Implications and future research agenda:
First, findings of the study confirm that automation technology could significantly affect the patterns of world apparel production and trade. Apparel “Made in the USA”, “Made in Japan” and “Made in EU” may see a sizable return in the new automation era. Second, findings of the study call our attention to the potential losers of automation technology, particularly developing countries like Bangladesh that rely heavily on making and exporting apparel to support their economic growth and job creation. How to help developing countries overcome the potential negative impact of automation technology in apparel manufacturing will be a critical research agenda to explore further.

References


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