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Article

Measuring the Effectiveness of the Chinese Innovation System: A Global Value Chain Approach

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Abstract: This paper study argues that some disruptive new trends are surfacing with the emergence of new technologies, which makes an efficient and effective R&D and innovation system even more relevant for any country to compete at a global level. Against this backdrop, the study tries to measure the effectiveness of the Chinese innovation system, using the "R&D spending as percentage of GDP" as the input variable and the "contribution of R&D and related business activities to the value-added manufacturing exports" as the output variable. Based on a 59-country sample in the OECD-WTO TiVA database, the regression results show a significant and positive correlation between the two variables. The findings also complement with other existing empirical and qualitative studies in this area. The overall findings show that China has achieved significant efficiency and effectiveness in its innovation system compared with many other countries; in fact, since 2009, the efficiency has accelerated. However, it still lags behind the major global players. This means China still has some room to improve in order to transform its increasing inputs in R&D and technology innovation into commensurate outputs. This situation calls for further improvements in its innovation ecosystem.

Keywords: Innovation, China, Global Value Chain, R&D, Trade

JEL code: O3, F1, O1, L6, L8

1. Introduction

Some important changes are taking place in global value chains (GVCs) amidst the overall sluggish global trade growth of recent years. For instance, since 2005, the global GDP growth has been surpassing the global trade growth, reversing the long trend in the past decades. Meanwhile, there has been a boom of

cross-border data transactions with the emergence of new technologies and intelligent mobile devices. All these have led the global economy into a new age of "digitized" GVCs, where the manufacturing and trade are gradually moving away from the traditional large-scale and centralized production and trading centers to smaller-scale, more decentralized and "intelligent" value chains, with fewer tiered supplier chains and more customized production.

Under such a new paradigm, firm productivity will be less dependent on the scale and more reliant on the personalized products and faster delivery. This entails firms to quickly adopt or adapt to the fast changing technologies, ideas, and business processes in order to create new products in a rapid and efficient manner. All this means that a country's R&D and innovation system will play a more and more important role in its manufacturing sector, export competitiveness, and overall participation in the GVC. However, are the R&D and innovation systems in different countries getting ready for this new challenge? How effectively or efficiently are they contributing to the countries' manufacturing exports? This study, starting with some broad context of the GVC, intends to briefly examine the efficiency or effectiveness of R&D spending on value-added manufacturing exports for 59 sample countries. The study then looks into the case of China with a more detailed approach and, based on the findings, derives some policy implications.

Owing to the slow recovery of the global economy and some structural changes in the emerging economies, global trade growth has remained modest following three years of weak expansion. The growth of merchandise trade in terms of volume was just 2.2% in 2012, and 2.5% in 2013 as well as 2014. In 2015, the value of total goods traded fell 13.8%—the biggest plunge since 2009; however, in terms of volume, it grew 2.5%, lower than the global GDP growth of 3.1%. A new phenomenon of the global trade is that its growth has been lower than the global GDP growth. Before 2005, global trade grew much faster than the output, and used to be twice as fast; however, since 2000, the gap between the global trade growth and GDP growth began to narrow, and since 2005, the GDP growth has surpassed the trade growth except the brief period following the 2008 financial crisis (Frankel, 2015). Furthermore, the flows of finance, people, and trade have slowed—falling from a peak of 53% of global output in 2007 to 39% in 2014 (Donnan, 2016). Meanwhile, the elasticities of global merchandise trade with respect to real GDP have been declining since 2000, and the speed of decline has accelerated in recent years (WEF, 2015).

Several factors have contributed to this change. These include the slow-down in China and rebalancing of the growth model, leading to lower demand for commodities and manufacturing inputs. Another factor could be the sluggish global demand, especially in Europe. However, all these factors do not seem enough to explain the overall drop in global trade.

A striking fact that accompanies this change is the rapid emergence of new intelligence technologies and trans-border data flow (Donnan, 2016). The flow of digital information around the world more than doubled during the 2013–2015 period to an estimated 290 terabytes per second. This figure will grow by a third again this year, which means that by the end of 2016, companies and individuals around the world would send 20 times more data across borders than they did in 2008. In 2014, cross-border flows of capital, goods, services, and data added an extra $7.8tn to the global economy. The added value of data flows alone accounted for $2.8tn of that total, slightly more than the $2.7tn attributed to the global trade in goods (McKinsey Global Institute, 2016; Donnan, 2016).