Market linkages with fragmented production

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Abstract

I use a Ricardian model to analyze the transmission of technology shocks between countries when production processes are fragmented. The analysis emphasizes the role of three factors in determining how the gains from technical progress are shared between the innovating country and the rest of the world: the elasticity of substitution in consumption of final goods, the elasticity of substitution between intermediate and final production stages, and the pattern of production. In contrast to models with trade in final goods only, a high elasticity of substitution in consumption may be associated with losses for the innovating country when there is complete vertical specialization in production. I also examine the transmission of shocks in a three-country world where two countries are linked in a vertical production relationship.
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1. Introduction

When economies are linked through trade, shocks to technology in one country will affect other countries through their impact on trade flows and relative prices. The increasing

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globalization of the world economy has been widely documented—reductions in transport costs, tariff barriers, and communications costs have expanded the volume of trade relative to national income and increased the linkage among countries. However, there is increasing evidence that in addition to expanding the volume of trade, globalization has also affected the nature of linkages among countries. One important feature of the expanding volume of trade has been the fact that the production process has become "fragmented across borders," with stages of production in individual goods being produced in a variety of countries around the world. The outsourcing of stages of the production process for foreign firms has been an increasingly common phenomenon in a number of industries.[1]

The purpose of this paper is to identify how the pattern of trade affects the transmission of technology shocks among countries. It is argued that under certain circumstances, the impact of technical change in one country on factor markets and incomes will differ depending on whether the trading countries are trading final goods or whether they are linked through exchange of different stages of a production process. For example, Taiwan is a major producer of electronics products and that sector accounts for 60% of the market capitalization on its stock exchange. Many of these products are sold in the U.S. market. If these products are final products that compete directly with U.S. products in the U.S. market, then a favorable productivity shock to electronics firms in the U.S. will increase the competitiveness of U.S. products and displace Taiwanese products in the U.S. market. However, the effect will be quite different if the relationship is one of vertical specialization between the U.S. and Taiwan. If U.S. firms are outsourcing the production of electronics components, an increase in the productivity of U.S. firms in the production of final goods will increase the demand for intermediate products being purchased from Taiwan. If the degree of outsourcing is changing over time, the way in which shocks are transmitted among countries may also be changing over time. Understanding of these linkages is, therefore, important for analyzing how the effects of technical progress will be transmitted among countries.

The Ricardian model of trade is a natural starting point for such an investigation, because it focuses on technology as the primary source of comparative advantage and has been frequently used to analyze the transmission of technological progress among countries.[2] I examine a two-sector Ricardian trade model in which each sector has two production stages. This simple production structure allows for the consideration of a variety of (exogenously given) production patterns, that range from traditional trade in final goods only to vertical specialization in which all countries participate in some stage in each sector. This model can then be used to analyze how changes in technology affect wages and real incomes in each country, and how this transmission varies with the initial pattern of comparative advantage. The analysis identifies three parameters that play a key role in the determination

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[1] Evidence of this phenomenon is provided by Hummels et al. (2002)Hummels, Ishii, and Yi (2002) and Feenstra (1998).

[2] Dornbush et al. (1977)Dornbush, Fisher, and Samuelson (1977) used a Ricardian model with a continuum of goods to analyze the transmission of technology shocks under the assumption that preferences for final goods are Cobb-Douglas. Jones (1979) addressed the question of technology change in a three-good model, which emphasized the importance of whether countries are linked by producing a common good. Wilson (1980) extended the continuum model to allow for more general assumptions about the demand for final products.