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The skill premium and economic growth with costly investment, complementarities and international trade of intermediate goods

Oscar Afonso [a,*], Pedro Cunha Neves [b,1], Maria Thompson [c]

[a] Faculdade de Economia, Universidade do Porto, Portugal
[b] Departamento de Gestão e Economia, Universidade da Beira Interior (UBI), and CEFAGE-UBI, Covilhã, Portugal
[c] NIPE, Escola de Economia e de Gestão, Universidade do Minho, Porto, Portugal

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ABSTRACT

We analyse the behaviour of the skill premium and the growth rate in an innovator–imitator general equilibrium growth model with international trade of intermediate goods, internal costly investment in both physical capital and R&D, and complementarities between intermediate goods in production. We find that, as opposed to the growth rate, the skill premium is not affected by the complementarities degree nor the investment cost, in any of the countries. We also conclude that, in line with related empirical literature, openness to trade leads to an increase in the skill premium in both countries, while the sign of its impact on the growth rate depends on the magnitude of its counteracting determinants.

1. Introduction

Three simultaneous trends have been observed in developed and developing countries, since the early 1980s. They are: growing technological knowledge; widening wage gaps in favour of high-skilled labour; and increasing international trade flows (e.g., Coe et al., 1997; Berman et al., 1998; Acemoglu, 2003; Avalos and Savvides, 2006). Empirical evidence also pinpoints growing proportions of high-skilled labour in developed countries (e.g., Machin and van Reenen, 1998; Kranz, 2006).

Two main lines of research accounting for the above referred empirical observations can be identified within economic growth literature. One of these lines is made of wage-inequality growth models, which emphasize the interaction between labour endowments and wage inequality (e.g., Acemoglu and Zilibotti, 2001; Acemoglu, 2003; Kranz, 2006). This line of research is subdivided into two contrasting approaches: the trade approach, anchored on the Stolper–Samuelson theorem (e.g., Leamer, 1998; Wood, 1995); and the skill-biased technological-change theory, rooted in the effects of market-size on the technological-knowledge bias that drives wages (e.g., Acemoglu, 2002). The second line of research gathers the technological-knowledge diffusion growth models, which focus on the relationship between economic growth and the diffusion of technological knowledge from developed to developing countries (e.g., Grossman and Helpman, 1991). This branch further argues that the substantial international trade flows of intermediate goods throughout the last decades have constituted a major vehicle of technological-knowledge diffusion from developed to developing countries.

* Corresponding author at: Faculdade de Economia, Universidade do Porto, Portugal. Tel.: +351919991111; fax: +351225571100.
E-mail address: oafonso@fep.up.pt (O. Afonso).
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In another line of research, still within the growth literature, Thompson (2008) and Afonso et al. (2014) have pointed out the relevance of incorporating in growth models two important elements of contemporary economies: internal costly investments in both R&D and physical capital, and complementarities between intermediate goods in the production of final goods. According to Benavie et al. (1996) and Romer (1996) growth models should treat investment as a decision variable of firms, which requires assuming costs to capital accumulation. Bryant (1983) and Matsuyama (1995), on their turn, note that complementarities between intermediate goods should be considered when explaining economic growth, business cycles and underdevelopment.

In Afonso et al.'s (2014) model without trade, we have addressed some of the above empirical facts, combining elements from these strands of the growth literature. Specifically, building on Acemoglu and Zilibotti (2001), we have developed a two-country skill-biased technological change model, with growth generated by vertical R&D, and: (i) complementarities between intermediate goods; (ii) internal investment costs; and (iii) technological-knowledge diffusion from the innovator (developed) to the imitator (developing) country. We paid particular attention to the effects on both countries' economic growth rate and skill premium of these three economic features as well as of the innovator country's high-skilled labour supply. We found that all these elements influence the economic growth in both countries and the skill premium in the imitator country. They do not influence, however, the skill premium in the innovator country.

With the present paper, we wish to convey the idea of technological-knowledge diffusion through international trade. With this purpose, we extend Afonso et al.'s (2014) model by introducing international trade of intermediate goods. In our framework of a three-sector endogenous growth model, the innovator country is more productive than the imitator due to better institutions, higher human capital and innovative R&D (e.g., Aghion and Howitt, 1992). The imitator country has a marginal advantage cost in production (e.g., Grossman and Helpman, 1991) and its R&D activities consist in imitating innovations. The imitator country imports innovative intermediate goods embodying innovative technological knowledge, and exports imitated intermediate goods embodying imitated technology. That is, internationally traded intermediate goods are the vehicle for technological-knowledge diffusion.

This paper has two goals. Firstly, we wish to analyse how the introduction of international trade of intermediate goods in Afonso et al.'s (2014) model affects its main conclusions. We find that both skill premiums are affected by high-skilled labour supply, but none is influenced by the complementarities degree or internal investment costs. Regarding the growth rate, common to both countries, the effects of high-skilled labour supply and the degree of complementarities continue to be positive. However, the introduction of international trade generates a different effect of internal investment costs on growth: given that with trade flows the common growth rate is determined by R&D activities in both countries, the imitator's investment cost affects growth negatively, while the innovator's investment cost has an ambiguous impact on growth.

The second goal of the paper is to analyse the direct impact of openness to trade on the skill premium and on the growth rate in both countries. The majority of theoretical and empirical literature finds a positive impact of trade openness on the skill premium (e.g., Morrison and Siegel, 2001; Thoenig and Verdier, 2003; Zeira, 2007; Helpman et al., 2008; Egger and Kreickemeier, 2008; Egger et al., 2013). Regarding the impact of trade openness on growth, there is less consonance. On the theoretical side, as reviewed by Yanikkaya (2003), growth models suggest a very complex and ambiguous relationship between these two variables. The endogenous growth literature, for example, provides a diverse array of models with opposite results (e.g., Romer, 1990; Grossman and Helpman, 1990; Rivera-Batiz and Romer, 1991; Matsuyama, 1992). In turn, the new trade theory says that the magnitude of the gains from trade depends on several fundamental variables, like differences in comparative advantages, and economy-wide increasing returns. Empirical findings are also far from consensual in this regard. Although numerous studies find a positive effect of trade openness on growth, others find otherwise, in particular when analysing developing and underdeveloped countries (e.g., Rodriguez and Rodrik, 2001; Baliamoune, 2002). Many believe that much of this diversity is due to methodological differences, namely those concerning trade openness measurement (e.g., Edwards, 1998; Rodriguez and Rodrik, 2001; Yanikkaya, 2003).

Consistent with its related literature, our present model predicts that openness to trade induces an increase in the skill premium in both countries. The direct impact of trade openness on both countries' common growth rate is not so straightforwardly predicted. It depends on the magnitude of its counteracting determinants. More specifically, both countries are more likely to benefit from openness to trade if: (i) the imitation capacity is strong, because a stronger imitation capacity implies faster technological-knowledge transfer, also benefiting, through feedback effects, innovative activities; (ii) the technological-knowledge gaps between the innovator and the imitator are low, meaning that the number of quality rungs to be imitated is small which implies less imitation costs; (iii) international competition causes a small decrease in intermediate-good firms' mark-ups, that is, if incentives to R&D in both countries are not significantly reduced in comparison with the pre-trade protective environment; and (iv) the market dimension in both countries is large, given that, through the market-size channel, broader markets encourage R&D activities in both countries.

The remainder of this paper is organized as follows. We set up the model in Section 2 and characterize the steady-state in Section 3. Section 4 explains the main results and analyses the steady-state effects. Concluding remarks are presented in Section 5.

2. The model

Each country is populated by a time-invariant number of heterogenous households who supply labour and decide on their income allocation between savings and consumption of final goods. Perfectly competitive final goods are produced using labour and quality-adjusted intermediate goods as inputs. Intermediate-good production requires vertical R&D and is performed in monopolistic competition. The developed country is our innovator country, where all R&D activities are innovative, aimed at discovering new higher quality intermediate goods. The developing country is the imitator country, in which R&D activities are directed at imitating a quality that is already exists. The two countries differ in terms of productivity levels, labour endowments, R&D capacity, technological-knowledge stocks, and costs of intermediate-good production. These differences are assumed to have historical roots, reflected in current institutional characteristics.

There is international trade of intermediate goods between countries. Final-good producers of both countries can import intermediate goods, hence not being limited to use domestically produced ones. Likewise, intermediate-good producers can sell their goods in both