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Factor price differences in a general equilibrium model of trade and imperfect competition

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ABSTRACT

Except for the famous Dornbusch–Fischer–Samuelson (DFS) models, most general equilibrium models of trade rely on factor price equalization. The DFS models demonstrate the gains from trade without factor price equalization under perfect competition. This paper employs a general equilibrium model of oligopolistic competition which implies distortions both at the intensive and extensive margin. If factor prices do not equalize, imperfect competition will not reverse the specialization pattern. However, mutual gains from trade are not guaranteed, but one country may be worse off by trade.

1. Introduction

Traditional models of trade discuss mostly the incentives for and the outcomes of trade between relatively similar countries, an implication of which is that factor prices across countries are equalized. While this seems to be consistent with the observation of significantly large intra-industry trade volumes between countries with similar factor endowments, factor price equalization has found little empirical support. Once the trading partners are sufficiently different (in terms of size, in terms of factor endowments, or in terms of production technology, etc.), it is a well-established result that factor prices will no longer be equalized.[1] The consequences of trade when factor prices are different across countries are, however, not well scrutinized in the trade literature. This paper hence contributes to the literature by delineating the implications of different factor prices across countries, originating from factor endowment differences across countries, on the patterns of and gains from trade, in a multi-industry general equilibrium model of oligopolistic competition with free market entry and exit of firms. The model features two factors of production: capital which is used to establish firms, and labor which is used for production.

It is mainly the literature on the economics of multinational firms and vertical integration that focuses on the implications of different factor prices across countries. Helpman (1984), for example, shows in a general equilibrium framework that when countries are sufficiently asymmetric in terms of their relative factor endowments, factor prices will not equalize in equilibrium, which generates incentives for firms to vertically integrate. Also he finds that the extent of multinationality increases with an increase in the difference between relative factor endowments of the trading partners. In his model, the relative factor prices across countries tend to converge, especially with a sufficiently large number of

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[1] For instance, by introducing differences in country size as measured by labor endowments, the only factor of production, Krugman (1980) shows that the wage rate is necessarily higher in the larger country.

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multinational firms: the existence of multinationals puts a downward (upward) pressure on the wage–rental ratio in the capital-abundant (labor-abundant) country. Similarly, in a general equilibrium framework, Feenstra and Hanson (1997) study the labor market consequences of vertical integration between North (the USA) and South (Mexico). They show that different factor prices across countries lead firms to vertically integrate, and that capital flows from a capital- (and skilled-labor-) abundant (North) country to an unskilled-labor-abundant (South) country increase demand for skills and the average skill intensity in both countries, which can explain the increase in the skill premium in both the USA and Mexico in the late 1980s.[2]

In this paper, we do not focus on multinational activities, but on the effects of trade when factor prices do not equalize across countries. The model we employ can be seen as an extension of the famous Dornbusch–Fischer–Samuelson (DFS) model, Dornbusch et al. (1980), who demonstrate the gains from trade without factor price equalization under perfect competition. We depart from the DFS model, and from the standard approach to imperfect competition and trade (e.g., a general equilibrium model of monopolistic competition as in Krugman (1980)), by considering a model in which all commodity markets are imperfectly competitive, and there are economies of scale in all industries. The modeling approach in this paper is also different from Markusen (1981), who employs a two-sector model that features one monopoly and one perfectly competitive industry, and focuses on the implications of trade that originates from country size differences. He shows that factor prices do not equalize across countries of different size, and that welfare in a smaller country unambiguously increases, whereas the welfare implications of trade are ambiguous in a larger country.

Our model setup in this study is similar to Koska and Stähler (2014), building on the famous Dornbusch–Fischer–Samuelson (DFS) model, but we now accommodate factor price differences. Koska and Stähler (2014) focus only on trade equilibria with equal factor prices across countries, while the model here scrutinizes the role of different factor prices across countries: we look at inter-industry trade between countries that are sufficiently different in their factor endowments (e.g., North–South or South–North trade).[3] In this setup, domestic and foreign firms cannot coexist in the same industry. However, oligopolistic competition does not reverse the specialization patterns as they are well known from classical trade models: the capital-abundant country is a net exporter of capital services and a net importer of labor services as embodied in trade. Unless one country specializes in production of a sufficiently small range of goods, the wage–rental ratio increases in both countries. If the countries are sufficiently asymmetric in terms of their capital endowments, then a beneficial rationalization effect of free trade under different factor prices will be materialized unambiguously (via a decrease in the number of firms) in industries that are hosted by the relatively labor-abundant country, whereas the trade-induced changes in firm size and/or per capita consumption are ambiguous. According to our simulation results, a sufficient increase in the capital stock of the capital-abundant country – so that the countries become sufficiently asymmetric in terms of factor endowments – reduces welfare in the capital-abundant country, while increasing welfare in the labor-abundant country.

The remainder of the paper is organized as follows. Section 2 introduces the model and discusses the autarky equilibrium. Section 3 scrutinizes the equilibrium with no factor price equalization (NFPE) and discusses the implications of inter-industry trade. Section 4 delineates trade-induced changes in per capita consumption, discusses welfare implications, and presents simulation results. Section 5 offers some concluding remarks. For convenience, we have relegated most proofs and technical details to the Appendix section.

2. The model

We consider two countries: Home (North) and Foreign (South). All variables that are specific to Foreign are presented with (∗). Each country is endowed with labor (L or L^*) and capital (K or K^*). Factor endowments are fixed in each country: there is no factor mobility across countries. In each country, capital is used to establish a firm, and labor is used for producing output. There is a continuum of goods, indexed by $z \in [0,1]$. Households are symmetric and have Cobb–Douglas-type preferences, represented by the utility function $U = \int_0^1 \ln(\hat{y}(z))\,dz$ where $\hat{y}(z)$ denotes per capita consumption of commodity z. In autarky, the aggregate output of industry z in Home is $Y(z) = L\hat{y}(z)$, and in Foreign is $Y^*(z) = L^*\hat{y}^*(z)$, leading to an inverse demand function $p(z) = I/Y(z)$ in Home, and $p^*(z) = I^*/Y^*(z)$ in Foreign, where I and I^* denote, respectively, Home and Foreign income, and $p(z)$ and $p^*(z)$ denote the price of good z in Home and Foreign, respectively. The profit of firm i in industry z that is hosted by Home, denoted $\Pi_i(z)$, and by Foreign, denoted $\Pi_i^*(z)$, is respectively, equal to

$$\Pi_i(z) = (p(z) - \lambda(z)w)y_i(z) - r\kappa(z), \quad \Pi_i^*(z) = (p^*(z) - \lambda(z)w^*)y_i^*(z) - r^*\kappa(z), \tag{1}$$

where w and w^* denote, respectively, Home and Foreign labor wages; and r and r^* denote, respectively, the rental rate in Home and in Foreign. Firm-level outputs are denoted by $y_i(z)$ in Home, and by $y_i^*(z)$ in Foreign. The aggregate output of industry z is equal to $Y(z) = \sum_i y_i(z)$ in Home and $Y^*(z) = \sum_i y_i^*(z)$ in Foreign. In each country, all firms within industry z are symmetric: $Y(z) = n(z)y_i(z)$ in (Home) equilibrium, and $Y^*(z) = n^*(z)y_i^*(z)$ in (Foreign) equilibrium, where $n(z)$ and $n^*(z)$ denote, respectively, the number of active Home and Foreign firms in industry z. For a given industry z, the labor input

[2] Feenstra and Hanson (1997) discuss that similar results hold also with an increase in capital endowments of both countries as long as the increase is more in South, or with technological progress in both countries as long as it is at a faster rate in South.

[3] Volumes of trade between countries with sufficiently different factor endowments are significantly large. UNCTAD (2013), for instance, reports that North–South and South–North trade comprises, approximately, 40 percent of global trade.