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Trade and imperfect competition in general equilibrium☆

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ABSTRACT

This paper employs a multi-industry general equilibrium model of oligopolistic competition, free market entry and trade in which capital is used to establish firms and labor is used for production. We show that both absolute and relative endowments matter for the pattern of trade. We demonstrate that market entry to each industry is either too excessive or too moderate while the effect on firm size is ambiguous. If countries are sufficiently symmetric, trade will increase the wage–rental ratio in both countries. Furthermore, trade will increase per-capita consumption in capital-intensive industries and reduce it in labor-intensive industries. Nevertheless, trade will be mutually welfare-improving under relatively mild conditions.

1. Introduction

This paper scrutinizes the role of factor endowments for trade patterns, factor prices and industry structures in a multi-industry, multi-factor world with endogenous market entry/exit and without perfect competition in any industry. It develops a general equilibrium model of trade, oligopolistic competition and endogenous market entry in all industries by extending the famous Dornbusch–Fischer–Samuelson (DFS) model, Dornbusch et al. (1980).[1] The innovation of the paper is that all industries are subject to economies of scale, and thus all commodity markets are imperfectly competitive. Furthermore, we consider two factors, capital and labor, that play different roles: the capital market is the market for firm assets, and capital is, thus, used to establish firms, while labor is used to run the established firms. Industries differ w.r.t. their input requirements, both for capital and labor. Thus, we offer a general equilibrium framework which goes beyond models that have confined their analyses either to a fixed number of firms (no entry) with or without a general equilibrium approach, or to a one-factor (labor) case.[2]

In the international trade literature, the standard approach to imperfect competition and trade is to employ a general equilibrium model of monopolistic competition, following the seminal paper by Krugman (1980). These models show that economies of scale and product variety are further channels through which trade can improve welfare. However, these models assume that firms behave like monopolists and do not take strategic interactions into account when deciding on prices or outputs, and thus they cannot accommodate any pro-competitive effects of trade. Reciprocal dumping models developed by Brander (1981) and Brander and Krugman (1983) do focus on strategic interactions, but their role in trade theory has remained much less influential than that of either perfectly or monopolistically competitive models of trade; see Neary (2009, 2010). The reciprocal dumping models argue that trade may occur even in the absence of either comparative advantage or product differentiation, but they fail to address many of the classic questions of trade theory (Bensel and Elmslie, 1992; Neary, 2009). As

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[1] See Romalis (2004) for a model of monopolistic competition in a DFS framework. See also Dornbusch et al. (1977) for a (one-factor) Ricardian version of their model. Lawrence and Spiller (1983) model monopolistic competition and the existence of a competitive industry in general equilibrium.

[2] For example, see Markusen (1981) for a simple Cournot model with no market entry/exit in a general equilibrium framework, Markusen and Melvin (1981) for a model with increasing returns to scale as a determinant of trade, Venables (1985) and Horstmann and Markusen (1986) for a one-factor, partial equilibrium model with imperfect competition and free entry. Markusen and Venables (1988) show that substantially different results emerge by combining different assumptions (i.e., fixed number of firms vs endogenous market entry, segmented markets vs integrated markets).

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for the predictions about the welfare effects of trade, they are not immune against assumptions concerning firms' market entry and exit.

Many of both monopolistic competition and reciprocal dumping models assume quasi-linear preferences, one factor of production and the existence of a perfectly competitive industry that effectively buffers all factor price effects so that trade has no impact on factor markets.[3] This is a significant sacrifice, in particular compared to traditional models of trade in which the change of both absolute and relative factor prices is at the heart of the analysis. Models which incorporate general equilibrium effects of imperfectly competitive industries on factor markets assume that firms with market power take factor prices as given. Under this assumption, Markusen (1981) shows in a two-sector model of a monopoly and a perfectly competitive industry that the autarky prices are the same in any two countries and differences in country sizes give rise to trade. Factor prices do not equalize, and the smaller country unambiguously gains from trade and becomes a net exporter of the good produced under imperfect competition, while the welfare effect for the larger country is not clear.[4] Lahiri and Ono (1995) allow for endogenous market entry in the oligopolistic industry which implies different autarky prices while opening up for trade leads to factor price equalization and benefits both countries because it lowers the oligopoly price. Markusen and Venables (1998) run simulations in a two-sector model with two factors of production and endogenous factor prices to discuss the role of trade and foreign direct investment.[5]

While the assumption of no market power of large firms on factor markets in a two-sector model seems problematic, its remedy is not straightforward. For example, a very large firm may have an influence on factor prices and may take this into account. When we allow for this effect, the firm even has to take into account that it has an influence on a country's GDP.[6] The important question is at which stage firms play strategically. In our model, there is a large (infinite) number of oligopolistic industries, and this setup allows us to follow Neary (2007, 2009) and Neary and Tharakan (2012) who have suggested that firms are small in the large and large in the small, that is, firms take factor prices as given, but they do not take prices in their own industry as given if a sufficiently large number of industries exists. Consequently, firms exercise market power in the commodity market they are operating, but they have no influence on factor markets. This approach allows studying factor price changes originating from oligopolistic competition in a general equilibrium framework. We follow this approach in the current paper as we also find it reasonable that firms compete for resources without taking account of their influence on factor prices (and thus on national income), but that they do know very well the role they play in their commodity market.

Our main goal is to develop a better understanding on how the effects of trade relate to the primitives, especially in a general equilibrium model of oligopolistic competition that allows for strategic interactions among firms. We find that an equilibrium that equalizes factor prices may exist if countries are sufficiently similar in terms of endowment. In this environment, our model is able to derive a number of novel results: First, we show that both relative and absolute endowments play an important role in explaining trade patterns. Second, while both countries diversify such that they produce all goods, per-capita consumption will not increase with trade across the board. Third, the equilibrium number of active firms in an industry is either too small or too large while the effect on firm size is ambiguous.

Why is the analysis of entry decisions important? First, we will demonstrate that entry implies a distortion: there is too little investment when entry investment is costly and too much when entry investment is relatively easy. This is in contrast to the partial equilibrium analysis in the industrial organization literature which concludes that entry is excessive in Cournot models. Second, trade integration was expected to lead to substantial rationalization gains, but this does not seem to have come true empirically. For example, Cox and Harris (1985) estimated an increase in scale and welfare due to the formation of NAFTA for Canada, but empirical evidence suggests that this effect has been small, if at all significant (see, for example, Head and Ries, 1999). Our paper sheds some new light on the possible limitations of rationalization effects.

The remainder of the paper is organized as follows. Section 2 introduces the model and discusses the autarky equilibrium. Section 3 identifies the factor price equalization set and discusses the implications of trade. Section 4 investigates how our results generalize when we allow a more general demand structure. Section 5 offers some concluding remarks.

2. The model and the case of autarky

As in the DFS model, we consider a continuum of goods which are indexed by z and defined over the interval [0, 1], and we assume that households are symmetric and their preferences are Cobb–Douglas. Our model wants to focus on the supply side effects, and this is the reason why we keep the demand structure of the model as simple as possible in the main body of the paper and assume that expenditure shares are identical across commodities. This allows us to specify the utility function such that $U = \int_0^1 ln(\hat{y}(z))dz$ where $\hat{y}(z)$ denotes per-capita consumption of commodity z. The aggregate output of industry z is $Y(z) = L\hat{y}(z)$ where L denotes the number of workers in the economy (which has to be replaced by $L + L^*$ when countries trade). This preference structure leads to an inverse demand function $p(z) = I/Y(z)$, where I denotes income, and $p(z)$ is the price of good z. Firms in this industry use labor for producing output and capital as to establish a firm. The profit of firm i in industry z is equal to

$$\Pi_i(z) = (p(z) - \lambda(z)w)y_i(z) - r\kappa(z). \tag{1}$$

The input requirement of labor is equal to $\lambda(z)$ in industry z; w denotes the wage. Each active firm has to make an investment of size $\kappa(z)$ as to set up a plant where $\kappa(z) > 0$; r denotes the rental rate. $y_i(z)$ is the firm-level output such that $Y(z) = \sum_i y_i(z)$. All firms within industry z are symmetric such that $Y(z) = n(z)y_i(z)$ in equilibrium, where $n(z)$ denotes the number of active firms in industry z.[7]

Before we proceed we have to be more specific on the index z, and for this reason we rank industries in terms of their capital input requirements without loss of generality. We assume that industries can be ranked such that the capital input requirement is a differentiable function of z,[8] and we introduce the following:

Definition 1. Industries are ranked such that z decreases with the capital input requirement κ: $\kappa'(z) \leq 0$.

Note that we do not make any assumption on how labor input requirements behave. Let us now consider the domestic country which has a capital endowment of size K, used to establish firms, and a labor

[3] See for example Horstmann and Markusen (1986), Markusen and Venables (1988) and Venables (1985). Nevertheless, note that fixed number of firms vs endogenous market entry already makes an important difference in these models; this has also been shown for trade policies in a recent paper by Bagwell and Staiger (2012).

[4] For extensions of the fixed market structure model, see Ruffin (2003) for a Ricardian model and Fujiwara and Shimonura (2005) for differences in relative factor endowments.

[5] In an early paper on imperfect competition in general equilibrium, Gabszewicz and Vial (1972) assume that consumers get a share of firm outputs for their inputs, and these goods are then traded among consumers. While this avoids the modeling of factor markets, firms do not maximize profits but the real wage of their shareholders.

[6] Taking this effect into account leads to severe technical difficulties; see Neary (2009) for a discussion of these difficulties, and Markusen and Robson (1980) for an early contribution.

[7] Since $p_{Y(z)} + p_{Y(z)Y(z)}y_i(z) = -I(n(z) - 2)/n(z)Y(z)^2 \leq 0$, where $p_{Y(z)}$ denotes the derivative of the inverse demand function with respect to aggregate output, firms compete by strategic substitutes in the sense of Bulow et al. (1985).

[8] Assuming differentiability of the κ-ranking simplifies our analysis. However, all our results do also hold if the κ-ranking is almost everywhere differentiable.