Research in Economics 69 (2015) 157–165

Contents lists available at ScienceDirect

Research in Economics

journal homepage: www.elsevier.com/locate/rie

Intra-industry trade with Bertrand and Cournot oligopoly: The role of endogenous horizontal product differentiation

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ARTICLE INFO

Article history:
Received 9 February 2015
Accepted 26 February 2015
Available online 5 March 2015

Keywords:
Bertrand
Cournot
Product differentiation
Intra-industry trade
Gains from trade

ABSTRACT

This paper investigates the effect of endogenous horizontal product differentiation on trade patterns and the gains from trade under Bertrand and Cournot oligopoly. If trade occurs, Bertrand firms always differentiate their products more that Cournot firms. However, sufficiently high differentiation costs can prevent product differentiation. Trade in homogeneous products never takes place under Bertrand competition. Bertrand firms will either differentiate their products or will not export. Cournot firms, however, may trade in either homogeneous or differentiated products. Product differentiation can significantly increase the gains from trade under both Cournot and Bertrand oligopoly.

1. Introduction

In the 1980s, the role of imperfect competition in international trade emerged as a central focus of attention in international economics. This development allowed international trade theory to address important empirical realities, including the extent of intra-industry trade and the associated implications for trade policy. Work on imperfect competition in international trade was channeled into two distinct streams, however, depending on whether the assumed form of imperfect competition was monopolistic competition or oligopoly.[1]

Strikingly, the role of product differentiation has been treated very differently in these two research streams. Following the pioneering work of Krugman (1979, 1980), the analysis of international trade based on monopolistic competition treats product differentiation as a fundamental determinant of trade patterns and source of gains from trade. In this literature consumer demand is typically represented by Dixit–Stiglitz preferences (Dixit and Stiglitz (1977)). Such preferences imply that product differentiation is horizontal as consumers have a taste for variety but no one variety is intrinsically superior to another.[2]

The early work on oligopoly in international trade, such as Brander (1981) and Brander and Krugman (1983), abstracts from within-industry product differentiation entirely, focusing instead on intra-industry trade involving cross-hauling of

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[1] Neary (2010) refers to the oligopoly version as only "half a theory" of international trade due to its use of partial equilibrium analysis (or very simple general equilibrium models). More complete general equilibrium models of oligopolistic trade include Lahiri and Ono (1995) and Neary (2009). See also Section 4.1 of Etro (2014) which outlines a model structure that nests perfect competition, monopolistic competition and oligopoly in a general equilibrium framework with international trade, and Bernhofen (2001) which integrates monopolistic competition and oligopoly into a single framework.

[2] Melitz (2003) provides a highly influential analysis of trade under monopolistic competition with firm-level heterogeneity induced by productivity differences among firms. Furthermore, recent work, such as Bertoletti and Etro (2013), allows for vertical (product quality) choices in models of trade with monopolistic competition.

http://dx.doi.org/10.1016/j.rie.2015.02.007
1090-9443/

homogeneous products. A literature dealing with trade in vertically differentiated products under oligopoly did develop, including Shaked and Sutton (1984), Motta (1994), and Zhou et al. (2002), among others. In such work different firms produce goods of different quality.

In this paper we analyze the role of endogenous *horizontal* product differentiation in trade under oligopoly. One main objective is to investigate whether endogenous horizontal product differentiation in an international oligopoly context is a potentially significant determinant of the pattern of trade and source of gains from trade. The second main objective is to compare the consequences of Bertrand and Cournot oligopoly for product differentiation decisions and the resulting trade and welfare effects.[3]

We are not the first to consider horizontal product differentiation in international oligopoly. Such differentiation is incorporated in Bernhofen (2001) but is exogenously given rather than being chosen endogenously by firms. As we show here, allowing for firms to choose differentiation investments has major consequences. The closest paper to ours is Bastos and Straume (2012), which builds on the general equilibrium Cournot oligopoly model developed by Neary (2003, 2009) and allows for endogenous horizontal product differentiation. Bastos and Straume (2012) does not analyze the Bertrand model, however, so it does not contain comparative results. Also, that paper assumes an interior solution in which Cournot firms always differentiate their products. Our formulation allows for the important possibility that Cournot firms will engage in intra-industry trade in homogenous products.

One empirically relevant implication of our analysis is that firms engaged in Bertrand competition are much more likely to undertake product differentiation than firms engaged in Cournot competition. Bertrand firms differentiate their products in a wider range of cases than do Cournot firms and, if differentiation takes place, variety as measured by a lower substitutability of products is always greater under Bertrand competition. In our model, trade in homogeneous products never takes place under Bertrand competition. Bertrand firms will either differentiate their products or they will not export. Cournot firms, however, may trade in either homogeneous or differentiated products.

Section 2 describes the basic model structure. Section 3 deals with product differentiation and intra-industry trade in the Bertrand model, and Section 4 considers the Cournot model. Section 5 compares the two sets of results. Section 6 then examines the gains from trade and Section 7 contains concluding remarks.

2. Basic model structure

We consider a duopoly model in which each firm is based in a different country. The oligopoly model is similar to that of Brander and Spencer (2015). The innovation in this paper is to consider an international context that incorporates an export decision. Each firm has a sequence of three decisions to make: the export decision in stage 1, the product differentiation decision in stage 2 and the Cournot output or Bertrand price decision in stage 3. The two firms act simultaneously at each of these three decision stages. The stage 3 price (or quantity) decisions are made separately for each country. Thus our model is what has been referred to as a *reciprocal markets* model (Brander, 1995) or a *segmented markets* model (Helpman, 1987).

In the first stage each firm decides whether to export and, if it decides to export, pays some up-front fixed trade cost. We have in mind that a firm must invest in a distribution system in the export market. This cost might be very small. Possibly all that is needed is to take the time and effort to conclude an agreement with a local distributor in the export market. But the cost is strictly positive.

In the second stage each firm decides on whether and how much it wishes to invest in differentiating its product from the rival's product. One possibility is to interpret the differentiation investment as an advertising cost aimed at making the product more distinct from the other product in the eyes of consumers. For example Coke and Pepsi engage in extensive advertising campaigns to differentiate their products. Many customers cannot distinguish between the products in blind taste tests but exhibit strong loyalty to one product or the other, presumably induced by advertising or by cosmetic variations in things such as bottle design or logos. Another possibility is to interpret the investment as the cost of changing some physical characteristic of the product that differentiates it from the other product, as when car manufacturers adopt new colors and or new body shapes for cars or undertake other differentiation activities of a costly but essentially horizontal nature.

One issue concerns whether differentiation expenditures are country-specific or whether they apply across countries. For example, if firms invest in local television advertisements in each country or create local product variations in color or design then the differentiation investment is country specific. Alternatively, differentiation expenditures for basic product design might apply equally to both countries. Quite possibly both types of differentiation investments might be relevant in a given case. However, to keep things as simple as possible, we assume that differentiation expenditures are country-specific.

Finally, in the third stage, each firm decides on its price (in the Bertrand case) or its quantity (in the Cournot case) in each of the segmented markets, domestic or foreign, that it is engaged in. If there is no trade, each firm charges a monopoly price in its domestic market.

[3] As shown by Eaton and Grossman (1986), among others, the form of oligopoly has important consequences for oligopoly behavior in an international context and for the associated incentives for trade policy.