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# Multiproduct competition in a North-South model with technological differences

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## ABSTRACT

This paper examines multiproduct competition in a simple North-South model with technological differences. I mainly focus on strategic decisions on the product scope in the global economy. I find that there are several different types of equilibria depending on technological differences and relative cost advantage of the Northern and Southern firms. When each firm has local cost advantage and technological difference between firms is sufficiently large, firms reallocate resources toward their more profitable products. By contrast, when there exists a small technological difference or global cost advantage, the more productive firm may expand the product line.

## 1. Introduction

Multiproduct firms dominate international trade in most developed countries. According to the study on US firms by [Bernard, Jensen, Redding, and Schott \(2007\)](#), 57.8 percent of exporting firms produce multiple products, and multiproduct firms account for more than 99.6 percent of export value in the year 2000.<sup>1</sup> Due to this dominant role in the global economy, trade economists have recently taken more interest in multiproduct firms and examine their activity.<sup>2</sup>

In this paper, I analyze multiproduct competition in a simple North-South model with technological differences. The basic theoretical setup is similar to [Eaton and Schmitt \(1994\)](#) and [Eckel and Neary \(2010\)](#). They all accept flexible manufacturing. Flexible manufacturing allows firms to expand their product lines, but this expansion is limited due to the cost of modification. Marginal production cost increases when firms produce varieties further from their basic product or core competence.<sup>3</sup> Meanwhile, [Eckel and Neary \(2010\)](#) also introduce demand linkage. There exists the “cannibalization effect” when multiproduct firms produce differentiated products. Because a larger output of one variety tends to crowd out demand for all other varieties, a multiproduct firm needs to restrict its output of each variety.

I follow this framework basically, but there are some noticeable differences in this paper. First, I formally consider the framework of a homogeneous product oligopoly model in which firms compete directly in the same product market in order to focus on the strategic

<sup>1</sup> In this study, a *product* is defined at the ten-digit Harmonized System (HS) code level. Also [Bernard et al. \(2010\)](#) used five-digit Standard Industry Classification (SIC) code as a measure of *product*. Following their definition, multiproduct firms account for 87 percent of total output while they represent 39 percent of total firms in 1997.

<sup>2</sup> Besides articles introduced in the text, refer [Eckel, Iacovone, Javorcik, and Neary \(2015\)](#), [Feenstra and Ma \(2007\)](#), [Mayer, Melitz, and Ottaviano \(2014\)](#), [Lopresti \(2016\)](#), [Neary and Tharakan \(2012\)](#).

<sup>3</sup> [Eaton and Schmitt \(1994\)](#) assume that firms can produce a basic product by paying a sunk cost of product development. A basic product can be modified to other variants, but this modification incurs additional production costs that are proportional to the difference between the basic product and the variant. [Eckel and Neary \(2010\)](#) suppose that the marginal cost varies across varieties. The core competence variety is defined as the variety with the lowest marginal cost. That is, firms employ the most efficient production process at their core competence varieties.

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behavior of firms.<sup>4</sup> Hence, multiproduct firms in the current model have more incentives to adjust their product scope strategically in response to changes in the market conditions. Second, a basic product is supposed to be a cost advantage not only within a firm, but also across firms. This assumption distinguishes my approach to production technology from the earlier literature such as [Eaton and Schmitt \(1994\)](#) and [Eckel and Neary \(2010\)](#). Their approach supposes that a core competency is only a cost advantage within a firm, but not across firms. In contrast, I assume that we can arrange all products within an industry in rank order according to the required technology level. For example, consider smartphone makers. Apple leads the market with its advanced technology. If Apple wants, it can produce nearly every smartphone based on its technological advantage. On the other hand, every smartphone maker cannot produce top-tier phones like the iPhone. Sometimes it may be impossible for a Southern firm to compete with a Northern firm in a specific product market due to technological barriers which result from the exclusive patent right or cumulative experience in production process. I define the distance between firms' basic products on the product space as technological differences. The existence of technological differences also indicates that flexible manufacturing is imperfect because the physically feasible production lines may be different among multiproduct firms.

The model yields several interesting predictions about the product scope for multiproduct firms in a North-South trade model. Relative cost advantage and technological differences are main factors that affect the product line selection. Cost advantage is classified into two categories: global cost advantage and local cost advantage. Global cost advantage exists when the most productive firm generates a lower marginal cost for each product than any other firms for the corresponding product. On the other hand, local cost advantage exists when each firm may have its own products produced most efficiently since product line expansion is sufficiently costly. There are several different types of equilibria as a result of strategic behaviors of heterogeneous multiproduct firms. When each firm in the North and the South has local cost advantage and technological difference between firms is sufficiently large, firms concentrate more on their basic products after trade liberalization. This is similar to a traditional Ricardian model from the standpoint of specialization due to a gap between production technologies. This outcome is also consistent with the prediction of [Eckel and Neary \(2010\)](#) that implies globalization induces firms to concentrate on their core competence. Although each firm has its own segmented monopolized markets, intensified competition among differentiated goods leads firms to focus on their more profitable products. By contrast, when there exists a small technological difference or global cost advantage, the more productive firm in a duopoly market expands the product line while the less productive firm reduces its product scope in the global economy. This is because a high-productivity firm can create its monopolistic power in some varieties by expanding its product line.

This paper is inspired by interesting results of recent research on multiproduct firms' product scope. One noticeable prediction regarding the firms' product scope adjustment is as follows. Trade liberalization induces firms to reallocate resources towards their relatively high-profit (i.e., core-competency) products. For instance, [Bernard, Redding, and Schott \(2011\)](#) model product-specific competencies as the strength of consumers' tastes for firm variety. The opening of trade intensifies product-market competition and so induces surviving firms to drop products with lower consumer tastes from the domestic market. Meanwhile, [Eckel and Neary \(2010\)](#) assume that firms typically own a core competence in the production of a particular variety. Yet, multiproduct firms are less efficient in the production of their varieties which are further away from the core product. They predict that globalization encourages multiproduct firms to focus on their core competence because greater competition hits those varieties produced at higher costs harder. [Baldwin and Gu \(2009\)](#) obtain a similar conclusion from a model where marginal costs of production are identical across products within the firm while each firm has its idiosyncratic productivity. Because firms behave as oligopolists in the model, they reduce product scope in order to relax competition in response to trade liberalization. In addition, [Iacovone and Javorcik \(2008\)](#) document empirical evidence for core competencies from the study of Mexican firms. They found the positive correlation between the rank of export varieties (in terms of their export values) and the rank of expansion of export varieties. Thus, exporters tend to expand their most important export products.

By contrast, a series of papers predict heterogeneous responses of multiproduct firms. According to these papers, the most productive firms expand their product scope as trade costs decline while less productive firms reduce their product scope. [Dhingra \(2013\)](#) assumes that firms need to invest in product and process innovation. In this setting, a firm's new variety cannibalizes its existing products but a new process does not cause cannibalization effects. The impact of opening to trade differs by firm productivity and access to foreign markets. [Dhingra \(2013\)](#) shows that more productive exporters enjoy the gains from increasing market size and can overcome more intense competition to expand product scope. They undertake greater product and process innovation. However, non-exporters or low productivity exporters face tougher competition and cut back on their product lines. [Qiu and Zhou \(2013\)](#) assume that firms differ in productivity and should pay a fixed cost to add new varieties. A firm's optimal product scope is achieved when the profit of the least efficient variety (marginal variety) is enough to cover its variety-introduction fee. Therefore, a firm will expand its product line if the profit of its marginal variety increases. [Qiu and Zhou \(2013\)](#) notice that a high productivity firm's marginal variety may be quite efficient in comparison with the industry's average variety. In this regard, firms with highly efficient marginal varieties can expand product scope after globalization while firms with less efficient marginal varieties contract their product lines.

This paper contributes to the theoretical literature by exploring some unexamined questions. First of all, multiproduct firms are generally big firms which have considerably large shares within the industry.<sup>5</sup> Thus, we need to examine strategic behaviors of multiproduct firms explicitly given the industry's market structure. However, most studies are characterized by monopolistically

<sup>4</sup> The distinguishing feature of this assumption appears in equation (9) in the text. Compare it with the corresponding notion in [Eckel and Neary \(2010\)](#), in which firms sell heterogeneous products.

<sup>5</sup> Multiproduct firms are larger than single product firms in the same industry in terms of both shipments and employment. See [Bernard et al. \(2010\)](#).

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