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Multi-product firms at home and away: Cost- versus quality-based competence☆

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ABSTRACT

We develop a new model of multi-product firms which invest to improve the perceived quality of both their individual products and their brand. Because of flexible manufacturing, products closer to firms' core competence have lower costs, so firms produce more of them, and also have higher incentives to invest in their quality. These two effects have opposite implications for the profile of prices. Mexican data provide robust confirmation of the model's key prediction: firms in differentiated-good sectors exhibit quality-based competence (prices fall with distance from core competence), but export sales of firms in non-differentiated-good sectors exhibit the opposite pattern.

1. Introduction

What makes a successful exporting firm? This question has attracted much interest from policy makers, keen to design effective export promotion programs, and from academics, keen to understand the implications of globalization for economic growth. Two answers have been proposed. The first focuses on firm productivity. Studies by Clerides et al. (1998) and Bernard and Jensen (1999), among others, have found that firms self-select into export markets on the basis of their successful performance at home. This evidence inspired the theoretical work by Melitz (2003) where only the most productive firms find it worthwhile to cover the extra costs of exporting. The second answer focuses on product quality. A growing body of work has provided evidence that successful exporters charge higher prices on average, suggesting that quality matters.[1]

This study integrates these two views and shows both theoretically and empirically that firms may choose to compete on the basis of either cost or quality depending on the characteristics of the products they sell and the markets in which they operate.[2] Unlike other studies which have compared the behavior of different firms, and emphasized the between-firm extensive margin, we focus on the portfolio of products sold by multi-product firms, and highlight what Eckel and Neary (2010) call the "intra-firm extensive margin". Our theoretical innovation is to construct a model of multi-product firms in which the quality of goods is determined endogenously by the firms' profit-maximizing

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[1] A large and growing literature includes Antoniades (2009), Baldwin and Harrigan (2011), Baller (2013), Crozet et al. (2012), Demir (2012), Hallak and Schott (2011), Hallak and Sivadasan (2013), Iacovone and Javorcik (2007), Johnson (2012), Khandelwal (2010), Kneller and Yu (2008), Kugler and Verhoogen (2012), Mandel (2009), Manova and Zhang (2012), and Verhoogen (2008).

[2] Hallak and Sivadasan (2013) also integrate the productivity and quality approaches in a model of international trade by assuming two sources of exogenous firm heterogeneity: productivity and "caliber", the latter being the ability to produce quality using fewer fixed inputs. Provided exporting requires attaining minimum quality levels, their model explains the empirical fact that firm size is not monotonically related to export status, and predicts that, conditional on size, exporters sell products of higher quality and at higher prices. However, they confine attention to single-product firms.

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decisions. Because of flexible manufacturing, products closer to a firm's core competence have lower costs. As a result, firms produce more of those products, but they also have higher margins on them, and therefore higher incentives to invest in their quality. These two effects have opposite implications for the profile of prices and, depending on which effect dominates, the model implies one of two possible configurations which we call "cost-based" and "quality-based" competence, respectively. The former corresponds to the case where a firm's core products are sold at lower prices, in order to induce consumers to buy more of them. In the words of Jack Cohen, founder of the UK supermarket chain Tesco, firms "pile 'em high and sell 'em cheap". As a result, the profile of prices across a firm's products is inversely correlated with its profile of sales. By contrast, quality-based competence corresponds to the case where the dominant effect comes from firms' investing more in enhancing the quality of their core products. As a result, these products command higher prices, and so the profile of prices across a firm's products is positively correlated with its profile of sales.

Our model not only allows for different profiles of prices but also makes predictions about which kinds of goods should exhibit which profile. In particular, it predicts that a higher level of product differentiation encourages firms to invest relatively more in the quality of individual varieties than in the quality of their overall brand. As a result, quality-based competence should be more in evidence in sectors where products are more differentiated. We test this prediction using a rich Mexican data set already used by Iacovone and Javorcik (2007, 2010). Most previous empirical studies of multi-product firms at plant level have been constrained to use data on export sales only, or to combine export and production data at different levels of disaggregation.[3] By contrast, a unique characteristic of our data is that it provides consistently disaggregated information on both the home and export sales of all goods produced by a large representative sample of manufacturing establishments.[4] As we show, the Mexican data provide robust confirmation of the model's key prediction: comparing price profiles with sales profiles, we find that firms in differentiated-good sectors exhibit quality-based competence to a much greater extent than firms in non-differentiated-good sectors, both at home and abroad. The contrast is particularly striking in export markets, where Mexican producers in non-differentiated-good sectors engage in cost-rather than quality-based competence. Our results are robust to focusing attention on a variety of subsamples, including only those products sold both at home and abroad, only those plants which sell on the home market and also select into exporting, and only single-plant firms.

Our paper builds on and extends the existing literature on multi-product firms in international trade. While there already existed a large literature on multi-product firms in the theory of industrial organization, our model is one of a number of recent trade models which is more applicable to the kinds of large-scale firm-level data sets which are increasingly becoming available.[5] Within this latter tradition, existing models impose one or other profile of a firm's prices by assumption. One class of models assumes that products are symmetric on both the demand and supply sides, with the motivation for producing a range of products coming from economies of scope. As a result, all products sell in the same amount and at the same price[6]. A different approach, pioneered by Bernard et al. (2010, 2011), emphasizes asymmetries between products on the demand side due to exogenous stochastic factors. Before they decide to enter, firms draw their overall level of productivity and also a set of product-market-specific demand shocks. The latter determine the firm's scale and scope of sales in different markets, and imply that its price and output profiles are always positively correlated. By contrast, Eckel and Neary (2010) develop a model that emphasizes asymmetries between products on the cost side and implies that price and output profiles are always negatively correlated.[7]

The present paper integrates these demand and cost approaches in an endogenous way. We extend the "flexible manufacturing" approach of Eckel and Neary (2010) by allowing costs to affect the profile of investment in quality across different varieties, and develop a model which is more in line with recent work on models of heterogeneous firms that engage in process R&D: see, for example, Bustos (2011) and Lileeva and Trefler (2010) on single-product firms, and Dhingra (2013) on multi-product firms. It is even more closely related to those papers which allow for endogenous investment in quality, such as Antoniades (2009) and Kugler and Verhoogen (2012), including the view that quality is really perceived quality, which may be market-specific, so investment in quality includes spending on marketing as in Arkolakis (2010). All this work has so far focused on single-product firms only. Our specification is we believe the first to incorporate investment in quality into a model of multi-product firms, combining insights from extensive literatures in both industrial organization and marketing science. From the former, especially Stigler and Becker (1977), we take the view that firms invest in perceived quality through advertising, which enters the utility function directly in a way that is complementary to consumption itself. From the latter, notably Jacoby et al. (1971), Boush et al. (1987), and Aaker and Keller (1990), we take the view that consumers of multi-product firms are affected both by product-specific marketing and by advertising of a firm's overall brand, and that the relative effectiveness of the former is greater when products are more differentiated.

This brief review of the literature on multi-product firms highlights our main interest: how the theoretical models differ in the way they model the demand for and the decision to supply multiple products. The models also differ in other ways which are of less interest in the present application. One type of difference is in the assumptions made about market structure. In particular, most recent models assume that markets can be characterized by monopolistic competition, in which firms produce a large number of products but are themselves infinitesimal relative to the size of the overall market.[8] By contrast, Eckel and Neary (2010) assume in their core model that markets are oligopolistic. In this paper, we know little about the market environment facing individual firms: we do not know with which other Mexican plants in the sample they compete directly, and we have no information at all on their foreign competitors. Hence we prefer to remain agnostic on this issue, where possible deriving predictions which will hold at the level of individual firms irrespective of the market structure in which they operate. A further dimension of difference concerns the level of analysis, whether partial or general equilibrium. Some of the trade theory papers, including Eckel and Neary (2010), highlight general-equilibrium adjustments working through factor markets as an important channel of transmission of external shocks. However, with the

[3] Examples of the first approach include Arkolakis and Muendler (2010), Berthou and Fontagné (2013), Eaton et al. (2008), and Mayer et al. (2014). Examples of the second include Bernard et al. (2011), and Goldberg et al. (2010a,b). Baldwin and Gu (2009) use compatible data on production and exports by Canadian plants, but implement a theoretical framework which imposes symmetry between a firm's products, an issue which we discuss in more detail below.

[4] While our data set is unique in providing information at the same level of disaggregation on both home and export sales, we cannot distinguish between different export destinations. Fortunately, this problem is not so severe in the case of Mexico, since the U.S. is by far the dominant market for most Mexican manufacturing exports.

[5] Most models of multi-product firms in industrial organization make one or more assumption which makes them harder to apply to large firm-level data sets. In particular, they typically assume that products are vertically but not horizontally differentiated; and/or that the number of products produced by a firm is fixed, so the key question of interest is where in quality space it will choose to locate; and/or that the number of products produced is relatively small. For examples from a large literature, see Brander and Eaton (1984), Klemperer (1992), and Johnson and Myatt (2003). Baldwin and Ottaviano (2001) apply this kind of model in a trade context.

[6] See, for example, Allanson and Montagna (2005), Feenstra and Ma (2008), Ju (2003), Nocke and Yeaple (2014), and Dhingra (2013).

[7] Arkolakis and Muendler (2010) and Mayer et al. (2014) apply this approach to heterogeneous-firm models of monopolistic competition with CES and quadratic preferences, respectively.

[8] This is true, for example, of all the theoretical models cited in the preceding paragraph, including Section 5.1 of Eckel and Neary (2010).