



## Playing the lottery or dressing up? A model of firm-level heterogeneity and the decision to export



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### ABSTRACT

In models of firm heterogeneity whether firms export or not depends on their productivity. These models assume that firms enter a market only to find their productivity levels revealed to them as in a lottery. However, if productivity is not determined as in a lottery, why do some firms export early and some late? In this paper we propose a model of firm heterogeneity to address this question. In our model exporting is an investment decision with a real option value. Our model illustrates that whether not a firm exports is a matter of timing. Some firms may always find it more worthwhile to postpone exporting, depending on the nature of the product, the target market, and firm-level characteristics. For instance, our model shows that firms evaluating exporting to a volatile, or two foreign market, will need more time to dress up (prepare) for this. We derive implications for policies to support exporting.

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## 1. Introduction

In models of firm heterogeneity (e.g. Bernard & Jensen, 1999a, 2004; Melitz, 2003) differences in export behavior are due to differences in firm-level productivity. To survive in domestic markets firms need to be productive; however to export they need to be even more productive. This implies that productivity thresholds may exist according to which some firms will produce only for the domestic market, some will export and others, namely the most productive, will also invest abroad (Bernard, Jensen, Redding, & Schott, 2007; Chang & van Marrewijk, 2011; Greenaway & Kneller, 2007; Helpman, Melitz, & Yeaple, 2004).

According to earlier theory firms' productivity levels are the outcome of a lottery, so that they faced "an exogenous ex-ante distribution of potential productivity levels" (Marin & Verdier, 2007:4). Entrepreneurs are therefore ignorant *a priori* about their firms' productivity levels before they start-up. Once the firms enter the market, however, the outcome of the productivity lottery is known. Confronted with this information the firm will either immediately exit, produce only for the local market, or export, depending on their realized productivity level.

The assumption of productivity lotteries is however inconsistent with a number of features of exporting behavior. For one, the assumption implies that firms self-select into exporting based on static productivity and market access, rather than make strategic investments to raise their productivity. Second, it implies that all exporting firms are early exporters ("born globals"). This is because once productivity lottery outcomes are known, firms immediately react either by quitting, exporting or not exporting. All exporting firms are therefore born-global firms. They do not wait or learn or grow, but immediately assign themselves to an export or non-exporting market (or quit

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altogether). This conflicts with empirical evidence (see e.g. Lileeva & Trefler, 2010; Wagner, 2007). The majority of firms do not start exporting at birth. As Lileeva and Trefler (2010) using Canadian plant-level data find, firms often first need to invest in raising their productivity, for instance by investing in innovation when they have improved market access. Similarly Bustos (2011) used MERCOSUR data to find that increased market access stimulates investment in technological upgrading. Hence Johanson and Vahlne (1977) argues that older firms would be more likely to export given that exporting is complex and requires the prior development of key firm capabilities. The upshot is that firm productivity is not the exogenous outcome of a lottery.

Models of firm heterogeneity have not yet dealt with heterogeneity in the timing of exporting. If there are early and late exporters as there clearly are in practice, what can we say or expect about their productivity levels? If productivity is not the outcome of a lottery, why do some firms export early and some late? Does the phenomenon of late exporters mean that there is some preparation (or “dressing up”) period during which firms can raise their productivity? And what about early exporters – how do they achieve the threshold productivity if there is no productivity lottery – can they also “dress-up”?

Firms are heterogeneous in terms of managerial ability, management effort, entrepreneurial orientation and the degree to which they adopt new technology (e.g. Ceccagnoli, 2005). In contrast to the assumption in early models of firm heterogeneity, firms strategically invest in these aspects before entering international markets. Their productivity after market entry is therefore rather the result of firm-level strategic considerations. In other words, firms can invest in their productivity *before exporting*. And in contrast to current theory, firms can be irregular exporters to the extent to which their productivity is the outcome of managerial ability and adoption of technology following a dressing-up phase.

So far these inconsistencies between theory and practice have not received attention in models of firm heterogeneity. Models of firm-level heterogeneity ought to explain heterogeneity not only in terms of exporting, but also in terms of the timing of exporting. The point in time at which a firm starts exporting may not be a trivial issue (Naudé & Rossouw, 2010). We know that timing is important in decision-making: for instance in investment decisions timing is essential. Given fixed costs the decision whether and when to export is very similar to an investment decision. However, whereas in real option models timing is crucial because of the characteristics of the external market, in the case of exporting the decision when to export may depend rather more on the characteristics of the firm.

In this paper we contribute to the theory of firm-level heterogeneity by using real option theory to model entrepreneurs' decision when to start exporting. We shed light on the process behind the distribution of productivity which sorts firms into productive exporters or less productive non-exporters. While the distribution of firm-level productivity is often assumed to be exogenous we argue that exporting is the result of a decision to invest in it (dressing up). Investment (dressing up) determines if a firm will become sufficiently productive to export. The decision is not just an *if* a firm exports, but also a *when* a firm exports. We show that exporting is a matter of timing for all firms; some will sooner or later enter export markets, but many will despite investment efforts continue to find it more worthwhile to postpone exporting. We identify firm and market characteristics that matter for the decision to enter or postpone exporting. We illustrate that firms that can expect sufficiently large profits in foreign markets will become early exporters and that firms in volatile markets will rather postpone exporting.

The remainder of our paper is structured as follows. In Section 2 we propose a real option model to describe the decision when to export. In Section 3 we use this model to identify the determinants of the timing of exporting and illustrates the comparative static properties of the model and discuss some (policy) implications. Section 4 concludes.

## 2. A real option model of exporting

### 2.1. Underlying idea

A firm's productivity is not the outcome of a lottery. Firms may try to raise their productivity levels before exporting. Costantini and Melitz (2008) describe how firms “dress-up” for exporting by adopting better technology – e.g. by spending more on research and development. Castellani and Giovannetti (2010) find empirical support for the notion of “dressing-up” from a sample of Italian firms. The “dressing-up” phase is akin to an investment decision under uncertainty as modeled by Dixit (1989). Although Dixit (1989) does not explicitly consider export market entry, but rather the decision of an existing firm to invest in a new project or not, one could interpret *project* to include also the task of exporting. Dixit (1989) shows that if the returns to a risk-neutral firm of investing in a new project are subject to uncertainty and there are sunk costs it will be costly for firms to reverse their decision. In such cases the option to wait has a positive value. Accordingly the decisions of a firm to export can be analyzed using the Dixit and Pindyck (1994) approach.

An advantage of this approach is the incorporation of uncertainty by taking into account the costliness of reversing a decision. While in real option models investment decisions largely depend on an exogenous improvement of market conditions, in our paper it depends on firm-level determinants, in particular the decision and ability of the firm to investment with the aim to generate productivity growth. Such investment may eventually enable the firm to export. As we show in the next subsection, uncertainty and non-reversibility are important characteristics of the firm's decision to export.

### 2.2. Export market entry under uncertainty

In what follows we describe the decision of a firm that considers exporting as having to choose between different profit streams, each subject to a stochastic process. We derive a price or profit threshold at which it is optimal for the firm to start exporting. Identifying this profit threshold allow us to determine the duration of the dressing-up period, and hence identify the time when a firm will start to export. The sorting of firms into exporters and non-exporters through a lottery is thus replaced by an investment decision. The timing is the outcome of three elements, namely (i) the accumulated investment cost and benefits of dressing up (see Section 2.2.1), the (ii) value of exporting (the expected net value of uncertain profits) (see Section 2.2.2) and (iii) the option value of exporting late which includes the possibility of further improving the quality of the product (see Section 2.2.3). We discuss each of these three components in what follows.

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