

Firm Flexibility and Export Potential

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1 Motivation and Policy Impact

A core task of the Trade Council of Denmark (TCD) is to help small and medium-sized enterprises export (Trade Council of Denmark, 2008). To succeed in this task, it must identify the challenges firms face when they export. In particular, exporting is risky. Market power reductions, exchange rate fluctuations, and constantly changing foreign preferences all increase the demand volatility faced by exporters. Successful exporters need to have flexible¹ production structures in order to manage this increased volatility. Inflexible firms cannot adjust their productions quickly enough to manage. The volatility costs may outweigh the benefits from exporting.

On the other hand, exporting may allow firms to better manage domestic volatility. Firms may be able to use export markets to hedge low demand shocks in the domestic market, and vice versa. Even though exporters are exposed to more sources of volatility, they have more markets to which they can divert output.

This project examines these two opposing forces. The project uses detailed firm level data to find the correlation between exporting and a firm's flexibility, or ability to adjust its inputs and output in response to market volatility. This has two direct consequences for the TCD. First, the TCD can educate potential exporters about the relationship between exporting and flexibility: how exporting will affect the firm's volatility of output and the volatilities of its inputs such as labor, capital, and energy. Second, this study can help the TCD choose which firms to target for export promotion. If exporting increases a firm's demand volatility, then the TCD should concentrate export promotion to those firms that demonstrate flexible input supply chains and/or production structures. On the other hand, if exporting acts as a hedge against domestic volatility, then the TCD should promote exporting to even more firms to take advantage of this hedge.

2 Background and Research Contributions

The theoretical Industrial Organization literature has suggested that a firm does not unequivocally prefer to be larger. Mills (1986) shows how smaller firms can more easily adjust their outputs in response to exogenous time-varying demand shocks. Firms must trade off economies of scale with output flexibility. Mills and Schumann (AER 1985, hereafter MS1985) find support for this hypothesis within a small sample of American firms.

The proposed project compares the output volatilities of firms that export to that of firms that supply only to Denmark. Foreign market fluctuations drive firms to adjust production, sales across markets and factors of production such as labor, capital and

¹Stigler (1939) defines flexibility as the ability to vary output in response to exogenous shocks.

energy. By comparing these adjustments for exporters to these for non-exporters, we are able to examine whether additional export volatility along these margins may present potential exporters with challenges.

The study has three main purposes. First, it performs the analysis of MS1985 with a much more complete census dataset covering the universe of Danish firms. As MS1985 predicts, we expect that a firm's size is inversely related to its flexibility. In other words, large firms are rigid and supply their markets at lower volatility than small and flexible firms.

Second, it introduces a model expanding on that of Mills (1986). Mills' model considers only one market and thus cannot predict the consequences of exporting. To encompass both foreign and domestic demand volatility, we expand the model by introducing an optional export market. Firms choosing to export are exposed to volatility on both the domestic and foreign markets. This means that even after accounting for differences in size, exporting firms absorb more volatility in their production, sales and input requirements. On the other hand, since exporting firms can divert their output to multiple markets, exporting firms do not have to sacrifice economies of scale for flexibility as much as non-exporters do. The negative correlation between size and volatility should decrease with the number of markets served by an exporter.

Third, we test this new model with Danish firm census data. It tests the above predictions and the model assumption that output volatility comes from exogenous demand shocks and not cost shocks. If it is the latter and a firm uses the same technology to produce exports and domestic goods, then foreign and domestic sales should be positively correlated. However, if exogenous demand volatilities are the source and foreign market shocks are uncorrelated or negatively correlated to domestic demand shocks, then foreign and domestic sales should be uncorrelated or negatively correlated.

This study contributes to a recent literature that examines the source of exporter heterogeneity. Differences in the skill of labor to operate different technologies (Yeaple, 2005) may separate firms. The skill of managers to monitor workers' efforts (Davis and Harrigan, 2007) can also lead to success in exporting. More recently, Nguyen (2009) shows how demand volatility across destinations can lead to exporting via experimentation.

3 Research questions and Empirical Strategy

The detailed firm level data is applied to examine the role of demand volatility on the volatility of firm inputs and output. Specifically, we answer the following questions.

1. Do Danish firms face a trade off between flexibility and economies of scale? In particular, do large firms supply markets at low volatility while small firms supply the markets at high volatility. No previous study has been able to test this theory with our granulation.
2. After accounting for differences in size, are exporters more volatile on the domestic output market? Given that firms within narrow industries supply the same market

and are subject to the same level of uncertainty, this allows us to tease out whether exporters are inherently more flexible than non-exporters.

3. Within the group of exporters, does firm size predict a firm's flexibility measured by sales volatility? To our knowledge we are the first to test this hypothesis. If the data confirms this prediction, this means that in addition to size and economies of scale, flexibility matters for exports.
4. Are exporter's input demand more volatile than non-exporter's input demands? This question relates to a recent macro literature that examine the risk content of trade. We examine the consequences of exporting on the firm's labor, capital, and energy usage.

4 Data

We have access to several Danish firm registers from which we compile our dataset. The Account Statistics register contains firm-level observations of capital stock, input costs and energy consumption. The FIDA database in Statistics Denmark contains information on the size and value added of each firm, as well as the industry in which it belongs. The "industriens salg af varer" register contains sales records for all Danish firms with at least 10 employees. The Danish External Trade Statistics (Udenrigshandelsstatistikken) records the detailed product classification of each shipment, the value and weight (in kilos) of the shipment, the month of the shipment, the destination or origin country, and the identity of the Danish firm engaging in the trade.

5 Project participants and their experience

Georg Schaur's work in international trade has been to examine the effects of demand volatilities on trade flows (see attached CV). This was done mainly at the industry level, and with this project, can now be done at the firm level. Daniel Nguyen's main body of work has been in studying exporting with heterogeneous firms, both theoretically and empirically (see attached CV). His previous work has been with Danish firm-level register data. Thus, this pair of researchers has the necessary prerequisites to perform original research as outlined in this proposal.

6 Time plan and projected outcome

The scheduled duration of the project is $1\frac{1}{2}$ years starting December 2009. The aim of the project is to publish one or more articles in leading journals.

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