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Market size, structure, and access: Trade with capacity constraints

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ABSTRACT

This paper develops a model of international trade where firms are heterogeneous across capacity and productivity. A binding capacity constraint induces firms to raise prices in order to take advantage of access to new markets. This generates markets with a flexible competitive structure giving rise to instances where trade and trade liberalization negatively impact welfare. Its key predictions can be identified by observing the presence of small yet highly productive firms and substitution by firms across markets as accessibility evolves. Using Thai firm-level data I establish the prevalence of these anomalous firms and demonstrate they face capacity constraints.

1. Introduction

With finite resources firms face physical constraints on production. The question is not whether these capacity constraints exist, but rather how firm behavior changes when they bind. Overcoming a capacity constraint is costly, either explicitly through investment to produce beyond the constraint or implicitly by weakening a firm's competitiveness. It is well known that firms adapt their pricing and production decisions when capacity constraints bind. However, the implications of firms facing capacity constraints on international trade have been widely ignored by economists.

Conversely, policy makers and trade commissions are well aware of how capacity constraints hinder gains from trade. Each annual report from 2011 to 2013 produced by the *United Nations Economic and Social Commission for Asia and the Pacific* highlights the role of production capacity on the ability of developing industries to succeed in global markets.[1] Also, recent *Organization for Economic Cooperation and Development* reports, including OECDReport (2012) and Hallaert and Munro (2010), focus on the importance of understanding and addressing the impact of production capacity on trade by developing industries in low income countries. This paper models the welfare implications of firms facing capacity constraints with international trade and utilizes firm level data from Thailand to support the theoretical predictions. The results presented here corroborate the claims from institutions tasked with promoting global development that capacity plays a significant role in the ability of countries to fully benefit from globalization. The model also points to gains to the trading partners of

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[1] UNESCAP (2011) devotes an entire chapter to the discussion of the need to address capacity constraints in the least developed industries if they are to succeed in global markets.

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constrained countries. Capacity constrained firms are shown to have strong internal linkages across destinations and thus pass any distortionary behavior to each of their markets.[2]

In standard heterogeneous firm models of trade, production decisions are completely flexible. In reality, capacity costs put real constraints on firms' production and pricing decisions. This paper adds the real-world feature of costly capacity by developing a model of international trade where firms are heterogeneous not only in productivity, but also capacity. Firms interact in a monopolistically competitive market for their differentiated varieties. They set markups endogenously given their production capabilities and demand for their good. A firm cannot produce beyond its underlying capacity without undertaking costly expansion. When capacity constraints do not bind, the firm freely sets price and quantity to maximize profits given market conditions (number of competitors, trade costs, and market size in origin and destination countries). On the other hand, firms facing a binding capacity constraint cannot freely expand production to access markets. Their only margin of adjustment comes through raising prices or making costly investment. This limits the competitive responses available to the constrained firm as market conditions change.

As markets grow firms approach their underlying capacity constraint. Since firms producing at capacity are unable to expand production without incurring additional marginal costs, they take advantage of access to larger markets by raising prices. The presence of capacity constrained firms leads to a market-wide softening of competition such that average prices can increase with market size even in the face of tougher selection on productivity.

International trade instantly increases the size of the market available each firm. Consider an unconstrained firm utilizing 70% of its capacity to serve the domestic market. Suppose this firm is efficient enough to export and would optimally double production to serve the international market. This firm's capacity constraint binds before satisfying export demand. Since it cannot access the market by expanding sales, the firm adjusts its pricing strategy. Optimally the firm raises the price of its variety in each market as it either passes through the explicit cost of capacity expansion or absorbs the implicit cost of capacity to slow production.

This logic implies that access to international markets generates an opportunity cost – foregoing foreign sales – associated with domestic sales by capacity constrained firms. This opportunity cost implies substitution across markets as global conditions change. A growing foreign market (or a decrease in trade costs) causes the marginal benefit to constrained firms from selling abroad to rise. As the marginal benefit of exporting grows, constrained firms absorb the opportunity cost of foregoing domestic sales and substitute sales from the domestic market to the foreign market. Sudden shocks to market size from opening trade thus allow us to understand the linkages across markets as they are transmitted through capacity constraints.

Constrained firms substituting across destinations shift the weight of their pricing distortions across markets. Trade thus amplifies the distortions caused by firms facing capacity constraints due to the immediate demand for exporters to increase production. These results give a palatable explanation for why many countries are resistant to trade liberalization. Firms facing binding capacity constraints erode the expected gains from trade that come through enhanced price competition. This result calls back to the "second best results" of Bhagwati and Ramaswami (1963). As in the second best literature, I demonstrate that markets may be distorted to such an extent that consumer welfare falls with trade and trade liberalization.

The key predictions of the model can be identified by observing the presence of small yet highly productive firms and substitution by firms across markets as the relative ease to access markets changes at the firm-level. Firm-level data from Thailand allow me to estimate the substitution patterns of firms in light of changes in implicit marginal costs and relative accessibility of markets from tariff movements. My model demonstrates that declining trade barriers lead to increasing opportunity costs of domestic sales for capacity constrained exporters. Implicit opportunity costs imply a feedback effect of trade liberalization which decreases domestic sales that is magnified for firms facing tight constraints. I explore these predictions by decomposing the impact of tariff changes on sales across domestic and foreign markets. I present evidence that the impact of tariffs on domestic sales depends on both the tightness of a firm's capacity constraint and its presence in export markets. Furthermore, I demonstrate throughout my analysis that more productive firms have higher sales after controlling for the effects of capacity. My model also explains the existence of high productivity firms with relatively low sales. I show these firms are prevalent in the data and that their existence can be explained by capacity constraints.

By allowing firms to endogenously set markups, my model demonstrates the impact of capacity constraints on market structure. Melitz and Ottaviano (2008) provide a tractable framework where firms set markups endogenously in order to explain some stylized facts linking market size and competition. Syverson (2007) establishes empirically that larger markets are occupied by firms charging relatively lower markups and prices as a consequence of greater goods market competition and tougher selection. Holding the number of capacity constrained firms constant, my model maintains these results. However, in larger markets constrained firms become more prevalent, and since they access markets through prices, it is possible to see higher average prices in larger markets. This result is similar to Staiger and Wolak (1992) who assert that between markets of identical size, the market with scarce capacity will display higher prices and weaker competition.

The industrial organization literature examining market outcomes in the presence of capacity constraints is vast. Levitan and Shubik (1972) establish the effects of fixed capacity levels on Bertrand duopolies. Spence (1977) demonstrates the

[2] Although not explicitly examined here, the linkages developed in this model across markets within firms have the potential to yield insight into our understanding of how market characteristics such as exchange rates and shocks to supply or demand are passed through by firms. Understanding the source of these linkages would aid in investigating how firm behavior shapes fundamentals such as inflation and elasticities of trade.