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Do falling iceberg costs explain recent U.S. export growth?☆

George Alessandria [a,b,*], Horag Choi [c]

[a] University of Rochester, United States
[b] Federal Reserve Bank of Philadelphia, United States
[c] Monash University, Australia

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ABSTRACT

We study empirically and theoretically the growth of U.S. manufacturing exports from 1987 to 2007. We use plant-level data on exporters' export intensity to identify the changes in iceberg costs over this period. Given this change in iceberg costs, we find that a GE model with heterogeneous establishments and dynamic exporting decision from a sunk cost of starting to export is consistent with both aggregate U.S. export growth and the changes in the number and size of U.S. exporters. The model also captures the gradual response of U.S. exports to the cut in iceberg costs. A model with a static exporting decision generates substantially less trade growth and misses out on the timing of export growth. We also study the interplay between changes in the structure of manufacturing and trade. We find that the growth in trade contributed little to the contraction in U.S. manufacturing while changes in the structure of manufacturing from changes in sectoral productivity, capital intensity, idiosyncratic shocks, and corporate taxation reduced U.S. export growth by as much as 10%.

1. Introduction

The world has become much more integrated. For instance, the share of U.S. manufacturing shipments exported doubled from 1987 to 2007. This integration is generally attributed to a decline in trade barriers such as tariffs, transport costs, and non-tariff barriers. This finding though is mostly tautological since most empirical studies of trade integration use a gravity framework[1] with a linear relationship between the trade share and trade costs. These studies then either estimate the trade elasticity using a measure of changes in some observed trade costs (Baier and Bergstrand, 2001) or estimate the decline in unobserved trade costs given a calibrated trade elasticity (Head and Ries, 2001; Jacks et al., 2010). These approaches do not directly distinguish between the different types of trade barriers,[2] from per unit iceberg costs[3] to fixed costs of entering or continuing in export markets, to taxes or subsidies, that are the crucial microeconomic determinants of export participation by heterogenous producers. They thus provide limited guidance to policymakers on the impact of various trade policies.

In this paper, we propose an alternative approach to measuring the change in trade barriers and estimating the contribution of these changes to growing trade integration in a model with a non-linear relationship between trade costs and aggregate trade volumes. This approach builds on the new trade theories of producer heterogeneity and fixed export costs pioneered in a series of papers by Baldwin, Dixit and Krugman[4] and generalized by Melitz (2003) along with the increased availability of rich microdata on the characteristics of exporters and non-exporters. We apply this approach to study U.S. export growth from 1987 to 2007. This is a period of rapid but uneven export expansion and substantial changes in the structure of the manufacturing sector related to trade and longer term trends. Consistent with previous work, we find falling trade costs, specifically per unit iceberg costs, do

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* Corresponding author at: Economics Department, University of Rochester, United States.
E-mail addresses: George.Alessandria@gmail.com (G. Alessandria), Horag.Choi@monash.edu (H. Choi).

[1] For a comprehensive review of the literature on gravity equations see the recent handbook chapter by Head and Mayer (2013).

[2] These studies try to identify the source of these trade barriers by regressing them on many features of bilateral trade partners such as distance, trade relations, language, colonial links, and common currency. In this way these barriers are converted into iceberg cost equivalents.

[3] In what follows we do not distinguish between tariffs and iceberg costs.

[4] See, in particular, Baldwin (1988, 1989); Baldwin and Krugman (1989); and Dixit (1989a, b). These papers attribute the non-constant relationship between trade and relative prices to the dynamics of entry and exit from the export market.

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indeed account for the dynamics of the U.S. export share of manufacturing shipments. Unlike most previous work though, this wasn't guaranteed. These changes in iceberg costs could have induced different changes in export participation and the characteristics of exporters than predicted by the model. Indeed, we show that it takes a model with a dynamic exporting decision from a sunk cost to match the data.

Our first goal is to show how producer level data can be used to measure the decline in variable costs of trade. Specifically, we decompose the change in the share of manufacturing shipments exported into three margins. First, there is the familiar extensive margin that measures the change in the fraction of producers that export. Second, the exporter premium measures the change in the size of exporters relative to all establishments. Third, the export intensity margin measures the change in the fraction of shipments exported among exporters. In most theories, this last margin is primarily determined by iceberg costs and thus can be used to infer the change in iceberg costs. Previous work that decomposes export growth into just two margins[5] by combining our last two margins only identifies the change in variable trade costs under very specific parametric assumptions about the distributions of productivity and iceberg costs.[6] It does not generalize to a dynamic environment.

We also apply our decomposition to different time periods in our sample and find that there is a non-linear relationship between the change in iceberg costs and aggregate trade growth. Trade grows more relative to iceberg costs in the long-run (over 20 years) than in the short-run (first 10 years). This evidence of an increasing response of trade to changes in iceberg costs is consistent with the evidence presented by Yi (2003) for U.S. exports in periods that overlap with ours. The rising trade elasticity can be attributed to the slow changes in the stock of U.S. exporters as suggested by Baldwin and Krugman (1989).

Our second goal is to examine whether a standard heterogeneous producer model can capture the long-run change in the export share of manufacturing shipments as well as the non-linear growth in U.S. export growth and changes in variable trade costs at different horizons. We find a model with dynamic exporting decisions from a sunk cost in the spirit of Das et al. (2007) that captures the timing and size of the increases in export participation and declines in the size premium of exporters.

The benchmark model is a variation of our heterogenous producer general equilibrium model (Alessandria and Choi, 2011) extended to capture more aspects of plant heterogeneity and the changing aggregate structure of the U.S. economy. Unlike our earlier paper, the focus here is on applying this model to a particular trade liberalization episode. This model has heterogenous producer's moving in and out of export markets in response to idiosyncratic shocks to productivity and fixed export costs. There is a sunk cost of exporting as the cost of starting to export is larger than the per period cost of continuing. Numerous papers find that this type of dynamic model more accurately captures the characteristics and microdynamics of exporters. It has been suggested that this type of model can generate a different short-run and long-run trade response (Ruhl, 2008). We find that this is indeed the case. The model provides a relatively close fit to the non-linear trade dynamics observed in the data. Some of the export growth from 1997 to 2007 reflects the time it takes for export participation to respond to the earlier declines in iceberg costs.

We show that a simpler model with a static export decision is inconsistent with the observed overall change in trade and the change in export intensity. This is perhaps surprising since it is well known that under certain assumptions this model has a gravity structure (Chaney, 2008). That is, there is linear relationship between the trade share and variable trade costs that is governed by the heterogeneity in producer ability. While this insight is true, it requires treating the producer distribution as a free parameter. In our quantitative assessment, by calibrating to U.S. producer and exporter heterogeneity as well as exporter intensity, the model is disciplined in a way that restricts the trade elasticity. To make the static exporting model consistent with the data thus requires introducing a second set of aggregate shocks to the fixed cost of exporting. To capture the observed non-linear dynamics between iceberg costs and the export share requires these fixed cost shocks to be a relatively large driver of export growth in the second half of the time period studied. Thus, we find that abstracting from important elements of the producer export decision leads to very different conclusions about the changing nature of trade barriers.

The third, and final, contribution of this paper is to estimate the two-way interaction between trade and structural change in manufacturing. It is well known that lowering iceberg costs will concentrate production in larger establishments: A prediction that is violated strongly in the data. Plants became considerably smaller in this period. It is also well known that changes in producer heterogeneity will affect trade growth. This is a potentially important consideration since the period studied included substantial changes in the manufacturing sector that may or may not be related to international trade.

To evaluate the interplay between trade and manufacturing we consider four particular changes in the manufacturing sector. First, manufacturing's share of overall employment has fallen drastically, while its share of value added has held roughly constant. This implies relatively strong productivity growth in manufacturing and a less than unitary elasticity of substitution between manufacturing and non-manufacturing. Second, within manufacturing, the size distribution shifted away from large scale operations. This shift to smaller manufacturing operations at a time of growing trade integration is a puzzle for heterogeneous producer models since they predict the opposite changes. We capture some of this shift to smaller plants by making a fraction of entry costs paid in final goods. With the biased productivity growth in manufacturing this lowers the average plant size; however, the shift to smaller establishments reflects more than a decline in the mean plant but also a change in the shape of the distribution. To capture this feature of the data we allow the idiosyncratic shock process facing firms to be a bit less volatile. Third, capital intensity has changed both within manufacturing and between manufacturing and non-manufacturing. This requires allowing capital intensity to vary across sectors and by size. Fourth, there was a substantial increase in the tax rate on profits from export sales. This policy does not change iceberg costs but does change the benefits from exporting. It is particularly relevant since it highlights the rich array of policies used by policymakers.[7]

In terms of the effects of trade on manufacturing, we find that the observed decrease in iceberg costs account for only about 3% of the decline in manufacturing employment and counterfactually predicts production should be concentrated in larger establishments. In terms of the effects of structural change in manufacturing on trade, we find that changes in idiosyncratic productivity and the taxation of exporter profits lower overall export growth by about 10% (roughly equally split). We find the changes in capital intensity and sectoral productivity growth have almost no impact on aggregate export growth, but do affect our measures of the margins of export growth, particularly among relatively large manufacturers and explain most of the shift to smaller scaled establishments.

We undertake the first empirical and quantitative examination of the dynamics of U.S. aggregate and establishment-level trade flows. Previous work relating aggregate trade flows to establishment-level heterogeneity primarily focuses on the cross section of export participation. For instance, Bernard et al. (2003) study export participation

[5] See Eaton et al. (2004); and Chaney (2008).

[6] This approach only identifies the change in iceberg costs when there is no sunk export cost and productivity is Pareto.

[7] One could consider this a change in trade barriers rather than a structural change in manufacturing.