Journal of International Economics 94 (2014) 207–223

Contents lists available at ScienceDirect

Journal of International Economics

journal homepage: www.elsevier.com/locate/jie

Establishment heterogeneity, exporter dynamics, and the effects of trade liberalization ☆

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

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

ARTICLE INFO

Article history:
Received 14 January 2013
Received in revised form 5 August 2014
Accepted 8 August 2014
Available online 30 August 2014

JEL classification:
E31
F12

Keywords:
Sunk cost
Fixed cost
Establishment heterogeneity
Tariff
Welfare

ABSTRACT

We study the effects of tariffs and iceberg trade costs in a two-sector dynamic variation of the Melitz (2003) model extended to include a sunk cost of exporting, establishment-level uncertainty in productivity, capital accumulation, and material usage. We calibrate the model to match both cross-sectional and dynamic aspects of US producers related to export participation and the establishment lifecycle. We find a tariff equivalent of fixed export costs of 30 percentage points. We also find that a sizeable share of export profits is a return to the organizational capital from investing in export capacity rather than creating an establishment. We use the model to estimate the effect of reducing tariffs on welfare, trade, and export participation. We find that eliminating an 8 percent tariff increases the ratio of trade to GDP from 3.9% to 7.4% and raises welfare by 1.02%. Along the transition, consumption overshoots its steady state, even as trade and the capital stock grow gradually, so that the change in steady state consumption understates the welfare gain. Models without a dynamic export decision generate more gradual aggregate transition dynamics and smaller gains from trade. Capital accumulation and material usage are important sources of the welfare gains to trade.

1. Introduction

Melitz (2003) has developed a new theory of trade that extends the partial equilibrium model of heterogeneous producers and endogenous export participation from a sunk cost of exporting developed in a series of papers by Baldwin, Dixit, and Krugman (BDK hereafter) to general equilibrium.[1] This model is quite useful to evaluate the aggregate effect of trade barriers. It also suggests the possibility of larger gains from a cut in trade barriers through the endogenous response of export participation. However, Arkolakis, Costinot, and Rodriguez-Clare, (2012[2], ACR hereafter) show that this theory, as commonly formulated, yields the exact same welfare gains from a change in trade barriers as earlier trade models that lack fixed export costs when these models are parameterized to yield the same trade elasticity. In this paper, we re-evaluate the impact of reducing tariffs on welfare, trade, and the organization of production in a general equilibrium formulation of the Melitz (2003) model with producer dynamics and a sunk export cost that can capture key cross-sectional and dynamic elements of US establishments and exporters. Unlike the ACR formulation of Melitz (2003), and consistent with the ideas of BDK, exporting here is an explicitly dynamic decision.[3] We find that the welfare gains from cutting tariffs are up to 2.4 times larger with a dynamic decision than a static decision and that transition dynamics are crucial to these differences.

We embed a variation of the empirical model of Das et al. (2007) of exporting under uncertainty into a two sector general equilibrium

☆ The views expressed here are those of the authors and do not necessarily reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System. We thank Ariel Burstein and three anonymous referees for their helpful comments. We thank Andy Atkeson, Roc Armenter, Yan Bai, Sam Kortum, Amatrya Lahiri, Marc Melitz, Virgiliu Midrigan, Alex Monge, Fabrizio Perri, Esteban Rossi-Hansberg, Kim Ruhl, Mike Waugh, Daniel Xu, and Kei-Mu Yi for useful comments. We also thank the seminar participants at Berkeley, University of Chicago, University of Texas, Tulane, NYU, Science Po, Stanford, SUNY-Albany, 2006 Philadelphia Fed International Trade Workshop, 2006 Minneapolis Fed Macroeconomics Without Frontiers Conference, Vancouver SED Meetings, Stanford Institute for Theoretical Economics in 2007, 2009 Frontier Research on Markets with Frictions, 2010 NY/Philly Fed Quantitative Macro Conference, and 2011 Yale conference on New Perspectives on International Trade, Development, and Macroeconomics.

* Corresponding author at: Ten Independence Mall, Philadelphia, PA 19106, United States.
E-mail address: george.alessandria@gmail.com (G. Alessandria).

[1] See, in particular, Baldwin (1988, 1989), Baldwin and Krugman (1989), and Dixit (1989a,b). These papers are interested in explaining the non-constant dynamic relationship between trade and relative prices.

[2] Specifically, ACR show under certain assumptions that moving from autarky to zero tariffs generates the same gain in the Melitz (2003) and Krugman (1980) trade models. They also show that with no tariffs, the gains from trade from a change in iceberg costs are the same in these models when they are constrained to have the same trade response.

[3] In Melitz (2003) producer productivity is permanent so the distinction between startup and continuation costs does not matter in steady state.

http://dx.doi.org/10.1016/j.jinteco.2014.08.006
0022-1996/

model of trade and capital accumulation.[4] Variations of this theory have been found to capture producer and export dynamics in numerous countries. In a companion paper (Alessandria and Choi, 2011) we show the model developed here can match the non-linear relationship between U.S. export growth and declines in trade costs over time. It involves three main modifications to the standard GE heterogeneous producer trade model of Melitz (2003). First, establishments face persistent idiosyncratic productivity shocks. Second, there is a sunk cost of starting to export and a smaller period-by-period cost of continuing to export. The sunk cost makes the export decision dynamic. Third, there are temporary idiosyncratic shocks to these fixed export costs. These elements generate what Baldwin and Krugman (1989) call exporter hysteresis in that establishments continue to export even after their production costs have risen above the levels that led them to start exporting. They are necessary to match the high persistence of exporting and the substantial heterogeneity in characteristics of US exporters.

Our calibration provides an estimate of US trade costs divided between variable, startup, and continuation costs. We find a 30 percentage point tariff equivalent of fixed costs, explaining, in part, why direct measures of trade costs are so much lower than those inferred from trade flows (Anderson and van Wincoop, 2004). Consistent with previous work, we also find relatively large costs of starting to export.[5] The average cost of starting to export is 3.7 times the average cost of continuing to export. In aggregate, fixed export costs account for 53% of gross profits in our dynamic formulation but only 17% when exporting is a static decision.

The much larger share of fixed export costs, and smaller share of net export profits, with a sunk cost arises because a substantial chunk of gross export profits is a return on the organizational capital embedded in exporters rather than establishments. Organizational capital determines the payments to establishment owners, compensating them for the up-front cost of building establishments or export capacity and the time it takes to benefit from these investments. In this respect, with sunk costs, tariffs are more a tax on the organization capital of exporters and less a tax on the organization capital of establishments.

With a sunk cost we find that the long-run response of exporting and trade to a cut in tariffs is larger than when exporting is a static decision. With a static export decision, current productivity determines export participation while with a dynamic export decision, future productivity also matters. With mean reverting productivity the value to a producer from exporting thus rises less steeply with current productivity than in the static model, making export participation more sensitive to changes in trade barriers. It also implies that the decision to accumulate establishments rather than exporters depends strongly on the nature of the export decision. In our benchmark model, lowering tariffs increases the number of exporters while reducing the number of establishments. With a static export decision, we find the opposite: lowering tariffs increases the number of exporters and producers created.[6] The very different effects on establishment creation arise because with the sunk cost the typical selection effect is weaker as lower tariffs encourage relatively unproductive exporters to hang around longer. With these relatively unproductive varieties available there is less incentive to undertake the relatively costly investment to create new varieties. The different effects of tariffs on establishment creation lead to transition dynamics that depend on the dynamics of exporting.

With sunk costs and exporter dynamics there are rich transition dynamics following an unanticipated removal of tariffs. Consistent with the macro evidence, trade grows gradually with the long-run response about twice as large as the short-run response as it takes time to build up the stock of exporters.[7] Considering this transition period, steady state consumption understates the welfare gain by about 18%, since along the transition the economy overshoots the new steady state, with consumption peaking 10 years after the reform. This overshooting is particularly surprising since the economy must build up both its stock of physical capital and exporters.[8]

The boom in economic activity occurs because tariffs lead to the creation of too many tradable establishments and not enough exporters relative to the no tariff steady state. With lower tariffs, existing establishments can be used effectively to produce new varieties for the foreign market by exporting. In addition, current exporters, which have already incurred the startup cost, continue exporting longer, boosting the return on that past investment in export capacity. Both margins allow the investment embodied in existing establishments and exporters to be used more effectively along the transition. Additionally, there is a boom and bust in productivity from the surge in export entry as new exporters start out being relatively productive. This overshooting behavior of aggregates disappears when there is no dynamic aspect to the export decision as the familiar neoclassical motive to accumulate more establishments and capital dampens consumption growth so that steady state consumption overstates the welfare gains.

We next consider if the main insights of ACR generalize to our model of exporter dynamics. Specifically, we examine whether 1) the gains from trade are the same across models with and without fixed export costs for the same trade elasticity and 2) the change in steady state consumption our model can be described by a simple, but intuitive, formula relating the trade elasticity to the change in absorption of domestic goods. While there is no reason to expect the findings of ACR to apply to our more general, dynamic environment and consideration of transitions and tariffs, it is straightforward to evaluate their insights. We find that the welfare gain is about 2.4 times larger in our benchmark model than simpler static models even with the same long-run trade response. The different gains arise primarily from the stronger consumption response along the transition path in our dynamic model.

We find that the ACR formula overstates the change in steady state consumption from a change in trade in our model. In the policies we consider, the formula overstates the gains by 20 to 60%. This is true even with zero tariffs and a cut in iceberg costs, the case for which the formula holds exactly with no fixed export costs. These gaps arise because labor in production depends on trade barriers and the long-run trade elasticity is not constant. Eliminating discounting, so that agents value future periods equally and labor in production remains constant, the gap between the formula and the model is smaller and is due to non-constant long-run trade elasticity.[9]

A final methodological contribution is to apply quantitative methods to the study of a dynamic heterogeneous producer trade model. This allows us to consider more general, and realistic, processes for individual establishment dynamics and trade costs and solve for the transition

[4] Alessandria and Choi (2007) and Irarrazabal and Opromolla (2008) develop GE models with sunk costs.

[5] Many papers infer the presence of fixed export costs with a large up-front sunk aspect from the exporting behavior of firms (see Roberts and Tybout, 1997; Campa, 2004; Bernard and Jensen, 2004; Bernard and Wagner, 2001; Das et al., 2007; and Aw et al., 2011). Arkolakis (2010) shows that sunk costs may not be necessary to explain export dynamics in the presence of market penetration costs.

[6] This statement is about the effect of tariffs in the static export model considered. In other models with a static export decision and no non-tradables, lowering iceberg costs typically does not change the number of varieties created but lowers the number of active producers.

[7] Ruhl (2004) summarizes some papers on the dynamics of the trade response. The BDK framework was originally aimed at explaining this non-constant relationship. Using US industry level data, Gallaway et al. (2003) find that trade responds less over the short-run than long run to changes in relative prices. Alessandria et al. (2013) show that aggregate exports respond slowly to movements in real exchange rates following devaluations.

[8] Chaney (2005) discusses the dynamics of trade and establishment dynamics following a trade liberalization without establishment dynamics or a sunk aspect of exporting but does not solve for the transition path. He also suggests overshooting will occur because of an abundance of producers relative to the free trade equilibrium. We find that in versions of the model Chaney proposes there is no meaningful overshooting of consumption.

[9] In Appendix A we show the formula holds for a marginal cut in iceberg cost.