



Endogenous trade participation with price rigidities[☆]



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ABSTRACT

This paper investigates the interaction of endogenous export participation and nominal rigidities and its implications for the dynamics of intensive and extensive margins of trade. I develop a two-country dynamic stochastic general equilibrium model wherein firms make state-dependent decisions on entry and exit in the export market, and where price adjustments are staggered across firms and time.

My model reveals that, when an aggregate shock has significant effects on optimal export prices, such as a shock to domestic productivity or monetary policy, it generates large responses in the number of exporters. These movements in turn amplify responses along the intensive margin of trade and international transmission of the shock. I trace this result to the micro-level price rigidities in my model. Because staggered price changes delay intensive margin adjustments among incumbent exporters following aggregate shocks, they permit sizable shifts in the profitability of export participation. Whereas such shifts are virtually eliminated in models of exporter entry and exit with flexible prices, here they are sufficient to induce quantitatively important movements along the extensive margin of trade.

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1. Introduction

Over the past decade, the increasing availability of micro-level trade data has revealed important exporter characteristics previously overlooked in theoretical models of international trade. In particular, empirical studies have reported that, beyond changes in the volume of trade, countries also experience changes in the number of exporters and export varieties over time, and that exporters differ from non-exporters in several dimensions such as productivity and firm size.

It is also widely documented in both closed- and open-economy literatures that individual prices do not adjust flexibly period by period. Importantly, despite large fluctuations in nominal exchange rates, prices of traded goods exhibit significant nominal rigidities.¹ This has a number of important implications for international macroeconomics, such as cross-country transmission of shocks, exchange rate pass-through, and optimal monetary policy.

While separate strands of the literature on nominal rigidities and the extensive margin of trade have each flourished, little work

has been done to examine the macroeconomic interaction of these two important microeconomic phenomena. This paper studies this interaction and investigates its implications for the dynamics of intensive and extensive margins of trade and international transmission of shocks. I develop a two-country dynamic stochastic general equilibrium model wherein (a) individual firms reset their nominal prices infrequently, with the timing of those adjustments governed by a time-dependent hazard function, and (b) costs of entry and continuation in the export market induce endogenous, state-dependent entry and exit decisions among exporters. I allow for idiosyncratic elements in these costs in order to ensure that an interior fraction of each firm type chooses to export in any given period. Consistent with recent empirical findings at the micro level, producers of traded goods in my model exhibit persistent differences in their prices, productivities and trade status.²

I calibrate the parameters governing the microfoundations of my model to match a number of empirical observations regarding exporter characteristics and turnover. In particular, I target the fraction of firms that export, the entry rate into exporting, the continuation rate among existing exporters as well as the average difference in productivity among exporting versus non-exporting firms observed in the data on U.S. exporters. In addition to these exporter

[☆] The views expressed in this paper are my own and do not reflect those of the Bank of Canada.

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¹ See, for example, Gopinath and Rigobon (2008), Neiman (2010), Nakamura and Steinsson (2012), and Schoenle (2010).

² A number of exporter characteristics and firm-level production patterns are documented in recent empirical studies using micro-level trade data. See, for example, Bernard and Jensen (1999, 2004) and Bernard et al. (2003).

characteristics, my model is calibrated to reproduce the average frequency of price adjustment in disaggregated data and the aggregate imports-to-GDP ratio.

In any given period, each of the individual characteristics mentioned above influences whether and how much a firm exports. For example, all else equal, firms with higher current productivity are more likely to export since their larger expected values imply greater willingness to incur trade costs. For the same reason, firms are also more likely to export if their prices are closer to a forward-looking target price that is consistent with their productivity and the economy's aggregate state. My model calibration implies that firm-level differences in current productivity and export costs are more important determinants of firms' export participation decisions than differences in the vintage of their prices. Moreover, because the average entry cost for newly exporting firms exceeds the average continuation cost, forward-looking exporters recognize that exit may be costly. Since re-entering the export market in the future will involve another payment of the entry cost, a large fraction of incumbent exporters choose to continue exporting in the next period, even when they face current losses from exporting. This generates persistence in firms' export decisions as observed in the data.

Exploring aggregate fluctuations in my model and in comparison with a series of special-case variants, I show that my two departures from standard open-economy models—price rigidities and exporter entry and exit—matter jointly for the aggregate dynamics that would not arise in models with only one or the other of these two features. Only with a realistic degree of price rigidities, models of endogenous export participation generate movements along the extensive margin of trade that have distinct effects on the aggregate dynamics and generate the observed cross-country comovements of investment and employment. Conversely, relative to standard models with price rigidities, my inclusion of exporter entry and exit amplifies the responsiveness of the intensive margin and international transmission of shocks to aggregate productivity and monetary policy.

I find that, when aggregate shocks have significant effects on the marginal cost of production or the real exchange rate, such as shocks to domestic productivity or monetary policy, the limited adjustment along the intensive margin of trade by incumbent exporters due to microeconomic price rigidity leads to substantial movements in the value of export participation, and the number of exporters exhibits immediate, large responses following the shocks. This channel is absent in endogenous export participation models with the flexible price assumption.

Because new exporters in my model are able to choose optimal prices upon entry, movements along the extensive margin of trade endogenously alter the fraction of exporters with optimal prices. Therefore, while individual incumbent exporters face the same level of price rigidity, movements along the extensive margin of trade introduce additional flexibility at the aggregate level, and amplify the responses of export volumes, the export price index and international transmission of shocks, relative to sticky-price models without exporter entry and exit.

This mechanism becomes clearer when I examine the dynamic responses of my model to shocks that have negligible effects on optimal export prices but strong effects on the demand for exported goods, such as foreign demand shocks. In this case, little movements in optimal export prices imply that price rigidities do not hinder incumbent exporters from responding to the change in demand. Therefore, the immediate adjustment along the intensive margin by incumbent exporters leaves a smaller scope for the movements along the extensive margin of trade. These results are consistent with the pattern of international trade during the recent great trade collapse of 2008–09, as reported by Gopinath et al. (2012), that prices of differentiated traded goods exhibited marked stability and the drastic

fall in international trade occurred mainly along the intensive margin of trade.

My findings are in stark contrast to the predictions of existing models of endogenous export participation with the flexible price assumption, as in Alessandria and Choi (2007). When prices are perfectly flexible, incumbent exporters immediately respond to aggregate shocks by adjusting their prices period by period. Therefore, regardless of the source of the shocks, the immediate adjustment along the intensive margin of trade among incumbent exporters leaves little room for the adjustment along the extensive margin of trade. Consequently, substantially smaller movements along the extensive margin of trade have negligible effects on the economy's aggregate dynamics predicted by a model without exporter entry and exit. These findings suggest that market structure and pricing conventions are critical in understanding the implications of endogenous export participation for international business cycles.

My inclusion of micro-level price rigidities also brings the business cycle properties of endogenous trade participation models more consistent with international data, such as positive cross-country correlations of investment and labor, despite my assumption of complete international financial markets. In standard two-country models with complete asset markets, these cross-country correlations are negative while the reverse is true in the data.³ One way to resolve this 'international comovement puzzle' (Baxter, 1995) is to allow some degree of microeconomic-level nominal price rigidity, as in the monetary model of Chari et al. (2002). In principle, the presence of endogenous exporter entry and exit gives my model an extra margin of flexibility in responding to macroeconomic shocks, and hence has the potential to offset the implications of micro-level price rigidities and reinstate the comovement problem. However, I find that the success of nominal rigidities in delivering comovement in a complete markets setting survives my extension of the model to accommodate greater realism with respect to the micro-level trade data.

The remainder of the paper is organized as follows. Section 2 reviews the related literature. In Section 3, I describe the model. Section 4 summarizes calibration and steady-state characteristics of exporters. Results are presented in Section 5. Section 6 examines the sensitivity of my main results to alternative parameterizations of the model. Section 7 concludes.

2. Related literature

Earlier studies on the implications of export costs and entry decisions for the dynamics of net exports include Baldwin (1988), Baldwin and Krugman (1989) and Dixit (1989a,b). These authors developed partial equilibrium models of export decisions, and show that the presence of sunk entry costs leads foreign exporters to continue exporting following an appreciation of their own currency, even when their products may have become more expensive. I contribute to this line of works by building a general equilibrium model with nominal rigidities and endogenous exporter entry and exit. Beyond offering a richer treatment of the extensive margin and price-setting decisions, my extension to a general equilibrium framework permits the analyses of the responses of aggregate variables, trade flows and their endogenous feedback on individual firms' export decisions.

More recently, Bernard et al. (2003) and Melitz (2003) developed heterogeneous-firm models in which the presence of export costs

³ See, for example, Backus et al. (1993), Baxter and Crucini (1993) and Baxter (1995). This finding has led subsequent studies to propose a number of mechanisms to resolve it, such as endogenous incomplete markets (Kehoe and Perri, 2002) and financial autarky (Heathcote and Perri, 2002).

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