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Firm entry, trade, and welfare in Zipf's world ☆

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ABSTRACT

Firm size follows Zipf's Law, a very fat-tailed distribution that implies a few large firms account for a disproportionate share of overall economic activity. This distribution of firm size is crucial for evaluating the welfare impact of economic policies such as barriers to entry or trade liberalization. Using a multi-country model of production and trade calibrated to the observed distribution of firm size, we show that the welfare impact of high entry costs is small. In the sample of the 50 largest economies in the world, a reduction in entry costs all the way to the U.S. level leads to an average increase in welfare of only 3.25%. In addition, when the firm size distribution follows Zipf's Law, the welfare impact of the extensive margin of trade – newly imported goods at or near the exporting cutoff – is negligible. The extensive margin of imports accounts for only about 5.2% of the total gains from a 10% reduction in trade barriers in our model. This is because under Zipf's Law, the large, infra-marginal firms have a far greater welfare impact than the much smaller firms that comprise the extensive margin in these policy experiments. The distribution of firm size matters for these results: in a counterfactual model economy that does not exhibit Zipf's Law the gains from a reduction in fixed entry barriers are an order of magnitude larger, while the gains from a reduction in variable trade costs are an order of magnitude smaller.

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1. Introduction

An influential recent literature combines fixed costs of production and exporting with firm heterogeneity to study firm-level participation in international trade. Naturally, when the unit of the analysis is the firm, much of the emphasis has been placed on the entry decision into export markets — the so-called "extensive margin." This literature is closely related to the research agenda in economic growth that documents the existence of large impediments to entry and cross-border trade, especially in developing countries.

This paper evaluates the importance of fixed costs of production and trade and the extensive margin of imports for welfare.[1] The key ingredient of our study is the observation that firm size follows Zipf's Law, a very fat-tailed distribution that implies a few large firms account for a disproportionate share of overall economic activity.[2] Our main result is that once Zipf's Law in firm size is accounted for, the impact of fixed costs and the extensive margin on welfare is vanishingly small.

The analysis is based on the workhorse multi-country model of international trade in the spirit of Melitz (2003) and Eaton et al. (2011). We show how this model can be calibrated to match Zipf's Law in firm size, and illustrate analytically how the shape of the firm size distribution affects the importance of fixed costs and the extensive

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[1] As will become clear below, we analyze the extensive margin defined as the (dis) appearance of firms and exporters due to the changes in the production and exporting productivity cutoffs. This extensive margin is the focus of Chaney (2008), Arkolakis (2010), and Eaton et al. (2011), among many others. The longer NBER WP version of our paper (di Giovanni and Levchenko, 2010) also discusses the impact of the extensive margin coming from changes in the mass of potential firms in the economy, as in Krugman (1980) and Melitz (2003).

[2] This has been documented by Axtell (2001) for the census of U.S. firms, and by di Giovanni et al. (2011) for the census of French firms. Similar findings obtain for several European countries (Fujiwara et al., 2004) and Japan (Okuyama et al., 1999). Other phenomena known to follow power laws include city size, income and wealth, and CEO compensation (Gabaix, 2009).

margin of trade. Then, we calibrate the model to the 50 largest economies in the world, paying special attention to the observed variation in the fixed costs of starting a business or trading internationally. Paradoxically, when the canonical heterogeneous firm framework ideally suited to study the extensive margin of trade is actually calibrated to the observed degree of firm heterogeneity, the extensive margin ceases to matter.

In the quantitative exercise, we first simulate the welfare impact of a world-wide reduction in the fixed costs of entry and exporting all the way to the U.S. level — a 6-fold fall in fixed costs for the average country in the sample. Even such a sizeable improvement leads to an average increase in welfare of only 3.25%. Second, we reduce the variable ("iceberg") trade costs by 10%, and decompose the welfare impact of this change into the intensive margin – existing exporters selling more at lower prices – and the extensive margin – new exporters entering markets. The results are striking: the extensive margin of foreign varieties accounts for only 5.2% of the total welfare gains in this policy experiment. By contrast, the intensive margin is responsible for 98% of the total welfare impact of the fall in the iceberg costs.[3] Finally, we show that Zipf's Law matters a great deal quantitatively. We carry out a counterfactual calibration in which the firm size distribution is instead not fat-tailed. Under this alternative, gains from a reduction in fixed costs are about 12 times *higher*, while total gains from the reduction in iceberg trade costs are 15 times *lower*. Predictably, in this counterfactual calibration the extensive margin of trade is also more important, accounting for 14.7% of the total welfare impact of a 10% fall in variable trade costs. Thus, the distribution of firm size matters a great deal for whether fixed or variable costs have a larger welfare impact. In fact, depending on whether the firm size distribution is fat-tailed, the conclusions are reversed: in Zipf's world fixed costs matter little, while variable costs a great deal; the opposite is true in the counterfactual alternative calibration.

What is the intuition for these results? Changes in fixed costs affect only the behavior of marginal firms; similarly, the welfare impact of the extensive margin of international trade comes by definition from new, marginal exporters. The distribution of firm size contains information about the relative importance of the marginal compared to the infra-marginal firms for welfare. It is especially important to take this into account because Zipf's Law – a power law with an exponent close to −1 – is a very fat-tailed distribution.[4] Economically, Zipf's Law implies that the marginal producers and exporters are far less productive, and therefore are much smaller and sell much less. As a result, their weight in the price index (this index corresponding roughly to the inverse of welfare) is extremely low. By contrast, the infra-marginal, extremely large firms sell a lot and carry a large weight in the price index. Therefore, what happens to the large firms has a first-order impact on welfare. Our calibration exercise allows us to make this mechanism quantitatively precise. In fact, we show analytically that in the limit as the model parameters approach Zipf's Law, the welfare impact of the extensive margin of foreign trade goes to zero.

Ever since the influential work of Djankov et al. (2002), it has been known that cross-country differences in the cost of entry by firms are pronounced. These authors assemble data on the entry regulations in 85 countries, and document that the amount of time, the number of procedures, and the costs – in either dollar terms or as a percentage of per capita income – required to start a business vary widely between countries. The World Bank's Doing Business Initiative collected data on regulations regarding obtaining licenses, registering property, hiring workers, getting credit, and more. Almost invariably, the data show that the variation in these regulations across countries is considerable. In addition, in a cross section of countries entry barriers are robustly negatively correlated with per-capita income and other measures of welfare. However, using cross-country econometric models to quantify the size of the impact is difficult, if not impossible. Our paper presents an alternative approach to welfare analysis. We use the World Bank's Doing Business Indicators database to calibrate the observed variation in fixed costs across countries, and show that a model-based welfare assessment reaches very different conclusions.

Parallel to the research on entry barriers, recent advances in international trade have focused attention on the role of individual firms, both in theory and empirics. Many stylized facts have emerged: most firms do not export, most exporters sell only small amounts abroad, while the bulk of exports at any one point in time is accounted for by a relatively small number of firms (see, e.g. Bernard et al., 2007). The very same model we analyze in this paper has been used in dozens of studies to examine the firm's decision whether to export (e.g., Chaney, 2008), or how much to export (e.g., Arkolakis, 2010). Our analysis suggests that this literature's emphasis on the marginal firms may have been misplaced, at least when it comes to aggregate welfare.

Arkolakis et al. (2008) and Arkolakis et al. (2012) show that in several classes of models, including the standard model of monopolistic competition with endogenous variety adopted in this paper, gains from trade are summarized by the overall trade volume relative to domestic absorption. These authors argue that the overall trade volume is a "sufficient statistic," and thus information on the extensive margin is not necessary to estimate the total gains from trade. Atkeson and Burstein (2010) and Feenstra (2010) show that in two-country heterogeneous firm models with free entry and international trade, the welfare impact of newly imported varieties and existing firms' productivity upgrading decisions is largely offset by the impact of changes in net entry, resulting in virtually no net welfare gains from variety.

Relative to these two results, our paper's substantive point is complementary and distinct. In the sufficient statistic literature, the extensive margin "doesn't matter" only in the sense that one need not observe it to estimate the gains from trade. The sufficient statistic analysis is silent on whether observed changes in the overall trade volumes, and therefore welfare, are due to the extensive or intensive margins. Thus, it cannot be used to determine which policy instruments – for instance, fixed or variable costs – have the greatest welfare impact. In our analysis, the extensive margin doesn't matter for a very different, economic reason: the marginal firms are small. It is thus informative about the role of fixed versus variable costs in welfare. Our results complement Atkeson and Burstein's (2010) and Feenstra's (2010) by demonstrating that under Zipf's Law, the welfare impact of not only the "net extensive margin" – foreign plus domestic – but also of the "gross extensive margin" – foreign and domestic individually – vanishes. In a sense, this is a stronger result as it does not depend on the two gross margins canceling out perfectly. Instead we show that they are both vanishingly small in absolute value. Finally, an additional contribution of this paper is quantitative: we present a systematic assessment of the role of both fixed entry costs and variable trade barriers for welfare in a calibrated multi-country model.

Neary (2010) and Bekkers and Francois (2008) depart from the monopolistic competition paradigm, and develop heterogeneous firm models that feature strategic interactions between the large firms. Since we show that under the empirically observed distribution of firm size the small firms are unimportant, our results are complementary to the research agenda that seeks a richer model of the interaction between the largest firms.

Before moving on to the description of the model, a caveat is in order for interpreting the results. Our quantitative exercise does not strictly speaking tell us that the extensive margin does not matter

[3] The disappearing domestic varieties (the domestic extensive margin) have a correspondingly negative welfare impact.

[4] A random variable generating a power law with an exponent between −1 and −2 has infinite variance. When the power law exponent is less than 1 in absolute value, the mean becomes infinite as well.

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