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Entry assumptions and welfare gains from trade ☆

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HIGHLIGHTS

- When entry is exogenous, aggregate profits accrue to consumers as dividends.
- The extra adjustment in dividends dampens the relative increase in real wage.
- Hence, welfare gains from trade are lower under exogenous relative to free entry.
- This wedge grows with the extent of trade liberalization.

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ABSTRACT

When productivities are not Pareto distributed, welfare gains from trade are not necessarily isomorphic between entry assumptions. Under exogenous entry, the extra adjustment in dividends dampens the relative increase in real wage as trade costs decline, resulting in lower welfare gains than under free entry.

1. Introduction

The measurement of the gains from trade is a key challenge in the trade literature. Recently, Arkolakis et al. (2012) have shown that a large class of trade models have identical welfare implications. In particular, regardless of the micro-structure and the entry assumptions, the relative change in welfare as a result of a policy change can be calculated based on the observed domestic trade share and trade elasticity. Further work by Melitz and Redding (2015) demonstrates that the Arkolakis et al. (2012) result is a knife edge implication of a Pareto distributional assumption. While the Arkolakis et al. (2012) result provides a good local approximation to the gains from trade, Melitz and Redding (2015) have shown that over large trade liberalizations, trade models differ in terms of the predicted gains from trade once a Pareto distributional assumption is abandoned. In this paper we further demonstrate that welfare implications are not invariant to firm entry assumptions.

There are two types of firm entry assumptions usually made in trade models along the lines of Melitz (2003), namely, the *free entry* assumption and the *exogenous entry* assumption. The *free entry* assumption introduced in Melitz (2003) postulates that there is an infinite pool of prospective entrants. To enter, firms must first incur a sunk entry cost. After this cost is incurred, firms observe their productivity and decide whether to participate in a market or exit. The *exogenous entry* assumption introduced in Chaney (2008) postulates that there is a fixed mass of new entrants. Each of them costlessly draws a productivity and, based on the productivity realization, decides whether to participate in a market or exit.

From the perspective of welfare analysis, the crucial difference between the two entry assumptions arises from the redistribution of profits in the general equilibrium. Under the free entry assumption, the aggregate profits are used to pay for the sunk entry costs. As a result, the aggregate income is given by the total wage bill. In contrast, under the exogenous entry assumption, aggregate

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profits accrue to consumers in the form of dividends. These extra dividends increase the aggregate income and, potentially, welfare.

An entry assumption does not affect the measurements of the relative gains from trade if the firm-level productivity is Pareto distributed. Due to the scale invariance property of a Pareto distribution, aggregate profit is a constant multiple of the total wage bill. Hence, the welfare is given by a constant exogenous multiplier of the real wage regardless of the entry assumption. The extra dividends which consumers receive under exogenous entry, therefore, are proportional to the total wage bill and do not alter the relative changes in welfare due to changes in variable trade costs.

The isomorphism breaks down once we deviate from the Pareto distributional assumption. For a general distribution of productivities, the welfare multiplier in a model with exogenous entry is endogenous and depends on trade costs. We demonstrate that the endogenous multiplier dampens estimates of the gains from trade due to changes in the variable trade costs relative to a model with free entry.

To demonstrate the intuition as clearly as possible we develop our analysis in a symmetric two country context and use labor as the numeraire good. Appendix A contains full characterization of our analytical results and proofs to all propositions.

2. Entry and welfare

2.1. Set-up

Consider an otherwise standard set-up of the Melitz (2003) model. Welfare is defined as the real income per capita:

$$W \equiv \frac{Y/P}{L}, \tag{1}$$

where Y is the aggregate income, P is the aggregate price level, and L is the mass of consumers.

Under the free entry assumption as in Melitz (2003), the aggregate income equals the total payments to labor, i.e. $Y = L$. Hence, welfare can be measured by the real wage, or

$$W^{FE} = \frac{1}{P}, \tag{2}$$

where the superscript FE stands for "Free Entry".

Under the exogenous entry assumption as in Chaney (2008), the aggregate income is given by the sum of the total payments to labor and the total profits of domestic firms, i.e. $Y = L + \Pi$. Hence, the real wage alone does not define welfare. Instead, the welfare can be expressed as a multiplier of the real wage as

$$W^{EE} = \kappa \times \frac{1}{P}, \tag{3}$$

where superscript EE stands for "Exogenous Entry", and κ is the welfare multiplier and is greater than unity.

From Eqs. (2) and (3), the elasticity of welfare with respect to the variable trade costs, $d\ln W/d\ln\tau$, is determined by the elasticity of the aggregate price index, $d\ln P/d\ln\tau$. In the context of the exogenous entry assumption, this elasticity can potentially be amplified or dampened by the elasticity of the welfare multiplier, $d\ln\kappa/d\ln\tau$, causing the two entry assumptions to be non-isomorphic in terms of their welfare predictions.

2.2. A Pareto example

Under a Pareto distribution, the welfare multiplier κ is constant, independent of the variable trade cost τ, and is given by $\sigma\xi/(\sigma\xi - (\sigma-1))$, where ξ is a Pareto shape parameter and σ is the elasticity of substitution. Hence, under the exogenous entry, the elasticity of welfare with respect to the variable trade cost is determined solely by the elasticity of the price index. This elasticity, in turn, is identical between entry assumptions and is given by

$$\left(\frac{d\ln P}{d\ln\tau}\right)^{\text{Pareto}} = \frac{\tau^{-\xi}(f_x/f_d)^{1-\frac{\xi}{\sigma-1}}}{1+\tau^{-\xi}(f_x/f_d)^{1-\frac{\xi}{\sigma-1}}}. \tag{4}$$

In this case, no knowledge of the underlying entry structure is necessary and the two assumptions are isomorphic in terms of predicted welfare changes due to changes in variable trade costs.

2.3. The elasticity of the aggregate price index

Given the isomorphism of the two entry assumptions under a Pareto distribution, the relative change in the inverse of the price index is often used as a measure of the welfare gains regardless of the entry assumptions. Proposition 1 below shows that for a general distribution of productivity draws, the price index is more elastic under exogenous entry compared to free entry. The non-isomorphism of the price elasticity under a general distribution signals potential differences in the estimates of welfare gains.

Proposition 1. *Consider a distribution of productivity draws, $G(\varphi)$, such that the function $\gamma(\varphi_i) \equiv \frac{\varphi_i^{\sigma} g(\varphi_i)}{\int_{\varphi_i}^{+\infty}\varphi^{\sigma-1}g(\varphi)d\varphi}$ is strictly increasing in φ_i. Holding all other parameters constant, suppose there exists a relationship between the exogenous mass of entrants J in the exogenous entry model, and the sunk entry cost f_e in the free entry model, such that the domestic trade shares in an open economy equilibrium are equal between the two models. Then*

(i) The domestic productivity entry thresholds are equal across the two entry assumptions:

$$(\varphi_d)^{EE} = (\varphi_d)^{FE}. \tag{5}$$

(ii) The elasticity of the domestic productivity entry threshold with respect to variable trade costs in the exogenous entry model is smaller than that in the free entry model:

$$\left(\frac{d\ln\varphi_d}{d\ln\tau}\right)^{EE} < \left(\frac{d\ln\varphi_d}{d\ln\tau}\right)^{FE} < 0. \tag{6}$$

(iii) The elasticity of the aggregate price index with respect to variable trade costs in the exogenous entry model is larger than that in the free entry model:

$$0 < \left(\frac{d\ln P}{d\ln\tau}\right)^{FE} < \left(\frac{d\ln P}{d\ln\tau}\right)^{EE}. \tag{7}$$

To understand the intuition behind result (iii) in Proposition 1, note that the price index in both models can be expressed as a sum of entry and selection effects

$$\frac{d\ln P}{d\ln\tau} = \frac{1}{\sigma-1}\underbrace{\left(\frac{d\ln\lambda}{d\ln\tau} - \frac{d\ln\delta(\varphi_d)}{d\ln\tau}\right)}_{\text{selection effect}>0} + \frac{1}{\sigma-1}\underbrace{\left(-\frac{d\ln M^e}{d\ln\tau}\right)}_{\text{entry effect}\le 0}, \tag{8}$$

where M^e is the mass of entrants (either endogenous or exogenous), λ is the domestic trade share, and $\delta(\varphi_i) \equiv \int_{\varphi_i}^{+\infty}\varphi^{\sigma-1}g(\varphi)d\varphi$. The *selection effect* can be expressed as

$$\text{Selection Effect} = (1-\lambda)(\sigma-1+\gamma_x) + \left[(1-\lambda)\gamma_x + \lambda\gamma_d\right]\frac{d\ln\varphi_d}{d\ln\tau} > 0,$$

and captures the effect of exit of less productive firms on the aggregate price level.[1] By parts (i) and (ii) of Proposition 1, the

[1] γ_i refers to $\gamma(\varphi_i)$.