

Globalization beyond partitioning

Jan G. Jørgensen* Philipp J.H. Schröder† Zhihao Yu‡

August 2008

Abstract

In an ultra-globalized world, all existing firms service all markets (zero partitioning) and some may need to cross-subsidize. Especially, intense competition forces low productivity firms to compensate losses on the home market with profits made on foreign markets. Are there still gains from further trade liberalization in such a situation? We present a simple and tractable heterogeneous firms specification to address this question. The answer we find is: yes, even more.

JEL: F12, F13, F15

Key Words: Intra-industry trade, monopolistic competition, heterogeneous firms.

*Department of Business and Economics, University of Southern Denmark, Denmark, jgj@sam.sdu.dk.

†Department of Economics, Aarhus School of Business, University of Aarhus, Denmark, psc@asb.dk.

‡Department of Economics, Carleton University, Canada, zhihao_yu@carleton.ca.
Acknowledgements: Jan G. Jørgensen and Philipp J.H. Schröder gratefully acknowledge financial support from the Danish Social Sciences Research Council (grant no. 275-06-0025).

1 Introduction

In most countries, the lion's share of domestic consumptions is serviced from home and only a fraction of all domestic firms are engaged in export. In line with these stylized facts, the newly emerged heterogeneous firms trade theory (e.g. Melitz, 2003) commonly sets a partitioning condition, i.e. the barriers to trade remain so substantial that not all firms in a sector find it worthwhile to engage in foreign markets.

Though this is the empirically relevant case, the hypothetical situation of an ultra-globalized world where trade liberalization has progressed beyond this point opens a range of questions. It may, for instance, echo the structure envisaged in popular – and sometimes fearful – accounts of globalization. Beyond the point of zero partitioning, intra-industry reallocations have eliminated purely domestic firms such that all existing firms service all markets and some firms may be forced to cross-subsidize. Intense competition from abroad results, for low productivity firms, in losses on the home market, which must be compensated by profits from export sales to ensure the survival of firms.¹

The present paper examines such a situation. Specifically, we ask if there continues to be gains from further trade liberalization, once integration has progressed beyond the point of zero partitioning and firms cross-subsidize. We address this issue by exploring a simple symmetric two country intra-

¹Even though such a situation is surely an exception, it may reflect situations for some firms in small highly trade-open economies. The aim to compensate home losses has been featured as an export motive already in the early literature on exporter behavior, see the widely cited survey by Bilkey (1978). More recently, the 'born-global' literature provides accounts of sectors and firms where the cross-subsidization scenario may prevail, see, for example, Moen and Servais (2002) or Knight and Cavusgil (2004).

industry trade model in the spirit of Melitz (2003), albeit replacing the firm level marginal cost heterogeneity with fixed cost heterogeneity. The originators of this approach are Schmitt and Yu (2001) and Jørgensen and Schröder (2008). The key difference in the present paper is that firms are heterogeneous in their fixed costs both on the home and foreign markets. In the resulting model we are able to characterize stationary equilibria and explore consequences of trade liberalization for industry dynamics. The main benefit of fixed cost heterogeneity – instead of marginal cost heterogeneity – is that all firms charge the same price. The cost of this simplicity is of course that firm size within a given category (exporter/non-exporter) does not differ. Still, many of the key features are preserved by the present modeling choice, e.g. exporters are more productive and larger than non-exporters, see Jørgensen and Schröder (2008).² For the present purpose of studying a hypothetical ultra-globalized situation, the fixed cost heterogeneity assumption is particularly useful because it makes for a highly trackable framework delivering simple analytical solutions for welfare.

The present paper contributes to the literature in two ways. Firstly we provide an application of the firm-level heterogeneous fixed costs specification following Schmitt and Yu (2001) and Jørgensen and Schröder (2008), and thereby illustrate the simplicity of this alternative to the marginal cost heterogeneity assumption (e.g. Montagna, 2001; Melitz, 2003). We improve upon the previous fixed cost heterogeneity models by modeling firm heterogeneity already on the home market (not only in export market access), while

²The productivity of firms is heterogeneous, even though marginal productivity is homogeneous. Firms spread an identical scale across different fixed costs. Thus observable productivity, such as value added over labor usage, is unique to each firm. Obviously, the true underlying driver of firm heterogeneity is ultimately an empirical question, and is likely to change for different industries, countries, and times.

still preserving the entry mechanism in the manner of Hopenhayn (1992) and Melitz (2003). Secondly, and more importantly, we use this framework to study the consequences of trade liberalization in an already ultra-globalized world. From the model we arrive at the following results. Once we relax the partitioning condition, i.e. allowing for all firms in equilibrium to be export active, further trade liberalization will still generate more trade. The resulting increased competition and induced industry reallocations may force low productivity firms to cross-subsidize losses on the home market with profits made from export sales. The welfare implications of further trade liberalization in such a situation are analyzed. Firstly, we find that reductions in iceberg trade costs (as well as in fixed trade costs) always increase welfare, regardless of the presence of cross-subsidization. Secondly, any given reduction in iceberg trade costs turns out to generate a larger welfare gain once the economy is beyond the point of zero-partitioning. The reason for this latter, and somewhat counter intuitive, finding is as follows. With partitioning, trade liberalization benefits the trading firms and harms the purely domestic firms, yet bestowing overall gains via industry reallocations and increased variety. Beyond zero partitioning, all firms trade, and no purely domestic firms can be harmed. Still, reallocations continue to occur. Specifically with lower trade costs, in the ultra-globalized economy, firm entry becomes more attractive resulting in more variety, even though a larger share of firms are starting to cross-subsidize.

The next section presents the autarky benchmark of the fixed cost heterogeneity model. In Section 3 we introduce the open economy version and derive the results with and without the customary partitioning condition. Section 4 presents our welfare results. Section 5 concludes.

2 The Autarky Benchmark

The preferences of a representative consumer feature love of variety. All consumption goods, c , enter symmetrically. Utility is given by

$$U = \sum^{N_d} c_i^\theta, \quad \theta \in (0, 1). \quad (1)$$

The number of variants actually produced (n_d) is assumed to be large, although smaller than N_d .

Firms

The decision to start production is firm-endogenous, with some firms deciding not to start production at all. Production requires only one input, labor L , remunerated at the economy-wide wage rate w . The firms' cost function exhibits constant marginal costs, β , which are homogeneous across firms and fixed – but heterogeneous – market access costs, a_i , due in every period (e.g. marketing, distribution network, etc.). Prior to entry, all firms are homogeneous, upon entry the firm specific fixed cost is disclosed. The firms' specific fixed cost, a_i , is, for simplicity, assumed to be uniformly distributed on the interval $[0, \alpha]$, with $F(\cdot)$ denoting the distribution function that is public knowledge.

To enter, firms face initial sunk fixed entry costs, f ; loosely speaking, these are the costs of participating in the lottery for firm specific fixed costs. Such sunk entry costs capture costs that are distinct from the cost of production, and instead capture the cost of innovating a new variety, which then may or may not turn out to be profitably brought to the market.

Under these assumptions, the profit functions of a firm becomes

$$\pi_{d,i} = p_d x_d - (a_i + \beta x_d)w, \quad (2)$$

where x_d and p_d are output and price respectively.

Finally, various market-clearing relations complete the model: goods market clearing $Lc_d = x_d$ and labor market clearing.

Prices and quantities

Maximization of (1) leads to the familiar inverse demand functions of the form $p_d = \frac{\theta c_d^{\theta-1}}{\lambda}$. Then, profit maximization of (2) with respect to x_d results in the prices

$$p_d^a = \frac{\beta w}{\theta} \quad (3)$$

identical for all firms. Since prices are the same, consumer utility maximization results in identical sales quantities, x_d .

The actual production scale can be determined as being driven by free entry/exit. Following Melitz (2003), we model a simplified Hopenhayn (1992)-type entry. If a firm draws a high fixed cost, a_i , too high to break even at the given production scale, the firm would lose money and choose immediate exit. If, however, a firm does produce, it is confronted by a constant probability δ per period of a bad shock (firm death). We only consider stable steady state equilibria, so that in equilibrium each firm that finds it profitable to launch production continuous to produce until hit by a bad shock. Accordingly, the value of a firm i is $\sum_{t=0}^{\infty} (1 - \delta)^t \pi_{d,i} = \frac{1}{\delta} \pi_{d,i}$.

Firms know the distribution of a_i 's, the values of β and δ , and the relations given above. There must exist some cut-off levels, a_{prod} , of the firm specific fixed costs denoting the firm that is exactly indifferent between engaging in production or not launching any production at all. Firms determine their entry subject to expected profits and sunk cost. The entry of firms occurs until expected profits equal entry cost f . In particular,

$$\pi^{exp} = \frac{1}{\delta} [F(a_{prod}) \pi_d] = f. \quad (4)$$

Since the expected fixed costs must be $\frac{a_{prod}}{2}$, equation (4) reads

$$\pi^{exp} = \frac{1}{\delta} \frac{a_{prod}}{\alpha} [p_d x_d - (\frac{a_{prod}}{2} + \beta x_d) w] = f, \quad (5)$$

which can be solved for x_d to yield

$$x_d = \frac{\theta}{(1 - \theta)\beta w} \frac{a_{prod}^2 w + 2f\delta\alpha}{2a_{prod}}. \quad (6)$$

The indifferent firm

With the prices and quantities derived above, it is straightforward to identify the firm that is indifferent towards starting production. This firm is characterized by a fixed cost of a_{prod} such that $\pi_{d,i} = 0$ must hold, i.e. the indifferent firm makes zero profits from starting production. Base on the above, one can solve

$$a_{prod}^a = \sqrt{\frac{2\alpha f \delta}{w}}. \quad (7)$$

All firms i such that $a_i \in [0, a_{prod}^a]$ make non-negative profits, while all firms i such that $a_i \in]a_{prod}^a, \alpha]$ would lose money and hence are non-producing firms (immediate exit). Notice that $a_{prod}^a < \alpha$, given the participation constraint, i.e. there will be firms exiting (choosing not to produce). To see the logic of this, assume the counterfactual situation where the production scale (which is the same for all firms) is so large that even the highest fixed cost firm with fixed costs, α , breaks even. Then all firms would make positive profits, which in turn would trigger entry and reduce the per firm scale. At a lower scale, the high fixed cost firms can no longer recover those fixed costs and hence will choose not to start production in the first place. Moreover, even though all firms have the same sales, they all make different profits and have different productivity.³ Inserting (7) in (6) we get output for producing firms

³Even though we have identical marginal productivity (β), firms' actual productivity (the inverse of average costs) is unique to each firm, depending on the different a_i s. This

in autarky:

$$x_d^a = \frac{\sqrt{2f\alpha\delta\theta}}{\beta\sqrt{w}(1-\theta)}. \quad (8)$$

The number of firms

The total number of active firms (the stock) in the industry is denoted by m . In a stationary equilibrium, the per period shock driven exit must be exactly replaced by successful new entrants, i.e. $\delta m = \frac{a_{prod}^a}{\alpha}n$, where n is the number of firms participating in the lottery (developing a new variety) in any period, and accordingly $n_{ex} = (1 - a_{prod}^a)n + \delta m$ is the number of firm exits per period. Furthermore, labor absorption is given by the expected production costs of active firms plus the innovation costs of n entry attempts

$$L = m\left(\frac{a_{prod}^a}{2} + \beta x_d\right) + nf, \quad (9)$$

which can be solved to give

$$m^a = \frac{L(1-\theta)}{1+w+\theta(1-w)}\sqrt{\frac{2w}{f\alpha\delta}} \quad (10)$$

$$n^a = \frac{L(1-\theta)w}{f(1+w+\theta(1-w))}. \quad (11)$$

3 Opening to Trade

Consider two symmetric countries, home and foreign (denoted by $*$), similar to the one above but open to trade. Utility (1) can more specifically be written as

$$U = \sum_{i_d=1}^{N_d} c_{d,i_d}^\theta + \sum_{i_t=1}^{N_t} c_{t,i_t}^\theta + \sum_{i_f=1}^{N_f} c_{f,i_f}^\theta, \quad (12)$$

where c_{d,i_d} is consumption of variant i_d of non-exported domestic products, c_{t,i_t} is consumption of variant i_t of the exported domestic products, and c_{f,i_f} can easily be verified by calculating firm total output over firm labor usage in the model.

is consumption of variant i_f of imported products. The number of variants actually produced (n_d , n_t , and n_f) is assumed to be large, although smaller than N_d , N_t , and N_f . The symmetry of the setup implies $n_t = n_f^* = n_f = n_t^*$ and that trade is balanced.

Firms

Firms can produce their specific variant for the home market alone or for both the home and foreign markets. The decision to start production and to start the export activity is firm-endogenous. We analyze two different situations: i) Some firms may decide not to start production at all and not all producing firms will export, i.e. the partitioning condition is binding; and ii) some firms may decide not to start production at all but all producing firms will export even though some may face a loss on the home market (cross-subsidization), i.e. the partitioning condition is relaxed.

The key difference to the closed economy is an additional fixed foreign market access cost. We express this cost as a fraction, γ , of the home market fixed costs, a_i , i.e. γa_i , where $\gamma \in [0, \infty[$. The fixed costs of exporting represent, for example, the cost of building up a distribution network abroad, the cost of foreign marketing, the cost of collecting information or additional costs of adapting a product to foreign specifications or tastes, and may be smaller or larger than the firms' fixed costs at home. In addition, firms from both countries face the same iceberg trade costs $\tau = 1 + t$, $t > 0$, when selling abroad. The presence of fixed and variable export costs creates an asymmetry between trading and non-trading firms and, hence, the profit functions of a purely domestic firm only servicing the home market and an exporting home

firm servicing both markets are

$$\pi_d = p_d x_d - (a_i + \beta x_d)w \quad (13)$$

$$\pi_z = p_t x_t + p_z x_z - (a_i + \gamma a_i + \beta x_t + \beta \tau x_z)w, \quad (14)$$

where x_d is the production of a purely domestic firm, and x_t and x_z are the output of an exporting firm to the home and the foreign markets respectively. Finally, the goods market-clearing relations become $L_{c_d, i_d} = x_{d, i_d}$, $L_{c_t, i_t} = x_{t, i_t}$, and $L^*_{c_f, i_f} = x_{z, i_t}$, where the foreign index i_f and the home index i_t denote one and the same variant.

Prices and quantities

Following similar procedures as above, the prices become

$$p_d = p_t = \frac{\beta w}{\theta} \quad (15)$$

$$p_z = \frac{\beta w \tau}{\theta} = p_d \tau \quad (16)$$

for sales on the home and the foreign markets respectively. In equilibrium, maximization of utility (12) requires that the ratio of the marginal utility of an extra consumption unit equals the price ratio, i.e. $\frac{\theta c_d^{\theta-1}}{\theta c_f^{\theta-1}} = \frac{p_d}{p_z^*} = \frac{1}{\tau}$. Utilizing the goods market clearing conditions, this implies

$$x_z = x_z^* = x_d \tau^{\frac{1}{\theta-1}}. \quad (17)$$

Thus, exporting firms charge the same price on their home market and have the same sales volume as non-trading firms, but charge higher prices and sell less of their variant on the foreign market. By the same token, domestic consumers pay more and consume less of imported product varieties compared to domestically produced varieties.

With these relations in place, production scale can be determined as being driven by free entry/exit. Firms know the distribution of a_i 's and

the relations given in (17). However, the outcome depends on which of the situations we are analyzing (with partitioning/beyond partitioning). To begin with, we analyze the situation with partitioning (superscript p); i.e. case i) where some firms may decide not to start production at all and where not all producing firms will export.

Partitioning

There must exist some cut-off levels, a_{ex} , of the firm specific fixed costs denoting the firm that is exactly indifferent between engaging in exports and being a non-trading firm. Furthermore, there must exist a new cut-off level, a_{prod}^p , of the firm specific fixed costs denoting the firm that is exactly indifferent between engaging in production or not launching any production at all. Firms determine their entry subject to expected profits and sunk costs. Entry of firms occurs until expected profits equal entry cost f . In particular, $\pi^{exp} = F(a_{ex}^p)\pi_z + (F(a_{prod}^p) - F(a_{ex}^p))\pi_d = f$. Using (13) and (14) and realizing that the expected fixed costs of exporting firms must be $\frac{a_{ex}}{2}$ and the expected fixed costs of domestic firms must be $\frac{a_{prod} + a_{ex}}{2}$, the equation reads

$$\begin{aligned} & \frac{1}{\delta} \left[\frac{a_{ex}^p}{\alpha} \left(p_d x_d + p_z x_z - \left(\frac{a_{ex}^p}{2} + \gamma \frac{a_{ex}^p}{2} + \beta x_d + \tau \beta x_z \right) w \right) \right. \\ & \left. + \left(\frac{a_{prod}^p}{\alpha} - \frac{a_{ex}^p}{\alpha} \right) \left(p_d x_d - \left(\frac{a_{prod}^p + a_{ex}^p}{2} + \beta x_d \right) w \right) \right] = f. \end{aligned} \quad (18)$$

Inserting from above, (18) can be solved for x_d to yield

$$x_d = \frac{\theta}{(1-\theta)\beta w} \frac{(a_{prod}^p)^2 + a_{ex}^p \gamma}{2(a_{prod}^p + a_{ex}^p \tau^{\frac{\theta}{\theta-1}})} w + 2f\delta\alpha, \quad (19)$$

which is also the home market production scale of exporting firms (x_t) and can be plugged into (17) to determine x_z . Note that when trade costs are

prohibitive and accordingly $a_{ex}^p = 0$, the production scale reaches the autarky case given in (6).

The indifferent firm

The production indifferent firm is characterized by a fixed market access cost, a_{prod}^p such that $p_d x_d - (a_{prod}^p + \beta x_d)w = 0$, i.e. the indifferent firm makes zero profits from producing. The firm that is indifferent between becoming an exporting firm or becoming a purely domestic firm is characterized by a fixed cost of exporting, a_{ex}^p , such that $p_z x_z - (\gamma a_{ex}^p + \tau \beta x_z) = 0$, i.e. the export indifferent firm makes zero profits from the exporting activity. After inserting prices and quantities from above, one finds

$$a_{ex}^p = \frac{\sqrt{2f\alpha\delta} \tau^{\frac{\theta}{\theta-1}}}{\sqrt{w\gamma(\gamma + \tau^{\frac{2\theta}{\theta-1}})}}. \quad (20)$$

And similarly

$$a_{prod}^p = \frac{\sqrt{2f\alpha\delta\gamma}}{\sqrt{w(\gamma + \tau^{\frac{2\theta}{\theta-1}})}}. \quad (21)$$

All firms i such that $a_i \in [0, a_{ex}^p]$ make non-negative profits from exporting, all firms i such that $a_i \in]a_{ex}^p, a_{prod}^p]$ are non-trading firms, while all firms i such that $a_i \in]a_{prod}^p, \alpha]$ are non-producing firms.

The number of firms

In a stationary equilibrium, the per period shock driven exit must be exactly replaced by successful new entrants, i.e. $\delta m^p = \frac{a_{prod}^a}{\alpha} n^p$, where n^p is the number of firms participating in the lottery (developing a new variety) in any period, and accordingly $(1 - a_{prod}^a) n^p + \delta m^p$ is the number of firm exits, n_{ex}^p per period. The number of traded (m_t^p) and non-traded (m_d^p) firms are

given by⁴:

$$\begin{aligned} m_t^p &= \left(\frac{a_{ex}^p}{a_{prod}^p} \right) m^p \\ m_d^p &= \left(1 - \frac{a_{ex}^p}{a_{prod}^p} \right) m^p. \end{aligned} \quad (22)$$

Furthermore, labor absorption is given by the production costs of active firms plus the innovation costs of n^p entry attempts

$$L = m_t^p \left(\frac{a_{ex}^p}{2} + \gamma \frac{a_{ex}^p}{2} + \beta x_d + \tau \beta x_z \right) + m_d^p \left(\frac{a_{ex}^p + a_{prod}^p}{2} + \beta x_d \right) + n^p f, \quad (23)$$

which can be solved for n and subsequently for m , m_t and m_d to give:

$$n^p = n^a = \frac{L(1-\theta)w}{f(1+w+\theta(1-w))} \quad (24)$$

$$m^p = n^p \frac{\sqrt{2f\gamma}}{\sqrt{w\alpha\delta(\gamma + \tau^{\frac{2\theta}{\theta-1}})}}. \quad (25)$$

The point of zero-partitioning

The above partitioning situation, where some firms export and others do not, is of course dependent on a certain parameter range of trade costs. In particular, a situation of zero-partitioning features $a_{ex}^p = a_{prod}^p$. This is the case for specific combinations of τ and γ . Solving $a_{ex}^p = a_{prod}^p$ gives

$$\tau = \gamma^{\frac{\theta-1}{\theta}} \iff \gamma = \tau^{\frac{\theta}{\theta-1}}. \quad (26)$$

Hence, partitioning occurs for $\tau > \gamma^{\frac{\theta-1}{\theta}}$, which is the usually evoked assumption, see Melitz (2003). Yet, the model by itself does not require this condition. In particular, for $\tau < \gamma^{\frac{\theta-1}{\theta}}$ we can examine issues of the ultra-globalized economy including situations of cross-subsidization.

⁴Note that the distribution of active firms only runs from 0 to a_{prod} .

Beyond partitioning – cross-subsidization

Compared to the situation with partitioning where some firms produce only for the domestic market the case beyond partitioning is different, since now all firms that produce will export. Moreover, if firms must endure both market access costs a_i and γa_i , say because they can not switch nationality, some firms will experience losses on the home market that they must cover via profits on the foreign market, i.e. they will be cross-subsidizing (superscript c).⁵

There must exist some cut-off levels, a_{ex}^c , of the firm specific fixed costs denoting the firm that is exactly indifferent between engaging in production and exports or not launching any production at all. Entry of firms occurs until expected profits equal entry cost f . In particular

$$\frac{1}{\delta} \left[\frac{a_{ex}^c}{\alpha} \left(p_d x_t + p_z x_z - \left(\frac{a_{ex}^c}{2} + \gamma \frac{a_{ex}^c}{2} + \beta x_t + \tau \beta x_z \right) w \right) \right] = f. \quad (27)$$

Inserting from above, (27) can be solved for x_t to yield

$$x_t = \frac{\theta}{(1-\theta)\beta w} \frac{(a_{ex}^c)^2 w(1+\gamma) + 2f\delta\alpha}{2a_{ex}^c(1+\tau^{\frac{\theta}{\theta-1}})}, \quad (28)$$

which can be plugged into (17) to determine x_z .

The indifferent firm

The production and export indifferent firm is characterized by a fixed market access cost, a_{ex}^c , such that $p_d x_t + p_z x_z - (a_{ex}^c + \gamma a_{ex}^c + \beta x_t + \tau \beta x_z)w = 0$, i.e. the indifferent firm makes zero profits from producing, exporting, and selling on the home market. After inserting p_d and x_t from above, one can solve

$$a_{ex}^c = \sqrt{\frac{2f\alpha\delta}{w(1+\gamma)}}. \quad (29)$$

⁵It is straightforward to solve the model also without cross-subsidization, i.e. the situation where firms may choose to service only the foreign market.

Note that the expression is independent of τ , but dependent on γ , i.e. the extensive margin no longer changes, but the intensive margin does. In particular, for $\gamma = 0$ we are back at the expression for the closed economy (7), i.e. without additional market entry barriers firms face just one market entry decision. All firms produce for both the home and foreign markets. However, some firms make losses on the home market, whereas others make gains on the home market. It is straightforward to identify the firm which exactly makes zero profit at home. It is characterized by a fixed market access cost, a_{prod}^c , such that $p_d x_t - (a_{prod}^c + \beta x_t)w = 0$. After inserting p_d and x_t from above, one can solve:

$$a_{prod}^c = \sqrt{\frac{2f\alpha\delta}{w(1+\gamma)} \frac{1+\gamma}{1+\tau^{\frac{\theta}{\theta-1}}}} = a_{ex}^c \frac{1+\gamma}{1+\tau^{\frac{\theta}{\theta-1}}}. \quad (30)$$

All firms i such that $a_i \in [0, a_{prod}^c]$ are exporting firms that make non-negative profits on the home market, all firms i such that $a_i \in]a_{prod}^c, a_{ex}^c]$ are exporting firms that make negative profits on home market, i.e. are cross-subsidizing, while all firms i such that $a_i \in]a_{ex}^c, \alpha]$ are non-producing firms.

The number of firms

The way to find the number of firms is similar to the autarky and participation situations. The relations for the number of exporting firms making non-negative profits on the home market ($m_{t,gain}^c$) and the number of exporting firms making negative profits on the home market ($m_{t,loss}^c$) are given by⁶

$$\begin{aligned} m_{t,gain}^c &= \left(\frac{a_{prod}^c}{a_{ex}^c}\right)m \\ m_{t,loss}^c &= \left(1 - \frac{a_{prod}^c}{a_{ex}^c}\right)m. \end{aligned} \quad (31)$$

⁶Note that the distribution of active firms only runs from 0 to a_{ex}^c .

Furthermore, labor absorption is given by the production costs of active firms plus the innovation costs of n^c entry attempts, $m^c \left(\frac{a_{ex}^c}{2} + \gamma \frac{a_{ex}^c}{2} + \beta x_d + \beta \tau x_d \right) + n^c f = L$, which can be solved for n and subsequently for m^c , $m_{t,gain}^c$, and $m_{t,loss}^c$ to give

$$n^c = n^a = \frac{L(1-\theta)w}{f(1+w+\theta(1-w))} \quad (32)$$

$$m^c = n^c \frac{\sqrt{2f}}{\sqrt{w\alpha\delta(1+\gamma)}}. \quad (33)$$

4 Welfare Results

Consumer utility is our measure of welfare. Given goods market clearing and (1) in the autarky case, and (12) in the open economy case, we can write $U^a = m^a \left(\frac{x_d^a}{L}\right)^\theta$ in autarky and in the trade case $U = n_d \left(\frac{x_d}{L}\right)^\theta + n_t \left(\frac{x_t}{L}\right)^\theta + n_f \left(\frac{x_f}{L}\right)^\theta$. Setting in values from above and simplifying gives

$$U^a = \frac{2^{\frac{1+\theta}{2}} L w^{\frac{1-\theta}{2}} \beta^{-\theta} \theta^\theta (1-\theta)^{(1-\theta)} (f\alpha\delta)^{\frac{\theta-1}{2}}}{1+w(1-\theta)+\theta}, \quad (34)$$

$$U^p = U^a \gamma^{\frac{\theta-1}{2}} \left(\gamma + \tau^{\frac{2\theta}{\theta-1}} \right)^{\frac{1-\theta}{2}}, \quad (35)$$

$$U^c = U^a (1+\gamma)^{\frac{\theta-1}{2}} \left(1 + \tau^{\frac{\theta}{\theta-1}} \right)^{1-\theta}. \quad (36)$$

The following results can be stated.

Proposition 1. *Reductions in iceberg trade costs, τ , and fixed trade costs, γ , always increase welfare, independently of the status of partitioning, i.e. $\frac{\partial U^i}{\partial \tau}, \frac{\partial U^i}{\partial \gamma} < 0, i = p, c$.*

Proposition 2. *At the point of zero partitioning, the utility expressions with partitioning (35) and beyond partitioning (36) display identical levels and slopes of welfare, i.e. $U^p = U^c|_{\tau=\gamma^{\frac{\theta-1}{\theta}}}$ and $\frac{\partial U^p}{\partial \tau} = \frac{\partial U^c}{\partial \tau}|_{\tau=\gamma^{\frac{\theta-1}{\theta}}}$.*

Proposition 3. *A given reduction in τ results in a larger welfare gain beyond partitioning, compared to a situation with partitioning, i.e. $\frac{\partial \frac{\partial U^c}{\partial \tau}}{\partial \tau} > \frac{\partial \frac{\partial U^p}{\partial \tau}}{\partial \tau}$.*

5 Conclusion

This paper examines the welfare impact of trade liberalization in a two country intra-industry trade model with firm-level fixed cost heterogeneity. The model departs from the usually assumed parameter range, where barriers to trade are postulated to be sufficiently large such that not all firms will find it worthwhile to export. This assumption is commonly known as the partitioning condition. We relax the partitioning condition in the present framework. Studying the model beyond zero partitioning, we find that all firms export and we examine situations of cross-subsidization. Driven by intense competition from abroad, firms compensate losses on the home market with profits from export sales. The paper shows, that even though the economy has progressed beyond partitioning, i.e. the ultra-globalized world situation, further trade liberalization still increases welfare. In particular, a given reduction in iceberg trade costs turns out to generate a larger welfare gain once the economy is beyond the point of zero-partitioning.

In essence, the forces that are at work compare to those present in a closed economy – which is of course a good approximation to the ultra-globalized world. Within a closed economy, firm entry and survival depends on overall market size, not on the local or nearby market alone. Firms operating within one country will more often than not be cross-subsidizing, in the sense that sales and scale in their local region or city do not suffice to cover the firms' fixed costs.

References

- Bilkey, Warren J. (1978), An Attempted Integration of the Literature on the Export Behavior of Firms. *Journal of International Business Studies*, Vol. 9 (1), pp. 33–46.
- Hopenhayn, H. (1992), Entry, Exit, and Firm Dynamics in Long Run Equilibrium. *Econometrica*, Vol. 60, pp. 1127–1150.
- Jørgensen, J.G. and P.J.H. Schröder (2008), Fixed export cost heterogeneity, trade and welfare. *European Economic Review*, in press.
- Knight, Gary A. and S. Tamar Cavusgil (2004), Innovation, organizational capabilities, and the born-global firm. *Journal of International Business Studies*, Vol. 35, pp. 124–141.
- Melitz, Marc J. (2003), The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity. *Econometrica*, Vol. 71 (6), pp. 1695–1725.
- Moen, Oystein and Per Servais (2002), Born Global or Gradual Global? Examining the Export Behavior of Small and Medium-Sized Enterprises. *Journal of International Marketing*, Vol. 10 (3), pp. 49–72.
- Montagna, Catia (2001), Efficiency Gaps, Love of Variety and International Trade. *Economica*, Vol. 68, pp. 27–44.
- Schmitt, Nicolas and Zhihao Yu (2001), Economics of scale and the volume of intra-industry trade. *Economics Letters*, Vol. 74, pp. 127–132.