How the Type of Trade Liberalisation and the Preference Structure of Individuals Affects the Group of Supporting Firms

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This paper finds that within a heterogeneous trade model the effect of trade liberalisation on the export profits of different firms and in particular on overall profits across firms crucially depends on both the assumed demand structure and the type of trade cost decline. Two striking effects of marginal trade liberalisation can occur. A negative effect for the subset of the most and the least productive exporters. Quasi-linear quadratic preferences and CES-Preferences in combination with iceberg and unit trade costs are used in order to shed light on both, the mechanism which causes this effect and the general validity of these results. Thereby, the paper emphasises the interaction between the trade cost reduction effect and the pro-competitive effect as a result of trade liberalisation.

Keywords international trade, heterogeneous firms, trade cost

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1 Introduction

From a general perspective, it might be enough to conclude that average firm profits rise due to trade liberalisation. For an individual firm however, this conclusion is unsatisfactory. Also from a political economy perspective it seems rather important to understand how different types of liberalisation affect different firms differently.

Trade liberalisation treaties generally run through several steps of political negotiation accompanied by advocating and opposing lobby groups. The Dominican Republic-Central America Free Trade Agreement (CAFTA-DR) is an example where even within industries lobby groups argued in opposing directions. On the one hand the anti-CAFTA association argued that the resulting pro-competitive effect would harm the textile industry in the US. On the other hand some textile association supported the agreement and advocated the possibility to enter new markets ‘duty-free’. This shows clearly that even within one industry the firm heterogeneity leads to supporters and opponents of the free trade agreement.

At the same time trade liberalisation treaties become more and more differentiated. Tariff barriers become less important and the reduction of non-tariff barriers is in focus when reducing trade costs. Anderson and van Wincoop (2004) broadly define trade costs and thus potential channels through which liberalisation can take place, as an combination of transportation costs, policy barriers (tariffs and non-tariff barriers), information costs, contract enforcement costs, currency costs, legal costs, and distribution costs.

This paper brings these two findings together by showing that implications for firms crucially differ depending on the type of trade liberalisation. As such the paper focuses on the mechanisms of action in order to understand why different change affect different firms differently. Generally bilateral trade liberalisations can affect firms in two different manners. There is the apparent direct effect of lower trade costs. This effect intuitively should be positive even though the effect size might differ crucially across firms. Thus ceteris paribus all existing exporters can compile larger export profits and some of the before solely domestic firms will find it profitable to export. Secondly, as a result of the cost reduction effect firms also face a pro-competitive effect. While the effect declines profits ceteris paribus the magnitude differs across firms.

Comparing two of the most important heterogeneous trade models, Melitz (2003)
and Melitz and Ottaviano (2008), the first insight of this paper is that effects crucially depend on the assumed demand structure. In the first framework all exporters gain from a marginal bilateral reduction in the iceberg trade costs while solely domestic firms loose. In the second framework domestic firms loose but there are winners and losers in the subset of exporting firms. Both the most and the least productive exporters do not favour such liberalisations. The effect on the most productive firms is crucially dependent on the fact that the per unit trade cost reduction is largest for the most productive firms. The effect on the least productive exporters is more resistant to the type of trade liberalisation. This is illustrated using the Melitz and Ottaviano (2008) framework with a modified trade cost assumption. In line with Melitz and Trefler (2012) unit trade cost are introduced. The fact that the per unit trade cost change by the same amount for all firms eliminates the negative overall effect on the most productive firms. However, for the least productive firms the negative pro-competitive effect continues to dominate.

This paper is connected to two strands of trade literature. Despite their advantages as a modelling device in theoretic work, iceberg trade costs can only explain one part of the overall trade costs and fails to deliver a complete picture. This paper tries to face the legitimate criticism expressed by empiric works such as Baier and Bergstrand (2001), Hummels and Skiba (2004), or Anderson and van Wincoop (2004) by focusing on the implicit differences between the often used iceberg trade cost and unit trade cost. Thereby trying to understand the channels through which different liberalisations influence the profits of firms. As such this paper is part of the literature discussing variations in firm performance on the export markets. Kim (2013) finds that US firm which are more productive are more likely to lobby in favour of tariff reductions. Abel-Koch (2013) as well as the online extension of the paper by Ossa (2011) use models of firm heterogeneity to explore tariff settings. This literature is crucially based on the heterogeneous firm literature setting a stage by introducing models of firm heterogeneity. By emphasizing crucial differences in terms of across firm implications of different types of trade liberalisation this paper is in line with the work of Schröder and Sørensen (2014). They find that welfare effects of trade liberalisations depend on the type of liberalisation. In their work they differentiate between iceberg trade cost, fixed export cost, ad valorem tariff and a
trade license. As the paper evaluates the effect across heterogeneous firms, it is also part of a growing number of papers in international policy economy which try to understand the different lobbying incentives of firms within industries. Osgood (2013) show that within a Melitz and Ottaviano (2008) framework trade liberalisation in form of iceberg trade costs as well as ad valorem tariffs have different implications for firms within one industry. As such they explain why within an industry firms might take opposing lobbying position when it comes to trade liberalisation. While most of these studies only compare iceberg trade costs with ad valorem tariffs this paper focuses on the comparison with unit trade costs. Schröder and Sorensen (2010) similarly compare ad valorem with unit taxes in a closed economy version of the Melitz (2003) framework. The following analysis differs from their approach by using quasilinear quadratic preferences as in Melitz and Ottaviano (2008).

The remainder of this paper is organized as follows. In a first step the firm implications of marginal and discrete trade liberalisation within the Melitz (2003) model are revisited. In a second step the Melitz and Ottaviano (2008) framework is used to assess how a linear demand structure alters the effect of trade liberalisation for firms. In the following the assumption of iceberg trade cost is replaced by a unit trade cost assumption. In a final step the three frameworks are compared and the determinacy of the different implications are evaluated. In the conclusion the paper sums up the implications and the mechanism of action of the two types of trade liberalisation.

2 The Effect of Trade Liberalisation on Firm Profits

For most of the heterogeneous firm trade models it holds that trade liberalisation is associated with two effects. The direct effect is some form of trade cost reduction. At the same time this reduction causes changes in the market structure leading to more competitive markets. From an overall perspective both effects are rather positive considering that for most cases tougher competition is favourable. However, from a firm perspective these two effects have opposing signs. The effect due to lower trade cost ceteris paribus makes exporting more profitable. This direct effect influences only the profits of exporting firms. At the same time all firms have to face tougher competition which ceteris paribus translates into profit losses. Therefore, one can conclude that the pro-competitive effect implies that purely domestic firms suffer
from liberalisation. The overall effect of liberalisation for exporting firms as well as for those which become exporters due to liberalisation is not as clear cut.

2.1 CES- Preferences and Iceberg Trade Cost

This section is based on the [Melitz (2003)](http://example.com) framework. Key features of this model are a two tiered preference structure. Cobb-Douglas preferences across sectors and constant elasticity of substitution preferences across a continuum of differentiated goods within each sector, are assumed; where \( \sigma > 1 \) denotes the elasticity of substitution between any two varieties. In addition to the differentiated sectors a homogeneous goods sector is modelled where production takes place under constant returns to scale and perfect competition. Assuming a one to one mapping between labour and output of the homogeneous good and using it as numéraire pins down the wage to unity. The heterogeneous good sectors are assumed to be monopolistically competitive and each firm specializes on the production of a single horizontally-differentiated variety. Production embeds fix cost \( f \) and marginal cost \( c \), which varies across firms.\(^2\) Marginal costs can be interpreted as an inverse measure of the productivity of a firm and thus uniquely specifies a firm. As by now standard, it is assumed that productivities are Pareto distributed and potential market entrants can draw their productivity at a cost \( f_E \). For simplicity the analysis is restricted to a two country case where both countries are identical. Trade comprises fix cost of exporting \( f_X \) as well as iceberg type transport cost \( \tau \) which are the same in both countries.

Solving the model by setting up the profit maximisation of firms and equating the costs and expected benefits of entering the market, two marginal cost cutoffs can be derived:

\[
\begin{align*}
c_D &= \left( \frac{\sigma - 1}{k - (\sigma - 1)} \right) \frac{f + \tau^{-k} \left( \frac{f_X}{f_E} \right)^{\frac{k}{\sigma-1}} f_X}{\frac{f_X}{f_E}} \left( \frac{f_X}{f_E} \right)^{\frac{1}{\sigma-1}} \left( \frac{f_X}{f_E} \right)^{\frac{1}{\sigma-1}} \end{align*}
\]

where \( c_D \) is the domestic cutoff which identifies the firm being indifferent between starting domestic production and leaving the market. The marginal exporting firm is depicted by the export cutoff \( c_X \).

\(^2\)Notation wise the marginal cost \( c \) is used compared to [Melitz (2003)](http://example.com) who uses the productivity. This makes later comparison to the other two frameworks easier.
Figure 1: Overview on the different effects of different types of trade liberalisation
Trade liberalisations in form of lower iceberg trade costs result in a decline of the domestic cutoff and increase of the export cutoff. While the most unproductive solely domestic firms leave the market, the most productive solely domestic firms start exporting.

The domestic cutoff thereby can be interpreted as an inverse measure of competition. A decline due to trade liberalisations thus reflects the pro-competitive effect.

Profits of a firm can be written as a function of a firms marginal cost and the domestic cutoff:

$$\pi_D(c) = \left( \frac{c_D}{c} \right)^{\sigma - 1} - 1 \right) f ; \quad \pi_X(c) = \left( \frac{c_D}{c} \right)^{\sigma - 1} \tau^{1-\sigma} f - f_X$$

(2)

$$\pi(c)_{e<e_X} = \left( \frac{c_D}{c} \right)^{\sigma - 1} (1 + \tau^{1-\sigma}) f - f - f_X .$$

(3)

Figure 1a top panel depicts profits as a function of marginal costs and illustrates that domestic, export and overall profits rise the more productive a firm is. Instead of illustrating the profit distribution across firms for a given size of trade cost Figure 2 illustrates profits from a single firm’s perspective as a function of trade cost. For $^3$For the remainder of the paper profits always refer to operating profits excluding the sunk up front fix cost $f_E$.
rather large trade costs the firm only supplies the domestic market. If trade costs are low enough $\tau \leq \tau^*_c$ the firm starts exporting. The upward sloping overall profit line for $\tau > \tau^*_c$ illustrates what was argued before in a more general manner, solely domestic firms lose in terms of overall profits if trade is liberalised. The intuition thereby is straight forward. The domestic cutoff falls, creating fierce competition and in consequence domestic profits fall. The cost reduction effect only applies for exporting firms and thus solely domestic firms lose. The export profit equation and the overall profit equation of an exporting firm depict the interplay of the pro-competitive effect (decline in $c_D$) and the cost reduction effect (falling $\tau$) due to trade liberalisations. Figure 2 depicts a firm for which, if exporting, the pro-competitive effect is dominated by the cost reduction effect. In order to show that this holds true for any exporting firm a closer look at the derivatives is necessary:

\[
\frac{\partial \pi_D}{\partial \tau} = - \frac{(\sigma - 1) f f_X}{\tau \left( f f^k \left( \frac{f_X}{f} \right)^{\frac{1}{\sigma}} + f_X \right)} \left( \frac{c_D}{c} \right)^{\sigma - 1} < 0 \tag{4}
\]

\[
\frac{\partial \pi_X}{\partial \tau} = \left( \frac{\sigma - 1}{f} \right)^{\frac{k - (\sigma - 1)}{\sigma - 1}} \frac{(\sigma - 1) f f_X}{\tau \left( f f^k \left( \frac{f_X}{f} \right)^{\frac{1}{\sigma}} + f_X \right)} \left( \frac{c_D}{c} \right)^{\sigma - 1} > 0 . \tag{5}
\]

It is straight forward that export profits rise when trade is liberalised and thus the cost reduction effect dominates the pro-competitive effect on the export market. However, for an exporting firm not only export profits but overall profit and thus the sum of both effects are important.

For an finite variance of the productivity distribution it must hold that $k > \sigma - 1$. To ensure selection into the export market it must hold that $\tau^{\sigma - 1} f_X > f$. Due to these parameter restrictions it is clear that the effect on the export profits is larger in absolute terms than the effect on domestic profits. The pro-competitive effect on the domestic and the export market is dominated by the trade reduction effect on the export market and thus all already exporting firms benefit from trade liberalisations.

Finally, there is the question what happens to profits of those firms which start exporting after trade is liberalised. Considering a marginal trade liberalisation the answer is unambiguous and illustrated by Figure 1(d) center panel. The increase in export profits, as a consequence of trade liberalisation, is larger than the decline in domestic profits. The marginal exporter gains if trade is liberalised marginally. Looking at a discrete change the effect of trade liberalisation for those firms which
start exporting is ambiguous. While the most productive of this subset of firms will
gain, it is possible that the least productive of the new exporters will lose, in terms
of overall profits. Considering the firm in Figure 2 a reduction of trade costs from
\( \tau_1 \) to \( \tau_2 \) would lead to a situation in which the firm starts exporting, however this
would lead to a decline in overall profits.

The profit derivatives (1) and (2) also show that the domestic profits fall most in
absolute terms for the most productive firms while export profits rise most. Figure
1a center panel depicts this effect. More explicitly both the pro-competitive effect
as well as the cost reduction effect of trade liberalisations rise along with the firm’s
productivity.

One can define the profit elasticity with respect to trade cost changes as \( \frac{\partial \pi}{\partial \tau} \). The
bottom panel of Figure 1a illustrates this elasticity. Opposite to the absolute change
the relative change declines with the firm’s productivity. This implies that the most
productive exporters (solely domestic firms) gain (lose) least in relative terms. As
such ceteris paribus the profit distribution across firms becomes more equal. Putting
things together the following corollary can be established.

**Corollary 2.1** Within a framework with constant elasticity of substitution preferences a marginal decline in iceberg trade costs lowers profits of solely domestic firms and increases overall profits of all exporting firms. Overall profits of the most productive exporting firms increase most in absolute terms, however, least in relative terms.

### 2.2 Quasilinear Quadratic Preferences and Iceberg Trade Cost

The theoretical framework by Melitz (2003) builds on the assumption of constant
elasticity of substitution preferences. This assumption entails two results which
stand at odds with empirical findings. Firstly, the mark-up charged by firms is the
same across firms and independent of the degree of competition. Levinsohn (1993)
as well as Feenstra and Weinstein (2010), among several others, show that trade
liberalisation typically increases competition and forces firms to lower their mark-
ups and prices. The second result at odds with reality is that the CES demand
structure implies that the market size affects only the mass of firms but not the
within-industry productivity distribution. Yet, Campbell and Hopenhayn (2005)
present empirical evidence that retail establishments in large markets have higher
sales and employment. Furthermore, Syverson (2004) finds that larger markets have both, a higher average plant size and a higher average productivity.

These two caveats are accommodated by Melitz and Ottaviano (2008) who depart from using CES preferences and assume that consumer preferences are quasi-linear between a homogeneous and a differentiated sector with quadratic preferences across varieties within the differentiated sector. The production technology is almost identical to Melitz (2003). Labour is the only factor of production and each country is endowed with \( L \) workers which also can be referred to as the market size. The homogeneous good is produced under perfect competition and constant returns to scale with a unit labour requirement. Choosing the homogeneous good as numéraire also pins down a unitary wage in each country. The differentiated varieties are produced under conditions of monopolistic competition and constant returns to scale. In order to enter the differentiated sector and to learn its marginal cost draw which again is assumed to be Pareto distributed, a firm must incur a sunk entry cost of \( f_E \) units of labour. In contrast to Melitz (2003), there are no further fixed production costs neither on the domestic nor on the foreign market. The existence of a choke price, due to the quasi linear quadratic preferences, is sufficient to ensure selection into exporting. In analogy to the previous framework the analysis is restricted to a two country case where trade of the differentiated good comprises iceberg transport costs which are assumed to be the same independent of the direction of trade.

Setting up the profit maximisation of firms and imposing the free entry condition allows to solve for the domestic and export cutoffs

\[
    c_D = \frac{L}{4\gamma} \left( \frac{1}{1 + \tau^{-k}} \right)^{\frac{1}{1+k}} \left( \frac{\gamma \phi}{L} \right)^{\frac{1}{1+k}}; \quad c_X = \frac{c_D}{\tau}, \tag{6}
\]

which, due to the symmetry, are the same in both countries. As in the previous framework the domestic cutoff identifies the firm which is indifferent between starting production on the domestic market and exiting it. The export cutoff identifies the firm which is indifferent between starting to export and solely domestic supply. In line with the previous results, trade liberalisations in form of a iceberg trade cost reduction lowers the domestic cutoff, increasing the competition on the market and forcing the least productive firms to exit the market while it raises the export cutoff. This enables relatively less productive firm to start exporting.

\(^4\)In order to allow an easier comparison to the other frameworks and to simplify manners it is assumed that both countries have the same size.
Using the domestic cutoff as a measure of the competitive pressure on the market
firm profits can be written as

$$\pi_D(c) = \frac{L}{4\gamma} [c_D - c]^2, \quad \pi_X(c) = \frac{L}{4\gamma} [c_D - \tau c]^2, \quad \pi(c|c < c_X) = \pi_D + \pi_X, \quad (7)$$

where overall profits are given by the sum of domestic and export profits, if a firm
also exports, and otherwise are equal to domestic profits. As illustrated in the
upper panel of Figure [10] profits fall the larger the marginal cost. This holds true for
domestic and export profits and in consequence also for overall profits. Comparing
the profit curves to the ones in the Melitz (2003) framework, it becomes clear that
different from their result, even an infinitely productive firm with zero marginal
cost would earn finite profits. This is a direct result of the quasilinear quadratic
preferences and the resulting linear demand structure.

![Figure 3: Profits of two specific firm as a function of bilateral iceberg trade costs in
a framework with Quasilinear Quadratic Preferences. Firm 1 (gray) is the relatively
less productive firm.](image)

Considering the effect of iceberg trade cost reduction for a single firm, Figure [11] shows
that the interplay between the cost reduction and the pro-competitive is more com-
plicated. It illustrates two exemplary firms. Firm 1 (gray) which is the relatively less productive one, starts exporting for $\tau \leq \tau^{*}_{c_1}$ while firm 2 (black) is exporting for any considered transport cost. Considering overall profits in the range of transport costs where firm 1 only serves the domestic market illustrates that it again is true that domestic profits are only affected by the pro-competitive effect and in consequence solely domestic firms loose in overall profit terms if trade is liberalised.

Considering profits of firm 1 in the range between $\tau^{P}_{c_1}$ and $\tau^{*}_{c_1}$, shows that overall profits fall when trade is liberalised within this range, even though the firm is exporting and thus benefits from the transport reduction effect. The transport costs $\tau^{P}_{c_1}$ thereby mark the critical value beneath which further cost reduction implies a positive effect on overall profits of firm 1. In a next step let us consider the relatively more productive firm 2. Starting out with high transport costs trade liberalisation increases overall profits as the decrease in domestic profit’s is overcompensated by the rising export profits. However, as soon as trade costs fall below $\tau^{N}_{c_2}$ the still rising export profits fail to compensate for the domestic losses when trade is liberalised. Summing things up firm 2 finds transport costs of $\tau^{N}_{c_2}$ optimal while firm 1 prefers free trade. The analysis of these two exemplary firms shows that the effect of trade liberalisation has rather different implications even within the subset of exporting firms.

The interplay of the opposing pro-competitive and trade cost reduction effect is illustrated in the export profit equation (8). The direct cost reduction effect rises export profits due to lower iceberg trade costs. The pro-competitive effect, also present on the export market, is lowering the entry cutoff and thus lowering charged mark-ups and also profits from exporting. Other than for Melitz (2003) there is no clear dominance of one of the two effects. Differentiating the profit equation with respect to the iceberg trade cost shows this ambiguity

$$\frac{\partial \pi_D}{\partial \tau} = \frac{L}{2\gamma} \left( c \frac{k}{k + 2} \frac{c_D(c_D - c)}{\tau (1 + \tau^k)} \right) > 0, \quad \text{if } c \leq c_D \quad (8)$$

$$\frac{\partial \pi_X}{\partial \tau} = \frac{L}{2\gamma} \left[ c^2 - \left( c_X + \frac{k}{k + 2} \frac{c_X}{1 + \tau^k} \right) c + \frac{k}{k + 2} \frac{c_X^2}{1 + \tau^k} \right] \leq 0, \quad \text{if } c \leq c_X \quad (9)$$

The effect of trade liberalisations takes a quadratic form with respect to the firms marginal costs. It becomes clear that the export profits of the marginal exporter do not change when trade costs are reduced marginally. In consequence, the marginal exporter faces lower overall export profits if trade is liberalised as the decline in
domestic profits is not compensated by rising export profits. This is different to the \textcite{Melitz2003} framework where also the marginal exporter gains from trade liberalisation both in terms of export and overall profits. Due to the quadratic form the effect of trade liberalisation on export profits is positive for an intermediate range of marginal exporters. However, the most productive firms with marginal cost close to zero face a lost in terms of export profits if trade is liberalised.

Putting the argument differently it can be shown that for given trade cost there exist two additional cutoffs determining exporting firms which are indifferent between further marginal trade liberalisation and status quo. As illustrated in Figure \ref{figure:figure11} three subgroups can be identified within the group of exporters. The least productive exporters \(c \in (c_{x}, c_{x_{1}})\), lose in terms of overall profits if trade is liberalized. Somewhat surprisingly this also holds for the most productive firms \(c \in (0, c_{\tau})\). Only the intermediate productive exporters \(c \in (c_{x}, c_{\tau})\) gain from trade liberalisations in terms of overall profits. The indifference cutoffs can be solved explicitly and are given by:

\[
c_{x_{\tau}} = \frac{(k (\tau^{k+1} + 2\tau + 1) + 2\tau (\tau^{k} + 1)) (\tau^{k+1})^{\frac{k+1}{k}} (\frac{\gamma\phi}{L})^{\frac{1}{k+1}}}{2(k + 2)\tau^{2} (\tau^{k} + 1)}
\]

\[
\pm \sqrt{\left(\frac{\tau^{k+1}}{\tau^{k+1}}\right)^{\frac{1}{k+1}} \left((k (\tau^{k+1} + 2\tau + 1) + 2\tau (\tau^{k} + 1))^{2} - 8k(k + 2)\tau^{2} (\tau^{k} + 1)\right) (\frac{\gamma\phi}{L})^{\frac{2}{k+2}}} \frac{2(k + 2)\tau^{2} (\tau^{k} + 1)}{2(k + 2)\tau^{2} (\tau^{k} + 1)}.
\]

In order to understand the economic intuition of the effect of trade liberalisations on overall profits one needs to understand the effect on the export profits first. The argument thereby is two folded. One the one hand the more productive a firm and thus the larger the number of products sold in a market, the larger is the negative pro-competitive effect of trade liberalisations. This is illustrated in the center panel of Figure \ref{figure:figure11} by the upwards sloping dashed line depicting the change in domestic profits. The positive relationship between the productivity of a firm and the faced competition effect is also present on the export market.

On the other hand there is the trade cost reduction effect which by itself can be split up in two separate effects. The iceberg specification implies that the per unit cost of an exported good \(\tau c\) changes by \(c\) if trade is liberalised. As such the per unit cost reduction of trade liberalisation is highest for the least productive exporters.
For a possible firm with zero marginal costs this implies the somewhat strange result that a trade cost reduction has no positive unit cost effect. At the same time the quantity sold, decreases with the export productivity, where the marginal exporter sells only zero units. For the cost reduction effect this implies a hump shaped relationship. While the most productive and the marginal exporter do not encounter a cost reduction effect (the first because he faces no unit cost reduction the latter because he sells no units) the medium range realises a cost reduction effect.

Bringing together the cost reduction and the pro-competitive effect on the export market suggests that the gains in terms of export profits increase starting with a zero increase for the marginal exporter. With an increase in productivity the cost reduction effects first dominates the pro-competitive effect, the rising productivity results in a stronger pro-competitive effect causing a decline in the still positive effect of trade liberalization. With further increasing productivity the positive cost reduction effect starts to fall and for the most productive exporters is dominated by the pro-competitive effect on the foreign market.

Adding the result of the domestic market to this picture allows to understand the overall effect. The negative domestic effect implies that the least productive exporting firms face overall profit losses when trade is liberalised. The most productive firms lose in terms of overall profits because domestic profits fall when trade is liberalised and export profits either also fall or rise by a non sufficient amount to cover the domestic profit decline. Only the intermediate productive exporting firms, for which the cost reduction effect is the largest gain, if trade is liberalised.

The bottom panel of Figure 16 illustrates how elastic profits react to trade liberalisations. In line with the first framework the relative response in domestic and export profits to trade liberalisation decreases with the firms productivity. However, in contrast to the first framework export profits fall for the most productive firms. For the domestic profit distribution this means an increase in inequality. The opposite is true for the export profit distribution because the more productive an exporter, the less positive is the effect of trade liberalisations in relative terms. The relative change of overall profits within the subgroup of exporting firms can be best described as a hump shaped form which is skewed toward the less productive exporters. The medium to relatively less productive exporting firms gain most in relative terms while the most and least productive firms lose most in relative terms.
Corollary 2.2 Within a framework of quasilinear quadratic preferences only the intermediate productive exporting firms gain from a marginal decline in iceberg trade costs. Solely domestic firms as well as overall profits of the most and least productive exporting firms fall. The intermediate to relative less productive exporting firms are also those which gain most in relative terms.

2.3 Quasilinear Quadratic Preferences and Unit Trade Cost

The negative effect of trade liberalisations for the most productive firms in the Melitz and Ottaviano (2008) framework seems to some extent puzzling. In order to illustrate the limitations of this result it is helpful to consider a slight modification of the discussed framework as used by Melitz and Trefler (2012). Instead of using iceberg trade costs, which assume the same productivity in the production and the transport process, simple unit transport costs $t$ are introduced. All other assumptions are maintained. Profit maximisation of firms thus is almost identical of course differing by the modelling of transport cost. Using the fact that as before the marginal cost cutoff has to be equal to the choke price in the market, one can write profits of a firm as

$$\pi_D(c) = \frac{L}{4\gamma}[c_D - c]^2; \quad \pi_X(c) = \frac{L}{4\gamma}[c_D - c - t]^2; \quad \pi(c)|_{c<c_X} = \pi_D + \pi_X. \quad (11)$$

As domestic profits are not directly affected by the modified transport cost assumption they do not differ compared to the previous section apart from the different underlying cutoff. For exporters unit costs now are given by the sum of production and transport cost $c + t$. In order to ensure selection into exporting it must hold that $c_D > t > 0$ or respectively $c_{\text{max}} < c_X > 0$ such that at least some and not all firms serve the export market. This assumption is equivalent to the assumption that unit trade costs are positive and smaller than the prohibitive price. The top panel of Figure 1c illustrates profits across firms. Different to the case of iceberg trade costs now profits on the domestic and the export market differ also for the most productive firms. Even more the difference between the two markets increases. This is because more productive firms export more and thus also overall transport costs increase with the productivity.

Figure 4 illustrates a single firm perspective on trade cost. As in the previous two
frameworks a trade cost reduction affects firm profits negatively if a firm is only selling on the domestic market \((t > t^*_c)\). In a situation where unit trade cost are such that a firm only sells few quantities on the export market \(t^D_c < t < t^*_c\), trade liberalisations decrease overall profits. Thereby \(t^D_c\) marks the critical size of trade cost below which the specific firm gains if transport cost are lowered even further. This is similar to the previous framework with quasilinear preferences and iceberg trade cost.

Due to the additive nature of the transport cost it is not possible to solve for the cutoffs explicitly. Imposing the free entry condition defines the domestic cutoff in the following implicit form

\[
c^k_D + (c_D - t)^{k+2} = \frac{\gamma \phi}{L}.
\]  

The implicit formulation implicates that a decline in trade cost is associated with a decline of the domestic cutoff as the change of the left hand side of the equation has to be zero which only can be true if the domestic cutoff also falls. Taking into account that the export cutoff is given as \(c_X = c_D - t\) the implicit formulation of the domestic cutoff also implies that the export cutoff has to increase if trade costs fall. This seems intuitive as a cost reduction should allow also relatively less productive firms the earn profits on the export market.

Figure 4: Profits of a specific firm as a function of bilateral unit trade costs in a framework with Quasilinear Quadratic Preferences.
Different to the iceberg specification, a trade cost reduction has the same unit cost reduction effect for all exporters. It is thus clear that the cost reduction effect of trade liberalisation is largest for the exporters selling the most products on the foreign market. As such both the cost reduction and the pro-competitive effect on the export market increases with the number of sold products and therefore with productivity. The direct cost reduction effect however dominates, resulting in rising export profits when trade is liberalised. This dominance can be derived using the implicit cutoff condition \((12)\) and the profit equation \((11)\). As argued before the export cutoff falls implying that the change in the domestic cutoff is smaller then the change in the unit trade cost. This fact directly implicates that profits will rise. The center panel of Figure 1d depicts the increase in export profits and the decline in domestic profits if trade is liberalised. The profit derivatives with respect to unit trade costs

\[
\frac{\partial \pi_D}{\partial t} = \frac{L}{2 \gamma} \frac{c_{X}^{k+1}}{c_{D}^{k+1} + c_{X}^{k+1}} (c_D - c) > 0 \quad \text{if } c \leq c_D, \quad (13)
\]

\[
\frac{\partial \pi_X}{\partial t} = - \frac{L}{2 \gamma} \frac{c_{X}^{k+1}}{c_{D}^{k+1} + c_{X}^{k+1}} (c_X - c) < 0 \quad \text{if } c \leq c_X, \quad (14)
\]

\[
\frac{\partial \pi}{\partial t} = - \frac{L}{2 \gamma} \left( \frac{c_D c_X (c_{D}^{k} - c_{X}^{k})}{c_{D}^{k+1} + c_{X}^{k+1}} - \frac{c_{D}^{k+1} - c_{X}^{k+1}}{c_{D}^{k+1} + c_{X}^{k+1}} \right) \leq 0 \quad \text{if } c \leq c_X, \quad (15)
\]

confirm this argumentation and also allow to understand the overall effect. For the least productive exporters the pro-competitive effect on both markets dominates the cost reduction effect on the export market. This effect is comparable with the results of declining iceberg trade cost. However, there is no negative effect of trade liberalisation for the most productive firms, they actually gain most in absolute terms. The firm producing with marginal cost of \(c_T = \frac{c_{X} c_{D} (c_{D}^{k} - c_{X}^{k})}{c_{D}^{k+1} - c_{X}^{k+1}}\) can be identified as the exporter who is indifferent if trade is liberalised marginally.

Similar to the previous two frameworks export and domestic profits of the most productive firms change the least in relative terms if trade is liberalised, illustrated in the bottom panel of Figure 1d. In turn, overall profits rise most in relative terms for the most productive firms. At the same time the least productive exporting firms lose most within the subgroup of exporters and the least productive domestic firms lose most in relative terms. As such the profit inequality across firms increases for both the subset of exporting firms as well as across all firms.
Corollary 2.3  Within a framework of quasilinear quadratic preferences only the most productive exporting firms gain from a marginal reduction in unit trade costs. Solely domestic firms as well as the least productive exporting firms lose in terms of overall profits. In relative terms the most productive firm gain most while the least productive firms lose most causing a ceteris paribus increase in inequality between firm profits.

3  Comparison of the Three Frameworks

Before comparing the implications of the presented frameworks it is important to once again emphasise the models’ differences in terms of underlying assumptions. The two main differences are within the assumed preference structure of individuals and the cost structure of firms. The first framework uses a two tier CES-preference structure. Consequently, demand is iselastic. This specification implies that there exists a positive demand independent of the price. As such there is no natural selection into exporting. Furthermore, an iselastic demand structure implies an infinite demand if prices converge towards zero. In the second and third framework quasilinear quadratic preferences and in consequence a linear demand structure is assumed. Key features are a prohibitive price and a finite demand even if prices are zero. This itself ensures selection into exporting if trade costs are positive. Thus, in the second and third framework, other than in the first framework, one can drops fix costs.

Trade costs are modelled in the iceberg-type fashion in the first two frameworks. The idea is that $\tau > 1$ units of goods have to be shipped in order to sell one unit on the export market. This assumption implies that firms are as productive in the good production as in the trading process. In consequence, the most productive firms also pay the lowest unit transport costs and in the limit an infinitely productive firm pays zero unit transport costs. In the third framework unit transport costs are used, implying that each product exported causes trade cost of $t > 0$. As such all firms are equally productive in the trading process.

The assumption of quasilinear quadratic preferences implies that even for a firm with zero marginal costs profits are finite, while the iselastic demand structure resulting from the CES-Preferences implies infinite demand and profits, if marginal
costs are zero. The iceberg cost assumption and a linear demand structure leads to a declining difference between domestic and export profits the more productive a firm. For a firm with zero marginal costs this means identical profits on both markets. The unit trade cost assumption alters this result. Contrary the difference between the domestic and the foreign profit increases with the productivity of firms. The same holds true for the CES-framework. This is the case because a firm’s overall trade cost rises with productivity. Overall trade costs fall as the decline of unit trade costs is overthrown by the even more rising demand. This again is a result of the isoelastic demand structure.

The effect of trade liberalisation on domestic profits is the same, independent of the preference and cost assumption. Domestic profits fall due to the pro-competitive effect. While within the subset of solely domestic the most productive firms lose most in absolute terms they lose the least in relative terms.

The CES-Preference structure implies that exporters gain if trade is liberalised. While the most productive ones gain most in absolute terms they gain least in relative terms. The use of quasilinear quadratic preferences reveals two different effects. Trade cost reductions are negative for the least and the most productive firms. While the first effect is independent of the trade cost assumption the second is caused by the iceberg trade cost assumption.

The negative effect for the most productive firms is due to the iceberg typ trade cost assumption. A reduction of iceberg trade cost implies the smallest unit cost change for the most productive firms. If the change in sold quantities is finite when trade cost are changed marginally there exist a range of the most productive firms for which the cost reduction effect is dominated by the pro-competitive effect. The isoelastic demand conceals this effect in the CES framework. If the marginal costs converge to zero on the one hand the unit cost reduction effect of trade liberalisation converges to zero. On the other hand isoelastic demand implies that the exported quantities converge to infinity. In total, the quantity effect dominates, implying that the cost reduction effect converges towards infinity and thus also the effect of trade liberalisation is positive.

The negative effect of trade liberalisations for the subset of low productive exporting firms can be explained by the relative small significance of the export profits for overall profits. While the cost reduction effect and the increase in export profits is relatively small, because only few quantities are sold the losses on the domestic market due to the pro-competition effect are large, because relatively many quanti-
ties are sold domestically. This negative effect for the least productive exporters is not present in the CES framework. The reason for this result can be found in the assumption on export fix costs. The selection into exporting condition implies that fix costs are at such a height that even for the marginal exporter the export profit gains from trade liberalization overcompensate the losses on the domestic market.

The relative change in profits due to trade liberalisations do not crucially differ across the three frameworks if one compares the effect on the two markets separately. While the relative effect on domestic profits is negative and largest for the least productive firms it is positive for export profits and also largest for the least productive firms. Only in the second framework the most productive exporting firms face a negative effect which is largest for the most productive firms.

The relative effect of trade liberalisations on overall profits of exporting firm differs however crucially across frameworks. With CES- preferences the least productive exporters gain most. In complete opposite with quadratic preferences and unit trade cost the most productive exporters gain most while the least productive even lose if trade is liberalised. In the second framework the relative effect is more complicated. In the subset of relatively productive exporters the most productive ones lose most. Within the subset of least productive exporters the least productive ones lose most. Only the group of intermediate productive exporter gain if trade is liberalised marginally.

4 Conclusion

Most of the results were already discussed in the previous section. As such the conclusion will only give a rather short overview and concentrate on the implications for the political economy and possible further research.

Domestic firms lose from marginal trade liberalisation for both preference structures and both types of trade cost reduction. The reason for this is that the domestic market is only affected by the pro-competition effect. As such this argument is true for domestic profits in general.

The effect of trade liberalisation on exporting profits and in particular on overall profits crucially depends on both the assumed demand structure and the type of trade cost decline. Two striking effects can be identified. The first effect is a negative effect of liberalisation for the relatively small exporters,
because for those the negative pro-competitive effect is relatively large. This is true for both types of trade liberalisation. In the first framework where the selection into exporting condition implied positive fix costs this effect is not present as the imposed size of fix costs implies that there is no such subset of relative unproductive exports.

The second effect is that the subgroup of most productive exporters opposes trade liberalisations. This can be linked to the iceberg trade cost specification and their tide connection to the firms marginal costs. The result does not hold for unit trade cost. In addition in a CES framework the isoelastic demand structure implies an opposing and dominating effect which is why in the [Melitz (2003)] framework this effect of iceberg trade liberalisations is not visible.

From a political economy perspective this demonstrates the theoretical importance of differentiation between different types of liberalisation. Therefore, the different mechanisms through which per unit trade cost, per value trade cost, per marginal cost trade cost and fix costs affect firms’ costs and consequently profits need to be understood. Knowing the mechanism helps to understand why different firms prefer or oppose different types of trade liberalisations. At the same time this analysis is limited to the extent that for most part only marginal trade liberalisations are considered. Even though this helps when evaluating discreet changes due to trade liberalisations it misses out some aspects. As such this paper can be understood as an indication that when trying to understand firms lobbying as a consequence of a free trade treaty it is important to differentiate between the different channels in order to understand why a specific firm supports or opposes.

Within this paper it seems important to add a section on per value trade costs (ad valorem tariffs) as well as on the effect of changes in the export fix costs. This would add two other main types of trade costs and as such enhance the understanding of the differentiated effect of trade liberalisation on firms. However, this comes with costs in terms of algebraic solvability.

As the implications for firms are rather different it is important to understand both, which types of trade cost are relevant and to which extend. Furthermore, it is important to empirically evaluate which firms on the one hand lobby in favour or against trade liberalisation and on the other hand actually profit from trade liberalisation. Both questions need further investigation and thus should be considered for further research.
References


