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Welfare Effects of Trade Liberalization with Intra-industry Reallocations: The Importance of Preferences and Market Failures

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Welfare Effects of Trade Liberalization with Intra-industry Reallocations: The Importance of Preferences and Market Failures

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Abstract

This paper shows that the novel gains from trade liberalization driven by intra-industry reallocations (Melitz (2003)) are not robust to changes in the preference structure. In the Melitz (2003) setting the unambigousness of the welfare effect depends crucially on the assumption of traditional CES preferences, which ensures equivalence of the market equilibrium and the social planner solution. For other preferences this equivalence is broken and trade liberalization may reduce welfare by magnifying market failures. An exact condition for trade liberalization to reduce overall welfare is derived under the assumptions of generalized CES preferences and a specific distribution (Pareto) of firm heterogeneity.

Keywords: Heterogenous firms, monopolistic competition, trade liberalization, welfare.

JEL codes: D6, F12 and F15.

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1 Introduction

The advent of a third consensus model in international trade heralds novel gains from trade liberalization. It is a novel and widely noted prediction of the seminal paper 'The impact of trade on intra-industry reallocations and aggregate productivity' by Marc Melitz (Melitz (2003)) that trade liberalizations induce unambiguous welfare improving intra-industry reallocations among heterogenous firms. Firm heterogeneity in productivity combined with fixed costs of production and exporting implies that firms self-select into exiters, non-exporters and exporters. Trade liberalization therefore impacts differently on different firms, and market shares shift from low-productivity non-exporting firms towards high-productivity exporting firms. This in turn improves overall production efficiency. Intra-industry reallocations improve welfare due to changes in average productivity and in the number of varieties available to consumers and are by now widely accepted as an important source of gains form intra-industry trade.

The main contribution of the present paper is to show that the aggregate gains from trade liberalization in the Melitz (2003) framework are not robust to changes in the utility specification. The finding that with firm-heterogeneity trade liberalization brings some negative elements to the welfare calculus is by no means new (see e.g. Montagna (2001), Melitz (2003), Jørgensen and Schröder (2008), Demidova and Rudríguez-Clare (2009) and Baldwin and Forslid (2010)); yet what is new is that the actual balance of positive and negative contributions may tip, such that the aggregate effect from multilateral trade liberalization on welfare may become negative even when countries are symmetric.[1] The gains from trade liberalization may turn into pains from trade liberalization when preferences are not of the traditional CES type assumed in Melitz (2003). Trade liberalization is traditionally modelled as a reduction in real trade costs (iceberg) and therefore corresponds to

[1]In fact Montagna (2001) identifies overall negative welfare effects comparing situations of free-trade with autarky for asymmetric countries, see the detailed discussion below. Furthermore, negative net-welfare effects from multilateral trade liberalization among symmetric countries are found in Jørgensen and Schröder (2008) in a setting with symmetric countries and fixed export costs heterogeneity, while Melitz (2003) and Baldwin and Forslid (2010) arrive at overall positive welfare effects, despite identifying possible negative contributers to welfare. Demidova and Rodríguez-Clare (2009) show, albeit in a small open economy setting, that introducing an import tariff or an export tax improves welfare as they counteract existing market failures.

an improved export technology which naturally improves welfare in the social planner equilibrium. Thus amplified market failures are the source of a possible welfare loss from trade liberalization. In the Melitz (2003) setting with increasing returns and monopolistic competition market failures are generally present. However, in the special case of traditional CES preferences market failures cancel out and trade liberalization becomes unambiguously welfare improving. That market failures cancel out in this case is a central point of Benassy (1996)[2], albeit derived for a closed economy with homogenous firms. In particular, Benassy (1996) shows that a necessary condition for the social planner optimum in a monopolistic industry to coincide with the market equilibrium is that the taste for variety must be linked to the elasticity of demand exactly as it is in the case with traditional CES preferences.

Increases in the number of varieties due to trade have been shown to be important quantitatively and have important welfare consequences (see e.g. Broda and Weinstein (2004 and 2006)). However, the monopolistic trade model of Krugman (1980) with traditional CES preferences and homogenous firms overstates the welfare gains from increases in the number of varieties (see Ardelean (2009)). Generalized CES preferences, used in the present paper, extend traditional CES preferences by including a separate taste of variety parameter and thereby break the link between taste of variety and the elasticity of substitution implied by traditional CES preferences. Generalized CES preferences are thus able to capture that increases in the number of varieties are important but not necessarily as important as suggested by the traditional CES preferences.[3]

Generalized CES aggregates are not new to trade theory. In a monopolistic competition setting Ethier (1982) considers a generalized CES production function defined over an endogenous set of intermediate inputs to analyze the interaction between increasing returns at the firm level (due to fixed costs of production) and at the aggregate level (due to taste of variety over intermediate inputs). The assumption of

[2] A similar result was previously shown by Dixit and Stiglitz (1975) in a working paper version of their seminal work published in 1977.

[3] Moreover, as generalized CES preferences are analytically tractable in monopolistic competition general equilibrium settings they serve as a convenient special case to illustrate the fundamental point of possible welfare losses from trade liberalization in heterogenous firm monopolistic competition trade models.

a generalized CES production function is equivalent to an assumption of generalized CES preferences from a welfare perspective as varieties of the intermediate input and the production function of the homogenous and non-traded final good may be reinterpreted as varieties of a final good and as a utility function, respectively. More recently generalized CES preferences/production functions have been applied in a trade context by Montagna (2001), Corsetti et. al. (2007), Felbermayr, Prat and Schmerer (2008) and Egger and Kreickemeier (2009). In trade and macroeconomics the more extreme case of no taste of variety is considered by e.g. Blanchard and Kiyotaki (1987), Startz (1989), Blanchard and Giavazzi (2003) and Felbermayr and Prat (2007).

This paper shows that applying such generalized CES preferences in the Melitz (2003) model with Pareto distributed marginal productivities implies that trade liberalization reduces welfare for a nontrivial parameter subspace. Welfare losses are more likely at low levels of market integration and when firms are less heterogenous. Moreover, for the class of generalized CES preferences the necessary condition for equivalence of the social planner and the market outcome in a monopolistic industry derived in Benassy (1996) is extended to an open economy setting with costly trade and heterogenous firms. In particular, it is shown that the market equilibrium of the Melitz (2003) model is only identical to the social planner solution when preferences are exactly of the traditional CES type. However, for other preferences this equivalence does not hold and in these cases trade liberalization may in fact reduce welfare due to amplified market failures. This possibility can be seen as a direct implication of the theory of the second best and that trade liberalization reduces welfare in some parameter subspaces in trade models with imperfect competition, and increasing returns should therefore not be neglected or seen as exotic special cases. What should be seen as a special case is that trade liberalization unambiguously improves welfare in the Melitz (2003) model.

In a related paper Demidova and Rodríguez-Clare (2009) consider the importance of the market failures generated by imperfect competition and increasing returns albeit in a small open economy. Indeed they show that free trade is not optimal as welfare improves by active use of unilateral trade policies to counteract market failures. The paper perhaps most closely related to the present work is Montagna (2001); one of the pioneers within the literature of heterogenous firms in monopolistic competition trade models. Montagna (2001) shows in an asymmetric two country setting with generalized CES preferences that moving from autarky to free trade may hurt the more efficient country provided that the taste of variety is sufficiently low. The welfare loss occurs as the low valued gains from an increase in the number of varieties cannot offset the loss from reduced average productivity. The present work complements and extends the result of Montagna (2001) in two directions. First, it shows that trade liberalization may reduce welfare even when countries are symmetric, i.e. trade liberalization may hurt all countries and thus reduce global welfare. Secondly, the result is derived for the by now conventional entry/exit mechanism of Melitz (2003). An attractive feature of the Melitz (2003) exit/entry mechanism is that in combination with an assumption of Pareto distributed marginal productivities it allows analytical results throughout. While Montagna (2001) compares autarky with free trade the present paper analyzes the entire path from autarky to free trade. Although the central prediction of the model in the present paper is that trade liberalization may reduce welfare, another interesting prediction in the light of Montagna´s work is that welfare in the free trade equilibrium exceeds that of the autarkic equilibrium.

The rest of the paper is organized as follows. Section 2 describes the Melitz (2003) model with generalized CES preferences and Pareto distributed marginal productivities. Section 3 analyzes the effects of trade liberalization on welfare, number of varieties and average productivity and derives conditions under which trade liberalization decreases welfare. Section 4 concludes.

2 The model

This section provides a version of the Melitz (2003) model, with $n+1$ symmetric countries, but augmented by the assumption of generalized CES preferences, which breaks the important but arbitrary link between taste of variety and the elasticity of substitution between any two goods (and thus the elasticity of demand) implied by traditional CES preferences. In line with the literature only steady-state equilibria with no time discounting is considered.

Households

The representative household chooses consumption to maximize utility

$$U = M_t^{v-\frac{1}{\sigma-1}} Q, \tag{1}$$

where

$$Q = \left[\int_{\omega\in\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}} \tag{2}$$

is the traditional CES consumption aggregate from the Melitz (2003) model, varieties are indexed by ω, Ω is the set of varieties, M_t is the measure of varieties available to the consumers, $\sigma > 1$ is the elasticity of substitution between any two varieties, and the crucial new parameter $v \geq 0$ measures the taste of variety.[4] For example, preferences display no taste of variety for $v = 0$, while for $v = \frac{1}{\sigma-1}$, i.e. $U = Q$, we arrive at the traditional Melitz (2003) model. Optimal demand reads

$$q(\omega) = \frac{E}{P}\left(\frac{p(\omega)}{P}\right)^{-\sigma}, \tag{3}$$

where E is nominal expenditures and P, being the price of one unit of Q, reads

$$P = \left[\int_{\omega\in\Omega} p(\omega)^{1-\sigma} d\omega\right]^{\frac{1}{1-\sigma}}. \tag{4}$$

As the measure of varieties, M_t, is exogenous demand is not affected by the taste of

[4] If the household consumes the same amount (q) of each variety utility is given by

$$\begin{aligned} U &= M_t^{v-\frac{1}{\sigma-1}} \left[\int_{\omega\in\Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega\right]^{\frac{\sigma}{\sigma-1}} \\ &= M_t^{v-\frac{1}{\sigma-1}} \left[M_t q^{\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} = M_t^{1+v} q \\ &= M_t^{v} (M_t q) \end{aligned}$$

For a given total consumption ($M_t q$) the elasticity of utility wrt. the measure of available varieties reads $\left.\frac{dU}{dM_t}\frac{M_t}{U}\right|_{M_t q \text{ fixed}} = v \geq 0$.

variety, v. This in turn implies that the market outcome corresponds to the market outcome in Melitz (2003). Finally, each of the L households exogenously supplies one unit of labour.

Firms

To enter the monopolistic industry firms face sunk costs of developing a new variety (F_E).[5] A random variety/firm specific marginal productivity, $\varphi(\omega)$, is associated with each variety immediately after development.[6] Production exhibits increasing returns as firms face fixed costs of production (F). Export requires the firm to pay fixed export costs of F_X per export market and variable iceberg trade costs, $\tau \geq 1$, i.e. firms have to ship τ units for one unit to arrive at the export market. Due to symmetry in preference a firm is fully characterized by marginal productivity and the firm/variety identity ω is suppressed in the following.

As firms cf. (3) face a constant elasticity of demand, σ, they set prices as a constant mark-up on marginal costs, implying

$$\begin{aligned} p_D(\varphi) &= \frac{\sigma}{\sigma-1}\frac{1}{\varphi} \\ p_X(\varphi) &= \frac{\sigma}{\sigma-1}\frac{\tau}{\varphi}, \end{aligned} \tag{5}$$

where subscript D (X) refers to the domestic (export) market. Using (3) and (5) flow profits in the domestic and in each export market read

$$\pi_D(\varphi) = B\varphi^{\sigma-1} - F \tag{6}$$

$$\pi_X(\varphi) = B\varphi^{\sigma-1}\tau^{1-\sigma} - F_X, \tag{7}$$

where $B \equiv \frac{1}{\sigma-1}\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma} EP^{\sigma-1}$ is a common revenue component. Firms self-select into exiters ($\varphi < \varphi^*$), non-exporters ($\varphi^* \leq \varphi < \varphi_x^*$) and exporters ($\varphi \geq \varphi_x^*$) where

[5] The costs consist of employing F_E units of labour. However, as we set the wage w to be the numeraire ($w \equiv 1$) the costs equal F_E.

[6] When marginal productivity is revealed the innovation costs (F_E) are sunk, i.e. firms are uncertain about their productivity prior to entry. In the related paper of Montagna (2001) an exogenous pool of heterogenous potential entrants know their productivity prior to endogenous entry.

the exit and export threshold is defined by $\pi_D(\varphi^*) = 0$ and $\pi_X(\varphi^*) = 0$. The self-selection occurs as flow profits increase in productivity, φ, and only firms with sufficiently high productivity can recover their fixed costs. As the country has n trading partners total flow profits read

$$\pi(\varphi) = \max\left[0, \pi_D(\varphi), \pi_D(\varphi) + n\pi_X(\varphi)\right].$$

There is free entry into the industry. Accordingly firms enter until expected flow profits equal sunk costs of entry, i.e. until

$$\sum_{t=0}^{\infty} \pi(\varphi)(1-\delta)^t \, dG(\varphi) = f_{E,} \tag{8}$$

where $\delta > 0$ is a constant and exogenous per period death probability and $G(\varphi)$ is the cumulative distribution function of marginal productivity. To obtain closed form solutions productivities are in line with the existing literature (see e.g. Helpman, Melitz and Yeaple (2004), Chaney (2007) and Eaton, Kortum and Kramarz (2008)) assumed to be drawn from the Pareto distribution

$$G(\varphi) = \left\{ \begin{array}{ccc} 1-\left(\frac{\varphi_0}{\varphi}\right)^k & if & \varphi \geq \varphi_0 > 0 \\ 0 & if & \varphi < \varphi_0 \end{array} \right., \tag{9}$$

where φ_0 and $k > \sigma - 1$ are scale (lower bound) and shape parameters.[7] The exit and export thresholds are determined from the free entry condition (8) and read

$$\varphi^* = \bar{\varphi}_0 \left(\frac{F}{\delta F_E}\frac{(\sigma-1)}{k-(\sigma-1)}\right)^{\frac{1}{k}} \left(1 + n\frac{F_X}{F}\left(\frac{\tau^{\sigma-1}F_X}{F}\right)^{-\frac{k}{\sigma-1}}\right)^{\frac{1}{k}} \tag{10}$$

$$\varphi_X^* = \varphi^* \left(\frac{\tau^{\sigma-1}F_X}{F}\right)^{\frac{1}{\sigma-1}} \tag{11}$$

The assumed partitioning of firms (the empirically relevant case) occurs for $\bar{\varphi}_0 <$

[7] The assumption of $k > \sigma - 1$ is necessary to bound expected profits from above.

$\varphi^* < \varphi_X^*$ where the latter inequality requires that $\frac{\tau^{\sigma-1}F_X}{F} > 1$, i.e. that trade costs are sufficiently high. If the latter inequality is violated all active firms export and the exit and export thresholds collapse to a common threshold of

$$\varphi_{TRADE}^* = \bar{\varphi}_0 \left(\frac{nF_X + F}{\delta F_E} \frac{(\sigma - 1)}{k - (\sigma - 1)} \right)^{\frac{1}{k}} \tag{12}$$

It is throughout assumed that $\min\{\varphi^*, \varphi_{TRADE}^*\} > \bar{\varphi}_0$, i.e. that some firms choose to leave the industry.

Aggregation

The price index (4) of Q becomes

$$\begin{aligned} P &= \left[M \int_{\varphi^*}^{\infty} (p_D(\varphi))^{1-\sigma} \frac{g(\varphi)}{1 - G(\varphi^*)} d(\varphi) + nM_x \int_{\varphi_X^*}^{\infty} (p_X(\varphi))^{1-\sigma} \frac{g(\varphi)}{1 - G(\varphi_X^*)} d(\varphi) \right]^{\frac{1}{1-\sigma}} \\ &= \frac{\sigma}{\sigma - 1} M_t^{\frac{1}{1-\sigma}} \tilde{\varphi}_t^{-1}, \end{aligned} \tag{13}$$

where $M_t = M + nM_x = M + np_x M$ is the mass of varieties available to the consumers (M domestic and $np_x M$ imported). Average productivity reads

$$\tilde{\varphi}_t = \left[\frac{M}{M_t} \left[\tilde{\varphi}(\varphi^*)\right]^{\sigma-1} + \frac{nM_x}{M_t} \left[\tau^{-1} \tilde{\varphi}(\varphi_X^*)\right]^{\sigma-1} \right]^{\frac{1}{\sigma-1}} \tag{14}$$

$$= \left[\frac{k}{k - (\sigma - 1)} \frac{1 + n\left(\frac{F_X}{F}\right)^{1 - k\frac{1}{\sigma-1}} \tau^{-k}}{1 + n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}} \tau^{-k}} \right]^{\frac{1}{\sigma-1}} \varphi^*, \tag{15}$$

where $\tilde{\varphi}(\varphi^*) = \left[\frac{1}{1-G(\varphi^*)} \int_{\varphi^*}^{\infty} \varphi^{\sigma-1} dg(\varphi)\right]^{\frac{1}{\sigma-1}}$ ($\tilde{\varphi}(\varphi_X^*) = \left[\frac{1}{1-G(\varphi_X^*)} \int_{\varphi_X^*}^{\infty} \varphi^{\sigma-1} dg(\varphi)\right]^{\frac{1}{\sigma-1}}$) is average factory gate productivity among domestic (foreign) firms serving the domestic market. Average productivity is measured at the market place and therefore factory gate productivity of exported goods is corrected for trade costs.[8]

The assumptions of no time discounting and free entry imply no returns to savings and zero aggregate profits. Accordingly total income equals labour income,

[8] See Melitz (2003) for further discussion.

i.e. $E = L$. Given the thresholds (10) and (11) the mass of varieties follows from the exit condition $\pi_D(\varphi^*) = 0$:

$$M_t = \frac{L}{\sigma F}\left(\frac{\varphi^*}{\tilde{\varphi}_t}\right)^{\sigma-1} = \frac{L}{\sigma F}\frac{k-(\sigma-1)}{k}\frac{1+n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}}{1+n\left(\frac{F_X}{F}\right)^{1-k\frac{1}{\sigma-1}}\tau^{-k}} \tag{16}$$

Similarly, in equilibria in which all active firms export aggregate variables become

$$\tilde{\varphi}_t = \left(\frac{k}{k-(\sigma-1)}\frac{1+n\tau^{1-\sigma}}{1+n}\right)^{\frac{1}{\sigma-1}}\varphi^*_{TRADE} \tag{17}$$

$$M_t = \frac{L}{\sigma F}\frac{k-(\sigma-1)}{k}\frac{1+n}{1+n\frac{F_X}{F}} \tag{18}$$

3 Trade liberalization and welfare

Welfare is given by indirect utility and using (13) it reads

$$W = M_t^{\upsilon-\frac{1}{\sigma-1}}Q = M_t^{\upsilon-\frac{1}{\sigma-1}}\frac{1}{P} = \frac{\sigma-1}{\sigma}M_t^{\upsilon}\tilde{\varphi}_t \tag{19}$$

Welfare increases in the mass of varieties (M_t) and in average productivity $\tilde{\varphi}_t$. The importance of the mass of varieties relative to average productivity is captured by our taste of variety parameter $\upsilon \geq 0$. To obtain a better understanding of when and why trade liberalization may reduce welfare the effects on mass of varieties and average productivity are analyzed before turning to welfare. Here we focus on a reduction in variable trade costs, τ. The corresponding analysis for a reduction in fixed trade costs, F_X, is briefly covered in the Appendix.

Varieties

The effect of trade liberalization on the mass of varieties derives from (16) and

(18) and reads

$$\left.\frac{dM_t}{d\tau}\right|_{\varphi_X^*>\varphi^*} = M_t \frac{n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}}{1+n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}} \frac{\frac{k}{\tau}\left(\frac{F_X}{F}-1\right)}{1+n\left(\frac{F_X}{F}\right)^{1-k\frac{1}{\sigma-1}}\tau^{-k}} \lesseqgtr 0 \qquad (20)$$

$$\left.\frac{dM_t}{d\tau}\right|_{\varphi_{TRADE}^*} = 0 \qquad (21)$$

Proposition 1 *In equilibria in which firms are partitioned into exporters and non-exporters the mass of varieties increases (decreases) due to lower iceberg trade costs if $F_X < F$ ($F_X > F$). In equilibria in which all active firms export iceberg trade costs have no impact on the mass of varieties.*

The mass of varieties increases (decreases) for $F_X < F$ ($F_X > F$). For $F_X > F$ export market activity requires more labour for the marginal exporting firm than domestic market activity does for the marginal firm, and an additional exporter therefore squeezes more than one non-exporter out of the market.[9] The mass of varieties decreases accordingly as trade liberalization increases entry into the export market. That trade liberalization may reduce the mass of varieties when trade costs are high was suggested by Melitz (2003). Baldwin and Forslid (2010) later derived the exact condition for the Pareto distribution and denoted such a reduction in the mass of varieties as an anti-variety effect of trade liberalization. Yet, as will become clear below the anti-variety effects does not need to be the driver behind a negative welfare impact of trade liberalization.

Average productivity

The effect of trade liberalization on average productivity derives from (15) and

[9] Recall that labour is the only factor of production and thus determines the mass of firms.

(17) and reads

$$\left.\frac{d\tilde{\varphi}_t}{d\tau}\right|_{\varphi_X^*>\varphi^*} = \tilde{\varphi}_t \frac{n\left(\frac{F_X}{F}\right)^{1-k\frac{1}{\sigma-1}}\tau^{-k-1}\left(\frac{k\frac{1}{\sigma-1}\left(\frac{F}{F_X}-1\right)}{1+n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}}-1\right)}{\left(1+n\left(\frac{F_X}{F}\right)^{1-k\frac{1}{\sigma-1}}\tau^{-k}\right)} \lesseqgtr 0 \qquad (22)$$

$$\left.\frac{d\tilde{\varphi}_t}{d\tau}\right|_{\varphi_{TRADE}^*} = -\tilde{\varphi}_t \frac{n\tau^{-\sigma}}{1+n\tau^{1-\sigma}} < 0 \qquad (23)$$

Proposition 2 *In equilibria in which firms are partitioned into exporters and non-exporters average productivity increases (decreases) due to lower iceberg trade costs if* F_X *is above (below)* $F_X^* < F$*, where* F_X^* *is defined as the solution to* $k\frac{1}{\sigma-1}\left(\frac{F}{F_X^*}-1\right) = 1+n\left(\frac{F_X^*}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}$*. In equilibria in which all active firms export reductions in iceberg trade costs always increase average productivity.*

As noted by Melitz (2003), without pinning down explicit conditions as in Proposition 2, trade liberalization may reduce average productivity as the measure factors in real trade costs and thus captures average productivity at the market place and not at the factory gate. This inclusion of real variable trade costs follows from the term τ^{-1} in the definition of average productivity (14). Hence, although trade liberalization shifts market shares from low-productivity non-exporters to high-productivity exporters average productivity may fall when taking trade costs into account. Measured at the factory gate trade liberalization always increases average productivity, but consumers/households care about c.i.f. prices/productivities and not f.o.b. prices/productivities.

In equilibria in which all firms export trade liberalization has no impact on the industry structure.[10] Accordingly, trade liberalization will not imply intra-industry reallocations and average productivity increases as productivity measured at the export market increases.

When firms are partitioned into exporters and non-exporters there is still the effect that among exporting firms productivity measured at the export market in-

[10] Formally, φ_{TRADE}^* does not depend on τ, cf. (12)

creases which tends to increase average productivity. However, there is a counter-acting effect due to market share reallocations. In particular among ex-ante non-exporting firms the most productive begin to export and the least productive leave the industry. For $F_X < F$ the productivity of the marginal exporter measured at the export market is below the productivity of the marginal domestic firm measured at the domestic market as less fixed costs have to be recovered in the export market, i.e. $\tau^{-1}\varphi_X^* < \varphi^*$, and the intra-industry reallocation tends to reduce average productivity. Obviously, the former effect is stronger when initial trade is large and thus adverse effects on average productivity from intra-industry reallocations are more likely at the outset of a liberalization process.

Welfare

The welfare effect of trade liberalization is a weighted average of the effects on the mass of available varieties and average productivity. The taste of variety parameter is central as it captures the relative weight of the mass of varieties. From the welfare expression (19) it follows that

$$\frac{dW}{d\tau} = \frac{W}{\tau}\left[v\frac{dM_t}{d\tau}\frac{\tau}{M_t} + \frac{d\tilde{\varphi}_t}{d\tau}\frac{\tau}{\tilde{\varphi}_t}\right]$$

and inserting (20)-(23) gives

$$\begin{aligned}
\left.\frac{dW}{d\tau}\right|_{\varphi_X^*>\varphi^*} &= \frac{W}{\tau}\frac{n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}}{1+n\left(\frac{F_X}{F}\right)^{1-k\frac{1}{\sigma-1}}\tau^{-k}}\left[\frac{k\left(v-\frac{1}{\sigma-1}\right)\left(\frac{F_X}{F}-1\right)}{1+n\left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}}\tau^{-k}}-1\right] \lesseqgtr 0 \\
\left.\frac{dW}{d\tau}\right|_{\varphi_{TRADE}^*} &= -\frac{W}{\tau}\frac{n\tau^{1-\sigma}}{1+n\tau^{1-\sigma}} < 0
\end{aligned}$$

The following result follows immediately.

Proposition 3 *Trade liberalization may reduce welfare. Trade liberalization reduces* *welfare iff*[11]

$$\min \left\{ \frac{k\left(v - \frac{1}{\sigma-1}\right)\left(\frac{F_X}{F} - 1\right)}{1 + n\left(\frac{F_X \tau^{\sigma-1}}{F}\right)^{-k\frac{1}{\sigma-1}}}, \frac{F_X \tau^{\sigma-1}}{F} \right\} > 1$$

Proposition 3 shows the main result of the paper, namely that trade liberalization may reduce welfare when preferences are not traditional CES preferences, i.e. when $v \neq \frac{1}{\sigma-1}$. This is an important result, as it shows that the finding of unambiguous gains from trade liberalization in the Melitz (2003) model is sensitive to the specific utility formulation.

Another interesting implication of Proposition 3 is that welfare reducing trade liberalizations are ceteris paribus more likely for high iceberg trade costs, τ, i.e. for trade liberalization among less integrated economies, and when firms are less heterogenous, high k.

Corollary 4 *Trade liberalization increases welfare in the special case of traditional CES preferences, i.e. for* $v = \frac{1}{\sigma-1}$*, and in the special case where fixed costs of exporting equals fixed costs of production, i.e. for* $F_X = F$*. Moreover, trade liberalization increases welfare when all active firms export.*

Corollary 5 *Trade liberalization decreases welfare when 1)* $F_X > F$ *and* v *is sufficiently large and 2)* $F_X < F_X^*$ *(*F_X^* *is defined in Proposition 2),* τ *is sufficiently high and* v *is sufficiently small.*

From Propositions 1 and 2 it follows that trade liberalization does not simultaneously have adverse effects on average productivity and the mass of available varieties. Corollary 4 states that the net effect on welfare is always positive in the special case of traditional CES preferences, i.e. for a taste of variety given by $v = \frac{1}{\sigma-1}$. In this case potential losses in one dimension (varieties or productivity) is more than offset by gains in the other dimension. For $F_X = F$ and/or when all firms export welfare improves as the mass of varieties in unchanged and average productivity increases,

[11] Recall that $\frac{F_X \tau^{\sigma-1}}{F} > 1 \Leftrightarrow \varphi_X^* > \varphi^*$.

cf. Propositions 1 and 2. The case where all firms export corresponds to the effect in a Krugman (1980) model with iceberg trade costs.

Corollary 5 states that when the taste of variety differs from the traditional CES case trade liberalization may reduce welfare. Indeed, when trade liberalization reduces average productivity (cf. Proposition 2) welfare deteriorates provided the utility gain from the increasing mass of varieties is sufficiently small. Similarly, when the mass of varieties is sufficiently important an increasing average productivity cannot balance the loss from less varieties.[12]

Figure 1 sums up graphically on the impacts of trade liberalization on the mass of available varieties, average productivity and welfare.

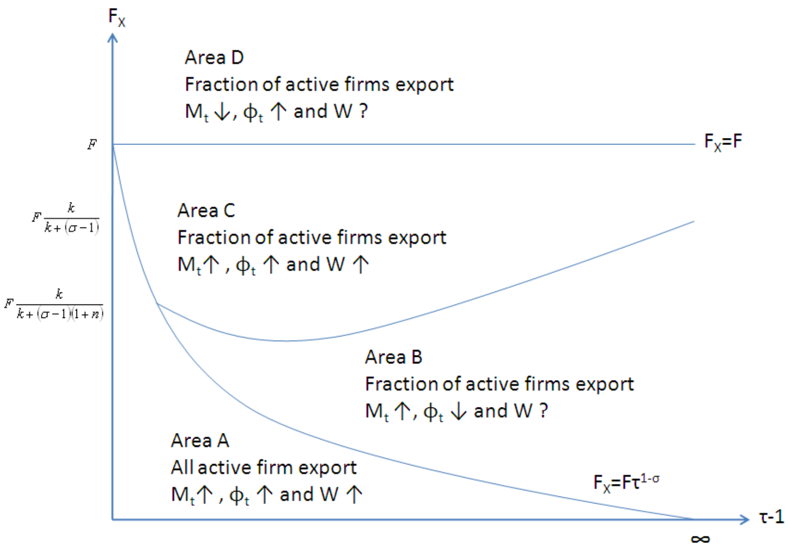

Figure 1: Effects of lower variable trade costs

According to Corollary 5 trade liberalization reduces welfare in Area B (D) if the taste of variety is sufficiently low (high). The potential welfare loss in Area B arises due to excess entry into the export market from a social point of view. The excess export market entry boosts the mass of available varieties but at the cost of lower average productivity, cf. Proposition 1 and 2, and this reduces welfare if the taste

[12]Baldwin and Forslid (2010) point out that the anti-variety effect may imply a welfare loss provided the taste of variety is sufficiently strong.

of variety is sufficiently low. In Area D the potential welfare loss is also related to excess entry into the export market as each newly imported variety squeezes more than one existing domestic variety out of the market and thereby reduces the total mass of available varieties, cf. Proposition 1. In both cases the welfare loss occurs due to a market failure in the sense that trade liberalization magnifies the excess entry into the export market.

In the special case of traditional CES preferences, $\upsilon = \frac{1}{\sigma-1}$, the market equilibrium coincides with the social planner solution and trade liberalization therefore unambiguously improves welfare in this case as 'the budget set' of the social planner expands when real trade costs fall. The social planner solution is considered in the Appendix.

4 Conclusion

This paper has challenged the conventional view that trade liberalization unambiguously increases welfare due to intra-industry reallocations in settings of heterogenous firms a'la Melitz (2003). It has been shown that the welfare effect of trade liberalization is only unambiguously positive because the assumed CES preferences imply that the market equilibrium coincides with the social planner solution. For other preferences there will in general be market failures due to the presence of increasing returns and imperfect competition. Trade liberalization can amplify these market failures, such that the overall welfare effect from trade liberalization turns negative. The present work exemplified this possibility by considering generalized CES preferences that break the crucial but arbitrary link between the taste of variety and the elasticity of substitution implied by the traditional CES preferences, assumed in settings following Melitz (2003). For this specific class of preferences it is shown that welfare may in fact be reduced following trade liberalization due to excess export market entry (market failure). The possible adverse welfare effect of trade liberalization appears particularly interesting because it derives in a setting of symmetric countries. This implies that trade liberalization potentially reduces welfare in all involved countries and thus globally.

The possibility of a negative welfare effect from trade liberalization in a slightly more general Melitz (2003) setting stresses the importance of careful robustness checks of trade models along several dimensions before turning to policy advises. However, the present analysis also implies an expanded scope for trade policy. The possible negative welfare effects from trade liberalization through a reduction in real trade costs when assuming generalized CES preferences occur due to excess entry into the export market, and this excess entry may be counteracted through trade policy by increasing/introducing tariffs or artificial export market entry barriers including fixed costs of exporting. Such interactions between reduced real trade costs, market failures and facilitating trade policies is an important topic for future research.

5 Appendix

5.1 Social planner solution/equilibrium

Generalized CES preferences

In the social planner optimum the marginal rates of substitution must equal the corresponding marginal rates of transformation for all produced varieties. Moreover, due to increasing returns (fixed costs of production and fixed costs of exporting) the social planner will only let high productivity firms/varieties absorb these fixed costs. Accordingly, the social planner will partition firms/varieties into exiters, non-exporters and exporters. Let $\hat{\varphi}^*$ and $\hat{\varphi}_X^*$ denote these productivity thresholds.

Setting marginal rates of substitution equal to the corresponding marginal rates of transformation implies that

$$\begin{aligned} q(\varphi) &= q(\hat{\varphi}^*)\left(\frac{\varphi}{\hat{\varphi}^*}\right)^{\sigma} \\ q_X(\varphi) &= q(\hat{\varphi}^*)\left(\frac{\varphi}{\hat{\varphi}^*\tau}\right)^{\sigma} = q_X(\hat{\varphi}_X^*)\left(\frac{\varphi}{\hat{\varphi}_X^*}\right)^{\sigma} \end{aligned}$$

where $q(\varphi)$ $(q_X(\varphi))$ denotes consumption of a domestic (imported) variety produced with marginal productivity φ. The constraint of the social planner reads

$$\begin{aligned} L &= M\left(\frac{\delta F_E}{1-G(\hat{\varphi}^*)} + F + np_X F_X + \int_{\hat{\varphi}^*}^{\infty}\frac{q(\varphi)}{\varphi}\frac{g(\varphi)}{1-G(\hat{\varphi}^*)}d\varphi + n\int_{\hat{\varphi}_X^*}^{\infty}\frac{q_X(\varphi)\tau}{\varphi}\frac{g(\varphi)}{1-G(\hat{\varphi}^*)}d\varphi\right) \\ &= M\left(\frac{\delta F_E}{1-G(\hat{\varphi}^*)} + F + np_X F_X + \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)\right) \end{aligned}$$

where $p_X = \left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k}$ is the fraction of varieties exported. The objective of the social planner is given by

$$
\begin{aligned}
U &= M_t^{v-\frac{1}{\sigma-1}} Q \\
&= (M(1+np_X))^{v-\frac{1}{\sigma-1}} \left[M \int_{\hat{\varphi}^*}^{\infty} q(\varphi)^{\frac{\sigma-1}{\sigma}} \frac{g(\varphi)}{1-G(\hat{\varphi})} d\varphi + nM \int_{\hat{\varphi}_X^*}^{\infty} q_X(\varphi)^{\frac{\sigma-1}{\sigma}} \frac{g(\varphi)}{1-G(\hat{\varphi})} d\varphi \right]^{\frac{\sigma}{\sigma-1}} \\
&= \frac{\left(\frac{k}{k-(\sigma-1)}\right)^{\frac{\sigma}{\sigma-1}} L^{v+1} \left(1+n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k}\right)^{v-\frac{1}{\sigma-1}} q(\hat{\varphi}^*) \left[1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right]^{\frac{\sigma}{\sigma-1}}}{\left[\frac{\delta F_E}{1-G(\hat{\varphi}^*)} + F + n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k} F_X + \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)\right]^{v+1}}
\end{aligned}
$$

The social planner problem can be formulated as

$$
\max_{\hat{\varphi}^*, \frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}, q(\hat{\varphi}^*)} U = \frac{\left(\frac{k}{k-(\sigma-1)}\right)^{\frac{\sigma}{\sigma-1}} L^{v+1} \left(1+n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k}\right)^{v-\frac{1}{\sigma-1}} q(\hat{\varphi}^*) \left[1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right]^{\frac{\sigma}{\sigma-1}}}{\left[\frac{\delta F_E}{1-G(\hat{\varphi}^*)} + F + n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k} F_X + \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)\right]^{v+1}}
$$

and the optimality conditions read

$$
\begin{aligned}
\frac{\partial U}{\partial q(\hat{\varphi}^*)} &= \frac{U}{q(\hat{\varphi}^*)} \left(1 - \frac{(v+1)\frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)}{\frac{\delta F_E}{1-G(\hat{\varphi}^*)} + F + n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k} F_X + \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)}\right) = 0 \\
\frac{\partial U}{\partial \hat{\varphi}^*} &= \frac{-(v+1)\frac{U}{\hat{\varphi}^*}\left(\frac{\delta F_E}{1-G(\hat{\varphi}^*)}\frac{g(\hat{\varphi}^*)\hat{\varphi}^*}{1-G(\hat{\varphi}^*)} - \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)\right)}{\frac{\delta F_E}{1-G(\hat{\varphi}^*)} + F + n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k} F_X + \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)} = 0 \\
\frac{\partial U}{\partial\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)} &= Un\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k-1} \left[\begin{array}{c} \frac{(v+1)\left(kF_X + \frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}k\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1}\right)}{\frac{\delta F_E}{1-G(\hat{\varphi}^*)}+F+n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k}F_X+\frac{q(\hat{\varphi}^*)}{\hat{\varphi}^*}\frac{k}{k-(\sigma-1)}\left(1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}\right)} \\ -\frac{\left(v-\frac{1}{\sigma-1}\right)k}{1+n\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{-k}} - \frac{\frac{\sigma}{\sigma-1}(k-(\sigma-1))\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1}}{1+n\tau^{1-\sigma}\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)^{\sigma-1-k}} \end{array}\right] = 0
\end{aligned}
$$

Isolate $q(\hat{\varphi}^*)$ in $\frac{\partial U}{\partial q(\hat{\varphi}^*)} = 0$, insert this into $\frac{\partial U}{\partial \hat{\varphi}^*} = 0$ and $\frac{\partial U}{\partial\left(\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*}\right)} = 0$ and use that productivities are Pareto distributed to obtain

$$\frac{\hat{\varphi}_X^*}{\hat{\varphi}^*} = \left(\frac{(vk-1)\,\delta F_E \left(\frac{\hat{\varphi}^*}{\bar{\varphi}_0}\right)^k - F}{nF_X} \right)^{-\frac{1}{k}} \tag{24}$$

$$\begin{aligned} \tau^{\sigma-1} F_X \left(\frac{(vk-1)\,\delta F_E \left(\frac{\hat{\varphi}^*}{\bar{\varphi}_0}\right)^k - F}{nF_X} \right)^{\frac{\sigma-1}{k}} &= \frac{(vk-1)\,\delta F_E \left(\frac{\hat{\varphi}^*}{\bar{\varphi}_0}\right)^k - F + F_X}{\left(\frac{k}{\sigma-1} - 1\right)\delta F_E \left(\frac{\hat{\varphi}^*}{\bar{\varphi}_0}\right)^k - F + F_X} \\ &\quad \times \left(\delta F_E \left(\frac{\hat{\varphi}^*}{\bar{\varphi}_0}\right)^k k \left(\frac{1}{\sigma-1} - v\right) + F \right) \end{aligned} \tag{25}$$

Unfortunately, due to the non-linearities closed form solutions of the social planner problem cannot be derived. However, it follows straightforwardly that in contrast to the market equilibrium the social planner solution depends on v.

Traditional CES preferences

In the special case of traditional CES preferences (as in Melitz (2003)), $v = \frac{1}{\sigma-1}$, there is a closed form solution to the social planner problem, i.e. to (24) and (25), and it reads

$$\begin{aligned} \hat{\varphi}^* &= \bar{\varphi}_0 \left(1 + n\frac{F_X}{F} \left(\frac{\tau^{\sigma-1}F_X}{F}\right)^{-\frac{k}{\sigma-1}} \right)^{\frac{1}{k}} \left(\frac{\sigma-1}{k-(\sigma-1)} \frac{F}{\delta F_E} \right)^{\frac{1}{k}} \\ \hat{\varphi}_X^* &= \hat{\varphi}^* \left(\frac{\tau^{\sigma-1}F_X}{F} \right)^{\frac{1}{\sigma-1}} \end{aligned}$$

It follows that the social planner thresholds are identical to the market equilibrium thresholds (10) and (11). Moreover, relative quantities are also identical due to constant elasticities of demand and constant mark-ups. Finally, absolute demand for each variety is also the same as

$$\frac{\partial U}{\partial \hat{\varphi}^*} = 0 \Rightarrow q(\hat{\varphi}^*) = \hat{\varphi}^* (\sigma - 1) F$$

$$\pi_D(\varphi^*) = 0 \Rightarrow \left(p_D(\varphi^*) - \frac{1}{\varphi^*} \right) q(\varphi^*) = F \Rightarrow q(\varphi^*) = \varphi^* (\sigma - 1) F$$

when noting that $\hat{\varphi}^* = \varphi^*$. Hence the social planner solution coincides with the market equilibrium in the case of traditional CES preferences.

5.2 Trade liberalization through lower fixed trade costs

The impact on welfare of lower fixed trade costs is given by

$$\begin{aligned} \left.\frac{dW}{dF_X}\right|_{\varphi_X^* > \varphi^*} = {} & \frac{W}{F_X} \frac{n \left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}} \tau^{-k}}{\left(1 + n \left(\frac{F_X}{F}\right)^{1-k\frac{1}{\sigma-1}} \tau^{-k}\right) \left(1 + n \left(\frac{F_X}{F}\right)^{-k\frac{1}{\sigma-1}} \tau^{-k}\right)} \\ & \times \left[\left(\frac{1}{\sigma - 1} - v \right) k \frac{1}{\sigma - 1} \left(1 - \frac{F_X}{F} \right) + \left[\frac{1}{k} - v \right] \frac{F_X}{F} \left(1 + n \left(\frac{F_X}{F} \right)^{-k\frac{1}{\sigma-1}} \tau^{-k} \right) \right] \end{aligned}$$

$$\left.\frac{dW}{dF_X}\right|_{\varphi^*_{TRADE}} = \frac{W}{F_X} \frac{nF_X}{nF_X + F} \left[\frac{1}{k} - v \right]$$

It follows that trade liberalization reduces welfare in equilibria in which all active firms export provided $v < \frac{1}{k}$. Similarly, trade liberalization reduces welfare in equilibria in which active firms are partitioned into non-exporters and exporters if $\left[\left(\frac{1}{\sigma-1} - v \right) k \frac{1}{\sigma-1} \left(1 - \frac{F_X}{F} \right) + \left[\frac{1}{k} - v \right] \frac{F_X}{F} \left(1 + n \left(\frac{F_X}{F} \right)^{-k\frac{1}{\sigma-1}} \tau^{-k} \right) \right] > 0$.

In both types of equilibria the assumption of traditional CES preferences, i.e. $v = \frac{1}{\sigma-1}$, ensures welfare gains as $k > \sigma - 1$.

The effect on the mass of available varieties and average productivity can be derived similarly. Figure 2 below summarizes these effects

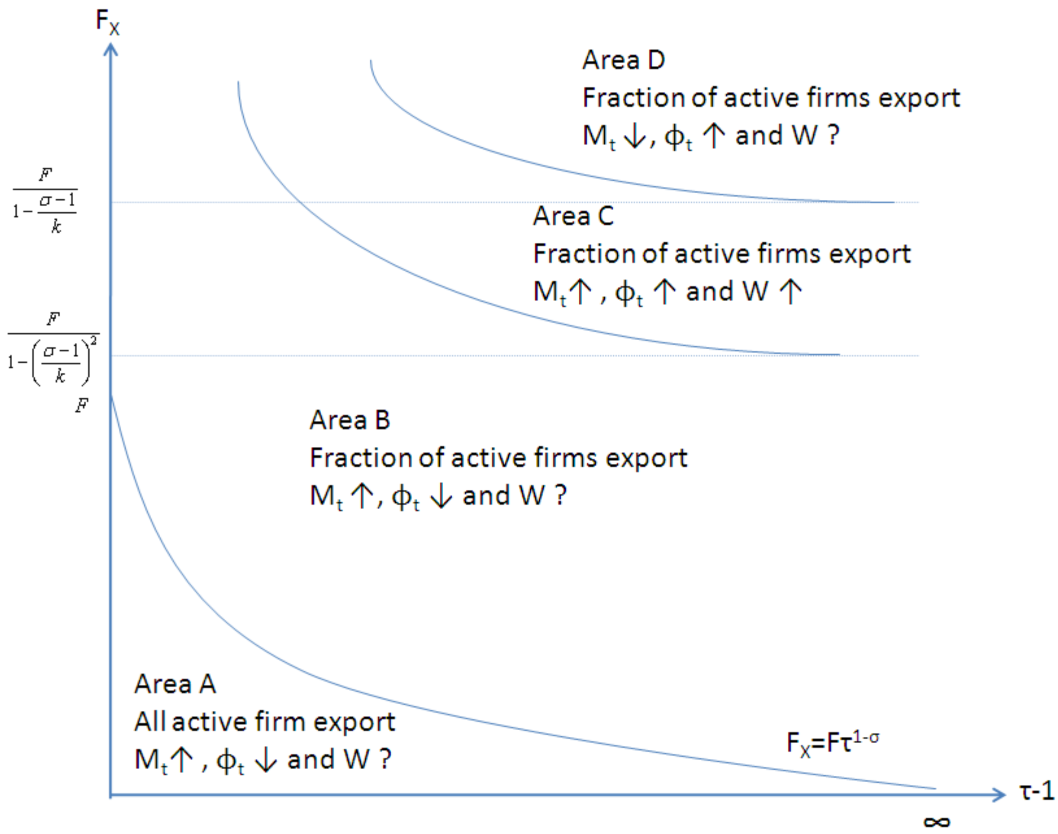

Figure 2: Effects of lower fixed trade costs

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