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‘Distorted Gravity: The Intensive and Extensive Margins of International Trade’, revisited: An Application to an Intermediate Melitz Model*

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Abstract

With the extension of the standard Melitz Model from Ahn et al. [2011], the important role of intermediaries in facilitating trade is now recognized. In this paper, we are going to expand Chaney's [2008] approach to an Intermediate Melitz Model. By researching if Chaney's results still apply for an Intermediate Melitz Model, main results of Chaney are confirmed for the direct export model, but this is not so for the indirect export mode. Here, the elasticity of substitution still dampens the extensive margins; however, whether the dampening effect on the extensive margin still dominates the magnifying effect on the intensive margin is ambiguous. Also, the elasticities of trade flows are no longer larger, but rather smaller than in the Krugman Model. All results are economically meaningful.

Keywords: International Trade, Intermediate Melitz Model, Firm Heterogeneity, Elasticities of Trade Flows, Extensive and Intensive Margins

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1 Introduction

The importance of firm heterogeneity (i.e. the possibility to model the extensive margin of trade) for the explanation of international trade is now well known; if nothing else, this insight is due to Melitz [2003]. Now, one is also aware of the important role of intermediaries in facilitating trade. Ahn et al. [2011] extend the Melitz Model for an intermediary sector;[1] the model predicts, that exporting firms endogenously select for an export mode - either indirect or direct - based on firm productivity.

This extension for an intermediary sector is important as it indicates that the total number of exporters is greater, and the number of direct exporters is smaller than in the Melitz Model; the thresholds of profitability for indirect and direct exports are exceeded earlier and later, respectively [Ahn et al., 2011, Felbermayr and Jung, 2011]. The Intermediate Melitz Model is still a non-tractable, theoretical model, wherein important parameters (i.e. elasticity of substitution, elasticity of trade flows, and extensive and intensive margin elasticities) are not estimable.

Here, we are going to expand Chaney's [2008] approach to an Intermediate Melitz Model, where explicit formulas for gravity equations, elasticities of trade flows, and extensive and intensive margin elasticities are to be derived. The aim of this paper is to analyze if Chaney's results for the Melitz Model still apply for an Intermediate Melitz Model.

For the direct export mode, main results of Chaney are confirmed: '…[T]he elasticity of substitution magnifies the sensitivity of the intensive margin to trade barriers and dampens the sensitivity of the extensive margin. …[T]he dampening effect on the extensive margin dominates the magnifying effect on the intensive margin' [Chaney, 2008, p. 1785]. Also, the statement that '…the same trade barriers will have a larger impact on trade flows than in the [Krugman] Model with representative firms …' can be confirmed [Chaney, 2008, p. 1708].

Contrary to the indirect export mode, neither Chaney's first proposition nor his second proposition can be confirmed. Indeed, the elasticity of substitution still magnifies the sensitivity of the intensive margin to trade barriers and dampens the sensitivity of the extensive margin. But the dampening effect on the extensive margin no longer dominates the magnifying effect on the extensive margin. Likewise, for the elasticities of trade flows, the same trade barriers will have no longer a greater, but rather a smaller impact on trade flows than in the Krugman Model [1980].

Geometrically, these countervailing results - in particular for the extensive margin - are explained by the fact that for the indirect export mode, changes in trade barriers not only affect the lower threshold of profitability, but also the upper threshold of profitability, i.e. the threshold of profitability where an exporter is just indifferent between indirect and direct exports. The impacts on the former threshold are always negative, but the impacts

[1] For a similar approach see Felbermayr and Jung [2011].

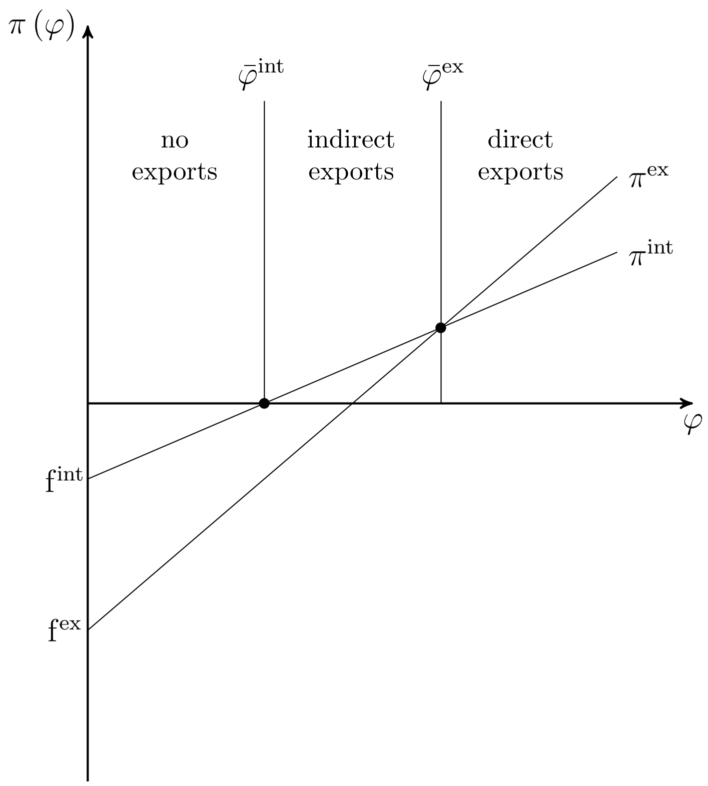


Figure 1: Exporter Profits under Different Export Modes

on the latter are ambiguous. The changes along the upper threshold of profitability define if there are only changes in size or reversals in sign. What can already be concluded is that the same trade policy will have different impacts on trade flows with regard to the export mode.

All results of this paper have economically consistent interpretations.

In the next section we illustrate the model structure of an Intermediate Melitz Model. In the third section elasticities of trade flows and extensive and intensive margin elasticities for the indirect and the direct export mode, respectively, are discussed. The last section concludes.

2 An Intermediate Melitz Model

In this section, a simple Intermediate Melitz Model is derived; in principle, the theoretical model follows Ahn et al. [2011] and the analytics Chaney [2008] and Bombarda [2011]. The model is first graphically motivated and then analytically derived.

The basic idea of an Intermediate Melitz Model is illustrated in Figure 1. In the figure, two profit functions π^{int} and π^{ex} are depicted against firm productivity φ. π^{int} defines a profit function for indirect exports and π^{ex} a profit function for direct exports, respectively. The two functions diverge in shape as for indirect exports exporters outsource their international trading activities to an intermediary - only some minor intermediate fixed costs f^{int} have to be beared to make products internationally tradable[2] - who in response charges for this service an additional variable trade cost λ.

The slope of the other profit function π^{ex} is steeper, as for direct exports no international trading activities are outsourced but autonomously to be managed; hence, the marginal profitability is enhanced by the amount of intermediate trade costs λ. But to manage the international trading activities alone requires not only the establishment of an own trading network, but also its maintenance. The required fixed costs are defined as f^{ex}; where, $f^{ex} > f^{int}$.

Depending on firm productivity level φ, firms first endogenously select for exports or no exports, and if they have opted for exports they select for indirect or direct exports. As the profit function of indirect exports π^{int} is flatter than its counterpart, the relevant threshold of profitability is reached earlier. From productivity level $\bar{\varphi}^{int}$ onward indirect exports become profitable, whereas direct exports only become profitable relative to indirect exports from productivity level $\bar{\varphi}^{ex}$ onward.

Model Setup

In principle, the derivation of the model follows Chaney [2008] with the exception that not only direct exports but also indirect exports are modelled; the different modelling of the supply side will have implications for the solution of the general equilibrium.

Analogous to Chaney, model setup starts with the demand side. There are N potentially asymmetric countries that produce goods using only labour. Each country indexed by i has a population of L_i. Its consumers maximize utility derived from the consumption of goods from H + 1 sectors. Besides a single homogeneous good sector 0, there are H additional sectors producing always a continuum of differentiated goods. If Ω_h indicates the set of varieties ω of good h, then the utitility maximization problem is

[1] $$U \equiv q_0^{\mu_0} \prod_{h=1}^{H} \left(\int_{\Omega_h} q_h(\omega)^{(\sigma_h - 1)/\sigma_h} \, d\omega \right)^{[\sigma_h/(\sigma_h-1)]\mu_h}$$

where $\mu_0 + \sum_{h=1}^{H} \mu_h = 1$, and where $\sigma_h > 1$ is the elasticity of substitution between two varieties ω of good h. Further, q_0 and $q_h(\omega)$ indicate the units consumed of the homogeneous good and of the variety ω of good h, respectively.

Trade Barriers and Technology. - Contrary to Chaney, the supply side is characterized by two export modes - an indirect and a direct export mode. Depending on the export mode, different variable and different country-specific fixed trade costs are charged: in general, all exporters have to pay the same variable trade costs τ_{ij}^{h} for exports from i

[2] Intermediary fixed costs could be either global [Ahn et al., 2011] or country specific [Felbermayr and Jung, 2011]; in the former case, the intermediary fixed costs would be redistributed with regard to net profit shares across the different export regions.

to j, but only for indirect exports are additional intermediate trade costs λ^{h} charged by an intermediary. However, using an intermediary has the advantage of not needing to establish or maintain an own trading network, which in return reduces the fixed costs for indirect exports $f_{ij}^{h,int}$. For direct exports, the fixed costs $f_{ij}^{h,ex}$ are accordingly higher.

For technology, the same assumptions apply as under Chaney; hence, firm specific unit labour productivies φ are drawn randomly from a Pareto Distribution $G_h(\varphi)$ with shape parameter γ^h. The costs of producing one unit of a good in country i are defined as $c_i = \frac{w_i}{\varphi}$, where w_i is the wage in i. And the corresponding domestic price under monopolistic competition is $p_i^h(\varphi) = \frac{w_i}{\rho\varphi}$, where ρ $\left(\rho = \frac{\sigma_h}{\sigma_h - 1}\right)$ is a standard markup.

Differences, however, emerge with regard to the prices that are charged by indirect and direct exporters for goods to be sold in country j. Direct exporters charge the common export price, i.e. $p_{ij}^{h,ex}(\varphi) = \frac{w_i \tau_{ij}^h}{\rho\varphi}$, but indirect exporters only charge the domestic price $p_i^h(\varphi)$. The last point becomes obvious if one considers that indirect exporters do not sell their goods abroad but at home; if there were price differences, then arbitrage should equalize them. The price charged abroad by the intermediary is $p_{ij}^{h,int}(\varphi) = \frac{w_i \lambda^h \tau_{ij}^h}{\rho\varphi}$ [Ahn et al., 2011].

The price differences are important as they affect not only quantities, but also firm profits. The relevant profit functions for indirect and direct exports are

[2] $$\pi_{ij}^{h,int}(\varphi) = \frac{\mu_h Y_j}{\sigma_h} \lambda^{-\sigma_h} \left(\frac{w_i \tau_{ij}^h}{\rho\varphi P_j^h}\right)^{1-\sigma_h} - f_{ij}^{h,int}$$

and

[3] $$\pi_{ij}^{h,ex}(\varphi) = \frac{\mu_h Y_j}{\sigma_h} \left(\frac{w_i \tau_{ij}^h}{\rho\varphi P_j^h}\right)^{1-\sigma_h} - f_{ij}^{h,ex}$$

where $q_{ij}^{h,int}(\varphi)$ and $q_{ij}^{h,ex}(\varphi)$ are units consumed of good h in country j that were either indirectly or directly exported by a firm form i with productivity level φ.

Demand for Differentiated Goods. - To close the model setup, demand functions still have to be derived. Therefore, Y_j indicates total income of workers in j; Y_j is composed of workers' labour income $(w_j L_j)$ and of dividends workers get from their portfolio $(w_j L_j \pi)$, where π is the dividend per share of a global mutual fund. Indirect and direct exports from country i to country j in sector h, by a firm with productivity level φ, then are

[4] $$x_{ij}^{h,int}(\varphi) = p_{ij}^{h,int}(\varphi)\, q_{ij}^{h,int}(\varphi) = \mu_h Y_j \left(\frac{p_{ij}^{h,int}(\varphi)}{P_j^h}\right)^{1-\sigma_h} \quad , \text{if } \bar{\varphi}_{ij}^{h,ex} \geq \varphi \geq \bar{\varphi}_{ij}^{h,int}$$

$$x_{ij}^{h,ex}(\varphi) = p_{ij}^{h,ex}(\varphi)\, q_{ij}^{h,ex}(\varphi) = \mu_h Y_j \left(\frac{p_{ij}^{h,ex}(\varphi)}{P_j^h} \right)^{1-\sigma_h} \quad , \text{if } \varphi \geq \bar{\varphi}_{ij}^{h,ex} \tag{5}$$

where P_j^h is an ideal price index for good h in country j. If only those firms in sector h are considered which are productive enough to export profitable - either indirectly or directly - to country j, i.e. all firms with a productivity level φ higher than $\bar{\varphi}_{ij}^{h,int}$, then the ideal price index P_j^h and dividends per share π are defined as

$$P_j^h = \left(\sum_{i=1}^{N} w_i L_i \left(\int_{\bar{\varphi}_{ij}^{h,int}}^{\bar{\varphi}_{ij}^{h,ex}} \left(\frac{w_i \lambda^h \tau_{ij}^h}{\rho \varphi} \right)^{1-\sigma_h} dG_h(\varphi) + \int_{\bar{\varphi}_{ij}^{h,ex}}^{\infty} \left(\frac{w_i \tau_{ij}^h}{\rho \varphi} \right)^{1-\sigma_h} dG_h(\varphi) \right) \right)^{\frac{1}{1-\sigma_h}} \tag{6}$$

and

$$\pi = \frac{\sum_{h=1}^{H} \sum_{i,j=1}^{N} w_i L_i \left(\int_{\bar{\varphi}_{ij}^{h,int}}^{\bar{\varphi}_{ij}^{h,ex}} \pi_{ij}^{h,int} dG_h(\varphi) + \int_{\bar{\varphi}_{ij}^{h,ex}}^{\infty} \pi_{ij}^{h,ex} dG_h(\varphi) \right)}{\sum_{n=1}^{N} w_n L_n}. \tag{7}$$

Analogous to Chaney, only sector h is considered for now. For easier notation, the subscript h and superscript h, respectively, are dropped.

Trade with Heterogeneous Firms

Now the general equilibrium with trade is to be computed with the model. The selection of firms for an indirect or a direct export mode is to be modelled, and predictions for aggregate bilateral trade flows for both export modes, indirect or direct, are to be generated. Again, the structure is close to Chaney [2008]. Derivations also follow Bombarda [2011].[3]

Thresholds of Profitability. - As indicated above, the selection of a firm for indirect or direct exports depends on its magnitude of potential profits, i.e. the exceeding of a particular threshold of profitability. The first relevant threshold of profitability for exports is the threshold of profitability for indirect exports $\bar{\varphi}_{ij}^{int}$, i.e. the productivity level φ where the least productive, indirectly exporting firm is just indifferent between indirect exports to country j and no exports. Solving $\pi_{ij}^{int}\left(\bar{\varphi}_{ij}^{int}\right) = 0$ for $\bar{\varphi}_{ij}^{int}$ yields

$$\bar{\varphi}_{ij}^{int} = \lambda_1 \left(\frac{f_{ij}^{int}}{Y_j} \right)^{\frac{1}{(\sigma-1)}} \frac{w_i \tau_{ij}}{P_j} \left(\lambda^{-\sigma} \right)^{\frac{1}{(1-\sigma)}} \tag{8}$$

[3]A similar approach to Bombarda is also developed in Irarrazabal et al. [2010].

with λ_1 a constant.[4] The other relevant threshold of profitability is the threshold of profitability for direct exports $\bar{\varphi}^{ex}_{ij}$, i.e. the productivity level φ where the least productive, directly exporting firm is just indifferent between indirect or direct exports to country j. Solving $\pi^{int}_{ij}\left(\bar{\varphi}^{ex}_{ij}\right) = \pi^{ex}_{ij}\left(\bar{\varphi}^{ex}_{ij}\right)$ for $\bar{\varphi}^{ex}_{ij}$ yields

$$[9] \qquad \bar{\varphi}^{ex}_{ij} = \lambda_1 \left(\frac{f^{int}_{ij} - f^{ex}_{ij}}{Y_j}\right)^{\frac{1}{(\sigma-1)}} \frac{w_i \tau_{ij}}{P_j} \left(\lambda^{-\sigma} - 1\right)^{\frac{1}{(1-\sigma)}}.$$

Equilibrium Price Index. - Having specified explicit formulas for the thresholds of profitability $\bar{\varphi}^{int}_{ij}$ and $\bar{\varphi}^{ex}_{ij}$, one can solve for the general equilibrium ideal price index. Considering that $Y_i = w_i L_i (1+\pi)$ so $w_i L_i = \frac{Y_i}{(1+\pi)}$, the ideal price index [6] can be rewritten as

$$[10] \qquad P_j = \lambda_2 Y_j^{\frac{(\sigma-1)-\gamma}{\gamma(\sigma-1)}} \theta_j$$

where $\theta_j^{-\gamma} \equiv \sum_{i=1}^{N} \left(\frac{Y_i}{Y}\right) \left[(w_i \lambda \tau_{ij})^{-\gamma} \times \left[\left(f^{int}_{ij}\right)^{\frac{1}{1-\sigma}} \times \lambda^{\frac{1}{\sigma-1}} \right]^{(\sigma-1)-\gamma} + (w_i \tau_{ij})^{-\gamma} \times \left[\left(f^{int}_{ij} - f^{ex}_{ij}\right)^{\frac{1}{\sigma-1}} \times \left(\lambda^{-\sigma} - 1\right)^{\frac{1}{1-\sigma}} \right]^{(\sigma-1)-\gamma} \right]$, Y is world output, and λ_2 is a constant.[5]

θ_j is an aggregate index of country j's remoteness from the rest of the world. In principle, the index is reminiscent of Anderson and van Wincoop's [2003] 'multilateral trade resistance' index, with the exception that θ_j additionally takes into account the impact of fixed costs and of firm heterogeneity on aggregate prices.

Equilibrium Exports, Thresholds, and Profits. - Plugging the general equilibrium price index [10] into the corresponding demand functions [4] and [5] and into the corresponding thresholds of profitability [8] and [9], allows one to solve for the general equilibrium. In general equilibrium, indirect exports $x^{int}_{ij}(\varphi)$ from country i to country j by an individual firm with productivity φ, the threshold of profitability $\bar{\varphi}^{int}_{ij}$ above which indirect exports to j become profitable, aggregate output Y_j, and dividends per share π, are given as

$$[11] \qquad \begin{cases} x^{int}_{ij}(\varphi) &= \begin{cases} \lambda_3 \left(\frac{Y_j}{Y}\right)^{\frac{(\sigma-1)}{\gamma}} \left(\frac{w_i \lambda \tau_{ij}}{\theta_j}\right)^{1-\sigma} \varphi^{\sigma-1} & \text{, if } \bar{\varphi}^{ex}_{ij} \geq \varphi \geq \bar{\varphi}^{int}_{ij} \\ 0 & \text{otherwise,} \end{cases} \\ \bar{\varphi}^{int}_{ij} &= \lambda_4 \left(\frac{Y}{Y_j}\right)^{\frac{1}{\gamma}} \left(\frac{w_i \tau_{ij}}{\theta_j}\right) \left(f^{int}_{ij}\right)^{\frac{1}{(\sigma-1)}} \left(\lambda^{-\sigma}\right)^{\frac{1}{(1-\sigma)}}, \\ Y_i &= (1+\lambda_5) w_i L_i, \\ \pi &= \lambda_5, \end{cases}$$

and the corresponding equilibrium variables for direct exports are given as

[4] $\lambda_1 = (\sigma/\mu)^{1/(\sigma-1)} (\sigma/(\sigma-1))$.

[5] $\lambda_2^{\gamma} = \left(\frac{\gamma-(\sigma-1)}{\gamma}\right) \left(\frac{\sigma}{\mu}\right)^{\gamma/(\sigma-1)-1} \left(\frac{\sigma}{\sigma-1}\right)^{\gamma} \left(\frac{1+\pi}{Y}\right)$.

$$
\text{[12]} \qquad \begin{cases} x_{ij}^{ex}(\varphi) &= \begin{cases} \lambda_3 \left(\frac{Y_j}{Y}\right)^{\frac{(\sigma-1)}{\gamma}} \left(\frac{w_i \tau_{ij}}{\theta_j}\right)^{1-\sigma} \varphi^{\sigma-1} & \text{, if } \varphi \geq \bar{\varphi}_{ij}^{ex} \\ 0 & \text{otherwise,} \end{cases} \\ \bar{\varphi}_{ij}^{ex} &= \lambda_4 \left(\frac{Y}{Y_j}\right)^{\frac{1}{\gamma}} \left(\frac{w_i \tau_{ij}}{\theta_j}\right) \left(f_{ij}^{int} - f_{ij}^{ex}\right)^{\frac{1}{(\sigma-1)}} \left(\lambda^{-\sigma} - 1\right)^{\frac{1}{(1-\sigma)}}, \\ Y_i &= (1+\lambda_5)\, w_i L_i, \\ \pi &= \lambda_5, \end{cases}
$$

with λ_3, λ_4, and λ_5 as constants.[6]

Aggregate Trade. - The general equilibrium variables [11] and [12] allow one to solve for aggregate bilateral trade flows for indirect and direct exports. Solving the corresponding integrals[7] yields the following gravity equation for indirect exports

$$
\text{[13]} \qquad X_{ij}^{ex} = \mu \frac{Y_i Y_j}{Y} \left(\frac{w_i \tau_{ij}}{\theta_j}\right)^{-\gamma} \left(\frac{f_{ij}^{int} - f_{ij}^{ex}}{\lambda^{-\sigma} - 1}\right)^{\frac{(\sigma-1)-\gamma}{\sigma-1}}
$$

and the following gravity equation for direct exports

$$
\text{[14]} \qquad X_{ij}^{int} = \mu \left(\frac{Y_i Y_j}{Y}\right) \left(\frac{\tau_{ij} w_i}{\theta_j}\right)^{-\gamma} \left[\left(\frac{f_{ij}^{int} - f_{ij}^{ex}}{\lambda^{-\sigma} - 1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right]^{(\sigma-1)-\gamma}.
$$

As expected, bilateral exports X_{ij}^{int} and X_{ij}^{ex} depend on the usual gravity variables, i.e. economic mass variables, gravitational distance variables, and a measure of trade remoteness. Additionally, exports now also depend on fixed trade costs and intermediate trade costs.

3 Intensive versus Extensive Margins of Trade

In this section, the relation between the elasticity of substitution and intensive and extensive margin elasticities, respectively, is revisited. Besides this, the sizes of elasticities of trade flows and the signs of intensive and extensive margin elasticities are compared. The definitions of intensive and extensive margin elasticities follow Chaney [2008]; hence, the intensive margin measures how much each existing exporter changes its exports in response to a change in a trade barrier, and the extensive margin measures how much new entrants export. Formulas for the intensive and extensive margin elasticities are given in Table 1;[8] additional information on the corresponding signs of the elasticities and of their

[6] $\lambda_3 = \sigma \lambda_4^{1-\sigma}$; $\lambda_4 = [\sigma/\mu \times \gamma/[\gamma - (\sigma-1)] \times 1/(1+\lambda_5)]^{1/\gamma}$.

[7] Details on the derivation of gravity equations are given in Appendix A.1.

[8] Details on the derivation of intensive and extensive margin elasticities are given in Appendix A.2.

derivatives w.r.t. elasticity of substitution are given in Table 2 and Table 3, respectively.

For the direct export mode main results of Chaney [2008] are confirmed:

'. . . [T]he elasticity of substitution magnifies the sensitivity of the intensive margin to trade barriers and dampens the sensitivity of the extensive margin. . . . [T]he dampening effect on the extensive margin dominates the magnifying effect on the intensive margin.' [Chaney, 2008, p. 1715]

For the indirect export mode the first proposition still applies; the elasticity of substitution magnifies the sensitivity of the intensive margin to trade barriers and dampens the sensitivity of the extensive margin, i.e. the intensive margin elasticity is increasing with the elasticity of substitution and the extensive margin elasticity is decreasing. But the dampening effect on the extensive margin does not dominate the magnifying effect on the intensive margin anymore. For instance, the partial derivatives w.r.t. elasticity of substitution for variable trade costs (i.e. iceberg trade costs τ_{ij} or ad valorem tariffs $\mathrm{t_{ij}}$) are greater than zero, i.e. the dampening effect is dominated by the magnifying effect and not in reverse. The dampening effect only dominates in the case of intermediate trade costs λ, when the corresponding extensive margin elasticity is positive (see Table 2, Table 3).

Additionally, for the direct export mode, it is also confirmed that

'. . . the same trade barriers will have a larger impact on trade flows than in the [Krugman] Model with representative firms. When trade barriers decrease, each firm exports more.' [Chaney, 2008, p. 1708]

On the contrary, for the indirect export mode, the same trade barriers will have an even smaller impact on trade flows than in the Krugman Model [1980]. The extensive margin elasticities for variable trade costs $(\tau_{\mathrm{ij}}, \mathrm{t_{ij}})$ have negative signs; hence, the corresponding elasticities of trade flows are smaller in total (see Table 2).

In general, intensive and extensive margin elasticities have the expected signs (see Table 2); ambiguous are only the results for intermediate trade costs λ and fixed costs $\mathrm{f^{int}}$ under the indirect export mode. Here, two effects seem to counteract each other, where an increase in intermediate trade costs λ (intermediate fixed costs $\mathrm{f^{int}}$) not only decreases the lower productivity threshold $\bar{\varphi}^{\mathrm{int}}$ (i.e. decreases the exports of new entrants), but also increases the upper productivity threshold $\bar{\varphi}^{\mathrm{ex}}$ (i.e. increases the exports of new entrants) (see Figure 2). Which effect dominates is an empirical question.

Despite the reversals in sign and the changes in size - at least in part - all the results for the indirect export mode are economically meaningful. An equal percentage decrease in variable trade costs $(\tau_{\mathrm{ij}}, \mathrm{t_{ij}})$ does not imply the same percentage decrease in trade costs for the indirect export mode, as it does for the direct export mode. Under the indirect export mode, additional intermediate trade costs λ have to be beared; hence, there is a relative comparative cost disadvantage. This comparative cost disadvantage explains the negative sign for the extensive margin elasticity w.r.t. variable trade costs $(\tau_{\mathrm{ij}}, \mathrm{t_{ij}})$.

This comparative cost disadvantage is decreasing with the elasticity of substitution,

Table 1: Elasticities of Trade Flows (Formulas of Intensive & Extensive Margins)

	Krugman Model	**Intermediate Melitz Model**				**Melitz Model**	
	direct mode	indirect mode		direct mode		direct mode	
	intensive	intensive	extensive	intensive	extensive	intensive	extensive
iceberg trade costs (τ_{ij})	$\sigma - 1$	$\sigma - 1$	$\Gamma_1 (\gamma - (\sigma - 1))$	$\sigma - 1$	$\gamma - (\sigma - 1)$	$\sigma - 1$	$\gamma - (\sigma - 1)$
intermediate trade costs (λ)	–	$\sigma - 1$	$\Gamma_3 \left(\frac{\gamma\sigma}{\sigma-1} - \sigma\right)$	–	$\Gamma_2 \left(\frac{\gamma\sigma}{\sigma-1} - \sigma\right)$	–	–
ad valorem tariffs (t_{ij})	σ	σ	$\Gamma_1 \left(\frac{\gamma\sigma}{\sigma-1} - \sigma\right)$	σ	$\frac{\gamma\sigma}{\sigma-1} - \sigma$	σ	$\frac{\gamma\sigma}{\sigma-1} - \sigma$
fixed costs (f_{ij}^{ex})	–	–	$\Gamma_6 \left(\frac{\gamma-(\sigma-1)}{\sigma-1}\right)$	–	$\Gamma_4 \left(\frac{\gamma-(\sigma-1)}{1-\sigma}\right)$	–	$\frac{\gamma-(\sigma-1)}{\sigma-1}$
intermediate fixed costs (f_{ij}^{int})	–	–	$\Gamma_7 \left(\frac{\gamma-(\sigma-1)}{\sigma-1}\right)$	–	$\Gamma_5 \left(\frac{\gamma-(\sigma-1)}{\sigma-1}\right)$	–	–

Notes: $\omega := \lambda^{1-\sigma}; \Gamma_1 := \left[\frac{X^{ex}}{X^{int}}(\omega - 1) - 1\right]; \Gamma_2 := \frac{\lambda^{-\sigma}}{\lambda^{-\sigma}-1}; \Gamma_3 := \left[\frac{X^{ex}}{X^{int}}(\omega - \Gamma_2) - 1\right]; \Gamma_4 := \frac{f^{ex}}{f^{int}-f^{ex}}; \Gamma_5 := \frac{f^{int}}{f^{int}-f^{ex}}; \Gamma_6 := \left[\frac{X^{ex}}{X^{int}}\Gamma_4\right]; \Gamma_7 := \left[\frac{X^{ex}}{X^{int}}(\omega - \Gamma_5) - 1\right].$

Table 2: Elasticities of Trade Flows (Signs)

	Krugman Model	**Intermediate Melitz Model**				**Melitz Model**	
	direct mode	indirect mode		direct mode		direct mode	
	intensive	intensive	extensive	intensive	extensive	intensive	extensive
iceberg trade costs (τ_{ij})	$\hat{\varepsilon}_{\tau}^{km} > 0$	$\hat{\varepsilon}_{\tau}^{int} > 0$	$\bar{\varepsilon}_{\tau}^{int} < 0$	$\hat{\varepsilon}_{\tau}^{ex} > 0$	$\bar{\varepsilon}_{\tau}^{ex} > 0$	$\hat{\varepsilon}_{\tau}^{mm} > 0$	$\bar{\varepsilon}_{\tau}^{mm} > 0$
intermediate trade costs (λ)	–	$\hat{\varepsilon}_{\lambda}^{int} > 0$	$\bar{\varepsilon}_{\lambda}^{int} \lesseqqgtr 0$	–	$\bar{\varepsilon}_{\lambda}^{ex} < 0$	–	–
ad valorem tariffs (t_{ij})	$\hat{\varepsilon}_{t}^{km} > 0$	$\hat{\varepsilon}_{t}^{int} > 0$	$\bar{\varepsilon}_{t}^{int} < 0$	$\hat{\varepsilon}_{t}^{ex} > 0$	$\bar{\varepsilon}_{t}^{ex} > 0$	$\hat{\varepsilon}_{t}^{mm} > 0$	$\bar{\varepsilon}_{t}^{mm} > 0$
fixed costs (f_{ij}^{ex})	–	–	$\bar{\varepsilon}_{fex}^{int} < 0$	–	$\bar{\varepsilon}_{fex}^{ex} > 0$	–	$\bar{\varepsilon}_{fex}^{mm} > 0$
intermediate fixed costs (f_{ij}^{int})	–	–	$\bar{\varepsilon}_{fint}^{int} \lesseqqgtr 0$	–	$\bar{\varepsilon}_{fint}^{ex} < 0$	–	–

Notes: $\hat{\varepsilon}_{\theta}^{m}/\bar{\varepsilon}_{\theta}^{m} :=$ intensive/extensive margin elasticity of trade flows w.r.t. θ for model m.

Table 3: Elasticities of Trade Flows (Partial Derivatives w.r.t. Substitution Elasticity)

	Krugman Model	**Intermediate Melitz Model**		**Melitz Model**
	direct mode	indirect mode	direct mode	direct mode
iceberg trade costs (τ_{ij})	$\frac{\partial\varepsilon_{\tau}^{\mathrm{km}}}{\partial\sigma} > 0$	$\frac{\partial\varepsilon_{\tau}^{\mathrm{int}}}{\partial\sigma} > 0$	$\frac{\partial\varepsilon_{\tau}^{\mathrm{ex}}}{\partial\sigma} = 0$	$\frac{\partial\varepsilon_{\tau}^{\mathrm{mm}}}{\partial\sigma} = 0$
intermediate trade costs (λ)	–	$\frac{\partial\varepsilon_{\lambda}^{\mathrm{int}}}{\partial\sigma} \gtreqless 0$	$\frac{\partial\varepsilon_{\lambda}^{\mathrm{ex}}}{\partial\sigma} > 0$	–
ad valorem tariffs $(\mathrm{t_{ij}})$	$\frac{\partial\varepsilon_{\mathrm{t}}^{\mathrm{km}}}{\partial\sigma} > 0$	$\frac{\partial\varepsilon_{\mathrm{t}}^{\mathrm{int}}}{\partial\sigma} > 0$	$\frac{\partial\varepsilon_{\mathrm{t}}^{\mathrm{ex}}}{\partial\sigma} < 0$	$\frac{\partial\varepsilon_{\mathrm{t}}^{\mathrm{mm}}}{\partial\sigma} < 0$
fixed costs $\left(\mathrm{f_{ij}^{ex}}\right)$	–	$\frac{\partial\varepsilon_{\mathrm{f^{ex}}}^{\mathrm{int}}}{\partial\sigma} > 0$	$\frac{\partial\varepsilon_{\mathrm{f^{ex}}}^{\mathrm{ex}}}{\partial\sigma} < 0$	$\frac{\partial\varepsilon_{\mathrm{f^{ex}}}^{\mathrm{mm}}}{\partial\sigma} < 0$
intermediate fixed costs $\left(\mathrm{f_{ij}^{int}}\right)$	–	$\frac{\partial\varepsilon_{\mathrm{f^{int}}}^{\mathrm{int}}}{\partial\sigma} \gtreqless 0$	$\frac{\partial\varepsilon_{\mathrm{f^{int}}}^{\mathrm{ex}}}{\partial\sigma} > 0$	–

Notes: $\frac{\partial\varepsilon_{\theta}^{\mathrm{m}}}{\partial\sigma}$:= partial derivative of $\varepsilon_{\theta}^{\mathrm{m}}$ w.r.t. substitution elasticity σ; $\varepsilon_{\theta}^{\mathrm{m}}$:= elasticity of trade flows w.r.t. θ for model m.

since a higher elasticity of substitution implies an increase in competition, and thus smaller market shares. If market shares decrease, then it should become more difficult to become a direct exporter. If, however, the number of direct exporters is decreasing, then the number of exporters with a comparative cost advantage should also decrease. Hence, the comparative cost advantage that can be realized under the direct export mode should become smaller, and thus the negative effect on the indirect export mode, too. With an increase in the elasticity of substitution, the extensive margin elasticity w.r.t. variable trade costs (τ_{ij}, t_{ij}) should become less negative.

The same economic logic applies for intermediate trade costs λ and fixed costs f^{int}. Here, depending on the sign of the extensive margin elasticity - positive or negative - the partial derivaties w.r.t. elasticity of substitution are decreasing or increasing; in both cases the extensive margin elasticity becomes less sensitive.

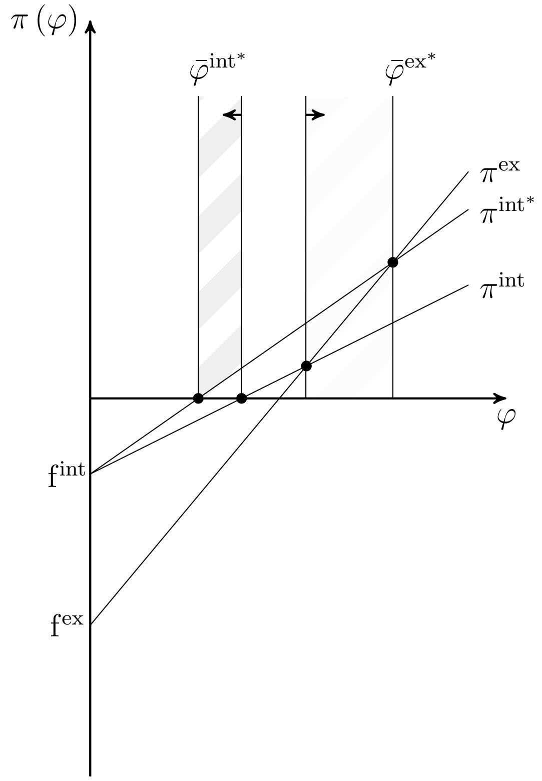
Cross effects are not further discussed here; they have the expected signs under the direct, as well as under the indirect export mode.

4 Conclusions

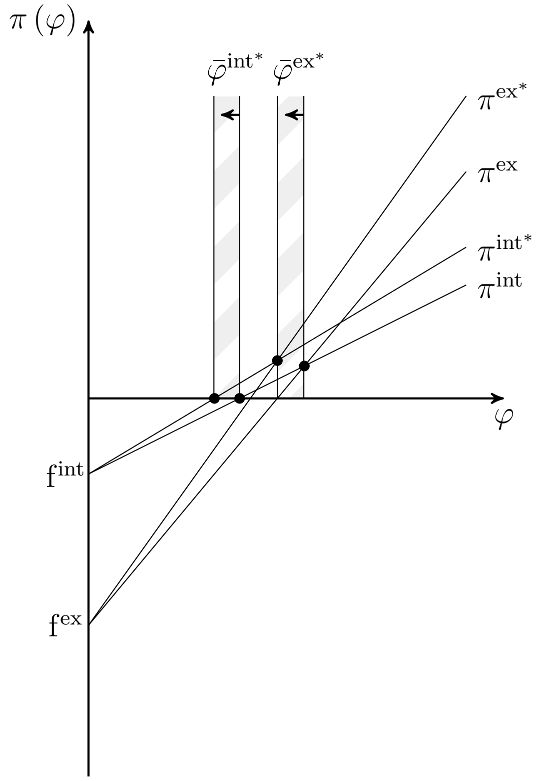
The important role of intermediaries in facilitating trade is now recognized with the extension of the standard Melitz Model by Ahn et al. [2011]; Ahn et al. extend the standard Melitz Model [Melitz, 2003] for an intermediary sector. In this paper we expanded Chaney's [2008] approach to an Intermediate Melitz Model. As Chaney suggested, we can derive explicit forms for gravity equations and extensive and intensive margin elasticities. For the direct export mode, the main results of Chaney are confirmed: '. . . [T]he elasticity of substitution magnifies the sensitivity of the intensive margin to trade barriers and dampens the sensitivity of the extensive margin. . . . [T]he dampening effect on the extensive margin dominates the magnifying effect on the intensive margin' [Chaney, 2008, p. 1785]. Further, it is confirmed that '. . . the same trade barriers will have a larger impact on trade flows than in the [Krugman] Model with representative firms' [Chaney, 2008, p. 1708].

But, Chaney's propositions only apply in part for the indirect export mode. Still, the elasticity of substitution magnifies the sensitivity of the intensive margin to trade barriers and dampens the sensitivity of the extensive margin, but the dampening effect no longer dominates the magnifying effect on the intensive margin. Also, the same trade barriers have no longer a larger, but rather a smaller impact on trade flows than in the Krugman Model [1980].

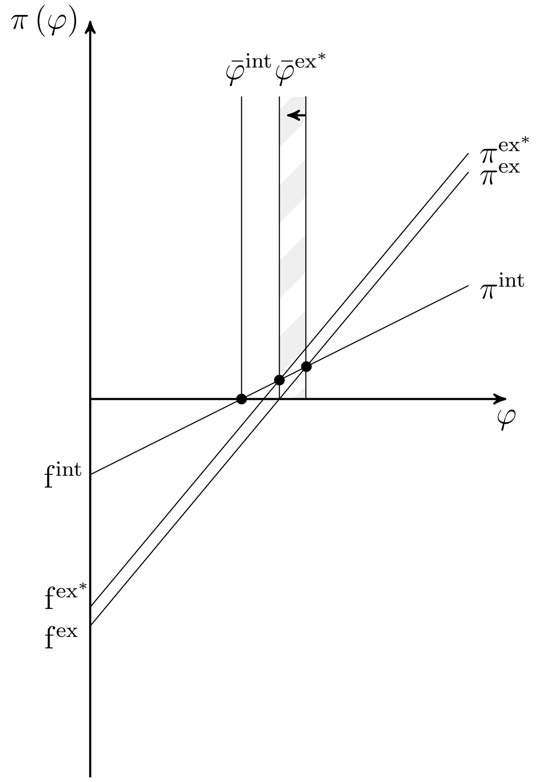
The results of this paper are important as they indicate that trade policies should be chosen with caution: depending on the export mode and the affected trade cost barriers, the impacts can not only change in size but also in sign. This should have impacts for the distribution of welfare among smaller and larger exporters or firms.



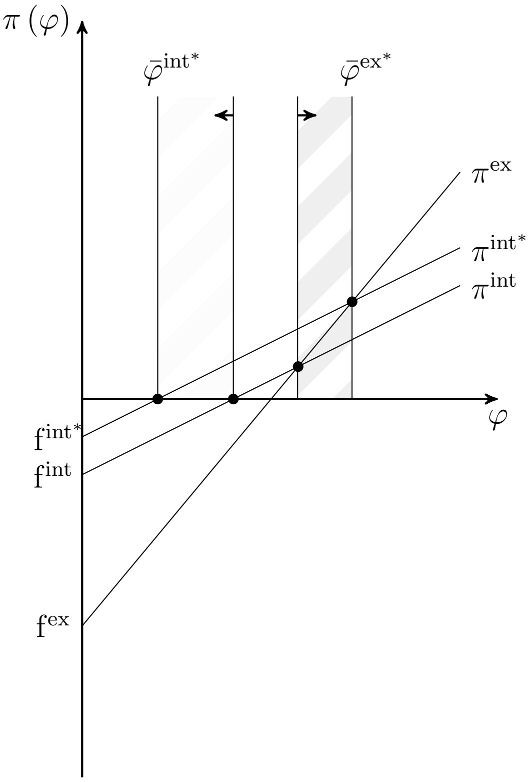
(a) Intermediate Trade Costs ($\lambda \downarrow$)



(b) Iceberg Trade Costs ($\tau \downarrow$)



(c) Fixed Costs ($\text{f}^{\text{ex}} \downarrow$)



(d) Intermediate Fixed Costs $\left(\text{f}^{\text{int}} \downarrow\right)$

Figure 2: Elasticities of Trade Flows (Graphical Illustration)

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A Mathematical Appendix

This mathematical appendix discusses in detail (1) how one derives the gravity trade model equation [14] for the intermediate sector and (2) the elasticities of the extensive margins. Details on other derivations (i.e. derivation of the gravity trade model equation [13] for the direct export sector and elasticities of the intensive margins) can be found in Chaney [2008] and Cole [2011], respectively. The approaches here mimic in principle Bombarda [2011].

A.1 Deriving the Gravity Equation of the Intermediate Sector

Total aggregate exports of the intermediate sector from i to j are defined as the sum of indirect exports of each individual firm with productivity between $\bar{\varphi}_{ij}^{ex} \geq \varphi \geq \bar{\varphi}_{ij}^{int}$:

$$X_{ij}^{int} = w_i L_i \int_{\bar{\varphi}_{ij}^{int}}^{\bar{\varphi}_{ij}^{ex}} x_{ij}^{int}(\varphi)\, dG(\varphi).$$

Considering the definitions of $x_{ij}^{int}\left(\varphi | \bar{\varphi}_{ij}^{ex} \geq \varphi \geq \bar{\varphi}_{ij}^{int}\right)$, $\bar{\varphi}_{ij}^{int}$, and $\bar{\varphi}_{ij}^{ex}$ (see [11], [12]), and using the specific assumption about the distribution G of productivity shocks, then aggregate exports can be rewritten as

$$X_{ij}^{int} = w_i L_i \int_{\bar{\varphi}_{ij}^{int}}^{\bar{\varphi}_{ij}^{ex}} \lambda_3 \left(\frac{Y_j}{Y}\right)^{\frac{\sigma-1}{\gamma}} \left(\frac{\lambda \tau_{ij} w_i}{\theta_j}\right)^{1-\sigma} \varphi^{\sigma-1} \frac{\varphi^{-\gamma-1}}{\gamma} d\varphi,$$

where λ_3 and λ_4 are constants. Further, if one assumes Pareto distributed productivities φ, then the integral can be solved and rearranged as

$$\begin{aligned}
X_{ij}^{int} &= \left(\frac{Y_j}{Y}\right)^{\frac{\sigma-1}{\gamma}} \left(\frac{\theta_j}{\tau_{ij} w_i}\right)^{\sigma-1} \frac{w_i L_i \lambda_3 \gamma}{\gamma-(\sigma-1)} \left[\lambda_4 \left(\frac{Y}{Y_j}\right)^{\frac{1}{\gamma}} \left(\frac{\tau_{ij} w_i}{\theta_j}\right) \left(\left(\frac{f_{ij}^{int}-f_{ij}^{ex}}{\lambda^{-\sigma}-1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right)\right]^{(\sigma-1)-\gamma} \\
&= w_i L_i \lambda_3 \left(\frac{Y_j}{Y}\right) \left(\frac{\theta_j}{w_i \tau_{ij}}\right)^{\gamma} \frac{\gamma}{\gamma-(\sigma-1)} \left[\lambda_4 \left(\left(\frac{f_{ij}^{int}-f_{ij}^{ex}}{\lambda^{-\sigma}-1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right)\right]^{(\sigma-1)-\gamma} \\
&= \lambda_3 (\lambda_4)^{(\sigma-1)-\gamma} \frac{\gamma}{\gamma-(\sigma-1)} \left(\frac{w_i L_i Y_j}{Y}\right) \left(\frac{\tau_{ij} w_i}{\theta_j}\right)^{-\gamma} \left[\left(\frac{f_{ij}^{int}-f_{ij}^{ex}}{\lambda^{-\sigma}-1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right]^{(\sigma-1)-\gamma} \\
&= \sigma (\lambda_4)^{-\gamma} \frac{\gamma}{\gamma-(\sigma-1)} \left(\frac{w_i L_i Y_j}{Y}\right) \left(\frac{\tau_{ij} w_i}{\theta_j}\right)^{-\gamma} \left[\left(\frac{f_{ij}^{int}-f_{ij}^{ex}}{\lambda^{-\sigma}-1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right]^{(\sigma-1)-\gamma} \\
&= \mu (1+\lambda_5) \left(\frac{w_i L_i Y_j}{Y}\right) \left(\frac{\tau_{ij} w_i}{\theta_j}\right)^{-\gamma} \left[\left(\frac{f_{ij}^{int}-f_{ij}^{ex}}{\lambda^{-\sigma}-1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right]^{(\sigma-1)-\gamma} \\
&= \mu \left(\frac{Y_i Y_j}{Y}\right) \left(\frac{\tau_{ij} w_i}{\theta_j}\right)^{-\gamma} \left[\left(\frac{f_{ij}^{int}-f_{ij}^{ex}}{\lambda^{-\sigma}-1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right]^{(\sigma-1)-\gamma}.
\end{aligned}$$

Hence, total aggregate exports X_{ij}^{int} of the intermediate sector from i to j are defined as

[14] $$X_{ij}^{int} = \mu \left(\frac{Y_i Y_j}{Y}\right) \left(\frac{\tau_{ij} w_i}{\theta_j}\right)^{-\gamma} \left[\left(\frac{f_{ij}^{int} - f_{ij}^{ex}}{\lambda^{-\sigma} - 1}\right)^{\frac{1}{\sigma-1}} - \left(\frac{f_{ij}^{int}}{\lambda^{-\sigma}}\right)^{\frac{1}{\sigma-1}}\right]^{(\sigma-1)-\gamma}.$$

A.2 Deriving the Elasticities of the Extensive Margin

Differentiating total aggregate direct exports $X_{ij}^{ex} = w_i L_i \int_{\bar{\varphi}_{ij}^{ex}}^{\infty} x_{ij}^{ex}(\varphi)\, dG(\varphi)$ w.r.t. θ_{ij} and multiplying the resulting term by θ_{ij}/X_{ij}^{ex} leads to the following formal decomposition of the elastiticity of trade flows for direct exports

$$-\frac{dX_{ij}^{ex}}{d\theta}\frac{\theta}{X_{ij}^{ex}} = \underbrace{-\frac{\theta}{X_{ij}^{ex}}\left(w_i L_i \int_{\bar{\varphi}_{ij}^{ex}}^{\infty} \frac{\partial x_{ij}^{ex}(\varphi)}{\partial \theta} dG(\varphi)\right)}_{\text{Intensive margin elasticity}} + \underbrace{\frac{\theta}{X_{ij}^{ex}}\left(w_i L_i x\left(\bar{\varphi}_{ij}^{ex}\right) G'\left(\bar{\varphi}_{ij}^{ex}\right)\frac{\partial \bar{\varphi}_{ij}^{ex}}{\partial \theta}\right)}_{\text{Extensive margin elasticity}}.$$

The first term corresponds to the intensive margin elasticity and the second term to the extensive margin elasticity. An analogous approach leads to following decomposition for total aggregate intermediate exports $X_{ij}^{int} = w_i L_i \int_{\bar{\varphi}_{ij}^{int}}^{\bar{\varphi}_{ij}^{ex}} x_{ij}^{int}(\varphi)\, dG(\varphi)$

$$\begin{aligned}-\frac{dX_{ij}^{int}}{d\theta}\frac{\theta}{X_{ij}^{int}} \; &= \; \underbrace{-\frac{\theta}{X_{ij}^{int}}\left(w_i L_i \int_{\bar{\varphi}_{ij}^{int}}^{\bar{\varphi}_{ij}^{ex}} \frac{\partial x_{ij}^{int}(\varphi)}{\partial \theta} dG(\varphi)\right)}_{\text{Intensive margin elasticity}} \\ &\underbrace{-\frac{\theta}{X_{ij}^{int}}\left[\left(w_i L_i x\left(\bar{\varphi}_{ij}^{ex}\right) G'\left(\bar{\varphi}_{ij}^{ex}\right)\frac{\partial \bar{\varphi}_{ij}^{ex}}{\partial \theta}\right) - \left(w_i L_i x\left(\bar{\varphi}_{ij}^{int}\right) G'\left(\bar{\varphi}_{ij}^{int}\right)\frac{\partial \bar{\varphi}_{ij}^{int}}{\partial \theta}\right)\right]}_{\text{Extensive margin elasticity}}.\end{aligned}$$

To construct explicit formulas for the extensive margin elasticities, thresholds of profitability $\bar{\varphi}_{ij}^{ex}$ and $\bar{\varphi}_{ij}^{int}$ are to be differentiated first w.r.t. to θ_{ij}, where $\theta_{ij} = \left\{\tau_{ij}, \lambda, f_{ij}^{ex}, f_{ij}^{int}\right\}$. If $\partial\theta_j/\partial\theta_{ij} \approx 0$, then the derivatives are

$$\frac{\partial \bar{\varphi}_{ij}^{ex}}{\partial \tau_{ij}} = \frac{\bar{\varphi}_{ij}^{ex}}{\tau_{ij}}, \quad \frac{\partial \bar{\varphi}_{ij}^{ex}}{\partial \lambda} = \frac{\sigma}{\sigma-1}\frac{\bar{\varphi}_{ij}^{ex}}{\lambda^{-\sigma}-1}\frac{\lambda^{-\sigma}}{\lambda}, \quad \frac{\partial \bar{\varphi}_{ij}^{ex}}{\partial f_{ij}^{ex}} = \frac{1}{1-\sigma}\frac{\bar{\varphi}_{ij}^{ex}}{f_{ij}^{int}-f_{ij}^{ex}},$$
$$\frac{\partial \bar{\varphi}_{ij}^{ex}}{\partial f_{ij}^{int}} = \frac{1}{\sigma-1}\frac{\bar{\varphi}_{ij}^{ex}}{f_{ij}^{int}-f_{ij}^{ex}},$$

and

$$\frac{\partial \bar{\varphi}_{ij}^{int}}{\partial \tau_{ij}} = \frac{\bar{\varphi}_{ij}^{int}}{\tau_{ij}}, \quad \frac{\partial \bar{\varphi}_{ij}^{int}}{\partial \lambda} = \frac{\sigma}{\sigma-1}\frac{\bar{\varphi}_{ij}^{int}}{\lambda^{-\sigma}}, \quad \frac{\partial \bar{\varphi}_{ij}^{int}}{\partial f_{ij}^{ex}} = 0, \quad \frac{\partial \bar{\varphi}_{ij}^{int}}{\partial f_{ij}^{int}} = \frac{1}{\sigma-1}\frac{\bar{\varphi}_{ij}^{int}}{f_{ij}^{int}},$$

respectively. Additionally, $w_i L_i x_{ij}^{ex} G'\left(\bar{\varphi}_{ij}^{ex}\right)\bar{\varphi}_{ij}^{ex}$ and $w_i L_i x_{ij}^{int} G'\left(\bar{\varphi}_{ij}^{int}\right)\bar{\varphi}_{ij}^{int}$ can be defined as

$$w_i L_i x_{ij}^{ex} G'\left(\bar{\varphi}_{ij}^{ex}\right)\bar{\varphi}_{ij}^{ex} = (\gamma - (\sigma-1))\, X_{ij}^{ex}$$

and

$$w_i L_i x_{ij}^{int} G'\left(\bar{\varphi}_{ij}^{int}\right)\bar{\varphi}_{ij}^{int} = (\gamma - (\sigma-1))\left[\omega X_{ij}^{ex} - X_{ij}^{int}\right].$$

Proof. If x_{ij}^{int} and x_{ij}^{ex} are redefined as $x_{ij}^{int} = \lambda_{ij}^{int}\varphi^{\sigma-1}$ and $x_{ij}^{ex} = \lambda_{ij}^{int}\lambda^{1-\sigma}\varphi^{\sigma-1}$ (see [11] and [12]), and if the following property of the Pareto Distribution $G'(\varphi) = \varphi^{-\gamma-1}/\gamma$ is considered, then aggregate indirect exports can be rewritten as

$$
\begin{aligned}
X_{ij}^{int} &= w_i L_i \int_{\bar{\varphi}_{ij}^{int}}^{\bar{\varphi}_{ij}^{ex}} x_{ij}^{int}(\varphi)\, dG(\varphi) \\
&= w_i L_i \int_{\bar{\varphi}_{ij}^{int}}^{\bar{\varphi}_{ij}^{ex}} \lambda_{ij}^{int}\varphi^{1-\sigma}\gamma\varphi^{\gamma-1} d\varphi \\
&= w_i L_i \tfrac{\gamma}{\gamma-(\sigma-1)} \left[\lambda_{ij}^{int}\left(\bar{\varphi}_{ij}^{ex}\right)^{1-\sigma}\left(\bar{\varphi}_{ij}^{ex}\right)^{\gamma} - \lambda_{ij}^{int}\left(\bar{\varphi}_{ij}^{int}\right)^{1-\sigma}\left(\bar{\varphi}_{ij}^{int}\right)^{\gamma}\right] \\
&= w_i L_i \tfrac{1}{\gamma-(\sigma-1)} \left[\underbrace{\lambda^{1-\sigma}}_{\omega} x_{ij}^{ex}\left(\bar{\varphi}_{ij}^{ex}\right) G'\left(\bar{\varphi}_{ij}^{ex}\right)\bar{\varphi}_{ij}^{ex} - x_{ij}^{int}\left(\bar{\varphi}_{ij}^{int}\right) G'\left(\bar{\varphi}_{ij}^{int}\right)\bar{\varphi}_{ij}^{int}\right] \\
&= w_i L_i \tfrac{1}{\gamma-(\sigma-1)}\omega x_{ij}^{ex}\left(\bar{\varphi}_{ij}^{ex}\right) G'\left(\bar{\varphi}_{ij}^{ex}\right)\bar{\varphi}_{ij}^{ex} - w_i L_i \tfrac{1}{\gamma-(\sigma-1)} x_{ij}^{int}\left(\bar{\varphi}_{ij}^{int}\right) G'\left(\bar{\varphi}_{ij}^{int}\right)\bar{\varphi}_{ij}^{int}
\end{aligned}
$$

$$
\begin{aligned}
w_i L_i x_{ij}^{int}\left(\bar{\varphi}_{ij}^{int}\right) G'\left(\bar{\varphi}_{ij}^{int}\right)\bar{\varphi}_{ij}^{int} &= (\gamma-(\sigma-1))\left[w_i L_i \tfrac{\omega}{\gamma-(\sigma-1)} x_{ij}^{ex}\left(\bar{\varphi}_{ij}^{ex}\right) G'\left(\bar{\varphi}_{ij}^{ex}\right)\bar{\varphi}_{ij}^{ex} - X_{ij}^{int}\right] \\
&= (\gamma-(\sigma-1))\left[\omega X_{ij}^{ex} - X_{ij}^{int}\right]
\end{aligned}
$$

□

Given these definitions, the extensive margin elasticities for the direct export mode are calculated as

$$
\begin{aligned}
\text{Elasticity of the extensive margin w.r.t. intermediate trade costs } (\lambda) &= \left(\tfrac{\gamma\sigma}{\sigma-1} - \sigma\right)\underbrace{\left[\frac{\lambda^{-\sigma}}{\lambda^{-\sigma}-1}\right]}_{\Gamma_2} \\
\text{Elasticity of the extensive margin w.r.t. fixed costs } \left(f_{ij}^{ex}\right) &= \left(\tfrac{\gamma-(\sigma-1)}{1-\sigma}\right)\underbrace{\left[\frac{f_{ij}^{ex}}{f_{ij}^{int}-f_{ij}^{ex}}\right]}_{\Gamma_4} \\
\text{Elasticity of the extensive margin w.r.t. intermediate fixed costs } \left(f_{ij}^{int}\right) &= \left(\tfrac{\gamma-(\sigma-1)}{\sigma-1}\right)\underbrace{\left[\frac{f_{ij}^{int}}{f_{ij}^{int}-f_{ij}^{ex}}\right]}_{\Gamma_5}
\end{aligned}
$$

and the extensive margins elasticities for the indirect export mode as

$$
\begin{aligned}
\text{Elasticity of the extensive margin w.r.t. iceberg trade costs } (\tau_{ij}) &= (\gamma-(\sigma-1))\underbrace{\left[\frac{X_{ij}^{ex}}{X_{ij}^{int}}(\omega-1)-1\right]}_{\Gamma_1} \\
\text{Elasticity of the extensive margin w.r.t. intermediate trade costs } (\lambda) &= \left(\tfrac{\gamma\sigma}{\sigma-1} - \sigma\right)\underbrace{\left[\frac{X_{ij}^{ex}}{X_{ij}^{int}}(\omega-\Gamma_2)-1\right]}_{\Gamma_3} \\
\text{Elasticity of the extensive margin w.r.t. fixed costs } \left(f_{ij}^{ex}\right) &= \left(\tfrac{\gamma-(\sigma-1)}{\sigma-1}\right)\underbrace{\left[\frac{X_{ij}^{ex}}{X_{ij}^{int}}\Gamma_4\right]}_{\Gamma_6} \\
\text{Elasticity of the extensive margin w.r.t. intermediate fixed costs } \left(f_{ij}^{int}\right) &= \left(\tfrac{\gamma-(\sigma-1)}{\sigma-1}\right)\underbrace{\left[\frac{X_{ij}^{ex}}{X_{ij}^{int}}(\omega-\Gamma_5)-1\right]}_{\Gamma_7}.
\end{aligned}
$$

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		2009
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		2010
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1004	Deimel, Mark und Ludwig Theuvsen	Standortvorteil Nordwestdeutschland? Eine Untersuchung zum Einfluss von Netzwerk- und Clusterstrukturen in der Schweinefleischerzeugung
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Diskussionspapiere (2000 bis 31. Mai 2006: Institut für Rurale Entwicklung der Georg-August-Universität, Göttingen)

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Die Wurzeln der **Fakultät für Agrarwissenschaften** reichen in das 19. Jahrhundert zurück. Mit Ausgang des Wintersemesters 1951/52 wurde sie als siebente Fakultät an der Georgia-Augusta-Universität durch Ausgliederung bereits existierender landwirtschaftlicher Disziplinen aus der Mathematisch-Naturwissenschaftlichen Fakultät etabliert.

1969/70 wurde durch Zusammenschluss mehrerer bis dahin selbständiger Institute das **Institut für Agrarökonomie** gegründet. Im Jahr 2006 wurden das Institut für Agrarökonomie und das Institut für Rurale Entwicklung zum heutigen **Department für Agrarökonomie und Rurale Entwicklung** zusammengeführt.

Das Department für Agrarökonomie und Rurale Entwicklung besteht aus insgesamt neun Professuren mit folgenden Themenschwerpunkten:

- Agrarpolitik
- Betriebswirtschaftslehre des Agribusiness
- Internationale Agrarökonomie
- Landwirtschaftliche Betriebslehre
- Landwirtschaftliche Marktlehre
- Marketing für Lebensmittel und Agrarprodukte
- Soziologie Ländlicher Räume
- Umwelt- und Ressourcenökonomik
- Welternährung und rurale Entwicklung

In der Lehre ist das Department für Agrarökonomie und Rurale Entwicklung führend für die Studienrichtung Wirtschafts- und Sozialwissenschaften des Landbaus sowie maßgeblich eingebunden in die Studienrichtungen Agribusiness und Ressourcenmanagement. Das Forschungsspektrum des Departments ist breit gefächert. Schwerpunkte liegen sowohl in der Grundlagenforschung als auch in angewandten Forschungsbereichen. Das Department bildet heute eine schlagkräftige Einheit mit international beachteten Forschungsleistungen.

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