Assessing Gains of Trade in Monopolistic Competition Under the Presence of Industry Leaders

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Abstract

A recent literature has documented a widespread rise of superstar firms. This is at odds with the simplifying assumption of a continuum of firms, predominant in International Trade. In this paper, we assess its consequences by identifying the magnitude and direction in which gains of trade depart from monopolistic competition once we account for leading firms. With this goal, we extend the Melitz model by incorporating a revenue threshold such that truly negligible firms are modeled as in Melitz, while the largest ones are treated as non-negligible firms that earn positive profits. Firm-level data for several countries show that accounting for leaders entails greater gains of trade in all cases, with differences of up to 20%. The outcome is explained by an additional benefit of reallocating resources towards more productive firms, not captured by the Melitz model: increases in aggregate income through positive effects on profits.

Keywords: gains of trade, monopolistic competition, industry leaders, superstar firms.
JEL codes: F12, F10.

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1 Introduction

A recent literature has documented a worldwide increase in concentration, along with the emergence of superstar firms (Autor et al. 2020; De Loecker et al. 2020; Bighelli et al. 2021). While the study of concentration has traditionally been circumscribed to the realm of the Industrial-Organization field, the importance of the finding lies in its widespread nature. It determines that the phenomenon goes beyond this field, and has implications for analyses conducted at the aggregate level. In particular, the International-Trade field has commonly supposed monopolistic competition as a market structure. Consequently, trade liberalization has been studied supposing negligible firms, and hence not accounting for industry leaders (henceforth, ILs).

In this paper, we investigate the consequences of such an assumption, by comparing gains of trade under monopolistic competition and an extension incorporating ILs. This allows us to assess quantitatively (i) whether the simplifying assumption of negligible firms has a substantial impact on gains of trade, and (ii) whether trade liberalization entails greater or lower gains when ILs are accounted for.

Our results establish that accounting for ILs implies higher gains of trade, with differences of up to 20%. The outcome reflects an additional benefit relative to Melitz: the reallocation of resources towards oligopolistic firms, which boosts profits and hence income. This channel is absent by definition in monopolistic competition, given the assumption of zero aggregate profits.

We proceed by considering a modeler with some given dataset and two options for computing gains of trade. In the first option, all firms are treated as in a monopolistic-competition model à la Melitz (2003). Thus, firms are conceived as ex-ante homogeneous companies that do not know their efficiency upon entry, but can discover their profitability by paying an entry cost. We refer to these firms as monopolistic firms (henceforth, MFs).

The second option is motivated by the implications of monopolistic competition when there are large differences in firm size. A setting à la Melitz entails that a firm incorporates the possibility of becoming a market leader into its expected profit. Thus, for instance, any craft brewer ventures into the beer industry by considering it possible to become AB InBev (owner of brands such as Budweiser, Corona, Stella Artois, among others), and a small furniture shop enters the industry under the possibility of becoming Ikea. Each firm's entry decision is affected by the consideration of this possibility since, even if the probability of becoming an IL is low, these firms earn substantial profits. Taking this into account, we investigate results when a modeler treats leading firms separately. Specifically, we follow Alfaro and Warzynski (2021) and conceive ILs as well-established oligopolistic firms that garner positive profits, whereas the rest of the firms are still represented as in Melitz.

To provide an example of what this second option accomplishes, consider sports apparel. The setup makes it possible to distinguish Nike, Adidas, Puma, and other big players, from typical textile companies operating on a small scale. Firms in the first group are described as leading firms that are already established in the industry (i.e., they do not incur an entry cost and know their efficiency) and garner substantial profits. On the contrary, a typical small textile company ventures into the market with uncertainty about its profitability, but expecting to remain negligible conditional on surviving. The description is supported by mounting evidence on small firms that has been documented since at least Dunne et al. (1988).[1]

This second variant for calculating gains of trade is particularly suitable for our purposes, given that it constitutes a strict generalization of Melitz—it allows us to let the data speak and assess whether Melitz fits the data well. This becomes possible since the model converges continuously to the case of Melitz: gains of trade across models become more similar when the ILs' revenue shares are lower, and end up being identical to Melitz' under absence of leaders. Consequently, the model entails a more flexible market structure, rather than a completely different one; it does not impose a prior characterization of firms, and collapses to Melitz if firms are truly insignificant in the data.

For the computation of gains of trade, we consider the standard case of two symmetric countries. The assumption allows us to isolate other motives to trade, and thereby exclusively focus on the effects of treating ILs in monopolistic competition as negligible firms. The model is calibrated by using firm-level information on manufacturing from the ORBIS dataset. By obtaining results for several countries, we get a grasp of whether our conclusions hold under different country features.

While the vast majority of countries in ORBIS do not include firms reporting both revenues

[1] In particular, it is consistent with evidence that truly negligible firms enter industries without expecting to become big or even having this goal. See, for instance, Hurst and Pugsley (2011).

and exports, there are four countries where virtually every firm does so: Croatia, France, Greece, and Turkey. Our analysis focuses in particular on Croatia and France, given their high coverage relative to official statistics. Instead, Greece and Turkey are used as robustness checks, providing further support for our conclusions.

Utilizing a revenue threshold to split firms into ILs and MFs, we derive several conclusions. The first one is that accounting for the presence of MFs seems appropriate to model aggregate phenomena, since the bulk of income comes from industries comprising a pool of negligible firms (85% for Croatia and 96% for France). The result is consistent with Alfaro and Warzynski (2021), who show that more than 80% of revenue in Danish manufacturing is generated in industries with several negligible firms operating.[2] Nonetheless, we simultaneously observe that the presence of ILs is pervasive: among the industries with a set of negligible firms, those including at least one IL encompass more than 90% of revenue in these countries. Altogether, this provides evidence in favor of our second setup variant as a good approximation for industries generating the bulk of income.

The computation of results establishes that gains of trade in the variant with ILs are greater than in Melitz, irrespective of the country used for the calibration. The outcome highlights how the reallocation of resources towards ILs can increase profits, and so be welfare-improving through its effect on income. Such a mechanism does not arise in monopolistic competition, since changes in aggregate profits are zero by definition.

We also identify features affecting the magnitude in which gains of trade differ between models. They make it possible to explain why Croatia exhibits a higher difference relative to France (20% vs 6%). The conclusion is based on several theoretical results we derive, which explain why trade liberalization increases aggregate profits relatively more in Croatia.

The analysis identifies in particular two features influencing profits and hence income. First, on average, Croatian ILs generate a greater portion of each industry's revenue and exhibit greater export intensity; consequently, better export opportunities have a more positive impact on Croatian ILs' profits. Second, the export intensity of Croatian MFs is lower relative to French MFs. This implies that better export opportunities induce relatively less entry in Croatia, which represents less competition for ILs in the goods and labor markets. As a corollary, the negative

[2] Coexistence of both types of firms within an industry has also been shown for France by Gaubert and Itskhoki (2021) and for the US by Hottman et al. (2016).

impact on the ILs' profits through this channel is mitigated.

Our paper contributes to a vast literature quantifying gains of trade under imperfect competition. In International Trade, prominent recent studies incorporating non-negligible firms into quantitative models are Atkeson and Burstein (2008), Eaton et al. (2012), Edmond et al. (2015), and Gaubert and Itskhoki (2021). Our approach to incorporate non-negligible firms follows in particular Alfaro and Warzynski (2021), which considers an industry with coexistence of monopolistic and oligopolistic firms. The article concentrates exclusively on the operating mechanisms of this setup, highlighting the granular effects of large firms on Danish manufacturing. On the contrary, we compare gains of trade across models and countries. The focus is in particular on the quantitative consequences of a modeler estimating gains of trade through Melitz, thus taking all firms negligible and therefore ignoring the existence of superstar firms. The goal is twofold: to know whether Melitz approximates gains of trade well, and if the differences predicted entail greater or lower gains of trade relative to the variant with ILs.

The paper proceeds as follows. Section 2 presents the setup and the approaches for calculating gains of trade. Section 3 derives various analytical results to compare outcomes across models. Section 4 describes the data and establishes the quantitative results. Section 5 concludes.

2 The Model

We consider a scenario with two symmetric countries, where the set of countries is denoted by $\mathcal{C}$. Throughout the paper, we use a variable's subscript ij to index countries, with i representing the country of origin and j the destination country. Moreover, the setup is described by taking countries $i, j \in \mathcal{C}$ and some industry $k \in \mathcal{I}$, where $\mathcal{I}$ is the set of industries.

2.1 Supply Side

Each country i and industry k comprises a set of firms $\overline{\Omega}^k$ that can serve any country with a unique variety. To cover the different approaches, we suppose that $\overline{\Omega}^k$ can be partitioned into a finite set $\overline{\mathscr{L}}^k$ and a real interval $\overline{\mathcal{M}}^k$. Firms in the former group are referred to as ILs, whereas those in the latter as MFs. Following an extensive literature (e.g., Shimomura and Thisse 2012; Neary 2016; Gaubert and Itskhoki 2021), we suppose that ILs have market power in their industries, but are small for the country as a whole. This implies that all firms behave as income and wage takers.[3]

The partitioning of firms makes it possible to encompass the two setup variants we analyze in a unified way. The first one is the standard Melitz model, where all firms are treated as monopolistic. This arises when the modeler supposes that $\overline{\mathscr{L}}^k$ is empty, so that there is no partition of firms and all belong to $\overline{\mathcal{M}}^k$. Instead, the extended version accounting for ILs emerges when the subset of most profitable firms belong to $\overline{\mathscr{L}}^k$, and so are treated as oligopolistic firms.

We model supply by considering labor as the sole factor of production, with each country having a mass L of identical agents. These agents are immobile across countries, and offer a unit of labor inelastically. While aggregate profits of MFs are zero, ILs earn net positive profits that need to be redistributed. We suppose in particular that agents are the owners of their country's firms, with each getting the same fraction of profits.[4]

MFs in country i and industry k are modeled as in Melitz. They comprise an unbounded set of potential entrants that are ex-ante identical and do not know their productivity. Each can incur a sunk entry cost F^k expressed in units of home workers, allowing it to receive a productivity draw φ and an assignation of a unique variety $\omega \in \overline{\mathcal{M}}_i^k$. We denote the mass of firms paying the entry cost in each country and industry k by $M_i^{E,k}$. Moreover, we consider that productivity draws in industry k come from a random variable with support $\left[\underline{\varphi}^k, \overline{\varphi}^k\right]$ and cdf G^k.

Likewise, the set of ILs from i and industry k comprises an exogenous number of oligopolistic firms and is possibly empty. Each IL serves countries with a unique variety $\omega \in \overline{\mathscr{L}}_i^k$ and has productivity φ_ω. We suppose that $\varphi_\omega > \overline{\varphi}^k$ for any $\omega \in \overline{\mathscr{L}}_i^k$, so that ILs are more productive than any other MF in the industry.

Each MF and IL ω chooses prices p_{ij}^ω in j, where $p_{ij}^\omega = \infty$ captures that ω does not serve country j. Moreover, firm ω has to pay an overhead fixed cost f_{ij}^k if it serves j, which is expressed in terms of home workers and satisfies $f_{ij}^k > f_{ii}^k$ for $i \neq j$. The technology of production

[3]This assumption can be formalized by assuming a continuum of industries.

[4]Since we eventually assume that countries are symmetric, assumptions related to firm ownership are irrelevant for profit redistribution. In particular, we could allow for a domestic firm to be owned by foreign workers. This would imply that an identical firm is located abroad, so that workers would obtain the same income from profits. Alternatively, following Chaney (2008), we could assume that firms belong to a global mutual fund that collects the profits of all firms in the world. Since each country has identical total profits, this assumption also determines the same income for workers in each country.

determines that an MF from i with productivity φ exhibits constant marginal costs. Formally, $c\left(\varphi,\tau_{ij}^{k},w_i\right):=\frac{w_i}{\varphi}\tau_{ij}^{k}$, where τ_{ij}^{k} is a trade cost taking values $\tau_{ii}^{k}:=1$ and $\tau^{k}>1$ if $i\neq j$. We suppose the same cost function for IL ω, but with trade costs $\tau_{ii}^{\omega}:=1$ and $\tau_{ij}^{\omega}:=\tau^{\omega}\tau^{k}$ if $j\neq i$. Firm-specific trade costs for ILs leave unrestricted an IL's export intensity, allowing us to let the data identify it. As a corollary, an IL could be either domestic- or export-oriented.[5]

2.2 Demand Side

The upper-tier utility function between goods is Cobb Douglas. Formally, given quantity and price indices $\left(\mathbb{Q}_j^k,\mathbb{P}_j^k\right)_{j\in\mathcal{C},k\in\mathcal{I}}$, along with parameters $\beta^k\geq 0$ such that $\sum_{k\in\mathcal{I}}\beta^k=1$, the utility in country j is

$$U_j := \exp\left[\sum_{k\in\mathcal{I}}\beta^k \ln \mathbb{Q}_j^k\right].$$

Utility maximization determines that $\mathbb{P}_j^k\mathbb{Q}_j^k=E^k$, where $E_j^k:=\beta^k Y_j$ is j's total expenditure on industry k and Y is j's income.

Likewise, preferences for each industry k are given by a CES sub-utility function. Thus, the demand in j of a variety produced by firm ω from i is

$$Q_{ij}^{\omega} := E^k\left(\mathbb{P}_j^k\right)^{\sigma^k-1}\left(p_{ij}^{\omega}\right)^{-\sigma^k},$$

where $\sigma^k>1$, and $\mathbb{P}_j^k$ is j's price index given by

$$\mathbb{P}_j^k=\left\{\sum_{i\in\mathcal{C}}\left[\int_{\omega\in\mathcal{M}_{ij}^k}\left(p_{ij}^{\omega}\right)^{1-\sigma^k}\mathrm{d}\omega+\sum_{\omega\in\mathscr{L}_{ij}^k}\left(p_{ij}^{\omega}\right)^{1-\sigma^k}\right]\right\}^{\frac{1}{1-\sigma^k}}, \tag{1}$$

where $\mathcal{M}_{ij}^k$ and $\mathscr{L}_{ij}^k$ are the set of varieties available in j that are produced by MFs and ILs from i, respectively.

2.3 Equilibrium

We consider an equilibrium with active MFs in each industry, and a possibly empty set of ILs. Moreover, we suppose selection into exporting among MFs, so that only the most productive

[5] The firm-specific term in trade costs simply allows for an IL's export intensity to take any value between 0 and 1—it does not affect the model in any other respect. We could equivalently assume that an IL has a firm-specific demand shifter in each market. This approach, in fact, rationalizes our empirical approach for calibrating each IL's revenue share. We kept the framework simpler by only adding firm-specific trade costs, since our theoretical results only depend on an IL's export intensity.

MFs export. Notice that any exporting MFs necessarily serves its domestic market, given the existence of trade costs and the fact that countries are symmetric. A corollary of this is that any active IL always serves home, since ILs are more productive than the most productive MF.

The symmetry of countries implies the existence of a symmetric equilibrium. This entails that equilibrium wages are equal in each country, and we take them as the númeraire. Symmetry also implies that trade is always balanced, and that each industry k shares an identical vector of equilibrium variables across countries, $\left(\mathbb{P}^k, M^{E,k}, E^k, Y\right)$.

Exploiting that the equilibrium is symmetric, we streamline notation by defining a variable's subscript d for ii (i.e., for domestic variables) and x for ij with $i \neq j$. Furthermore, we utilize that revenue shares in industry k are sufficient statistics for oligopolistic firms under a CES demand. Formally, s_{ij}^{ω} is the revenue share of IL ω from i due to its sales in j, and is given by the function $s\left(p_{ij}^{\omega}, \mathbb{P}^k\right) := \left(\frac{p_{ij}^{\omega}}{\mathbb{P}^k}\right)^{1-\sigma}$. Moreover, we define IL ω's price elasticity of demand by $\varepsilon\left(s_{ij}^{\omega}\right) := \sigma^k + s_{ij}^{\omega}\left(1-\sigma^k\right)$, with this term becoming σ^k for MF ω.

The optimal price of a firm ω from i that is active in j is given by the usual markup rule:

$$p_{ij}^{\omega} = m\left(s_{ij}^{\omega}\right) c_{ij}^{\omega}, \tag{2}$$

where $m\left(s_{ij}^{\omega}\right) := \frac{\varepsilon\left(s_{ij}^{\omega}\right)}{\varepsilon\left(s_{ij}^{\omega}\right)-1}$ is IL ω's markup, and $\frac{\sigma^k}{\sigma^k-1}$ is an MF's markup.

An MF serves country j if it earns non-negative profit. This decision rule can be characterized by a productivity cutoff, $\varphi_{ij}^k := \frac{\sigma^k \tau_{ij}^k}{\left(\sigma^k-1\right)\mathbb{P}^k}\left(\frac{\sigma^k f_{ij}^k}{\beta^k E^k}\right)^{\frac{1}{\sigma-1}}$, which corresponds to the level of productivity resulting in zero profits. It establishes that the optimal price for an MF from i with productivity φ is

$$p_{ij}^{\mathcal{M}}\left(\varphi, \mathbb{P}^k, \tau_{ij}^k\right) := \begin{cases} \frac{\sigma^k}{\sigma^k-1}\frac{\tau_{ij}^k}{\varphi} & \text{if } \varphi \geq \varphi_{ij}^k \\ \infty & \text{otherwise,} \end{cases}$$

where an infinite price reflects the decision of not serving market j. In turn, free entry determines that an MF's expected profit has to equal the entry fixed cost:

$$\pi_i^{\mathbb{E},k} := \int_{\varphi_d^k}^{\overline{\varphi}} \left[\frac{r_d\left(\mathbb{P}^k, E^k; \varphi\right)}{\sigma^k} - f_d^k\right] \mathrm{d}G^k(\varphi) + \int_{\varphi_x^k}^{\overline{\varphi}} \left[\frac{r_x\left(\mathbb{P}^k, E^k, \varphi, \tau^k\right)}{\sigma^k} - f_x^k\right] \mathrm{d}G^k(\varphi) = F^k, \tag{3}$$

where $r_{ij}\left(\mathbb{P}^k, E^k, \varphi, \tau_{ij}^k\right) := E^k s\left(p_{ij}^{\mathcal{M}}, \mathbb{P}^k\right)$ is the optimal revenue in j of an MF with productivity φ.

Equilibrium in industry k for one specific country requires that the sum of each active firm's sales equals $E^k = \beta^k Y$. Formally,

$$R_d^{\mathcal{M}}\left(\mathbb{P}^k, E^k, M^{E,k}\right) + R_x^{\mathcal{M}}\left(\mathbb{P}^k, E^k, M^{E,k}\right) + \sum_{\omega \in \overline{\mathscr{L}}_d^k} R_d^{\omega}\left(\mathbb{P}^k, E^k\right) + \sum_{\omega \in \overline{\mathscr{L}}_x^k} R_x^{\omega}\left(\mathbb{P}^k, E^k, \varphi_\omega\right) = E^k,$$

where $R_{ij}^{\omega}\left(\mathbb{P}^k, E^k\right) := E^k s_{ij}^{\omega}\left(\mathbb{P}^k\right)$ is IL ω's revenue evaluated at optimal prices, and $R_{ij}^{\mathcal{M}}\left(\mathbb{P}^k, E^k, M^{E,k}\right) := M^{E,k} \int_{\varphi_{ij}^k}^{\overline{\varphi}} r_{ij}\left(\mathbb{P}^k, E^k; \varphi\right) \mathrm{d}G^k(\varphi)$ is the optimal revenue in j by all active MFs from i.

Also, each country's income is given by

$$Y = L + \Pi\left[\left(\mathbb{P}^k\right)_{k\in\mathcal{I}}, Y\right], \tag{4}$$

where $\Pi\left[\left(\mathbb{P}^k\right)_{k\in\mathcal{I}}, Y\right] := \sum_{k\in\mathcal{I}} \sum_{\omega \in \overline{\mathscr{L}}_i^k} \pi_i^{\omega}\left(\mathbb{P}^k, E^k\right)$ is the country's total profit earned by ILs, with the optimal profit of IL ω in industry k being

$$\pi_i^{\omega}\left(\mathbb{P}^k, E^k\right) := \left(\frac{R_d^{\omega}\left(\mathbb{P}^k, E^k\right)}{\varepsilon\left[s_d^{\omega}\left(\mathbb{P}^k\right)\right]} - f_d^k\right) + \left(\frac{R_x^{\omega}\left(\mathbb{P}^k, E^k, \tau^{\omega}\right)}{\varepsilon\left[s_x^{\omega}\left(\mathbb{P}^k\right)\right]} - f_x^k\right). \tag{5}$$

2.4 Computing Gains of Trade

For the computation of gains of trade, we consider a small proportional reduction in each industry's trade costs, i.e., $\mathrm{d}\ln\tau^k \neq 0$ for each k. All the derivations of this section are relegated to Appendix A.

Gains of trade are defined as the percentage impact of trade liberalization on real income, $\mathbb{W} := \frac{Y}{\prod_{k\in\mathcal{I}}\left(\mathbb{P}^k\right)^{\beta^k}}$. Irrespective of the setup variant we consider, gains of trade are formally given by

$$\mathrm{d}\ln\mathbb{W} := \mathrm{d}\ln Y - \sum_{k\in\mathcal{I}} \beta^k \,\mathrm{d}\ln\mathbb{P}^k, \tag{6}$$

where recall that β^k is the proportion of income spent on industry k. Our goal is to study the quantitative differences when a modeler can use two approaches for computing gains of trade. In the first variant, the modeler employs the canonical Melitz model. Thus, firms are not partitioned into small and large, and all are treated as monopolistic. In terms of our setup, this is equivalent to assuming an empty set of ILs, so that all firms in industry k belong to $\overline{\mathcal{M}}^k$. It implies that gains of trade in Melitz expressed through observables are

$$\mathrm{d}\ln\mathbb{W}^{\mathrm{M}} = \sum_{k\in\mathcal{I}} \beta^k e^k, \tag{7}$$

where $e^k := \frac{R_x^{\mathcal{M}} + \sum_{\omega \in \overline{\mathscr{L}}_i^k} R_x^\omega}{R_d^{\mathcal{M}} + R_x^{\mathcal{M}} + \sum_{\omega \in \overline{\mathscr{L}}_i^k} \left(R_d^\omega + R_x^\omega \right)}$ is the aggregate export intensity in industry k (i.e., total exports in k relative to total revenues in k). Notice that changes in welfare under this variant are identical to the impact on the price indexes, since zero expected profit determines $\mathrm{d} \ln Y = 0$ once wages are taken as the númeraire.

In the second approach, a modeler incorporates the possibility of significant differences in firm size. This is accomplished through a revenue threshold that splits firms into ILs and MFs. Thus, for instance, Coca-Cola and PepsiCo are not described as negligible firms that are uncertain about their productivity and expect zero profits. Rather, they are considered ILs in carbonated beverages that earn substantial profits, and do not incur an entry cost since they know their efficiency.

Following this approach, gains of trade are given by (6), with each term being the solution to the following system:

$$\mathrm{d} \ln \mathbb{P}^k = -\left(e_{\mathcal{M}}^k + \frac{1}{\sigma^k - 1} \mathrm{d} \ln Y \right) \text{ for each } k \in \mathcal{I}, \tag{8a}$$

$$\mathrm{d} \ln Y = \left(\frac{\sum_{k \in \mathcal{I}} \left[\left(\sigma^k - 1 \right) \beta^k \right] \left[\sum_{\omega \in \overline{\mathscr{L}}_d^k} \frac{s_d^\omega}{\varepsilon_d^\omega} \frac{\sigma^k - \sigma^k s_d^\omega}{\sigma^k - \varepsilon_d^\omega s_d^\omega} + \sum_{\omega \in \overline{\mathscr{L}}_x^k} \frac{s_x^\omega}{\varepsilon_x^\omega} \frac{\sigma^k - \sigma^k s_x^\omega}{\sigma^k - \varepsilon_x^\omega s_x^\omega} \right]}{1 - \sum_{k \in \mathcal{I}} \beta^k \left(\sum_{\omega \in \overline{\mathscr{L}}_d^k} \frac{s_d^\omega}{\varepsilon_d^\omega} + \sum_{\omega \in \overline{\mathscr{L}}_x^k} \frac{s_x^\omega}{\varepsilon_x^\omega} \right)} \right) \mathrm{d} \ln \mathbb{P}^k + \left(\frac{\sum_{k \in \mathcal{I}} \left(\sigma^k - 1 \right) \beta^k \left(\sum_{\omega \in \overline{\mathscr{L}}_x^k} \frac{s_x^\omega}{\varepsilon_x^\omega} \right)}{1 - \sum_{k \in \mathcal{I}} \beta^k \left(\sum_{\omega \in \overline{\mathscr{L}}_d^k} \frac{s_d^\omega}{\varepsilon_d^\omega} + \sum_{\omega \in \overline{\mathscr{L}}_x^k} \frac{s_x^\omega}{\varepsilon_x^\omega} \right)} \right), \tag{8b}$$

where $e_{\mathcal{M}}^k := \frac{R_x^{\mathcal{M}}}{R_d^{\mathcal{M}} + R_x^{\mathcal{M}}}$ is the MFs' export intensity in industry k. For future references, we denote (6) computed through (8) by $\mathrm{d} \ln \mathbb{W}^{\mathrm{IL}}$.

Unlike Melitz, welfare changes in this extended model reflect variations in both the price indexes and income. Furthermore, variations in income exclusively capture changes in each IL's profit, once that wages are taken as the númeraire.

Profits in this variant can be positively or negatively impacted by trade liberalization, entailing that income can increase or decrease. While it cannot be ruled out that income decreases to such an extent that gains of trade are negative, this only arises under very exceptional circumstances.[6] Due to this, our analysis is described for scenarios with positive gains of trade.

[6]For instance, it can never happen when there is only one IL in each country. Furthermore, counterexamples require extremely high values of export intensity for MFs and of home bias for ILs. See Alfaro and Warzynski (2021).

3 Analytical Results

Next, we derive some analytical results to guide our empirical analysis. They develop some intuition about when gains of trade in the variant with ILs are higher or lower relative to Melitz. The conclusions are particularly helpful for explaining the differences in outcomes across countries in the quantitative analysis.

To shed light on these results as clearly as possible, we consider a simplified setup with only one industry and one IL in each country. The former means that $\beta^k = 1$, making industry expenditure and income equal. Incorporating this, we simplify notation by omitting the industry superscript of any variable.

The analysis focuses on a modeler evaluating two options for computing gains of trade, (6), for some dataset. Given σ, gains of trade in Melitz are computed through (7), and need a calibration for the aggregate export intensity, e. Likewise, gains of trade in the variant with ILs are computed by using (8). This requires calibrating the MFs' export intensity ($e_{\mathcal{M}}$) and IL ω's revenue share in each market (s_d^ω and s_x^ω).

Notice that, since the same dataset is utilized for the computations, *the calibrations for Melitz and the variant with ILs are not independent*: the calibration $(e_{\mathcal{M}}, s_d^\omega, s_x^\omega)$ in the variant with ILs completely identifies the aggregate export intensity, e. Specifically, it can be shown that $e = e_{\mathcal{M}}\left(1 - s_x^\omega - s_d^\omega\right) + s_x^\omega$, which can be reexpressed to show that e is the revenue-weighted average export intensity of MFs and ILs.

A corollary of this is that the export intensities of MFs and ILs affect gains of trade in the variant with ILs, but also in Melitz, by changing the calibration of the aggregate export intensity. Taking this into account, the quantitative differences in gains of trade do not simply arise because the most productive firms are modeled differently in each model—the behavior of MFs in each variant also differs, due to their dissimilar export intensities.

3.1 Differences in Gains of Trade Between Models

Gains of trade in each model are given by (7) and (8), and the calibrations of models are related by $e = e_{\mathcal{M}}\left(1 - s_x^\omega - s_d^\omega\right) + s_x^\omega$. Using this expression for e, we can express the differences in gains of trade between models as a function of $(e_{\mathcal{M}}, s_d^\omega, s_x^\omega)$. Formally, we show in Appendix A that $\mathrm{d}\ln \mathbb{W}^{\mathrm{IL}} = \alpha \times \mathrm{d}\ln \mathbb{W}^{\mathrm{M}}$, where

$$\alpha := \frac{\sigma\left(\frac{s_x^\omega}{\varepsilon_x^\omega}\right) + \left[(1-\rho) - \sigma\left(\frac{s_d^\omega}{\varepsilon_d^\omega}\frac{\sigma - \sigma s_d^\omega}{\sigma - \varepsilon_d^\omega s_d^\omega} + \frac{s_x^\omega}{\varepsilon_x^\omega}\frac{\sigma - \sigma s_x^\omega}{\sigma - \varepsilon_x^\omega s_x^\omega}\right)\right] e_{\mathcal{M}}}{(1-\rho)\left[e_{\mathcal{M}}\left(1 - s_d^\omega - s_x^\omega\right) + s_x^\omega\right]}, \tag{9}$$

with $\rho := \frac{s_d^\omega}{\varepsilon_d^\omega}\frac{s_d^\omega\left(\sigma - \varepsilon_d^\omega\right)}{\sigma - \varepsilon_d^\omega s_d^\omega} + \frac{s_x^\omega}{\varepsilon_x^\omega}\frac{s_x^\omega\left(\sigma - \varepsilon_x^\omega\right)}{\sigma - \varepsilon_x^\omega s_x^\omega}$.

Equation (9) entails that α is a function such that $\alpha\left(e_{\mathcal{M}}, s_d^\omega, s_x^\omega\right)$, where gains of trade are greater in the variant with ILs if $\alpha > 1$, and greater in Melitz if $\alpha < 1$. Next, we analyze how each term of $(e_{\mathcal{M}}, s_d^\omega, s_x^\omega)$ affects the relative differences in gains of trade.

3.2 Determinants of Differences in Gains of Trade

The factors explaining differences in gains of trade between models are quite complex: the setups differ in multiple dimensions, including the calibration of MFs in each variant. Nonetheless, it is possible to provide some heuristics to interpret the quantitative results that we eventually find.

Irrespective of which variant entails greater gains of trade, it is intuitive that differences across models become more pronounced when the IL accrues greater revenue shares (i.e., when s_d^ω and s_x^ω are bigger). This simply follows because gains of trade depart more from monopolistic competition when an IL has a greater size.

Furthermore, the following proposition establishes that whether the IL's revenue comes from domestic sales or exports is key to knowing which model predicts greater gains of trade. All the proofs of this section are relegated to Appendix B.

Proposition 3.1. *Consider* $\mathrm{d}\ln \mathbb{W}^{IL} = \alpha \times \mathrm{d}\ln \mathbb{W}^{M}$, *where* α *is given by* (9).

- *If the IL only serves home, then* $\alpha < 1$. *Thus, gains of trade in Melitz are greater than in the variant with ILs.*
- *If the IL only exports, then* $\alpha > 1$. *Thus, gains of trade in the variant with ILs are greater than in Melitz.*

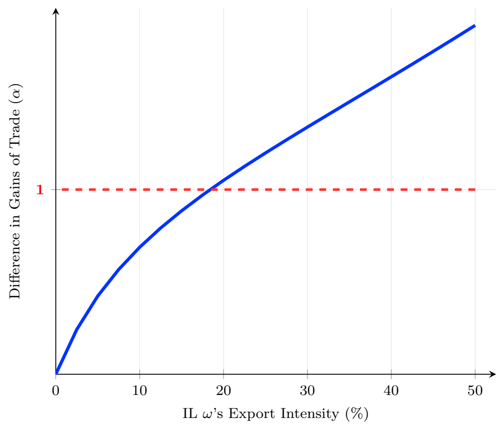
The proposition identifies outcomes in extreme scenarios where the IL exclusively serves home or exports.[7] However, we can extend the conclusion to cases where the IL serves both

[7]Notice that extreme scenarios where an IL only serves home or exports can arise in practice. For instance, the former arises when a multinational firm sets operations in the country to avoid trade costs, or when a firm sells a product that is only popular at a local level. On the contrary, an example of export-oriented IL is a multinational using the country as an export platform.

markets, by utilizing an IL's export intensity. Exploiting the continuity of the model, gains of trade in the variant with ILs are greater relative to Melitz when the IL exports a substantial portion of their production, or when at least it does not exhibit a pronounced home bias. The opposite happens when the IL has a significant home bias.

This is graphically illustrated in Figure 1, which includes a horizontal line identifying two possibilities. Greater gains of trade in Melitz occur under low values for the IL's export intensity, with the opposite happening for large values. Furthermore, the positive slope of the curve indicates that greater export intensity of the IL increases α.[8] This has implications for our quantitative results, where we find that $\alpha > 1$ and so gains of trade are greater in the variant with ILs: differences in gains of trade between models become more pronounced when ILs exhibit greater export intensity.

Figure 1. *Gains of Trade in the Variant with ILs Relative to Melitz (α)*
The Role of an IL's Export Intensity



Note: When $\alpha = 1$, gains of trade in the variant with ILs and Melitz are equal. Gains of trade are greater in the variant with ILs when $\alpha > 1$, and in Melitz when $\alpha < 1$.

Greater export intensity of the IL affects the difference in gains of trade between models through two mechanisms. First, it makes the IL benefit relatively more from better export opportunities, and so its profit increases more following trade liberalization. This translates into higher gains of trade in the variant with ILs through increases in income, along with the indirect reductions in the price index that this causes. Second, ILs correspond to the most productive firms in Melitz. Thus, greater export intensity of the IL increases the aggregate export intensity, thereby positively impacting gains of trade in Melitz. Specifically, it induces

[8] This result is not stated as a proposition since it is possible to find some counterexamples. Nonetheless, these counterexamples only arise under quite extreme values of calibrations.

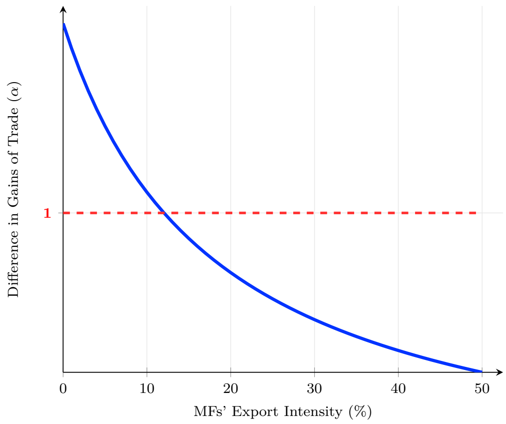
a more pronounced entry of MFs following trade liberalization, and hence a more marked reduction in the price index. Overall, Proposition 3.1 establishes that the first mechanism dominates, so that α increases when the IL has greater export intensity.

Moreover, we can show that greater export intensity of MFs always decreases α. This also has implications for our quantitative results. It captures in particular that higher export intensity of MFs reduces the differences in gains of trade when the variant with ILs determines greater gains of trade. The following proposition formalizes this.

Proposition 3.2. *Consider* $\mathrm{d}\ln \mathbb{W}^{IL} = \alpha \times \mathrm{d}\ln \mathbb{W}^{M}$*, where* α *is given by* (9)*. Then,* α *is decreasing in the MFs' export intensity. This implies in particular that, if gains of trade are higher in the variant with ILs relative to Melitz (i.e.,* $\alpha > 1$*), the difference in gains of trade is smaller when MFs have greater export intensity.*

The fact that α is decreasing in the MF's export intensity is illustrated in Figure 2, through a negative slope of the curve.

Figure 2. *Gains of Trade in the Variant with ILs Relative to Melitz (α)*
The Role of the MFs' Export Intensity



Note: When $\alpha = 1$, gains of trade in the variant with ILs and Melitz are equal. Gains of trade are greater in the variant with ILs when $\alpha > 1$, and in Melitz when $\alpha < 1$.

The negative slope reflects two mechanisms acting simultaneously. First, greater export intensity of MFs increases the expected profits of MFs in the variant with ILs, but also of any firm in Melitz. The latter occurs since the aggregate export intensity is the revenue-weighted average of export intensities. This induces a more pronounced entry of MFs in both models, and hence a more marked reduction in the price index of both models following trade liberalization.

The second mechanism arises because a decrease in the price index represents more competition for the IL in the variant with ILs. Thus, unlike Melitz, the variant with ILs additionally entails a negative impact on income, through the effect on the IL's profit. Proposition 3.2 determines that, overall, greater export intensity of MFs increases welfare in Melitz relatively more. Thus, when gains of trade in the variant with ILs are higher than in Melitz, greater export intensity of MFs reduces the differences in gains of trade.

4 Quantitative Results

The data at our disposal comes from ORBIS, a commercial dataset by Bureau van Dijk. This is one of the most comprehensive firm-level datasets encompassing multiple countries. It includes information on around 400 million companies, collected from balance sheets and income statements. Our focus is on firms reporting unconsolidated financial statements and operating in manufacturing for the year 2019.

The variables included in ORBIS vary by country, and very few countries have firms reporting both revenues and exports. Due to this, our analysis is exclusively based on countries where virtually all firms report both variables: Croatia, France, Greece, and Turkey.[9] The coverage in ORBIS also differs substantially across countries, with a tendency for bias towards large firms.[10] Based on this, we start by comparing features of the ORBIS dataset against official statistics by Eurostat.[11]

Table 1 indicates the revenue and export value covered by country. The results reveal a high coverage in Croatia and France. Taking this into account, our analysis relies on these countries, illustrating the results through Croatia and subsequently comparing them with France. On the contrary, the coverage of Greece and Turkey is relatively low, and so we merely use these countries for robustness checks.

[9]There is a fifth country that satisfies this property: Slovenia. Although we find the same qualitative conclusions for this country, it exhibits quite particular properties: its firms have an average export intensity of more than 80%, with this number rising to 87% for MFs. Due to this, we discarded it.

[10]It is worth remarking that a bias against small firms does not necessarily invalidate our results. It could actually make them stronger, since this feature in principle would increase the relative gains of trade in Melitz, while we find the opposite. This claim is based on Proposition 3.2 and the mounting evidence that only the most productive firms export. The latter implies that small firms exporting are more likely to be covered in the dataset, while the excluded small firms are low revenue firms that only serve locally. If this is the case, the export intensity of small firms in ORBIS would be higher and, by Proposition 3.2, work towards predicting higher gains of trade in Melitz. On the contrary, our results predict greater gains of trade in the setup with ILs. Thus, if this mechanism is operating, our outcomes would constitute a lower bound for the difference in gains of trade.

[11]The information for Turkey comes from the Turkish Statistical Institute.

Table 1. *Coverage in ORBIS Relative to Eurostat (in %)*

	Croatia	**France**	**Greece**	**Turkey**
Revenue Covered	87.45	85.14	47.13	37.56
Exports Covered	92.02	91.59	45.03	21.63

Our quantitative results are computed through a multi-industry model and classifying firms into small and large. Due to this, next we provide further comparisons in these respects against official statistics for Croatia. Similar conclusions hold for France.[12] Croatian data cover 13,436 firms, and we end up with 12,808 firms after cleaning the data. Overall, 36% of these companies are exporters, and each industry has an average of 281 firms. Throughout the paper, we define industries at the NACE (rev. 2) 4-digit level.

Table 2 compares features in the ORBIS dataset against the Structural Business Statistics (SBS) by Eurostat. We do this for the year 2018, since it is the last year available in SBS. Table 2a shows that ORBIS replicates quite well the distribution of revenue share by sector, and hence the importance of each sector in Croatian manufacturing.

Additionally, Tables 2b and 2c report statistics for Croatia when we classify firms according to their size. One caveat regarding these tables is that there are fewer firms reporting the number of employees in ORBIS, relative to those that report revenues and exports. This makes the comparison exclude almost 3,000 Croatian firms that we use for computations.

Table 2b illustrates the typical bias against small firms in the ORBIS dataset, as measured by the number of firms. However, a comparison based on the number of firms can exaggerate the importance of small firms (Kalemli-Ozcan et al., 2015). Many of them are companies with no employees (i.e., they are self-employed) and do not have a major impact on total revenue, even when we take them as a whole. Due to this, in Table 2c we measure the coverage of firms in terms of revenue. It points out that small firms exhibit similar revenue shares in both datasets, with even some possible under-representation of the largest firms.[13]

[12]Some of the comparisons for France cannot be performed, since official statistics do not necessarily report all values due to confidentiality concerns.

[13]The fact that the largest firms exhibit a lower revenue share in ORBIS relative to Eurostat could be due to different reasons. First, some firms solely report consolidated financial statements, whose values encompass data of subsidiaries across countries and industries. Additionally, revenues are reported according to the main activity of the firm. Consequently, a firm's revenue does not show up in manufacturing if, for instance, the firm declares retailing as its main activity.

Table 2. *ORBIS vs Eurostat - Croatia*

(a) Revenue Share by Sector (in %)

Sector	Eurostat	Orbis
Food	24.4	21.6
Metal Goods	10.6	13.4
Minerals	6.5	6.7
Wood	5.9	6.4
Rubber and Plastic	5.4	4.8
Machinery	5.2	5.2
Electrical Equip.	4.9	4.9
Beverages	4.6	3.9
Chemicals	4.0	3.6
Pharmaceuticals	3.9	4.7
Printing	3.3	2.1
Furniture	3.1	3.4
Paper	2.9	2.6
Apparel	2.7	2.9
Computers	2.5	4.2
Leather	2.4	1.8
Other Transport	2.4	1.7
Basic Metals	2.0	2.5
Motors	1.2	1.5
Other Manuf.	1.1	1.0
Textiles	1.0	1.1

(b) Share of Firms by Firm Size (in %)

Number of Employees	Eurostat	Orbis
0 to 9	81.9	70.3
10 to 19	8.2	13.4
20 to 49	5.8	9.7
50 to 249	3.2	5.3
more than 249	0.9	1.3

(c) Revenue Share by Firm Size (in %)

Number of Employees	Eurostat	Orbis
0 to 9	8.4	8.2
10 to 19	5.4	7.5
20 to 49	10.2	12.9
50 to 249	23.9	31.8
more than 249	52.1	39.6

4.1 Calibration

Conditional on parameters $(\sigma^k)_{k\in\mathcal{I}}$, gains of trade in the standard Melitz are given by (7), and they can be computed with information on each industry's aggregate export intensity. Likewise, gains of trade accounting for ILs are computed by solving the system (8). This requires information for each industry regarding both the MFs' export intensity and the domestic and export revenue share of each IL.

$(\sigma^k)_{k\in\mathcal{I}}$ has been estimated numerous times in the literature, and we utilize in particular the estimates by Soderbery (2015). They are calculated using the methodology in Broda and Weinstein (2006), accounting for small-sample biases. Our conclusions are not particularly sensitive to these parameters, and all the qualitative results hold if we utilize a revenue-weighted average value (i.e., $\sigma := 3.61$) for each industry.

Calculations for Melitz and the variant with ILs suppose the existence of a pool of negligible firms. Due to this, we perform our analysis relying on industries where this property is satisfied. With this goal, we check the existence of at least 10 firms in each industry, and that the 10 firms with the lowest revenue shares accrue less than 1% of revenue share altogether. Furthermore, we employ 5% of revenue share to classify a firm as a leader in the variant with ILs, allowing for the possibility of an empty set of ILs. In the sensitivity analysis of Appendix C, we replicate the results for alternative cutoffs and show that all the conclusions remain valid.

By utilizing these criteria to classify industries in Croatia and France, we can derive some conclusions. First, the bulk of manufacturing revenue comes from industries with coexistence of small and large firms. As for Croatia, industries with a pool of negligible firms encompass 85% of manufacturing revenue, and all of them comprise at least one IL. This pattern is also corroborated in France: 96% of revenue comes from industries with a pool of negligible firms, and 93% of this revenue is from industries with at least one IL.[14] Remarkably, the relevance of these industries is not revealed by merely counting industries. For instance, they represent less than half of the total in Croatia (96 out of a total of 209 in the sample).[15]

The characterization just provided allows us to conclude that the presence of ILs is widespread in industries comprising MFs. Nonetheless, it is only when ILs command a substantial portion of revenues that gains of trade across models would actually differ. The data point out that this is the case. In a typical industry, Croatian ILs and French ILs accrue 65% and 52% of industry revenue, respectively. A similar conclusion follows utilizing the Herfindahl-Hirschman index: 54% of the industries in Croatia are either moderately or highly concentrated, while this number is 30% for France.

4.2 Croatia

Gains of trade under a calibration for Croatia are presented in Figure 3a. Recall that, once we take wages as the númeraire, gains of trade in Melitz reflect changes in the price index. Instead, gains of trade in the variant accounting for ILs reflect variations in both the price index and income; Figure 3b decomposes the result into these variables.

The conclusion is that gains of trade in the setup with ILs are greater than in Melitz. This is despite Melitz entailing a greater reduction in the price index relative to the variant with ILs (0.357% vs 0.309%).

The differential in the price index variations can be rationalized by the features of MFs in each model. It reflects that a firm's expected profit in Melitz considers the possibility of

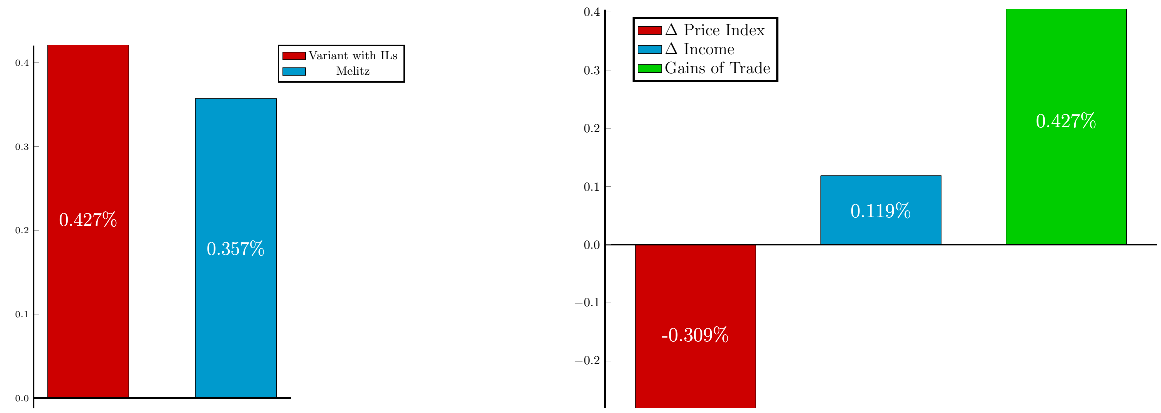
[14] Further characterization of revenue generated by industries with coexistence of MFs and ILs can be found in Appendix D. There, we also provide information regarding the importance of ILs by sector regarding revenues and exports.

[15] The result is related to some literature finding a highly skewed distribution of firm size (e.g, Axtell 2001), although it differs in an important respect. This literature shows that the size distribution of all firms follows a fat-tailed distribution, so that the coexistence of small and large firms is at an aggregate level. On the contrary, we find coexistence of small and large firms within the industries explaining the bulk of aggregate income.

becoming an IL, with ILs exhibiting greater export intensity on average. Consequently, firms in Melitz expect higher benefits from better export opportunities than MFs, inducing more entry of MFs and hence a more significant increase in competition in Melitz.

Figure 3. *Gains of Trade - Calibration based on Croatia*

(a) Gains of Trade **(b)** Variant with ILs



Note: Gains of Trade in Melitz are $\mathrm{d}\ln \mathbb{W}^{\mathrm{M}}$ and given by (7). Gains of trade in the variant with ILs are $\mathrm{d}\ln \mathbb{W}^{\mathrm{IL}}$ and correspond to $\mathrm{d}\ln \mathbb{W}$ computed by (8). In Figure 3b, Δ Price Index is given by (8*a*) and Δ Income by (8*b*).

However, the variant with ILs additionally entails that resources are reallocated towards ILs, which are firms that garner positive profits. Overall, the increase in income through this channel outweighs the differential decreases in the price index between models. Thus, gains of trade in the variant with ILs end up being greater than in Melitz.

4.3 Calibrations Based on Several Countries

Table 3 presents results for Croatia, France, Greece, and Turkey. The table reveals that the same conclusion holds for all countries: gains of trade in the variant with ILs are greater than those in Melitz. In Appendix C, we show that the same conclusions hold under alternative cutoffs for the classification of industries and firms, and when calibrations are based on other years.

Presenting results across countries allows us to illustrate how country features explain the heterogeneous differences in gains of trade. To do this, we compare the results for Croatia and France. These countries differ in some key features that lead to different calibrations for computing gains of trade.

Table 3. *Results with Calibrations based on Different Countries*

	Croatia	**France**	**Greece**	**Turkey**
Variant with ILs				
Gains of Trade	0.427	0.338	0.359	0.238
Δ Price Index	-0.309	-0.304	-0.308	-0.228
Δ Income	0.119	0.034	0.051	0.010
Melitz				
Gains of Trade	0.357	0.318	0.332	0.234
Difference (%)				
Gains of Trade	19.678	6.435	8.044	1.871

Throughout the explanation, we say that there is a *greater difference in the relative gains of trade* when the gains of trade in the variant with ILs are not only greater than in Melitz, but also more pronounced. In other words, given that Croatia and France exhibit greater gains of trade in the setup with ILs, our goal is to identify country features explaining why the difference in relative gains of trade is almost 20% in Croatia and 6% in France.

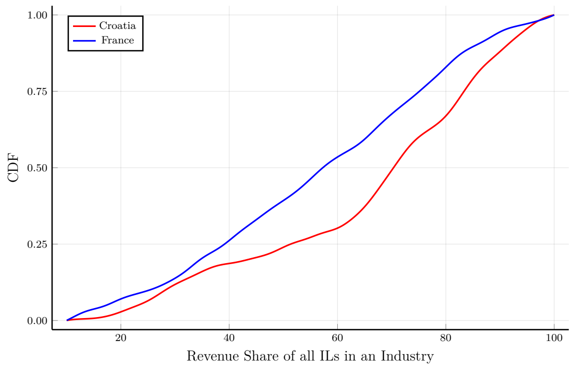
Inspection of Table 3 unveils that these differences are explained by changes in profits (and so income) in the variant with ILs, since the variation in the price index is almost the same in both countries. There are three aspects that work in the same direction and act increasing profits more in Croatia than in France: i) Croatian ILs generate a greater portion of industry revenue, ii) the export intensity of Croatian ILs is higher, and iii) the export intensity of Croatian MFs is lower. Next, we explain each point in more detail.

Regarding i), it is intuitive that differences in relative gains of trade become more pronounced when ILs accumulate more revenue. Figure 4a provides information on this matter, by comparing the revenue share of ILs in each industry across countries. Specifically, the graph sorts industries according to the revenue share accrued by all ILs, from the lowest to the highest. It reveals that the French distribution is dominated by Croatia's, so that Croatia has more industries with ILs accruing high shares of income. Figure 4b summarizes this information through average values. It points out that Croatian ILs accrue 65% of revenue in a typical industry, while this number is 52.5% in France.

As for ii), Figure 4c establishes that, on average, Croatian ILs have greater export intensity than French ILs. By Proposition 3.1, this implies greater differences in relative gains of trade in Croatia. Intuitively, it reflects that Croatian ILs benefit relatively more from better export opportunities, and so their profits increase more following trade liberalization.

Figure 4. *Country Features - Comparison Between Croatia and France*

(a) Empirical CDF of Revenue Share Accrued by ILs in an Industry



(b) Average Revenue Share by Group of Firms

	Croatia	**France**
ILs	65.0	52.5
MFs	35.0	47.5

(c) Average Export Intensity by Group of Firms

	Croatia	**France**
ILs	39.4	34.3
MFs	22.9	28.6

Note: Figure 4 orders industries, based on the revenue share of ILs as a group. Figure 4b shows the unweighted average revenue share of MFs and ILs in an industry, while Figure 4c shows the unweighted average export intensity of MFs and ILs.

Finally, regarding iii), Figure 4c also states that Croatian MFs exhibit lower export intensity than French MFs. By Proposition 3.2, this results in greater relative gains of trade in Croatia. The intuition is that, in the variant with ILs, the lower export intensity of Croatian MFs makes trade liberalization induce relatively less entry of MFs than in France. This implies less pronounced competition for ILs in the goods and labor market, and hence a mitigated negative impact on the ILs' profits through this channel.

5 Conclusion

Monopolistic competition supposes that all firms in an industry are negligible and expect zero profits. The assumption turns analyses in International Trade more tractable, but simultaneously distorts the characterization of industry leaders. In this paper, we assessed the quantitative consequences of this fact for gains of trade.

Our analysis supposed a modeler with two available options for computing gains of trade. The first one was the standard Melitz model, while the second variant was an extension accounting for industry leaders. The latter incorporated a revenue threshold that partitions firms into two subsets: negligible companies that behave as in Melitz, and oligopolistic firms that know their productivity and earn positive profits.

One advantage of comparing gains of trade between these two approaches is that we let the data speak. This occurs since results in the second variant become more similar to Melitz when large firms have lower revenue shares, and are identical in the limit. Thus, we do not impose a prior characterization of firms, and the results collapse to Melitz if all firms are truly negligible in the data.

Results for several countries indicated that gains of trade accounting for industry leaders are greater than in Melitz. The outcome highlights how trade liberalization reallocates resources towards industry leaders, thereby increasing profits and a country's income. This channel is not reflected in monopolistic competition, due to the assumption of zero aggregate profits.

Our conclusion is relevant in light of the recent evidence documenting a worldwide increase in concentration. The finding has triggered an intense debate regarding how to interpret the phenomenon. Some authors have maintained that higher concentration reflects a decline in competition, and therefore has a negative impact on economies (e.g., De Loecker et al. 2020). Others have sustained that it reflects a "winner-takes-all" feature of industries, entailing efficiency enhancements through reallocations towards more productive firms (e.g., Autor et al. 2020; Bighelli et al. 2021). Our quantitative results are in line with this second literature, indicating that ignoring industry leaders underestimates gains of trade.

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Online Appendix—not for publication

A Derivations of Gains of Trade

As for gains of trade in Melitz, differentiating (3) for each $k \in \mathcal{I}$, we obtain that $\frac{\partial \pi_i^{\mathbb{E},k}}{\partial \ln \mathbb{P}^k} \mathrm{d} \ln \mathbb{P}^k + \frac{\partial \pi_i^{\mathbb{E},k}}{\partial \ln \tau^k} \mathrm{d} \ln \tau^k + \frac{\partial \pi_i^{\mathbb{E},k}}{\partial \ln E^k} \mathrm{d} \ln E^k = 0$. Moreover, $\mathrm{d} \ln E^k = \mathrm{d} \ln Y$ and with wages taken as the númeraire and aggregate profits always zero, then $\mathrm{d} \ln Y = 0$. Using that $\frac{\partial \pi_i^{\mathbb{E},k}}{\partial \ln \mathbb{P}^k} = \frac{\sigma^k - 1}{\sigma^k} \left(r_d^k + r_x^k \right)$ and $\frac{\partial \pi_i^{\mathbb{E},k}}{\partial \ln \tau^k} = \frac{1-\sigma^k}{\sigma^k} r_x^k$ where $r_{ij}^k := r_{ij} \left(\mathbb{P}^k, E^k, \varphi, \tau^k \right)$, and multiplying and dividing by $M^{E,k}$ each expression, it is determined that $\mathrm{d} \ln \mathbb{P}^k = e^k$. Substituting this into (6), we obtain (7).

As for gains of trade in the setup with ILs, differentiating (3) determines (8b). Moreover, differentiating (4) establishes that

$$\mathrm{d} \ln Y \left[Y - \sum_{\iota \in i} \left(\sum_{\omega \in \overline{\mathscr{L}}_d^{\iota}} \frac{R_d^\omega}{\varepsilon_d^\omega} + \sum_{\omega \in \overline{\mathscr{L}}_x^{\iota}} \frac{R_x^\omega}{\varepsilon_x^\omega} \right) \right] = \left(\sigma^k - 1 \right) \left[\sum_{\omega \in \overline{\mathscr{L}}_d^k} \frac{R_d^\omega}{\varepsilon_d^\omega} \frac{\sigma^k - \sigma^k s_d^\omega}{\sigma^k - \varepsilon_d^\omega s_d^\omega} + \sum_{\omega \in \overline{\mathscr{L}}_x^k} \frac{R_x^\omega}{\varepsilon_x^\omega} \frac{\sigma^k - \sigma^k s_x^\omega}{\sigma^k - \varepsilon_x^\omega s_x^\omega} \right] \mathrm{d} \ln \mathbb{P}^k,$$

$$\mathrm{d} \ln Y \left[Y - \sum_{\iota \in i} \left(\sum_{\omega \in \overline{\mathscr{L}}_d^{\iota}} \frac{R_d^\omega}{\varepsilon_d^\omega} + \sum_{\omega \in \overline{\mathscr{L}}_x^{\iota}} \frac{R_x^\omega}{\varepsilon_x^\omega} \right) \right] = \sum_{\omega \in \overline{\mathscr{L}}_x^k} \frac{R_x^\omega}{\varepsilon_x^\omega} \mathrm{d} \ln \tau^k,$$

from which we obtain $\frac{\partial \ln Y}{\partial \ln \mathbb{P}^k}$ and $\frac{\partial \ln Y}{\partial \ln \tau^k}$. Multiplying and dividing each side by E^k and using $\mathrm{d} \ln Y = \sum_{k \in \mathcal{I}} \frac{\partial \ln Y}{\partial \ln \mathbb{P}^k} \mathrm{d} \ln \mathbb{P}^k + \sum_{k \in \mathcal{I}} \frac{\partial \ln Y}{\partial \ln \tau^k} \mathrm{d} \ln \tau^k$, we obtain (8a).

Next, we derive the term α in (9). defined such that $\mathrm{d} \ln \mathbb{W}^{\mathrm{IL}} = \alpha \, \mathrm{d} \ln \mathbb{W}^{\mathrm{M}}$. To streamline notation, define $\delta_1 := \sum_{\omega \in \overline{\mathscr{L}}_d} \frac{s_d^\omega}{\varepsilon_d^\omega}$, $\delta_2 := \sum_{\omega \in \overline{\mathscr{L}}_d} \frac{s_d^\omega}{\varepsilon_d^\omega} \frac{\sigma - \sigma s_d^\omega}{\sigma - \varepsilon_d^\omega s_d^\omega}$, $\chi_1 := \sum_{\omega \in \overline{\mathscr{L}}_x} \frac{s_x^\omega}{\varepsilon_x^\omega}$, and $\chi_2 := \sum_{\omega \in \overline{\mathscr{L}}_d} \frac{s_x^\omega}{\varepsilon_x^\omega} \frac{\sigma - \sigma s_x^\omega}{\sigma - \varepsilon_x^\omega s_x^\omega}$. Equation (6) computed through (8) provides us with gains of trade in the variant with ILs. This requires substituting (8b) into (8a), we can express while gains of trade in the standard Melitz are $\mathrm{d} \ln \mathbb{W}^{\mathrm{M}} = e = e_{\mathcal{M}} \left(1 - s_x^\omega - s_d^\omega \right) + s_x^\omega$. Using these expressions and after some algebra, the relative gains of trade α, so that

$$\mathrm{d} \ln \mathbb{W}^{\mathrm{IL}} := \frac{\sigma \chi_1 + \left[\left(1 - \delta_1 - \chi_1 + \delta_2 + \chi_2 \right) - \sigma \left(\delta_2 + \chi_2 \right) \right] e_{\mathcal{M}}}{\left(1 - \delta_1 - \chi_1 + \delta_2 + \chi_2 \right)},$$

while gains of trade in the standard Melitz are $\mathrm{d} \ln \mathbb{W}^{\mathrm{M}} = e = e_{\mathcal{M}} \left(1 - s_x^\omega - s_d^\omega \right) + s_x^\omega$. Using these expressions and after some algebra, the difference in gains of trade is given by

$$\alpha = \frac{\sigma \chi_1 + \left[\left(1 - \delta_1 - \chi_1 + \delta_2 + \chi_2 \right) - \sigma \left(\delta_2 + \chi_2 \right) \right] e_{\mathcal{M}}}{\left(1 - \delta_1 - \chi_1 + \delta_2 + \chi_2 \right) \left[e_{\mathcal{M}} \left(1 - s_x^\omega - s_d^\omega \right) + s_x^\omega \right]},$$

which corresponds to (9).

B Proofs of Propositions

For the proofs, we keep using the same definitions for δ_1, δ_2, χ_1, and χ_2, used in Appendix A.

Proof of Proposition 3.1. Consider first the case where the IL only serves its domestic market. The proof requires showing that $\alpha < 1$, which holds iff $\frac{(1-\delta_1+\delta_2)-\sigma\delta_2}{(1-\delta_1+\delta_2)\left(1-s_d^\omega\right)} < 1$. This expression can be reduced to $s_d^\omega (1-\delta_1+\delta_2) < \sigma\delta_2$, or just $s_d^\omega \left(1 - \frac{s_d^\omega}{\varepsilon_d^\omega} - \frac{s_d^\omega}{\varepsilon_d^\omega}\frac{\sigma-\sigma s_d^\omega}{\sigma-\varepsilon_d^\omega s_d^\omega}\right) < \sigma\frac{s_d^\omega}{\varepsilon_d^\omega}\left(\frac{\sigma-\sigma s_d^\omega}{\sigma-\varepsilon_d^\omega s_d^\omega}\right)$. Working out the expression and using that $\varepsilon_d^\omega - s_d^\omega = \sigma - \sigma s_d^\omega$, the inequality reduces to $\varepsilon_d^\omega > 1$, which always holds.

Consider now the case where the IL only exports. We need to show that $\alpha > 1$, which holds iff $\frac{\sigma\chi_1+[1-\chi_1+\chi_2-\sigma\chi_2]e_{\mathcal{M}}}{(1-\chi_1+\chi_2)[e_{\mathcal{M}}(1-s_x^\omega)+s_x^\omega]} > 1$ and hence iff $\sigma(\chi_1-\chi_2) > [(1-\chi_1+\chi_2)s_x^\omega - \sigma\chi_2](1-e_{\mathcal{M}})$. Since $\chi_1-\chi_2>0$ because $\frac{\sigma-\sigma s_x^\omega}{\sigma-\varepsilon_x^\omega s_x^\omega} < 1$, if we show that

$$(1-\chi_1+\chi_2)s_x^\omega - \sigma\chi_2 = \left(1 - \frac{s_x^\omega}{\varepsilon_x^\omega} + \frac{s_x^\omega}{\varepsilon_x^\omega}\frac{\sigma-\sigma s_x^\omega}{\sigma-\varepsilon_x^\omega s_x^\omega}\right)s_x^\omega - \sigma\frac{s_x^\omega}{\varepsilon_x^\omega}\frac{\sigma-\sigma s_x^\omega}{\sigma-\varepsilon_x^\omega s_x^\omega} < 0,$$

the result follows. Working out the expression and using that $\varepsilon_x^\omega - s_x^\omega = \sigma - \sigma s_x^\omega$, the inequality holds iff $\varepsilon_x^\omega > 1$, which always holds. ■

Proof of Proposition 3.2. Let $e'_{\mathcal{M}}$ and $e''_{\mathcal{M}}$ be export intensities of MFs, where $e''_{\mathcal{M}} > e'_{\mathcal{M}}$. Define $\alpha(e_{\mathcal{M}})$ as the function defined by (9). The proof requires showing that $\alpha(e''_{\mathcal{M}}) < \alpha(e'_{\mathcal{M}})$ or, what is same,

$$\frac{\sigma\chi_1+\kappa e'_{\mathcal{M}}}{(1-\delta_1-\chi_1+\delta_2+\chi_2)\left[e'\left(1-s_d^\omega-s_x^\omega\right)+s_x^\omega\right]} > \frac{\sigma\chi_1+\kappa e''_{\mathcal{M}}}{(1-\delta_1-\chi_1+\delta_2+\chi_2)\left[e''_{\mathcal{M}}\left(1-s_d^\omega-s_x^\omega\right)+s_x^\omega\right]},$$

where $\kappa := (1-\delta_1-\chi_1+\delta_2+\chi_2) - \sigma(\delta_2+\chi_2)$. If $\kappa < 0$ the result follows trivially, so consider that $\kappa > 0$. The inequality holds iff $\frac{e''+\gamma}{e'+\gamma} > \frac{\frac{\sigma\chi_1}{\kappa}+e''_{\mathcal{M}}}{\frac{\sigma\chi_1}{\kappa}+e'_{\mathcal{M}}}$ where $\gamma := s_x^\omega\left(1-s_x^\omega-s_d^\omega\right)^{-1}$. Working out the expression, this reduces to show that

$$\frac{\sigma}{\varepsilon_x^\omega} > \frac{1-s_d^\omega\left(\frac{\sigma-s_d^\omega}{\sigma-\varepsilon_d^\omega s_d^\omega}\right) - s_x^\omega\left(\frac{\sigma-s_x^\omega}{\sigma-\varepsilon_x^\omega s_x^\omega}\right)}{1-s_d^\omega-s_x^\omega}.$$

Since the left-hand side is greater than one, the result follows if we show that the right-hand side is always lower than 1. But this always holds, since $\frac{\sigma-s_d^\omega}{\sigma-\varepsilon_d^\omega s_d^\omega} > 1$ and $\frac{\sigma-s_x^\omega}{\sigma-\varepsilon_x^\omega s_x^\omega} > 1$. ■

C Sensitivity Analyses

Next, we recompute results for Croatia and France under alternative cutoffs for the classification of industries and firms. We also incorporate results based on calibrations for other years. The goal is to show that these aspects do not affect the qualitative results—the model with ILs still entails greater gains of trade than in Melitz.

First, our baseline procedure defined the existence of MFs in each industry in a specific way: the 10 firms with the lowest revenue accumulate less than 1% of revenue. Table C.1 recalculates the results considering 15 or 20 firms, rather than 10.

Table C.1. *Sensitivity Analysis - Cutoff Defining Industries with a Pool of MFs*

(a) Croatia

	10 MFs (baseline)	**15 MFs**	**20 MFs**
Variant with ILs			
Gains of Trade	0.427	0.370	0.379
Δ Price Index	-0.309	-0.28	-0.286
Δ Income	0.119	0.090	0.093
Melitz			
Gains of Trade	0.357	0.327	0.334
Difference (%)			
Gains of Trade	19.678	13.141	13.608

(b) France

	10 MFs (baseline)	**15 MFs**	**20 MFs**
Variant with ILs			
Gains of Trade	0.338	0.338	0.333
Δ Price Index	-0.304	-0.304	-0.300
Δ Income	0.034	0.033	0.034
Melitz			
Gains of Trade	0.318	0.318	0.315
Difference (%)			
Gains of Trade	6.435	6.139	5.735

As it can be appreciated, the qualitative results are the same, i.e. gains of trade in the setup with ILs are greater than in Melitz. Furthermore, the quantitative results are almost identical for France, while those for Croatia are somewhat more sensitive. This follows by the smaller market size of Croatia, which reduces the number of small firms that can profitably operate. Thus, for instance, industries with 20 firms accumulating less than 1% of revenue explain 90% of income; instead, this number becomes 70% for Croatia.

The second sensitivity analysis considers alternative revenue-share cutoffs to partitioning firms into MFs and ILs. Notice that this threshold only influences outcomes in the variant with ILs. On the contrary, gains of trade in Melitz are not impacted because an industry's aggregate export intensity, which is a sufficient statistic for gains of trade in Melitz, is independent of this threshold.

Table C.2 indicates that gains of trade in the setup with ILs are still greater than in Melitz, irrespective of whether we consider a smaller cutoff (3%) or a greater cutoff (10%) relative to the baseline scenario. In fact, the quantitative results are quite similar in each country.

Table C.2. *Sensitivity Analysis - Cutoff Defining ILs*

(a) Croatia

	5% (baseline)	3%	10%
Variant with ILs			
Gains of Trade	0.427	0.429	0.422
Δ Price Index	-0.309	-0.305	-0.322
Δ Income	0.119	0.123	0.100
Melitz			
Gains of Trade	0.357	0.357	0.357
Difference (%)			
Gains of Trade	19.678	20.035	18.058

(b) France

	5% (baseline)	3%	10%
Variant with ILs			
Gains of Trade	0.338	0.340	0.339
Δ Price Index	-0.304	-0.299	-0.311
Δ Income	0.034	0.041	0.028
Melitz			
Gains of Trade	0.318	0.318	0.318
Difference (%)			
Gains of Trade	6.435	7.053	6.710

Finally, the main body of the paper estimates differences in gains of trade between models based on calibrations for the year 2019. Next, we replicate the results based on data from 2018 and 2017. The main conclusion is that the qualitative results are the same, i.e. gains of trade in the variant with ILs are greater than in Melitz.

Table C.3. *Sensitivity Analysis - Results for Other Years*

(a) Year 2018

	Croatia	France	Greece	Turkey
Variant with ILs				
Gains of Trade	0.392	0.337	0.360	0.230
Δ Price Index	-0.295	-0.302	-0.309	-0.221
Δ Income	0.097	0.034	0.051	0.009
Melitz				
Gains of Trade	0.343	0.316	0.333	0.225
Difference (%)				
Gains of Trade	14.277	6.582	8.034	1.908

(b) Year 2017

	Croatia	France	Greece	Turkey
Variant with ILs				
Gains of Trade	0.393	0.358	0.360	0.229
Δ Price Index	-0.298	-0.311	-0.309	-0.223
Δ Income	0.095	0.047	0.051	0.006
Melitz				
Gains of Trade	0.345	0.330	0.333	0.225
Difference (%)				
Gains of Trade	14.018	8.378	8.035	1.800

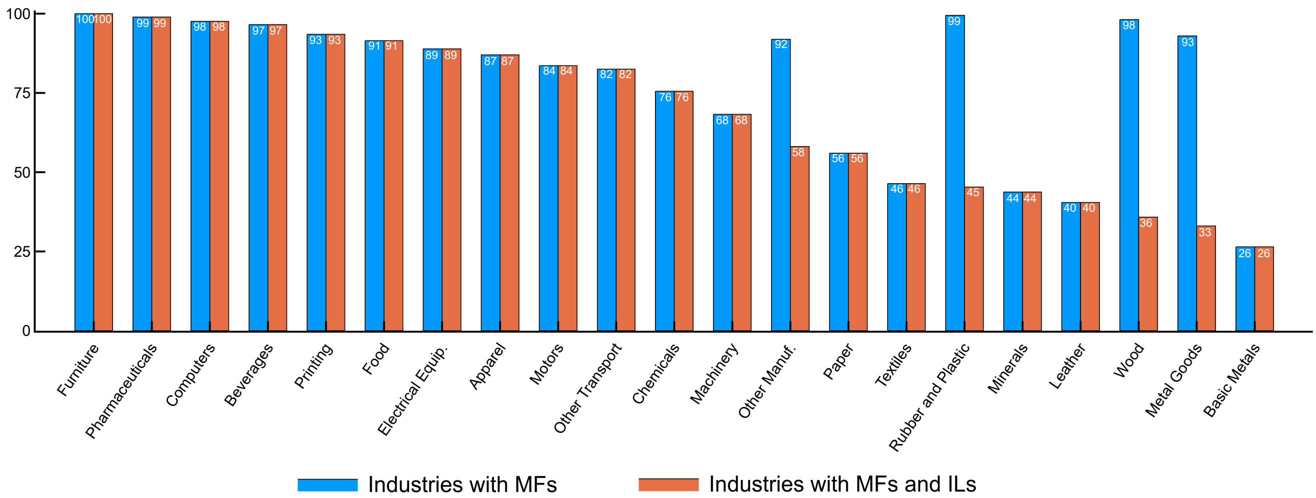
D Further Information on Industry Leaders

In this appendix, we complement the information provided in Section 4 for Croatia and France. First, we show the revenue generated in industries with MFs and with MFs and ILs coexisting. Unlike the main body of the paper, we decompose the results by sectors.

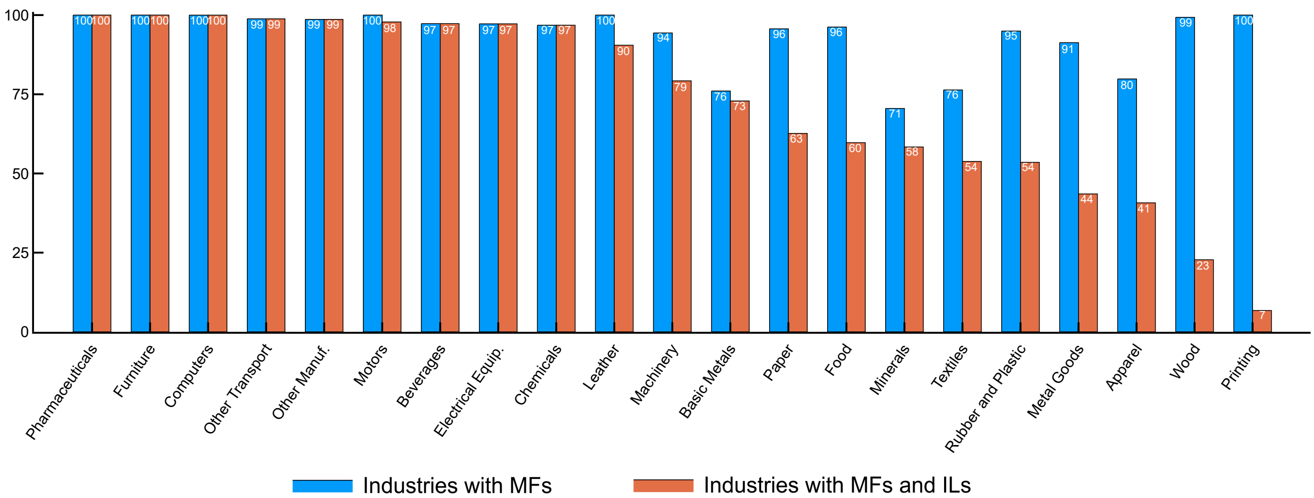
Recall that the main body of the paper defines an IL if it has 5% as industry revenue share, and virtually all the manufacturing revenue comes for industries with one IL, relative to the set of industries with negligible firms. Thus, to show the results as stark as possible, we define an IL as a firm having at least 10% of industry revenue share. Figure D.1 reveals the importance of these industries, even when we use this more demanding condition for defining an IL. Relative to the set of negligible firms, 87% of France's manufacturing revenue comes from industries with coexistence of MFs and ILs, while this number is 82% for Croatia's manufacturing revenue.

Figure D.1. *Revenue Generated by Each Type of Industry*

(a) Croatia



(b) France

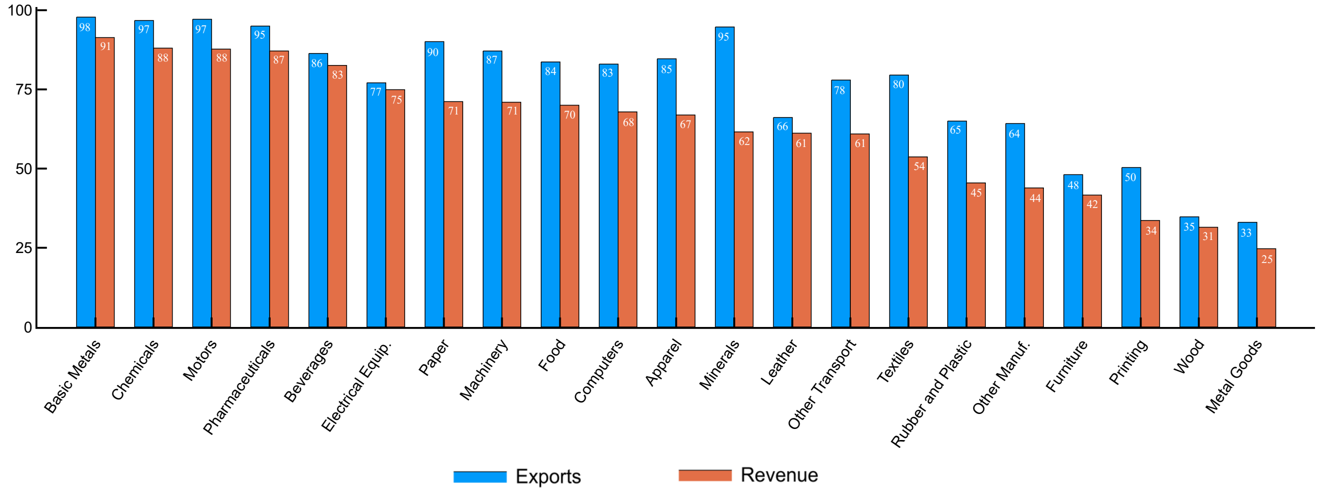


Note: Bars express results as percentages of sector revenues.

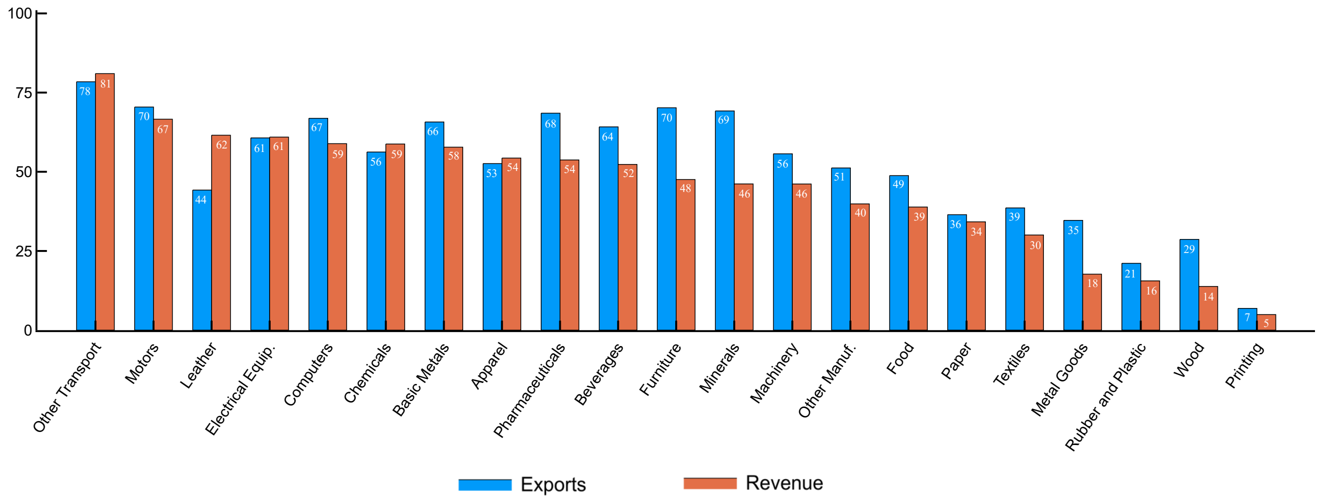
Additionally, we provide information on the importance of ILs within industries, using the baseline criterion of an IL (i.e., a minimum of 5% of industry revenue share). The average revenue and export value by all ILs as a group are presented in Figure D.2. Consistent with the results indicated in the paper, the figure shows that Croatian ILs accrue a greater share of each variable than French ILs.

Figure D.2. *Average Revenue and Export Shares of all ILs in an Industry (in %)*

(a) Croatia



(b) France



Note: Results expressed as an (unweighted) average across industries belonging to each sector.