# A Unified Explanation of Trade Liberalization Effects Across Models of Imperfect Competition

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**Abstract**

This paper reconciles for the first time the wide range of outcomes arising in studies of trade liberalizations. We define an imperfect-competition model encompassing the major variants of monopolistic competition (Krugman, Melitz, and Chaney) and Cournot (with free and restricted entry). This model reveals that seemingly disparate outcomes are not due to market structure, as usually conjectured, but differences in marginal entrants' features. Thus, once we reconcile these differences, the same outcomes emerge across all models. By identifying assumptions on marginal entrants that generate pro-competitive, anti-competitive, or null effects, we also explain why puzzling outcomes arise in some standard frameworks.

**JEL codes:** F10, F12, D43, L13.

**Keywords:** imperfect competition, unilateral liberalization, import competition, export opportunities.

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# 1 Introduction

Many changes occur simultaneously following a reduction in trade barriers and it is difficult to disentangle how each individually affects market conditions. Furthermore, the results that emerge are often puzzling, leading scholars like Helpman and Krugman (1989) to remark on the surprising and counterintuitive effects of trade policy under imperfect competition. As a result, a conclusion that has emerged in this literature is that outcomes are highly sensitive to the type of competition assumed.[1]

In this paper, we show that the seemingly inconsistent results obtained in the literature across various forms of imperfect competition are not actually due to differences in market structure. Rather, they are caused by differences in a feature of the model that has received less attention: the characteristics of marginal entrants. Once we reconcile the specification of marginal entrants across the different models of imperfect competition, they generate the same qualitative outcomes after a trade shock, independently of the assumptions on the rest of the firms or other aspects of the setup.

The findings are relevant, not only because they unify various outcomes that arise in the literature across market structures, but also because they enable us to establish conditions that generate specific results. In particular, we identify when counterintuitive outcomes, such as anti-competitive or null effects, arise.

We are able to obtain these insights by approaching the study of trade liberalizations from an alternative perspective relative to the existing literature. Our analysis starts with the premise that, in order to compare the models, it is necessary to develop a framework that allows us to conduct a unified study of them. Once this is accomplished, it becomes possible to identify what assumptions differ across these models, and then evaluate their role in determining outcomes. With this goal in mind, we develop what we denominate a *comprehensive imperfect competition (CIC) model*.[2]

Similar in spirit to Melitz (2003), in the CIC model there is free entry and firms do not know their productivity before entering the industry. However, unlike that model, each

[1] In their survey on trade policy, Helpman and Krugman (1989) state that one of the main messages of the book is that "*the theory of trade policy under imperfect competition suggests that market structure will be crucial in making predictions about policy effects*". A similar conclusion is reached by Markusen and Venables (1988).

[2] Rather than being conceived as a general model to analyze trade phenomena, the CIC model constitutes an analytical tool to lay bare the differences across existing models and determine how they impact the results. Therefore, the relevance of our conclusions are not regarding the CIC model itself but, rather, its implications for the standard models of imperfect competition used in the literature.

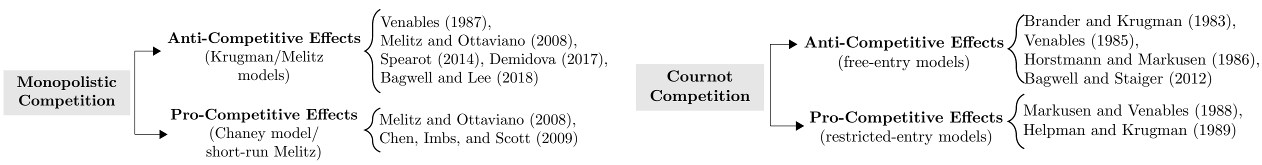
firm gets a draw from a *firm-specific* productivity distribution after paying an entry cost. Different assumptions on this distribution, along with whether firms are negligible or non-negligible, are able to generate the standard versions of monopolistic competition (i.e., à la Krugman 1979, Melitz 2003, and Chaney 2008) and oligopoly (Cournot competition with free and restricted entry).

In the CIC model, a group of firms which we denominate marginal industry entrants (MIEs) play a crucial role in the analysis. They correspond to the set of firms through which extensive-margin adjustments at the *industry* (rather than the market) take place. Formally, they are the least-productive firms among those that pay the entry cost to have a variety and draw of productivity assigned.

In Section 3, we formalize the CIC model. To obtain conclusions that apply to the different studies in the literature, we specify a demand system that satisfies two features: all the variants of imperfect competition contained by the CIC model have utilized it to analyze trade, and through its use different outcomes have arisen across models (i.e., pro-competitive and anti-competitive effects). Both characteristics are satisfied by the CES and linear demands. We choose the latter, in its Melitz and Ottaviano (2008) variant, since it generates variable markups under any of the models considered. Thus, it is possible to determine whether prices and markups are, in fact, impacted by trade. Figure 1 summarizes the disparity of outcomes obtained with a linear demand when a unilateral liberalization between two large countries is considered.

Figure 1: *Examples of Studies and Results that We Unify*

(a) Monopolistic Competition (b) Cournot Competition




In addition, to rule out the possibility that simplifying assumptions are driving the results, we keep the model as general as possible in other respects. Specifically, we do not restrict the analysis to any specific productivity distribution, and allow for country-specific asymmetries in demands and productivity distributions.

In Section 4, we consider monopolistic competition. The goal is to establish conditions under which trade shocks affect the domestic competitive environment, rather than entailing mere changes in the mass of firms. To isolate the different channels through which an industry in isolation is affected, we consider reductions in inward and outward trade barriers under a small economy. This allows us to classify the effects on the domestic market conditions into (a) an **import-competition** (henceforth, denoted IC) **channel**, and an **export-opportunities** (henceforth, denoted EOs) **channel**. These channels are defined such that their activation creates pro-competitive effects, while their deactivation entails no effects on the competitive environment. In particular, the IC channel acts through the generation of tougher competitive conditions which induces the exit of domestic firms. Regarding the EOs channel, it works through the increase in profits triggered by new business opportunities, which fosters the entry of firms that sell domestically.

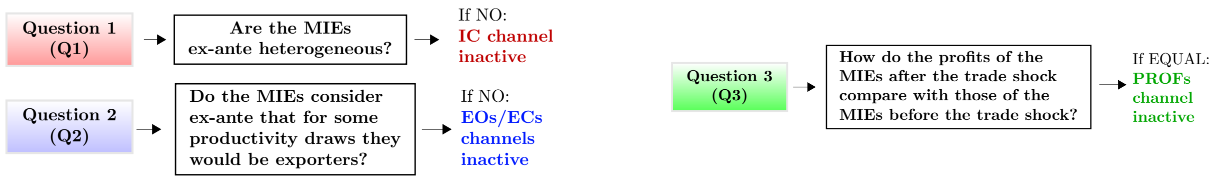
From the analysis, it is established that MIEs completely determines which channels are active. Why do they play such an essential role in producing specific market outcomes? In the CIC model, the profits of MIEs characterize the zero-expected-profits condition. Different standard assumptions in the literature make this condition completely pin down the equilibrium choke price, which acts a single sufficient statistic for the firms' decisions. Thus, if any trade shock under consideration does not affect the expected profits of MIEs, then prices, quantities, markups, and their survival productivity cutoff are not affected. Instead, the model adjusts exclusively through variations in the mass of firms that pay the entry cost.

In particular, two of the MIEs' characteristics are crucial. First, whether MIEs are ex-ante exporters, i.e., if MIEs may become exporters for some productivity draws that occur with positive probability. Second, whether MIEs are ex-ante homogeneous, in which case they obtain productivity draws from the same distribution.

The activation of channels according to the MIEs' features is summarized by the two questions in Figure 2a. First, *it is necessary that domestic MIEs are ex-ante heterogeneous for the IC channel to be active*. This is indicated by Q1 in Figure 2a. On the other hand, if MIEs are ex-ante homogeneous, there is only one choke price consistent with zero expected profits, and this is independent of any shock to the foreign firms. Additionally, Q2 of Figure 2a states that *the EOs channel is activated when domestic MIEs expect to serve both the domestic and the foreign market for some productivity draws*. Intuitively, this follows because, otherwise, the MIEs' expected profits would not be affected by the trade costs for exporting.

Figure 2: *Conditions for Activation of the Channels that Affect the Domestic Economy*

(a) Monopolistic and Cournot Competition (b) Cournot Competition




**Note**: MIEs are the set of least-profitable firms that pay the entry cost to enter the industry. In the case of Cournot, they comprise only one firm (the last entrant). PROFs refers to the MIEs profits channel.

In Section 5 we make use of the results of the CIC model under monopolistic competition to understand different outcomes in the literature. First, we apply the results to the **Krugman, Melitz**, and **Chaney** models. For the Melitz and Krugman models, we show that the IC channel is always shut because heterogeneity of firms is ruled out by assumption: all firms are alike and get draws of productivity from the same distribution.[3] Besides, since for some productivity draws firms would export, the EOs channel is active. As for the Chaney model, which is isomorphic to a short-run version of Melitz, the following holds. First, since it corresponds to a CIC model where each firm obtains a productivity draw from a different degenerate distribution, MIEs are ex-ante heterogeneous. This establishes that the IC channel is active. Second, as selection into exporting is assumed, the MIEs are not ex-ante exporters and, so, the EOs channel is inactive.

The second application we consider refers to trade liberalizations with two large countries. Unlike the case of small countries, feedback effects are created since changes in the conditions of one country potentially have an impact on the other. To account for these effects, we introduce the **export-conditions** (henceforth, denoted ECs) **channel**. This captures the total effect triggered by the direct impact of the trade shock on the trading partner's choke price. Conditional on the presence of feedback effects, *the conditions for the deactivation of the ECs channel are the same as for the EOs channel*. This is indicated by Q2 in Figure 2a. By applying the results of the CIC model to unilateral liberalizations, we provide the specific assumptions on MIEs that determine the various outcomes in the literature presented in Figure 1a. In addition, we are able to establish conditions under which, for instance, all the channels are inactive and, so, they entail null effects on the competitive environment and the behavior of active domestic firms.

In Section 6, we consider the **Cournot model** viewed as a CIC model under oligopolistic

[3]For the Melitz model, Alfaro (2019) shows that this result is more general, since it holds for any demand function that captures the competitive conditions through a single sufficient statistic.

competition.[4] We show that, just as with monopolistic competition, the features of the MIEs determines which channels are operative. Under oligopoly, the MIEs collapse to the least-productive firm that is active in the domestic market, which we refer to as the last entrant. Thus, the characterization of merely one firm is all we need to know in order to determine which channels are active in equilibrium.

Under this setup the last entrant can potentially earn positive profits.[5] Therefore, the impact of trade shocks on the domestic market also requires a comparison of the profits garnered by the last entrant of each equilibrium. We refer to the effects caused by this as the **MIEs profits channel**. Remarkably, we show that, *as long as the profits of the last entrants before and after the trade shock are equal, the MIEs profits channel is inactive.* Thus, the MIEs profits channel is not operative even if the last entrant obtains positive profits. This fact is captured by Q3 in Figure 2b. On the other hand, the MIEs profits channel is active and creates pro-competitive effects when trade reduces the profits of the last entrant.

In Section 7, we apply the results of the oligopolistic CIC model to explain different outcomes obtained in the literature, including those in Figure 1b. We conclude the following. First, when there is free entry and the MIEs profits channel is shut, the effects of trade shocks are determined exactly as in monopolistic competition. This result is of particular relevance since it applies to the pervasive case in which the integer number of firms is assumed away. From this we deduce that, the fact that firms engage in strategic behavior does not qualitatively affect the results: if the last entrant of each equilibrium is earning the same profits (i.e., the MIEs profits channel is inactive), the remaining channels are activated by the same set of questions as those in Figure 2a. As a corollary, the effects of trade between two large countries can be analyzed in the same way as in monopolistic competition.

Second, we obtain conclusions for a setup with restricted entry (i.e., for a fixed set of firms serving the market). This case corresponds to a CIC model where the productivity

[4]With an oligopoly, additional considerations need to be made in terms of the setup. Given the existence of multiple equilibria, the literature has usually resorted to assuming that the order in which firms enter each market is determined according to a productivity rank. In the international trade literature, this is a maintained assumption in, for instance, Feenstra and Ma (2007), Atkeson and Burstein (2008), Eaton et al. (2012), Edmond et al. (2015), and Gaubert and Itskhoki (2018). Since our goal is to delve into the determinants of common results found across the studies, we maintain this assumption.

[5]The possibility that no firm breaks even is not exclusive to oligopoly models. In standard versions of monopolistic competition, this simply does not arise because they include assumptions to rule it out. This point reinforces the idea that the differences in outcomes across models are due to different assumptions rather than the market structure.

distribution is such that trade shocks do not induce extensive-margin adjustments. For this case, we establish that the MIEs profits channel is active and reinforces any pro-competitive effect.

**Related Literature and Contributions**. Our paper is primarily related to the literature which analyzes the effects of a trade liberalization under different models of imperfect competition. Our contribution in this respect is to show that the disparity of results found in all of the studies referenced in Figure 1 do not stem from differences in the market structure. Rather, they are caused by different assumptions concerning MIEs. Furthermore, by applying our findings, we provide the conditions under which pro-competitive, anti-competitive, or null effects would arise after a trade shock.

Another contribution is the provision of an approach to work with imperfect-competition models under the demand system by Melitz and Ottaviano (2008). Arguably, this has become the main alternative to the CES among demands displaying love for variety. Exploiting the fact that the MIEs' features characterize the equilibrium, we are able to establish conditions to easily identify the equilibrium. This also allows us to propose algorithms to solve the model computationally, allowing for different productivity distributions and demand heterogeneity.[6]

# 2 An Illustration of How to Apply the Results

In this section, we show how our methodology can be applied to predict the outcomes of trade shocks based on the features of MIEs. To do this, we decompose the effects for different models of imperfect competition into the channels defined in Section 1. In addition, to clearly illustrate the mechanisms underlying the results, we present several graphs coming from numerical exercises. For further details about them, see Appendix D.

**1) <u>Channels in Standard Models of Monopolistic Competition</u>**: For this application, we consider a small country. As indicated in Figure 2a, given a reduction in inward trade barriers, if MIEs are ex-ante homogeneous then the IC channel is shut. In terms of the standard models of monopolistic competition, this characterization of MIEs applies to the Melitz and Krugman models. The intuition behind the result is that, since MIEs are ex-ante identical, they all have the same expected profits. Taking into account that their

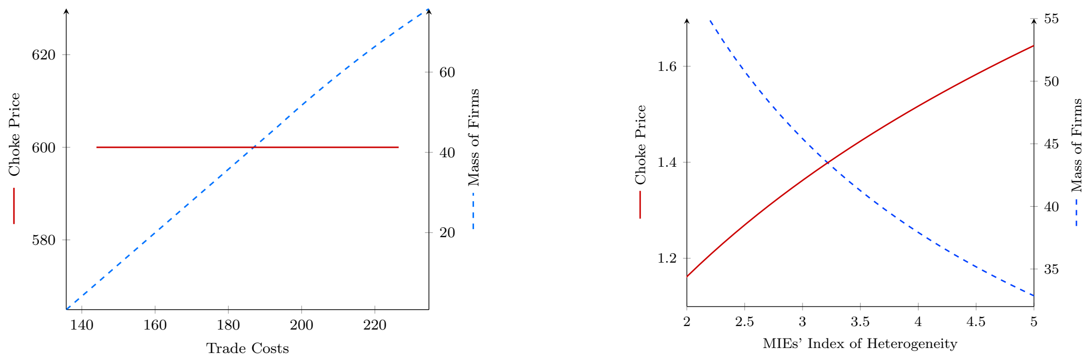
[6]In Appendix D, we illustrate the use of these algorithms through several numerical exercises.

profits are not directly affected by inward trade barriers, the choke price is identified by the zero-expected-profits condition with independence of them. As a corollary, since the choke price is a sufficient statistic for prices, quantities, markups, and the marginal-cost cutoff to serve a market, none of these variables change either. Instead, the model adjusts exclusively through a variation in the mass of domestic firms. This is illustrated in Figure 3a, which depicts the choke price and mass of domestic firms for different values of trade costs.

Figure 3: *Variations in Inward Trade Costs in a Small Economy - Monopolistic Competition*

(a) Homogeneous MIEs

(b) Heterogeneous MIEs




**Note**: In Figure 3b, a given reduction in trade costs is considered. In addition, the choke price is normalized and expressed as a difference relative to its initial value.

On the other hand, when MIEs are ex-ante heterogeneous, the IC channel is reactivated. This characterization of MIEs holds in the Chaney model, whose framework is isomorphic to a short-run version of the Melitz model (i.e., with an exogenous measure of incumbents). In terms of the CIC model, it corresponds to a setup where productivity draws come from degenerate firm-specific productivity distributions.[7]

In Figure 3b, we depict the type of adjustment for the case of ex-ante heterogeneous firms. To clearly demonstrate the impact of the MIEs' degree of heterogeneity, we consider a unilateral increase in inward trade costs. This enables us to isolate the role of MIEs by comparing domestic economies that are identical before the trade shock but differ in terms of the pool of most-productive inactive firms. The graph indicates that, for a given increase in inward trade costs, part of the adjustment takes place through the choke price and leads to pro-competitive effects. The figure also reveals that, nevertheless, as MIEs become less heterogeneous (i.e., productivity draws get less dispersed), more of the adjustment takes

[7] In the Chaney model, the fact that firms are ex-ante heterogeneous follows because, at the country level, the distribution of productivity is assumed to be atomless. Given that there are no atoms, the set of firms which have the same productivity are of measure zero and, so, are ipso facto heterogeneous.

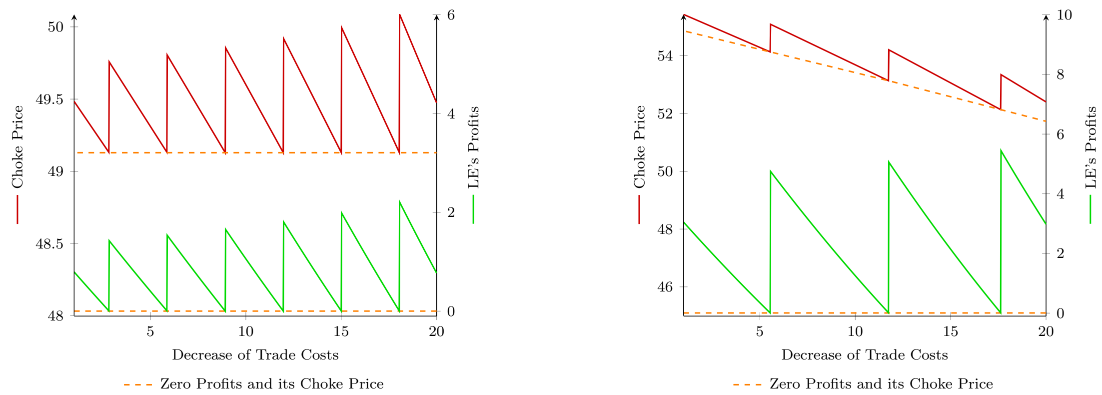
place through the mass of MIEs. In fact, it can be shown that, by decreasing the degree of heterogeneity, the model converges smoothly to a limit with an adjustment as in Figure 3a.

Regarding the EOs channel, consider a reduction in outward trade barriers. As established in Figure 2a, when MIEs are ex-ante exporters, the EOs channel is active and generates pro-competitive effects. This feature of the MIEs applies to the Melitz and Krugman models since it is assumed that, by paying the entry cost, the MIEs would become exporters for some productivity values. On the other hand, in the Chaney model, the EOs channel is inactive. This occurs because to capture selection, so that only the most-productive firms export, it is assumed that MIEs do not export. Thus, new EOs do not directly affect either the profits of MIEs or the equilibrium condition of the domestic market, determining that the choke price is pinned down independently of them.

**2) Cournot Competition and the MIEs profits channel**: Using the Cournot version of the CIC model, in Figure 4 we depict the effect of decreases in inward trade costs. These graphs differ according to whether the IC channel is activated. The first conclusion we can infer from both figures is that the choke price follows the pattern of the last entrant's profits. This reflects one of the main insights of our paper: under standard assumptions, just by knowing the features of a subset of firms (i.e., the MIEs) and how they affect their expected profits, we can deduce the market outcomes. The strong implication of this result is clearly demonstrated in Cournot since MIEs comprise just one firm.

Figure 4: *Variations in Inward Trade Costs in a Small Economy - Cournot*

(a) Homogeneous Last Entrants (b) Heterogeneous Last Entrants




**Note**: LE refers to last entrant.

Second, from Figure 2 it is concluded that, when the MIEs profits channel is inactive, the effects in oligopolistic competition resemble those in monopolistic competition. The implications of this case are of relevance since they occur when the integer constraint is assumed away. To identify outcomes where this channel is shut, we need to consider variations in trade costs such that last entrants earn the same profits. In Figure 4 we identify one of these cases by including a dashed line that indicates when last entrants are breaking even. Any point where the dashed and solid lines intersect gives the equilibrium choke price when last entrants earn zero profits and, so, the MIEs profits channel is inactive.

Comparing points where the MIEs profits channel is inactive reveals that the adjustment and results are the same as in monopolistic competition. In Figure 4a, last entrants are homogeneous and, so, the IC channel is shut. Thus, the choke price does not vary with trade costs. Rather, the model adjusts exclusively through the number of firms. On the other hand, in Figure 4b, last entrants are heterogeneous and it determines that the IC channel is active and generates pro-competitive effects.

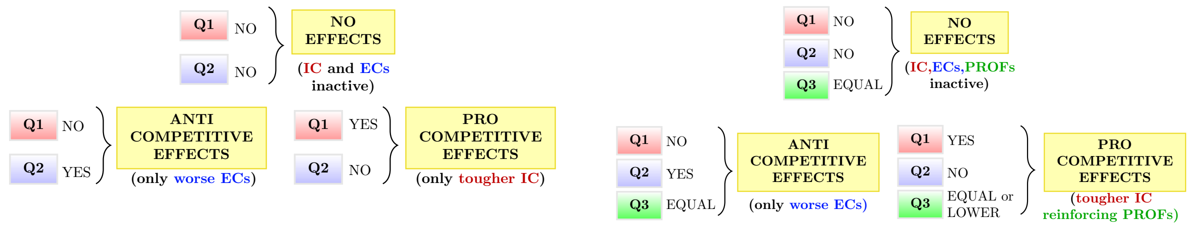
Additionally, either of these figures can be used to infer the effects when entry is restricted. This case arises when variations in trade costs do not induce extensive-margin adjustments. Graphically, the impact on each variable is given by the difference between any two points along a segment with a discontinuous jump. This illustrates the result that, under restricted entry, the MIEs profits channel is active and, since the shock reduces the last entrant's profits, it generates pro-competitive effects. This can be seen particularly clearly in Figure 4a, where the MIEs profits channel is the only one operating.

**3) Unilateral Liberalizations with Two Large Economies**: Consider a world consisting of two large countries, denoted by $H$ and $F$, and a reduction in inward trade barriers in $H$ as a trade shock. Unlike the case of small economies, this experiment creates feedback effects that need to be taken into account. Thus, in addition to the IC and EOs channel, we need to take the ECs channel into account. As indicated in Figure 2a, this channel is activated and deactivated by the same conditions as those for the EOs channel.

The impact of the shock on $H$ for both monopolistic and Cournot competition is summarized in Figure 5. This figure maps the characteristics of MIEs (i.e., Q1, Q2, and Q3 from Figure 2) into different market outcomes (i.e., null, anti-competitive, and pro-competitive effects).

Figure 5: *Unilateral Liberalizations with Two Large Countries: Effects in the Domestic Economy*

(a) Monopolistic Competition (b) Cournot Competition




**Note**: PROFs refers to the MIEs profits channel. Q1, Q2, and Q3 are defined as in Figure 2. Specifically, **Q1**: Are the MIEs ex-ante heterogeneous? **Q2**: Are the MIEs ex-ante exporters? **Q3**: How do the profits of the MIEs in each equilibrium compare?

According to Figure 5a, a unilateral liberalization creates anti-competitive effects in a scenario where domestic MIEs are (i) homogeneous, and (ii) serve both the domestic and foreign markets. In terms of $H$, (i) determines that the IC channel is inactive, while (ii) activates the ECs channel. As for $F$, (ii) entails that the EOs and ECs channels are active. Given which channels are operating in each of the standard models of monopolistic competition, this rationalizes why this result has been obtained in the Melitz and Krugman models, but not in the Chaney model.

The mechanisms that generate the results are as follows. In the Melitz model, better EOs for $F$ create tougher competitive conditions there. This translates into worse ECs for $H$ which, given that the IC channel is shut, is the only effect that arises in equilibrium in $H$. On the other hand, pro-competitive effects are generated in the Chaney model, because the IC channel is active while the ECs channel is shut. Thus, the only effect captured in $H$ is the impact of tougher import competition on the competitive environment.

Figure 5a also extends the results by establishing what outcomes appear under different conditions. For instance, if in both countries MIEs are ex-ante homogeneous and exclusively serve the domestic market, a unilateral liberalization only impacts the mass of firms, without any consequence for the competitive environment. Remarkably, by approaching the analysis through the CIC model, we can show that the result holds even if the rest of the firms export or are ex-ante heterogeneous.

As for Cournot competition, the effects of a unilateral liberalization on $H$ are summarized by Figure 5b. In the literature, it has been customary to assume away the integer number of firms, ensuring that the last entrant earns exactly zero profits. This assumption determines that the MIEs profits channel is always inactive and, hence, the effects of a unilateral trade liberalization follow the same analysis as in monopolistic competition. Thus, for instance, the anti-competitive outcomes obtained for the studies in Figure 1a arise by the same assumptions as in monopolistic competition.

# 3 Setup

In this section, we define the CIC model. Throughout the setup description, we focus on monopolistic competition since oligopoly arises as a discrete version of it. All the proofs and derivations of this paper are presented in Appendix A.

We conceive a world economy with a set $\mathcal{C}$ of countries. Each country has a unitary measure of identical agents supplying one unit of labor inelastically. This is the only factor of production, and firms can hire workers within the country at wage $w_i$ for $i \in \mathcal{C}$.

There are two sectors. One consists of a homogeneous good supplied under perfect competition, with a possibly country specific technology that displays constant returns to scale. The price of this good is taken as a numéraire and is freely traded and produced in each country in equilibrium. This implies that wages are pinned down by the competitive sector. The other sector consists of a horizontally differentiated good with a continuum of varieties and it is the focus of our analysis.

## 3.1 Demand Side

Let $\overline{\Omega}$ be the set of all the potentially conceivable varieties that might be produced in the industry. A representative consumer from country $i \in \mathcal{C}$ has the utility function,

$$U_i := q_0 + \alpha_i \int_{\omega\in\overline{\Omega}} q(\omega)\,\mathrm{d}\omega - \frac{\gamma_i}{2}\int_{\omega\in\overline{\Omega}} [q(\omega)]^2\,\mathrm{d}\omega - \frac{\eta_i}{2}\left[\int_{\omega\in\overline{\Omega}} q(\omega)\,\mathrm{d}\omega\right]^2,$$

where $\alpha_i, \gamma_i, \eta_i > 0$, and $q_0$ and $q(\omega)$ denote the consumption of the homogeneous good and variety $\omega$, respectively. We assume that income is high enough such that there is consumption of both goods in equilibrium.

Throughout the text we employ the convention that, for any variable, the first subscript represents the origin country and the second the destination. Let $\Omega_{ij} := [0, M_{ij}]$ be the set of varieties produced in $i$ and consumed in $j \in \mathcal{C}$, and $\Omega_j := [0, M_j]$ the set of total varieties consumed in $j$, where $M_j := \sum_{i\in\mathcal{C}} M_{ij}$. Usual optimization procedures determine that the demand per capita in country $j$ for a variety $\omega \in \Omega_{ij}$ is given by

$$q_{ij}(\omega) := \frac{\alpha_j}{\gamma_j + \eta_j M_j} - \frac{1}{\gamma_j} p_{ij}(\omega) - \frac{\eta_j}{\gamma_j}\frac{\mathbb{P}_j}{\gamma_j + \eta_j M_j},$$

where $\mathbb{P}_j := \sum_{i\in\mathcal{C}} \int_{\omega\in\Omega_{ij}} p_{ij}(\omega)\, \mathrm{d}\omega$.

The choke price of a variety $\omega$ in $j$, defined as the infimum price that makes demand zero, is denoted $p_j^{\max}$ and given by

$$p_j^{\max}(\mathbb{P}_j, M_j) := \frac{\alpha_j\beta_j + \mathbb{P}_j}{\beta_j + M_j}, \tag{CHK}$$

where $\beta_j := \gamma_j/\eta_j$. (CHK) establishes that the choke price is the same for all varieties, irrespective of their country of origin. In addition, the demand can be expressed in terms of it as

$$q_{ij}(\omega) = \frac{p_j^{\max} - p_{ij}(\omega)}{\gamma_j}.$$

Due to this, the choke price can be interpreted as a measure of toughness of the competitive environment in $j$: increases in the mass of firms serving $j$ and decreases in the price of its active firms decrease the choke price which, in turn, lowers the demand of variety $\omega$.

The price elasticity of the demand in $j$ is given by $\varepsilon_{ij}(\omega) = \frac{p_{ij}(\omega)}{p_j^{\max} - p_{ij}(\omega)}$ and satisfies that $\frac{\partial\varepsilon_{ij}(\omega)}{\partial p_{ij}(\omega)} = \frac{p_j^{\max}}{\left[p_j^{\max} - p_{ij}(\omega)\right]^2} > 0$. For future reference, we define linear and relative markups by $\mu := p - c$ and $m := \frac{p}{c}$, respectively.

## 3.2 Supply Side

In each country $i \in \mathcal{C}$ there is a set $\overline{\Omega}_i$ of potential single-product firms that are of zero measure under monopolistic competition. This set is partitioned into different groups, with group $\theta$ having a total mass of firms $\overline{M}_i^{\theta}$. Each firm has the possibility of entering the industry by paying a sunk fixed entry cost $F_i^E > 0$. We denote by $M_i^{\theta}$ the mass of incumbents from $i$ and group $\theta$ that pay this entry cost, and refer to any of them as being active in the industry.

When a firm pays the entry cost, it gets assigned a unique variety $\omega$ and a draw of productivity $\varphi$ from some firm-specific cdf $D_i^{\omega}$. Given a productivity draw $\varphi$, the costs in $i$ to have one unit arrive at destination $j \in \mathcal{C}$ are $c_{ij}^{\tau}(\varphi) := c_i(\varphi) + \tau_{ij}$, where $c_i(\varphi) := \frac{w_i}{\varphi}$ and $\tau_{ij}$ are trade costs.[8] We adopt the convention that $\tau_{ii} := 0$. Moreover, exploiting that there is a one-to-one relation between $c_i(\varphi)$ and $\varphi$, we characterize the model in terms of marginal costs rather than productivity.

[8]In Appendix B.1.2, we consider iceberg trade costs. For that case, the results are the same regarding the competitive environment and, hence, the conditions for activation and deactivation of channels. However, we show that the behavior of foreign firms is possibly indeterminate. For this reason, we have opted for additive trade costs as the baseline case.

The potential productivity draws determine a distribution of marginal costs at the country level. This is represented by a cdf $G_i$ that describes the marginal-cost distribution of the mass $\overline{M}_i$ of potential firms, with density $g_i$ and support $[\underline{c}_i, \overline{c}_i]$ where $\underline{c}_i \in \mathbb{R}_+$ and $\overline{c}_i \in \mathbb{R}_+ \cup \{\infty\}$. Likewise, the marginal-cost cdf of $\theta$ at the group level is denoted by $G_i^\theta$ with density $g_i^\theta$ and support $\left[\underline{c}_i^\theta, \overline{c}_i^\theta\right]$. We suppose that the groups of firms determine a partition of $[\underline{c}_i, \overline{c}_i]$. As a result, the sets of marginal costs do not overlap and each group can be ordered according to their expected profits.

Among the firms from $i$ that pay $F_i^E$, each has to decide whether to serve country $j \in \mathcal{C}$. If a firm does so, it has to incur a country-specific fixed cost $f_{ij} \geq 0$ and make a decision on quantities $q_{ij}(\omega) \in \left[0, \overline{q}_j\right]$. Given a choice for the quantities, prices are $p_{ij}(\omega) \in \left[0, \overline{p}_j\right]$, with $\overline{p}_j \in \mathbb{R}_{++} \cup \{\infty\}$ greater than or equal to the demand's choke price of country $j$. We denote by $M_{ij}^\theta$ the set of firms from $i$ that belong to the group $\theta$ and serve $j$.

Regarding markets, we suppose they are segmented, such that firms can sell at a different price in each country. Also, we assume that the home country constitutes the most profitable market of each potential firm. The purpose of this assumption is to ensure that, as is standard in the literature, any firm that is active in at least one country necessarily serves its domestic market.

## 3.3 Definitions and Partition of Firms

Throughout the paper, we compare the equilibrium outcomes in two different scenarios, defined by the trade costs $\boldsymbol{\tau}^* := \left(\tau_{ij}^*\right)_{i,j\in\mathcal{C}}$ and $\boldsymbol{\tau}^{**} := \left(\tau_{ij}^{**}\right)_{i,j\in\mathcal{C}}$. Next, we define a baseline setting for monopolistic competition that is used to derive the propositions for this market structure.[9]

We suppose that each $\overline{\Omega}_i$ is partitioned into groups $\mathcal{I}$, $\mathcal{E}$, and $\mathcal{N}$, which comprise what we denominate insiders, entrants, and non-active firms, respectively. These labels reflect the role they play during a trade liberalization. The set $\mathcal{I}$ includes those firms which pay the entry cost under both $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ and have a productivity distribution that ensures they are always active in the domestic market. At the other extreme, the group $\mathcal{N}$ consists of those firms that are inactive in the industry under both vectors of trade costs. As for $\mathcal{E}$, it constitutes the group of firms at which extensive-margin adjustments at the industry take place. We suppose that the support of their distribution is such that only a subset of firms

[9]We consider alternative partitions in the appendix when we derive results and perform numerical exercises for non-standard versions of monopolistic competition.

in $\mathcal{E}$ are active in the domestic market. A particular subset of $\mathcal{E}$, which we have referred to as MIEs, plays a critical role for the results we obtain in this paper.

**Definition 3.1:** ***Marginal industry entrants*** *are the set of the least-productive domestic firms that pay the entry cost in a given equilibrium.*

The structure of the cdf $D_i^{\omega}$ corresponding to $\mathcal{E}$ characterizes MIEs. Next, we define two variants of the CIC model based on alternative assumptions regarding this cdf. They encompass the standard versions of monopolistic competition used in the literature. We refer to the first one as a *group-specific CIC model*. In this version, $D_i^{\omega}$ is the same for each firm in $\mathcal{E}$ and, so, it coincides with the cdf $G_i^{\mathcal{E}}$. We suppose that this distribution is atomless and possibly degenerate to encompass the Krugman model. Moreover, we assume that, under this CIC variant, the set of least-productive firms that serve at least one country sell exclusively at home.

The second variant, which we refer to as a *degenerate CIC model*, consists of a degenerate and firm-specific $D_i^{\omega}$ for $\mathcal{E}$ that determines an atomless distribution at the group level. Implicitly, since this distribution has no atoms, the set of firms obtaining the same productivity draw has measure zero. In Section 5.1 we show that the Melitz and Krugman models are special cases of a group-specific CIC model, while the Chaney model is a special case of a degenerate CIC model.

Next, we define two features regarding the firms in each group which are crucial for the activation and deactivation of the channels.

**Definition 3.2:** *Consider firms from $i \in \mathcal{C}$ which belong to some group $\theta$.* ***Firms in $\theta$ are ex-ante exporters to*** *$j \in \mathcal{C} \backslash \{i\}$ when there exists a $c' \in \left[\underline{c}_i^{\theta}, \overline{c}_i^{\theta}\right]$ such that a non-zero measure of firms in $\theta$ with $c \leq c'$ would export to $j$.* ***Firms in $\theta$ are ex-ante heterogeneous*** *when any subset of firms in $\theta$ that obtain productivity draws from the same $D_i^{\omega}$ has measure zero.*

Notice that an ex-ante qualification is irrelevant in a degenerate CIC model, given that each firm has only one possible productivity draw. The same remark applies to the distinction between expected and realized profits. For this reason, when there is no risk of confusion, we omit these terms when this model is used.

Applying these definitions to each CIC variant, we determine the following. First, firms in $\mathcal{E}$ are always ex-ante homogeneous in a group-specific CIC model, and ex-ante heterogeneous in a degenerate CIC model.[10] Second, in a degenerate CIC model, firms in $\mathcal{E}$ are ex-ante exporters to some country $F$ only when there is no selection into exporting. However, supposing no selection constitutes a strong assumption. It implies that, given that the least-productive firms would be exporting, then any other firm from $i$ would export too.

# 4 Monopolistic Competition

In this section, we analyze the CIC model under monopolistic competition. We begin by describing the solution for a partition of firms as in Section 3.3 and trade costs $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$. Since alternative assumptions generate a different description of some of the solutions, we only characterize those that are common across the setups and relegate a full characterization to Appendix A.1. After this, we analyze the effects of trade shocks according to alternative assumptions on the MIEs. Our focus is on the impact on the domestic competitive environment and the behavior of domestic firms.

We provide some additional results in the appendix. In Appendix B.1, we extend the results by characterizing how foreign firms are affected by the trade shocks of each proposition. In Appendix D.1, we describe how to compute the equilibrium under monopolistic competition and illustrate its use through numerical exercises.

## 4.1 Equilibrium

To characterize the equilibrium for the world economy, we start by describing the optimal decisions for active firms. Since firms from a specific country with the same marginal cost solve the same optimization problem, we index the solutions by this variable. Optimal prices and quantities in $j \in \mathcal{C}$ of an active firm from $i \in \mathcal{C}$ with $c_{ij}^{\tau}$ are given by:

$$p_{ij}\left(p_j^{\max}, c; \tau_{ij}\right) := \frac{p_j^{\max} + c_{ij}^{\tau}}{2}, \tag{PRICE}$$

$$q_{ij}\left(p_j^{\max}, c; \tau_{ij}\right) := \frac{p_j^{\max} - c_{ij}^{\tau}}{2\gamma_j}. \tag{QUANT}$$

As for the firms that do not pay either the entry cost or the fixed cost to serve $j$, they set quantities equal to zero and a price greater than or equal to the choke price of that market. In turn, the linear and relative markups set in $j$ are given by $\mu_{ij}\left(p_j^{\max}, c; \tau_{ij}\right) := \frac{p_j^{\max} - c_{ij}^{\tau}}{2}$

[10] By dispensing with the assumption of no atoms in the productivity distribution at the group level, the degenerate CIC model is easily extended to allow for ex-ante homogeneous firms.

and $m_{ij}\left(p_j^{\max}, c; \tau_{ij}\right) := \frac{p_j^{\max}+c_{ij}^{\tau}}{2c_{ij}^{\tau}}$, respectively. For a firm with marginal cost $c$, we denote by $p_{ij}^*(c)$ and $q_{ij}^*(c)$ the solutions (PRICE) and (QUANT) for an equilibrium choke price $p_j^{\max *}$. Likewise, the equilibrium markups are denoted $\mu_{ij}^*(c)$ and $m_{ij}^*(c)$.

Regarding optimal profits of a firm with $c_{ij}^{\tau}$ that is active in $j$, they are

$$\pi_{ij}\left(p_j^{\max}, c; \tau_{ij}\right) := \frac{\left(p_j^{\max} - c_{ij}^{\tau}\right)^2}{4\gamma_j} - f_{ij}. \tag{PROF}$$

For trade costs $\boldsymbol{\tau}^*$ or $\boldsymbol{\tau}^{**}$, we denote the equilibrium values of any variable by a superscript $*$ and $**$, respectively. The marginal-cost cutoff to serve $j \in \mathcal{C}$ in each of these scenarios is denoted by $c_{ij}^*$ and $c_{ij}^{**}$. Moreover, in the description of the solutions, we anticipate that MIEs belong to $\mathcal{E}$ under $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$.

Since the derivations of the equilibrium conditions for the market stage and marginal-cost cutoffs do not play any role for understanding the results, we relegate their characterization to the appendix. Instead, we focus on the conditions implied by free entry in a CIC model.[11] For the case of a group-specific CIC model, we denote $\widetilde{\pi}_{ji}^{\theta}$ the optimal expected profits of a firm belonging to $\theta$. It can be shown that, under this variant, the marginal-cost cutoff of a firm from $j$ to serve $i$ can be expressed as a function of $\left(p_i^{\max *}; \tau_{ji}^*\right)$. Thus, in equilibrium, any firm belonging to $\mathcal{I}$ satisfies

$$\sum_{i\in\mathcal{C}} \widetilde{\pi}_{ji}^{\mathcal{I}}\left(p_i^{\max *}; \tau_{ji}^*\right) > F_j^E \text{ and } \sum_{i\in\mathcal{C}} \widetilde{\pi}_{ji}^{\mathcal{I}}\left(p_i^{\max **}; \tau_{ji}^{**}\right) > F_j^E,$$

and, for firms in $\mathcal{E}$,

$$\sum_{i\in\mathcal{C}} \widetilde{\pi}_{ji}^{\mathcal{E}}\left(p_i^{\max *}; \tau_{ji}^*\right) = \sum_{i\in\mathcal{C}} \widetilde{\pi}_{ji}^{\mathcal{E}}\left(p_i^{\max **}; \tau_{ji}^{**}\right) = F_j^E. \tag{1}$$

Regarding the case of a degenerate CIC model, any firm with marginal costs $c$ that belongs to $\theta \in \{\mathcal{I}, \mathcal{E}\}$ and is not a MIE has profits that satisfy

$$\sum_{i\in\mathcal{C}} \pi_{ji}^{\theta}\left(p_i^{\max *}, c; c_{ji}^*, \tau_{ji}^*\right) > F_j^E \text{ and } \sum_{i\in\mathcal{C}} \pi_{ji}^{\theta}\left(p_i^{\max **}, c; c_{ji}^{**}, \tau_{ji}^{**}\right) > F_j^E,$$

where $\pi_{ji}^{\theta}\left(p_i^{\max}, c; c_{ji}, \tau_{ji}\right) := \mathbb{1}_{(c\le c_{ji})}\pi_{ij}\left(p_j^{\max}, c; \tau_{ij}\right)$. Regarding the MIEs, their marginal costs under each scenario are denoted by $c_i^*$ and $c_i^{**}$. Supposing that they have non-negative

[11]It is possible that there are equilibria where all firms garner strictly positive expected profits and, thus, the MIEs profits channel is active. Since this is ruled out in the standard versions of monopolistic competition, we only consider equilibria where the zero-expected-profits condition holds.

profits in a set of countries $\mathcal{F}$, their profits are

$$\sum_{i\in\mathcal{F}} \pi_{ji}^{\mathcal{E}} \left(p_i^{\max *}, c_i^*; \tau_{ji}^*\right) = \sum_{i\in\mathcal{F}} \pi_{ji}^{\mathcal{E}} \left(p_i^{\max **}, c_i^{**}; \tau_{ji}^{**}\right) = F_j^E. \tag{2}$$

In the remaining parts of this section, we inquire upon the conditions that activate and deactivate the channels. This is done by only modifying assumptions relating to our country of interest, denoted $H$. For the rest of the countries, we do not restrict the analysis to a specific market structure. Rather, we suppose it can be described by either a group-specific or degenerate CIC model.

Furthermore, we suppose that $H$ is a small economy in the sense of Alfaro (2019). This has similar implications to the definition by Demidova and Rodríguez-Clare (2009) adapted to the case with an outside sector pinning down wages. In particular, the fact that $H$ is a small economy establishes that firms from $H$ and $H$'s domestic conditions are negligible for the domestic market of any other country $j \in \mathcal{C}\setminus\{H\}$. Thus, they do not affect $\left(p_j^{\max *}\right)_{j\in\mathcal{C}\setminus\{H\}}$.

## 4.2 Deactivating the Import-Competition Channel: Ex-Ante Homogeneity of Marginal Industry Entrants

Next, we show that, when firms from $H$ belonging to $\mathcal{E}$ are ex-ante homogeneous, the IC channel is shut and only entails variations in the mass of MIEs. In terms of the versions of a CIC model we take as a baseline case, this property corresponds to the group-specific variant.

**Proposition 4.1**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Let trade costs $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ be such that $\tau_{jH}^* \geq \tau_{jH}^{**}$ for each $j \neq H$ with strict inequality for at least one country. Suppose a CIC model under monopolistic competition as in Section 3.3, where MIEs under $\boldsymbol{\tau}^*$ belong to $\mathcal{E}$.*
*Then, if the firms from $H$ in $\mathcal{E}$ are ex-ante homogeneous:*

- $p_H^{\max *} = p_H^{\max **}$ *and* $c_{HH}^* = c_{HH}^{**}$,
- *for firms that are active in both equilibria,* $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$, *and* $\mu_{HH}^{**}(c)$ *are the same as in the equilibrium with* $\boldsymbol{\tau}^*$, *and*
- $M_H^{\mathcal{E}**} < M_H^{\mathcal{E}*}$.

This proposition can be understood in the following way. When trade costs become lower, the increase in quantities supplied by active foreign firms and entry of foreign firms create an excess of supply. The model begins to adjust by reducing the mass of the least-productive firms in the market, i.e., the MIEs. If before and after the trade shock MIEs belong to $\mathcal{E}$, the characterization of this group of firms is the key to describing the adjustment process. Assuming that firms in $\mathcal{E}$ are ex-ante homogeneous determines that there is only one choke price consistent with the zero-expected-profits condition. Due to this, the equilibrium is restored through the exit of MIEs, without inducing any variation in the choke price.

## 4.3 Activating the Import-Competition Channel: Ex-Ante Heterogeneity of Marginal Industry Entrants

The following proposition establishes that, when firms in $\mathcal{E}$ are ex-ante heterogeneous, the IC channel is active and generates pro-competitive effects. In terms of the variants of the CIC model we take as a baseline case, ex-ante heterogeneity corresponds to a degenerate CIC model.

**Proposition 4.2**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Let trade costs $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ be such that $\tau^*_{jH} \geq \tau^{**}_{jH}$ for each $j \neq H$ with strict inequality for at least one country. Suppose a CIC model under monopolistic competition as in Section 3.3, where MIEs under $\boldsymbol{\tau}^*$ belong to $\mathcal{E}$, and $\boldsymbol{\tau}^{**}$ satisfies some boundary condition such that MIEs also belong to $\mathcal{E}$ under $\boldsymbol{\tau}^{**}$.*
*Then, if the firms from $H$ in $\mathcal{E}$ are ex-ante heterogeneous:*

- $p_H^{\max **} < p_H^{\max *}$ *and* $c^{**}_{HH} < c^*_{HH}$,
- *for firms that are active in both equilibria,* $p^{**}_{HH}(c)$, $q^{**}_{HH}(c)$, $m^{**}_{HH}(c)$, *and* $\mu^{**}_{HH}(c)$ *decrease relative to the equilibrium with* $\boldsymbol{\tau}^*$, *and*
- $M^{**}_{HH} < M^*_{HH}$.

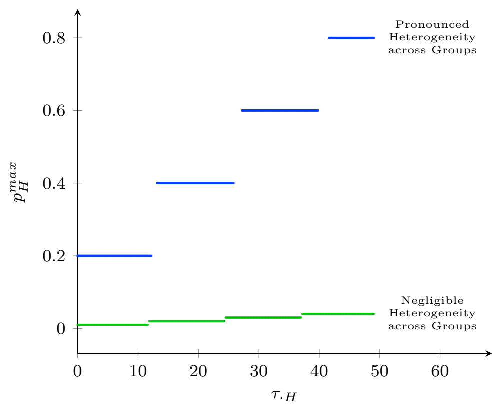
When MIEs are ex-ante heterogeneous, the adjustment to redress excess supply is different from the case of ex-ante homogeneity. The reason for this is that the critical choke price which induces exit now varies across MIEs. Consequently, the exit of domestic firms cannot be accomplished without it varying. In addition, since the choke price changes, any excess of supply is eliminated through both variations in the quantities produced by active firms and the exit of MIEs. This means that, when the IC channel is active, the whole distribution of productivity matters for the adjustment.

In Appendix C, we prove theoretically that, nonetheless, the MIEs' degree of heterogeneity still plays a distinctive role in the magnitude of the IC channel: unlike what happens with $\mathcal{I}$, when the heterogeneity of firms in $\mathcal{E}$ is small, the effect of the trade shock on the choke price is negligible. More generally, we prove that the less heterogeneous the productivity is across MIEs, the lower the impact on the choke price, converging smoothly to a limit with null effects when MIEs become homogeneous.

To provide some intuition for this fact and for the differences in the adjustment when MIEs are ex-ante homogeneous or heterogeneous, consider the following experiment. Suppose two distributions in $H$ with an identical characterization of active firms from $H$. In addition, the set of inactive marginal entrants in $H$ consists of several groups of firms that are homogeneous within them but heterogeneous across them. By considering an increase in trade costs, we can inquire upon the adjustment process for firms in $H$ that are identical before the shock but which differ by the MIEs after the shock.

We depict this adjustment graphically in Figure 6, which corresponds to a numerical exercise detailed in Appendix D.1.2. The figure contains two cases distinguished by whether heterogeneity between the groups of inactive firms is large (blue lines) or small (green lines).

Figure 6: *The MIEs' Degree of Heterogeneity and the Choke Price*




**Note**: $\tau_{\cdot H}$ refers to $\tau_{jH}$ for some $j \in \mathcal{C} \backslash \{H\}$. The choke price and trade costs are normalized and expressed as a difference relative to their initial value.

In this experiment, there is an adjustment through ex-ante homogeneous MIEs when the variation in trade costs is such that MIEs belong to the same group before and after the trade shock. Graphically, the effect on the choke price is demonstrated by variations along any of the different horizontal line segments. Thus, the choke price does not vary and the model is adjusting through the exit of MIEs.

On the other hand, an adjustment with ex-ante heterogeneous MIEs arises when the increase in trade costs is big enough such that MIEs belong to different groups. This case is depicted graphically by a discontinuous increase in the choke price.

Additionally, by comparing the blue and green lines, we can see how the magnitude of the discontinuous jump in the choke price depends on the MIEs' degree of heterogeneity. Specifically, if the differences in marginal costs between the groups is more pronounced, then greater variations in the choke price are necessary to restore the equilibrium. Otherwise, when differences in marginal costs are negligible, the variation in the choke price is trivial.

## 4.4 Activating the Export-Opportunities Channel: Ex-Ante Exporting Marginal Industry Entrants

Finally, we inquire upon the conditions to activate the EOs channel. The next proposition establishes that, if MIEs are ex-ante exporters, the EOs channel is active.

**Proposition 4.3**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Let trade costs $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ be such that $\tau_{HF}^{**} < \tau_{FH}^{*}$ for some country $F \in \mathcal{C} \setminus \{H\}$. Suppose a CIC model under monopolistic competition as defined in Section 3.3, where MIEs under $\boldsymbol{\tau}^*$ belong to $\mathcal{E}$ and there is some condition which ensures that MIEs also belong to $\mathcal{E}$ under $\boldsymbol{\tau}^{**}$. Then:*

- *If firms from $H$ in $\mathcal{E}$ are ex-ante exporters in $F$,*
  - $p_H^{\max *} < p_H^{\max *}$ *and* $c_{HH}^{**} < c_{HH}^{*}$,
  - *for firms that are active in both equilibria,* $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$, *and* $\mu_{HH}^{**}(c)$ *decrease relative to the equilibrium with* $\boldsymbol{\tau}^*$, *and*
  - $M_{HH}^{**} > M_{HH}^{*}$;
- *If firms from $H$ in $\mathcal{E}$ are not ex-ante exporters in $F$, $p_H^{\max *}$ does not vary and neither the prices, quantities, survival marginal-cost cutoff and masses of firms serving $H$ do so.*

The key to understanding this proposition is that the new EOs increases the profits of MIEs. Thus, some of them become active and, by the assumption that any active firm serves its domestic market, this leads to tougher domestic conditions. Mathematically, this is reflected by the fact that, given an increase in profitability, zero expected profits can only be restored if the choke price is lower.

# 5 Applications to Monopolistic Competition

In this section, we make use of the results we obtained for the CIC model under monopolistic competition. First, in Section 5.1, we exploit the fact that the setup of monopolistic competition in Krugman (1979), Melitz (2003), and Chaney (2008) constitute special cases of the CIC model. This allows us to determine which channels are active in each of those variants.[12] Then, in Section 5.2, we apply the results to unilateral liberalizations between two large economies. In particular, we establish conditions that generate null, anti-competitive, and pro-competitive effects in the domestic economy.

## 5.1 Case I: Krugman, Melitz, and Chaney Models

To generate the standard setups of monopolistic competition through the CIC model, we suppose that there is no partition of firms. Specifically, we set $\underline{c}_i^{\mathcal{E}} = \underline{c}_i$ and $\overline{c}_i = \overline{c}_i^{\mathcal{E}}$, so that $\mathcal{E}$ constitutes the only group in the economy. In addition, although other assumptions are added in the literature when these models are defined, the ones detailed here are those which are critical for determining the outcomes.

- **Melitz and Krugman models**. The Melitz model corresponds to a group-specific CIC model where firms are ex-ante exporters. The Krugman model is the limiting case of Melitz, where each firm gets a productivity draw from the same degenerate distribution.
- **Chaney model/short-run Melitz**. It is a degenerate CIC model with selection into exporting (i.e., the least-productive firms are not ex-ante exporters).

By applying the different propositions for the CIC model, we can characterize these models. First, since the Melitz and Krugman models are particular cases of the group-specific CIC model, the MIEs are ex-ante homogeneous and, so, the IC channel is always inactive. Therefore, Proposition 4.1 applies.

In addition, in the Melitz and Krugman models, the EOs channel is always active and, so, Proposition 4.3 with ex-ante exporters holds. This follows because, in the Melitz model, any firm deciding whether to enter the industry exports with a positive probability. In the case of the Krugman model, it holds because, in order to have trade, it is necessary to assume that at least one firm exports. Thus, due to the symmetry assumption, all of them would export.

As for the Chaney model, the IC channel is always active and, hence, Proposition 4.2 holds. This is so because, in a degenerate CIC model, it is assumed that the distribution at the country level is atomless, which implies that MIEs are ex-ante heterogeneous.

[12] In Appendix F, we demonstrate how the decomposition in channels can be performed. We do it through a scenario as in Melitz and Ottaviano (2008), with two symmetric countries and a Pareto productivity distribution.

Additionally, in the Chaney model, the EOs channel is inactive and, hence, Proposition 4.3 for MIEs that are not ex-ante exporters applies. The reason for this is that, since any active firm serves their domestic market, MIEs coincide with the marginal entrants at the home market in this model. Thus, given selection into exporting, MIEs are not exporters.

## 5.2 Case II: Unilateral Liberalizations between Large Economies

In this part, we suppose the existence of two large countries, $H$ and $F$, and a reduction in inward trade barriers in $H$ given by $\mathrm{d}\tau_{FH} < 0$. In addition to the IC and EOs channels, the presence of feedback effects gives rise to the ECs channel (i.e., the export-conditions channel). This incorporates the total effects triggered by the impact of the trade shock on the trading partner's choke price. Importantly, the conditions for the activation of the ECs channel are equivalent to those for the EOs channel.

We relegate a formal treatment to Appendix A.2. Instead, here, we provide some intuition and show how the outcomes follow naturally when they are analyzed through the channels presented in Section 4.

The equilibrium conditions of the CIC model in any of the variants defined in Section 3.3 determine reduced-form equations $p_H^{\max}\left(p_F^{\max}; \tau_{FH}\right)$ and $p_F^{\max}\left(p_H^{\max}; \tau_{FH}\right)$. The equilibrium is given by a pair $(p_H^{\max *}, p_F^{\max *})$ such that:

$$p_H^{\max *} = p_H^{\max}\left(p_F^{\max *}; \tau_{FH}\right),$$
$$p_F^{\max *} = p_F^{\max}\left(p_H^{\max *}; \tau_{FH}\right).$$

By keeping some variables constant, these functions enable us to split the total effect on each choke price into the different channels. Specifically, consider country $F$, which is the country that faces new EOs. Then, the total effect on its choke price is given by

$$\frac{\mathrm{d}p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \underbrace{\lambda \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{EOs channel}} + \underbrace{\lambda \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial p_H^{\max}} \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}}, \tag{3}$$

where $\lambda > 0$ is a multiplier of effects. The EOs channel is given by the total effects triggered by the direct impact of $\tau_{FH}$ on $p_F^{\max *}$. As for the ECs channel, it is given by the total effect triggered by the impact of $\tau_{FH}$ on $p_H^{\max *}$.

Regarding country $H$, which is the one that faces tougher IC, the total effect can be split in the following way:

$$\frac{\mathrm{d}p_H^{\max *}(p_F^{\max *};\tau_{FH})}{\mathrm{d}\tau_{FH}} = \underbrace{\lambda\frac{\partial p_H^{\max *}(p_F^{\max *})}{\partial \tau_{FH}}}_{\text{IC channel}} + \underbrace{\lambda\frac{\partial p_H^{\max *}(p_F^{\max *})}{\partial p_F^{\max}}\frac{\partial p_F^{\max *}(p_H^{\max *};\tau_{FH})}{\partial \tau_{FH}}}_{\text{ECs channel}}. \tag{4}$$

The IC channel is given by the total effect on the choke price due to the direct impact of $\tau_{FH}$ on $p_H^{\max *}$. Regarding the ECs channel, it comprises the total effects on $H$'s choke price caused by the direct impact of $\tau_{FH}$ on $p_F^{\max *}$.

Expressions (3) and (4), along with the conditions for the deactivation and activation of each channel in Propositions 4.1, 4.2, and 4.3, allow us to determine conditions that lead to specific outcomes. In particular, we are able to explain the results from the studies in Figure 1a. To illustrate its use, we present how results in $H$ can be generated by characterizing MIEs.

- **Anti-Competitive Effects**: if MIEs in both countries are ex-ante homogeneous (i.e., the IC channel is inactive) and ex-ante exporters (i.e., the EOs and ECs channels are active). For instance, this arises in the Krugman and Melitz models.
- **Pro-Competitive Effects**: if MIEs in $H$ are ex-ante heterogeneous (i.e., the IC channel is active) and are not ex-ante exporters (i.e., the EOs and ECs channels are inactive). For instance, this is the case in the Chaney model.
- **Null Effects**: if MIEs in $H$ are ex-ante homogeneous (i.e., the IC channel is inactive) and not ex-ante exporters (i.e., the EOs and ECs channels are inactive). For instance, this holds in a group-specific CIC model where, for any productivity draw, the set of MIEs would only serve the domestic market, irrespective of the characterization for the rest of the firms. In addition, it also arises in an extended version of the degenerate CIC model that allows for atoms in the productivity distribution at the group level. To generate the result under that framework, it is required that firms in $\mathcal{E}$ obtain draws from the same productivity distribution and that there is selection into exporting.

# 6 The Oligopoly Model

In this section, we consider the CIC model with non-negligible firms. Unlike monopolistic competition, it is not necessary to partition firms to isolate the role of MIEs since, when there is an integer number of firms, the MIEs comprise only one firm. We refer to this firm as the last entrant, which corresponds to the least-profitable one that is active in the industry.

Incorporating non-negligible firms modifies the analysis relative to monopolistic competition in two respects. First, since firms can influence market conditions, they take strategic considerations into account when making decisions. Second, with an integer number of firms, extensive-margin adjustments at the market have discontinuous effects and it is not necessarily the case that the least-productive active firm earns exactly zero profits.

The conclusions that emerge from the propositions we state below are: (i) the fact that the last entrant does not necessarily break even introduces a new channel to the analysis, and (ii) the inclusion of strategic considerations per se does not affect the conclusions obtained under monopolistic competition.

The new channel introduced in (i) is the MIEs profits channel. We show that this channel is inactive as long as the profits of the last entrant of each equilibrium are the same, *independently of whether these profits are zero*. Moreover, when the last entrant's profits after a trade shock are lower, we establish that the effects stemming from the MIEs profits channel are pro competitive. Regarding (ii), we show this holds by proving that, conditional on the MIEs profits channel being inactive, the same conditions prevail for the activation of channels as in monopolistic competition. This result is particularly relevant since it characterizes the equilibrium when the integer number of firms is assumed away.

In the appendix, we provide some additional results. In Appendix B.2 we extend the propositions to include the impact on foreign firms. Additionally, in Appendix D.2, we describe an algorithm to compute the equilibrium and present numerical exercises to illustrate its use.

## 6.1 Setup and Optimal Variables

The framework is similar to monopolistic competition in some respects. In particular, incorporating that there is a discrete number of varieties and firms, it has a demand and supply side as in Section 3.1 and Section 3.2. On the other hand, to generate the versions of oligopolistic competition used in the literature, we suppose that each firm $\omega$ gets a productivity draw from a degenerate $D_i^{\omega}$. This is not necessarily different across firms and determines a marginal cost $c_{\omega}$. In addition, we consider that competition is in quantities.

The inverse demand for a variety $\omega$ produced in $i$ and sold in $j$ is $p_{ij}(\omega) = \alpha_j - \gamma_j q_{ij}(\omega) -$

$\eta_j \mathbb{Q}_j$ with $\mathbb{Q}_j := \sum_{i \in \mathcal{C}} \mathbb{Q}_{ij}$ and $\mathbb{Q}_{ij} := \sum_{\omega \in \Omega_{ij}} q_{ij}(\omega)$. We denote the marginal cost of a firm $\omega$ inclusive of trade costs by $c_\omega^{\tau_{ij}} := c_\omega + \tau_{ij}$. In this framework each firm is able to influence $p_j^{\max}(\mathbb{Q}_j)$ through its choice of quantities. Thus, the best-response quantities in $j$ of an active firm from $i$ with marginal costs $c_\omega$ are

$$q_{ij}^{BR}\left(\mathbb{Q}_j^{-\omega}; c_\omega^{\tau_{ij}}\right) := \frac{\alpha_j - \eta_j \mathbb{Q}_j^{-\omega} - c_\omega^{\tau_{ij}}}{2(\gamma_j + \eta_j)}, \tag{Q$_{BR}$-BF}$$

where $\mathbb{Q}_j^{-\omega}$ is the sum of quantities supplied in $j$ by all firms except $\omega$.

To establish a direct link with the monopolistic competition case, we reexpress the optimal variables in terms of the choke price. To do this, we exploit that there is a one-to-one relation between $p_j^{\max}$ and $\mathbb{Q}_j$, given by $p_j^{\max}(\mathbb{Q}_j) = \alpha_j - \eta_j \mathbb{Q}_j$. Thus, the inverse demand is $p_{ij}(\omega) = p_j^{\max}(\mathbb{Q}_j) - \gamma_j q_{ij}(\omega)$, which determines that the optimal quantities and prices as functions of the choke price are:

$$\begin{aligned} q_{ij}\left[p_j^{\max}(\mathbb{Q}_j); c_\omega^{\tau_{ij}}\right] &:= \frac{p_j^{\max}(\mathbb{Q}_j) - c_\omega^{\tau_{ij}}}{2\gamma_j + \eta_j}, \\ p_{ij}\left[p_j^{\max}(\mathbb{Q}_j); c_\omega^{\tau_{ij}}\right] &:= \frac{p_j^{\max}(\mathbb{Q}_j)(\gamma_j + \eta_j) + \gamma_j c_\omega^{\tau_{ij}}}{2\gamma_j + \eta_j}. \end{aligned} \tag{Q$_{\mathbb{Q}}$-BF}$$

Moreover, optimal linear markups are $\mu\left[p_j^{\max}(\mathbb{Q}_j); c_\omega^{\tau_{ij}}\right] := \frac{\gamma_j + \eta_j}{2\gamma_j + \eta_j}\left[p_j^{\max}(\mathbb{Q}_j) - c_\omega^{\tau_{ij}}\right]$, while relative markups are $m\left[p_j^{\max}(\mathbb{Q}_j); c_\omega^{\tau_{ij}}\right] := \frac{\gamma_j}{2\gamma_j + \eta_j} + \frac{\gamma_j + \eta_j}{2\gamma_j + \eta_j} \frac{p_j^{\max}(\mathbb{Q}_j)}{c_\omega^{\tau_{ij}}}$. In turn, optimal profits in $j$ of an active firm $\omega$ from $i$ are

$$\pi_{ij}\left[p_j^{\max}(\mathbb{Q}_j); c_\omega^{\tau_{ij}}\right] := \frac{\gamma_j + \eta_j}{(2\gamma_j + \eta_j)^2}\left[p_j^{\max}(\mathbb{Q}_j) - c_\omega^{\tau_{ij}}\right]^2 - f_{ij}. \tag{PROF-BF}$$

## 6.2 Entry Process and Reindex of Variables

Given that a plethora of equilibria can arise in oligopolies, additional structure is required to characterize the model. The standard assumption to ignore equilibria where less-productive firms crowd out more productive ones is that firms enter following a productivity order.[13] Since our goal is to explain the results found in previous studies, we maintain it. This, in addition, allows for a direct comparison with monopolistic competition, where the assumption holds as a property of the equilibrium.

Specifying an order for heterogeneous firms requires the consideration of some subtle details. For this reason, we formalize the assumption by an order relation. To be able to

[13]See Footnote 4 for some literature using this assumption. More generally, a profitability ranking could be defined as the criteria to order firms. Since, in our case, firm heterogeneity is exclusively due to efficiency, productivity and profitability rankings are equivalent.

compare every firm (i.e., having a complete order relation), we follow the standard approach used in the literature on oligopolies with firm heterogeneity (e.g., Eaton et al. 2012 and Gaubert and Itskhoki 2018). Thus, we suppose that country-specific fixed costs are strictly positive and equal in each country, so that firms differ only by the marginal cost of delivering to a market.[14] To avoid a taxonomy of cases, we take as a baseline case that $F_i^E = 0$ for $i \in \mathcal{C}$. Positive entry costs are reestablished in Proposition 6.3 when we study the EOs channel.

To define the order relation, we suppose that each variety in $\overline{\Omega}$ corresponds to a specific firm, so that $\overline{\Omega} = \cup_{k\in\mathcal{C}}\overline{\Omega}_i$. For each country $i$, we use $c_{\omega}^{\tau_{ji}}$ as the cost index of a firm $\omega$ from $j$. Given the existence of trade costs, the cost incurred by a firm supplying one unit depends on the market being served. Thus, there is a different order relation for each country. Formally, we define $\succsim_i$ on $\overline{\Omega}$ such that $\omega'' \succsim_i \omega'$ iff $c_{\omega''}^{\tau_{ji}} \geq c_{\omega'}^{\tau_{ki}}$, where $\omega'' \in \overline{\Omega}_j$, $\omega' \in \overline{\Omega}_k$, and $j,k \in \mathcal{C}$. Notice that, since $\succsim_i$ is defined on $\overline{\Omega}$, it orders all the conceivable firms in the world.

Without further assumptions, $\left(\overline{\Omega}, \succsim_i\right)$ is only a complete pre-ordered set (i.e., complete and transitive). This implies that the equivalence classes defined by $\succsim_i$ are not necessarily singletons and, therefore, we cannot establish a strict order for the entry process. For the purposes of this paper, any order among equivalent firms is inconsequential. Thus, from now on, we suppose there is some arbitrary order among the firms belonging to a same equivalence class. In this way, we are allowed to extend the complete preorder to a linear order, such that $\left(\overline{\Omega}, \succsim_i\right)$ is a chain.[15] Also, we suppose that, if after a variation in the trade costs some firms end up having the same cost index, the order of the status quo is preserved.

When $\left(\overline{\Omega}, \succsim_i\right)$ is a chain, we can construct an order-preserving bijective function which allows us to reindex all the variables in a one-to-one fashion.[16] Formally, for each country $i$, there exists a mapping $\omega \mapsto r_i(\omega)$ that orders the elements of $\overline{\Omega}$ according to $\succsim_i$: given $\omega'', \omega' \in \overline{\Omega}$, the mapping is such that $r_i(\omega'') \geq r_i(\omega')$ iff $\omega'' \succsim_i \omega'$. We denote by $N_i$ the total number of active firms in $i$, and $\Omega_i := \left\{\omega \in \overline{\Omega} : r_i(\omega) \leq N_i\right\}$ the set of active firms in $i$. Likewise, we denote $N_{ji}$ the number of firms from $j$ which are active in $i$, and $\Omega_{ji} := \left\{\omega \in \overline{\Omega}_j : r_i(\omega) \leq N_i\right\}$ the set of active firms in $i$ from $j$. Notice that the terms $N_i$ and $N_{ji}$ play the dual role of total number of firms and index of the last entrant.

[14] Strictly positive fixed costs rules out that a set of firms earning zero profits would provide zero quantities. Otherwise, this would make the equilibrium indeterminate.

[15] This is because it satisfies the additional property of $\succsim_i$ being antisymmetric, and so the equivalence classes are singletons.

[16] Formally, the function would be order isomorphic. See, for instance, Ok (2007), Section B.2.

To keep notation simple, when we use $r_i$ as an index, we implicitly assume that it is relative to the set $\overline{\Omega}$. Likewise, the index $r_{ji}$ is relative to the set $\overline{\Omega}_j$. In addition, we occasionally omit country subscripts for trade costs when only the order of the firm is relevant. Thus, for instance, we denote the cost index of the last entrant in $i$ by $c^{\tau}_{N_i}$.

Henceforth, we refer to the framework of Section 6.1 and Section 6.2 as a CIC model à la Cournot. Furthermore, given that there is no uncertainty regarding the firms' marginal costs, we do not add any ex-ante qualification to describe the features of firms.

### 6.3 Equilibrium

We consider equilibria where there is at least one domestic and one foreign firm active. Given optimal quantities ($Q_{\mathbb{Q}}$-BF), the total quantity supplied by firms from $j$ to $i$ is given by $\mathbb{Q}_{ji}(\mathbb{Q}_i; \tau_{ji}) := \sum_{\omega \in \Omega_{ji}} q_{ji}\left[p_i^{\max}(\mathbb{Q}_i), c_{\omega}^{\tau_{ji}}\right]$. The equilibrium at the market stage for a given $\Omega_i$ requires that

$$\sum_{j \in \mathcal{C}} \mathbb{Q}_{ji}(\mathbb{Q}_i; \tau_{\cdot i}) = \mathbb{Q}_i, \tag{NE-BF}$$

so that the optimal quantities chosen by each firm are consistent with the aggregate quantities.

Firms serve each country as long as they anticipate positive profits. This implies that, for country $i \in \mathcal{C}$, the following inequalities have to hold:

$$\pi_{ji}\left(p_i^{\max}(\mathbb{Q}_i); c_{\omega}^{\tau_{ji}}\right) \geq 0 \text{ for all } \omega \in \Omega_{ji} \text{ and } j \in \mathcal{C},$$
$$\text{for any } q_{\omega} > 0,\ \pi_{ji}\left[p_i^{\max}(\mathbb{Q}_i + q_{\omega}), q_{\omega}; c_{\omega}^{\tau_{ji}}\right] < 0 \text{ for } \omega \notin \Omega_{ji} \text{ and } j \in \mathcal{C}.$$

Given the entry order, the reindex of variables, and the monotonicity of optimal profits on the index cost, the conditions can be reexpressed as

$$p_i^{\max}(\mathbb{Q}_i) - c^{\tau}_{N_i} \geq \xi_i \tag{FE-BF}$$
$$p_i^{\max}\left(\mathbb{Q}_i + q^{N_i+1}\right) - c^{\tau}_{N_i+1} < \xi_i,$$

where $q^{N_i+1} := q\left[\mathbb{Q}_i, c^{\tau}_{N_i+1}\right]$ is the best response given by ($Q_{BR}$-BF), and $\xi_i := 2\sqrt{\gamma_i f}$.

In the next part, we inquire upon the conditions that activate and deactivate the channels by following a similar approach as in Section 4. Specifically, we focus on a country $H$, which we suppose is small, and compare the equilibrium under two vectors of trade costs, $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$. Also, we continue to denote their equilibrium values with superscripts $*$ and $**$, respectively. To keep notation simple, we also refer to the last entrant of each equilibrium by $N_H^*$ and $N_H^{**}$, with corresponding profits $\overline{\pi}_H^*$ and $\overline{\pi}_H^{**}$.

## 6.4 Channels

The next proposition analyzes the effects coming from the IC channel when MIEs are homogeneous. Formally, this corresponds to the case where $c_{N_H^*}^{\tau^*} = c_{N_H^{**}}^{\tau^{**}}$, so that the last entrants have the same marginal cost.

**Proposition 6.1**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Suppose a CIC model à la Cournot and let $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ be such $\tau_{jH}^{**} \leq \tau_{jH}^*$ with strict inequality for at least one country. If the last entrants in $H$ are homogeneous, then:*

- *if $\overline{\pi}_H^{**} < \overline{\pi}_H^*$, then*
  - $p_H^{\max **} < p_H^{\max *}$,
  - *for firms that are active in both equilibria, $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$ and $\mu_{HH}^{**}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}_{.H}^*$, and*
  - *the set of domestic firms is either the same or some of them exit;*
- *if $\overline{\pi}_H^{**} = \overline{\pi}_H^*$, then*
  - $p_H^{\max **} = p_H^{\max *}$,
  - *for domestic firms that are active in both equilibria, $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$ and $\mu_{HH}^{**}(c)$ do not vary relative to the equilibrium with $\boldsymbol{\tau}^*$, and*
  - *some of the domestic firms exit.*

Before interpreting the results, we present the case of heterogeneous MIEs, i.e., when $c_{N_H^*}^{\tau^*} \neq c_{N_H^{**}}^{\tau^{**}}$.

**Proposition 6.2**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Suppose a CIC model à la Cournot and let $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ be such $\tau_{jH}^{**} \leq \tau_{jH}^*$ with strict inequality for at least one country. If last entrants in $H$ are heterogeneous and $\overline{\pi}_H^{**} \leq \overline{\pi}_H^*$:*

- $p_H^{\max **} < p_H^{\max *}$,
- *for firms that are active in both equilibria, $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$ and $\mu_{HH}^{**}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}^*$, and*
- *the set of domestic firms is either the same or some domestic firms exit.*

By Proposition 6.1 and Proposition 6.2, we are able to conclude that the MIEs profits channel is shut when $\overline{\pi}_H^* = \overline{\pi}_H^{**}$, and is active and generates pro-competitive effects when $\overline{\pi}_H^* < \overline{\pi}_H^{**}$. In addition, by focusing on the case where $\overline{\pi}_H^* = \overline{\pi}_H^{**}$, the MIEs profits channel is not operating and, thus, we can make a comparison with the case of monopolistic competition.

From this, we establish that the same condition for the deactivation and activation of the IC channel holds, i.e., whether MIEs are homogeneous or heterogeneous.

Two remarks are in order regarding the MIEs profits channel. First, when $\overline{\pi}_H^* > \overline{\pi}_H^{**}$ and MIEs are homogeneous, even though there are pro-competitive effects, they are bounded by the profits of the last entrant: in any equilibrium, the choke price cannot be lower than the level that makes the last entrant earn exactly zero profits. Second, the MIEs profits channel is capable of leading to anti-competitive effects. This occurs when the effect from the exit of firms has a greater impact on the market conditions than the pro-competitive effects from lower trade costs.

Next, we consider how the EOs channel affects the domestic economy. Since we want to concentrate on the role of new EOs for domestic MIEs, we state the result supposing that the least-profitable firms in each equilibrium are domestic. In addition, we restore the assumption $F_H^E > 0$.

**Proposition 6.3**

*Consider a world economy with an arbitrary number of countries where $H$ is a small economy. Suppose a CIC model à la Cournot and let $\boldsymbol{\tau}^*$ and $\boldsymbol{\tau}^{**}$ be such that $\tau_{HF}^{**} < \tau_{HF}^*$ for some country $F \in \mathcal{C} \setminus \{H\}$. If in $H$ the least profitable firms are domestic and the last entrant serves both $H$ and $F$, then:*

- *if there are extensive-margin adjustments of domestic firms and $\overline{\pi}_H^{**} \leq \overline{\pi}_H^*$, then*
  - $p_H^{\max **} < p_H^{\max *}$,
  - *for firms that are active in both equilibria, $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$, and $\mu_{HH}^{**}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}^*$, and*
  - *some inactive firms from $H$ become active;*
- *if there are no extensive-margin adjustments of domestic firms, then there are no changes in the $H$.*

In the proposition, the impact on the choke price is exclusively due to the EOs channel when $\overline{\pi}_H^{**} = \overline{\pi}_H^*$. Thus, it establishes that, when the MIEs profits channel is inactive and the trade shock induces changes in the extensive margin, the activation of the EOs channel requires that MIEs are ex-ante exporters. As a corollary, if there is a variation in the set of active firms, the EOs channel is activated in the same fashion as in monopolistic competition.

# 7 Applications to Oligopoly

In this section, we apply the results of the CIC model under oligopolistic competition. Using the results from Section 6.4, we consider two applications. The first explores the consequences of assuming away the integer constraint, while the second considers restricted entry. The results are of particular relevance since they explain the outcomes of the studies in Figure 1b.

**Assuming Away the Integer Constraint**. Formally, this means that $N_H \in \mathbb{R}_{++}$ and implies that, after any shock, the value of $N_H$ adjusts to ensure that $\overline{\pi}^{**}_H = \overline{\pi}^{*}_{H}$. Thus, the MIEs profits channel is inactive and there are always extensive-margin adjustments.[17] As a corollary, all the conclusions holding under monopolistic competition, including those of trade liberalizations with two large economies, apply. Specifically, the homogeneity of MIEs shuts the IC channel while heterogeneity reactivates it. Furthermore, by applying Proposition 6.3 under the existence of extensive-margin adjustments, the activation of the EOs channel depends on whether MIEs are exporters.

**Restricted Entry**. In Appendix A.4 we show that, when there are no extensive-margin adjustments of domestic firms and the last entrant under $\boldsymbol{\tau}^*$ is domestic, decreases in inward trade barriers in $H$ determine that $\overline{\pi}^{**}_H < \overline{\pi}^{*}_{H}$.[18] Thus, from Propositions 6.1–6.2, we conclude that this trade shock induces pro-competitive effects in $H$. In addition, by Proposition 6.3, we can also establish that, with restricted entry, a reduction in outward trade barriers has no impact on the domestic economy. This follows because the activation of the EOs channel presumes the existence of extensive-margin adjustments of domestic firms, which is ruled out by definition under restricted entry.

# 8 Conclusion

This paper conciliates the disparate outcomes found in studies of trade liberalizations under imperfect competition. With this aim, we developed a framework that we referred to as the

[17]To understand why there are always extensive-margin adjustments, $N_H$ can be defined formally as $\widetilde{N}_H + \delta$, where $\widetilde{N}_H \in \mathbb{N}$ is the integer part of $N_H$ and $\delta \in \mathbb{R}_{++}$. The term $1 + \delta$ can be interpreted as the measure of the last entrant. After any trade shock and given the value $\widetilde{N}_H$ of the new equilibrium, assuming the integer number of firms away means that $\delta$ always adjusts to ensure that the mass of the last entrant is consistent with zero profits.

[18]Additionally, in Appendix A.4, we prove a more general result which indicates that $p^{\max **}_H < p^{\max *}_H$ even if the last entrant under $\boldsymbol{\tau}^*_{\cdot H}$ is not domestic.

CIC model. This allowed us to encompass the standard versions of monopolistic competition (i.e., Krugman, Melitz, and Chaney) and oligopoly (Cournot under free and restricted entry) in a unified setup. In this way, it made it possible to identify what the major imperfect-competition models have in common and the aspects in which they differ.

Making use of the CIC model, we studied how shocks to inward and outward trade barriers affect domestic market conditions. This involved disentangling the effects of trade shocks into separate channels, and determining which model assumptions activate them. The main conclusion we obtained is that the various outcomes found in the literature are not due to the type of competition but, rather, the assumptions on the features of MIEs. Thus, once the models have the same assumptions regarding MIEs, they generate the same impact on the domestic market in all the models of imperfect competition.

# References


Alfaro, M. (2019). The Microeconomics of New Trade Models. *Mimeo*. 3, 4.1

Atkeson, A. and A. Burstein (2008). Pricing-to-Market, Trade Costs, and International Relative Prices. *American Economic Review 98*(5), 1998–2031. 4

Bagwell, K. and S. H. Lee (2018). Trade Policy under Monopolistic Competition with Firm Selection. *Mimeo*.

Bagwell, K. and R. W. Staiger (2015). Delocation and trade agreements in imperfectly competitive markets. *Research in Economics 69*(2), 132 – 156.

Brander, J. and P. Krugman (1983). A 'Reciprocal Dumping' Model of International Trade. *Journal of International Economics 15*(3), 313–321.

Brander, J. A. (1995). Strategic trade policy. Volume 3 of *Handbook of International Economics*, pp. 1395 – 1455. Elsevier.

Chaney, T. (2008). Distorted Gravity: The Intensive and Extensive Margins of International Trade. *American Economic Review 98*(4), 1707–1721. 1, 5

Chen, N., J. Imbs, and A. Scott (2009). The dynamics of trade and competition. *Journal of International Economics 77*(1), 50–62.

Demidova, S. (2017). Trade policies, firm heterogeneity, and variable markups. *Journal of International Economics 108*, 260 – 273.

Demidova, S. and A. Rodríguez-Clare (2009). Trade policy under firm-level heterogeneity in a small economy. *Journal of International Economics 78*(1), 100 – 112. 4.1

Eaton, J., S. S. Kortum, and S. Sotelo (2012). International Trade: Linking Micro and Macro. Working Paper 17864, National Bureau of Economic Research. 4, 6.2

Edmond, C., V. Midrigan, and D. Y. Xu (2015). Competition, Markups, and the Gains from International Trade. *American Economic Review 105*(10), 3183–3221. 4

Feenstra, R. and H. Ma (2007). Optimal Choice of Product Scope for Multiproduct Firms under Monopolistic Competition. Working Paper 13703, National Bureau of Economic Research. 4

Gaubert, C. and O. Itskhoki (2018). Granular comparative advantage. Technical report, National Bureau of Economic Research. 4, 6.2

Helpman, E. and P. R. Krugman (1989). *Trade Policy and Market Structure*. MIT press. 1, 1

Horstmann, I. J. and J. R. Markusen (1986). Up the average cost curve: Inefficient entry and the new protectionism. *Journal of International Economics 20*(3), 225 – 247.

Krugman, P. R. (1979). Increasing Returns, Monopolistic Competition, and International Trade. *Journal of International Economics 9*(4), 469–479. 1, 5

Markusen, J. R. and A. J. Venables (1988). Trade policy with increasing returns and imperfect competition: Contradictory results from competing assumptions. *Journal of International Economics 24*(3-4), 299–316. 1

Melitz, M. J. (2003). The Impact of Trade on Intra-industry Reallocations and Aggregate Industry Productivity. *Econometrica 71*(6), 1695–1725. 1, 5

Melitz, M. J. and G. I. P. Ottaviano (2008). Market Size, Trade, and Productivity. *The Review of Economic Studies 75*(1), 295–316. 1, 1, 12, 8, B.1.2, F

Ok, E. A. (2007). *Real Analysis with Economic Applications*, Volume 10. Princeton University Press. 16

Spearot, A. (2014). Tariffs, Competition, and the Long of Firm Heterogeneity Models. *Mimeo*.

Venables, A. (1985). Trade and trade policy with imperfect competition: The case of identical products and free entry. *Journal of International Economics 19*(1-2), 1–19.

Venables, A. (1987). Trade and trade policy with differentiated products: A chamberlinian-ricardian model. *Economic Journal 97*(387), 700–717.

# Appendices—For Online Publication

The structure of the appendices is as follows. In Appendix A we include derivations for some of the expressions in the main part of the paper and the proofs of the propositions. The remaining appendices include additional results. Appendix B considers how trade liberalizations affect the behavior of foreign firms. In Appendix C, we study the magnitude of the effects coming through the IC channel when it is active. Appendix D shows how the equilibrium can be computed and presents some numerical exercises. In Appendix E, we outline some conditions for existence and uniqueness of the equilibrium. Finally, in Appendix F we illustrate how the decomposition of effects into channels can be applied in a setup as in Melitz and Ottaviano (2008), with symmetric countries and a Pareto distribution.

## A Derivations and Proofs

### A.1 Monopolistic Competition

The framework for the CIC model under monopolistic competition is that of Section 3.3. For some of the proofs, it is necessary to distinguish between the degenerate and group-specific CIC variants since they have a different description of the productivity distribution of $\mathcal{E}$ at the group level.

Regarding notation, we keep indicating the equilibrium values of any variable under $\boldsymbol{\tau}^*$ or $\boldsymbol{\tau}^{**}$ by a superscript $*$ and $**$, respectively. When we refer to some generic equilibrium with trade costs $\boldsymbol{\tau}$, we use $*$ as superscript. Furthermore, regarding trade costs, we extend the notation by defining $\boldsymbol{\tau}_{\cdot H} := (\tau_{jH})_{j\in\mathcal{C}\setminus\{H\}}$ and $\boldsymbol{\tau}^{**}_{H\cdot} := (\tau_{Hj})_{j\in\mathcal{C}\setminus\{H\}}$.

For each firm from country $i$ belonging to group $\theta$, we define its minimum marginal cost to serve $j$ by $c_{ij}^{\theta*} := \min\left\{c_{ij}^*, \overline{c}_i^\theta\right\}$. This variable captures that $c_{ij}^{\theta*} = \overline{c}_i^\theta$ when all the firms belonging to $\theta$ are active in $j$. To simplify notation, for group $\theta$ and equilibrium $*$ we define $G_{ij}^{\theta*} := G_i^\theta\left(c_{ij}^{\theta*}\right)$ and $g_{ij}^{\theta*} := g_i^\theta\left(c_{ij}^{\theta*}\right)$. Moreover, $\mathbb{C}_{ij}^{\tau,\theta*} := \int_{\underline{c}_i^\theta}^{c_{ij}^{\theta*}} c_{ij}^\tau \,\mathrm{d}G_i^\theta(c)$ and, when we refer to a domestic firm from $i$, we omit the superscript $\tau$ and refer to it as $\mathbb{C}_{ii}^{\theta*}$. In addition, when it is clear from the context, if all firms from $i$ belonging to a group $\theta$ are active in $j$, we simply use the notation $\mathbb{C}_{ij}^\theta$ to emphasize that $c_{ij}^{\theta*} = \overline{c}_i^\theta$. Finally, we occasionally omit the dependence of functions in some of the arguments.

The next lemma characterizes the productivity distribution of active MIEs.

**Lemma A.1.** *Given a mass of incumbents $M_i^\theta$ and $i \in \mathcal{C}$, the density of active firms belonging to $\theta$ with marginal costs $c$ is $M_i^\theta g_i^\theta(c)$ in the group-specific CIC model, and $\overline{M}_i^\theta g_i^\theta(c)$ in the degenerate CIC model.*

**Proof of Lemma A.1.** For both variants of the CIC model, the density of firms from $i$ belonging to $\theta$ that are active in $j$ and have marginal costs $c$ is $M_{ij}^\theta \frac{g_i^\theta(c)}{G_{ij}^{\theta*}}$. In the case of the group-specific model, we know that $M_{ij}^\theta = M_i^\theta G_{ij}^{\theta*}$ and, so, the result follows. Regarding the degenerate variant, $G_{ij}^\theta$ describes the distribution of the $\overline{M}_i^\theta$ firms. Out of this mass, only a mass $M_{ij}^\theta = \overline{M}_i^\theta G_{ij}^{\theta*}$ is active in $j$ and, so, the result follows. ■

Next, we characterize the marginal-cost cutoff for serving each market. We do it by distinguishing between the set of countries that are served by the least-productive firms that are active in the domestic market.

**Lemma A.2.** *In either the group-specific or degenerate CIC model, suppose that the least-productive firms from $i \in \mathcal{C}$ that are active in at least one country only serve their home market. Then, the cutoff to serve $j \in \mathcal{C}\setminus\{i\}$ is given by*

$$c_{ij}^*\left(p_j^{\max};\tau_{ij}\right) := p_j^{\max} - \tau_{ij} - \xi_{ij}, \tag{ZCP}$$

*where $\xi_{ij} := 2\sqrt{\gamma_j f_{ij}}$. For the group-specific CIC model, the same condition applies for $j = i$. For the degenerate CIC model, the condition for $j = i$ is also (ZCP) but with $\xi_{ii} := 2\sqrt{\gamma_i\left(f_{ii} + F_i^E\right)}$. In addition, if for the degenerate CIC model the least-productive firms from $i$ have non-negative optimal profits in its* *domestic country and a set $\mathcal{F}$ of foreign countries, then $c_{ij}^*$ for $j \in \{i\} \cup \mathcal{F}$ is given by some $c_{ii}^*$ that satisfies*

$$\frac{\left(p_i^{\max *} - c_{ii}^*\right)^2}{4\gamma_i} + \sum_{f \in \mathcal{F}} \frac{\left(p_f^{\max *} - c_{ii}^* - \tau_{if}^*\right)^2}{4\gamma_f} = F_i^E + f_{ii} + \sum_{f \in \mathcal{F}} f_{if}. \tag{ZCP2}$$

**Proof of Lemma A.2**. Given optimal profits (PROF), the value $c_{ij}^*$ which is consistent with zero profits satisfies $\frac{\left[p_j^{\max} - \left(c_{ij}^* + \tau_{ij}\right)\right]^2}{4\gamma_j} = f_{ij}$. Working out the expression, we obtain (ZCP). For the case of a group-specific CIC model, only a strict subset of firms that pay the entry cost become active in at least one market and they exclusively serve their domestic market. Hence, (ZCP) also applies to $i = j$. Whereas, in a degenerate CIC model, we know that firms become active in the industry as long as they have nonnegative expected profits. Regarding the case where the least-productive firms only serve their home market, since $D_i^\omega$ is degenerate, $c_{ii}^*$ is the value that satisfies

$$\frac{\left(p_i^{\max} - c_{ii}^*\right)^2}{4\gamma_i} - f_{ii} = F_i^E,$$

which determines a function as in (ZCP) but with $\xi_{ii} := 2\sqrt{\gamma_i \left(f_{ii} + F_i^E\right)}$. Regarding the case of a degenerate CIC model where the least-productive firms from $i$ are serving $i$ and a set of foreign countries $\mathcal{F}$, (ZCP2) is obtained since $c_{ii}^*$ is derived from the zero-profits condition. ■

Next, we characterize the equilibrium condition at the market stage, i.e., for a given set of firms that paid the entry cost.

**Lemma A.3.** *In either the group-specific or degenerate CIC model, the equilibrium at the market stage in $j \in \mathcal{C}$ is given by a $p_j^{\max *}$ which satisfies*

$$\sum_{i \in \mathcal{C}} \Phi_{ij}\left(p_j^{\max *}; \tau_{ij}\right) + 2\beta_j p_j^{\max *} = 2\beta_j \alpha_j. \tag{MS}$$

*Moreover, if in country $i$ the least-productive firms serving $j$ belong to $\mathcal{E}$, then $\Phi_{ij}\left(p_j^{\max *}; \tau_{ij}\right) := \Phi_{ij}^{\mathcal{I}}\left(p_j^{\max *}; \tau_{ij}\right) + \Phi_{ij}^{\mathcal{E}}\left(p_j^{\max *}; \tau_{ij}\right)$ with $\Phi_{ij}^\theta := M_i^\theta \left(G_{ij}^{\theta *} p_j^{\max *} - \mathbb{C}_{ij}^{\tau, \theta *}\right)$.*

**Proof of Lemma A.3**. The equilibrium at the market stage in $j$ requires that $p_j^{\max *}$ is a fixed point of (CHK). Define $\mathbb{P}_j\left(p_j^{\max}; \boldsymbol{\tau}_{\cdot j}\right) := \sum_{i \in \mathcal{C}} \mathbb{P}_{ij}\left(p_j^{\max}; \tau_{ij}\right)$ and $M_j\left(p_j^{\max}; \boldsymbol{\tau}_{\cdot j}\right) := \sum_{i \in \mathcal{C}} M_{ij}\left(p_j^{\max}; \tau_{ij}\right)$. Thus, the equilibrium condition in $j$ is given by a value $p_j^{\max *}$ such that

$$p_j^{\max *} = \frac{\alpha_j \beta_j + \mathbb{P}_j\left(p_j^{\max *}; \boldsymbol{\tau}_{\cdot j}\right)}{\beta_j + M_j\left(p_j^{\max *}; \boldsymbol{\tau}_{\cdot j}\right)}.$$

Working out the expression, this becomes

$$p_j^{\max *} \sum_{i \in \mathcal{C}} M_{ij}\left(p_j^{\max *}; \tau_{ij}\right) - \sum_{i \in \mathcal{C}} \mathbb{P}_{ij}\left(p_j^{\max *}; \tau_{ij}\right) + p_j^{\max *} \beta_j = \alpha_j \beta_j,$$

and, so, by defining

$$\frac{\Phi_{ij}\left(p_j^{\max *}; \tau_{ij}\right)}{2} := p_j^{\max *} M_{ij}\left(p_j^{\max *}; \tau_{ij}\right) - \mathbb{P}_{ij}\left(p_j^{\max *}; \tau_{ij}\right), \tag{5}$$

(MS) is obtained.

Now, consider the group-specific CIC model. Suppose that in $i$ the least-productive firms that serve $j$

belong to $\mathcal{E}$. For given $M_i^{\mathcal{I}}$ and $M_i^{\mathcal{E}}$, then,

$$\begin{aligned}\mathbb{P}_{ij}\left(p_j^{\max};\tau_{ij}\right) :=& M_i^{\mathcal{I}}\int_{\underline{c}_i^{\mathcal{I}}}^{\overline{c}_i^{\mathcal{I}}} p_{ij}\left(p_j^{\max};c,\tau_{ij}\right)\mathrm{d}G_i^{\mathcal{I}}(c) + M_i^{\mathcal{E}}\int_{\underline{c}_i^{\mathcal{E}}}^{c_{ij}^{*}} p_{ij}\left(p_j^{\max};c,\tau_{ij}\right)\mathrm{d}G_i^{\mathcal{E}}(c),\\ M_{ij}\left(p_j^{\max};\tau_{ij}\right) :=& M_i^{\mathcal{I}} + M_i^{\mathcal{E}}G_{ij}^{\mathcal{E}*}.\end{aligned}$$

Using these definitions, optimal prices (PRICE), and the characterization of active firms, we can express $\Phi_{ij}=\Phi_{ij}^{\mathcal{I}}+\Phi_{ij}^{\mathcal{E}}$ as

$$\Phi_{ij}^{\theta}\left(p_j^{\max *};\tau_{ij}\right) := M_i^{\theta}\left(G_{ij}^{\theta *}p_j^{\max *} - \mathbb{C}_{ij}^{\tau,\theta *}\right). \tag{6}$$

As for the degenerate CIC model, the same expression (5) holds. Moreover, (6) is satisfied by substituting $M_i^{\theta}$ by $\overline{M}_i^{\theta}$. ■

**Lemma A.4.** *$p_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$, $q_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$, $c_{ij}^{*}$ given by either (ZCP) or (ZCP2), $m_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$, and $\mu_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$ are increasing in $p_j^{\max}$.*

**Proof of Lemma A.4**. Taking derivatives of each function: $\frac{\partial p_{ij}(\cdot)}{\partial p_j^{\max}}=\frac{1}{2}$, $\frac{\partial q_{ij}(\cdot)}{\partial p_j^{\max}}=\frac{1}{2\gamma_j}$, $\frac{\partial m_{ij}(\cdot)}{\partial p_j^{\max}}=\frac{1}{2c_{ij}^{\tau}}$, and $\frac{\partial \mu_{ij}(\cdot)}{\partial p_j^{\max}}=\frac{1}{2}$. If $c_{ij}^{*}$ is given by (ZCP) then $\frac{\partial c_{ij}^{*}}{\partial p_j^{\max}}=1$. In case $c_{ij}^{*}$ is given by (ZCP2), then $\frac{\partial c_{ij}^{*}}{\partial p_j^{\max *}}=\left(\frac{p_j^{\max *}-c_{ii}^{*}-\tau_{ij}}{2\gamma_j}\right)\left(\frac{p_i^{\max *}-c_{ii}^{*}}{\gamma_i}+\sum_{f\in\mathcal{F}}\frac{p_f^{\max *}-c_{ii}^{*}-\tau_{if}}{2\gamma_f}\right)^{-1}>0$. ■

**Lemma A.5.** *$p_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$ is increasing in $\tau_{ij}$, and $q_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$, $c_{ij}^{*}$ given by either (ZCP) or (ZCP2), $m_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$, and $\mu_{ij}\left(p_j^{\max};c_{ij}^{\tau}\right)$ are decreasing in $\tau_{ij}$.*

**Proof of Lemma A.5**. Taking derivatives of each function: $\frac{\partial p_{ij}(\cdot)}{\partial \tau_{ij}}=\frac{1}{2}$, $\frac{\partial q_{ij}(\cdot)}{\partial \tau_{ij}}=-\frac{1}{2\gamma_j}$, $\frac{\partial m_{ij}(\cdot)}{\partial \tau_{ij}}=-\frac{p_j^{\max}}{2\left(c_{ij}^{\tau}\right)^2}$, and $\frac{\partial \mu_{ij}(\cdot)}{\partial \tau_{ij}}=-\frac{1}{2}$. In addition, if $c_{ij}^{*}$ is given by (ZCP) then $\frac{\partial c_{ij}^{*}}{\partial \tau_{ij}}=-1$. If $c_{ij}^{*}$ is given by (ZCP2), then $\frac{\partial c_{ij}^{*}}{\partial \tau_{ij}}=-\left(\frac{p_j^{\max *}-c_{ii}^{*}-\tau_{ij}}{2\gamma_j}\right)\left(\frac{p_i^{\max *}-c_{ii}^{*}}{\gamma_i}+\sum_{f\in\mathcal{F}}\frac{p_f^{\max *}-c_{ii}^{*}-\tau_{if}}{2\gamma_f}\right)^{-1}<0$. ■

**Lemma A.6.** *Suppose that the least-productive firms from $i$ that are active in $j$ belong to $\mathcal{E}$. Then, at the market stage of either the group-specific or degenerate CIC model, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}}>0$ and $\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}<0$ for $\theta\in\{\mathcal{E},\mathcal{I}\}$. In addition, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}}=-\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}$.*

**Proof of Lemma A.6**. At the market stage, $M_i^{\mathcal{I}}$ and $M_i^{\mathcal{E}}$ are given. We begin by establishing some additional calculations regarding $\mathbb{C}_{ij}^{\tau,\theta *}$. If $c_{ij}^{\theta *}=\overline{c}_i^{\theta}$, then all firms in $\theta$ are active and, so, $\frac{\partial \mathbb{C}_{ij}^{\tau,\theta *}}{\partial p_j^{\max *}}=0$ and $\frac{\partial \mathbb{C}_{ij}^{\tau,\theta *}}{\partial \tau_{ij}}=1$. If $c_{ij}^{\theta *}=c_{ij}^{*}$, then $\frac{\partial \mathbb{C}_{ij}^{\tau,\theta *}}{\partial p_j^{\max *}}=\left(c_{ij}^{*}+\tau_{ij}\right)g_{ij}^{\theta *}$ and $\frac{\partial \mathbb{C}_{ij}^{\tau,\theta *}}{\partial \tau_{ij}}=-\left(c_{ij}^{*}+\tau_{ij}\right)g_{ij}^{\theta *}+G_{ij}^{\theta *}$.

As for $\Phi_{ij}^{\theta *}$, in the group-specific CIC model, if $c_{ij}^{\theta *}=\overline{c}_i^{\theta}$ then $\Phi_{ij}^{\theta *}:=M_i^{\theta}\left(p_j^{\max *}-\mathbb{C}_{ij}^{\tau,\theta *}\right)$ and, so, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}}=-\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}=M_i^{\theta}$. The same result is obtained for the degenerate CIC model by substituting $M_i^{\theta}$ with $\overline{M}_i^{\theta}$. Consider now $c_{ij}^{\theta *}=c_{ij}^{*}$. For the group-specific CIC model, $\Phi_{ij}^{\theta *}:=M_i^{\theta}\left(G_{ij}^{\theta *}p_j^{\max *}-\mathbb{C}_{ij}^{\tau,\theta *}\right)$. Performing the calculations, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}}=-\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}=M_i^{\theta}\left(G_{ij}^{\theta *}+g_{ij}^{\theta *}\xi_{ij}\right)$. Regarding the degenerate CIC model, the same result holds when (ZCP) is satisfied if $M_i^{\theta}$ is substituted by $\overline{M}_i^{\theta}$. Moreover, when (ZCP2) holds, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}}=\overline{M}_i^{\theta}\left(G_{ij}^{\theta *}+g_{ij}^{\theta *}\frac{\partial c_{ii}^{*}}{\partial p_j^{\max *}}\left(p_j^{\max *}-c_{ii}^{*}-\tau_{ij}\right)\right)>0$ which uses that $\frac{\partial c_{ii}^{*}}{\partial p_j^{\max *}}>0$ by Lemma A.4. Also, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}=\overline{M}_i^{\theta}\left(-G_{ij}^{\theta *}+g_{ij}^{\theta *}\frac{\partial c_{ii}^{*}}{\partial \tau_{ij}}\left(p_j^{\max *}-c_{ii}^{*}-\tau_{ij}\right)\right)<0$ since $\frac{\partial c_{ii}^{*}}{\partial \tau_{ij}}<0$ by Lemma A.5. By the same lemmas, it also follows that $\frac{\partial c_{ii}^{*}}{\partial p_j^{\max *}}=-\frac{\partial c_{ii}^{*}}{\partial \tau_{ij}}$, which implies that $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}}=-\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}$. ■

Lemma A.6 implies that the same signs for the effects of $p_j^{\max *}$ and $\tau_{ij}$ on $\Phi_{ij}^{\theta *}$ hold irrespective of the variant of the CIC model considered. This explains why, in the main part of the paper, we focused on country $H$ without describing the market structure for the rest of the countries. Specifically, by defining, $\Phi_{-H}\left(p_H^{\max};\boldsymbol{\tau}_{\cdot H}\right):=\sum_{j\in\mathcal{C}\setminus\{H\}}\Phi_{jH}\left(p_H^{\max};\tau_{jH}\right)$, all the propositions can be proved by using that $\frac{\partial \Phi_{-H}^{*}}{\partial p_H^{\max *}}>0$ and $\frac{\partial \Phi_{-H}^{*}}{\partial \tau_{iH}}<0$. We make use of this result for the derivations of the propositions in the main part of the paper. In Appendix B.1, we extend the results by considering the behavior of foreign firms.

Before proving the propositions concerning the IC channel, we establish some bounds for $\boldsymbol{\tau}^{**}_{\cdot H}$ such that, when the MIEs belong to $\mathcal{E}$ before the trade shock, they also belong to $\mathcal{E}$ after the trade shock.

**Lemma A.7.** *Suppose trade costs $\boldsymbol{\tau}^{*}_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ such that $\tau^{**}_{jH} \leq \tau^{*}_{jH}$ with strict inequality for at least one country. Consider that the MIEs belong to $\mathcal{E}$ when trade costs are $\boldsymbol{\tau}^{*}_{\cdot H}$. If, in the group-specific CIC model,*

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H p^{\max *}_{H} < 2\beta_H \alpha_H \tag{7}$$

*holds and, in the degenerate CIC model,*

$$\overline{M}^{\mathcal{I}}_{H}\left(\underline{c}^{\mathcal{E}}_{H} + \xi_{HH} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \Phi_{-H}\left(\underline{c}^{\mathcal{E}}_{H} + \xi_{HH}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H\left(\underline{c}^{\mathcal{E}}_{H} + \xi_{HH}\right) < 2\beta_H \alpha_H \tag{8}$$

*holds, then the MIEs in the equilibrium with $\boldsymbol{\tau}^{**}_{\cdot H}$ belong to $\mathcal{E}$.*

**Proof of Lemma A.7**. Consider the group-specific CIC model. Condition (MS) in $H$ for trade costs $\boldsymbol{\tau}^{*}_{\cdot H}$ can be expressed as:

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + M^{\mathcal{E}*}_{H}\left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{*}_{\cdot H}\right) + 2\beta_H p^{\max *}_{H} = 2\beta_H \alpha_H. \tag{9}$$

We also know that $\frac{\partial \Phi^{*}_{-H}}{\partial \tau_{iH}} < 0$ for $i \in \mathcal{C} \setminus \{H\}$ by Lemma A.6 and, so,

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + M^{\mathcal{E}*}_{H}\left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H p^{\max *}_{H} > 2\beta_H \alpha_H. \tag{10}$$

Next, we prove that $c^{**}_{HH} \in \left[\underline{c}^{\mathcal{E}}_{H}, \overline{c}^{\mathcal{E}}_{H}\right]$. We do this by showing that both $c^{**}_{HH} > \overline{c}^{\mathcal{E}}_{H}$ and $c^{**}_{HH} < \underline{c}^{\mathcal{E}}_{H}$ lead us to a contradiction.

Suppose that $c^{**}_{HH} > \overline{c}^{\mathcal{E}}_{H}$. Condition (MS) in $H$ with trade costs $\boldsymbol{\tau}^{**}_{\cdot H}$ becomes

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max **}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \overline{M}^{\mathcal{E}}_{H}\left(p^{\max **}_{H} - \mathbb{C}^{\mathcal{E}**}_{HH}\right) + \Phi^{\mathcal{N}}_{HH} + \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H p^{\max **}_{H} = 2\beta_H \alpha_H, \tag{11}$$

where $\Phi^{\mathcal{N}}_{HH} > 0$ is the additional term of $\Phi_{HH}$ corresponding to firms in group $\mathcal{N}$ that become active. Since the least-productive firms that are active in some country are exclusively serving its domestic market, then (ZCP) holds. Therefore, $c^{*}_{HH} = p^{\max *}_{H} - \xi_{HH}$ and $c^{**}_{HH} = p^{\max **}_{H} - \xi_{HH}$. Since $c^{**}_{HH} > \overline{c}^{\mathcal{E}}_{H}$ and $c^{*}_{HH} \in \left[\underline{c}^{\mathcal{E}}_{H}, \overline{c}^{\mathcal{E}}_{H}\right]$, it follows that $p^{\max **}_{H} > p^{\max *}_{H}$. In addition, $\overline{M}^{\mathcal{E}}_{H} \geq M^{\mathcal{E}*}_{H}$ by definition, and $\frac{\partial \Phi^{*}_{-H}}{\partial p^{\max *}_{H}} > 0$ and $\frac{\partial \Phi^{*}_{-H}}{\partial \tau_{jH}} < 0$ by Lemma A.6. Thus, the left-hand side (LHS) of (11) is greater than the LHS of (9). This implies that (11) cannot hold with an equality, which is a contradiction.

Towards a contradiction, now suppose that $c^{**}_{HH} < \underline{c}^{\mathcal{E}}_{H}$. In the equilibrium with trade costs $\boldsymbol{\tau}^{**}_{\cdot H}$, given that $c^{**}_{HH} < \underline{c}^{\mathcal{E}}_{H}$, (MS) becomes:

$$M^{\mathcal{I}**}_{H}\left(G^{\mathcal{I}**}_{HH} p^{\max **}_{H} - \mathbb{C}^{\mathcal{I}**}_{HH}\right) + \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H p^{\max **}_{H} = 2\beta_H \alpha_H,$$

and, so, combining this expression with (7),

$$\begin{aligned} \overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H p^{\max *}_{H} < \\ M^{\mathcal{I}**}_{H}\left(G^{\mathcal{I}**}_{HH} p^{\max **}_{H} - \mathbb{C}^{\mathcal{I}**}_{HH}\right) + \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_H p^{\max **}_{H}. \end{aligned} \tag{12}$$

Given $c^{**}_{HH} < \underline{c}^{\mathcal{E}}_{H}$ and $c^{**}_{HH} = p^{\max **}_{H} - \xi_{HH}$, then $p^{\max **}_{H} < \underline{c}^{\mathcal{E}}_{H} + \xi_{HH}$. Since MIEs belong to $\mathcal{E}$ when trade costs are $\boldsymbol{\tau}^{*}_{\cdot H}$, then $\underline{c}^{\mathcal{E}}_{H} + \xi_{HH} < p^{\max *}_{H}$ which implies that $p^{\max **}_{H} < p^{\max *}_{H}$. Also, by Lemma A.6, $\frac{\partial \Phi^{*}_{-H}}{\partial p^{\max *}_{H}} > 0$ and $\left(G^{\theta *}_{HH} p^{\max *}_{H} - \mathbb{C}^{\theta *}_{HH}\right)$ is increasing in $p^{\max *}_{H}$. Therefore, the LHS of (12) is greater than its right-hand side (RHS), which is a contradiction.

Consider now the degenerate CIC model. Condition (MS) with trade costs $\boldsymbol{\tau}^{*}_{\cdot H}$ is

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \overline{M}^{\mathcal{E}}_{H}\left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{*}_{\cdot H}\right) + 2\beta_H p^{\max *}_{H} = 2\beta_H \alpha_H,$$

and, since $\frac{\partial \Phi^{*}_{-H}}{\partial \tau_{iH}} < 0$ by Lemma A.6, then

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \overline{M}^{\mathcal{E}}_{H}\left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_{H} p^{\max *}_{H} > 2\beta_{H}\alpha_{H}. \tag{13}$$

The LHS of (13) is continuous and decreasing in $p^{\max *}_{H}$. Thus, combining (13) and (8), there exists a $p^{\max **}_{H} \in \left(\underline{c}^{\mathcal{E}}_{H} + \xi_{HH}, p^{\max *}_{H}\right)$ such that

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max **}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \overline{M}^{\mathcal{E}}_{H}\left(G^{\mathcal{E}**}_{HH} p^{\max **}_{H} - \mathbb{C}^{\mathcal{E}**}_{HH}\right) + \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) + 2\beta_{H} p^{\max **}_{H} = 2\beta_{H}\alpha_{H},$$

and the result follows. ■

In all the subsequent proofs, we use the fact that, when $H$ is a small economy, any trade shock in $H$ has a negligible impact on the rest of the world. Thus, $\left(p^{\max *}_{j}\right)_{j \in \mathcal{C}\setminus\{H\}}$ can be treated as a parameter.

**Proof of Proposition 4.1**. In terms of the CIC variants considered for monopolistic competition, the ex-ante homogeneity of MIEs only holds for the case of a group-specific CIC model. Thus, consider that framework. Since $H$ is a small economy and $\boldsymbol{\tau}^{*}_{H\cdot} = \boldsymbol{\tau}^{**}_{H\cdot}$, then, by (1), $p^{\max *}_{H} = p^{\max **}_{H}$. Since the choke price does not vary, then, for firms that are active in both equilibria, $p^{**}_{HH}(c)$, $q^{**}_{HH}(c)$, $m^{**}_{HH}(c)$, and $\mu^{**}_{HH}(c)$ have the same value as in the equilibrium with $\boldsymbol{\tau}^{*}_{\cdot H}$.

In addition, (MS) in each equilibrium is, respectively,

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + M^{\mathcal{E}*}_{H}\left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{*}_{\cdot H}\right) = 2\beta_{H}\left(\alpha_{H} - p^{\max *}_{H}\right),$$

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max **}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + M^{\mathcal{E}**}_{H}\left(G^{\mathcal{E}**}_{HH} p^{\max **}_{H} - \mathbb{C}^{\mathcal{E}**}_{HH}\right) + \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) = 2\beta_{H}\left(\alpha_{H} - p^{\max **}_{H}\right).$$

By making use of this system of equations, and since the choke price is the same before and after the trade shock:

$$M^{\mathcal{E}**}_{H} - M^{\mathcal{E}*}_{H} = \frac{\Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{*}_{\cdot H}\right) - \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right)}{G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}},$$

which, by applying Lemma A.6 to the numerator of the RHS, establishes that $M^{\mathcal{E}**}_{H} < M^{\mathcal{E}*}_{H}$. ■

**Proof of Proposition 4.2**. By assumption, the set $\mathcal{E}$ consists of firms that are ex-ante heterogeneous. This rules out the case of a group-specific CIC model. Thus, consider the degenerate CIC model, where the assumption holds. We also know that the MIEs belong to $\mathcal{E}$ for trade costs $\boldsymbol{\tau}^{*}_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ when (8) holds. Thus, (MS) in $H$ under each vector of trade costs is, respectively,

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max *}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \overline{M}^{\mathcal{E}}_{H}\left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right) + \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{*}_{\cdot H}\right) = 2\beta_{H}\left(\alpha_{H} - p^{\max *}_{H}\right),$$

$$\overline{M}^{\mathcal{I}}_{H}\left(p^{\max **}_{H} - \mathbb{C}^{\mathcal{I}}_{HH}\right) + \overline{M}^{\mathcal{E}}_{H}\left(G^{\mathcal{E}**}_{HH} p^{\max **}_{H} - \mathbb{C}^{\mathcal{E}**}_{HH}\right) + \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right) = 2\beta_{H}\left(\alpha_{H} - p^{\max **}_{H}\right).$$

This implies that

$$\underbrace{\left(M^{\mathcal{I}}_{H} + 2\beta_{H}\right)\left(p^{\max **}_{H} - p^{\max *}_{H}\right)}_{=:A_1} + \underbrace{\overline{M}^{\mathcal{E}}_{H}\left[\left(G^{\mathcal{E}**}_{HH} p^{\max **}_{H} - \mathbb{C}^{\mathcal{E}**}_{HH}\right) - \left(G^{\mathcal{E}*}_{HH} p^{\max *}_{H} - \mathbb{C}^{\mathcal{E}*}_{HH}\right)\right]}_{=:A_2} = \Phi_{-H}\left(p^{\max *}_{H}; \boldsymbol{\tau}^{*}_{\cdot H}\right) - \Phi_{-H}\left(p^{\max **}_{H}; \boldsymbol{\tau}^{**}_{\cdot H}\right).$$

Suppose that $p^{\max **}_{H} \geq p^{\max *}_{H}$. Then, $A_1 \geq 0$ and, by Lemma A.6, $A_2 \geq 0$. Therefore, the LHS is non-negative. Moreover, by Lemma A.6, the RHS is negative, which leads to a contradiction. Hence, $p^{\max **}_{H} < p^{\max *}_{H}$.

Since $p^{\max **}_{H} < p^{\max *}_{H}$, then, by Lemma A.4 and for firms that are active in both equilibria, $c^{**}_{HH}$, $p^{**}_{HH}(c)$, $q^{**}_{HH}(c)$, $m^{**}_{HH}(c)$ and $\mu^{**}_{HH}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}^{*}_{\cdot H}$. Moreover, $M^{**}_{HH} < M^{*}_{HH}$ since $c^{**}_{HH} < c^{*}_{HH}$. ■

Next, we establish some lemmas such that the MIEs in the equilibrium with $\tau_{HF}^{**}$ belong to $\mathcal{E}$. Basically, the lemmas show that, by choosing values for $\overline{M}_H^{\mathcal{E}}$ and $\overline{c}_H^{\mathcal{E}}$ that are large enough, this property is ensured.

**Lemma A.8.** *Consider the group-specific CIC model with set of countries $\mathcal{C}$ and let $\tau_{HF}^{*}$ and $\tau_{HF}^{**}$ be such that $\tau_{HF}^{**} < \tau_{HF}^{*}$. Suppose that the MIEs in the equilibrium with $\tau_{HF}^{*}$ belong to $\mathcal{E}$ and serve both $H$ and $F$. Then, it is always possible to choose a value of $\overline{M}_H^{\mathcal{E}}$ large enough such that the MIEs in the equilibrium with $\tau_{HF}^{**}$ belong to $\mathcal{E}$.*

**Proof of Lemma A.8.** Given that MIEs under $\boldsymbol{\tau}_{\cdot H}^{*}$ belong to $\mathcal{E}$, it is satisfied that

$$\int_{\underline{c}_H^{\mathcal{E}}}^{p_H^{\max *}-\xi_{HH}} \left[\frac{\left(p_H^{\max *}-c\right)^2}{4\gamma_H} - f_{HH}\right] \mathrm{d}G_H(c) + \int_{\underline{c}_H^{\mathcal{E}}}^{p_F^{\max *}-\tau_{HF}^{*}-\xi_{HF}} \left[\frac{\left(p_F^{\max *}-c-\tau_{HF}^{*}\right)^2}{4\gamma_F} - f_{HF}\right] \mathrm{d}G_H(c) = F_H^E.$$

Given that expected profits are decreasing in $\tau_{HF}$, then

$$\int_{\underline{c}_H^{\mathcal{E}}}^{p_H^{\max *}-\xi_{HH}} \left[\frac{\left(p_H^{\max *}-c\right)^2}{4\gamma_H} - f_{HH}\right] \mathrm{d}G_H(c) + \int_{\underline{c}_H^{\mathcal{E}}}^{p_F^{\max *}-\tau_{HF}^{**}-\xi_{HF}} \left[\frac{\left(p_F^{\max *}-c-\tau_{HF}^{**}\right)^2}{4\gamma_F} - f_{HF}\right] \mathrm{d}G_H(c) > F_H^E. \quad (14)$$

Moreover, there always exist a $\delta > 0$ such that

$$\int_{\underline{c}_H^{\mathcal{E}}}^{\underline{c}_H^{\mathcal{E}}+\delta} \left[\frac{\left(\underline{c}_H^{\mathcal{E}}+\xi_{HH}-c\right)^2}{4\gamma_H} - f_{HH}\right] \mathrm{d}G_H(c) + \int_{\underline{c}_H^{\mathcal{E}}}^{\underline{c}_H^{\mathcal{E}}+\delta} \left[\frac{\left(p_F^{\max *}-c-\tau_{HF}^{**}\right)^2}{4\gamma_F} - f_{HF}\right] \mathrm{d}G_H(c) < F_H^E. \quad (15)$$

Since expected profits are continuous and increasing in $p_H^{\max}$, by using (14) and (15), we can always find a $p_H^{\max **} \in \left(\underline{c}_H^{\mathcal{E}}, p_H^{\max *}-\xi_{HH}\right)$ such that

$$\int_{\underline{c}_H^{\mathcal{E}}}^{p_H^{\max **}-\xi_{HH}} \left[\frac{\left(p_H^{\max **}-c\right)^2}{4\gamma_H} - f_{HH}\right] \mathrm{d}G_H(c) + \int_{\underline{c}_H^{\mathcal{E}}}^{p_F^{\max *}-\tau_{HF}^{**}-\xi_{HF}} \left[\frac{\left(p_F^{\max *}-c-\tau_{HF}^{**}\right)^2}{4\gamma_F} - f_{HF}\right] \mathrm{d}G_H(c) = F_H^E. \quad (16)$$

Recall that $p_F^{\max *} = p_F^{\max **}$ due to the fact that $H$ is a small economy. If $p_H^{\max **}$ is such that (MS) holds, then the result follows. To show this, given that expected profits are increasing in $p_H^{\max}$, (16) determines that $p_H^{\max **} < p_H^{\max *}$. This establishes that $c_{HH}^{**} < c_{HH}^{*}$. In addition, $\boldsymbol{\tau}_{\cdot H}^{*} = \boldsymbol{\tau}_{\cdot H}^{**}$ and, given trade costs $\boldsymbol{\tau}_{\cdot H}^{*}$, (MS) is

$$\overline{M}_H^{\mathcal{I}}\left(p_H^{\max *}-\mathbb{C}_{HH}^{\mathcal{I}}\right) + M_H^{\mathcal{E}*}\left(G_{HH}^{\mathcal{E}*} p_H^{\max *}-\mathbb{C}_{HH}^{\mathcal{E}*}\right) + \Phi_{-H}\left(p_H^{\max *};\boldsymbol{\tau}_{\cdot H}^{*}\right) + 2\beta_H p_H^{\max *} = 2\beta_H\alpha_H,$$

and this implies that

$$\overline{M}_H^{\mathcal{I}}\left(p_H^{\max **}-\mathbb{C}_{HH}^{\mathcal{I}}\right) + M_H^{\mathcal{E}*}\left(G_{HH}^{\mathcal{E}**} p_H^{\max **}-\mathbb{C}_{HH}^{\mathcal{E}**}\right) + \Phi_{-H}\left(p_H^{\max **};\boldsymbol{\tau}_{\cdot H}^{**}\right) + 2\beta_H p_H^{\max **} < 2\beta_H\alpha_H. \quad (17)$$

Therefore, if $\overline{M}_H^{\mathcal{E}}$ is large enough, we can always find some $M_H^{\mathcal{E}**} \leq \overline{M}_H^{\mathcal{E}}$ such that, by substituting $M_H^{\mathcal{E}*}$ with $M_H^{\mathcal{E}**}$, (17) holds with equality. ■

**Lemma A.9.** *Consider the degenerate CIC model with set of countries $\mathcal{C}$ and let $\tau_{HF}^{*}$ and $\tau_{HF}^{**}$ be such that $\tau_{HF}^{**} < \tau_{HF}^{*}$. Suppose that the MIEs in the equilibrium with $\tau_{HF}^{*}$ belong to $\mathcal{E}$ and serve both $H$ and $F$. Then, it is always possible to choose a value of $\overline{c}_H^{\mathcal{E}}$ large enough such that the MIEs in the equilibrium with $\tau_{HF}^{**}$ belong to $\mathcal{E}$.*

**Proof of Lemma A.9.** The proof requires us to show that $p_H^{\max **} < p_H^{\max *}$ and $c_{HH}^{**} > c_{HH}^{*}$. By proving that, then we know that we can always choose a value of $\overline{c}_H^{\mathcal{E}}$ large enough such that $\overline{c}_H^{\mathcal{E}} > c_{HH}^{**}$ and the result follows.

In equilibrium,

$$\frac{\left(p_H^{\max *}-c_{HH}^{*}\right)^2}{4\gamma_H} + \frac{\left(p_F^{\max *}-c_{HH}^{*}-\tau_{HF}^{*}\right)^2}{4\gamma_F} = F_H^E + f_{HH} + f_{HF},$$

$$\frac{\left(p_H^{\max **}-c_{HH}^{**}\right)^2}{4\gamma_H} + \frac{\left(p_F^{\max **}-c_{HH}^{**}-\tau_{HF}^{**}\right)^2}{4\gamma_F} = F_H^E + f_{HH} + f_{HF}.$$

This implies that

$$\left[\frac{\left(p_H^{\max *}-c_{HH}^*\right)^2}{4\gamma_H}-\frac{\left(p_H^{\max **}-c_{HH}^{**}\right)^2}{4\gamma_H}\right]+\left[\frac{\left(p_F^{\max *}-c_{HH}^*-\tau_{HF}^*\right)^2}{4\gamma_F}-\frac{\left(p_F^{\max **}-c_{HH}^{**}-\tau_{HF}^{**}\right)^2}{4\gamma_F}\right]=0. \quad (18)$$

Towards a contradiction, suppose that $p_H^{\max **} \geq p_H^{\max *}$. We know that $\tau_{HF}^{**} < \tau_{HF}^*$ and $p_F^{\max *} = p_F^{\max **}$. By Lemmas A.4 and A.5, this determines that $c_{HH}^{**} > c_{HH}^*$. Regarding (MS),

$$\Phi_{HH}^{\mathcal{I}*} + \Phi_{HH}^{\mathcal{E}*} + \Phi_{-H}^* + 2\beta_H p_H^{\max *} = 2\beta_H \alpha_H,$$
$$\Phi_{HH}^{\mathcal{I}**} + \Phi_{HH}^{\mathcal{E}**} + \Phi_{HH}^{\mathcal{N}**} + \Phi_{-H}^{**} + 2\beta_H p_H^{\max **} = 2\beta_H \alpha_H,$$

which determines that

$$\left(\Phi_{HH}^{\mathcal{I}**} - \Phi_{HH}^{\mathcal{I}*}\right) + \left(\Phi_{HH}^{\mathcal{E}**} - \Phi_{HH}^{\mathcal{E}*}\right) + \Phi_{HH}^{\mathcal{N}**} + \left(\Phi_{-H}^{**} - \Phi_{-H}^*\right) + 2\beta_H \left(p_H^{\max **} - p_H^{\max *}\right) = 0. \quad (19)$$

We know that $\boldsymbol{\tau}_{H\cdot}^{**}$ does not directly affect (MS). Moreover, all the terms in the LHS of (19) are nonnegative. Also, since $p_H^{\max **} \geq p_H^{\max *}$ and $c_{HH}^{**} > c_{HH}^*$, at least one term is positive, determining that the LHS is positive. This contradicts (19) and, therefore, $p_H^{\max **} < p_H^{\max *}$.

Now we want to show that $c_{HH}^{**} > c_{HH}^*$. Suppose not, so that $c_{HH}^{**} \leq c_{HH}^*$. Then, in terms of (MS), this implies that

$$\left(\Phi_{HH}^{\mathcal{I}**} - \Phi_{HH}^{\mathcal{I}*}\right) + \left(\Phi_{HH}^{\mathcal{E}**} - \Phi_{HH}^{\mathcal{E}*}\right) + \left(\Phi_{-H}^{**} - \Phi_{-H}^*\right) + 2\beta_H \left(p_H^{\max **} - p_H^{\max *}\right) = 0. \quad (20)$$

Given that $p_H^{\max **} < p_H^{\max *}$, then $\Phi_{HH}^{\mathcal{I}**} < \Phi_{HH}^{\mathcal{I}*}$ and $\Phi_{-H}^{**} < \Phi_{-H}^*$ by Lemma A.6. Thus, (20) can only hold if $\Phi_{HH}^{\mathcal{E}**} > \Phi_{HH}^{\mathcal{E}*}$. But, since $p_H^{\max **} < p_H^{\max *}$ and $c_{HH}^{**} \leq c_{HH}^*$, then $\Phi_{HH}^{\mathcal{E}**} < \Phi_{HH}^{\mathcal{E}*}$, which is a contradiction. Therefore, $c_{HH}^{**} > c_{HH}^*$, and the result follows. ■

**Proof of Proposition 4.3**. We start by considering the group-specific CIC model. Suppose that $\overline{M}_H^{\mathcal{E}}$ is large enough such that, by Lemma A.9, MIEs belong to $\mathcal{E}$ if trade costs are $\tau_{HF}^*$ or $\tau_{HF}^{**}$. This determines that (1) is satisfied and, so,

$$\underbrace{\left[\widetilde{\pi}_{HH}^{\mathcal{E}}\left(p_H^{\max **}\right) - \widetilde{\pi}_{HH}^{\mathcal{E}}\left(p_H^{\max *}\right)\right]}_{=:A_1} + \underbrace{\left[\sum_{j\neq H} \widetilde{\pi}_{Hj}^{\mathcal{E}}\left(p_j^{\max **};\tau_{Hj}^{**}\right) - \sum_{j\neq H} \widetilde{\pi}_{Hj}^{\mathcal{E}}\left(p_j^{\max *};\tau_{Hj}^{*}\right)\right]}_{=:A_2} = 0. \quad (21)$$

By the fact that $H$ is a small economy, $p_j^{\max *} = p_j^{\max **}$ for any $j \in \mathcal{C} \backslash \{H\}$. Moreover, $\widetilde{\pi}_{HF}^{\mathcal{E}}$ is decreasing in $\tau_{HF}$. Thus, since $\tau_{HF}^{**} < \tau_{HF}^*$, then $A_2 > 0$. Moreover, $\widetilde{\pi}_{HH}^{\mathcal{E}}$ is increasing in $p_H^{\max}$, which means that (21) can only hold if $p_H^{\max **} < p_H^{\max *}$ so that $A_1 < 0$. Therefore, by Lemma A.4 and for firms that are active in both equilibria, $c_{HH}^{**}$, $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$ and $\mu_{HH}^{**}(c)$ are lower relative to the equilibrium with $\tau_{HF}^*$. Regarding the mass of incumbents,

$$\overline{M}_H^{\mathcal{I}}\left(p_H^{\max *} - \mathbb{C}_{HH}^{\mathcal{I}}\right) + M_H^{\mathcal{E}*}\left(G_{HH}^{\mathcal{E}*} p_H^{\max *} - \mathbb{C}_{HH}^{\mathcal{E}*}\right) + \Phi_{-H}\left(p_H^{\max *}; \boldsymbol{\tau}_{\cdot H}^*\right) = 2\beta_H\left(\alpha_H - p_H^{\max *}\right),$$

$$\overline{M}_H^{\mathcal{I}}\left(p_H^{\max **} - \mathbb{C}_{HH}^{\mathcal{I}}\right) + M_H^{\mathcal{E}**}\left(G_{HH}^{\mathcal{E}**} p_H^{\max **} - \mathbb{C}_{HH}^{\mathcal{E}**}\right) + \Phi_{-H}\left(p_H^{\max **}; \boldsymbol{\tau}_{\cdot H}^{**}\right) = 2\beta_H\left(\alpha_H - p_H^{\max **}\right).$$

which, combining both expressions, becomes

$$\underbrace{\left(M_H^{\mathcal{I}} + 2\beta_H\right)\left(p_H^{\max **} - p_H^{\max *}\right)}_{=:B_1} + \underbrace{\Phi_{-H}\left(p_H^{\max **}; \tau_{\cdot H}^{**}\right) - \Phi_{-H}\left(p_H^{\max *}; \tau_{\cdot H}^{*}\right)}_{=:B_2} =$$
$$M_H^{\mathcal{E}*}\left(G_{HH}^{\mathcal{E}*} p_H^{\max *} - \mathbb{C}_{HH}^{\mathcal{E}*}\right) - M_H^{\mathcal{E}**}\left(G_{HH}^{\mathcal{E}**} p_H^{\max **} - \mathbb{C}_{HH}^{\mathcal{E}**}\right).$$

Since $p_H^{\max **} < p_H^{\max *}$, $B_1 < 0$. Moreover, by Lemma A.6 and the fact that $\tau_{jH}^* = \tau_{jH}^{**}$ for any $j \in \mathcal{C} \backslash \{H\}$, then $B_2 < 0$. Both facts determine that it is necessary that the RHS is negative. In addition, by Lemma A.6, the term $\left(G_{HH}^{\mathcal{E}*} p_H^{\max *} - \mathbb{C}_{HH}^{\mathcal{E}*}\right)$ is increasing in $p_H^{\max *}$. Thus, reexpressing the RHS,

$$\frac{M_H^{\mathcal{E}**}}{M_H^{\mathcal{E}*}} > \frac{G_{HH}^{\mathcal{E}*} p_H^{\max *} - \mathbb{C}_{HH}^{\mathcal{E}*}}{G_{HH}^{\mathcal{E}**} p_H^{\max **} - \mathbb{C}_{HH}^{\mathcal{E}**}} > 1,$$

which determines that $M_H^{\mathcal{E}**} > M_H^{\mathcal{E}*}$.

As for the degenerate CIC model, by Lemma A.9, we know that if $\overline{c}_H^{\mathcal{E}}$ is large enough, MIEs belong to $\mathcal{E}$ under $\tau_{HF}^*$ and $\tau_{HF}^{**}$. Moreover, in the proof of Lemma A.9 we have already shown that $p_H^{\max *} > p_H^{\max **}$ and $c_{HH}^* < c_{HH}^{**}$. Therefore, by Lemma A.4 and for firms that are active in both equilibria, $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$, and $\mu_{HH}^{**}(c)$ are lower relative to the equilibrium with $\tau_{HF}^*$. Finally, since $c_{HH}^{**} > c_{HH}^*$, then $M_{HH}^{**} > M_{HH}^*$.

Finally, notice that if MIEs do not export, then neither (18) or (21) are affected by $\tau_{HF}$. Moreover, (MS) is not directly affected by $\tau_{HF}$. Thus, in both variants of the CIC model, $p_H^{\max *} = p_H^{\max **}$ and, so, prices, quantities, markups, and the marginal-cost cutoff do not change either. ■

## A.2 Applications To Monopolistic Competition

In this part, we formalize the results outlined in Section 5.2 for a unilateral liberalization between large countries. We consider a world economy with $\mathcal{C} := \{H, F\}$, where $H$ and $F$ are large countries. This implies that the market conditions and behavior of firms from one country will have an influence on the other. We study the effects of a decrease in $\tau_{FH}$ when MIEs belong to $\mathcal{E}$.

Irrespective of the specific equilibrium conditions that identify the choke price, we can always determine reduced-form equations $p_H^{\max}(p_F^{\max}; \tau_{FH})$ and $p_F^{\max}(p_H^{\max}; \tau_{FH})$. Given these equations, the equilibrium is obtained through a pair $(p_H^{\max *}, p_F^{\max *})$ such that

$$\begin{aligned} p_H^{\max *} &= p_H^{\max}\left(p_F^{\max *}; \tau_{FH}\right), \\ p_F^{\max *} &= p_F^{\max}\left(p_H^{\max *}; \tau_{FH}\right). \end{aligned} \tag{22}$$

The system (22) can be used to decompose the effects on each choke price in different channels. Specifically, differentiating (22), we obtain

$$\begin{aligned} \frac{\mathrm{d}p_H^{\max *}}{\mathrm{d}\tau_{FH}} &= \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}} + \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial p_F^{\max}} \frac{\mathrm{d}p_F^{\max *}}{\mathrm{d}\tau_{FH}}, \\ \frac{\mathrm{d}p_F^{\max *}}{\mathrm{d}\tau_{FH}} &= \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}} + \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial p_H^{\max}} \frac{\mathrm{d}p_H^{\max *}}{\mathrm{d}\tau_{FH}}. \end{aligned}$$

Solving for $\frac{\mathrm{d}p_H^{\max *}}{\mathrm{d}\tau_{FH}}$ and $\frac{\mathrm{d}p_F^{\max *}}{\mathrm{d}\tau_{FH}}$, we obtain expressions (3) and (4) from Section 5.2, where

$$\lambda := \left(1 - \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial p_F^{\max}} \frac{\partial p_F^{\max *}\left(p_H^{\max *}, \tau_{FH}\right)}{\partial p_H^{\max}}\right)^{-1}.$$

Next, we determine the signs of each effect according to the different versions of the CIC model. To do this, we characterize the system (22) corresponding to each variant of the CIC model. Then, we establish the sign of the different effects depending on the assumptions on MIEs.

For the group-specific CIC model, condition (1) for two large countries is:

$$\begin{aligned} \widetilde{\pi}_{HH}^{\mathcal{E}}\left(p_H^{\max *}\right) + \mathbb{1}_{\left(c_{HF}^* \in \left(\underline{c}_H^{\mathcal{E}}, \overline{c}_H^{\mathcal{E}}\right)\right)} \widetilde{\pi}_{HF}^{\mathcal{E}}\left(p_F^{\max *}\right) &= F_H^E, \\ \widetilde{\pi}_{FF}^{\mathcal{E}}\left(p_F^{\max *}\right) + \mathbb{1}_{\left(c_{FH}^* \in \left(\underline{c}_F^{\mathcal{E}}, \overline{c}_F^{\mathcal{E}}\right)\right)} \widetilde{\pi}_{FH}^{\mathcal{E}}\left(p_H^{\max *}; \tau_{FH}\right) &= F_F^E. \end{aligned} \tag{23}$$

The indicator functions in (23) reflect whether the MIEs in each country are ex-ante exporters.

As for the degenerate CIC model, there are two possible systems of equations that determine (22). First, if choke prices are determined by (2), then:

$$\pi^{\mathcal{E}}_{HH}\left(p^{\max *}_{H}, c^{*}_{HH}\right) + \mathbb{1}_{\left(c^{*}_{HH}=c^{*}_{HF}\right)}\pi^{\mathcal{E}}_{HF}\left(p^{\max *}_{F}, c^{*}_{FH}\right) = F^{E}_{H},$$
$$\pi^{\mathcal{E}}_{FF}\left(p^{\max *}_{F}, c^{*}_{FF}\right) + \mathbb{1}_{\left(c^{*}_{FF}=c^{*}_{FH}\right)}\pi^{\mathcal{E}}_{FH}\left(p^{\max *}_{H}, c^{*}_{FH}; \tau_{FH}\right) = F^{E}_{F}, \tag{24}$$

where the indicator function reflects whether the MIEs are exporting. Second, suppose that (22) is determined by (MS). In such a case, the following system of equations holds:

$$\Phi_{HH}\left(p^{\max *}_{H}\right) + \Phi_{FH}\left(p^{\max *}_{H}; \tau_{FH}\right) + 2\beta_{H}p^{\max *}_{H} = 2\beta_{H}\alpha_{H},$$
$$\Phi_{FF}\left(p^{\max *}_{F}\right) + \Phi_{HF}\left(p^{\max *}_{F}\right) + 2\beta_{F}p^{\max *}_{F} = 2\beta_{F}\alpha_{F}. \tag{25}$$

We denote the Jacobian matrix of either (23) or (24) by $J^{FE}$. Likewise, let the Jacobian matrix of (25) be $J^{MS}$. Next, we provide a lemma which establishes the sign of each partial effect.

**Lemma A.10.** *Consider that* $\mathrm{d}\tau_{FH} \neq 0$. *Suppose that* (22) *is determined by either* (23) *or* (24). *Then,* $\frac{\partial p^{\max *}_{H}(p^{\max *}_{F})}{\partial \tau_{FH}} = 0$. *Moreover, if firms from* $F$ *belonging to* $\mathcal{E}$ *are ex-ante exporters, then* $\frac{\partial p^{\max *}_{F}}{\partial \tau_{FH}} > 0$ *and* $\frac{\partial p^{\max *}_{F}}{\partial p^{\max *}_{H}} < 0$, *and if they are not ex-ante exporters both terms are zero. If firms from* $H$ *belonging to* $\mathcal{E}$ *are ex-ante exporters then* $\frac{\partial p^{\max *}_{H}}{\partial p^{\max *}_{F}} < 0$, *and if they are not ex-ante exporters the term is zero. Suppose that* (22) *is determined by* (25), *then* $\frac{\partial p^{\max *}_{H}}{\partial \tau_{FH}} > 0$, $\frac{\partial p^{\max *}_{F}}{\partial \tau_{FH}} = 0$, *and* $\frac{\partial p^{\max *}_{H}}{\partial p^{\max *}_{F}} = \frac{\partial p^{\max *}_{F}}{\partial p^{\max *}_{H}} = 0$.

**Proof of Lemma A.10**. Let $i, j \in \{H, F\}$ with $i \neq j$. For the case of a group-specific CIC model, given (24), $\frac{\partial \widetilde{\pi}^{\mathcal{E}}_{ji}(p^{\max *}_{i};\tau_{ji})}{\partial p^{\max *}_{i}} = -\frac{\partial \widetilde{\pi}^{\mathcal{E}}_{ji}(p^{\max *}_{i};\tau_{ji})}{\partial \tau_{ji}} = \frac{p^{\max *}_{i} G^{\mathcal{E}*}_{ji} - \mathbb{C}^{\tau,\mathcal{E}*}_{ji}}{2\gamma_{i}} > 0$, and $\frac{\partial \widetilde{\pi}^{\mathcal{E}}_{ji}(p^{\max *}_{i};\tau_{ji})}{\partial \tau_{ij}} = 0$. For the degenerate CIC model, given (23), then $\frac{\partial \pi^{\mathcal{E}}_{ji}(p^{\max *}_{i}, c^{*}_{ji}; \tau_{ji})}{\partial p^{\max *}_{i}} = -\frac{\partial \pi^{\mathcal{E}}_{ji}(p^{\max *}_{i}, c^{*}_{ji}; \tau_{ji})}{\partial \tau_{ji}} = \frac{p^{\max *}_{i} - c^{*}_{ji} - \tau_{ij}}{2\gamma_{i}} > 0$, and $\frac{\partial \pi^{\mathcal{E}}_{ji}(p^{\max *}_{i}, c^{*}_{ji}; \tau_{ji})}{\partial \tau_{ij}} = 0$. Denote by $\pi_{ij}$ either the expected profits in (23) or the profits in (24). Then,

$$\frac{\partial p^{\max *}_{F}\left(p^{\max *}_{H}, \tau_{FH}\right)}{\partial \tau_{FH}} = -\frac{\partial \pi_{FH}}{\partial \tau_{FH}}\left(\frac{\partial \pi_{FF}}{\partial p^{\max *}_{F}}\right)^{-1} > 0 \text{ and } \frac{\partial p^{\max *}_{H}\left(p^{\max *}_{F}\right)}{\partial \tau_{FH}} = 0,$$
$$\frac{\partial p^{\max *}_{i}}{\partial p^{\max *}_{j}} = \frac{\partial \pi_{ij}}{\partial p^{\max *}_{j}}\left(\frac{\partial \pi_{ii}}{\partial p^{\max *}_{i}}\right)^{-1} > 0.$$

Consider now the case where (22) is determined by (25). Then, $\frac{\partial p^{\max}_{H}}{\partial p^{\max}_{F}} = \frac{\partial p^{\max}_{F}}{\partial p^{\max}_{H}} = 0$ because there is no direct relation between the variables. Moreover, $\frac{\partial p^{\max *}_{F}}{\partial \tau_{FH}} = 0$ because $\tau_{FH}$ does not directly affect $p^{\max *}_{F}$. In addition,

$$\frac{\partial p^{\max *}_{H}}{\partial \tau_{FH}} = -\frac{\partial \Phi^{*}_{FH}}{\partial \tau_{FH}}\left(2\beta_{H} + \frac{\partial \Phi^{*}_{HH}}{\partial p^{\max *}_{H}} + \frac{\partial \Phi^{*}_{FH}}{\partial p^{\max *}_{H}}\right)^{-1} > 0,$$

where the sign follows by using Lemma A.6. ■

**Lemma A.11.** *Consider that* $\mathrm{d}\tau_{FH} \neq 0$. *Suppose that* (22) *is determined by either* (23) *or* (24). *If MIEs in at least one country are not ex-ante exporters, then* $\lambda = 1$. *If MIEs are ex-ante exporters in both countries then* $\lambda > 1$ *iff* $\det J^{FE} > 0$. *If* (22) *is determined by* (25), *then* $\lambda = 1$.

**Proof of Lemma A.11**. Irrespective of how (22) is determined, we can express

$$\lambda = \left(1 - \frac{\partial p^{\max *}_{H}\left(p^{\max *}_{F}\right)}{\partial p^{\max}_{F}}\frac{\partial p^{\max *}_{F}\left(p^{\max *}_{H}, \tau_{FH}\right)}{\partial p^{\max}_{H}}\right)^{-1}.$$

If MIEs in at least one country are not ex-ante exporters, then either $\frac{\partial p^{\max *}_{H}(p^{\max *}_{F})}{\partial p^{\max}_{F}} = 0$ or $\frac{\partial p^{\max *}_{F}(p^{\max *}_{H}, \tau_{FH})}{\partial p^{\max}_{H}} = 0$ (or both) and, so, $\lambda = 1$. In case MIEs are ex-ante exporters in both countries, then

$$\lambda = \frac{\frac{\partial \pi_{HH}}{\partial p_H^{\max}} \frac{\partial \pi_{FF}}{\partial p_F^{\max}}}{\frac{\partial \pi_{HH}}{\partial p_H^{\max}} \frac{\partial \pi_{FF}}{\partial p_F^{\max}} - \frac{\partial \pi_{HF}}{\partial p_F^{\max}} \frac{\partial \pi_{FH}}{\partial p_H^{\max}}},$$

and $\lambda > 1$ iff the denominator is positive. Moreover, $J^{FE}$ is given by

$$J_{FE} := \begin{pmatrix} \frac{\partial \pi_{HH}}{\partial p_H^{\max}} & \frac{\partial \pi_{HF}}{\partial p_F^{\max}} \\ \frac{\partial \pi_{FH}}{\partial p_H^{\max}} & \frac{\partial \pi_{FF}}{\partial p_F^{\max}} \end{pmatrix},$$

and $\det J^{FE} > 0$ iff $\frac{\partial \pi_{HH}}{\partial p_H^{\max}} \frac{\partial \pi_{FF}}{\partial p_F^{\max}} > \frac{\partial \pi_{HF}}{\partial p_F^{\max}} \frac{\partial \pi_{FH}}{\partial p_H^{\max}}$, which holds iff $\lambda = 1$. If (22) is determined by (25), then $\frac{\partial p_F^{\max *}}{\partial \tau_{FH}} = 0$ and, so, $\lambda = 1$. ■

With these lemmas, we can establish the effects on choke prices for the different assumptions on MIEs. Next, we illustrate this by showing how they are determined for each of the cases stated in Section 5.2.

**Anti-Competitive Effects**. If MIEs in both countries are ex-ante homogeneous, then (22) is determined by (23). Moreover, assuming that MIEs are ex-ante exporters in both countries, $\lambda > 1$ iff $\det J^{FE} > 0$ by Lemma A.11. In addition, by using Lemma A.10:

$$\frac{\mathrm{d}p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \lambda \underbrace{\frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{EOs channel}>0} + \lambda \underbrace{\frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial p_H^{\max}} \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}=0},$$

$$\frac{\mathrm{d}p_H^{\max *}\left(p_F^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \lambda \underbrace{\frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{IC channel}=0} + \lambda \underbrace{\frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial p_F^{* \max}} \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}<0}.$$

Notice that, for $F$, the ECs channel is active but, given that $\frac{\partial p_H^{\max *}(p_F^{\max *})}{\partial \tau_{FH}} = 0$, then the ECs are not changing. Thus, the effect of this channel is zero.

**Pro-Competitive Effects**. Since MIEs in $H$ are ex-ante heterogeneous and are not ex-ante exporters, then (22) is determined by (25) and, by Lemma A.11, $\lambda = 1$. Moreover, by Lemma A.10,

$$\frac{\mathrm{d}p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \lambda \underbrace{\frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{EOs channel}=0} + \lambda \underbrace{\frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial p_H^{\max}} \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}=0},$$

$$\frac{\mathrm{d}p_H^{\max *}\left(p_F^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \lambda \underbrace{\frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{IC channel}>0} + \lambda \underbrace{\frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial p_F^{* \max}} \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}=0}.$$

**Null Effects**. Since MIEs in $H$ are ex-ante homogeneous, then (22) is determined by (23). Moreover, since MIEs in both countries are not ex-ante exporters, then, by Lemma A.11, $\lambda = 1$. Also, applying Lemma A.10,

$$\frac{\mathrm{d}p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \lambda \underbrace{\frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{EOs channel}=0} + \lambda \underbrace{\frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial p_H^{\max}} \frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}=0},$$

$$\frac{\mathrm{d}p_H^{\max *}\left(p_F^{\max *}; \tau_{FH}\right)}{\mathrm{d}\tau_{FH}} = \lambda \underbrace{\frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial \tau_{FH}}}_{\text{IC channel}=0} + \lambda \underbrace{\frac{\partial p_H^{\max *}\left(p_F^{\max *}\right)}{\partial p_F^{* \max}} \frac{\partial p_F^{\max *}\left(p_H^{\max *}; \tau_{FH}\right)}{\partial \tau_{FH}}}_{\text{ECs channel}=0}.$$

## A.3 Cournot Competition

For the following proofs, we use $p_H^{\max}$ as shorthand notation for $p_H^{\max}(\mathbb{Q})$.

**Lemma A.12.** *$q_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$, $p_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$, $m_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$, and $\mu_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$ are increasing in $p_j^{\max}$.*

**Proof of Lemma A.12.** Taking derivatives of each function: $\frac{\partial q_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{1}{2\gamma_j+\eta_j} > 0$, $\frac{\partial p_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{\gamma_j+\eta_j}{2\gamma_j+\eta_j} > 0$, $\frac{\partial m_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{\gamma_j+\eta_j}{2\gamma_j+\eta_j}\frac{1}{c_\omega^\tau} > 0$ and $\frac{\partial \mu_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{\gamma_j+\eta_j}{2\gamma_j+\eta_j} > 0$. ■

**Lemma A.13.** *$p_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$ is increasing in $c_\omega^\tau$ and $q_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$, $m_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$, and $\mu_{ij}\left(p_j^{\max}; c_\omega^\tau\right)$ are decreasing in $c_\omega^\tau$.*

**Proof of Lemma A.13.** Taking derivatives of each function: $\frac{\partial p_{ij}(\cdot)}{\partial c_\omega^\tau} = \frac{\gamma_j}{2\gamma_j+\eta_j} > 0$, $\frac{\partial q_{ij}(\cdot)}{\partial c_\omega^\tau} = -\frac{1}{2\gamma_j+\eta_j} < 0$, $\frac{\partial m_{ij}(\cdot)}{\partial c_\omega^\tau} = -\frac{\gamma_j+\eta_j}{2\gamma_j+\eta_j}\frac{p_j^{\max}}{(c_\omega^\tau)^2} < 0$, and $\frac{\partial \mu_{ij}(\cdot)}{\partial c_\omega^\tau} = -\frac{2(\gamma_j+\eta_j)}{2\gamma_j+\eta_j}\left(p_j^{\max} - c_\omega^\tau\right) < 0$. ■

**Lemma A.14.** *$\pi_{ij}\left(p_j^{\max}, c_\omega^\tau\right)$ is decreasing in $\mathbb{Q}_j^{-\omega}$ and $c_\omega^\tau$.*

**Proof of Lemma A.14.** Profits are given by (PROF-BF) and, so, $\frac{\partial \pi_{ij}[\cdot]}{\partial \mathbb{Q}_j^{-\omega}} = 2\frac{(\gamma_j+\eta_j)}{(2\gamma_j+\eta_j)^2}\left(p_j^{\max} - c_\omega^\tau\right)(-\eta_j) < 0$ and $\frac{\partial \pi_{ij}[\cdot]}{\partial c_\omega^\tau} = \frac{\partial \pi_{ij}[\cdot]}{\partial \mathbb{Q}_j^{-\omega}}\frac{1}{\eta_j} < 0$. Then, by the Envelope Theorem, optimal profits are decreasing in $\mathbb{Q}_j^{-\omega}$ and $c_\omega^\tau$. ■

For the subsequent lemmas, we use the following notation. Given trade costs $\boldsymbol{\tau}_{\cdot H}^{*}$ and $\boldsymbol{\tau}_{\cdot H}^{**}$, defined in the same way as in monopolistic competition, we denote the equilibrium values of each variable with superscripts $*$ and $**$, respectively. We still keep using the index $r_i$ when it is relative to the set $\overline{\Omega}$, and $r_{ji}$ when it is relative to $\overline{\Omega}_j$. Also, $c_{r_i}^\tau =: c_{r_{ji}}^\tau := c_{r_i} + \tau_{ji}$, depending on the reference set of the index and when it is clear from the context.

**Lemma A.15.** *Let $\boldsymbol{\tau}'_{\cdot H}$ and $\boldsymbol{\tau}''_{\cdot H}$ be such $\tau''_{jH} \leq \tau'_{jH}$ for each $j \in \mathcal{C}$. If $\left(\mathbb{Q}_j^{-\omega}\right)'' > \left(\mathbb{Q}_j^{-\omega}\right)'$ then $\mathbb{Q}''_j > \mathbb{Q}'_j$, where $\mathbb{Q}_j := \mathbb{Q}_j^{-\omega} + q_{ij}^{BR}\left(\mathbb{Q}_j^{-\omega}, c_\omega^\tau\right)$.*

**Proof of Lemma A.15.** Suppose not, so that $\mathbb{Q}''_j \leq \mathbb{Q}'_j$. Then, by definition, $\mathbb{Q}''_j = \left(\mathbb{Q}_j^{-\omega}\right)'' + q_{ij}^{BR}\left[\left(\mathbb{Q}_j^{-\omega}\right)'', c_\omega^{\tau''}\right]$ and $\mathbb{Q}'_j = \left(\mathbb{Q}_j^{-\omega}\right)' + q_{ij}^{BR}\left[\left(\mathbb{Q}_j^{-\omega}\right)', c_\omega^{\tau'}\right]$. Therefore, $\left(\mathbb{Q}_j^{-\omega}\right)'' + q_{ij}^{BR}\left[\left(\mathbb{Q}_j^{-\omega}\right)'', c_\omega^{\tau''}\right] \leq \left(\mathbb{Q}_j^{-\omega}\right)' + q_{ij}^{BR}\left[\left(\mathbb{Q}_j^{-\omega}\right)', c_\omega^{\tau'}\right]$. Since $q_{ij}^{BR}\left(\mathbb{Q}_j^{-\omega}, c_\omega^\tau\right)$ is given by ($\mathrm{Q}_{BR}$-BF), the inequality holds iff $(2\gamma_j + \eta_j)\left[\left(\mathbb{Q}_j^{-\omega}\right)'' - \left(\mathbb{Q}_j^{-\omega}\right)'\right] + \left[c_\omega^{\tau'} - c_\omega^{\tau''}\right] \leq 0$. Since $c_\omega^{\tau''} \leq c_\omega^{\tau'}$ by the assumption on trade costs, this implies that $\left(\mathbb{Q}_j^{-\omega}\right)'' \leq \left(\mathbb{Q}_j^{-\omega}\right)'$, which is a contradiction.■

**Lemma A.16.** *Let $\boldsymbol{\tau}'_{\cdot H}$ and $\boldsymbol{\tau}''_{\cdot H}$ be such $\tau''_{jH} \leq \tau'_{jH}$ for each $j \in \mathcal{C}$. Given $N''_H$ and $N'_H$ such that $N''_H > N'_H$, condition (NE-BF) only holds if $\mathbb{Q}''_H > \mathbb{Q}'_H$.*

**Proof of Lemma A.16.** By substituting in the optimal quantities given by ($\mathrm{Q}_{\mathbb{Q}}$-BF), condition (NE-BF) for trade costs $\boldsymbol{\tau}''_{\cdot H}$ and $\boldsymbol{\tau}''_{\cdot H}$ are given by, respectively, $\sum_{r_H \leq N'_H}\left(\frac{p_H^{\max}(\mathbb{Q}'_H) - c_{r_H}^{\tau'}}{2\gamma_H+\eta_H}\right) = \mathbb{Q}'_H$ and $\sum_{r_H \leq N''_H}\left[\frac{p_H^{\max}(\mathbb{Q}''_H) - c_{r_H}^{\tau''}}{2\gamma_H+\eta_H}\right] = \mathbb{Q}''_H$. Hence,

$$\sum_{r_H \leq N''_H}\left[\frac{p_H^{\max}\left(\mathbb{Q}''_H\right) - c_{r_H}^{\tau''}}{2\gamma_H + \eta_H}\right] - \sum_{r_H \leq N'_H}\left[\frac{p_H^{\max}\left(\mathbb{Q}'_H\right) - c_{r_H}^{\tau'}}{2\gamma_H + \eta_H}\right] = \mathbb{Q}''_H - \mathbb{Q}'_H,$$

which, given that $N''_H > N'_H$, can be expressed by

$$\underbrace{\sum_{r_H \leq N'_H}\left[\frac{p_H^{\max}\left(\mathbb{Q}''_H\right) - c_{r_H}^{\tau''}}{2\gamma_H + \eta_H}\right] - \sum_{r_H \leq N'_H}\left[\frac{p_H^{\max}\left(\mathbb{Q}'_H\right) - c_{r_H}^{\tau'}}{2\gamma_H + \eta_H}\right]}_{=:A_1} + \underbrace{\sum_{r_H > N'_H}^{N''_H}\left[\frac{p_H^{\max}\left(\mathbb{Q}''_H\right) - c_{r_H}^{\tau''}}{2\gamma_H + \eta_H}\right]}_{=:A_2} = \mathbb{Q}''_H - \mathbb{Q}'_H.$$

Towards a contradiction, suppose that $\mathbb{Q}''_H \leq \mathbb{Q}'_H$. Then, $p_H^{\max}\left(\mathbb{Q}''_H\right) \geq p_H^{\max}\left(\mathbb{Q}'_H\right)$ which, given $\tau''_{jH} \leq \tau'_{jH}$ for each $j \in \mathcal{C}$, implies that $A_1 \geq 0$. Moreover, $A_2$ comprises the optimal quantities of firms that are not active under $\boldsymbol{\tau}'_{\cdot H}$ but are under $\boldsymbol{\tau}''_{\cdot H}$. Thus, since the fixed cost is positive and, hence, the quantities of active firms is strictly positive, $A_2 > 0$. This determines that the LHS is positive. But, since $\mathbb{Q}''_H \leq \mathbb{Q}'_H$, the RHS is nonpositive, which is a contradiction. ■

**Lemma A.17.** *For some given trade costs $\boldsymbol{\tau}_{\cdot H}$, let two firms $r^1$ and $r^2$ with costs indices of serving market*

*$H$ given by $c^{\tau}_{r^1}$ and $c^{\tau}_{r^2}$, respectively, where $c^{\tau}_{r^2} > c^{\tau}_{r^1}$. If the firm with $c^{\tau}_{r^2}$ serves $H$ then the firm with $c^{\tau}_{r^1}$ does so too.*

**Proof of Lemma A.17**. Let $\mathbb{Q}^*_H$ denote the equilibrium aggregate quantity. Towards a contradiction, suppose that the firm with $c^{\tau}_{r^1}$ does not serve $H$. Let $\mathbb{Q}^1_H$ and $\mathbb{Q}^2_H$ be the aggregate quantity that the firms $r^1$ and $r^2$ face respectively when they have to make an entry decision. By the entry order and the fact that by Lemma A.16 $\mathbb{Q}$ is increasing in the number of firms, then $\mathbb{Q}^1_H \leq \mathbb{Q}^2_H$.

We know that $p^{\max}_H\left[\mathbb{Q}^2_H + q^{BR}\left(\mathbb{Q}^2_H; c^{\tau}_{r^2}\right)\right] - c^{\tau}_{r^2} \geq \xi_H$ but $p^{\max}_H\left[\mathbb{Q}^1_H + q^{BR}\left(\mathbb{Q}^1_H; c^{\tau}_{r^1}\right)\right] - c^{\tau}_{r^1} < \xi_H$, where $q^{BR}$ is the best response given by equation ($\mathbb{Q}_{BR}$-BF). Given that $\mathbb{Q}^1_H \leq \mathbb{Q}^2_H$ and $c^{\tau}_{r^2} > c^{\tau}_{r^1}$, and using Lemma A.14, then $p^{\max}_H\left[\mathbb{Q}^1_H + q\left(\mathbb{Q}^1_H; c^{\tau}_{r^1}\right)\right] - c^{\tau}_{r^1} \geq p^{\max}_H\left[\mathbb{Q}^2_H + q\left(\mathbb{Q}^2_H; c^{\tau}_{r^2}\right)\right] - c^{\tau}_{r^2} \geq \xi_H$, which implies that $p^{\max}_H\left[\mathbb{Q}^1_H + q\left(\mathbb{Q}^1_H; c^{\tau}_{r^1}\right)\right] - c^{\tau}_{r^1} \geq \xi_H$, which is a contradiction. ∎

**Lemma A.18.** *Let $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ be such $\tau^{**}_{jH} \leq \tau^*_{jH}$ for each $j \in \mathcal{C}\setminus\{H\}$, with strict inequality for at least one country. If $p^{\max **}_H < p^{\max *}_H$, then the number of domestic firms in $H$ with $\boldsymbol{\tau}^{**}_{\cdot H}$ is either lower or the same relative $\boldsymbol{\tau}^*_{\cdot H}$. If $p^{\max **}_H = p^{\max *}_H$, the number is lower.*

**Proof of Lemma A.18**. The lemma can be proved by showing that there are no new domestic firms serving $H$ when $\mathbb{Q}^{**}_H \geq \mathbb{Q}^*_H$. Formally, this means that $N^{**}_{HH} \leq N^*_{HH}$. Towards a contradiction, suppose that there is entry of some domestic firm $h$ with cost index $c_h$. Let $\mathbb{Q}^h_H$ be the aggregate quantity that the firm $h$ faces when it makes its entry decision with trade costs $\boldsymbol{\tau}^{**}_{\cdot H}$. First, since, by assumption, $h$ enters when trade costs are $\boldsymbol{\tau}^{**}_{\cdot H}$ but it is not active when they are $\boldsymbol{\tau}^*_{\cdot H}$, applying Lemma A.17 we know that $c_h \geq c^{\tau^*}_{N^*_H}$ and $c_h \leq c^{\tau^{**}}_{N^{**}_H}$. Moreover, given that $\tau^{**}_{jH} \leq \tau^*_{jH}$ for any $j \neq H$, then we know that, for any firm $r$, $c^{\tau^{**}}_r \leq c^{\tau^*}_r$. Thus, by Lemma A.17, an active firm $r^*$ with trade costs $\boldsymbol{\tau}^*_{\cdot H}$ satisfies that $c^{\tau^*}_{r^*} \leq c_h$ and so $c^{\tau^{**}}_{r^*} \leq c^{\tau^{**}}_{N^{**}_H}$. Therefore $N^h_H \geq N^*_H$, where $N^h_H$ is the number of firms when firm $h$ has to make an entry decision under $\boldsymbol{\tau}^{**}_{\cdot H}$. By Lemma A.16, we know that $\mathbb{Q}^h_H \geq \mathbb{Q}^*_H$, which implies by Lemma A.15 that $\mathbb{Q}^h_H + q^{BR}\left(\mathbb{Q}^h_H, c_h\right) \geq \mathbb{Q}^*_H + q^{BR}\left(\mathbb{Q}^*_H, c_h\right)$. Thus, $p^{\max}_H\left[\mathbb{Q}^h_H + q^{BR}\left(\mathbb{Q}^h_H, c_h\right)\right] - c_h \leq p^{\max}_H\left[\mathbb{Q}^*_H + q^{BR}\left(\mathbb{Q}^*_H, c_h\right)\right] - c_h$ and, since $\mathbb{Q}^h_H + q^{BR}\left(\mathbb{Q}^h_H, c_h\right) \leq \mathbb{Q}^{**}_H$, it implies that firm $h$ would have also been active with trade costs $\boldsymbol{\tau}^*_{\cdot H}$, which is a contradiction.

Now, we show that if, in particular, $\mathbb{Q}^{**}_H = \mathbb{Q}^*_H$ then $N^{**}_{HH} < N^*_{HH}$. Towards a contradiction, suppose not, so that, given that $N^{**}_{HH} \leq N^*_{HH}$, it implies that $N^{**}_{HH} = N^*_{HH}$. Taking the difference between (NE-BF) for the equilibrium under each trade cost,

$$\underbrace{\sum_{r_{HH} \leq N^{**}_{HH}} \frac{p^{\max}_H\left(\mathbb{Q}^{**}_H\right) - c_{r_{HH}}}{2\gamma_H + \eta_H} - \sum_{r_{HH} \leq N^*_{HH}} \frac{p^{\max}_H\left(\mathbb{Q}^*_H\right) - c_{r_{HH}}}{2\gamma_H + \eta_H}}_{=:B_1}$$

$$\underbrace{+\sum_{j \neq H}\left\{\sum_{r_{jH} \leq N^{**}_{jH}}\left[\frac{p^{\max}_H\left(\mathbb{Q}^{**}_H\right) - c^{\tau^{**}}_{r_{jH}}}{2\gamma_H + \eta_H}\right] - \sum_{r_{jH} \leq N^*_{jH}}\left[\frac{p^{\max}_H\left(\mathbb{Q}^*_H\right) - c^{\tau^*}_{r_{jH}}}{2\gamma_H + \eta_H}\right]\right\}}_{=:B_2} = \mathbb{Q}^{**}_H - \mathbb{Q}^*_H.$$

Since $\mathbb{Q}^{**}_H = \mathbb{Q}^*_H$ and $N^{**}_{HH} = N^*_{HH}$, then $B_1 = 0$. In addition, by using that $\tau^{**}_{jH} \leq \tau^*_{jH}$ for each $j \in \mathcal{C}\setminus\{H\}$, we can conclude that there is no exit of foreign firms. By assumption, for at least one country $f$, $\tau^{**}_{jH} < \tau^*_{jH}$. Therefore, active foreign firms from $f$ are supplying a greater quantity by Lemma A.13. These determine that $B_2 > 0$. But the RHS is zero, which is a contradiction. ∎

**Lemma A.19.** *Let $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ be such $\tau^{**}_{jH} \leq \tau^*_{jH}$ for each $j \neq H$, with strict inequality for at least one country. Suppose that the set of MIEs in $H$ are homogeneous. If $\overline{\pi}^{**}_H < \overline{\pi}^*_H$ then $p^{\max **}_H < p^{\max *}_H$, and if $\overline{\pi}^{**}_H = \overline{\pi}^*_H$ then $p^{\max **}_H = p^{\max *}_H$.*

**Proof of Lemma A.19**. Since MIEs in $H$ are homogeneous, then $c^{\tau^*}_{N^*_H} = c^{\tau^{**}}_{N^{**}_H}$. Hence, if $\overline{\pi}^{**}_H < \overline{\pi}^*_H$, then $p^{\max *}_H - c^{\tau^*}_{N^*_H} < p^{\max **}_H - c^{\tau^{**}}_{N^{**}_H}$ which determines that $p^{\max *}_H < p^{\max **}_H$. By the same token, if $\overline{\pi}^{**}_H = \overline{\pi}^*_H$ then $p^{\max *}_H = p^{\max **}_H$. ∎

**Lemma A.20.** *Let $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ be such $\tau^{**}_{jH} \leq \tau^*_{jH}$ for each $j \in \mathcal{C}\setminus\{H\}$, with strict inequality for at least* *one country. Suppose that the set of MIEs in H are heterogeneous. If $\overline{\pi}_H^{**} \leq \overline{\pi}_H^{*}$ then $p_H^{\max **} < p_H^{\max *}$.*

**Proof of Lemma A.20**. Towards a contradiction, suppose not, so that $p_H^{\max **} \geq p_H^{\max *}$ and, hence, $\mathbb{Q}_H^{**} \leq \mathbb{Q}_H^{*}$. Since $\overline{\pi}_H^{**} \leq \overline{\pi}_H$, then we know that $p_H^{\max **} - c_{N_H^{**}}^{\tau^{**}} \leq p_H^{\max *} - c_{N_H^*}^{\tau^*}$ which, given that $p_H^{\max **} \geq p_H^{\max *}$, implies that $c_{N_H^{**}}^{\tau^{**}} \geq c_{N_H^*}^{\tau^*}$. Thus, since $c_{N_H^*}^{\tau^*} \geq c_{N_H^*}^{\tau^{**}}$, then $c_{N_H^{**}}^{\tau^{**}} \geq c_{N_H^*}^{\tau^{**}}$.

Take any active firm when trade costs are $\boldsymbol{\tau}_{\cdot H}^*$. Also, suppose its costs are indexed by $\overline{c}_{\tau^*}$ and $\overline{c}_{\tau^{**}}$ when trade costs are $\boldsymbol{\tau}_{\cdot H}^*$ and $\boldsymbol{\tau}_{\cdot H}^{**}$, respectively. Then, since, by definition, the firm is active when trade costs are $\boldsymbol{\tau}_{\cdot H}^*$, by Lemma A.17 we know that $\overline{c}_{\tau^*} \leq c_{N_H^*}^{\tau^*}$. Moreover, since $\overline{c}_{\tau^{**}} \leq \overline{c}_{\tau^*}$ and $c_{N_H^*}^{\tau^*} \leq c_{N_H^{**}}^{\tau^{**}}$, then $\overline{c}_{\tau^{**}} \leq c_{N_H^{**}}^{\tau^{**}}$. Thus, by applying Lemma A.17, we establish that any active firm in the equilibrium with $\boldsymbol{\tau}_{\cdot H}^*$ is also active when trade costs are $\boldsymbol{\tau}_{\cdot H}^{**}$. Since there is no exit of firms, we know that $N_H^{**} \geq N_H^*$ and condition (NE-BF) is such that

$$\underbrace{\sum_{r_H \leq N_H^*} \left[ \frac{p_H^{\max}\left(\mathbb{Q}_H^{**}\right) - c_{r_H}^{\tau^{**}}}{2\gamma_H + \eta_H} \right] - \sum_{r_H \leq N_H^*} \left[ \frac{p_H^{\max}\left(\mathbb{Q}_H^{*}\right) - c_{r_H}^{\tau^{*}}}{2\gamma_H + \eta_H} \right]}_{=:A_1} + \underbrace{\sum_{r_H > N_H^*}^{N_H^{**}} \left[ \frac{p_H^{\max}\left(\mathbb{Q}_H^{**}\right) - c_{r_H}^{\tau^{**}}}{2\gamma_H + \eta_H} \right]}_{=:A_2} = \mathbb{Q}_H^{**} - \mathbb{Q}_H^{*}.$$

The term $A_1$ comprises firms that are active in both equilibria. We know that $c_{r_H}^{\tau^{**}} \leq c_{r_H}^{\tau^*}$ with strict inequality for at least one term, since $\tau_{jH}^* > \tau_{jH}^{**}$ for some $j \in \mathcal{C} \backslash \{H\}$. Moreover, $p_H^{\max}\left(\mathbb{Q}_H^{**}\right) \geq p_H^{\max}\left(\mathbb{Q}_H^{*}\right)$. Therefore, $A_1 > 0$. In addition, $A_2$ comprises firms that enter when trade costs are $\boldsymbol{\tau}_{\cdot H}^{**}$, but are inactive when trade costs are $\boldsymbol{\tau}_{\cdot H}^{*}$. Thus, since it is possible that $N_H^{**} = N_H^*$, it implies that $A_2 \geq 0$. Both facts determine that the LHS is positive. But, because we were assuming that $\mathbb{Q}_H^{**} \leq \mathbb{Q}^*{}_H$, the RHS is nonpositive, which is a contradiction. ■

**Proof of Proposition 6.1**. Consider the case where $\overline{\pi}_H^{**} < \overline{\pi}_H^{*}$. By Lemma A.19, this implies that $p_H^{\max **} < p_H^{\max *}$. Regarding domestic firms in $H$ that are active in both equilibria, by Lemma A.12 and the fact that $p_H^{\max **} < p_H^{\max *}$, we obtain that $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$ and $\mu_{HH}^{**}(c)$ are lower relative to the equilibrium with trade costs $\boldsymbol{\tau}_{\cdot H}^*$. Also, by Lemma A.18, there is no entry of new domestic firms.

Consider the case with $\overline{\pi}_H^{**} = \overline{\pi}_H^{*}$. By Lemma A.19, this implies that $p_H^{\max **} = p_H^{\max *}$. Therefore, since $p_H^{\max **} = p_H^{\max *}$, for any domestic firm that is active in $H$ in both equilibria, we get that $p_{HH}^{**}(c)$, $q_{HH}^{**}(c)$, $m_{HH}^{**}(c)$ and $\mu_{HH}^{**}(c)$ have the same value as in the equilibrium with $\boldsymbol{\tau}_{\cdot H}^*$. Also, by Lemma A.18, some of the domestic firms exit. ■

**Proof of Proposition 6.2**. Since MIEs are heterogeneous and $\overline{\pi}_H^{**} \leq \overline{\pi}_H^{*}$, applying Lemma A.20 we get that $p_H^{\max **} < p_H^{\max *}$. Then, the proof for the effects on prices, quantities, and markups of active domestic firms follows verbatim the proof of Proposition 6.1. ■

**Proof of Proposition 6.3**. The profits of the last entrants under $\boldsymbol{\tau}_{H\cdot}^*$ and $\boldsymbol{\tau}_{H\cdot}^{**}$ are, respectively,

$$\frac{\gamma_H + \eta_H}{\left(2\gamma_H + \eta_H\right)^2}\left(p_H^{\max *} - c_{N_H^*}\right)^2 + \frac{\gamma_F + \eta_F}{\left(2\gamma_F + \eta_F\right)^2}\left(p_F^{\max *} - c_{N_H^*}^{\tau^*}\right)^2 \geq F_H^E + 2f,$$
$$\frac{\gamma_H + \eta_H}{\left(2\gamma_H + \eta_H\right)^2}\left(p_H^{\max **} - c_{N_H^{**}}\right)^2 + \frac{\gamma_F + \eta_F}{\left(2\gamma_F + \eta_F\right)^2}\left(p_F^{\max **} - c_{N_H^{**}}^{\tau^{**}}\right)^2 \geq F_H^E + 2f.$$

Given that $\overline{\pi}_{\nu_H}^{*} \geq \overline{\pi}_{\nu_H}^{**}$, then

$$\underbrace{\frac{\gamma_H + \eta_H}{\left(2\gamma_H + \eta_H\right)^2}\left[\left(p_H^{\max *} - c_{N_H^*}\right)^2 - \left(p_H^{\max **} - c_{N_H^{**}}\right)^2\right]}_{=:A_1} + \underbrace{\frac{\gamma_F + \eta_F}{\left(2\gamma_F + \eta_F\right)^2}\left\{\left(p_F^{\max *} - c_{N_H^*}^{\tau^*}\right)^2 - \left(p_F^{\max **} - c_{N_H^{**}}^{\tau^{**}}\right)^2\right\}}_{=:A_2} \geq 0. \quad (26)$$

Moreover, taking the difference between (NE-BF) for each equilibrium, we obtain

$$\underbrace{\sum_{r_{HH}\leq N_{HH}^{**}} \frac{p_H^{\max}(\mathbb{Q}_H^{**}) - c_{r_{HH}}}{2\gamma_H + \eta_H} - \sum_{r_{HH}\leq N_{HH}^{*}} \frac{p_H^{\max}(\mathbb{Q}_H^{*}) - c_{r_{HH}}}{2\gamma_H + \eta_H}}_{=:B_1}$$
$$\underbrace{+\sum_{j\neq H}\left\{\sum_{r_{jH}\leq N_{jH}^{**}}\left[\frac{p_H^{\max}(\mathbb{Q}_H^{**}) - c_{r_{jH}}^{\tau}}{2\gamma_H + \eta_H}\right] - \sum_{r_{jH}\leq N_{jH}^{*}}\left[\frac{p_H^{\max}(\mathbb{Q}_H^{*}) - c_{r_{jH}}^{\tau}}{2\gamma_H + \eta_H}\right]\right\}}_{=:B_2} = \mathbb{Q}_H^{**} - \mathbb{Q}_H^{*}. \tag{27}$$

If there are no changes in the extensive-margin adjustments of domestic firms, then the shock does not affect market $H$ and, so, $p_H^{\max *} = p_H^{\max **}$ in order for (27) to hold. Since $\boldsymbol{\tau}_{H\cdot}^{*}$ and $\boldsymbol{\tau}_{H\cdot}^{**}$ can only affect the domestic market through the choke price and $H$ is a small economy, this implies that there are no changes in market $H$.

Consider now that there are extensive-margin adjustments in the domestic market. First, we rule out that $p_H^{\max *} = p_H^{\max **}$. If that were the case, the RHS would be zero. Moreover, given that the variation in trade costs does not affect the order of firms in $H$ and $p_H^{\max *} = p_H^{\max **}$, then $B_2 = 0$. Thus, it necessarily has to be that $B_1 = 0$. However, since $p_H^{\max *} = p_H^{\max **}$, this can only occur if the number of domestic firms is the same. But then there would no changes in the extensive margin of the domestic firms, which is a contradiction.

Next, we show that $p_H^{\max *} < p_H^{\max **}$ leads to a contradiction. The assumption implies $\mathbb{Q}_H^{*} > \mathbb{Q}_H^{**}$ and, so, the RHS of (27) is negative. Given that $p_H^{\max *} < p_H^{\max **}$ and the order of firms in the domestic market is the same, the same set of foreign firms is active before and after the trade shock. Thus, given that $\mathbb{Q}_H^{*} > \mathbb{Q}_H^{**}$, $B_2 > 0$. This determines that $B_1 < 0$. Also, since $\mathbb{Q}_H^{*} > \mathbb{Q}_H^{**}$, active domestic firms supply more quantities in the equilibrium with $\boldsymbol{\tau}_{H\cdot}^{**}$. Thus, $B_1 > 0$ only if there is exit of at least one domestic firm. This implies that $c_{N_H^{*}} \geq c_{N_H^{**}}$, with equality if MIEs are homogeneous. Since $p_H^{\max *} < p_H^{\max **}$ and $c_{N_H^{*}} \geq c_{N_H^{**}}$, then $A_1 < 0$, implying that $A_2 > 0$. But, if that is the case, then $c_{N_H^{**}}^{\tau^{**}} > c_{N_H^{*}}^{\tau^{*}}$ which is a contradiction, since $\tau_{HF}^{**} < \tau_{HF}^{*}$.

Given that $p_H^{\max *} > p_H^{\max **}$, the effects on prices, quantities and markups in $H$ follow by Lemma A.12.

Next, we prove that there is no exit of domestic firms which, joint with the assumption that there are extensive-margin adjustments of domestic firms, implies that some inactive firms from $H$ become active. Towards a contradiction, suppose that there is exit of at least one domestic firm. Given that $\mathbb{Q}_H^{*} < \mathbb{Q}_H^{**}$, the RHS of (27) is positive. Moreover, since optimal quantities are given by ($\mathrm{Q}_{\mathbb{Q}}$-BF) and $\mathbb{Q}_H^{*} < \mathbb{Q}_H^{**}$, any active domestic firm supplies less quantities in the equilibrium with $\boldsymbol{\tau}_{H\cdot}^{**}$. In addition, we have assumed that there is exit of at least one domestic firm. Hence $B_1 < 0$. This also implies that it necessarily has to be that $B_2 > 0$. But active foreign firms are supplying less quantities in the equilibrium with $\boldsymbol{\tau}_{H\cdot}^{**}$ and the profits of foreign firms are lower in equilibrium. This rules out entry of foreign firms. Thus, $B_2 < 0$, which is a contradiction. ■

## A.4 Applications to Cournot Competition

Next, we formalize the case of restricted entry outlined in Section 7. There, we stated that, when there is restricted entry, reductions in inward trade barriers decrease the profits of the last entrant. We proceed to prove this formally.

**Proposition A.21**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Suppose a CIC model in its Cournot version and let $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ be such $\tau^{**}_{jH} \leq \tau^*_{jH}$ with strict inequality for at least one country. If there are no changes in the set of active firms in $H$, then $p_H^{\max **} < p_H^{\max *}$. Moreover, if the last entrant under $\boldsymbol{\tau}^*_{\cdot H}$ is domestic, then $\overline{\pi}^{**}_H < \overline{\pi}^*_H$.*

**Proof of Proposition A.21**. Suppose that there is no change in the set of active domestic firms. Taking the difference between (NE-BF) for each equilibrium yields

$$\underbrace{\sum_{r_{HH} \leq N^{**}_{HH}} \frac{p_H^{\max}\left(\mathbb{Q}^{**}_H\right) - c_{r_{HH}}}{2\gamma_H + \eta_H} - \sum_{r_{HH} \leq N^{*}_{HH}} \frac{p_H^{\max}\left(\mathbb{Q}^{*}_H\right) - c_{r_{HH}}}{2\gamma_H + \eta_H}}_{=:B_1}$$

$$\underbrace{+\sum_{j \neq H} \left\{ \sum_{r_{jH} \leq N^{**}_{jH}} \left[ \frac{p_H^{\max}\left(\mathbb{Q}^{**}_H\right) - c^{\tau^{**}}_{r_{jH}}}{2\gamma_H + \eta_H} \right] - \sum_{r_{jH} \leq N^{*}_{jH}} \left[ \frac{p_H^{\max}\left(\mathbb{Q}^{*}_H\right) - c^{\tau^{*}}_{r_{jH}}}{2\gamma_H + \eta_H} \right] \right\}}_{=:B_2} = \mathbb{Q}^{**}_H - \mathbb{Q}^*_H.$$

Given that $\tau^{**}_{jH} \leq \tau^*_{jH}$ with strict inequality for at least one country, it is easy to see that $\mathbb{Q}^{**}_H = \mathbb{Q}^*_H$ cannot be part of an equilibrium. Thus, towards a contradiction, suppose that $\mathbb{Q}^{**}_H < \mathbb{Q}^*_H$, so that $p_H^{\max **} > p_H^{\max *}$. When this is the case, $B_1 > 0$ and $B_2 > 0$, but the RHS is negative, which is a contradiction. Thus, $p_H^{\max **} < p_H^{\max *}$.

Given that the last entrant is domestic when trade costs are $\boldsymbol{\tau}^*_{\cdot H}$, we have two possibilities regarding the last entrant under $\boldsymbol{\tau}^{**}_{\cdot H}$: it could either be domestic or foreign. If it is domestic, then the fact that $p_H^{\max **} > p_H^{\max *}$ implies that $\overline{\pi}^{**}_H < \overline{\pi}^*_H$. Suppose that the last entrant is foreign. Then, by using that $p_H^{\max **} > p_H^{\max *}$, this implies that $\overline{\pi}^*_H = \overline{\pi}^*_{HH} > \overline{\pi}^{**}_{HH} \geq \overline{\pi}^{**}_{FH}$, and the result follows. ■

# B Behavior of Foreign Firms

In the different propositions for monopolistic and oligopolistic competition in the main part of the paper, we did not inquire upon how trade liberalizations affected variables related to foreign firms. The reason was that alternatives assumptions on foreign countries are consistent with the same impact on the domestic market and its firms. Next, we explore how trade shocks affect foreign forms. We do it separately for the case of monopolistic competition and Cournot.

## B.1 Monopolistic Competition

For monopolistic competition, we proceed as follows. First, in Appendix B.1.1 we study how foreign firms respond to trade shocks in $H$ for each of the CIC variants we studied. Second, in Appendix B.1.2, we consider iceberg trade costs, with the goal of justifying why we chose additive trade costs as our baseline model. We study a scenario where there is a unilateral liberalization in a small economy and the IC channel is active. For this case, we establish that the effect of trade liberalizations on the choke price can be described in the same way as in the case of additive trade costs. As a corollary, the decisions made by domestic firms are also the same.[19] Nonetheless, the behavior of foreign firms can entail non-monotonicities.

### B.1.1 Baseline Model

[19] The same outcomes arise when the country under analysis faces new EOs.

**Proposition B.1**

*Suppose the conditions of Proposition 4.1 and let $j \in \mathcal{C}\backslash\{H\}$. Then, in either the group-specific or degenerate CIC model and for firms that are active in both equilibria, $p_{jH}^{**}(c)$ is lower, and $c_{jH}^{**}$, $M_{jH}^{**}$, $q_{jH}^{**}(c)$, $\mu_{jH}^{**}(c)$, and $m_{jH}^{**}(c)$ are greater relative to the equilibrium with $\boldsymbol{\tau}_{\cdot H}^{*}$.*

**Proof of Proposition B.1.** By Proposition 4.1, we know that $p_H^{\max *} = p_H^{\max **}$. Moreover, for any $j \in \mathcal{C}\backslash\{H\}$, by applying Lemma A.5 we establish that $q_{jH}^{**}(c)$, $m_{jH}^{**}(c)$, and $\mu_{jH}^{**}(c)$ increase, and $p_{jH}^{**}(c)$ decreases relative to the equilibrium with $\boldsymbol{\tau}_{\cdot H}^{*}$. In addition, by the same lemma, $c_{jH}^{*} < c_{jH}^{**}$ irrespective if (ZCP) or (ZCP2) holds, which implies that for any of the CIC variants $M_{jH}^{*} < M_{jH}^{**}$. ■

To obtain results that apply to each foreign firm, irrespective of its country of origin, next we consider a symmetric variation in trade costs.

**Proposition B.2**

*Suppose the conditions of Proposition 4.2 and that, in either the group-specific or degenerate CIC model, the variation of trade costs in each country $j \in \mathcal{C}\backslash\{H\}$ is symmetric, so that $\mathrm{d}\tau_{jH} = \mathrm{d}\tau < 0$. Then, for firms that are active in both equilibria, $p_{jH}^{**}(c)$ is lower, and $c_{jH}^{**}$, $M_{jH}^{**}$, $q_{jH}^{**}(c)$, $\mu_{jH}^{**}(c)$, and $m_{jH}^{**}(c)$ are greater relative to the equilibrium with $\boldsymbol{\tau}_{\cdot H}^{*}$ for any $j \in \mathcal{C}\backslash\{H\}$.*

**Proof of Proposition B.2.** Consider a variation $\mathrm{d}\tau_{jH} = \mathrm{d}\tau$ for each $j \in \mathcal{C}\backslash\{H\}$. By Proposition 4.2, we know that $\mathrm{d}p_H^{\max *} < 0$. Thus, since $\mathrm{d}\tau < 0$, we get that $p_{jH}^{**}(c) < p_{jH}^{*}(c)$ for $j \in \mathcal{C}\backslash\{H\}$ by Lemmas A.4 and A.5. Differentiating (MS), we obtain $\left(\sum_{k\in\mathcal{C}} \frac{\partial \Phi_{kH}^{*}}{\partial p_H^{\max *}} + 2\beta_H\right) \mathrm{d}p_H^{\max *} + \sum_{j\neq H} \frac{\partial \Phi_{jH}^{*}}{\partial \tau_{jH}} \mathrm{d}\tau = 0$. From this, we determine that

$$\frac{\mathrm{d}p_H^{\max *}}{\mathrm{d}\tau} = \frac{\sum_{j\neq H} \frac{\partial \Phi_{jH}^{*}}{\partial \tau_{jH}}}{2\beta_H + \sum_{k\in\mathcal{C}} \frac{\partial \Phi_{kH}^{*}}{\partial p_H^{\max *}}}. \tag{28}$$

Now, take some country $F \in \mathcal{C}\backslash\{H\}$. If (ZCP) holds, then, $\frac{\mathrm{d}c_{FH}^{*}}{\mathrm{d}\tau} = \frac{\mathrm{d}p_H^{\max *}}{\mathrm{d}\tau} - 1$. Therefore,

$$\frac{\mathrm{d}c_{FH}^{*}}{\mathrm{d}\tau} = \frac{\sum_{j\neq H} \frac{\partial \Phi_{jH}^{*}}{\partial \tau_{jH}}}{2\beta_H + \sum_{k\in\mathcal{C}} \frac{\partial \Phi_{kH}^{*}}{\partial p_H^{\max *}}} - 1.$$

If (ZCP2) holds, using the fact that $\frac{\partial c_{FH}^{*}}{\partial p_H^{\max *}} = -\frac{\partial c_{FH}^{*}}{\partial \tau} > 0$, then

$$\frac{\mathrm{d}c_{FH}^{*}}{\mathrm{d}\tau} = \frac{\partial c_{FH}^{*}}{\partial p_H^{\max *}} \left(\frac{\mathrm{d}p_H^{\max *}}{\mathrm{d}\tau} - 1\right)$$

By the proof of Lemma A.6, $\frac{\partial \Phi_{ij}^{\theta *}}{\partial p_j^{\max *}} = -\frac{\partial \Phi_{ij}^{\theta *}}{\partial \tau_{ij}}$ irrespective of the CIC model under consideration. Thus, $\sum_{j\neq H} \frac{\partial \Phi_{jH}^{*}}{\partial \tau_{jH}} < \sum_{k\in\mathcal{C}} \frac{\partial \Phi_{kH}^{*}}{\partial p_H^{\max *}}$ and, since $\mathrm{d}\tau < 0$, $c_{FH}^{*}$ increases when either (ZCP) or (ZCP2) holds. Reexpressing the variables in terms of $c_{FH}^{*}(\cdot)$, we have that $q_{FH}(\cdot) = \frac{c_{FH}^{*}(\cdot)+\xi_{FH}-c}{2\gamma_H}$, $\mu_{FH}(\cdot) = \frac{c_{FH}^{*}(\cdot)+\xi_{FH}-c}{2}$ and $M_{FH}^{*} = M_F G_{FH}^{*}$, where $M_F$ is either the mass of potential firms or the mass of incumbents depending on the CIC model under consideration. Given $\mathrm{d}\tau_{jH} = \mathrm{d}\tau$ for each $j \in \mathcal{C}\backslash\{H\}$, the sign of $\mathrm{d}q_{FH}^{*}(c)$, $\mathrm{d}\mu_{FH}^{*}(c)$ and $\mathrm{d}M_{FH}^{*}$ is equal to the sign of $\mathrm{d}c_{FH}^{*}$. Thus, $M_{FH}^{*}$, and $q_{FH}^{*}(c)$ and $\mu_{FH}^{*}(c)$ for each $c \leq c_{FH}^{*}$ also increase.

It remains to show that $m^*_{FH}(c)$ with $c \leq c^*_{FH}$ increases. Since, $m^*_{FH}(c) := \frac{1}{2} + \frac{p_H^{\max}}{2(c+\tau_{FH})}$, then

$$\mathrm{d}m^*_{FH}(c) = \frac{1}{2}\frac{\mathrm{d}p_H^{\max *}(c+\tau_{FH}) - p_H^{\max *}\mathrm{d}\tau_{FH}}{(c+\tau_{FH})^2},$$
$$\Rightarrow \operatorname{sgn}\{\mathrm{d}m^*_{FH}(c)\} = \operatorname{sgn}\{\mathrm{d}p_H^{\max *}(c+\tau_{FH}) - p_H^{\max *}\mathrm{d}\tau_{FH}\}.$$

Since $\mathrm{d}\tau_{FH} = \mathrm{d}\tau < 0$, then we need to show that $\left(\frac{\sum_{j\neq H}\frac{\partial \Phi^*_{jH}}{\partial \tau_{jH}}}{2\beta_H + \sum_{k\in\mathcal{C}}\frac{\partial \Phi^*_{kH}}{\partial p_H^{\max *}}}\mathrm{d}\tau\right)(c+\tau_{FH}) - p_H^{\max *}\mathrm{d}\tau > 0$ or, equivalently, that

$$\frac{p_H^{\max *}}{c+\tau_{FH}} > \frac{\sum_{j\neq H}\frac{\partial \Phi^*_{jH}}{\partial \tau_{jH}}}{2\beta_H + \sum_{k\in\mathcal{C}}\frac{\partial \Phi^*_{kH}}{\partial p_H^{\max *}}}. \tag{29}$$

But $\inf\left(\frac{p_H^{\max *}}{c+\tau_{FH}}\right) = \left(\frac{p_H^{\max *}}{c^*_{FH}}\right) = \frac{1}{1-\xi_{FH}/p_H^{\max *}} > 1$ and the RHS of (29) is lower than 1. Then, (29) holds and $m^*_{FH}(c)$ for each $c \leq c^*_{FH}$ increases. ■

**Proposition B.3**

*Suppose the conditions of Proposition 4.3. Then, in either the group-specific or degenerate CIC model and given $j \in \mathcal{C}\backslash\{H\}$:*

- *if MIEs in $H$ serve both the domestic market and $F$, then for firms which are active in both equilibria $c^{**}_{jH}$, $M^{**}_{jH}$, $p^{**}_{jH}(c)$, $q^{**}_{jH}(c)$, $m^{**}_{jH}(c)$, and $\mu^{**}_{jH}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}^*_{\cdot H}$.*
- *if MIEs in $H$ only serve their domestic market, then the prices, quantities, survival marginal-cost cutoff and masses of active firms from any country serving $H$ do not vary.*

**Proof of Proposition B.3**. If MIEs in $H$ serve both the domestic market and $F$ then, by Proposition 4.3, $p_H^{\max **} < p_H^{\max *}$. Therefore, by Lemma A.4, $p^{**}_{jH}(c)$, $q^{**}_{jH}(c)$, $m^{**}_{jH}(c)$, and $\mu^{**}_{jH}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}^*_{\cdot H}$. Furthermore, by the same lemma, $c^{**}_{jH} < c^*_{jH}$, which implies that in any of the CIC variants, $M^{**}_{jH} < M^*_{jH}$. If MIEs in $H$ are not ex-ante exporters to $F$, then $p_H^{\max *}$ does not vary and, hence, there is no impact on any variable of a foreign firm related to $H$. ■

### B.1.2 Iceberg Trade costs

Next, we analyze a unilateral liberalization in a small economy $H$. We concentrate on this case because, when the IC channel is activated, the choice of quantities by foreign firms is non-monotone. This result emerges because the response of foreign firms to a trade shock depends on whether the effect from the choke price or trade costs dominates. In the case of additive trade costs, this non-monotonicity does not arise since one of the effects always dominates.

To show the results as clearly as possible, we consider the Chaney model. This corresponds to a degenerate CIC model with only one group of firms in each country and where the least-productive firms that serve at least one market sell only domestically. With iceberg trade costs, the derivation of the equilibrium is the same as with additive trade costs but where $c^\tau_{ij} := \tau_{ij}c$ with $\tau_{ii} := 1$. Thus, using this definition of $c^\tau_{ij}$, the optimal prices, quantities, markups, and profits established in the main part of the paper are still valid. Regarding condition (ZCP), the marginal-cost cutoff becomes

$$c^*_{ij}\left(p_j^{\max};\tau_{ij}\right) := \frac{p_j^{\max} - \xi_{ij}}{\tau_{ij}}.$$

Throughout the proofs, we define $\mathbb{C}_{ij}^{\tau *} := \int_{\underline{c}_i}^{\frac{p_j^{\max *} - \xi_{ij}}{\tau_{ij}}} c_{ij}^{\tau} \, \mathrm{d}G_i\left(c\right)$ and $C_{ij}^{\tau *} := \mathbb{C}_{ij}^{\tau *}/G_{ij}^{*}$. Moreover, the equilibrium at the market stage is given by (MS) for $H$ but with $\Phi_{ij}$ defined through $\mathbb{C}_{ij}^{\tau *}$ in terms of iceberg trade costs. Next, we proceed to state some lemmas.

**Lemma B.4.** *$p_{ij}\left(p_j^{\max *}; c_{ij}^{\tau}\right)$, $q_{ij}\left(p_j^{\max *}; c_{ij}^{\tau}\right)$, $m_{ij}\left(p_j^{\max *}; c_{ij}^{\tau}\right)$, $\mu_{ij}\left(p_j^{\max *}, c; \tau_{ij}\right)$, and $c_{ij}^{*}\left(p_j^{\max *}; \tau_{ij}\right)$ are increasing in $p_j^{\max *}$.*

**Proof of Lemma B.4**. Taking derivatives and working out the expressions: $\frac{\partial p_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{1}{2}$, $\frac{\partial q_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{1}{2\gamma_j}$, $\frac{\partial m_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{1}{2c_{ij}^{\tau}}$, $\frac{\partial \mu_{ij}(\cdot)}{\partial p_j^{\max}} = \frac{1}{2}$, and $\frac{\partial c_{ij}^{*}(\cdot)}{\partial p_j^{\max}} = \frac{1}{\tau_{ij}}$. ■

**Lemma B.5.** *$p_{ij}\left(p_j^{\max *}; c_{ij}^{\tau}\right)$ is increasing in $\tau_{ij}$ and $q_{ij}\left(p_j^{\max *}; c_{ij}^{\tau}\right)$, $m_{ij}\left(p_j^{\max *}; c_{ij}^{\tau}\right)$, $\mu_{ij}\left(p_j^{\max *}, c; \tau_{ij}\right)$, and $c_{ij}^{*}\left(p_j^{\max *}; \tau_{ij}\right)$ are decreasing in $\tau_{ij}$.*

**Proof of Lemma B.5**. Taking derivatives of each function: $\frac{\partial p_{ij}(\cdot)}{\partial \tau_{ij}} = \frac{c}{2}$, $\frac{\partial q_{ij}(\cdot)}{\partial \tau_{ij}} = -\frac{1}{2\gamma_j} c$, $\frac{\partial m_{ij}(\cdot)}{\partial \tau_{ij}} = -\frac{p_j^{\max *}}{2(\tau_{ij})^2 c}$, $\frac{\partial \mu_{ij}(\cdot)}{\partial \tau_{ij}} = -\frac{c}{2}$, and $\frac{\partial c_{ij}^{*}(\cdot)}{\partial \tau_{ij}} = -\frac{\left(p_j^{\max *} - \xi_{ij}\right)}{(\tau_{ij})^2}$. ■

Next, we show that a unilateral liberalization determines the same impact on the competitive conditions and the behavior of domestic firms as in the case of additive trade costs.

**Proposition B.6**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy and countries have a market structure as in the Chaney model. If there is a unilateral liberalization in $H$ such that $\tau_{jH}$ decreases for each $j \in \mathcal{C} \backslash \{H\}$ and trade costs are of the iceberg type, then:*

- *$p_H^{\max *}$ decreases,*
- *$c_{HH}^{*}$, $p_{HH}^{*}\left(c\right)$, $q_{HH}^{*}\left(c\right)$, $m_{HH}^{*}\left(c\right)$ and $\mu_{HH}^{*}\left(c\right)$ for $c \leq c_{HH}^{*}$ decrease, and*
- *$M_{HH}^{*}$ decreases.*

**Proof of Proposition B.6**. Consider a vector of variations $\left(\mathrm{d}\tau_{jH}\right)_{j \in \mathcal{C} \backslash \{H\}}$ for each $j \in \mathcal{C} \backslash \{H\}$. Differentiating (MS) under iceberg trade costs and only one group of firms, we obtain

$$\mathrm{d}p_H^{\max *} = \frac{\sum_{j \in \mathcal{C} \backslash \{H\}} \frac{\overline{M}_j}{\tau_{jH}} \left[ g_{jH}^{*} \left(p_H^{\max *} - \xi_{jH}\right) \frac{\xi_{jH}}{\tau_{jH}} + \mathbb{C}_{jH}^{\tau *} \right] \mathrm{d}\tau_{jH}}{2\beta_H + \sum_{k \in \mathcal{C}} \overline{M}_k \left( G_{kH}^{*} + g_{kH}^{*} \frac{\xi_{kH}}{\tau_{kH}} \right)} < 0,$$

where the sign follows because $\mathrm{d}\tau_{jH} < 0$ for each $j \in \mathcal{C} \backslash \{H\}$ and $p_H^{\max *} > \xi_{jH}$. The latter holds since $p_H^{\max *} - \xi_{jH} = \tau_{jH} c_{jH}^{*}$.

Given that $p_H^{\max *}$ decreases, then, by Lemma B.4, $c_{HH}^{*}$, $p_{HH}^{*}\left(c\right)$, $q_{HH}^{*}\left(c\right)$, $m_{HH}^{*}\left(c\right)$, and $\mu_{HH}^{*}\left(c\right)$ decrease for $c \leq c_{HH}^{*}$. Moreover, since $c_{HH}^{*}$ decreases, then $M_{HH}^{*}$ decreases too. ■

However, without further assumptions, we cannot determine the behavior of foreign firms. This is not possible even if we restrict the analysis to a reduction in trade costs that affects only one country. In particular, in the next proposition, we prove that quantities might respond non-monotonically to a trade liberalization. Specifically, quantities of foreign firms might decrease for low marginal costs and increase for high marginal costs.

**Proposition B.7**

*Consider a setup with assumptions as in Proposition B.6. Assume also that* $\underline{c}_F < \frac{\partial p_H^{\max *}}{\partial \tau_{FH}}$. *If there is a decrease in* $\tau_{FH}$ *for some* $F \in \mathcal{C} \backslash \{H\}$, *then* $q_{FH}^*(c)$ *decreases for* $c < \widehat{c}_{FH}$ *and increases for* $c > \widehat{c}_{FH}$, *where*

$$\widehat{c}_{FH} := \frac{1}{\tau_{FH}} \frac{\overline{M}_F \left[ g_{FH}^* \left( p_H^{\max *} - \xi_{FH} \right) \frac{\xi_{FH}}{\tau_{FH}} + \mathbb{C}_{FH}^{\tau *} \right]}{2\beta_H + \sum_{k \in \mathcal{C}} \overline{M}_k \left( G_{kH}^* + g_{kH}^* \frac{\xi_{kH}}{\tau_{kH}} \right)}.$$

**Proof of Proposition B.7**. Given that optimal quantities are given by (QUANT), under iceberg trade costs we get $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} = \frac{1}{2\gamma_H} \left( \frac{\partial p_H^{\max *}}{\partial \tau_{FH}} - c \right)$ or, equivalently, $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} = \frac{1}{2\gamma_H} \frac{p_H^{\max *}}{\tau_{FH}} \left( \frac{\partial \ln p_H^{\max *}}{\partial \ln \tau_{FH}} - \frac{c\tau_{FH}}{p_H^{\max *}} \right)$. This implies that $\operatorname{sgn} \frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} = \operatorname{sgn} \left( \frac{\partial \ln p_H^{\max *}}{\partial \ln \tau_{FH}} - \frac{c\tau_{FH}}{p_H^{\max *}} \right)$.

By the proof of Proposition B.6 and considering that the reduction of trade costs only affects $F$, we get that

$$\frac{\partial \ln p_H^{\max *}}{\partial \ln \tau_{FH}} = \frac{1}{p_H^{\max *}} \frac{\overline{M}_F \left[ g_{FH}^* \left( p_H^{\max *} - \xi_{FH} \right) \frac{\xi_{FH}}{\tau_{FH}} + \mathbb{C}_{FH}^{\tau *} \right]}{2\beta_H + \sum_{k \in \mathcal{C}} \overline{M}_k \left( G_{kH}^* + g_{kH}^* \frac{\xi_{kH}}{\tau_{kH}} \right)} > 0.$$

Next, we show that there exists a $\widehat{c}_{FH}$ that satisfies $\frac{\partial q_{FH}(p_H^{\max *}, \widehat{c}_{FH}; \tau_{FH})}{\partial \tau_{FH}} = 0$ and, in addition, if $c < \widehat{c}_{FH}$ then $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} > 0$, and if $c > \widehat{c}_{FH}$ then $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} < 0$. To do this we apply the Intermediate Value Theorem.

First, since, by assumption, $\underline{c}_F < \frac{\partial p_H^{\max *}}{\partial \tau_{FH}}$ then $\frac{\underline{c}_F \tau_{FH}}{p_H^{\max *}} < \frac{\partial \ln p_H^{\max *}}{\partial \ln \tau_{FH}}$, and so $\frac{\partial q_{FH}\left(p_H^{\max *}, \underline{c}_F; \tau_{FH}\right)}{\partial \tau_{FH}} > 0$. Now, we prove that if $c = c_{FH}^*$, then $\frac{c_{FH}^* \tau_{FH}}{p_H^{\max *}} > \frac{\partial \ln p_H^{\max *}}{\partial \ln \tau_{FH}}$. This holds iff

$$\frac{1}{p_H^{\max *}} \frac{\overline{M}_F \left[ g_{FH}^* \left( p_H^{\max *} - \xi_{FH} \right) \frac{\xi_{FH}}{\tau_{FH}} + \mathbb{C}_{FH}^{\tau *} \right]}{2\beta_H + \sum_{k \in \mathcal{C}} \overline{M}_k \left( G_{kH}^* + g_{kH}^* \frac{\xi_{kH}}{\tau_{kH}} \right)} < \frac{c_{FH}^* \tau_{FH}}{p_H^{\max *}},$$

which, working out the expression, holds iff

$$\overline{M}_F \left[ \mathbb{C}_{FH}^{\tau *} - c_{FH}^* \tau_{FH} G_{FH}^* \right] < \left[ 2\beta_H + \sum_{j \neq F} \overline{M}_j \left( G_{jH}^* + g_{jH}^* \frac{\xi_{jH}}{\tau_{jH}} \right) \right] c_{FH}^* \tau_{FH}. \tag{30}$$

The RHS of (30) is positive. Regarding its LHS, notice that, by reexpressing it, it has the same sign as the term $C_{FH}^{\tau *} - c_{FH}^* \tau_{FH}$. While $C_{FH}^{\tau *}$ is the average marginal cost (inclusive of trade costs) of active firms from $F$ serving $H$, the term $c_{FH}^* \tau_{FH}$ represents the maximum marginal cost (inclusive of trade costs) of an active firm from $F$ serving $H$. Therefore, the LHS is negative, and the result follows.

We have shown that if $c < \widehat{c}_{FH}$ then $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} > 0$, and if $c > \widehat{c}_{FH}$ then $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} < 0$. Furthermore, $\frac{c\tau_{FH}}{p_H^{\max *}} - \frac{\partial \ln p_H^{\max *}}{\partial \ln \tau_{FH}}$ is strictly increasing in $c$ and continuous. Thus, by the Intermediate Value Theorem, there exists a unique $\widehat{c}_{FH}$ such that $\frac{\partial q_{FH}(p_H^{\max *}, c; \tau_{FH})}{\partial \tau_{FH}} = 0$. That value is defined as $\widehat{c}_{FH} := \frac{\partial p_H^{\max *}}{\partial \tau_{FH}}$ which gives the expression included in the statement of the proposition. ■

The intuition behind the result is that, when there is a trade liberalization and trade costs are of the iceberg type, there are two opposite effects impacting on quantities. Specifically, quantities increase due to the direct impact of a decrease in trade costs, but they also become lower due to the decrease in the choke price. Unlike the case of additive trade costs, where one effect dominates, under multiplicative trade costs the magnitude of each effect is proportional to the marginal cost. For instance, in the extreme case where a foreign firm has a marginal cost close to zero, the impact from lower trade costs is negligible since the effect is proportional to its marginal cost. Thus, in this case, the effect of a tougher competitive environment dominates the choices of the firm. On the other hand, when a foreign firm has high marginal costs, there is a substantial impact on its quantities due to the direct effect coming from a reduction in trade costs. Thus, this effect would dominate.

To reveal that this outcome can arise under standard cases, we consider a framework that we introduce in Appendix F. This corresponds to the setup in Melitz and Ottaviano (2008), so that $\xi_{kH} = 0$ for $k \in \mathcal{C}$ and all countries have the same Pareto productivity distribution. Moreover, $\underline{c}_F < \frac{\partial p_H^{\max *}}{\partial \tau_{FH}}$ holds since $\underline{c}_F = 0$ and $\frac{\partial p_H^{\max *}}{\partial \tau_{FH}} > 0$. Thus,

$$\widehat{c}_{FH} := \frac{k}{k+1} \frac{p_H^{\max *}}{\tau_{FH}} \frac{\overline{M}_F \rho_{FH}}{2\beta_H \left(\frac{p_H^{\max *}}{c_M}\right)^{-k} + \sum_k \overline{M}_k \rho_{kH}},$$

and, therefore, quantities in a setup as in Melitz and Ottaviano (2008) respond non-monotonically.

## B.2 Cournot Competition

Just as in the baseline case of monopolistic competition, to obtain definite results that apply to foreign firms from each country, we assume that trade costs are symmetric. The following lemma describes the implications when this is incorporated.

**Lemma B.8.** *Let $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ be such $\tau^{**}_{jH} = \tau^{**}$ and $\tau^*_{jH} = \tau^*$ for any $j \in \mathcal{C}\backslash \{H\}$, where $\tau^{**} < \tau^*$. If $\overline{\pi}^{**}_H = \overline{\pi}^*_H$ then $p_H^{\max **} - \tau^{**} > p_H^{\max *} - \tau^*$.*

**Proof of Lemma B.8**. Since $\overline{\pi}^{**}_H = \overline{\pi}^*_H$, then, by Lemma A.19, $\mathbb{Q}^{**}_H > \mathbb{Q}^*_H$ if MIEs are heterogeneous, and, by Lemma A.20, $\mathbb{Q}^{**}_H = \mathbb{Q}^*_H$ if MIEs are homogeneous.

Towards a contradiction, suppose that $p_H^{\max **} - \tau^{**} \leq p_H^{\max *} - \tau^*$. First, consider the case of heterogeneous MIEs. Since $\mathbb{Q}^{**}_H > \mathbb{Q}^*_H$, by Lemma A.18 we know that there is no entry of additional domestic firms when $\boldsymbol{\tau}^{**}_{\cdot H}$. Now, we show that there is no entry of new foreign firms either.

Towards a contradiction, suppose that there is entry of a foreign firm with index $f$. Then, by Lemma A.17, we know that $f$ is inactive with $\boldsymbol{\tau}^*_{\cdot H}$, so that $c_f^{\tau^*} \geq c_{N_H^*}^{\tau^*}$, and active with $\boldsymbol{\tau}^{**}_{\cdot H}$ so that $c_f^{\tau^{**}} \leq c_{N_H^{**}}^{\tau^{**}}$. Let $\mathbb{Q}^f_H$ be the quantity aggregate that the firm $f$ faces when it makes the entry decision. By Lemmas A.16 and A.17, we have that $\mathbb{Q}^f_H \leq \mathbb{Q}^{**}_H$. Given that $\tau^{**} < \tau^*$, then we know that $c_r^{\tau^{**}} \leq c_r^{\tau^*}$ for any firm $r$, with strict inequality for foreign firms. Thus, by Lemma A.17, a firm $r^*$ that is active with trade costs $\boldsymbol{\tau}^*_{\cdot H}$ satisfies $c_{r^*}^{\tau^*} \leq c_f^{\tau^*}$ and so $c_{r^*}^{\tau^{**}} \leq c_f^{\tau^*} \leq c_{N_H^{**}}^{\tau^{**}}$. Therefore, $N_H^f \geq N_H^*$ where $N_H^f$ is the number of firms when firm $f$ has to make its entry decision. By Lemma A.16, we know that $\mathbb{Q}^f_H \geq \mathbb{Q}^*_H$.

Furthermore, we know that $p_H^{\max *} - c_f^{\tau^*} < p_H^{\max *} - c_{N_H^*}^{\tau^*}$ since the set of MIEs are heterogeneous. Also $p_H^{\max *} - c_{N_H^*}^{\tau^*} = p_H^{\max **} - c_{N_H^{**}}^{\tau^{**}} < p_H^{\max **} - c_f^{\tau^{**}}$, where the first inequality follows because $\overline{\pi}^{**}_H = \overline{\pi}^*_H$, and the second because MIEs are heterogeneous and so $c_f^{\tau^{**}} < c_{N_H^{**}}^{\tau^{**}}$. Since we are supposing that $p_H^{\max **} - \tau^{**} \leq p_H^{\max *} - \tau^*$, we also know that $p_H^{\max **} - c_f^{\tau^{**}} \leq p_H^{\max *} - c_f^{\tau^*}$. But this implies that $p_H^{\max *} - c_f^{\tau^*} < p_H^{\max *} - c_{N_H^*}^{\tau^*} < p_H^{\max *} - c_f^{\tau^*}$, which is a contradiction.

Consider now the case of homogeneous MIEs. We show that there is no entry of new foreign firms in this case either. By applying the same reasoning as above,

$$p_H^{\max *} - c_f^{\tau^*} \leq p_H^{\max *} - c_{N_H^*}^{\tau^*} = p_H^{\max **} - c_{N_H^{**}}^{\tau^{**}} \leq p_H^{\max **} - c_f^{\tau^{**}} \leq p_H^{\max *} - c_f^{\tau^*}.$$

But this implies that all the inequalities hold with equality so that $c_f^{\tau^*} = c_{N_H^*}^{\tau^*}$ and $c_f^{\tau^{**}} = c_{N_H^{**}}^{\tau^{**}}$. Since $\mathbb{Q}^{**}_H = \mathbb{Q}^*_H$ then $c_f^{\tau^*} = c_f^{\tau^{**}}$, which is a contradiction since $f$ is foreign and $\tau^{**} < \tau^*$.

Hence, from this analysis, we can conclude that there is no entry of firms under $\boldsymbol{\tau}^{**}_{\cdot H}$ relative to $\boldsymbol{\tau}^*_{\cdot H}$. Formally, this means that $N_H^{**} \leq N_H^*$.

Now, consider condition (NE-BF) which, given that $N_H^{**} \leq N_H^{*}$, can be expressed by

$$\underbrace{\sum_{r_H \leq N_H^{**}} \left[ \frac{p_H^{\max}\left(\mathbb{Q}_H^{**}\right) - c_{r_H}^{\tau^{**}}}{2\gamma_H + \eta_H} \right] - \sum_{r_H \leq N_H^{**}} \left[ \frac{p_H^{\max}\left(\mathbb{Q}_H^{*}\right) - c_{r_H}^{\tau^{*}}}{2\gamma_H + \eta_H} \right]}_{=:A_1} - \underbrace{\sum_{r_H > N_H^{**}}^{N_H^{*}} \left[ \frac{p_H^{\max}\left(\mathbb{Q}_H^{*}\right) - c_{r_H}^{\tau^{*}}}{2\gamma_H + \eta_H} \right]}_{=:A_2} = \mathbb{Q}_H^{**} - \mathbb{Q}_H^{*}.$$

Irrespective of whether the set of MIEs are homogeneous or heterogeneous, we know that $\mathbb{Q}_H^{**} \geq \mathbb{Q}_H^{*}$ so that the RHS is nonnegative. Regarding the LHS, given that either $N_H^{**} = N_H^{*}$ or each term in $A_2$ would be the quantities of active firms which are strictly positive, $A_2 \geq 0$. Moreover, since we are assuming that $p_H^{\max **} - \tau^{**} \leq p_H^{\max *} - \tau^{*}$, the firms that are active in both equilibria are either not supplying more or supplying strictly less under $\boldsymbol{\tau}_{\cdot H}^{**}$ relative to $\boldsymbol{\tau}_{\cdot H}^{*}$, which implies that $A_1 < 0$. But, then the LHS is negative, which is a contradiction. ■

Next, we state the behavior of foreign firms for each scenario considered in the propositions of Section 6.4.

**Proposition B.9**

*Suppose the conditions of Proposition 6.1. Let $j \in \mathcal{C} \backslash \{H\}$ and consider firms with marginal costs $c$ that are active when trade costs are $\boldsymbol{\tau}_{\cdot H}^{*}$ and $\boldsymbol{\tau}_{\cdot H}^{**}$. Then,*

- *if $\overline{\pi}_H^{**} < \overline{\pi}_H^{*}$: $p_{jH}^{**}(c) < p_{jH}^{*}(c)$,*
- *if $\overline{\pi}_H^{**} = \overline{\pi}_H^{*}$, and $\tau_{jH}^{**} = \tau^{**}$ and $\tau_{jH}^{*} = \tau^{*}$ for all $j \in \mathcal{C} \backslash \{H\}$, where $\tau^{**} < \tau^{*}$: $p_{jH}^{**}(c)$ is lower, and $q_{jH}^{**}(c)$, $m_{jH}^{**}(c)$ and $\mu_{jH}^{**}(c)$ are greater relative to the equilibrium with $\boldsymbol{\tau}^{*}_{\cdot H}$.*

**Proof of Proposition B.9**. Consider the case where $\overline{\pi}_H^{**} < \overline{\pi}_H^{*}$. By Proposition 6.1, $p_H^{\max **} < p_H^{\max *}$. Let $j \in \mathcal{C} \backslash \{H\}$ and consider foreign firms which are active in $H$. Thus, applying Lemmas A.12 and A.13 we get that $p_{jH}^{**}(c)$ is lower relative to the equilibrium under $\boldsymbol{\tau}_{\cdot H}^{*}$, since the choke price and trade costs affect prices in the same direction.

Consider now the case with $\overline{\pi}_H^{**} = \overline{\pi}_H^{*}$ and symmetric trade costs in each country, so that $\tau^{**} < \tau^{*}$. Let $j \in \mathcal{C} \backslash \{H\}$ and consider firms from $j$ that are active in $H$ in both equilibria. We know that, by Proposition 6.1, $p_H^{\max **} = p_H^{\max *}$. Moreover, $\tau^{**} < \tau^{*}$. Therefore, by Lemma A.13, $q_{jH}^{**}(c)$, $m_{jH}^{**}(c)$ and $\mu_{jH}^{**}(c)$ increase, and $p_{jH}^{**}(c)$ decreases, relative to the equilibrium with $\boldsymbol{\tau}_{\cdot H}^{*}$. ■

**Proposition B.10**

*Suppose the conditions of Proposition 6.2. Let $j \in \mathcal{C} \backslash \{H\}$ and consider firms with marginal costs $c$ that are active when trade costs are $\boldsymbol{\tau}_{\cdot H}^{*}$ and $\boldsymbol{\tau}_{\cdot H}^{**}$. Then, if*

- *if $\overline{\pi}_H^{**} \leq \overline{\pi}_H^{*}$: $p_{jH}^{**}(c) < p_{jH}^{*}(c)$,*
- *if $\overline{\pi}_H^{**} = \overline{\pi}_H^{*}$, in addition to $\tau_{jH}^{**} = \tau^{**}$ and $\tau_{jH}^{*} = \tau^{*}$ for all $j \in \mathcal{C} \backslash \{H\}$, with $\tau^{**} < \tau^{*}$: $q_{jF}^{**}(c)$, $m_{jF}^{**}(c)$ and $\mu_{jF}^{**}(c)$ are greater relative to the equilibrium with $\boldsymbol{\tau}^{*}_{\cdot H}$.*

**Proof of Proposition B.10**. Consider that $\overline{\pi}_H^{**} \leq \overline{\pi}_H^{*}$. By Proposition 6.2, $p_H^{\max **} < p_H^{\max *}$. Thus, applying Lemmas A.12 and A.13, the result for prices follows.

Consider the scenario where $\overline{\pi}_H^{**} = \overline{\pi}_H^{*}$ and symmetric trade costs with $\tau^{**} < \tau^{*}$. Taking $j \in \mathcal{C} \backslash \{H\}$ and by Lemma B.8, $q_{jH}^{**}(c)$ and $\mu_{jH}^{**}(c)$ are greater relative to the equilibrium with $\boldsymbol{\tau}_{\cdot H}^{*}$ because $p_H^{\max **} - \tau^{**} > p_H^{\max *} - \tau^{*}$. Next, we prove that, among the foreign firms that are active in both equilibria, $m_{jH}^{**}(c)$ is greater than in the equilibrium with $\tau^{*}$. To do this, we need to show that $\frac{p_H^{\max **}}{c_\omega^{\tau^{**}}} > \frac{p_H^{\max *}}{c_\omega^{\tau^{*}}}$ for any active foreign firm $\omega$. Suppose not, so that $p_H^{\max **} \leq p_H^{\max *} \frac{c_\omega^{\tau^{**}}}{c_\omega^{\tau^{*}}}$. By Lemma B.8, we know that $p_H^{\max **} > \tau^{**} - \tau^{*} + p_H^{\max *}$, implying that $\tau^{**}-\tau^{*}+p_H^{\max *} \leq p_H^{\max *}\frac{c_\omega^{\tau^{**}}}{c_\omega^{\tau^*}}$. Rearranging the terms, we get that $\left(\tau^{**}-\tau^{*}\right)\left(\frac{c_\omega^{\tau^*}-p_H^{\max *}}{c_\omega^{\tau^*}}\right) \leq 0$. Since $\tau^{**}<\tau^{*}$, this implies that $c_\omega^{\tau^*} \geq p_H^{\max *}$. Given that fixed costs satisfy $f>0$, the quantities supplied by any active firm are strictly positive, contradicting that $c_\omega^{\tau^*} \geq p_H^{\max *}$. ■

**Proposition B.11**

*Suppose the conditions of Proposition 6.3. Let $j \in \mathcal{C}\backslash\{H\}$ and consider firms with marginal costs $c$ that are active when trade costs are $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$. Then, if there are adjustments in the extensive margin and $\overline{\pi}^{**}_H \leq \overline{\pi}^{*}_H$: $p^{**}_{jH}(c)$, $q^{**}_{jH}(c)$, $m^{**}_{jH}(c)$ and $\mu^{**}_{jH}(c)$ are lower relative to the equilibrium with $\boldsymbol{\tau}^{*}{}_{\cdot H}$.*

**Proof of Proposition B.11**. By Proposition 6.3, we know that $p_H^{\max *} > p_H^{\max **}$. Thus, the effects on prices, quantities and markups follow by Lemma A.12. ■

# C Magnitude of the IC Channel

Proposition 4.1 states that the IC channel is inactive when MIEs are ex-ante homogeneous. In addition, by Proposition 4.2, when MIEs are ex-ante heterogeneous, the IC channel is reactivated. Nonetheless, we have not investigated the magnitude of the IC channel according to the degree of MIEs' heterogeneity. This is the focus of this appendix.

The main result we prove is that the effect on the choke price from the IC channel is mitigated when MIEs are less heterogeneous. Furthermore, even though the whole distribution of productivity matters when the IC channel is active, the degree of heterogeneity of MIEs plays a distinctive role: when their heterogeneity is small, the effect on the choke price is also negligible.

We consider a CIC model with a small economy $H$, where $D_H^\omega$ for $\mathcal{E}$ is degenerate, firm-specific, and determines an atomless distribution at the group level. To account for more generality, we dispense with the partition of firms considered in Section 3.3. Instead, we suppose that in $H$ there are two possible distributions of marginal costs at the country level. The cdfs of each are denoted by $\underline{\underline{G}}_H$ or $\overline{\overline{G}}_H$. In terms of notation, for any variable $\cdot$ we denote its corresponding equilibrium value under each distribution by $\underline{\underline{\cdot}}$ and $\overline{\overline{\cdot}}$, respectively. The distributions are such that, for $c \leq c^{**}_{HH}$, both are identical with cdf $\underline{\underline{G}}_H = \overline{\overline{G}}_H =: G_H$ and density $g_H$. On the other hand, for $c \in [c^{**}_{HH}, \kappa]$, where $\kappa < \overline{c}_H$ and $\kappa > \max\left\{\underline{\underline{c}}^{*}_{HH}, \overline{\overline{c}}^{*}_{HH}\right\}$, we suppose that $\overline{\overline{g}}_H(c) > \underline{\underline{g}}_H(c)$.[20] The notation for the bounds of the distributions are consistent with assumptions that we state below, where $\overline{\overline{g}}_H(c)$ and $\underline{\underline{g}}_H(c)$ correspond to the densities of MIEs for the trade shocks under analysis.

Intuitively, the fact that $\overline{\overline{g}}_H(c) > \underline{\underline{g}}_H(c)$ for $c \in [c^{**}_{HH}, \kappa]$ means that MIEs are more concentrated when the cdf is $\overline{\overline{G}}_H$. Therefore, under the distribution $\overline{\overline{G}}_H$, the firms are less heterogeneous. In the limit, when $\overline{\overline{g}}_H$ is the Dirac Delta function, the distribution would be degenerate and MIEs homogeneous.

In the following proposition, we consider trade costs $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ such that $\tau^*_{jH} > \tau^{**}_{jH}$ for each $j \neq H$. To ensure that any difference in the outcomes stems from the behavior of MIEs, we suppose that $\boldsymbol{\tau}^{**}_{\cdot H}$ is such that the marginal-cost cutoff of domestic firms is given by $c^{**}_{HH}$. In that way, $H$ is identical under both distributions of marginal costs when trade costs are $\boldsymbol{\tau}^{**}_{\cdot H}$.

[20] Implicitly, this is valid by supposing that there is a set of inactive firms under both equilibria such that we can shift the distribution, without affecting the distribution of firms that are active in each equilibrium.

**Proposition C.1**

*Consider a world economy with an arbitrary number of countries, where $H$ is a small economy. Suppose a CIC model under monopolistic competition with two possible cdfs of marginal costs at the country level given by $\underline{\underline{G}}_H$ and $\overline{\overline{G}}_H$ defined as above. Consider trade costs $\boldsymbol{\tau}^*_{\cdot H}$ and $\boldsymbol{\tau}^{**}_{\cdot H}$ such that $\tau^*_{jH} > \tau^{**}_{jH}$ for each $j \neq H$ such that the marginal-cost cutoff of domestic firms under $\boldsymbol{\tau}^{**}_{\cdot H}$ is $c^{**}_{HH}$. Then, $\left|\Delta \overline{\overline{p}}^{\max}_H\right| < \left|\Delta \underline{\underline{p}}^{\max}_H\right|$ where $\Delta p^{\max}_H := p^{\max\,**}_H - p^{\max\,*}_H$.*

**Proof of Proposition C.1**. We denote the equilibrium values for each vector of trade costs by superscripts $*$ and $**$ respectively. By assumption, when trade costs are $\boldsymbol{\tau}^{**}_{\cdot H}$, the distributions of marginal costs corresponding to active firms are the same under $\underline{\underline{G}}_H$ and $\overline{\overline{G}}_H$. Therefore, the equilibrium condition (MS) is

$$\overline{M}_H \int_{\underline{c}_H}^{c^{**}_{HH}} \left(p^{\max\,**}_H - c\right) g_H(c)\,\mathrm{d}c + \Phi_{-H}\left(p^{\max\,**}_H; \boldsymbol{\tau}^{**}_{\cdot H}\right) = 2\left(\alpha_H - p^{\max\,**}_H\right)\beta_H, \tag{31}$$

which determines that $p^{\max\,**}_H$ and $c^{**}_{HH}$ are the same under $\underline{\underline{G}}_H$ and $\overline{\overline{G}}_H$.

Suppose now that trade costs are $\boldsymbol{\tau}^*_{\cdot H}$. Condition (MS) for each distribution is, respectively,

$$\overline{M}_H\left[\int_{\underline{c}_H}^{c^{**}_{HH}} \left(\overline{\overline{p}}^{\max\,*}_H - c\right) g_H(c)\,\mathrm{d}c + \int_{c^{**}_{HH}}^{\overline{\overline{c}}^*_H} \left(\overline{\overline{p}}^{\max\,*}_H - c\right) \overline{\overline{g}}_H(c)\,\mathrm{d}c\right] + \Phi_{-H}\left(\overline{\overline{p}}^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right) = 2\left(\alpha_H - \overline{\overline{p}}^{\max\,*}_H\right)\beta_H,$$
$$\overline{M}_H\left[\int_{\underline{c}_H}^{c^{**}_{HH}} \left(\underline{\underline{p}}^{\max\,*}_H - c\right) g_H(c)\,\mathrm{d}c + \int_{c^{**}_{HH}}^{\underline{\underline{c}}^*_H} \left(\underline{\underline{p}}^{\max\,*}_H - c\right) \underline{\underline{g}}_H(c)\,\mathrm{d}c\right] + \Phi_{-H}\left(\underline{\underline{p}}^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right) = 2\left(\alpha_H - \underline{\underline{p}}^{\max\,*}_H\right)\beta_H,$$

and they imply that

$$\begin{aligned}\overline{M}_H&\left[\int_{\underline{c}_H}^{c^{**}_{HH}} \left(\overline{\overline{p}}^{\max\,*}_H - c\right) g_H(c)\,\mathrm{d}c + \int_{c^{**}_{HH}}^{\overline{\overline{c}}^*_H} \left(\overline{\overline{p}}^{\max\,*}_H - c\right) \overline{\overline{g}}_H(c)\,\mathrm{d}c\right] + \Phi_{-H}\left(\overline{\overline{p}}^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right) + 2\beta_H \overline{\overline{p}}^{\max\,*}_H = \\ \overline{M}_H&\left[\int_{\underline{c}_H}^{c^{**}_{HH}} \left(\underline{\underline{p}}^{\max\,*}_H - c\right) g_H(c)\,\mathrm{d}c + \int_{c^{**}_{HH}}^{\underline{\underline{c}}^*_H} \left(\underline{\underline{p}}^{\max\,*}_H - c\right) \underline{\underline{g}}_H(c)\,\mathrm{d}c\right] + \Phi_{-H}\left(\underline{\underline{p}}^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right) + 2\beta_H \underline{\underline{p}}^{\max\,*}_H.\end{aligned} \tag{32}$$

Next, we show that $\overline{\overline{p}}^{\max\,*}_H > \underline{\underline{p}}^{\max\,*}_H$ and $\overline{\overline{p}}^{\max\,*}_H = \underline{\underline{p}}^{\max\,*}_H$ lead us to a contradiction. Suppose that $\overline{\overline{p}}^{\max\,*}_H > \underline{\underline{p}}^{\max\,*}_H$. By condition (ZCP), $\underline{\underline{c}}^*_{HH} = \underline{\underline{p}}^{\max\,*}_H - \xi_{HH}$ and $\overline{\overline{c}}^*_{HH} = \overline{\overline{p}}^{\max\,*}_H - \xi_{HH}$, which implies that $\overline{\overline{c}}^*_{HH} > \underline{\underline{c}}^*_{HH}$. Since $\frac{\partial \Phi^*_{jH}}{\partial p^{\max}_H} > 0$ for each $j \neq H$, then $\Phi_{-H}\left(\overline{\overline{p}}^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right) > \Phi_{-H}\left(\underline{\underline{p}}^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right)$. Finally, by assumption, $\overline{\overline{g}}_H(c) > \underline{\underline{g}}_H(c)$ for $c \in [c^{**}_{HH}, \kappa]$. But then the LHS of (32) is always greater than the RHS and the equality cannot hold.

Now consider that $\overline{\overline{p}}^{\max\,*}_H = \underline{\underline{p}}^{\max\,*}_H =: p^{\max\,*}_H$. This implies that $\overline{\overline{c}}^*_{HH} = \underline{\underline{c}}^*_{HH} =: c^*_{HH}$ and the equality in (32) can only hold if $c^{**}_{HH} = c^*_{HH}$ since $\overline{\overline{g}}_H > \underline{\underline{g}}_H$. This determines that $p^{\max\,**}_H = p^{\max\,*}_H$. But, if that is the case, then

$$\overline{M}_H\left[\int_{\underline{c}_H}^{c^{**}_{HH}} \left(p^{\max\,*}_H - c\right) g_H(c)\,\mathrm{d}c\right] + \Phi_{-H}\left(p^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right) = \overline{M}_H \int_{\underline{c}_H}^{c^{**}_{HH}} \left(p^{\max\,**}_H - c\right) g_H(c)\,\mathrm{d}c + \Phi_{-H}\left(p^{\max\,**}_H; \boldsymbol{\tau}^{**}_{\cdot H}\right). \tag{33}$$

The first terms on each side are equal since $p^{\max\,**}_H = p^{\max\,*}_H$. But then, since $\frac{\partial \Phi^*_{jH}}{\partial \tau_{jH}} < 0$ for each $j \neq H$, we have that $\Phi_{-H}\left(p^{\max\,**}_H; \boldsymbol{\tau}^{**}_{\cdot H}\right) > \Phi_{-H}\left(p^{\max\,*}_H; \boldsymbol{\tau}^*_{\cdot H}\right)$. Therefore, (33) cannot hold with equality, which is a contradiction. Thus, $\overline{\overline{p}}^{\max\,*}_H < \underline{\underline{p}}^{\max\,*}_H$.■

# D Simulations

In this appendix, we show how to compute the equilibrium of a CIC model under different productivity distributions. We demonstrate the approach by using numerical exercises that quantify the domestic effects from tougher IC in a small economy. We also make use of these illustrations to compare the mechanism of adjustment under different assumptions regarding the MIEs.

## D.1 Monopolistic Competition

Unlike the main part of the paper, we do not assume that there is a partition of firms in terms of insiders, entrants, and non-active firms. Rather, we establish a productivity distribution which distinguishes between always-active firms and the rest. This partition serves two purposes. First, it demonstrates how versatile the CIC model is. This is accomplished by showing that the model remains tractable even allowing for productivity distributions displaying different properties along its support. Second, it illustrates how sensitive the IC channel is to assumptions that only affect the MIEs' productivity distribution, rather than the whole group $\mathcal{E}$.

We present two types of results. First, we consider the distribution at the country level from Appendix C to demonstrate Proposition C.1. After this, we consider the scenario outlined in Section 4.3, where MIEs have a productivity distribution consisting of several mass points. This enables us to describe in a unified way the adjustment process when MIEs are homogeneous or heterogeneous.

In all the cases, we consider that each firm obtains a productivity draw from a degenerate distribution. Thus, we do not need to make any ex-ante qualification when referring to the MIEs' features.

### D.1.1 Continuous Productivity Distributions

To apply the results of Proposition C.1, we compare the outcomes for several domestic productivity distributions defined as in Appendix C. They have the property of coinciding for the set of active firms but differing for those which are inactive. Specifically, we suppose that the distribution is Pareto for active firms and uniform for the rest.

To implement the conditions of the proposition, it is necessary to ensure that, before the trade shock, the set of active firms for the different distributions is the same and coincides with the portion that has a Pareto distribution. We achieve this by calibrating the trade costs of the foreign firms such that, initially, the domestic distributions for active firms are identical. Then, we consider increases in trade costs so that the behavior of the domestic economy in each case differs exclusively by the productivity distribution of the MIEs.

Also, the use of a uniform distribution allows us to measure the degree of heterogeneity of MIEs through the length of the support. Thus, we refer to it as the index of heterogeneity and denote it by $l_{me}$. For a given measure of firms, a greater length determines that the levels of productivity are more dispersed and, hence, MIEs more heterogeneous.

**Algorithm Description.**

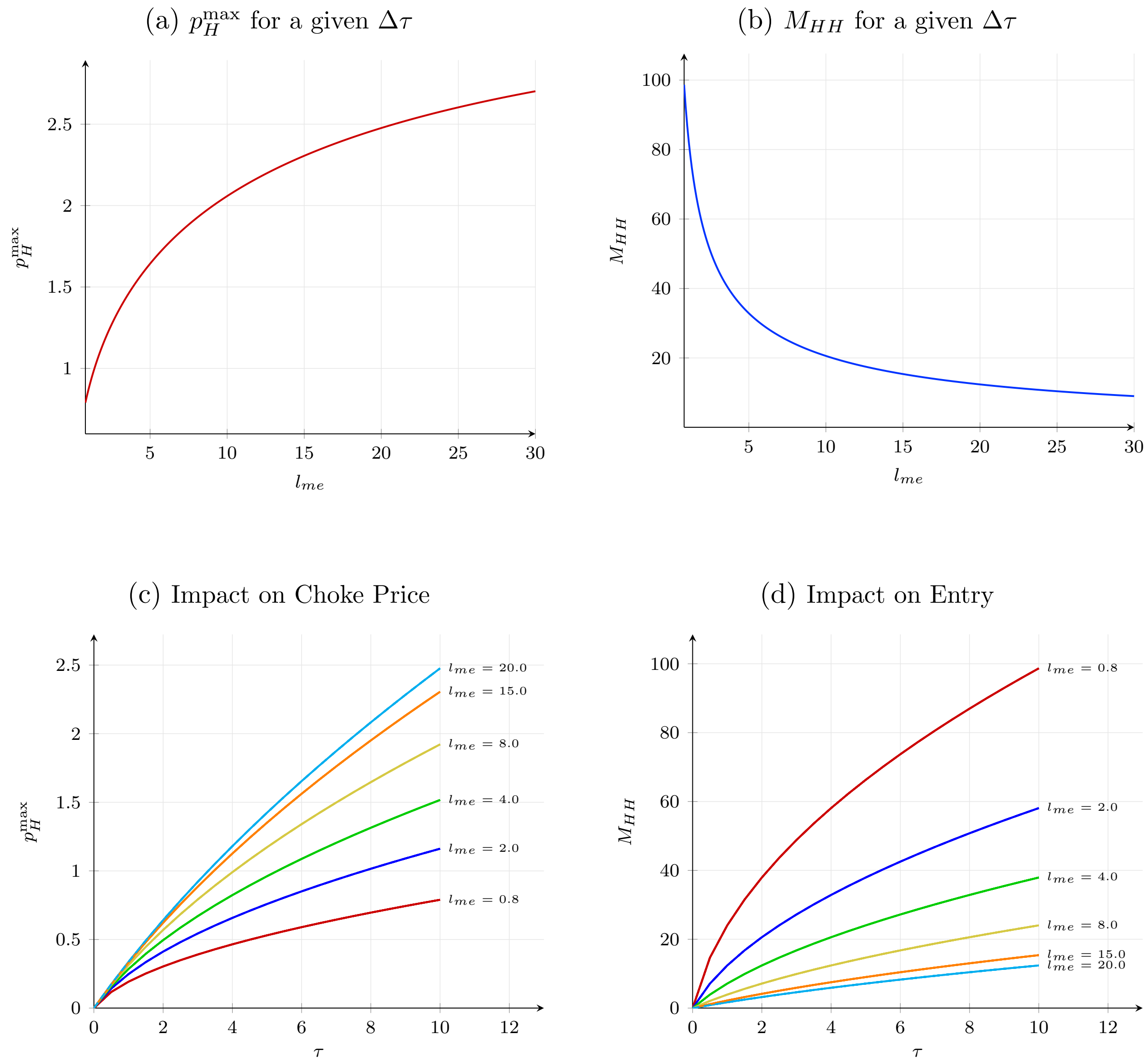
[1] Break down the distribution of domestic firms into always-active firms and the rest of the firms. Set a function that returns the trade costs which make all the firms in the group with a Pareto distribution serve the market, while ensuring the rest of the firms are inactive.

[2] Set a vector of trade costs greater than the value obtained in the previous step. Create a function that, for some $l_{me}$, calculates the equilibrium at the market stage for all the values of trade costs.

[3] Set a vector of values for $l_{me}$ and create a function that returns the equilibrium for this vector.

We present the results of the simulations and then proceed to its analysis.

Figure 7: *Unilateral Liberalization in a Small Economy: Monopolistic Competition with a Continuous Distribution*




**Note**: $l_{me}$ refers to the length of the uniform distribution. In Figures 7c and 7d, the choke price and measure of domestic MIEs are normalized by expressing them as a difference relative to its initial value.

The figures allow us to illustrate several results pertaining to the choke price and entry. First, consider Figures 7a and 7b. They refer to a specific variation in trade costs, allowing for the index of heterogeneity to change. Figure 7a presents the impact on the choke price, while Figure 7b depicts the effect on the measure of MIEs. They reveal that, in terms of adjustments, there is an inverse relation between these two variables. When MIEs become less heterogeneous (i.e., $l_{me}$ is lower and, so, the levels of productivity are less dispersed), the intensity of adjustment in terms of the choke price is diminished. Consequently, the competitive environment is less affected and the model adjusts more intensively in terms of the extensive margin.

Consider now Figure 7c and Figure 7d. They capture the outcomes when a vector of trade-costs variations is considered. The different lines correspond to different degrees of heterogeneity measured through $l_{me}$. From them, we can infer two conclusions. First, by comparing the curves in each figure, we can appreciate that they follow the opposite ordering. This is consistent with the relationships depicted in Figures 7a and 7b. Second, when the MIEs start to have a low degree of heterogeneity, the impact on the mass of MIEs becomes quite pronounced. In particular, the change is greater for variations between $l_{me} = 0.8$ and $l_{me} = 2.0$, relative to the variations between $l_{me} = 15$ and $l_{me} = 20$. If we shrink the length of the uniform distribution until $l_{me} \to 0$, the adjustment completely takes place through the extensive margin. However, this case cannot be depicted given the problems of numerical convergence that arise when we try to simulate it. For this reason, we relegate to Appendix D.1.2 the demonstration of this case, where we compare economies with productivity distributions that exhibit mass points.

### D.1.2 Productivity Distributions With Mass Points

In this part, we modify the productivity distribution for MIEs, while other aspects remain as in Appendix D.1.1. We suppose that the set of inactive firms can be partitioned into several non-zero measure groups where, within each of them, firms share the same productivity. Formally, this is reflected by assuming that firms within each subset obtain productivity draws from a degenerate distribution.

This type of distribution determines that, depending on the magnitude of the shock to trade costs, MIEs can be homogeneous or heterogeneous. On the one hand, MIEs are homogeneous when increases in trade costs are small enough (or the subset of the most productive firms among MIEs is big enough) so that all of the adjustment takes place within one particular group. On the other hand, MIEs are heterogeneous when the same shock induces entry of firms coming from more than one group of inactive firms. Thus, this distribution allows us to reflect in a unified way how the process of adjustment occurs when MIEs are homogeneous or heterogeneous.

For the numerical exercise, we define several distributions of marginal costs distinguished by a parameter $c_m$. This parameter indicates the difference of marginal costs between subsets of inactive firms, such that a greater value of $c_m$ corresponds to a scenario with more heterogeneity across firms. Due to this, in this experiment, $c_m$ becomes the index of heterogeneity.

Unlike the exercise considered in Appendix D.1.1, the simulations we present here avoid any convergence issues. In this way, we are able to show that the relation between heterogeneity of MIEs and the impact on the choke price is smooth and collapses to a zero effect when MIEs are homogeneous (i.e., when $c_m = 0$).

**Outline of the Algorithm.**

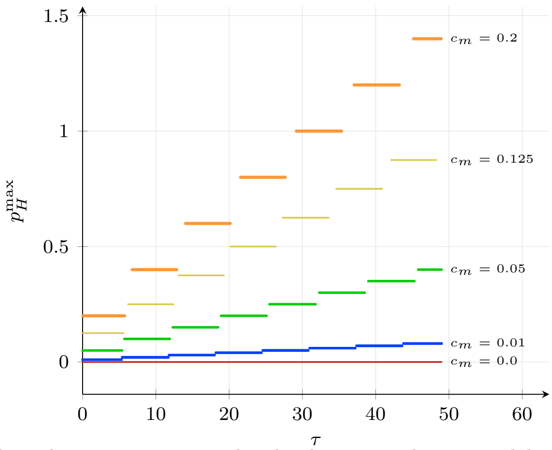
[1] Break down the distribution of domestic firms into always-active firms and the rest of the firms. Set a function that returns the trade costs which make all the firms in the group with a Pareto distribution serve the market, while the rest of the firms inactive.

[2] Set a vector of trade costs greater than the value obtained in the previous step. Create a function that calculates the equilibrium for each vector of trade costs and distribution of inactive firms, where the distributions differ according to the value of $c_m$. The calculation of the equilibrium for a specific variation of trade costs involves two steps. First, order the groups of inactive firms from the most to the least productive. Start by assuming that the equilibrium is given by entry of the first group. Calculate the measure of firms belonging to that group which would restore the equilibrium. If the measure is lower than the actual measure of potential firms within that group, the outcome constitutes an equilibrium. If the measure is greater, then consider an equilibrium with firms belonging to the second group. Iterate until there is convergence.

In Figure 8, we include only equilibrium values in which there is a positive measure of firms having zero profits.[21] The different lines in the graph correspond to different magnitudes of $c_m$.

[21] In other words, since we want to focus on the channels arising in standard models of monopolistic competition, we consider equilibria where the MIEs profits channel is inactive.

Figure 8: *Unilateral Liberalizations in a Small Economy: Monopolistic Competition with Mass Points*




**Note**: The choke price and trade costs are normalized relative to their initial levels. Only points where zero profits hold are considered.

Consider one of the lines with $c_m > 0$. An increase in inward trade costs leads to a shortage of supply. Under the presence of mass points, the model begins to adjust by entry of firms with the same productivity, among the group of the most-productive inactive ones. This occurs without any variation in the choke price, explaining the horizontal portions of the line.

When the variation in the measure of firms of that group is not capable of restoring the equilibrium, the choke price has to rise in order to further increase the quantity supplied. This is achieved through active firms increasing their quantity supplied as well as the entry of additional firms. In particular, the latter occurs via entry from the second group of most-productive inactive firms. In terms of the graph, this is reflected by each line exhibiting a stepped pattern.

The graph also clearly shows the implications of Proposition C.1: the lower the heterogeneity of the MIEs (i.e., the lower $c_m$), the lower the impact on the choke price. Furthermore, in the limit with $c_m = 0$, firms become homogeneous and all of the adjustment is through the mass of MIEs, with no impact on market conditions.

## D.2 Cournot Competition

Here, we provide further details of the numerical exercise in Section 2 corresponding to the Cournot model. We describe the algorithm to compute the equilibrium and present some additional figures.

The search for the equilibrium exploits the monotonicity of profits in $p_H^{\max *}$ (by Lemma A.14), the monotonicity of $p_H^{\max *}$ in $N_H$ (by Lemma A.16), and the order of profits (by Lemma A.17). The algorithm applied to a domestic country $H$ is as follows.

**Outline of the Algorithm.**

[1] Define the marginal costs (inclusive of trade costs) for all the potential firms across the world. Order the firms from the lowest to the greatest cost to serve market $H$.

[2] Establish a function for $H$ as in (NE-BF) which returns the total quantities in $H$ for a given a number of firms $N$.

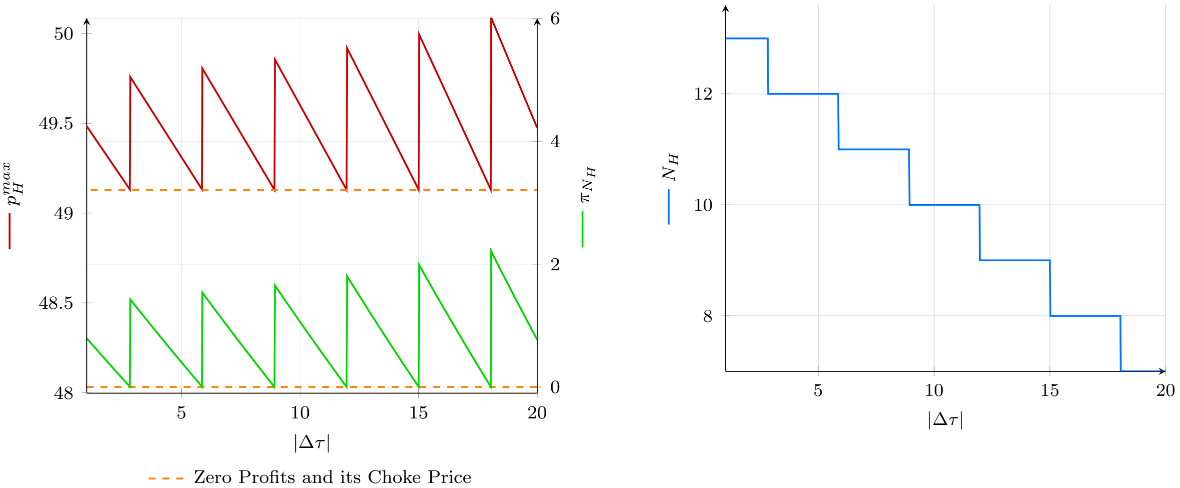
[3] Given an initial number of firms $N_0$, such that the least-productive firm has positive profits, then iterate (i.e., set $N_{j+1} = N_j + 1$) until the last entrant obtains negative profits. The equilibrium number of firms $N^*$ is given by $N^* = N_k - 1$, if this condition is triggered after $k$ iterations. Alternatively, if the least-productive firm has negative profits with $N_0$ firms, then iterate (i.e., set $N_{j+1} = N_j - 1$) until the last entrant obtains positive profits. In this case, $N^* = N_k$.

To simplify the analysis and ensure that foreign firms are always active, the results are presented under the assumption that these firms constitute the set of most-productive ones in the country. Thus, the analysis is conducted as if it were a closed economy where the firms with lowest marginal costs are always active.

Figure 9 and Figure 10 expand upon Figure 4 by illustrating how variations in trade costs impact entry for the case of homogeneous and heterogeneous last entrants, respectively.

Figure 9: *Unilateral Liberalizations in a Small Economy: Cournot with Homogeneous Last Entrants*

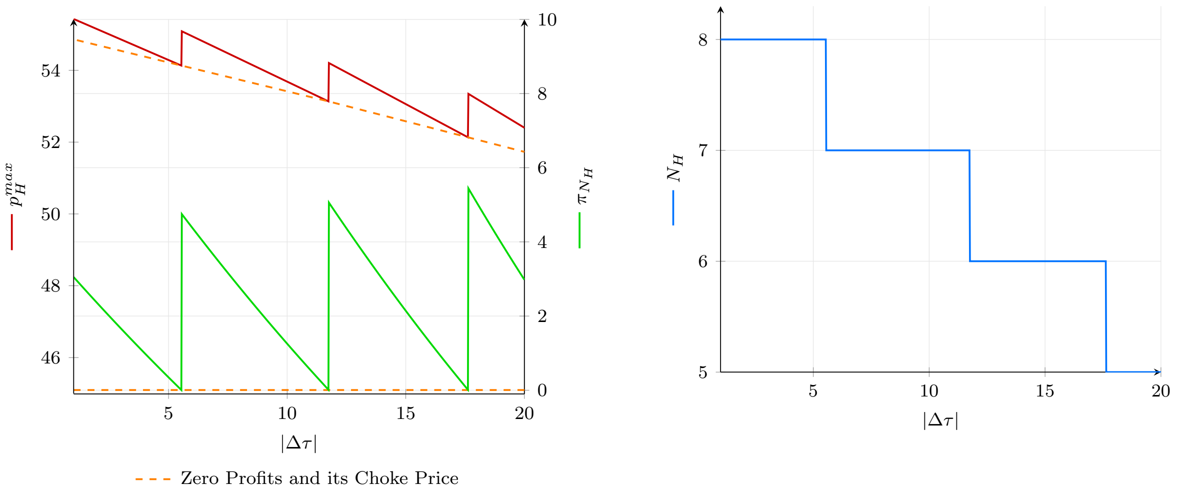
(a) Impact on Choke Price (b) Impact on Entry




**Note**: $\pi_{N_H}$ refers to the profits of the last entrant, and $N_H$ refers to the total number of active firms in the market.

Figure 10: *Unilateral Liberalizations in a Small Economy: Cournot with Heterogeneous Last Entrants*

(a) Impact on Choke Price (b) Impact on Entry




**Note**: $\pi_{N_H}$ refers to the profits of the last entrant, and $N_H$ refers to the total number of active firms in the market.

# E Existence and Uniqueness of the Equilibrium

In this appendix, we sketch some arguments to have uniqueness of the equilibrium in the CIC model when $H$ is a small country.[22] We also outline arguments for the existence of an equilibrium. For monopolistic competition, we consider a scenario where MIEs belong to $\mathcal{E}$ and break even.

Consider a country $H$. Irrespective of the CIC model under consideration, the set of choke prices is compact. To see this, by definition, $p_H^{\max}(\mathbb{Q}_j) := \alpha_H - \eta_H \mathbb{Q}_H$. Thus, $p_H^{\max} \in \left[\underline{p}_H^{\max}, \alpha_H\right]$. Moreover, since $\underline{p}_H^{\max}$ is nonnegative, we can suppose that $\underline{p}_H^{\max} := 0$.

Consider the degenerate CIC model. For country $H$, a solution requires that we find a $p_H^{\max *}$ such that condition (MS) holds. When $p_H^{\max} = \alpha_H$, then $\sum_{j\in\mathcal{C}} \Phi_{jH}(p_H^{\max};\tau_{jH}) > 2\beta_H(\alpha_H - p_H^{\max}) = 0$, and, when $p_H^{\max} = \underline{p}_H^{\max *}$, we can assume that $\alpha_H$ is high enough such that $\sum_{j\in\mathcal{C}} \Phi_{jH}(p_H^{\max};\tau_{jH}) + 2\beta_H p_H^{\max} < 2\beta_H\alpha_H$. Thus, since $\Phi_{jH}(\cdot;\tau_{jH})$ is continuous, a solution exists by the Intermediate Value Theorem. Moreover, given that $\frac{\partial \Phi_{jH}^*}{\partial p_H^{\max *}} > 0$, the solution is unique. Once that $p_H^{\max *}$ is determined, the rest of the equilibrium variables can be identified.

For the group-specific CIC model, uniqueness requires that there is a unique $p_H^{\max *}$ that satisfies (1) for $H$, and a unique $M_H^{\mathcal{E}*}$ that satisfies (MS) for $H$ given the optimal $p_H^{\max *}$. Regarding the former condition, the expected domestic profits of a firm belonging to $\mathcal{E}$ are $\widetilde{\pi}_{HH}^{\mathcal{E}}(p_H^{\max}) := \int_{\underline{c}_H^{\mathcal{E}}}^{p_H^{\max} - \xi_{HH}} \left[\frac{(p_H^{\max} - c)^2}{4\gamma_H} - f_{HH}\right] \mathrm{d}G_H(c)$ and satisfy that $\frac{\partial \widetilde{\pi}_{HH}^{\mathcal{E}}(p_H^{\max})}{\partial p_H^{\max}} = \int_{\underline{c}_H}^{p_H^{\max} - \xi_{HH}} \left(\frac{p_H^{\max} - c}{2\gamma_H}\right) \mathrm{d}G_H(c) > 0$. Given the monotonicity of the expected profits, if the equilibrium exists, $p_H^{\max *}$ is unique. For existence of $p_H^{\max *}$, typical arguments can be applied. Since $\widetilde{\pi}_{HH}^{\mathcal{E}}$ is continuous, we can suppose parameters values such that $\widetilde{\pi}_{HH}^{\mathcal{E}}\left(\underline{p}_H^{\max}\right) < F_H^E$ and $\widetilde{\pi}_{HH}^{\mathcal{E}}(\alpha_H) > F_H^E$. Then, the result would follow by applying the Intermediate Value Theorem. In addition, given the value $p_H^{\max *}$ that satisfies (1) and $\overline{M}_H^{\mathcal{E}}$ is monotone (MS), we know that there is a unique $M_H^{\mathcal{E}*}$ that satisfies (MS). Existence of this value would be obtained by defining conditions on the parameters such that we can always apply the Intermediate Value Theorem to (MS).

Regarding the Cournot model, the equilibrium at the market stage requires us to find a $\mathbb{Q}_H^*$ such that (NE-BF) holds for a given number of active firms from each country $j \in \mathcal{C}$. Let $\mathcal{F}_H(\mathbb{Q}_H; \boldsymbol{\tau}_{\cdot H}) := \sum_{j\in\mathcal{C}} \sum_{\omega\in\Omega_{jH}} \frac{\alpha_H - c_\omega - \tau_{jH} - \eta_H\mathbb{Q}_H}{2\gamma_H + \eta_H}$. At $\mathbb{Q}_H = 0$, we have that $\mathcal{F}_H(0; \boldsymbol{\tau}_{\cdot H}) > 0$. Moreover, we can always define a $\overline{\mathbb{Q}}_H$ such that $\mathcal{F}_H\left(\overline{\mathbb{Q}}_H; \boldsymbol{\tau}_{\cdot H}\right) < \overline{\mathbb{Q}}_H$ (for instance, we can accomplish this by assuming that $\alpha_H$ is large enough). Then, the $\mathbb{Q}_H^*$ that constitutes a fixed point of $\mathcal{F}$ would exist. Moreover, $\frac{\partial \mathcal{F}_H(\mathbb{Q}_H;\boldsymbol{\tau}_{\cdot H})}{\partial \mathbb{Q}_H} = \sum_{j\in\mathcal{C}} \sum_{\omega\in\Omega_{jH}} \frac{-\eta_H}{2\gamma_H + \eta_H}$ and so $\frac{\partial \mathcal{F}_H(\mathbb{Q}_H;\boldsymbol{\tau}_{\cdot H})}{\partial \mathbb{Q}_H} < 0$, which implies that the solution is unique, since $\frac{\partial \mathcal{F}_H(\mathbb{Q}_H;\boldsymbol{\tau}_{\cdot H})}{\partial \mathbb{Q}_H} - 1 < 0$. It remains to show that the number of firms from $j \in \mathcal{C}$ that are serving $H$ is unique. By applying Lemma A.16 under $\boldsymbol{\tau}''_{\cdot H} = \boldsymbol{\tau}'_{\cdot H}$, we know that $\mathbb{Q}$ is strictly increasing in the number of firms. In turn, profits are strictly increasing in $\mathbb{Q}$. Hence, given that the number of firms is determined by condition (FE-BF), the equation has at most one solution. If we assume that $\alpha_H$ is big enough, so that when there is only one active firm this has positive profits, then the solution would exist.

# F Pareto Distribution

In this appendix, we illustrate how the decomposition of effects into channels can be applied in a setup with a particular productivity distribution. Specifically. we consider a model with assumptions as in Melitz and Ottaviano (2008). In addition to the functional form of the demand, this requires some symmetry assumptions on both the supply and the demand side and the incorporation of iceberg trade costs.

The setup consists of a set $\mathcal{C} := \{H, F\}$ of countries with market structures à la Melitz. We do not specify whether these countries are small or large since we derive results for both cases.

[22] With large economies, uniqueness requires assumptions on the signs of the determinants of the systems of equations. Some of these conditions were incorporated in the different propositions of the main part of the paper since they were needed for comparative statics exercises.

Regarding the demand side, preferences are homogeneous among countries. This entails that the parameters $\alpha_i, \gamma_i$ and $\eta_i$ become $\alpha, \gamma$ and $\eta$, respectively. Moreover, we allow for the possibility of differences in market size, measured through the mass of agents $L_i$ in $i$.

Concerning the supply side, the productivity in each country is given by the same Pareto distribution with a shape parameter $k$. Hence the cdf of marginal costs is given by $G(c) := \left(\frac{c}{c_M}\right)^k$, with density $g(c) := \frac{k}{c}\left(\frac{c}{c_M}\right)^k$, where $c \in [0, c_M]$ and $k \geq 1$. This determines that $M_{ij} = M_i^E \rho_{ij} \left(\frac{p_j^{\max}}{c_M}\right)^k$, where $M_i^E$ is the mass of firms that pay the entry cost and $\rho_{ij} := (\tau_{ij})^{-k}$.

Given a Pareto distribution, the expected profits of a firm from $i$ in $j$ are

$$\widetilde{\pi}_{ij}\left(p_j^{\max}; \tau_{ji}\right) = \frac{L_j}{\gamma} \frac{\rho_{ij}}{\psi} \left(p_j^{\max}\right)^{k+2},$$

where $\psi := 2\left(c_M\right)^k (k+1)(k+2)$. We suppose that $\frac{L_i}{\gamma}\left(c_M\right)^2 > 2(k+1)(k+2)$ to ensure that the marginal-cost cutoff of serving each country is greater than $c_M$.

For each $i \in \mathcal{C}$, the equilibrium conditions become:

$$F^E \psi \gamma = \sum_{j \in \mathcal{C}} L_j \rho_{ij} \left(p_j^{\max *}\right)^{k+2}, \tag{34}$$

$$\sum_{j \in \mathcal{C}} M_j^{E*} \rho_{ji} \left(\frac{k+2}{\psi}\right) \left(p_i^{\max *}\right)^{k+1} = \beta\left(\alpha - p_i^{\max *}\right). \tag{35}$$

The system of equations (34) determines functions $p_i^{\max}\left(p_j^{\max}; \tau_{ij}\right)$ for each $i, j \in \{H, F\}$ with $i \neq j$, such that

$$\left[p_i^{\max}\left(p_j^{\max}; \tau_{ij}\right)\right]^{k+2} = \frac{\gamma F^E \psi - L_j \rho_{ij} \left(p_j^{\max}\right)^{k+2}}{L_i}. \tag{36}$$

From (36), we get that $\frac{\partial \ln p_i^{\max *}}{\partial \ln p_j^{\max}} = -\frac{L_j}{L_i} \rho_{ij} \left(\frac{p_j^{\max *}}{p_i^{\max *}}\right)^{k+2}$ and $\frac{\partial \ln p_j^{\max *}}{\partial \ln \tau_{ji}} = \frac{k}{k+2} \frac{L_i}{L_j} \left(\frac{p_i^{\max *}}{p_j^{\max *}}\right)^{k+2}$, with a multiplier effect given by $\lambda = \left(1 - \rho_{HF}\rho_{FH}\right)^{-1}$.

Making use of these calculations, we proceed to identify the effects on the choke price from unilateral liberalizations under small and large open economies. Specifically, we consider a decrease in $\tau_{FH}$ and focus on the impact on $H$. We omit the arguments of the functions $p_i^{\max}$ to keep the notation simple.

**Two Large Countries**. When $H$ and $F$ are both large, the total effect on each choke price is given by:

$$\begin{aligned}
\frac{\mathrm{d} \ln p_H^{\max *}}{\mathrm{d} \ln \tau_{FH}} &= \lambda \frac{\partial p_H^{\max *}}{\partial p_F^{\max}} \frac{\partial p_F^{\max *}}{\partial \tau_{FH}} \\
&= -\frac{\rho_{HF}}{1 - \rho_{HF}\rho_{FH}} \frac{k}{k+2} < 0, \\
\frac{\mathrm{d} \ln p_F^{\max *}}{\mathrm{d} \ln \tau_{FH}} &= \lambda \frac{\partial p_F^{\max *}}{\partial \tau_{FH}} \\
&= \frac{1}{1 - \rho_{HF}\rho_{FH}} \frac{k}{k+2} \frac{L_H}{L_F} \left(\frac{p_H^{\max *}}{p_F^{\max *}}\right)^{k+2} > 0.
\end{aligned}$$

Thus, given $d\tau_{FH} < 0$, there are anti-competitive effects in $H$, which follows from the results stated in Section 5.2. The reason is that $\frac{\mathrm{d} \ln p_H^{\max *}}{\mathrm{d} \ln \tau_{FH}}$ is only capturing the effects coming from the ECs channel. These are triggered by the new EOs in $F$, which is the only channel operating in $\frac{\mathrm{d} \ln p_F^{\max *}}{\mathrm{d} \ln \tau_{FH}}$.

**A Small Country** $H$. The effects on the competitive environment when $H$ is a small economy are mathematically equivalent to those obtained for two large countries, but with $\frac{\partial p_F^{\max *}}{\partial p_H^{\max}} = 0$ and $\frac{\partial p_F^{\max *}}{\partial \tau_{HF}} = 0$.

The former implies that $\lambda = 1$. Thus,

$$\begin{aligned}\frac{\mathrm{d}\ln p_H^{\max *}}{\mathrm{d}\ln \tau_{FH}} &= 0 \\ \frac{\mathrm{d}\ln p_F^{\max *}}{\mathrm{d}\ln \tau_{FH}} &= \frac{\partial \ln p_F^{\max *}}{\partial \ln \tau_{FH}} \\ &= \frac{k}{k+2}\frac{L_H}{L_F}\left(\frac{p_H^{\max *}}{p_F^{\max *}}\right)^{k+2},\end{aligned}$$

which reflects that the IC channel is inactive in $H$, as established in Proposition 4.1. In addition, the unilateral liberalization in $H$ represents a shock to the EOs in $F$. Thus, $\frac{\mathrm{d}\ln p_F^{\max *}}{\mathrm{d}\ln \tau_{FH}}$ captures the effect coming exclusively from this channel.

The key difference in $\frac{\mathrm{d}\ln p_F^{\max *}}{\mathrm{d}\ln \tau_{FH}}$ across the two cases considered above stems from the value of $\lambda$. With two large countries, $\lambda > 1$, while $\lambda = 1$ when $H$ is a small economy. This reflects that a reduction in $\tau_{FH}$ with large countries requires a more pronounced decrease in $p_F^{\max *}$ to restore the equilibrium. The reason is given by the feedback effect through $p_H^{\max *}$. This makes a variation in $p_F^{\max *}$ trigger an increase in $p_H^{\max *}$ which, in turn, decreases $p_F^{\max *}$ even more. Once this process converges, it determines that the direct impact is magnified $\frac{1}{1-\rho_{HF}\rho_{FH}}$ times.