Lobbying, Trade, and Misallocation*

Jaedo Choi
Federal Reserve Board

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Abstract

This paper studies how lobbying affects welfare gains from trade in a second-best world. I develop an open economy model of heterogeneous firms that can lobby to influence firm-specific distortions. As trade costs decline, exporters increase lobbying due to the complementarity between market size and lobbying benefits, impacting allocative efficiency, firm entry, and consequently gains from trade. I estimate the model using an IV strategy and indirect inference with US firm-level data. Gains from trade are 4% higher with lobbying, driven by larger improvements in allocative efficiency as more productive exporters increase lobbying, mitigating their initially unfavorable exogenous distortions. However, when selection is driven by exogenous distortions, trade may cause welfare losses exacerbated by lobbying. These findings suggest that firms' micro-level adjustments matter for gains from trade.

Keywords: lobbying, misallocation, gains from trade
JEL Codes: D24, D72, F14

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1. Introduction

The economic consequences of firms' political engagement have received significant attention in both politics and academic research, with the rise of large, politically-active firms.[1] While welfare gains from trade have been a central focus in international trade literature (Arkolakis et al., 2012), little is known about how these gains are affected by firms' political engagement. To address this gap, this paper studies how lobbying—one of the largest forms of firms' political spending (Bombardini and Trebbi, 2020)—influences welfare gains from trade in a second-best world.

The key contribution of this paper is novel quantification of welfare gains from trade in the presence of lobbying. I develop a two-country open-economy model with heterogeneous firms, where misallocation arises from firm-specific distortions consisting of both exogenous components and those endogenously determined by firms' lobbying. Using the model calibrated to US firm-level data, I find that firms' micro-level adjustments in lobbying matter for gains for trade. Gains from trade are 4% higher with lobbying than without, as more productive exporters increase their lobbying, mitigating their initially unfavorable exogenous distortions. However, whether lobbying amplifies or reduces gains from trade depends on which types of firms select into exporting in a second-best world. In an alternative scenario where trade leads to welfare losses due to selection into exporting driven by exogenous distortions, lobbying exacerbates these losses.

In the model, lobbying increases firm-specific distortions, making firms relatively more subsidized. Lobbying entails both variable and fixed costs. Due to the fixed costs, only firms whose additional profits from lobbying exceed these costs engage in lobbying. Firms are heterogeneous along three dimensions: productivity, exogenous distortions, and lobbying efficiency. Higher productivity allows firms to produce at lower costs, while firms with higher exogenous distortions initially receive greater subsidies or face lower taxes. These exogenous distortions represent sources of misallocation not directly affected by lobbying. Firms with greater lobbying efficiency can achieve higher subsidies while incurring lower variable lobbying costs.

Larger firms tend to invest more in lobbying due to the complementary between firm size and lobbying benefits. Openness to trade influences firm lobbying through this complementarity. Lower trade costs induce exporters to increase their lobbying due to increased market size, while non-exporters reduce theirs due to intensified foreign competition. This divergence between exporters and non-exporters impacts allocative efficiency, firm entry, and therefore gains from trade. In a simplified version of the model, I derive an analytical formula for welfare changes due to local iceberg trade cost shocks. Adjustments in firms' lobbying in response to these shocks change their subsidy levels, impacting both aggregate price levels and transfers to households. Consequently, the formula diverges from the standard sufficient statistics formulas proposed by Arkolakis et al. (2012), Melitz

[1] For example, see Drutman (2015) and Zingales (2017). The debate over the influence of special interests on US politics has deep historical roots, as highlighted by President Theodore Roosevelt's 1910 speech criticizing the control of government by business interests (Roosevelt, 1910).

and Redding (2015), and Bai et al. (2024) (henceforth ACR, MR, and BKL).

I construct the main dataset by combining US Compustat balance sheet data with firm lobbying expenditures that became available since the enactment of the Lobbying Disclosure Act (1995). Using this dataset, I estimate the model parameters through an IV strategy and indirect inference. To estimate the parameter governing the elasticity of lobbying on firm-specific distortions, I regress log firm-specific distortions—derived from revenue-based total factor productivity (TFPR)—on log lobbying expenditures, instrumented by state-level, time-varying appointments of a Congress member from the firm's headquarters' state as chairperson of the House or Senate Appropriations Committee. These appointments serve as exogenous shifters of lobbying expenditures because the chairperson wield significant influence over discretionary spending and federal contracts, making them attractive targets for lobbying, and these appointments are typically determined by seniority or unexpected political events, unlikely to be systematically correlated with time-varying economic conditions. The IV estimates indicate that a 1% increase in lobbying expenditures raises firms' subsidies by 0.08%.

I calibrate the remaining parameters using indirect inference, minimizing the distance between model moments and their data counterparts. The estimated parameters reveal a negative correlation between productivity and exogenous distortions, a negative correlation between productivity and lobbying efficiency, and a positive correlation between exogenous distortions and lobbying efficiency. These estimates suggest that more productive firms tend to be initially less subsidized and have lower lobbying efficiency.

Using the calibrated model, I examine how openness to trade affects firm lobbying. When moving from autarky to the current equilibrium with observed import shares, aggregating firms' heterogeneous responses, the overall probability of lobbying decreases by a 0.5 percentage point, driven by less participation from non-exporters. However, average lobbying expenditures increase by 1.75% due to increased lobbying by exporters.

Next, I compare the gains from trade in the presence and absence of lobbying. The gains are 4% larger with lobbying, mostly due to more significant improvements in allocative efficiency. Under the calibrated values, more productive firms initially face lower exogenous subsidies. By increasing lobbying after opening to trade, these firms offset their initially unfavorable subsidies, resulting in greater improvements in allocative efficiency. I also find that the gains predicted by the ACR/MR and BKL formulas understate the true gains by 2.8% and 2.3%, respectively, implying that firms' micro-level adjustments to trade shocks matter for gains from trade.

However, lobbying can also reduce gains from trade. In an alternative scenario where firm selection into exporting is more heavily influenced by exogenous distortions, as examined by Bai et al. (2024), trade results in welfare losses. These losses are further exacerbated by lobbying, as initially more subsidized firms select into exporting and increase their lobbying efforts, making them even more subsidized and worsening resource misallocation in the economy. These findings suggest that whether lobbying amplifies or reduces gains from trade depends on which types of firms select into exporting in a second-best world.

This paper contributes to the literature that studies gains from trade in distorted economies (see, among many others, Levchenko, 2007; Nunn, 2007; Khandelwal et al., 2013; Manova, 2013; Edmond et al., 2015; Święcki, 2017; Berthou et al., 2018; Costa-Scottini, 2021; Chung, 2019; Fajgelbaum et al., 2019; Choi et al., 2024). The most closely related paper is Bai et al. (2024), who investigate gains from trade in the presence of firm-specific exogenous distortions pioneered by Hsieh and Klenow (2009) and Restuccia and Rogerson (2008). I extend their open-economy model by incorporating firm lobbying decisions and find that lobbying makes true gains from trade deviate from the sufficient statistics formulas developed by Arkolakis et al. (2012), Melitz and Redding (2015), and Bai et al. (2024). While Cutinelli-Rendina (2021) and Bombardini et al. (2023) examine the escape competition effects of lobbying in an open economy, this paper focuses on the complementarity between market size and lobbying.

This paper also contributes to the literature on corporate lobbying, as surveyed by Bombardini and Trebbi (2020) (see, among many others, Richter et al., 2009; Bombardini and Trebbi, 2011, 2012; Igan et al., 2012; Blanes i Vidal et al., 2012; Bertrand et al., 2014; Kerr et al., 2014; Kang, 2016; Kim, 2017; Bertrand et al., 2020; García-Santana et al., 2020; Choi et al., 2021). My work is most closely related to Arayavechkit et al. (2017) and Huneeus and Kim (2018), who also model firm-specific distortions as endogenous outcomes of lobbying and quantitatively assess the impact of firms' lobbying on resource misallocation in a closed economy. I extend the model developed by Huneeus and Kim (2018) to an open economy and study gains from trade.

Finally, this paper is related to the literature on politics and trade (see, among many others, Grossman and Helpman, 1994; McLaren, 1997; Goldberg and Maggi, 1999; Gawande and Bandyopadhyay, 2000; Bombardini, 2008; Do and Levchenko, 2009; Bombardini and Trebbi, 2012; Gawande et al., 2012; Celik et al., 2013; Levchenko, 2013; Hennicke and Blanga-Gubbay, 2022; Campante et al., 2023; Bombardini et al., 2023; Blanga-Gubbay et al., forthcoming). See Rodrik (1995) and McLaren (2016) for surveys. I contribute to this literature by studying how firms' political engagement shapes gains from trade.

The remainder of this paper proceeds as follows. Section 2 outlines the theoretical model. Section 3 discusses the data and calibration procedure. Section 4 presents the quantitative results. Section 5 concludes.

2. Theoretical Framework

I construct a general equilibrium heterogeneous firm model with lobbying. The world consists of two large economies, Home and Foreign, which may differ in labor endowment and distributions of firm primitives. Households, immobile across countries, supply labor inelastically.

Households. Representative households in Home choose final goods consumption C to maximize their utility subject to the budget constraint: $PC = wL + \Pi + T$, where P is price of final goods, w is wage, L is labor endowment, Π is dividend income, and T is lump-sum transfer from the government.

Final goods producers. Non-tradable final consumption goods are produced by representative final goods producers under perfect competition using a CES aggregator. Under the CES aggregator, aggregate output Q and price index P take the following forms:

$$Q = \left[\int_{\omega \in \Omega} q(\omega)^{\frac{\sigma-1}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}}, \qquad P = \left[\int_{\omega \in \Omega} p(\omega)^{1-\sigma} \right]^{\frac{1}{1-\sigma}},$$

where σ is the elasticity of substitution ($\sigma > 1$), and $q(\omega)$ and $p(\omega)$ are the quantity demanded and price of variety ω. Ω is an endogenous set of varieties available in Home. Henceforward, ω is suppressed for convenience.

Intermediate goods producers and lobbying. Each intermediate goods producer produces a unique variety, referred to here as a firm. There is a mass of monopolistically competitive firms M, which is endogenous determined by firms' entry and production decisions. There is free entry. Initially identical potential entrants face sunk entry costs f_e in units of labor.

Each firm's production function is linear in labor, with labor the only factor of input for production:

$$y = \phi l, \tag{2.1}$$

where y is output produced, ϕ is productivity, and l is labor input. Production requires fixed costs f in units of labor, so total labor used for production is $y/\phi + f$.

Firms can export after incurring fixed export costs f_x in units of labor (Melitz, 2003) and iceberg costs $\tau_x > 1$, so delivering one unit of a variety to Foreign requires τ_x units. Firms' resource constraints are given by $y = q + x\tau_x q^x$, where x is a binary export status (1 if exporting, 0 otherwise) and $q = (p/P)^{-\sigma} Q$ and $q^x = (p^x/P_f)^{-\sigma} Q_f$ are the demand schedules in Home and Foreign, respectively. Here, P_f and Q_f denote the aggregate price index and output in Foreign. Henceforth, all Foreign aggregate and firm-level variables are denoted with subscript f.

Firms are subject to output distortions τ^y. If $\tau^y > 1$ (or < 1), they are subsidized (or taxed). Output distortions are composed of exogenous and endogenous lobbying components:

$$\tau^y = \begin{cases} \tau b^\theta & \text{if} \quad b > 0 \\ \tau & \text{if} \quad b = 0 \end{cases} \tag{2.2}$$

where b denotes firms' lobbying inputs and τ exogenous distortions drawn from a given distribution. If firms increase their lobbying efforts, they become relatively more subsidized. The parameter θ

governs how effectively lobbying increases output subsidies.[2]

Higher subsidies from lobbying apply to sales in both domestic and foreign markets. Alternatively, lobbying can be interpreted as providing subsidies to all the inputs firms use, as output distortions are equivalent to input distortions. These interpretations reflect real-world scenarios where firms lobby for tax exemptions on their total profits or inputs used (e.g., investment tax credits) or for particular policies more relevant to themselves. These interpretations are also consistent with Arayavechkit et al. (2017), who show that tax-related issues account for the largest share of aggregate lobbying expenditures; Richter et al. (2009), who find that firms with higher lobbying expenditures tend to have lower tax rates; and Bertrand et al. (2020), who find that firms' charitable contributions (a broadly defined form of lobbying) tend to be directed toward politician affiliated with committees that are more relevant to firms' policy interests.

Lobbying incurs variable and fixed costs, both of which are in units of domestic labor. The total labor used for lobbying inputs of b is

$$\kappa \frac{b}{\eta} + f_b, \tag{2.3}$$

where $\kappa b/\eta$ and f_b are variable and fixed costs of lobbying, respectively. κ is a parameter that governs overall levels of the variable costs. η is stochastic firm-specific lobbying efficiency that rationalizes the pattern in the data that small-sized firms participate in lobbying within industry.[3] Firms with higher η incur lower variable costs to achieve the same subsidy level. The fixed lobbying costs can be interpreted as a one-time setup expense required to initiate lobbying activities, such as establishing an in-house legal team for lobbying. Due to the fixed costs, firms engage in lobbying only when additional profits from lobbying exceed these fixed costs, which rationalizes the pattern that only a fraction of firms participate in lobbying (Bombardini, 2008; Kerr et al., 2014).

Firms are heterogeneous along three dimensions: productivity ϕ, exogenous distortions τ, and lobbying efficiency η. A firm-specific vector of primitives, $\boldsymbol{\psi} = (\phi, \tau, \eta)$, is drawn from a joint distribution $G(\boldsymbol{\psi})$ with an arbitrary correlation structure after incurring sunk entry costs. Each draw is independent across firms. Because firms with the same $\boldsymbol{\psi}$ behave identically, I index them by $\boldsymbol{\psi}$.

Conditional on entry, firms take the demand schedules in Home and Foreign as given and maxi-

[2] θ may reflect the quality of institutions or the political system. For example, θ can be higher in countries where corruption is prevalent.

[3] An alternative way of rationalizing small firms' lobbying is by allowing for heterogeneity in fixed lobbying costs. One difference with this approach is that, unlike heterogeneity in fixed lobbying costs that do not enter firm sales, variable lobbying efficiency enters firm sales directly and, therefore, allows for a more flexible fit of the firm size distribution.

mize their profits[4]:

$$\pi = \max_{\substack{\{b,p,p^x,\\ q,q^x,x\}}} \left\{ \tau b^\theta p q - w\frac{q}{\phi} - wf + x\Big(\tau b^\theta p^x q^x - w\frac{\tau_x q^x}{\phi} - wf_x\Big) - w\Big(\kappa\frac{b}{\eta} + f_b\Big) \right\} \times \mathbb{1}[b>0]$$
$$+ \left\{ \tau p q - w\frac{q}{\phi} - wf + x\Big(\tau p^x q^x - w\frac{\tau_x q^x}{\phi} - wf_x\Big) \right\} \times \mathbb{1}[b=0]$$
$$\text{subject to} \quad q = (p/P)^{-\sigma}Q, \quad q^x = (p^x/P_f)^{-\sigma}Q_f, \quad x \in \{0,1\}, \quad (2.4)$$

The first and second lines represent profits from engaging in lobbying and not engaging in lobbying, respectively, with lobbying status represented by indicator functions $\mathbb{1}[b>0]$ and $\mathbb{1}[b=0]$. Under monopolistic competition, firms charge constant mark-ups $\mu = \sigma/(\sigma-1)$ over their marginal costs, which gives pricing formulas of $p = \frac{\mu w}{\phi \tau^y}$ and $p^x = \frac{\mu \tau_x w}{\phi \tau^y}$.

Profits in Home and Foreign conditional on not lobbying (i.e., profits under standard monopolistic competition) are operating profits net of fixed costs:

$$\pi^d(0;\psi) = \underbrace{\frac{1}{\sigma}\Big(\frac{\mu w}{\phi}\Big)^{1-\sigma}\tau^\sigma P^\sigma Q}_{=\tilde{\pi}^d(0;\psi)} - wf \quad \text{and} \quad \pi^x(0;\psi) = \underbrace{\frac{1}{\sigma}\Big(\frac{\mu \tau_x w}{\phi}\Big)^{1-\sigma}\tau^\sigma P^\sigma Q}_{=\tilde{\pi}^x(0;\psi)} - wf_x, \qquad (2.5)$$

Solving for the first order condition with respect to b, profits conditional on lobbying for non-exporters and exporters are expressed as:

$$\begin{aligned} \pi^d(b^d;\psi) &= (1-\theta\sigma)\Big(\frac{\theta\sigma\eta}{\kappa w}\Big)^{\frac{\theta\sigma}{1-\theta\sigma}}\Big(\tilde{\pi}^d(0;\psi)\Big)^{\frac{1}{1-\theta\sigma}} - w(f+f_b) \\ \pi^x(b^x;\psi) &= (1-\theta\sigma)\Big(\frac{\theta\sigma\eta}{\kappa w}\Big)^{\frac{\theta\sigma}{1-\theta\sigma}}\Big(\tilde{\pi}^d(0;\psi) + \tilde{\pi}^x(0;\psi)\Big)^{\frac{1}{1-\theta\sigma}} - w(f+f_x+f_b). \end{aligned} \qquad (2.6)$$

Exporters enjoy discretely larger benefits from lobbying than non-exporters, as these benefits increase with market size. This is captured in the second line of the above expression, where lobbying exponentially amplifies the sum of non-lobbying exporters' operating profits across both markets $(\tilde{\pi}^d(0;\psi) + \tilde{\pi}^x(0;\psi))$, raising it to the power of $\frac{1}{1-\theta\sigma}$.

Because lobbying increases output subsidies for sales in both markets, lobbying and export decisions are jointly determined. For example, some firms with low productivity but high lobbying efficiency might choose to export only if lobbying technology is available. Firms' final profits are

[4] I also impose a technical restriction on values of θ: $0 < 1-\theta\sigma < 1$, which guarantees that firms do not spend infinite amounts on lobbying. If $1-\theta\sigma \geq 1$, output subsidies increase too quickly with b. This restriction is the second-order condition of firms' maximization problems. It is also empirically supported by my estimate of θ in Section 3.2. With the estimate of θ around 0.08, the assumption is satisfied with the commonly used values of 3 or 4 for the elasticity of substitution in the literature.

determined as the maximum of the following four options:

$$\pi(\psi) = \max\Big\{\pi^d(0;\psi), \pi^d(0;\psi) + \pi^x(0;\psi), \pi^d(b^d;\psi), \pi^x(b^x;\psi)\Big\}, \tag{2.7}$$

where the terms inside the bracket represent the profits of non-lobbying non-exporters, non-lobbying exporters, lobbying non-exporters, and lobbying exporters, respectively.

With the fixed costs, lobbying and export decisions are characterized by cutoff productivities $\bar{\phi}^b(\tau,\eta)$ and $\bar{\phi}^x(\tau,\eta)$ that decrease with τ and η. Only firms with productivity levels above these cutoffs engage in lobbying or exporting. Also, firms with higher τ or η are more likely to engage in lobbying or exporting, as they face lower cutoff productivities. The relative positions of these cutoffs depend on parameter values and firm-specific primitives, so the lobbying cutoff can be either higher or lower than the export cutoff. Similarly, due to fixed production costs, firms begin production only if their profits are positive, that is, when their productivity exceeds the zero-profit cutoff productivity $\bar{\phi}^e(\tau,\eta)$ that satisfies $\pi(\bar{\phi}^e(\tau,\eta),\tau,\eta) = 0$. Detailed expressions for these cutoffs are provided in Online Appendix A.1.

Equilibrium. In equilibrium, there is a mass of entrants M_e, a mass of operating firms M, and an ex-post distribution of firm primitives:

$$\hat{g}(\psi) = \begin{cases} \frac{g(\psi)}{\int_{\phi \geq \bar{\phi}^e(\tau,\eta)} g(\psi) d\psi} & \text{if} \quad \phi \geq \bar{\phi}^e(\tau,\eta) \\ 0 & \text{otherwise.} \end{cases}$$

Let $\hat{G}(\psi)$ denote the corresponding CDF of $\hat{g}(\psi)$. The probability of entry is $p_e = \int_{\bar{\phi}^e(\tau,\eta)}^{\infty} dG(\psi)$. The mass of producers is $M = p_e M_e$. The price index satisfies

$$P^{1-\sigma} = M\left[\int p(\psi)^{1-\sigma} d\hat{G}(\psi)\right] + M_f\left[\int x_f(\psi) p_f(\psi)^{1-\sigma} d\hat{G}_f(\psi)\right]$$

The free entry condition implies

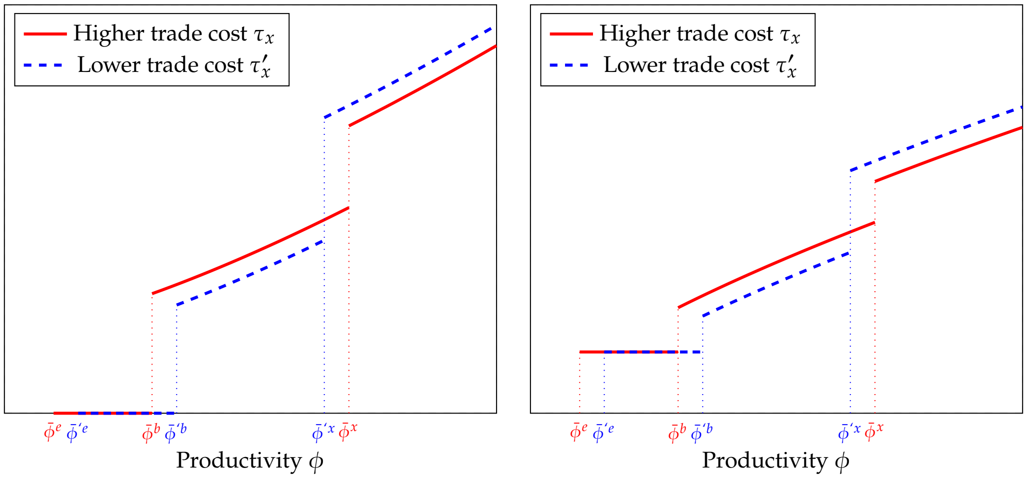
$$p_e\left[\int \pi(\psi) d\hat{G}(\psi)\right] = w f_e.$$

The government budget is balanced, and total tax revenues are transferred to consumers as a lump-sum:

$$T = M\left[\int \left(1 - \tau^y(\psi)\right)\Big(p(\psi)q(\psi) + x(\psi)p^x(\psi)q^x(\psi)\Big) d\hat{G}(\psi)\right].$$

Goods market-clearing requires $C = Q$, and labor market clearing satisfies

$$L = M\left[\int \left(l(\psi) + f + x(\psi)f_x + \kappa\frac{b(\psi)}{\eta} + \mathbb{1}[b(\psi) > 0] f_b\right) d\hat{G}(\psi)\right] + M_e f_e.$$



A. Lobbying expenditure, $w\kappa\frac{b}{\eta}$ B. Output distortion, τ^y

Figure 1: Lower trade costs lead exporters to increase their lobbying efforts, while non-exporters reduce theirs.

Notes. Panels A and B plot how firms change their lobbying expenditures and output distortions in response to declines in trade costs, depending on their productivity levels ϕ, holding τ and η constant. The figure considers a case in which the lobbying cutoff is lower than the export cutoff. The x-axes represent productivity ϕ.

The equilibrium conditions for the price index P_f, free entry, goods and labor market clearing in Foreign mirror those in Home. Additionally, trade is balanced:

$$M\left[\int x(\psi)p^x(\psi)q^x(\psi)d\hat{G}(\psi)\right] = M_f\left[\int x_f(\psi)p^x_f(\psi)q^x_f(\psi)d\hat{G}_f(\psi)\right].$$

An equilibrium is formally defined as follows:

Definition 1. *An equilibrium is defined as (a) wages $\{w, w_f\}$, (b) functions of Home and Foreign $\{p, p^x, q, q^x, x, l, b, \tau^y\}$ and $\{p_f, p^x_f, q_f, q^x_f, x_f, l_f, b_f, \tau^y_f\}$, (c) aggregate price indices and quantities $\{P, P_f, Q, Q_f\}$, (d) lump-sum government transfers $\{T, T_f\}$, and (e) masses of entry and operating firms $\{M, M_f, M_e, M_{e,f}\}$ such that (i) households maximize utility subject to their budget constraints; (ii) firms maximize profits; (iii) labor and goods markets clear; (iv) government budgets are balanced; (v) trade is balanced; and (vi) free entry conditions are satisfied.*

Lobbying, reallocation, and gains from trade. Figure 1 illustrates how firms change their lobbying expenditures and output distortions in response to declines in iceberg costs, depending on their productivity levels.[5] When iceberg costs decrease from τ_x to τ'_x, intensified foreign competition raise both the entry and lobbying cutoffs ($\bar{\phi}^e(\tau,\eta) > \bar{\phi}'^e(\tau,\eta)$ and $\bar{\phi}^b(\tau,\eta) > \bar{\phi}'^b(\tau,\eta)$), while the export cutoff decreases due to expanded market size ($\bar{\phi}'^x(\tau,\eta) > \bar{\phi}^x(\tau,\eta)$). This causes non-exporters to

[5]In this figure, I consider a special case where η is sufficiently high that the lobbying cutoff is lower than the export cutoff: $\bar{\phi}^b(\tau,\eta) < \bar{\phi}^x(\tau,\eta)$. In Online Appendix Figure B2, I graphically illustrate a case in which $\bar{\phi}^x(\tau,\eta) < \bar{\phi}^b(\tau,\eta)$. Even in this case, lower iceberg costs still induce a divergence between the two groups.

reduce their lobbying at both the intensive and extensive margins due to intensified competition, while exporters increase their lobbying at both margins due to larger market size.

A decline in iceberg costs reallocates more resources to exporters through two channels. The first is the standard selection channel, where larger market size leads to increased production by exporters that self-select into exporting. Both productivity and exogenous distortions influence this selection. The second channel is that exporters become relatively more subsidized compared to non-exporters by increasing their lobbying.

The lobbying channel impacts allocative efficiency, firm entry, and consequently gains from trade. One way to view this is through the following decomposition which holds in both the presence and absence of lobbying. Changes in welfare due to changes in iceberg cost can be approximated as

$$d\ln\mathbb{W} \approx \underbrace{\frac{1}{\sigma-1}d\ln M}_{=d\ln\mathbb{W}^{\mathrm{E}}\,:\,\text{Entry}} + \underbrace{d\ln\left[\int\left(\frac{1}{\phi}\frac{q(\psi)}{\tilde{q}}\right)d\hat{G}(\psi) + \int\left(x(\psi)\frac{\tau_x}{\phi}\frac{q(\psi)}{\tilde{q}}\right)d\hat{G}(\psi)\right]^{-1}}_{=d\ln\mathbb{W}^{\mathrm{AE}}\,:\,\text{Allocative efficiency}}, \tag{2.8}$$

where $\tilde{q} = \left[\int q(\psi)^{\frac{\sigma-1}{\sigma}}d\hat{G}(\psi) + \frac{M_f}{M}\int x_f(\psi)q_f(\psi)^{\frac{\sigma-1}{\sigma}}d\hat{G}_f(\psi)\right]^{\frac{\sigma}{\sigma-1}}$.[6]

The first term $d\ln\mathbb{W}^{\mathrm{E}}$ reflects changes in firm mass via entry. Lower iceberg costs always reduce firm entry due to intensified competition ($d\ln\mathbb{W}^{\mathrm{E}} < 0$).

The second term $d\ln\mathbb{W}^{\mathrm{AE}}$ is associated with allocative efficiency (Hsieh and Klenow, 2009). Allocative efficiency improves if more productive firms produce more output relative to the average $\tilde{q}$ (higher weights $q(\psi)/\tilde{q}$ for higher ϕ firms), but deteriorates if the opposite occurs. Suppose lobbying is unavailable. In the absence of any distortions, as in Melitz (2003), lower iceberg costs unambiguously improve allocative efficiency through productivity-driven selection. However, when exogenous distortions are present, the effect on allocative efficiency becomes ambiguous, as shown by Bai et al. (2024), which will be discussed more in detail below.

When lobbying is introduced, resources become more disproportionately allocated to large exporters as they benefit from higher lobbying-induced subsidies. This exacerbates the decline in $d\ln\mathbb{W}^{\mathrm{E}}$ by further reducing firm entry compared to the non-lobbying case. Additionally, lobbying interacts with the distributions of firm primitives and various selection margins, complicating its effect on allocative efficiency and leaving its overall sign ambiguous.

[6] For example, Hsieh and Klenow (2009), Edmond et al. (2015), Huneeus and Kim (2018), Choi and Shim (2023), and Choi et al. (2024) use the similar decomposition. In the closed economy, this allocative efficiency term coincides with the formula for aggregate TFP derived in Hsieh and Klenow (2009), where dispersion in TFPR decreases this allocative efficiency. More specifically, the exact relationship holds as follows: $d\ln\mathbb{W} = d\ln\mathbb{W}^{E} + d\ln\mathbb{W}^{AE} + d\ln(L^p/L)$, where $d\ln(L^p/L)$ is changes in shares of total variable labor used for production to total labor endowment. The approximation holds when $d\ln(L^p/L) \approx 0$, which is confirmed in quantitative exercises in Section 4 under the calibrated values. Detailed derivation is provided in Online Appendix A.2.

2.1 Welfare Formula for Gains from Trade

In this subsection, to better understand the implications of lobbying, I derive a sufficient statistics formula for the gains from trade in the presence of lobbying and compare it to the formulas developed by Arkolakis et al. (2012), Melitz and Redding (2015), and Bai et al. (2024) (henceforth ACR, MR, and BKL). For analytical tractability, I consider a special case in which every firm engages in lobbying ($f_b = 0$) and countries are symmetric. This symmetry, utilized also by Melitz and Redding (2015), ensures that the aggregate variables of both countries take identical values in equilibrium, simplifying the analysis. Without loss of generality, κ and w are normalized to 1.[7] These assumptions are formally stated as follows:

Assumption 2.1. *(i) $f_b = 0$; and (ii) countries are symmetric.*

In this case, the zero profit and export cutoffs are expressed as $\bar{\phi}^e(\tau, \eta) = \hat{\phi}^e \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}$ and $\bar{\phi}^x(\tau, \eta) = \hat{\phi}^x \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}$, where

$$\hat{\phi}^e = \frac{c f^{\frac{1-\theta\sigma}{\sigma-1}}}{P^{\frac{\sigma}{\sigma-1}} Q^{\frac{1}{\sigma-1}}} \quad \text{and} \quad \hat{\phi}^x = \frac{c f_x^{\frac{1-\theta\sigma}{\sigma-1}}}{P^{\frac{\sigma}{\sigma-1}} Q^{\frac{1}{\sigma-1}} [(1+\tau_x^{1-\sigma})^{\frac{1}{1-\theta\sigma}} - 1]^{\frac{1-\theta\sigma}{\sigma-1}}}.$$

for a constant c composed of the model parameters.[8] I introduce the following two functions: for any $\hat{\phi}^l < \hat{\phi}^u$,

$$\tilde{\lambda}(\hat{\phi}^l, \hat{\phi}^u) = \iiint_{\hat{\phi}^l \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}}^{\hat{\phi}^u \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}} \eta^{\frac{\theta(\sigma-1)}{1-\theta\sigma}} \tau^{\frac{\sigma-1}{1-\theta\sigma}} \phi^{\frac{(\sigma-1)(1-\theta)}{1-\theta\sigma}} g(\phi, \tau, \eta) d\phi d\tau d\eta$$

$$\tilde{S}(\hat{\phi}^l, \hat{\phi}^u) = \iiint_{\hat{\phi}^l \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}}^{\hat{\phi}^u \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}} \eta^{\frac{\theta\sigma}{1-\theta\sigma}} \tau^{\frac{\sigma}{1-\theta\sigma}} \phi^{\frac{\sigma-1}{1-\theta\sigma}} g(\phi, \tau, \eta) d\phi d\tau d\eta.$$

Using these functions, I define the share of the expenditure on domestic varieties as in ACR:

$$\lambda = \frac{\tilde{\lambda}(\hat{\phi}^e, \hat{\phi}^x) + (1+\tau_x^{1-\sigma})^{\frac{\theta(\sigma-1)}{1-\theta\sigma}} \tilde{\lambda}(\hat{\phi}^x, \infty)}{\tilde{\lambda}(\hat{\phi}^e, \hat{\phi}^x) + (1+\tau_x^{1-\sigma})^{\frac{\theta(\sigma-1)}{1-\theta\sigma}} \tilde{\lambda}(\hat{\phi}^x, \infty) + \tau_x^{1-\sigma}(1+\tau_x^{1-\sigma})^{\frac{\theta(\sigma-1)}{1-\theta\sigma}} \tilde{\lambda}(\hat{\phi}^x, \infty)} \tag{2.9}$$

and the share of variable labor used for producing domestic varieties as in BKL:

$$S = \frac{\tilde{S}(\hat{\phi}^e, \hat{\phi}^x) + (1+\tau_x^{1-\sigma})^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{S}(\hat{\phi}^x, \infty)}{\tilde{S}(\hat{\phi}^e, \hat{\phi}^x) + (1+\tau_x^{1-\sigma})^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{S}(\hat{\phi}^x, \infty) + \tau_x^{1-\sigma}(1+\tau_x^{1-\sigma})^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{S}(\hat{\phi}^x, \infty)}. \tag{2.10}$$

Unlike in ACR or BKL, trade costs appear in the numerators of λ and S because they influence

[7] With every firm participating in lobbying, κ only proportionally influences equilibrium outcomes.

[8] Specifically, this is driven from $\tilde{\pi}(b^x; \psi) = \tilde{\pi}(b^d; \psi) + f_x$. For selection into exporting to operate (i.e., $\hat{\phi}^x > \hat{\phi}^e$), I assume that $(f_x/f)^{\frac{1-\theta\sigma}{\sigma-1}} / [(1+\tau_x^{1-\sigma})^{\frac{1}{1-\theta\sigma}} - 1]^{\frac{1-\theta\sigma}{\sigma-1}}$ holds.

exporters' lobbying efforts, subsequently impacting their domestic prices and variable labor.[9]

I additionally define $\mathcal{L}^\lambda$ the ratio of expenditure on domestic varieties to its counterfactual value when exporters exert lobbying efforts as if they were in autarky (despite trade cost shocks), holding the general equilibrium effects (P and Q) constant. Similarly, I define $\mathcal{L}^s$ the ratio of domestic variable labor used to its counterfactual value when exporters exert lobbying efforts as if they were in autarky. Specifically, they are expressed as follows:

$$\mathcal{L}^\lambda = \frac{\tilde{\lambda}(\hat{\phi}^e, \hat{\phi}^x) + (1 + \tau_x^{1-\sigma})^{\frac{\theta(\sigma-1)}{1-\theta\sigma}} \tilde{\lambda}(\hat{\phi}^x, \infty)}{\tilde{\lambda}(\hat{\phi}^e, \infty)} \quad \text{and} \quad \mathcal{L}^s = \frac{\tilde{S}(\hat{\phi}^e, \hat{\phi}^x) + (1 + \tau_x^{1-\sigma})^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{S}(\hat{\phi}^x, \infty)}{\tilde{S}(\hat{\phi}^e, \infty)}. \tag{2.11}$$

In autarky ($\tau_x \to \infty$), both $\mathcal{L}^\lambda$ and $\mathcal{L}^s$ are equal to one ($\mathcal{L}^\lambda = \mathcal{L}^s = 1$). However, in an open economy ($1 < \tau_x < \infty$), they are strictly above one ($\mathcal{L}^\lambda > 1$ and $\mathcal{L}^s > 1$). The fact that they are strictly larger than one in an open economy reflects that exporters spend discretely larger lobbying expenditures compared to non-exporters due to discrete changes in market size upon opening to trade. Trade cost shocks have direct impacts on welfare through influencing price levels (reflected by λ as in ACR/MR) and firms' tax contributions (reflected by S as in BKL). Beyond these standard channels, $\mathcal{L}^\lambda$ and $\mathcal{L}^s$ capture the additional effects through firms' endogenous lobbying adjustments to trade shocks on welfare, which will be detailed below.

Following ACR/MR and BKL, I define two elasticities related to the extensive margin:

$$\gamma_\lambda(\hat{\phi}^e) = -(1 - \theta\sigma) \times \frac{d \ln \tilde{\lambda}(\hat{\phi}^e, \infty)}{d \ln \hat{\phi}^e} \qquad \text{and} \qquad \gamma_s(\hat{\phi}^e) = -(1 - \theta\sigma) \times \frac{d \ln \tilde{S}(\hat{\phi}^e, \infty)}{d \ln \hat{\phi}^e}, \tag{2.12}$$

which are scaled by the term $1 - \theta\sigma$. When $\theta = 0$ or in autarky, as in ACR/MR and BKL, $\gamma_\lambda(\hat{\phi}^e)$ becomes the elasticity of the cumulative sales of domestic firms above the cutoff $\hat{\phi}^e$ within Home, with respect to the cutoff, and $\gamma_s(\hat{\phi}^e)$ becomes the elasticity of the cumulative variable labor of domestic firms above the cutoff $\hat{\phi}^e$ within Home, with respect to the cutoff. However, with lobbying, $\tilde{\lambda}(\hat{\phi}^e, \infty)$ and $\tilde{S}(\hat{\phi}^e, \infty)$ are not proportional to the cumulative sales and variable labor of domestic firms. This discrepancy with ACR/MR and BKL arises because, at the export cutoff, exporters have discretely larger levels of lobbying compared to non-exporters.

Despite firms' heterogeneous responses to trade cost shocks and various selection margins of entry, production, and exporting, welfare changes can be expressed as a function of a few aggregate variables, as summarized in the proposition below.

[9] When $\theta = 0$, $\lambda = \frac{\tilde{\lambda}(\hat{\phi}^e,\infty)}{\tilde{\lambda}(\hat{\phi}^e,\infty)+\tau_x^{1-\sigma}\tilde{\lambda}(\hat{\phi}^x,\infty)}$ as in ACR and $S = \frac{\tilde{S}(\hat{\phi}^e,\infty)}{\tilde{S}(\hat{\phi}^e,\infty)+\tau_x^{1-\sigma}\tilde{S}(\hat{\phi}^x,\infty)}$ as in BKL.

Proposition 2.1. *Under Assumption 2.1, changes in welfare to local changes in iceberg costs are*

$$d\ln\mathbb{W} = \frac{1}{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}\left\{-d\ln\lambda + d\ln\mathcal{L}^\lambda + d\ln M_e\right\} + \left(\frac{\frac{\gamma_\lambda(\hat{\phi}^e)}{\sigma-1}+\theta(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}+1\right)d\ln PQ, \quad (2.13)$$

where $$d\ln PQ = \left(\frac{1}{1-\theta\sigma} - \frac{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e)+\sigma-1}\right)\left\{-d\ln\lambda + d\ln\mathcal{L}^\lambda + d\ln M_e\right\} \left(\frac{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e)+\sigma-1}\right)\left\{-d\ln\lambda + d\ln\mathcal{L}^\lambda + d\ln S - d\ln\mathcal{L}^s\right\}.$$

Proof. See Online Appendix A.3. □

ACR/MR. Before explaining details of this proposition, I first explain how the welfare formula in Proposition 2.1 can be connected to those studied in the previous papers. When lobbying is not allowed ($\theta = 0$) and firms are heterogeneous only along productivity that follows the Pareto distribution with the shape parameter κ, the trade elasticity becomes constant $\gamma_\lambda(\hat{\phi}^e) = \gamma_s(\hat{\phi}^e) = \kappa-(\sigma-1)$, $d\ln M_e = 0$, $S = \lambda$, and $\mathcal{L}^\lambda = \mathcal{L}^s = 1$. Equation (2.13) collapses to the ACR formula:

$$d\ln\mathbb{W} = \frac{1}{\kappa}\left\{-d\ln\lambda\right\}. \quad (2.14)$$

The welfare effects can be summarized by the two sufficient statistics: the trade elasticity κ and the changes in domestic expenditure shares (trade shares) $d\ln\lambda$.

When firm productivity follows more general distributions instead of Pareto as in MR, Equation (2.13) collapses to the MR formula:

$$d\ln\mathbb{W} = \frac{1}{\gamma_\lambda(\hat{\phi}^e)+\sigma-1}\left\{-d\ln\lambda + d\ln M_e\right\}. \quad (2.15)$$

Unlike the ACR formula, the trade elasticity becomes variable and amounts of firm entry ($d\ln M_e \neq 0$) matters for the gains.

BKL. When exogenous distortions are introduced in the MR setup, Equation (2.13) collapses to the BKL formula

$$d \ln \mathbb{W} = \underbrace{\frac{1}{\gamma_\lambda(\hat{\phi}^e) + \sigma - 1}\big\{ - d \ln \lambda + d \ln M_e \big\}}_{\text{ACR/MR}} + \underbrace{\left(\frac{\gamma_\lambda(\hat{\phi}^e)/(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e) + \sigma - 1} + 1 \right) d \ln PQ}_{\text{BKL: distortion}}$$

$$\text{where} \quad d \ln PQ = \frac{\gamma_s(\hat{\phi}^e) - \gamma_\lambda(\hat{\phi}^e)}{\gamma_s(\hat{\phi}^e) + \sigma - 1}\big\{ - d \ln \lambda + d \ln M_e \big\} + \left(\frac{\gamma_\lambda(\hat{\phi}^e) + \sigma - 1}{\gamma_s(\hat{\phi}^e) + \sigma - 1} \right)\big\{ - d \ln \lambda + d \ln S \big\}. \tag{2.16}$$

After normalizing w and L to 1, the welfare change can be expressed as $d \ln \mathbb{W} = d \ln \frac{1+T}{P}$.[10] In the efficient economy without any distortions as in ACR/MR, the transfer T is always zero ($d \ln(1 + T) = d \ln PQ = 0$), so effects of trade only operate through the price index (captured by the first ACR/MR term). However, in the distorted economy, trade directly affects the transfer T through influences on which types of firms produce and export, and therefore pay taxes. The second BKL term reflects these influences on the transfer, making the BKL formula deviate from the ACR/MR.

BKL showed that trade can result in welfare losses if the second term ($d \ln PQ < 0$) becomes negative, which may happen when the necessary condition $d \ln \lambda > d \ln S$ or $\gamma_\lambda(\hat{\phi}^e) > \gamma_s(\hat{\phi}^e)$ is met. The first part of the condition ($d \ln \lambda > d \ln S$) implies that exporters increase their variable labor more than their domestic sales, requiring the government to provide larger subsidies for their exported output after opening to trade. This, in turn, increases government spending and negatively impacts the transfer T. The second part of the condition ($\gamma_\lambda(\hat{\phi}^e) > \gamma_s(\hat{\phi}^e)$) implies that the rise in the domestic cutoff due to trade reduces domestic output relative to variable labor. This implies that surviving firms are those self-selected based on higher subsidies, which reduces tax revenues from domestic sales and deteriorates the transfer T.

Lobbying. Compared to the BKL formula, the formula with lobbying in Proposition 2.1 requires additional information: (1) the ratio of expenditure on domestic varieties to its counterfactual value when exporters exert lobbying efforts as if they were in autarky ($d \ln \mathcal{L}^\lambda$); (2) the ratio of domestic variable labor for producing domestic varieties to its counterfactual value ($d \ln \mathcal{L}^s$); and (3) the value of θ. Opening to trade makes exporters relatively more subsidized than non-exporters due to their increased lobbying. These endogenous changes in lobbying-induced subsidies affect firms' prices and tax contributions, impacting both the aggregate price index P and the transfer T, beyond the direct effects of trade cost shocks on these two aggregate variables. The additional impact of lobbying on the price index is captured by $d \ln \mathcal{L}^\lambda$ in the first term of Equation (2.13), while the additional impact on the transfer is summarized by both $d \ln \mathcal{L}^\lambda$ and $d \ln \mathcal{L}^s$ in the second term.

The proposition highlights the importance of microstructure for gains from trade. Computing

[10] Note that $\mathbb{W} = Q/L = PQ/PL = (wL + T)/PL = (1 + T)/P$, where the last equality comes from the normalization.

$d \ln \mathcal{L}^{\lambda}$ and $d \ln \mathcal{L}^{s}$ requires micro-level information on exporters' counterfactual lobbying efforts as if they were in autarky. Moreover, estimating θ is unlikely to be feasible from aggregate or sectoral data, requiring microdata with credible micro-level exogenous variation, as this parameter is related to firm-specific benefits from lobbying.

Corollary 2.1. *Consider a special case where ϕ follows a Pareto distribution with the shape parameter κ, with τ and η homogeneous across firms. Also, suppose Assumption 2.1 holds and fixed export costs f_x are sufficiently high. When moving from autarky to an open economy, the welfare effects of trade are given by*

$$d \ln \mathbb{W} = \underbrace{\frac{1}{\kappa}\left\{ - d \ln \lambda \right\}}_{>0} + \underbrace{\frac{1}{\kappa}\left\{ d \ln \mathcal{L}^{\lambda} \right\}}_{>0} + \underbrace{\left(\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma} - \frac{1}{\kappa}\right)\left\{ - d \ln \lambda + d \ln \mathcal{L}^{\lambda} \right\} + \left(\frac{\sigma}{\sigma-1} - \frac{1}{\kappa}\right)\left\{ d \ln S - d \ln \mathcal{L}^{s} \right\}}_{<0}. \quad (2.17)$$

Proof. See Online Appendix 2.1 □

Special case: Pareto productivity. To provide more intuition, I consider a special case where firm productivity follows a Pareto distribution with the shape parameter κ.[11] Corollary 2.1 presents the welfare formula under this special case.[12] The welfare formula deviates from the standard ACR formula by incorporating two additional terms. The second term, which is also positive, reflects declines in the price index P as exporters charge lower prices due to higher lobbying-induced subsidies. The third term, which is negative, reflects the adverse effects of exporters' lobbying-induced subsidies on the transfer T.

3. Taking the Model to the Data

This section outlines the data and calibration procedure of the model.

3.1 Data

I construct the main dataset by combining firm balance sheet information, lobbying data, and sector and state level databases. The sample period spans from 1998 to 2015.

[11] In Appendix A.5, I also analyze two other special cases: one where exogenous distortions are Pareto-distributed exogenous distortions and another where lobbying efficiency is Pareto-distributed, with the remaining dimensions homogeneous across firms in each case. In these cases, selection into exporting is driven solely by exogenous distortions or lobbying efficiency.

[12] Under the Pareto distribution, the mass of firm entry depends only on parameters unaffected by changes in iceberg costs and is given by: $M_e = \frac{\sigma-1}{\sigma}\frac{L}{\kappa f_e}$. This expression for entry mass is identical to that in the ACR framework with Pareto-distributed productivity.

Table 1: Descriptive Statistics

	Sales ($1M)	Lobbying expenditures ($1K)	$1[\text{Lobby}_{it} > 0]$	$1[\text{Lobby}_{it} > 0] \neq 1[\text{Lobby}_{i,t-1} > 0]$
	(1)	(2)	(3)	(4)
Mean	2130.93	196.71	0.18	0.17
SD	11646.85	1258.0	0.39	0.38

Notes. This table provides descriptive statistics. Nominal values are reported in 2009 USD. The dataset comprises 35,276 firm-year observations, representing 4,402 unique firms. SD represents standard deviations. The sample period spans from 1998 to 2015.

Firm-level lobbying and balance sheet data. I merge lobbying data obtained from Kim (2018) with Compustat, covering public firms listed on North American stock markets. The lobbying data, publicly disclosed since 1998 under the Lobbying Disclosure Act, include quarterly activity reports filed by registered lobbyists. These reports have information on lobbying expenditures, issue areas, and descriptions of lobbying activities. I restrict the sample to US-incorporated firms in manufacturing sectors, as these tradable sectors are most exposed to foreign competition and align with the theory in the previous section. I exclude observations with missing or negative values for employment, capital, or sales.

Industry and state-level data. Industry data come from the NBER-CES Manufacturing Industry Database, matched to firm-level data based on SIC 4-digit codes. I obtain 3-digit NAICS industry-state level wage rates from the US Census County Business Patterns data. These NAICS 3-digit codes are converted to 3-digit SIC codes and matched to firms based on their headquarters' state and industry affiliation.

Descriptive statistics. The descriptive statistics of the final dataset are presented in Table 1. Columns 1 and 2 report average sales and lobbying expenditures. Column 3 shows that 18% of firm-year observations have positive lobbying expenditures, indicating that lobbying is prevalent activities among publicly traded firms. Column 4 captures extensive margin changes, with only 17% of observations altering their lobbying status, indicating persistence of lobbying behavior.

3.2 Estimation of the Elasticity of Output Distortions to Lobbying

The parameter θ is a key parameter that governs how effectively lobbying increases output subsidies. I estimate this parameter using regression models derived from the theoretical framework. While sectoral and time dimensions are absent from the theoretical framework, I incorporate these dimensions into the estimation, assuming θ remains constant across them. These dimensions enable incorporating sector-time and firm-specific time-invariant fixed effects, allowing for the identification of θ by leveraging within-firm, time-varying lobbying expenditures.

In the theoretical framework, TFPR, measured as value-added divided by wage bills, is proportional to the inverse of output distortions[13]:

$$\text{TFPR}_{it} = \frac{\text{Value Added}_{it}}{w_{njt} l_{it}} \propto \frac{1}{\tau_{it} b_{it}^{\theta}}.$$

Here, l_{it} is firm i's employment in year t and w_{njt} is industry j wage in state n where firm i's headquarter is located. One issue is that b_{it} is the optimally chosen lobbying input (in units of labor), while the data only report lobbying expenditures in dollar terms. I assume that the reported lobbying expenditures are proportional to variable lobbying costs $w_t b_{it}/\eta_{it}$ of the theoretical framework and construct a variable $Lobby_{it}$ by dividing lobbying expenditures by wage, which is consistent with b_{it}/η_{it} in the theoretical framework. I use $Lobby_{it}$ as a proxy for b_{it}.

Taking logs, first-differencing, and rearranging yield:

$$\Delta \ln 1/\text{TFPR}_{i,t+1} = \theta \Delta \ln Lobby_{it} + \mathbf{X}_{it}' \gamma + \delta_{jt} + \underbrace{\Delta \ln \tau_{it} + \theta \Delta \ln \eta_{it}}_{=\Delta u_{it}}, \tag{3.1}$$

where Δ is the time-difference operator. The structural error term Δu_{it} depends on firm-specific exogenous distortions $\Delta \ln \tau_{it}$ and lobbying efficiency $\Delta \ln \eta_{it}$. $\Delta \ln \eta_{it}$ shows up in the error term because $Lobby_{it}$ ($= b_{it}/\eta_{it}$) is used as a proxy for b_{it}. To account for heterogeneous trends in TFPR that depend on unobservable and observable factors, I include sector-year fixed effects δ_{jt} and a set of observable variables $\mathbf{X}_{it}$ that include changes in log state-industry-level wages and initial lobbying status. I average observations over six years to mitigate potential seasonality in lobbying expenditures due to political cycles and measurement errors of TFPR. Standard errors are clustered at the state level.

Alternatively, leveraging the relationship between sales and lobbying inputs, I derive the following regression model:

$$\Delta \ln \text{Sale}_{i,t+1} = \theta \sigma \Delta \ln Lobby_{it} + \mathbf{X}_{it}' \gamma + \delta_{jt} + \underbrace{(\sigma - 1) \Delta \ln \phi_{it} + \sigma \Delta \ln \tau_{it} + \theta \sigma \Delta \ln \eta_{it}}_{=\Delta u_{it}}. \tag{3.2}$$

This model includes the same set of observables as in Equation (3.1), with standard errors clustered at the state level.

One issue arises from the presence of zeros in the lobbying data, which complicates log transformations. Simply excluding these observations would result in the loss of informative variation

[13] Value-added is computed as sales multiplied by sectoral value-added shares, while wage bills are calculated as firm employment multiplied by state-industry-specific wages. Sectoral value-added shares are derived from the NBER-CES Manufacturing database. Dividing value-added by wage bills mitigates concerns that TFPR variations reflect wage differences due to segmented labor markets.

between lobbying and non-lobbying firms. To address this issue, I assign zero values to $\ln Lobby_{it}$ for observations with zero lobbying expenditures and perform robustness checks.

IV strategy. In the first-difference specifications, time-invariant factors are differenced out and θ is identified through within-firm variation. Also, including sector-year fixed effects absorb out any common factors at the sector level. However, because $\ln Lobby_{it}$ is a function of firm primitives, changes in $\ln Lobby_{it}$ might be correlated with time-varying components of firm primitives in the structural error terms, leading to endogeneity in the OLS estimates.

To address this endogeneity, I employ an IV strategy that leverages exogenous variation in firm lobbying expenditures, which are seemingly uncorrelated with firm-specific primitives. The instrument for $\ln Lobby_{it}$ is based on the state-time-varying appointment of a Congress member from the firm's headquarters' state as chairperson of the House or Senate Appropriations Committee. This IV strategy follows the approach of Bertrand et al. (2020), who use variation in committee seats to study the impact of firms' charitable giving on political influences. Data on congressional committee memberships, including assignment and termination dates as well as the states represented by members, are sourced from Stewart and Woon (2017), which provides state-time-varying information on Appropriations Committee chairpersonship.

The appointment of a local Congress member as the chairperson serves as an exogenous shifter of lobbying expenditures.[14] These chairpersons, who are more likely to have personal connections with local firms, wield significant influence over discretionary spending and federal contract allocations, making them prime targets for lobbying (Stewart and Groseclose, 1999; Blanes i Vidal et al., 2012; Berry and Fowler, 2018). Importantly, such appointments are typically determined by seniority or unforeseen political events, such as loss of reelection, retirement, or death of the incumbent chairperson, ensuring their exogeneity to the economic conditions of specific states or firms (Aghion et al., 2009; Cohen et al., 2011).

The IV is computed as the six-year average of a dummy variable that equals 1 if a state Congress member serves as the chairperson in a given year. The exclusion restriction assumes that firm primitives are uncorrelated with the IV. A potential concern is that the appointment of local politicians could influence state-level exogenous distortions shared by all firms, thus correlating the IV with the error term.

To address this concern, I employ three strategies. First, I include changes in detailed state-level tax incentives and federal government transfers as controls to absorb observable state-level components of exogenous distortions. These tax incentives include corporate income taxes, job creation tax credits, R&D tax credits, and property tax abatements, obtained from the Panel Database on Incentives and Taxes (Bartik, 2018). Data on state-level federal transfers are sourced from the US Census.

Second, I show that results are robust when I demean dependent variables by the average of non-

[14]Within the theoretical framework, the IV can be interpreted as a variable Z_{it} that shifts fixed costs of lobbying.

lobbying firms within each state and two-digit SIC industry, excluding the firm itself.[15] Because the average is taken over non-lobbying firms, the demeaning process only removes exogenous components common within the categories, not related to lobbying. This approach is similar to Hsieh and Klenow (2009) who also demean firm specific distortions by the industry average to remove industry-common components.

Finally, I conduct an event study to examine potential pre-trends in lobbying expenditures associated with chairperson appointments, which is described in Online Appendix B.1.2. If pre-trends exist, they could indicate spurious correlations due to confounding factors or reverse causality, violating the exclusion restriction. However, I do not find pre-trends, supporting the validity of the IV strategy (Online Appendix Figure B1).

Regression results. Table 2 reports the regression results. After addressing the endogeneity using the IV strategy, I find significantly positive coefficients. The second-stage estimates indicate that a 1% increase in lobbying expenditures corresponds to approximately a 0.09% increase in output subsidies. In column 3, where the dependent variable is demeaned by the state-industry average, the estimate remains similar to column 2. Columns 4-6 report the OLS and IV estimates for the sales regression. The IV estimates in columns 5 and 6, which can be mapped to $\theta\sigma$, are approximately 0.30 and 0.25, aligning with the IV estimates in columns 2 and 3. Assuming values of σ of 3 and 4, the implied values of θ are around 0.06 and 0.08, consistent with the estimates in columns 2 and 3. All specifications in columns 1-6 share the same first stage. The first stage is strong, with the Kleibergen-Paap F-statistics of approximately 12. Additionally, the results remain robust to the weak-robust inference. The Anderson-Rubin (AR) test statistics, which provide weak-instrument-robust inference, reject the null hypothesis of zero coefficients at the 1% significance level.

These estimates are consistent with the previous estimates from Huneeus and Kim (2018). They estimated the elasticity using a regression model akin to Equation (3.2). Their approach employed a firm-level, time-varying shift-share IV based on firms' political connections and the weights assigned to each committee, inspired by Bertrand et al. (2020). Despite leveraging different sources of variation, their OLS and IV estimates of 0.048 and 0.21 closely align with my estimates, remaining within one standard deviation of the corresponding OLS and IV estimates reported in columns 4-6.

Alternative proxy for firm-specific distortions. If the model is misspecified, inferring TFPR as firm-specific distortions becomes problematic (e.g., Asker et al., 2014; Ruzic and Ho, 2023). To examine the robustness to potential model misspecification, I use the cash effective tax rate (ETR) developed by Dyreng et al. (2017) as an alternative proxy for firm-specific distortions. The ETR reflects firms' long-term tax avoidance activities, such as tax and investment credits, and can be directly constructed

[15] I demean by $\frac{1}{N_{sjt}^{\text{no lobby}}-1}\sum_{i'\in\mathcal{F}_{sjt}^{\text{no lobby}}/\{i\}}\ln 1/TFPR_{i't}$, where $\mathcal{F}_{sjt}^{\text{no lobby}}/\{i\}$ is a set of non-lobbying firms in state s in industry j in year t, excluding firm i, and $N_{sjt}^{\text{no lobby}}$ is the number of non-lobbying firms in state s in industry j in year t.

Table 2: Estimation Results for the Parameter θ

Dep.	$\Delta \ln 1/\text{TFPR}$			$\Delta \ln \text{Sale}$		
	OLS	IV		OLS	IV	
	(1)	(2)	(3)	(4)	(5)	(6)
	Panel A. Second stage					
$\Delta \ln Lobby_{it}$	−0.002	0.087***	0.084**	0.051***	0.302***	0.246***
	(0.005)	(0.031)	(0.033)	(0.013)	(0.058)	(0.051)
	Panel B. First stage					
IV		0.849***	0.849***		0.849***	0.849***
		(0.241)	(0.241)		(0.241)	(0.241)
KP-F		12.46	12.46		12.46	12.46
AR		13.21	15.61		14.17	8.33
AR p-val.		< 0.01	< 0.01		< 0.01	< 0.01
Dep. demeaned			✓			✓
Industry FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
N	1,206	1,206	1,206	1,206	1,206	1,206

Notes. Standard errors are clustered at the state level. * p<0.1; ** p<0.05; *** p<0.01. This table reports the OLS and IV estimates of Equations (3.1) and (3.2). The dependent variables are log inverse of TFPR and sales in columns 1-3 and 4-6, respectively. In columns 3 and 6, the dependent variables are demeaned by the state-industry average of non-lobbying firms, excluding the firm itself. All specifications include corporate income tax, job creation tax credit, investment tax credit, R&D tax credit, property tax abatement, and transfers from the federal government, changes in state-industry wages, the initial lobbying status, and SIC 4-digit fixed effects. KP-F is the Kleibergen-Paap F-statistics. AR and AR p-val are the Anderson-Rubin test statistics and its p-value.

from Compustat variables without relying on the theoretical model. It is defined as

$$\text{ETR}_{it} = \frac{\sum_{h=1}^{6} \text{TXPD}_{i,t-h}}{\sum_{h=1}^{6} \text{PI}_{i,t-h}}, \tag{3.3}$$

where TXPD_{it} is cash tax paid (Compustat Item 317) and PI_{it} is pretax income (Item 122). Following Hanlon and Slemrod (2009), ETR values exceeding 0.5 are capped at 0.5 to mitigate the influence of outliers. Each variable is averaged over six years to compute the long-run ETR, as suggested by Dyreng et al. (2017), who demonstrate that the long-term averages are more reliable. Because ETR represents firm-specific tax rates, I use $\ln(1 - \text{ETR}_{i,t+1})$ as an outcome, aligning with the interpretation of output distortions measured as the inverse of TFPR. The results indicate that lobbying reduces the ETR by magnitude similar to that observed in the baseline TFPR estimates (columns 1 and 2 of Online Appendix Table B1).

Additional robustness checks. I extend the model to include two production factors, labor and capital, and examine whether lobbying affects marginal revenue product of capital (MRPK).[16] I find no statistically significant relationships between lobbying and MRPK (columns 3-4 of Online Appendix Table B1). To examine the sensitivity of the results to assigning zero values to $\ln Lobby_{it}$ for observations with zeros, I consider alternative functional forms, including the inverse hyperbolic sine transformation of lobbying expenditures and a dummy variable indicating positive lobbying. Across different functional forms, I find statistically significant and positive estimates, with strong first stages (columns 5-12 of Online Appendix Table B1).

3.3 Method of Moments

I cannot directly infer the joint distribution of firm primitives from the data alone because only their truncated distribution is observed due to firms' selection into production, exporting, lobbying, and entry. To address this, I apply indirect inference. Home and Foreign are calibrated to cross-sectional data corresponding to the US and China in 2007. I assume that $\ln \boldsymbol{\psi} = (\ln \phi, \ln \tau, \ln \eta)$ of the US follows a joint log-normal distribution:

$$\begin{pmatrix} \ln \phi \\ \ln \tau \\ \ln \eta \end{pmatrix} \sim \mathcal{N}\left(\begin{pmatrix} \mu_\phi^{\mathrm{US}} \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\phi^2 & & \\ \rho_{\phi\tau}\sigma_\phi\sigma_\tau & \sigma_\tau^2 & \\ \rho_{\phi\eta}\sigma_\phi\sigma_\eta & \rho_{\tau\eta}\sigma_\tau\sigma_\eta & \sigma_\eta^2 \end{pmatrix} \right).$$

I normalize the mean of $\ln \tau$ and $\ln \eta$ to zero because the model is invariant to the mean of exogenous distortions, and the mean of lobbying efficiency cannot be separately identified from κ. The covariance matrix is characterized by three standard deviations $\boldsymbol{\sigma_\psi} = (\sigma_\phi, \sigma_\tau, \sigma_\eta)$ and three correlations $\boldsymbol{\rho_\psi} = (\rho_{\phi\tau}, \rho_{\phi\eta}, \rho_{\tau\eta})$. Given the absence of micro-level data for Foreign, I assume that $\boldsymbol{\psi}$ in Foreign follows a joint log-normal distribution with the same $\boldsymbol{\sigma_\psi}$ and $\boldsymbol{\rho_\psi}$ as in the US, but with a different productivity level μ_ϕ^F.[17] I further assume that f_e, f, and f_x for Foreign are identical to those of the US and that foreign firms cannot lobby.

The parameters $\{\theta, L^{\mathrm{US}}, L^F, \sigma, \mu_\phi^F, f_e\}$ are calibrated externally. θ is set to 0.08, based on the estimated values in Table 2. The labor of the US (L^{US}) is normalized to 10. The relative labor of Foreign to US (L^F/L^{US}) is normalized to 5.2 to match the relative labor between China and the US. The elasticity of substitution σ is set to 3 as in Hsieh and Klenow (2009). The mean productivity level of China (μ_ϕ^F) is normalized to 0. Finally, the entry cost f_e is normalized to 1, as standard in the literature.

[16] With the two factors of inputs with the Cobb-Douglas production function, capital distortions are proportional to $\frac{w_{njt}L_{it}}{K_{it}}$, where capital K_{it} is measured using PPEGT of Compustat. Similar to Equation (3.1), I can obtain the regression model for MRPK: $\Delta \ln \frac{w_{nj,t+1}L_{i,t+1}}{K_{i,t+1}} = \theta \Delta \ln Lobby_{it} + \Delta \mathbf{X}'_{it}\boldsymbol{\gamma} + \delta_{jt} + \Delta u_{it}$.

[17] Because foreign firms are not allowed to lobby, foreign variables are unaffected by the means of exogenous distortions and lobbying efficiency. Thus, these means are normalized to zero, consistent with the normalization applied to the US. Also, the estimate of $\rho_{\phi\tau}$ from Bai et al. (2024) based on Chinese micro data is −0.83, closely aligned with my estimate of −0.81 based on US firms in Compustat.

Table 3: Model Parameters

Parameter	Description	Value	Identifying Moment
Panel A. External calibration			
θ	Lobbying elasticity	0.08	Own estimate, col. 3 of Table 2
σ	Elasticity of substitution	3	Hsieh and Klenow (2009)
L^F/L^{US}	Foreign & US Labor	5.2	Relative labor of China to the US
μ_ϕ^F	China mean productivity	0	Normalization
$\mu_\tau^{\text{US}}, \mu_\tau^F$	US & China mean exo. distortion	0	Normalization
$\mu_\eta^{\text{US}}, \mu_\eta^F$	US & China mean lobbying effic.	0	Normalization
f_e	Entry cost	1	Normalization
Panel B. Internal calibration			
μ_ϕ^{US}	US mean productivity	3.01	Relative real GDP of the US
σ_ϕ	Std. productivity	1.96	Std. TFPQ
σ_τ	Std. exo. distortion	0.89	Std. residual
σ_η	Std. lobbying effic.	2.85	Std. lobbying expenditures
$\rho_{\phi\tau}$	Corr. productivity & exo. distortion	−0.81	Corr. TFPQ & residual
$\rho_{\phi\eta}$	Corr. productivity & lobbying effic.	−0.57	Corr. TFPQ & lobbying expenditures
$\rho_{\tau\eta}$	Corr. exo. distortion & lobbying effic.	0.21	Corr. residual & lobbying expenditures
κ	Variable lobbying cost	0.01	Med. sales of lobbying & non-lobbying firms
f_b	Fixed lobbying cost	0.03	Lobbying expenditures & sales dist.
τ_x	Iceberg trade cost	4.11	US import share from China
f_x	Fixed export	0.03	Share of exporters, Bernard et al. (2007)
f	Fixed cost of production	0.004	Sales dist.

Notes. This table summarizes the calibrated values for the model parameters and their identifying moments.

The remaining 12 parameters $\mathbf{\Theta} = \{\mu_\phi^{\text{US}}, \kappa, \sigma_\phi, \sigma_\tau, \sigma_\eta, \rho_{\phi\tau}, \rho_{\phi\eta}, \rho_{\tau\eta}, f_b, f, f_x, \tau_x\}$ are jointly calibrated using the method of moments. The parameters are estimated by minimizing the following objective function:

$$\hat{\mathbf{\Theta}} = \underset{\mathbf{\Theta}}{\text{argmin}} \left\{ \left(\mathbf{m} - \mathbf{m}(\mathbf{\Theta})\right)' \left(\mathbf{m} - \mathbf{m}(\mathbf{\Theta})\right) \right\},$$

where $\mathbf{m}$ is the empirical moments and $\mathbf{m}(\mathbf{\Theta})$ is the corresponding model moments. The moments are normalized to express deviations between the model and empirical moments as percentage differences.

I choose moments that are relevant and informative about the underlying parameters. In Online Appendix B.2, relationships between the parameters and the chosen moments are explained in detail. μ_ϕ^{US} is calibrated to match the relative real GDP of the US and China.[18] κ is calibrated to match the log difference between the median sales of lobbying and non-lobbying firms. Because κ governs the overall sales level of lobbying firms, this moment identifies κ.

[18] In the model, real GDP is defined as the sum of domestic and export revenues generated by domestic firms divided by the producer price index (PPI). The PPI is calculated using domestic firms' domestic prices as follows: $PPI = M(\int p(\psi)^{1-\sigma} d\hat{G}(\psi))^{1/(1-\sigma)}$.

Table 4: Data and Model Moments

Moments	Data (2007)	Model
Panel A. Targeted moments		
Relative real GDP	1.36	1.32
Corr. TFPQ & residual	−0.77	−0.90
Corr. TFPQ & lobbying expenditures	0.39	0.59
Corr. residual & lobbying expenditures	−0.42	−0.28
Std. TFPQ	1.83	1.75
Std. residuals	0.88	0.95
Std. lobbying expenditures	1.67	1.54
Std. TFPR	0.74	0.90
Share of lobbying firms	0.19	0.20
Log diff. med. sales of lobbying & non-lobbying firms	2.59	2.55
Share of exporters	0.18	0.19
US import shares from China	0.05	0.05
Log diff. sales of the 50p and 10p	3.38	3.18
Log diff. sales of the 70p and 50p	1.83	1.52
Log diff. sales of the 50p and 25p	1.76	1.70
Panel B. Non-targeted moments		
Shares of lobbying firms (Sales > 75p)	0.44	0.44
Shares of lobbying firms (75p ≥ Sales > 50p)	0.14	0.25
Shares of lobbying firms (50p ≥ Sales > 25p)	0.11	0.08
Shares of lobbying firms (25p ≥ Sales)	0.08	0.01
Std. log sales	2.50	2.28
Corr. TFPQ & TFPR	0.79	0.82
Corr. sales & lobbying expenditures	0.56	0.88
Corr. sales & residual	−0.60	−0.61
Corr. sales & TFPR	0.50	0.47
Corr. sales & TFPQ	0.83	0.89

Notes. Panels A and B report the targeted and non-targeted moments of the model and the data counterparts, respectively. Except for the relative GDP, the US share of exporters and the US import shares from China, all the moments are calculated from Compustat and the lobbying database of 2007. The relative GDP is obtained from the Penn World Table. The share of exporters comes from Bernard et al. (2007) and the US import shares are calculated from the WIOD in 2007.

σ_ϕ is fitted to match the standard deviation of quantity-based total factor productivity (TFPQ = (Value Added$_{it}^{\frac{\sigma}{\sigma-1}}$)$/w_{njt}l_{it}$), which is proportional to ϕ. σ_τ is set to match the standard deviation of the residuals from Equation (3.1), as $\ln\tau$ appear in these residuals. σ_η is set to match the standard deviation of lobbying expenditures that correspond to $w\kappa b/\eta$ in the theoretical framework. $\rho_{\phi\tau}$, $\rho_{\phi\eta}$, and $\rho_{\tau\eta}$ are fitted to the correlations between TFPQ and the residuals, TFPQ and log lobbying expenditures, and the residuals and log lobbying expenditures, respectively. TFPQ and the residuals are normalized by the weighted average within each industry, with weights based on value-added.

Additionally, I fit three additional moments: the standard deviation of TFPR, log difference in sales between the 75th and 50th percentiles (75p and 50p), and log difference in sales between the 50th and 25th percentiles (50p and 25p). These moments provide additional information about the standard deviations and correlations of the primitives.

f_b is set to match share of lobbying firms. f is fitted to log difference in sales between the 50th and 10th percentiles (50p and 10p), as f affects production decisions of small firms at the lower end of the sales distribution. f_x is fitted to match the share of exporters, reported as 0.18 in Bernard et al. (2007). τ_x is set to match the import shares of China in the US in 2007. The estimated τ_x is 4.11, higher than the estimates of 1.7 in Anderson and Van Wincoop (2004), 1.83 in Melitz and Redding (2015), and 2.85 in Bai et al. (2024), potentially reflecting higher trade costs between the US and China.

Estimation results. Table 3 reports the calibrated parameters and their corresponding identifying moments. Table 4 reports the model fit. The targeted moments are well-approximated in the model (Panel A). Also, Panel B reports non-targeted moments in the data. Matching these non-targeted moments is important because these non-targeted moments also provide information on the distributions of primitives, similar to the targeted moments. The model successfully reproduces these non-targeted moments both qualitatively and quantitatively.

The estimation results show that productivity is more dispersed than exogenous distortions ($\sigma_\phi > \sigma_\tau$). Productivity is negatively correlated with both exogenous distortions and lobbying efficiency ($\rho_{\phi\tau} < 0$ and $\rho_{\phi\eta} < 0$), indicating that more productive firms tend to face lower initial subsidies and lobbying efficiency.

4. Quantitative Results

4.1 Lobbying and Opening to Trade

I compare firms' lobbying activities in autarky to those in the current equilibrium with observed import shares. In the current equilibrium, lobbying activities align with the data, as the model is calibrated to match empirical moments, while lobbying activities in autarky are derived as counterfactual outcomes. The results, presented in Table 5, show that opening to trade increases average lobbying expenditures by 1.75% but decreases the probability of lobbying by a 0.5 percentage point.[19] Exporters increase lobbying at both the intensive and extensive margins due to increased market size, while non-exporters reduce lobbying at both margins due to intensified foreign competition. As a result,

[19] More precisely, in column 1, I compare the average lobbying expenditures, $\int_{\bar{\phi}^e} (w\kappa b(\psi)/\eta) d\hat{G}(\psi)$, of the autarky and the current equilibrium. In column 2, I compare the average lobbying expenditures in the autarky and the current equilibrium among exporters: $\int_{\bar{\phi}^x} (w\kappa b^a(\psi)/\eta) d\hat{G}(\psi)$ and $\int_{\bar{\phi}^x} (w\kappa b^t(\psi)/\eta) d\hat{G}(\psi)$, where b^a and b^t are their optimal lobbying inputs in the autarky and the current equilibrium. I restrict the comparison to this set of firms because there is no notion of exporting in the autarky. Similarly, in column 3, I compare the average lobbying expenditures in the autarky and the current equilibrium among non-exporters operating in the current equilibrium: $\int_{\bar{\phi}^e}^{\bar{\phi}^x} (w\kappa b^a(\psi)/\eta) d\hat{G}(\psi)$ and $\int_{\bar{\phi}^e}^{\bar{\phi}^x} (w\kappa b^t(\psi)/\eta) d\hat{G}(\psi)$. I compute the extensive margin results analogously.

Table 5: Lobbying and Opening to Trade

	Overall	Exporters	Non-exporters
	(1)	(2)	(3)
Δ Avg. lobbying expenditures (%)	1.75	1.25	−19.36
Δ Probability of lobbying (p.p)	−0.60	0.14	−0.76

Notes. This table reports changes in average lobbying expenditures and the probability of participating in lobbying when transitioning from autarky to the current equilibrium with observed import shares. Column 1 presents these changes for all firms, while columns 2 and 3 show the changes among exporters and non-exporters in the current equilibrium, respectively.

Table 6: Gains from Trade in the Presence and Absence of Lobbying. Baseline Scenario

	Gains from trade (%)		Diff. (p.p)
	(Lobbying)	(No lobbying)	(col. 1 - col. 2)
	(1)	(2)	(3)
	Panel A. True gains from trade		
Gains from trade, $d \ln \mathbb{W}$	2.19	2.11	0.08
Entry, $d \ln \mathbb{W}^{\mathrm{E}}$	−0.54	−0.44	−0.10
Allocative efficiency, $d \ln \mathbb{W}^{\mathrm{AE}}$	2.73	2.55	0.18
Own import shares, λ	95.27	95.59	−0.32
	Panel B. Sufficient statistics formulas		
ACR/MR	2.13	1.99	0.14
BKL	2.14	2.11	0.03

Notes. Panel A reports the true gains from trade for the two economies, one with lobbying and one without, under the baseline scenario (*Senario B*) based on the calibrated values in Table 3. Panel B reports the gains from trade as predicted by the sufficient statistics formulas of Arkolakis et al. (2012), Melitz and Redding (2015), and Bai et al. (2024).

the rise in average lobbying expenditures is mainly driven by exporters, whereas the decline in the probability of lobbying stems from non-exporters.

4.2 Lobbying and Gains from Trade

Baseline scenario. I compare welfare gains from trade between two economies: one with lobbying (lobbying economy) and one without (non-lobbying economy). Both economies share the same parameter values as those presented in Table 3, except that $\theta = 0$ in the non-lobbying economy. This comparison is referred as the *baseline scenario (Scenario B)*.

Table 6 reports the results. Gains from trade in the lobbying economy are 4% higher than the non-lobbying economy, with a 0.08 percentage point difference (2.19% vs. 2.11%). In both economies, the gains are primarily driven by improved allocative efficiency ($d \ln \mathbb{W}^{\mathrm{AE}}$ of Equation (2.8)), while the entry term ($d \ln \mathbb{W}^{\mathrm{E}}$) deteriorates due to reduced entry and increased exit by domestic firms. The improvement in $d \ln \mathbb{W}^{\mathrm{AE}}$ is 7% larger with lobbying (2.73% vs. 2.55%). However, this improvement is partially offset by a greater decline in $d \ln \mathbb{W}^{\mathrm{E}}$ (−0.54% vs. −0.44%).

Gains from trade are larger with lobbying due to the way lobbying interacts with firm primitives under the baseline calibrated values. More productive firms tend to face lower initial exogenous subsidies, as indicated by the negative correlation between productivity and exogenous distortions ($\rho_{\phi\tau} < 0$) and productivity has larger dispersion than exogenous distortions ($\sigma_\phi > \sigma_\tau$). As a result, increased lobbying by more productive exporters mitigate their initial distortions, leading to larger improvements in allocative efficiency in the lobbying economy. However, the reallocation of resources to large exporters through the lobbying channel reduces firm entry further, partially offsetting the gains from improved allocative efficiency. Despite this trade-off, the net effect leads to larger gains from trade in the presence of lobbying.

The difference in gains from trade between the two economies can be expressed as:

$$\underbrace{\ln \frac{\mathbb{W}_T^L}{\mathbb{W}_A^L}}_{\substack{\text{Gains from trade:} \\ \text{Lobbying} \\ = 2.19\%}} - \underbrace{\ln \frac{\mathbb{W}_T^{NL}}{\mathbb{W}_A^{NL}}}_{\substack{\text{Gains from trade:} \\ \text{No lobbying} \\ = 2.11\%}} = \underbrace{\underbrace{\ln \frac{\mathbb{W}_T^L}{\mathbb{W}_T^{NL}}}_{\substack{\text{Welfare effects of lobbying:} \\ \text{open economy = -17.15\%}}} - \underbrace{\ln \frac{\mathbb{W}_A^L}{\mathbb{W}_A^{NL}}}_{\substack{\text{Welfare effects of lobbying:} \\ \text{autarky = -17.23\%}}}}_{\text{Changes in welfare effects of lobbying = 0.06\%}}. \tag{4.1}$$

Subscripts T and A represent the open economy and autarky, while superscripts L and NL denote the lobbying and non-lobbying economies. The expression shows that the difference in gains from trade between the lobbying and non-lobbying economies is equivalent to the difference in welfare losses caused by lobbying between the open economy and autarky. In autarky, lobbying results in a welfare loss of −17.23%, which slightly improves to −17.15% in the open economy. This reduction in lobbying-induced welfare losses reflects the larger improvement in allocative efficiency when opening to trade in the lobbying economy.

Next, I examine how the true gains from trade under lobbying deviate from those predicted by the ACR/MR and BKL formulas, as shown in column 1 of Panel B. With lobbying, the ACR/MR and BKL formulas underestimate the true gains from trade by 2.8% and 2.3% (0.06 and 0.05 percentage points), respectively. These results show that firms' micro-level adjustment margins matter for gains from trade.

Scenario of welfare losses from trade. Unlike the *Scenario B*, where the welfare gains are positive in both the lobbying and non-lobbying economies, I consider an alternative scenario—referred to as *Scenario WL*—where opening to trade leads to welfare losses, as explored by Bai et al. (2024). This alternative scenario is achieved by assigning alternative parameter values: $\sigma_\phi = 1.2$, $\sigma_\tau = 1.1$, and $\rho_{\phi\tau} = -0.90$, while holding the other parameters as same in the *Scenario B*. These values satisfy a sufficient condition for welfare losses in the non-lobbying economy under joint-log normality,

Table 7: Gains from Trade in the Presence and Absence of Lobbying. Scenario of Welfare Losses from Trade

	Gains from trade (%) (Lobbying)	(No lobbying)	Diff. (p.p) (col. 1 - col. 2)
	(1)	(2)	(3)
	Panel A. True gains from trade		
Gains from trade, $d \ln \mathbb{W}$	−1.00	−0.29	−0.71
Entry, $d \ln \mathbb{W}^{\mathrm{E}}$	−0.60	−0.50	−0.10
Allocative efficiency, $d \ln \mathbb{W}^{\mathrm{AE}}$	−0.41	0.21	−0.62
Own import shares, λ	96.32	97.08	−0.76
	Panel B. Sufficient statistics formulas		
ACR/MR	1.31	0.99	0.32
BKL	−0.61	−0.29	−0.67

Notes. This table reports the results on gains from trade under an alternative scenario with welfare losses from trade (*Scenario WL*), achieved by setting $\sigma_\phi = 1.2$, $\sigma_\tau = 1.1$, and $\rho_{\phi\tau} = -0.90$. Panel A reports the true gains from trade for the two economies, one with and one without lobbying. Panel B reports the gains from trade as predicted by the sufficient statistics formulas of Arkolakis et al. (2012), Melitz and Redding (2015), and Bai et al. (2024).

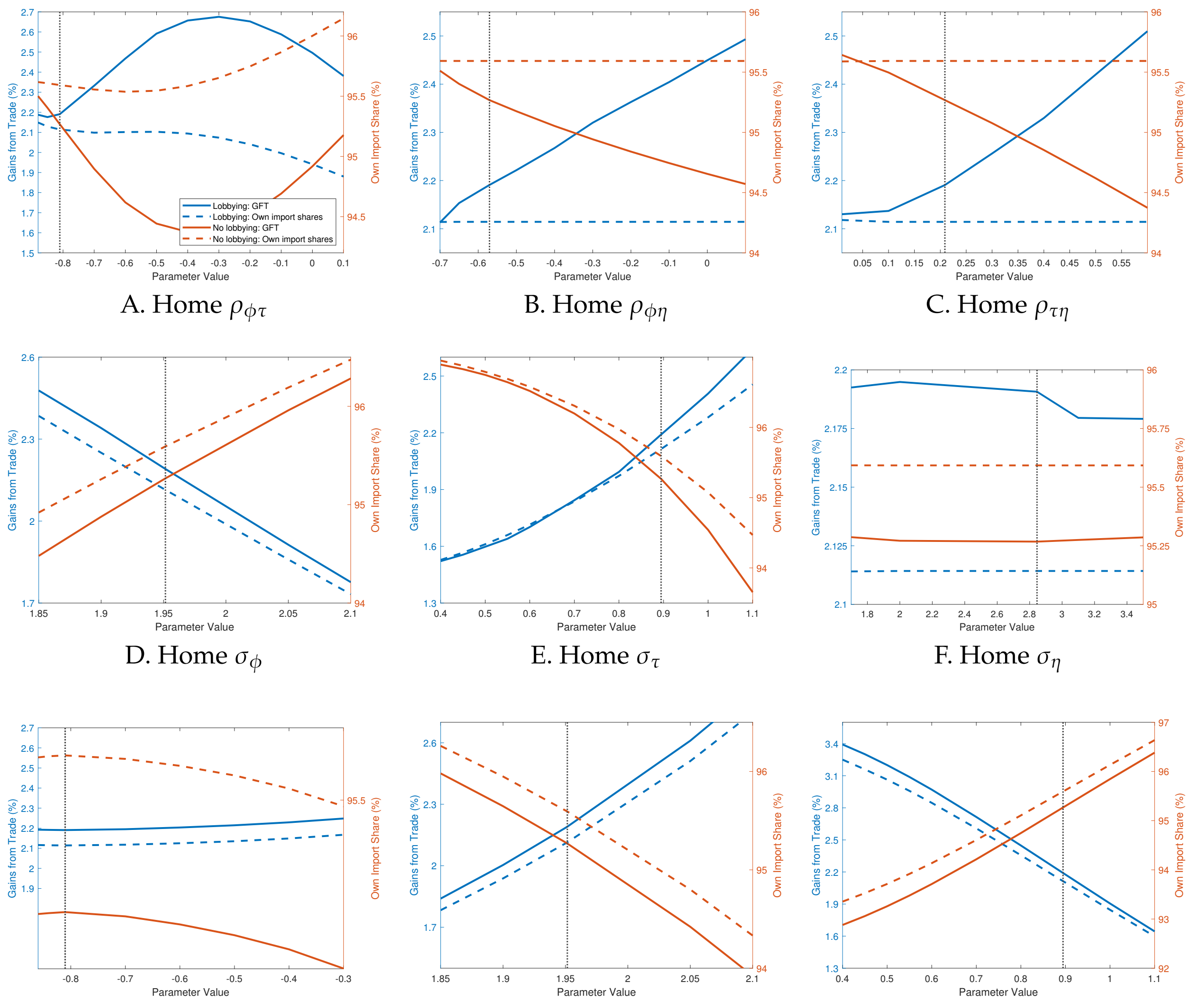
$\sigma_\tau \geq -\frac{\sigma-1}{\sigma}\rho_{\phi\tau}\sigma_\phi$, derived by Bai et al. (2024).[20] This sufficient condition implies that with sufficiently greater dispersion in exogenous distortions than productivity ($\sigma_\tau > \sigma_\phi$), selection into exporting is more significantly driven by exogenous distortions. Such distortion-driven selection worsens allocative efficiency and household transfers, resulting in welfare losses from trade.

Table 7 presents the results for the *Scenario WL*. Both economies experience welfare losses upon opening to trade, with greater losses in the lobbying economy. In particular, the deterioration of allocative efficiency is more pronounced with lobbying. This occurs because as selection here is primarily driven by exogenous distortions, initially more subsidized exporters further amplify their subsidies through increased lobbying efforts, worsening allocative efficiency. Additionally, the deviation between the true gains and those predicted by the ACR/MR formulas is larger than the *Scenario B* (Panel B), as the ACR/MR formulas always predict positive gains from trade. The loss predicted by the BKL formula is also 40% lower compared to the *Scenario B*.

To summarize, the results in Tables 6 and 7 indicate that whether lobbying amplifies or reduces gains from trade depends on which types of firms select into exporting in a second-best world. When more productive firms initially face unfavorable subsidies and selection is driven by productivity, lobbying amplifies gains from trade by allowing these exporters to mitigate their initial distortions through lobbying. On the other hand, when selection is driven by exogenous distortions, lobbying exacerbates misallocation and reduces gains from trade, as already subsidized exporters lobby for even greater subsidies.

[20] The baseline calibrated values do not satisfy this condition.

Figure 2: Interaction between Lobbying and Distributions of Home and Foreign Firm Primitives



A. Home $\rho_{\phi\tau}$ B. Home $\rho_{\phi\eta}$ C. Home $\rho_{\tau\eta}$

D. Home σ_{ϕ} E. Home σ_{τ} F. Home σ_{η}

G. Foreign $\rho_{\phi\tau}$ H. Foreign σ_{ϕ} I. Foreign σ_{τ}

Notes. This figure presents gains from trade and own import shares for varying values of parameters related to the distributions of firm primitives in Home and Foreign. The solid blue and red lines represent gains from trade in the lobbying and non-lobbying economies, respectively, while the dashed blue and red lines represent own import shares for these economies.

Interaction between lobbying and distributions of firm primitives. To better understand how lobbying interacts with the distributions of firm primitives in Home and Foreign, I evaluate gains from trade while varying one parameter related to these distributions, keeping all other parameters constant. Figure 2 shows that the results are most sensitive to the correlation between productivity and exogenous distortions $\rho_{\phi\tau}$ (Panel A). As $\rho_{\phi\tau}$ increases, gains from trade initially rise in the lobbying economy, as productive exporters are better able to offset initial distortions. At $\rho_{\phi\tau} = -0.81$ (the baseline calibrated value), the difference in gains from trade between the two economies is near the lower end of the observed range. This difference reaches its peak of about 1 percentage point around

$\rho_{\phi\tau} = -0.3$. Beyond this threshold, excessive lobbying by exporters reverses these patterns, reducing gains from trade in the lobbying economy.

Sensitivity analysis. I conduct a sensitivity analysis by varying one parameter by 1% of its calibrated value while holding other parameters constant. Additionally, I consider an alternative value of $\theta = 0.06$, based on the estimate from Huneeus and Kim (2018), with the remaining parameters re-calibrated through indirect inference. The results, presented in Table 8, remain robust to these alternative parameter values.

5. Conclusion

This paper studies welfare gains from trade in a second-best world in the presence of lobbying. As trade costs decline, exporters intensify their lobbying efforts compared to non-exporters due to the complementarity between market size and lobbying benefits. This divergence impacts allocative efficiency, firm entry, and ultimately gains from trade. I find that in the US, lobbying amplifies gains from trade as increased lobbying by exporters mitigates their initially unfavorable distortions, which leads to greater improvements in allocative efficiency compared to an economy without lobbying. However, in a scenario where trade results in welfare losses—due to selection into exporting driven by exogenous distortions—lobbying can exacerbate these losses. These findings highlight the importance of understanding how lobbying interacts with which types of firms select into exporting in a second-best world. These findings also highlight that firms' micro-level adjustments to trade shocks matter for gains from trade.

However, the use of Compustat data, which is limited to publicly traded firms, raises concerns about the representativeness of these findings to the broader US economy. Moreover, the model abstracts from strategic interactions among firms and competition dynamics. Future research should enrich both data and theory to explore interactions between lobbying and trade openness further. Moreover, extending this framework to analyze other rent-seeking behaviors, such as tax evasion or corporate bribery, presents promising avenues for research.

Table 8: Sensitivity Analysis

Parameters	Home $\rho_{\phi\tau}$		Home $\rho_{\phi\eta}$		Home $\rho_{\tau\eta}$		Home σ_ϕ		Home σ_τ		Home σ_η		Foreign $\rho_{\phi\eta}$		Foreign σ_ϕ		Foreign σ_ϕ		$\theta = 0.06$
	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	$\downarrow$1%	$\uparrow$1%	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
	Panel A. True gains from trade																		
Gains from trade (%)																			
Lobbying	2.20	2.19	2.19	2.18	2.18	2.18	2.24	2.13	2.19	2.21	2.19	2.18	2.19	2.19	2.12	2.27	2.22	2.17	2.16
No Lobbying	2.11	2.12	2.11	2.11	2.11	2.11	2.17	2.06	2.10	2.13	2.11	2.11	2.11	2.11	2.05	2.19	2.14	2.09	2.11
	Panel B. Sufficient statistics formulas																		
ACR/MR	2.17	2.11	2.15	2.14	2.13	2.14	2.20	2.08	2.10	2.17	2.14	2.14	2.13	2.13	2.06	2.21	2.16	2.11	2.12
BKL	2.16	2.13	2.15	2.14	2.13	2.14	2.20	2.09	2.13	2.17	2.15	2.14	2.14	2.14	2.07	2.22	2.17	2.12	2.13

Notes. This table presents the sensitivity analysis results for Home and Foreign parameters associated with the distribution of firm primitives in Home and Foreign, as well as the parameter θ. Panel A reports the true gains from trade for the two economies, one with and one without lobbying. Panel B provides the gains from trade as predicted by the sufficient statistics formulas of Arkolakis et al. (2012), Melitz and Redding (2015), and Bai et al. (2024). In columns 18, parameter values are adjusted by 1% from their baseline calibrated values. Column 19 examines the case where $\theta = 0.06$, based on the estimate from Huneeus and Kim (2018), with all other parameters recalibrated accordingly.

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ONLINE APPENDIX

(NOT FOR PUBLICATION)

A. Theory Appendix

A.1 Model Derivation

Derivation of optimal lobbying inputs and profits. I derive expressions for firms' optimal lobbying and profits conditional on lobbying. I first characterize non-exporters' optimal lobbying inputs and profits. Conditional on lobbying amounts of b, non-exporters' profits are

$$\pi^d(b;\psi) = \frac{1}{\sigma}\Big(\frac{\mu w}{\phi}\Big)^{1-\sigma}\tau^\sigma b^{\theta\sigma}P^{\sigma-1}E - w\Big(\kappa\frac{b}{\eta} + f_b + f\Big) = \tilde{\pi}^d(0;\psi)b^{\theta\sigma} - w\Big(\kappa\frac{b}{\eta} + f_b + f\Big) \tag{A.1}$$

where $\tilde{\pi}^d(0;\psi)$ are non-exporters' variable profits conditional on not lobbying.

Firms choose their optimal lobbying inputs that maximize profits, characterized by the first-order conditions (FOC). Taking the derivative with respect to b, I obtain the following FOC:

$$\kappa\frac{w}{\eta} = \theta\sigma\tilde{\pi}^d(0;\psi)b^{(\theta\sigma-1)}.$$

After arranging the above equation, the optimal lobbying inputs can be expressed as follows:

$$b^d = \Big(\frac{\theta\sigma\eta}{\kappa w}\tilde{\pi}^d(0;\psi)\Big)^{\frac{1}{1-\theta\sigma}}.$$

After substituting the optimal lobbying inputs into Equation (A.1), I obtain that

$$\pi^d(b;\psi) = (1-\theta\sigma)\Big(\frac{\theta\sigma\eta}{\kappa w}\Big)^{\frac{\theta\sigma}{1-\theta\sigma}}\tilde{\pi}^d(0;\psi)^{\frac{1}{1-\theta\sigma}} - w(f+f_b).$$

Exporters' optimal lobbying inputs and profits can be derived similarly. Conditional on lobbying inputs of b, exporters' profits are

$$\begin{aligned}\pi^x(b;\psi) &= \Big[\frac{1}{\sigma}\Big(\frac{\mu w}{\phi}\Big)^{1-\sigma}\tau^\sigma P^{\sigma-1}E + \frac{1}{\sigma}\Big(\frac{\mu\tau_x w}{\phi}\Big)^{1-\sigma}\tau^\sigma P_f^{\sigma-1}E_f\Big]b^{\theta\sigma} - w\Big(\kappa\frac{b}{\eta} + f_b + f + f_x\Big)\\ &= \big(\tilde{\pi}^x(0;\psi) + \tilde{\pi}^x(0;\psi)\big)b^{\theta\sigma} - w\Big(\kappa\frac{b}{\eta} + f_b + f + f_x\Big).\end{aligned}$$

where $\tilde{\pi}^x(0;\psi)$ are non-exporters' variable profits conditional on not lobbying. From the FOC with respect to b, the optimal lobbying inputs are expressed as

$$b^x = \Big(\frac{\theta\sigma\eta}{\kappa w}\big(\tilde{\pi}^x(0;\psi) + \tilde{\pi}^x(0;\psi)\big)\Big)^{\frac{1}{1-\theta\sigma}}.$$

After substituting the optimal lobbying inputs, I obtain that

$$\pi^x(b;\psi) = (1-\theta\sigma)\Big(\frac{\theta\sigma\eta}{\kappa w}\Big)^{\frac{\theta\sigma}{1-\theta\sigma}}\big(\tilde{\pi}^d(0;\psi) + \tilde{\pi}^x(0;\psi)\big)^{\frac{1}{1-\theta\sigma}} - w(f+f_b+f_x).$$

Zero profit cutoff. The zero profit cutoff productivity satisfies that $\pi(\bar{\phi}^e(\tau,\eta),\tau,\eta) = 0$, which is determined as

$$\bar{\phi}^e(\tau,\eta) = \left[\frac{\sigma f}{\frac{1}{\sigma}(\mu w)^{1-\sigma}P^{\sigma-1}E}\right]^{\frac{1}{\sigma-1}}. \tag{A.2}$$

Lobbying cutoff. The lobbying cutoff is characterized as

$$\max\left\{\pi^d(0;\bar{\phi}^b(\tau,\eta),\tau,\eta), \pi^d(0;\bar{\phi}^b(\tau,\eta),\tau,\eta) + \pi^x(0;\bar{\phi}^b(\tau,\eta),\tau,\eta)\right\}$$
$$= \max\left\{\pi^d(b^d;\bar{\phi}^b(\tau,\eta),\tau,\eta), \pi^x(b^x;\bar{\phi}^b(\tau,\eta),\tau,\eta)\right\},$$

where the left- and right-hand sides are the maximum profits conditional on not lobbying and lobbying, respectively.

More specifically, when η is sufficiently high, non-exporters may participate in lobbying, that is, $\bar{\phi}^b(\tau,\eta) < \bar{\phi}^x(\tau,\eta)$. In such a case, the lobbying cutoff is implicitly defined by the following condition:

$$(1-\theta\sigma)\left(\frac{\theta\sigma\eta}{\kappa w}\right)^{\frac{\theta\sigma}{1-\theta\sigma}}\left(\frac{1}{\sigma}\left(\frac{\mu w}{\bar{\phi}^b(\tau,\eta)}\right)^{1-\sigma}\tau^\sigma P^{\sigma-1}E\right)^{\frac{1}{1-\theta\sigma}} - wf_b = \frac{1}{\sigma}\left(\frac{\mu w}{\bar{\phi}^b(\tau,\eta)}\right)^{1-\sigma}\tau^\sigma P^{\sigma-1}E, \tag{A.3}$$

In the case in which $\bar{\phi}^b(\tau,\eta) \geq \bar{\phi}^x(\tau,\eta)$ holds, the lobbying cutoff is implicitly defined by the following condition:

$$(1-\theta\sigma)\left(\frac{\theta\sigma\eta}{\kappa w}\right)^{\frac{\theta\sigma}{1-\theta\sigma}}\left(\frac{1}{\sigma}\left(\frac{\mu w}{\bar{\phi}^b(\tau,\eta)}\right)^{1-\sigma}\tau^\sigma(P^{\sigma-1}E + \tau_x^{1-\sigma}P_f^{\sigma-1}E_f)\right)^{\frac{1}{1-\theta\sigma}} - wf_b$$
$$= \frac{1}{\sigma}\left(\frac{\mu w}{\bar{\phi}^b(\tau,\eta)}\right)^{1-\sigma}\tau^\sigma(P^{\sigma-1}E + \tau_x^{1-\sigma}P_f^{\sigma-1}E_f). \tag{A.4}$$

Export cutoff. The export cutoff is characterized by

$$\max\left\{\pi^d(0;\bar{\phi}^x(\tau,\eta),\tau,\eta) + \pi^x(0;\bar{\phi}^x(\tau,\eta),\tau,\eta), \pi^x(b^x;\bar{\phi}^x(\tau,\eta),\tau,\eta)\right\}$$
$$= \max\left\{\pi^d(0;\bar{\phi}^x(\tau,\eta),\tau,\eta), \pi^d(b^d;\bar{\phi}^x(\tau,\eta),\tau,\eta)\right\},$$

where the left-and right-hand sides are the maximum profits conditional on exporting and not exporting, respectively.

More specifically, in the case in which $\bar{\phi}^b(\tau,\eta) \geq \bar{\phi}^x(\tau,\eta)$ holds, the export cutoff satisfies that

$$\frac{1}{\sigma}\left(\frac{\mu\tau_x w}{\bar{\phi}^x(\tau,\eta)}\right)^{1-\sigma}\tau^\sigma P_f^{\sigma-1}E_f = wf_x.$$

From this condition, the export cutoff can be expressed as follows:

$$\bar{\phi}^x(\tau,\eta) = \left(\frac{wf_x}{\frac{1}{\sigma}(\mu\tau_x w)^{1-\sigma}\tau^\sigma P_f^{\sigma-1}E_f}\right)^{\frac{1}{\sigma-1}}. \tag{A.5}$$

In the case where $\bar{\phi}^b(\tau,\eta) < \bar{\phi}^x(\tau,\eta)$, the export cutoff satisfies

$$(1-\theta\sigma)\Big(\frac{\theta\sigma\eta}{\kappa w}\Big)^{\frac{\theta\sigma}{1-\theta\sigma}}\Big(\frac{1}{\sigma}\Big(\frac{\mu w}{\bar{\phi}^x(\tau,\eta)}\Big)^{1-\sigma}\tau^{\sigma}(P^{\sigma-1}E+\tau_x^{1-\sigma}P_f^{\sigma-1}E_f)\Big)^{\frac{1}{1-\theta\sigma}} - wf_x$$
$$= (1-\theta\sigma)\Big(\frac{\theta\sigma\eta}{\kappa w}\Big)^{\frac{\theta\sigma}{1-\theta\sigma}}\Big(\frac{1}{\sigma}\Big(\frac{\mu w}{\bar{\phi}^x(\tau,\eta)}\Big)^{1-\sigma}\tau^{\sigma}P^{\sigma-1}E\Big)^{\frac{1}{1-\theta\sigma}}.$$

From this condition, the export cutoff can be expressed as follows:

$$\bar{\phi}^x(\tau,\eta) = \left(\frac{\sigma^{\frac{1}{1-\theta\sigma}}wf_x}{(1-\theta\sigma)(\frac{\theta\sigma\eta}{\kappa w})^{\frac{\theta\sigma}{1-\theta\sigma}}(\mu w)^{\frac{1-\sigma}{1-\theta\sigma}}\tau^{\sigma}\big((P^{\sigma-1}E+\tau_x^{1-\sigma}P_f^{\sigma-1}E)^{\frac{1}{1-\theta\sigma}}-(P^{\sigma-1}E)^{\frac{1}{1-\theta\sigma}}\big)}\right)^{\frac{1-\theta\sigma}{\sigma-1}}. \tag{A.6}$$

A.2 Derivation of Equation (2.8)

The total labor used for production can be written as follows:

$$L^p = M\Big[\int \frac{q(\psi)}{\phi}d\hat{G}(\psi) + \int x(\psi)\frac{q^x(\psi)}{\phi}d\hat{G}(\psi)\Big].$$

Dividing both sides by $Q = \Big[M\int q(\psi)^{\frac{\sigma-1}{\sigma}}d\hat{G}(\psi) + M_f\int x_f(\psi)q_f^x(\psi)^{\frac{\sigma-1}{\sigma}}d\hat{G}_f(\psi)\Big]^{\frac{\sigma}{\sigma-1}}$, I can obtain that

$$\frac{L^p}{Q} = M\Big[\int \frac{1}{\phi}\frac{q(\psi)}{Q}d\hat{G}(\psi) + \int x(\psi)\frac{1}{\phi}\frac{q^x(\psi)}{Q}d\hat{G}(\psi)\Big],$$

which can be expressed as follows:

$$\frac{L^p}{Q} = M^{-\frac{1}{\sigma-1}}\Big[\int \frac{1}{\phi}\frac{q(\psi)}{\tilde{q}}d\hat{G}(\psi) + \int x(\psi)\frac{1}{\phi}\frac{q^x(\psi)}{\tilde{q}}d\hat{G}(\psi)\Big],$$

where $\tilde{q}$ is defined as follows:

$$\tilde{q} = \Big[\int q(\psi)^{\frac{\sigma-1}{\sigma}}d\hat{G}(\psi) + \frac{M_f}{M}\int x_f(\psi)q_f^x(\psi)^{\frac{\sigma-1}{\sigma}}d\hat{G}_f(\psi)\Big]^{\frac{\sigma}{\sigma-1}}.$$

Rearranging the terms, I can rewrite Q as follows:

$$Q = AL, \quad \text{where} \quad A = M^{\frac{1}{\sigma-1}} \times \Big[\int \frac{1}{\phi}\frac{q(\psi)}{\tilde{q}}d\hat{G}(\psi) + \int x(\psi)\frac{1}{\phi}\frac{q^x(\psi)}{\tilde{q}}d\hat{G}(\psi)\Big]^{-1} \times \frac{L^p}{L}.$$

Because $\mathbb{W} = Q/L$, when $d\ln(L^p/L)$ is sufficiently small,

$$d\ln\mathbb{W} \approx \frac{1}{\sigma-1}d\ln M + d\ln\Big[\int x(\psi)\frac{1}{\phi}\frac{q^x(\psi)}{\tilde{q}}d\hat{G}(\psi)\Big]^{-1}.$$

Comparison between the allocative efficiency Terms in Equation (2.8) and Hsieh and Klenow (2009). I show that the allocative efficiency term coincides with the allocative efficiency term derived in Hsieh and Klenow (2009). In the closed economy without lobbying, the second term can be rewritten as follows:

$$M^{-\frac{\sigma}{\sigma-1}}\left[\int \frac{1}{\phi}\Big(\frac{p(\psi)}{P}\Big)^{-\sigma} d\hat{G}(\psi)\right]^{-1}.$$

Using the ideal price index, this can be rewritten as follows:

$$\frac{\left[\int (\phi\tau)^{\sigma-1} d\hat{G}(\psi)\right]^{\frac{1}{\sigma-1}}}{\left[\int \tau \times \underbrace{\frac{(\mu w)^{1-\sigma}(\phi\tau)^{\sigma-1}P^{\sigma-1}E}{E}}_{=\omega(\psi)} d\hat{G}(\psi)\right]},$$

where $\omega(\psi)$ is the share of firms sales' to total expenditures. The denominator is the weighted average of τ where the weights are given by value-added shares of firms. Define $\overline{\text{TFPR}}$ as the denominator of the above expression. Because $\tau \propto$ TFPR, I can obtain the TFP formula of Hsieh and Klenow (2009):

$$A \propto \left[\int \Big(\phi \frac{\text{TFPR}}{\overline{\text{TFPR}}}\Big)^{\sigma-1} d\hat{G}(\psi)\right]^{\frac{1}{\sigma-1}}.$$

A.3 Proof of Proposition 2.1

This section presents the proof of Proposition 2.1. Without loss of generality, I normalize wage w to one. The price index can be expressed as follows:

$$\begin{aligned}P^{1-\sigma} = \mu^{\frac{(1-\sigma)(1-\theta)}{1-\theta\sigma}}\left(\frac{\theta}{\kappa}\right)^{\frac{\theta(\sigma-1)}{1-\theta\sigma}}(P^{\sigma}Q)^{\frac{\theta(\sigma-1)}{1-\theta\sigma}} \\ \times M_e\Big[\tilde{\lambda}(\hat{\phi}^e,\hat{\phi}^x) + (1+\tau_x^{1-\sigma})^{\frac{\theta(\sigma-1)}{1-\theta\sigma}}\tilde{\lambda}(\hat{\phi}^x,\infty) + \tau_x^{1-\sigma}(1+\tau_x^{1-\sigma})^{\frac{\theta(\sigma-1)}{1-\theta\sigma}}\tilde{\lambda}(\hat{\phi}^x,\infty)\Big],\end{aligned}$$

which can be re-expressed as follows:

$$P^{1-\sigma} = cons \times M_e (P^{\sigma}Q)^{\frac{\theta(\sigma-1)}{1-\theta\sigma}}\frac{\mathcal{L}^{\lambda}}{\lambda}\tilde{\lambda}(\hat{\phi}^e,\infty), \tag{A.7}$$

where $cons$ is a collection of parameters that are invariant to iceberg cost changes, λ is a share of expenditures on domestic varieties (Equation (2.9)) and $\mathcal{L}^{\lambda}$ is the ratio of expenditure on domestic varieties to its counterfactual value when exporters exert lobbying efforts as if they were in autarky (Equation (2.11)). Equation (A.7) is one of the two key equations for the proof.

The free entry condition implies that

$$
\begin{aligned}
& p_e\Big(\big(\mathbb{J}[\tilde{\pi}^d(b^d)] - (1-p_x)f\big) + \big(\mathbb{J}[\tilde{\pi}^x(b^x)] - p_x f_x - p_x f\big)\Big) = f_e \\
& \Leftrightarrow \mathbb{J}[\tilde{\pi}^d(b^d)] + \mathbb{J}[\tilde{\pi}^x(b^x)] = \Big(\frac{f_e}{p_e} + f + p_x f_x\Big),
\end{aligned}
\tag{A.8}
$$

where $p_e = \frac{1}{1-G(\bar{\phi}^e(\tau,\eta))}$ is the probability of entry, $p_x = \frac{1-G(\bar{\phi}^x(\tau,\eta))}{1-G(\bar{\phi}^e(\tau,\eta))}$ is the probability of exporting conditioning on entry, and $\mathbb{J}[\tilde{\pi}^d(b^d)]$ and $\mathbb{J}[\tilde{\pi}^x(b^x)]$ are defined as follows:

$$
\mathbb{J}[\tilde{\pi}^d(b^d)] = \iiint_{\hat{\phi}^e \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}}^{\hat{\phi}^x \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}} \underbrace{(1-\theta\sigma)\left(\frac{\theta\sigma\eta}{w}\right)^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{\pi}^d(0)^{\frac{1}{1-\theta\sigma}}}_{=\tilde{\pi}^d(b^d)} d\hat{G}(\psi)
$$

$$
\mathbb{J}[\tilde{\pi}^x(b^x)] = \iiint_{\hat{\phi}^x \tau^{\frac{-\sigma}{\sigma-1}} \eta^{\frac{-\theta\sigma}{\sigma-1}}}^{\infty} \underbrace{(1-\theta\sigma)\left(\frac{\theta\sigma\eta}{w}\right)^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{\pi}^x(0)^{\frac{1}{1-\theta\sigma}}}_{=\tilde{\pi}^d(b^d)} d\hat{G}(\psi),
$$

where $\tilde{\pi}^d(0)$ and $\tilde{\pi}^x(0)$ are operating profits conditional on not lobbying (i.e., operating profits under standard monopolistic competition): $\tilde{\pi}^d(0) = \frac{1}{\sigma}(\frac{\mu}{\phi})^{1-\sigma}\tau^\sigma P^\sigma Q$ and $\tilde{\pi}^x(0) = \frac{1}{\sigma}(\frac{\mu}{\phi})^{1-\sigma}\tau^\sigma(1+\tau_x^{1-\sigma})P^\sigma Q$.

Labor used for production for non-exporters and exporters is

$$
\begin{aligned}
l_d &= \frac{q_d}{\phi} = (\sigma-1)(\eta\theta\sigma)^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{\pi}^d(0)^{\frac{1}{1-\theta\sigma}} = \frac{\sigma-1}{1-\theta\sigma}\tilde{\pi}^d(b^d) \\
l^x &= \frac{q_d + \tau_x q^x}{\phi} = (\sigma-1)(\eta\theta\sigma)^{\frac{\theta\sigma}{1-\theta\sigma}} \tilde{\pi}^x(0)^{\frac{1}{1-\theta\sigma}} = \frac{\sigma-1}{1-\theta\sigma}\tilde{\pi}^x(b^x),
\end{aligned}
\tag{A.9}
$$

Labor used for lobbying for non-exporters and exporters is

$$
\begin{aligned}
\frac{b^d}{\eta} &= \eta^{\frac{\theta\sigma}{1-\theta\sigma}}(\theta\sigma)^{\frac{1}{1-\theta\sigma}} \tilde{\pi}^d(0)^{\frac{1}{1-\theta\sigma}} = \frac{\theta\sigma}{1-\theta\sigma}\tilde{\pi}^d(b^d) \\
\frac{b^x}{\eta} &= \eta^{\frac{\theta\sigma}{1-\theta\sigma}}(\theta\sigma)^{\frac{1}{1-\theta\sigma}} \big(\tilde{\pi}^d(0) + \tilde{\pi}^x(0)\big)^{\frac{1}{1-\theta\sigma}} = \frac{\theta\sigma}{1-\theta\sigma}\tilde{\pi}^x(b^x).
\end{aligned}
\tag{A.10}
$$

Labor market clearing condition implies that

$$
M\Big(\mathbb{J}[l^d + \frac{b^d}{\eta}] + \mathbb{J}[l^x + \frac{b^x}{\eta}] + f + p_x f_x\Big) + M_e f_e = L \tag{A.11}
$$

Combining Equations (A.9) and (A.10), I can obtain that

$$
\left[\frac{\sigma-1}{1-\theta\sigma} + \frac{\theta\sigma}{1-\theta\sigma}\right]\Big(\mathbb{J}[\tilde{\pi}^d(b^d)] + \mathbb{J}[\tilde{\pi}^x(b^x)]\Big) = \mathbb{J}[l^d + \frac{b^d}{\eta}] + \mathbb{J}[l^x + \frac{b^x}{\eta}]. \tag{A.12}
$$

Combining the free entry and labor market clearing conditions (Equations (A.8) and (A.12)), firm mass can be expressed as follows:

$$M = \frac{1-\theta\sigma}{\sigma}\frac{L}{(f + p_x f_x + \frac{f_e}{p_e})}. \tag{A.13}$$

Substituting Equations (A.13) and (A.12) into Equation (A.11), I obtain that

$$M\Big(\mathbb{J}[\tilde{\pi}^d(b^d)] + \mathbb{J}[\tilde{\pi}^x(b^x)]\Big) = \frac{\sigma - 1 + \theta\sigma}{\sigma}L,$$

which can be rewritten as

$$(\sigma-1)(\theta\sigma)^{\frac{\theta\sigma}{1-\theta\sigma}}\left(\frac{\mu}{\sigma}\right)^{\frac{1}{1-\theta\sigma}}\left[\tilde{S}(\hat{\phi}^e,\hat{\phi}^x) + (1+\tau_x^{1-\sigma})^{\frac{\theta\sigma}{1-\theta\sigma}}\tilde{S}(\hat{\phi}^x,\infty) + \tau_x^{1-\sigma}(1+\tau_x^{1-\sigma})^{\frac{\theta\sigma}{1-\theta\sigma}}\tilde{S}(\hat{\phi}^x,\infty)\right]$$
$$\times M_e P^{\frac{\sigma}{1-\theta\sigma}} Q^{\frac{1}{1-\theta\sigma}} = \frac{\sigma-1+\theta\sigma}{\sigma}L.$$

The above expression can be re-expressed as follows:

$$\frac{\mathcal{L}^s}{S}\tilde{S}(\hat{\phi}^e,\infty)M_e P^{\frac{\sigma}{1-\theta\sigma}} Q^{\frac{1}{1-\theta\sigma}} = cons, \tag{A.14}$$

where the right-hand side is a collection of parameters that are invariant to iceberg costs. Equation (A.14) is the second key equation for the proof.

Next, I totally differentiate Equations (A.7) and (A.14). Totally differentiating Equation (A.7) related to the price index, I can obtain the following expression:

$$(1-\sigma)d\ln P = \frac{\sigma\theta(\sigma-1)}{1-\theta\sigma}d\ln P + \frac{\theta(\sigma-1)}{1-\theta\sigma}d\ln Q + d\ln M_e - d\ln\big(\lambda/\mathcal{L}^\lambda\big) - \frac{1}{1-\theta\sigma}\gamma_\lambda(\hat{\phi}^e)d\ln\hat{\phi}^e. \tag{A.15}$$

Similarly, totally differentiating Equation (A.14) related to the labor market clearing and the free entry conditions, I can obtain the following expression:

$$d\ln M_e + \frac{\sigma}{1-\theta\sigma}d\ln P + \frac{1}{1-\theta\sigma}d\ln Q - d\ln(S/\mathcal{L}^s) - \frac{1}{1-\theta\sigma}\gamma_s(\hat{\phi}^e)d\ln\hat{\phi}^e = 0. \tag{A.16}$$

Totally differentiating the entry cutoff,

$$d\ln\hat{\phi}^e = -d\ln P - \frac{1}{\sigma-1}d\ln PQ. \tag{A.17}$$

Combining Equations (A.15) and (A.17), I can derive that

$$-d\ln P = \frac{1}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}\left\{-d\ln\big(\lambda/\mathcal{L}^\lambda\big) + d\ln M_e\right\} + \frac{\frac{\gamma_\lambda(\hat{\phi}^e)}{\sigma-1} + \theta(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}d\ln PQ. \tag{A.18}$$

Substituting the above equation into $d\ln Q = -d\ln P + d\ln PQ$, because changes in welfare are equivalent to changes in the aggregate quantities produced, $d\ln W = d\ln Q$, I can obtain that

$$d\ln W = \frac{1}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}\left\{-d\ln\left(\lambda/\mathcal{L}^\lambda\right) + d\ln M_e\right\} + \left(\frac{\frac{\gamma_\lambda(\hat{\phi}^e)}{\sigma-1} + \theta(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)} + 1\right) d\ln PQ. \tag{A.19}$$

Combining Equations (A.16) and (A.17),

$$-d\ln P = \frac{1}{\sigma-1} d\ln PQ + \frac{1-\theta\sigma}{\gamma_s(\hat{\phi}^e) + \sigma - 1}\left\{-d\ln(S/\mathcal{L}^s) + d\ln M_e\right\}.$$

Substituting Equation (A.18) into the above equation, I can obtain that

$$d\ln PQ = \frac{1}{1-\theta\sigma}\left\{-d\ln\left(\lambda/\mathcal{L}^\lambda\right) + d\ln M_e\right\} - \frac{\gamma_\lambda + (\sigma-1)(1-\theta)}{\gamma_s + \sigma - 1}\left\{-d\ln(S/\mathcal{L}^s) + d\ln M_e\right\}.$$

Rearranging the equation,

$$\begin{aligned} d\ln PQ = &\left(\frac{1}{1-\theta\sigma} - \frac{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e) + \sigma - 1}\right)\left\{-d\ln\left(\lambda/\mathcal{L}^\lambda\right) + d\ln M_e\right\} \\ &\left(\frac{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e) + \sigma - 1}\right)\left\{-d\ln\left(\lambda/\mathcal{L}^\lambda\right) + d\ln(S/\mathcal{L}^s)\right\}. \end{aligned} \tag{A.20}$$

Combining Equations (A.19) and (A.20) gives the desired result.

□

A.4 Proof of Corollary 2.1

I consider Pareto-distributed productivity with the shape parameter κ with the location parameter normalized to 1. Exogenous distortions and lobbying efficiency are homogeneous. Under the Pareto distribution, I can derive the following set of equations:

$$\begin{aligned} \tilde{\lambda}(\hat{\phi}^e, \infty) &= \int_{\hat{\phi}^e}^{\infty} \phi^{\frac{(\sigma-1)(1-\theta)}{1-\theta\sigma}} \kappa\phi^{-\kappa-1} d\phi = \frac{\kappa}{\kappa - \frac{(\sigma-1)(1-\theta)}{1-\theta\sigma}} (\hat{\phi}^e)^{-\kappa + \frac{(\sigma-1)(1-\theta)}{1-\theta\sigma}} \\ \tilde{S}(\hat{\phi}^e, \infty) &= \int_{\hat{\phi}^e}^{\infty} \phi^{\frac{\sigma-1}{1-\theta\sigma}} \kappa\phi^{-\kappa-1} d\phi = \frac{\kappa}{\kappa - \frac{\sigma-1}{1-\theta\sigma}} (\hat{\phi}^e)^{-\kappa + \frac{\sigma-1}{1-\theta\sigma}} \\ \gamma_\lambda(\hat{\phi}^e) &= -(1-\theta\sigma)\frac{d\ln\tilde{\lambda}(\hat{\phi}^e)}{d\ln\hat{\phi}^e} = (1-\theta\sigma)\kappa - (\sigma-1)(1-\theta) \\ \gamma_s(\hat{\phi}^e) &= -(1-\theta\sigma)\frac{d\ln\tilde{S}(\hat{\phi}^e)}{d\ln\hat{\phi}^e} = (1-\theta\sigma)\kappa - (\sigma-1), \end{aligned}$$

which gives

$$\frac{1}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)} = \frac{1}{(1-\theta\sigma)\kappa}.$$

$$\frac{\gamma_\lambda(\hat{\phi}^e)/(\sigma-1)+\theta(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}+1=\frac{\sigma}{\sigma-1}-\frac{1}{\kappa}.$$

$$\frac{1}{1-\theta\sigma}-\frac{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e)+\sigma-1}=\frac{\theta\sigma}{1-\theta\sigma}.$$

$$\frac{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e)+\sigma-1}=1.$$

Now, I show that $d\ln M_e=0$. The free entry condition (Equation (A.8)) can be written as follows:

$$\int_{\hat{\phi}^e}^{\hat{\phi}^x}\left(\frac{\phi}{\hat{\phi}^e}\right)^{\frac{\sigma-1}{1-\theta\sigma}}\tilde{\pi}^d(\hat{\phi}^e)dG(\phi)+\int_{\hat{\phi}^x}^{\infty}\left(\frac{\phi}{\hat{\phi}^x}\right)^{\frac{\sigma-1}{1-\theta\sigma}}\tilde{\pi}^x(\hat{\phi}^x)dG(\phi)-p_e f-p_e p_x f_x=f_e,$$

where I used that operating profits of non-exporters and exporters can be written in terms of the other firm: $\tilde{\pi}^o(\phi)=(\phi/\phi')^{\frac{\sigma-1}{1-\theta\sigma}}\tilde{\pi}^o(\phi')$ for $o\in\{d,x\}$. Using that $\tilde{\pi}^d(\hat{\phi}^e)=f$ and $\tilde{\pi}^x(\hat{\phi}^x)=\tilde{\pi}^d(\hat{\phi}^x)+f_x=(\hat{\phi}^x/\hat{\phi}^e)^{\frac{\sigma-1}{1-\theta\sigma}}f+f_x$,

$$f\int_{\hat{\phi}^e}^{\infty}\left(\frac{\phi}{\hat{\phi}^e}\right)^{\frac{\sigma-1}{1-\theta\sigma}}dG(\phi)+f_x\int_{\hat{\phi}^e}^{\hat{\phi}^x}\left(\frac{\phi}{\hat{\phi}^e}\right)^{\frac{\sigma-1}{1-\theta\sigma}}dG(\phi)-p_e f-p_e p_x f_x=f_e\Leftrightarrow p_e f+p_e p_x f_x=\frac{\kappa-\frac{\sigma-1}{1-\theta\sigma}}{\frac{\sigma-1}{1-\theta\sigma}}f_e.$$

Substituting the above expression into Equation (A.13) and using that $p_e M_e=M$, I obtain that $M_e=\frac{\sigma-1}{\sigma\kappa}\frac{L}{f_e}$, which is a function of only parameters and therefore remains constant regardless of values of iceberg costs. Combining these results, the welfare formula becomes

$$\begin{aligned}d\ln\mathbb{W}=&\frac{1}{\kappa}\{-d\ln\lambda\}+\frac{1}{\kappa}\{d\ln\mathcal{L}^\lambda\}\\&+\left(\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}-\frac{1}{\kappa}\right)\{-d\ln\lambda+d\ln\mathcal{L}^\lambda\}+\left(\frac{\sigma}{\sigma-1}-\frac{1}{\kappa}\right)\{d\ln S-d\ln\mathcal{L}^s\}.\end{aligned}$$

It remains to show signs of each term in the above equation. It is obvious that the first two terms are always positive when moving from autarky to an open economy. Therefore, it suffices to show that the last term is negative when fixed export costs are sufficiently high. Note that the following holds:

$$\begin{aligned}&\left(\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}-\frac{1}{\kappa}\right)\{-d\ln\lambda+d\ln\mathcal{L}^\lambda\}+\left(\frac{\sigma}{\sigma-1}-\frac{1}{\kappa}\right)\{d\ln S-d\ln\mathcal{L}^s\}<0\\&\Leftrightarrow(\lambda/\mathcal{L}^\lambda)^{\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}-\frac{1}{\kappa}}>(S/\mathcal{L}^s)^{\frac{\sigma}{\sigma-1}-\frac{1}{\kappa}}.\end{aligned}$$

Note that $\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}-\frac{1}{\kappa}>0$ and $\frac{\sigma}{\sigma-1}-\frac{1}{\kappa}>0$ holds under the regularity conditions. Also, note that

$$\frac{\lambda}{\mathcal{L}^\lambda}=\frac{\tilde{\lambda}(\hat{\phi}^e,\infty)}{\tilde{\lambda}(\hat{\phi}^e,\infty)+[(1+\tau_x^{1-\sigma})^{\frac{1-\theta}{1-\theta\sigma}}-1]\tilde{\lambda}(\hat{\phi}^x,\infty)}=\frac{1}{1+[(1+\tau_x^{1-\sigma})^{\frac{1-\theta}{1-\theta\sigma}}-1](\frac{\hat{\phi}^x}{\hat{\phi}^e})^{\frac{\sigma-1}{\sigma}(-\kappa+\frac{\sigma-1}{1-\theta\sigma})}}.$$

$$\frac{S}{\mathcal{L}^s}=\frac{\tilde{S}(\hat{\phi}^e,\infty)}{\tilde{S}(\hat{\phi}^e,\infty)+[(1+\tau_x^{1-\sigma})^{\frac{1}{1-\theta\sigma}}-1]\tilde{S}(\hat{\phi}^x,\infty)}=\frac{1}{1+[(1+\tau_x^{1-\sigma})^{\frac{1}{1-\theta\sigma}}-1](\frac{\hat{\phi}^x}{\hat{\phi}^e})^{\frac{\sigma-1}{\sigma}(-\kappa+\frac{\sigma}{1-\theta\sigma})}}.$$

In autarky, $\lambda/\mathcal{L}^\lambda=S/\mathcal{L}^s=1$. However, because $\frac{\hat{\phi}^x}{\hat{\phi}^e}=\left(\frac{f_x}{f}\right)^{\frac{1-\theta\sigma}{\sigma-1}}\frac{1}{[(1+\tau_x^{1-\sigma})^{\frac{1}{1-\theta\sigma}}-1]^{\frac{1-\theta\sigma}{\sigma-1}}}>1$ holds (i.e., the condition under which selection into exporting occurs), $1>\lambda/\mathcal{L}^\lambda>S/\mathcal{L}^s$ for $\forall\tau_x\in[1,\infty)$. As fixed export cost f_x increases, the gap between the two objects $\lambda/\mathcal{L}^\lambda-S/\mathcal{L}^s$ becomes higher for given values of τ_x. Therefore, there exists a sufficiently high f_x that makes $(\lambda/\mathcal{L}^\lambda)^{\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}-\frac{1}{\kappa}}>(S/\mathcal{L}^s)^{\frac{\sigma}{\sigma-1}-\frac{1}{\kappa}}$ holds for a given τ_x, which is equivalent to the condition under which the last term becomes negative.

$\square$

A.5 Two Special Cases

In this subsection, I consider two additional special cases: (a) τ is Pareto-distributed, and ϕ and η are homogeneous across firms; and (b) η is Pareto-distributed, and ϕ and τ are homogeneous. Corollary A.1 presents the welfare formula under these two cases

Corollary A.1. *Consider two special case: (a) τ follows a Pareto distribution with the shape parameter κ, with ϕ and η homogeneous across firms; and (b) η follows a Pareto distribution with the shape parameter κ, with ϕ and τ homogeneous across firms. Suppose Assumption 2.1 holds. When moving from autarky to an open economy, the welfare effects of trade are given by*

$$d\ln\mathbb{W}=\left(\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}\right)\left\{-d\ln\lambda+d\ln\mathcal{L}^\lambda\right\}+\left(\frac{\sigma}{\sigma-1}\right)\left\{d\ln S-d\ln\mathcal{L}^s\right\}. \tag{A.21}$$

A.5.1 Proof of Corollary 2.1

Pareto exogenous distortion. The entry and export cutoff distortions are given by $(\hat{\tau}^e)^{\frac{\sigma}{\sigma-1}}=\hat{\phi}^e$ and $(\hat{\tau}^x)^{\frac{\sigma}{\sigma-1}}=\hat{\phi}^x$. Under the Pareto distribution, I can derive the following set of equations:

$$\tilde{\lambda}(\hat{\phi}^e)=\int_{(\hat{\phi}^e)^{\frac{\sigma-1}{\sigma}}}^{\infty}\tau^{-\kappa+\frac{\sigma-1}{1-\theta\sigma}-1}\kappa d\tau=\frac{\kappa}{\kappa-\frac{\sigma-1}{1-\theta\sigma}}(\hat{\phi}^e)^{\frac{\sigma-1}{\sigma}(-\kappa+\frac{\sigma-1}{1-\theta\sigma})}$$

$$\tilde{S}(\hat{\phi}^e,\infty)=\int_{(\hat{\phi}^e)^{\frac{\sigma-1}{\sigma}}}\tau^{-\kappa+\frac{\sigma}{1-\theta\sigma}-1}\kappa d\tau=\frac{\kappa}{\kappa-\frac{\sigma}{1-\theta\sigma}}(\hat{\phi}^e)^{\frac{\sigma-1}{\sigma}(-\kappa+\frac{\sigma}{1-\theta\sigma})}.$$

$$\gamma_\lambda(\hat{\phi}^e)=\frac{\sigma-1}{\sigma}((1-\theta\sigma)\kappa-(\sigma-1))$$

$$\gamma_s(\hat{\phi}^e)=\frac{\sigma-1}{\sigma}((1-\theta\sigma)\kappa-\sigma),$$

$$\frac{1}{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}=\frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}\frac{1}{\kappa+1}$$

$$\frac{\gamma_\lambda(\hat{\phi}^e)/(\sigma-1)+\theta(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e)+(\sigma-1)(1-\theta)}+1=\frac{\sigma}{\sigma-1}\frac{\kappa}{\kappa+1}.$$

$$\frac{1}{1-\theta\sigma} - \frac{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e) + \sigma - 1} = \frac{1}{1-\theta\sigma} - \frac{\kappa+1}{\kappa}$$

$$\frac{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e) + \sigma - 1} = \frac{\kappa+1}{\kappa}.$$

Similar to the derivation in the case of Pareto-productivity, using that

$$f\int_{\hat{\tau}^e}^{\infty} (\tau/\hat{\tau}^e)^{\frac{\sigma}{1-\theta\sigma}} dG(\tau) + f_x \int_{\hat{\tau}^x}^{\infty} (\tau/\hat{\tau}^x)^{\frac{\sigma}{1-\theta\sigma}} dG(\tau) - p_e f - p_e p_x f_x = f_e,$$

I can obtain that $p_e f + p_e p_x f_x = f_e \frac{\kappa - \sigma/(1-\theta\sigma)}{\sigma/(1-\theta\sigma)}$ and substituting this into Equation (A.13) and using that $p_e M_e = M$, the entry mass can be expressed as $M_e = \frac{L}{\kappa f_e}$, which is a function of only parameters and therefore $d\ln M_e = 0$. Combining these results, the welfare formula becomes

$$d\ln \mathbb{W} = \frac{\sigma}{\sigma-1}\frac{1}{1-\theta\sigma}\{-d\ln\lambda + d\ln\mathcal{L}^\lambda\} + \frac{\sigma}{\sigma-1}\{d\ln S - d\ln\mathcal{L}^s\}.$$

Pareto lobbying efficiency. The entry and export lobbying efficiency cutoffs are given by $\hat{\eta}^e = (\hat{\phi}^e)^{\frac{\sigma-1}{\theta\sigma}}$ and $\hat{\eta}^x = (\hat{\phi}^x)^{\frac{\sigma-1}{\theta\sigma}}$. Under the Pareto-distribution, I obtain the following set of equations:

$$\tilde{\lambda}(\hat{\phi}^e,\infty) = \int_{(\hat{\phi}^e)^{\frac{\sigma-1}{\theta\sigma}}}^{\infty} \kappa\eta^{-\kappa+\frac{\theta(\sigma-1)}{1-\theta\sigma}-1} d\eta = \frac{\kappa}{\kappa - \frac{\theta(\sigma-1)}{1-\theta\sigma}} (\hat{\phi}^e)^{\frac{\sigma-1}{\theta\sigma}(-\kappa+\frac{\theta(\sigma-1)}{1-\theta\sigma})}.$$

$$\tilde{S}(\hat{\phi}^e,\infty) = \int_{(\hat{\phi}^e)^{\frac{\sigma-1}{\theta\sigma}}}^{\infty} \kappa\eta^{-\kappa+\frac{\theta\sigma}{1-\theta\sigma}-1} d\eta = \frac{\kappa}{\kappa - \frac{\theta\sigma}{1-\theta\sigma}} (\hat{\phi}^e)^{\frac{\sigma-1}{\theta\sigma}(-\kappa+\frac{\theta\sigma}{1-\theta\sigma})}.$$

$$\gamma_\lambda(\hat{\phi}^e) = \frac{\sigma-1}{\theta\sigma}((1-\theta\sigma)\kappa - \theta(\sigma-1)) \qquad \text{and} \qquad \gamma_s(\hat{\phi}^e) = \frac{\sigma-1}{\theta\sigma}((1-\theta\sigma)\kappa - \theta\sigma).$$

$$\frac{1}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)} = \frac{\sigma}{\sigma-1}\frac{\theta}{1-\theta\sigma}\frac{1}{\kappa+\theta}.$$

$$\frac{\gamma_\lambda(\hat{\phi}^e)/(\sigma-1) + \theta(\sigma-1)}{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)} + 1 = \frac{\sigma}{\sigma-1}\frac{\kappa}{\kappa+\theta}.$$

$$\frac{1}{1-\theta\sigma} - \frac{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e) + \sigma - 1} = \frac{1}{1-\theta\sigma} - \frac{\kappa+\theta}{\kappa}.$$

$$\frac{\gamma_\lambda(\hat{\phi}^e) + (\sigma-1)(1-\theta)}{\gamma_s(\hat{\phi}^e) + \sigma - 1} = \frac{\kappa+\theta}{\kappa}.$$

To show that $d\ln M_e = 0$, similar to the previous case, using the modified free entry condition,

$$f\int_{\hat{\eta}^e}^{\infty} (\eta/\hat{\eta}^e)^{\frac{\theta\sigma}{1-\theta\sigma}} dG(\eta) + f_x \int_{\hat{\eta}^x}^{\infty} (\eta/\hat{\eta}^x)^{\frac{\theta\sigma}{1-\theta\sigma}} dG(\eta) - p_e f - p_e p_x f_x = f_e,$$

I can obtain that $p_e f + p_e p_x f_x = \frac{\kappa - \theta\sigma/(1-\theta\sigma)}{\theta\sigma/(1-\theta\sigma)}$. Substituting this expression into Equation (A.13), I obtain that $M_e = \frac{\theta L}{\kappa f_e}$, which is a function of only parameters and therefore $d\ln M_e = 0$. Combining these results, the welfare formula is expressed as follows:

$$d \ln \mathbb{W} = \frac{\sigma}{\sigma - 1} \frac{1}{1 - \theta\sigma} \{-d \ln \lambda + d \ln \mathcal{L}^{\lambda}\} + \frac{\sigma}{\sigma - 1} \{d \ln S - d \ln \mathcal{L}^{s}\}.$$

□

B. Quantification Appendix

B.1 Estimation of the Elasticity of Output Distortions to Lobbying

B.1.1 Direction of the OLS Bias

The direction of bias of the OLS estimates $\hat{\beta}^{\text{OLS}}$ in Equation (3.1) can be interpreted through the lens of the model. The bias is affected by covariances and variances of firm primitives. For exposition purposes, I will consider the regression model without any controls and a simplified closed economy setup in which every firm is operating and lobbying, which can be achieved by setting $f_b = 0$, $f = 0$, and $\tau_x \to \infty$. Under this setup, selection into production, exporting, and lobbying do not affect the bias and the bias can be expressed as follows:

$$\hat{\beta}^{\text{OLS}} \xrightarrow{p} \theta + \underbrace{\frac{\text{Cov}(\ln Lobby_{it}, \ln \tau_{it} + \theta \ln \eta_{it})}{\text{Var}(\ln Lobby_{it})}}_{=\mathcal{B}(\ln \psi_{it})},$$

where $\mathcal{B}(\ln \psi_{it})$ is the bias that is a function of covariances and variances of firm primitives:

$$\begin{aligned}\mathcal{B}(\ln \psi_{it}) = \frac{1}{\text{Var}(\ln Lobby_{it})} \Bigg(& \frac{\theta^2 \sigma}{1 - \theta\sigma} \text{Var}(\ln \eta_{it}) + \frac{\sigma}{1 - \theta\sigma} \text{Var}(\ln \tau_{it}) \\ & + \frac{2\theta\sigma}{1 - \theta\sigma} \text{Cov}(\ln \tau_{it}, \ln \eta_{it}) + \frac{\sigma - 1}{1 - \theta\sigma} \text{Cov}(\ln \phi_{it}, \ln \tau_{it}) + \frac{\theta(\sigma - 1)}{1 - \theta\sigma} \text{Cov}(\ln \phi_{it}, \ln \eta_{it}) \Bigg), \end{aligned} \tag{B.1}$$

where

$$\begin{aligned}\text{Var}(\ln Lobby_{it}) = & \left(\frac{\theta\sigma}{1 - \theta\sigma}\right)^2 \text{Var}(\ln \eta_{it}) + \left(\frac{\sigma}{1 - \theta\sigma}\right)^2 \text{Var}(\ln \tau_{it}) + \left(\frac{\sigma - 1}{1 - \theta\sigma}\right)^2 \text{Var}(\ln \phi_{it}) \\ & + \frac{2\sigma(\sigma - 1)}{(1 - \theta\sigma)^2} \text{Cov}(\ln \phi_{it}, \ln \tau_{it}) + \frac{2\theta\sigma(\sigma - 1)}{(1 - \theta\sigma)^2} \text{Cov}(\ln \phi_{it}, \ln \eta_{it}) + \frac{2\theta\sigma^2}{(1 - \theta\sigma)^2} \text{Cov}(\ln \eta_{it}, \ln \tau_{it}).\end{aligned}$$

Depending on signs of the covariances, the bias can take both positive and negative values. If the covariances are sufficiently negative, the OLS estimate will be downward biased, as in Table 2. Based on the calibrated values and the estimates of the variances and covariances reported in Table 3 in the later section, the bias is −0.04, consistent with the downward bias.

Similarly, the bias of the sales regression model in Equation (3.2) can be expressed as follows:

$$\mathcal{B}^s(\psi_{it}) = \frac{1}{\mathrm{Var}(\ln Lobby_{it})} \times \mathrm{Cov}\left(\frac{\sigma-1}{1-\theta\sigma}\ln\phi_{it} + \frac{\sigma}{1-\theta\sigma}\ln\tau_{it} + \frac{\theta\sigma}{1-\theta\sigma}\ln\eta_{it}, (\sigma-1)\ln\phi_{it} + \sigma\ln\tau_{it} + \theta\sigma\ln\eta_{it}\right), \quad \text{(B.2)}$$

where

$$\begin{aligned}\mathrm{Cov}&\left(\frac{\sigma-1}{1-\theta\sigma}\ln\phi_{it} + \frac{\sigma}{1-\theta\sigma}\ln\tau_{it} + \frac{\theta\sigma}{1-\theta\sigma}\ln\eta_{it}, (\sigma-1)\ln\phi_{it} + \sigma\ln\tau_{it} + \theta\sigma\ln\eta_{it}\right)\\ &= \frac{(\sigma-1)^2}{1-\theta\sigma}\mathrm{Var}(\ln\phi_{it}) + \frac{\sigma^2}{1-\theta\sigma}\mathrm{Var}(\ln\tau_{it}) + \frac{(\theta\sigma)^2}{1-\theta\sigma}\mathrm{Var}(\ln\eta_{it})\\ &+ \frac{2\sigma(\sigma-1)}{1-\theta\sigma}\mathrm{Cov}(\ln\phi_{it},\ln\tau_{it}) + \frac{2\theta\sigma(\sigma-1)}{1-\theta\sigma}\mathrm{Cov}(\ln\phi_{it},\ln\eta_{it}) + \frac{2\theta\sigma^2}{1-\theta\sigma}\mathrm{Cov}(\ln\tau_{it},\ln\eta_{it}).\end{aligned}$$

Derivation of Equation (B.1). I derive the expression in Equation (B.1). In the simplified setup, firms' optimal lobbying inputs are expressed as

$$b_{it} \propto \eta_{it}^{\frac{1}{1-\theta\sigma}}\phi_{it}^{\frac{\sigma-1}{1-\theta\sigma}}\tau_{it}^{\frac{\sigma}{1-\theta\sigma}}.$$

Because $Lobby_{it} = b_{it}/\eta_{it}$,

$$Lobby_{it} \propto \eta_{it}^{\frac{\theta\sigma}{1-\theta\sigma}}\phi_{it}^{\frac{\sigma-1}{1-\theta\sigma}}\tau_{it}^{\frac{\sigma}{1-\theta\sigma}}.$$

Using the above equation, $\mathrm{Cov}(\ln Lobby_{it}, \ln\tau_{it} + \theta\ln\eta_{it})$ can be expressed as

$$\mathrm{Cov}(\ln Lobby_{it}, \ln\tau_{it} + \theta\ln\eta_{it}) = \mathrm{Cov}(\frac{\theta\sigma}{1-\theta\sigma}\ln\eta_{it} + \frac{\sigma-1}{1-\theta\sigma}\ln\phi_{it} + \frac{\sigma}{1-\theta\sigma}\ln\tau_{it}, \ln\tau_{it} + \theta\ln\eta_{it})$$

which can be rearranged to

$$\begin{aligned}\mathrm{Cov}(\ln Lobby_{it}, \ln\tau_{it} + \theta\ln\eta_{it}) &= \frac{\theta^2\sigma}{1-\theta\sigma}\mathrm{Var}(\ln\eta_{it}) + \frac{\sigma}{1-\theta\sigma}\mathrm{Var}(\ln\tau_{it})\\ &+ \frac{2\theta\sigma}{1-\theta\sigma}\mathrm{Cov}(\ln\tau_{it},\ln\eta_{it}) + \frac{\sigma-1}{1-\theta\sigma}\mathrm{Cov}(\ln\phi_{it},\ln\tau_{it}) + \frac{\theta(\sigma-1)}{1-\theta\sigma}\mathrm{Cov}(\ln\phi_{it},\ln\eta_{it}).\end{aligned}$$

$\mathrm{Var}(\ln Lobby_{it})$ can be expressed as

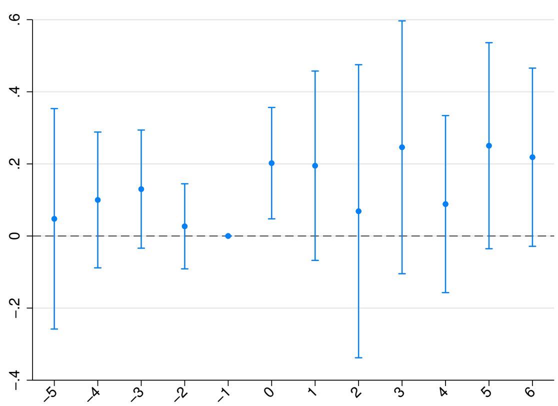
$$\begin{aligned}\mathrm{Var}(\ln Lobby_{it}) &= \left(\frac{\theta\sigma}{1-\theta\sigma}\right)^2\mathrm{Var}(\ln\eta_{it}) + \left(\frac{\sigma}{1-\theta\sigma}\right)^2\mathrm{Var}(\ln\tau_{it}) + \left(\frac{\sigma-1}{1-\theta\sigma}\right)^2\mathrm{Var}(\ln\phi_{it})\\ &+ \frac{2\sigma(\sigma-1)}{(1-\theta\sigma)^2}\mathrm{Cov}(\ln\phi_{it},\ln\tau_{it}) + \frac{2\theta\sigma(\sigma-1)}{(1-\theta\sigma)^2}\mathrm{Cov}(\ln\phi_{it},\ln\eta_{it}) + \frac{2\theta\sigma^2}{(1-\theta\sigma)^2}\mathrm{Cov}(\ln\eta_{it},\ln\tau_{it})\end{aligned}$$

B.1.2 Event Study

One concern is that the first-stage results may reflect spurious correlations between lobbying expenditures and firm primitives rather than causality. Although the exclusion restriction is untestable, an event study can detect spurious correlations caused by reverse causality problems or preexisting confounding factors by checking pre-trends. For example, a reverse causality problem can arise if a firm lobbies to make a local Congress member be appointed as a chairperson in the Appropriations Committee. I estimate the following event study specification:

$$\ln Lobby_{it} = \sum_{\tau=-5}^{5} \beta_\tau \text{Chair}_{i\tau} + \delta_i + \delta_{jt} + \varepsilon_{it}. \tag{B.3}$$

The dependent variable is log lobbying expenditures, with zero values assigned for observations with zero expenditures ($\ln Lobby_{it}$). $\text{Chair}_{i,t-\tau}$ are the event study variables defined as $\text{Chair}_{i,\tau} = \mathbb{1}[t = t_i^{\text{Chair}} - \tau]$, where t_i^{Chair} is the year when a local Congress member of the state in which firm i is headquartered is appointed as the chairperson. $\text{Chair}_{i,-1}$ is normalized to be zero, so β_τ is interpreted as the changes of lobbying expenditures relative to the one year before the appointment. The samples include both treated and non-treated firms. Firm fixed effects δ_i and sector-time fixed effects δ_{jt} are controlled to absorb time-invariant unobservables and sectoral shocks. Standard errors are clustered at the state-level.



Dep. $\ln Lobby_{it}$

Figure B1: Event Study. Lobbying and Appointment as Chairperson of the House or Senate Appropriations Committee

Notes. This figure illustrates event study coefficients β_τ in Equation (B.3). The dependent variables are log lobbying expenditures. The coefficient in $t-1$ is normalized to be zero. The specification includes firm fixed effects, sector-year fixed effects, and the initial lobbying status interacted with year fixed effects. Standard errors are clustered at the state level. The vertical lines show the 90% confidence intervals.

Figure B1 illustrates estimated coefficients β_τ in Equation (B.3). Before the events, there are no pre-trends in lobbying expenditures, but once a local Congress member becomes the chairperson, firms start increasing their lobbying expenditures. The evidence of no pre-trends supports the identifying assumption.

B.2 Identifying Moments

This section describes how the identifying moment in the data can be mapped to the data counterparts. In the calibration procedure, the internally calibrated parameters are all jointly determined, but I describe the identifying moment that is most relevant for each parameter.

- Mean productivity of the US relative to that of Foreign, $\mu_\phi^{\text{US}}/\mu_\phi^F$
  - I normalize the mean productivity of Foreign to be one $\mu_\phi^F = 1$. I define the real GDP as:

$$\text{Real GDP} = \frac{M\Big(\int r(\psi)d\hat{G}(\psi) + \int x(\psi)r^x(\psi)d\hat{G}(\psi)\Big)}{M\Big(\int p(\psi)^{1-\sigma}d\hat{G}(\psi)\Big)^{\frac{1}{1-\sigma}}},$$

  where r and r^x are domestic and export revenues, and the denominator is the defined PPI. Holding other parameters constant, the mean productivity of the US increases the US real GDP; therefore, this moment can pin down μ_ϕ^{US}.
- Standard deviation of log productivity, σ_ϕ
  - ϕ can be mapped to TFPQ in the data:

$$\phi \propto \text{TFPQ} = \frac{(\text{Value-Added})^{\frac{\sigma}{\sigma-1}}}{wL}.$$

  Therefore, the variance of the log TFPQ can pin down σ_ϕ.
- Standard deviation of log exogenous distortions, σ_τ
  - The residuals from Equation (3.1) can be mapped to $\theta \ln \eta + \ln \tau$. Therefore, the variance of this residual can be mapped to

$$\theta^2\sigma_\eta^2 + \theta\rho_{\tau\eta}\sigma_\eta\sigma_\tau + \sigma_\tau^2.$$

  The above relationship shows that conditional on θ, σ_η, and $\rho_{\tau\eta}$, the variance of the residuals is informative on σ_τ.
- Standard deviation of log lobbying efficiency, σ_η
  - The log lobbying expenditures in dollar terms ($B_{it} = \frac{\kappa w b}{\eta}$) is proportional to

$$B_{it} \propto \frac{1}{1-\theta\sigma}((\sigma-1)\ln\phi + \sigma\ln\tau + \theta\sigma\ln\eta).$$

  Therefore, the variance of log lobbying expenditures can be mapped to

$$\frac{1}{(1-\theta\sigma)^2}\Big((\sigma-1)^2\sigma_\phi^2 + \sigma^2\sigma_\tau^2 + (\theta\sigma)^2\sigma_\eta^2 + 2(\sigma-1)\sigma\rho_{\phi\tau}\sigma_\phi\sigma_\tau + 2(\sigma-1)\theta\sigma\rho_{\phi\eta}\sigma_\phi\sigma_\eta + 2\sigma(\theta\sigma)\rho_{\tau\eta}\sigma_\tau\sigma_\eta\Big),$$

  which is informative on σ_η conditioning on the other parameters.

- Correlation between log productivity and log exogenous distortions, $\rho_{\phi\tau}$
  - The correlation between the log of TFPQ and the residuals from Equation (3.1) can be mapped to $\theta\rho_{\phi\eta} + \rho_{\phi\tau}$, which is informative on $\rho_{\phi\tau}$.
- Correlation between log productivity and log lobbying efficiency, $\rho_{\phi\eta}$
  - The correlation between TFPQ and firm lobbying expenditures in dollar terms ($B_{it} = \frac{\kappa w b}{\eta}$) can be mapped to
$$\frac{\sigma-1}{1-\theta\sigma}\sigma_\phi^2 + \frac{\sigma}{1-\theta\sigma}\rho_{\phi\tau} + \frac{\theta\sigma}{1-\theta\sigma}\rho_{\phi\eta}.$$
- Correlation between log exogenous distortions and log lobbying efficiency, $\rho_{\tau\eta}$
  - The correlation between the residuals from Equation (3.1) and lobbying expenditures can be mapped to the numerator of the bias expressed in Equation (B.1):
$$\frac{\theta^2\sigma}{1-\theta\sigma}\sigma_\eta^2 + \frac{\sigma}{1-\theta\sigma}\sigma_\tau^2 + \frac{\theta(\sigma-1)}{1-\theta\sigma}\sigma_\phi\sigma_\eta\rho_{\phi\eta} + \frac{2\theta\sigma}{1-\theta\sigma}\sigma_\tau\sigma_\eta\rho_{\tau\eta} + \frac{\sigma-1}{1-\theta\sigma}\sigma_\phi\sigma_\tau\rho_{\phi\tau}.$$
- Parameter related to the level of variable lobbying cost, κ
  - To identify this parameter, I target the fraction of the median sales of lobbying firms to those of non-lobbying firms:
$$\frac{\text{Median}_{\{\psi|\phi\geq\bar{\phi}^b(\tau,\eta)\}}\{r(b;\psi)\}}{\text{Median}_{\{\psi|\phi<\bar{\phi}^b(\tau,\eta)\}}\{r(0;\psi)\}},$$
    where $r(b;\psi)$ and $r(0;\psi)$ are lobbying and non-lobbying firms' sales, respectively. Because κ only appears in lobbying firms' sales, this moment can pin down κ.
- Fixed lobbying costs, f_b
  - f_b affects extensive margin of lobbying (Equations (A.3) and (A.4)). By targeting the probability of participating in lobbying, I can pin down f_b.
- Fixed export costs, f_x
  - f_x affects extensive margin of exporting (Equations (A.5) and (A.6)). By targeting the probability of participating in exporting, I can pin down f_x.
- Fixed production costs, f
  - f affects production decisions of firms. Because only small-sized firms are affected by f, the difference between the median and 10p of log sales can pin down this parameter.
- Iceberg costs, τ_x
  - The aggregate US import shares can be expressed as follows:
$$\frac{M_f\left[\int x_f(\psi)\left(\frac{\mu\tau_x w_f}{\phi}\right)^{1-\sigma}\tau^\sigma\hat{G}_f(\psi)\right]P^{\sigma-1}E}{E}.$$
    Holding other variables constant, higher τ_x decreases the US import shares. Therefore, the US import shares pin down τ_x.

B.3 Algorithm

I describe an algorithm used for the method of moments.

Step 1. Guess a set of parameters.

Step 2. Based on the guess, simulate 250,000 number of firms whose primitives are randomly drawn from joint distributions based on the initial guess.

Step 3. Based on the 250,000 draws, solve for the equilibrium:

- The wage of Home is normalized to 100
- Guess five aggregate variables: $\{P^{(0)}, E^{(0)}, w_f^{(0)}, P_f^{(0)}, E_f^{(0)}\}$.
- Given this guess for the five unknowns, compute individual firms' optimal entry, production, exporting, and lobbying decisions.
- Using individual firms' decisions, compute firm mass using labor market clearing condition:

$$M = \frac{L}{\int \Big(l(\psi) + f + x(\psi)f_x + \kappa \frac{b(\psi)}{\eta} + \mathbb{1}[b(\psi) > 0]f_b\Big) d\hat{G}(\psi) + \frac{f_e}{p_e}}$$

and transfers

$$T = M\Bigg[\int \big(1 - \tau^y(\psi)\big)\Big(p(\psi)q(\psi) + x(\psi)p^x(\psi)q^x(\psi)\Big)d\hat{G}(\psi)\Bigg].$$

T_f and M_f can be obtained similarly using equilibrium conditions for Foreign.

- Check whether individual firms' optimal decisions are consistent with the guessed five aggregate variables: the price indices for both Home and Foreign

$$(P^{(0)})^{1-\sigma} = M\Bigg[\int p(\psi)^{1-\sigma} d\hat{G}(\psi)\Bigg] + M_f\Bigg[\int x(\psi)p(\psi)^{1-\sigma} d\hat{G}_f(\psi)\Bigg] \tag{B.4}$$

$$(P_f^{(0)})^{1-\sigma} = M_f\Bigg[\int p(\psi)^{1-\sigma} d\hat{G}_f(\psi)\Bigg] + M\Bigg[\int x(\psi)p(\psi)^{1-\sigma} d\hat{G}(\psi)\Bigg], \tag{B.5}$$

the goods market clearing conditions for both Home and Foreign

$$E^{(0)} = wL + T \qquad \text{and} \qquad E_f^{(0)} = w_f^{(0)} L_f + T_f \tag{B.6}$$

and the balanced trade condition

$$M\Bigg[\int x(\psi)p^x(\psi)q^x(\psi)d\hat{G}(\psi)\Bigg] = M_f\Bigg[\int x_f(\psi)p_f^x(\psi)q_f^x(\psi)d\hat{G}_f(\psi)\Bigg]. \tag{B.7}$$

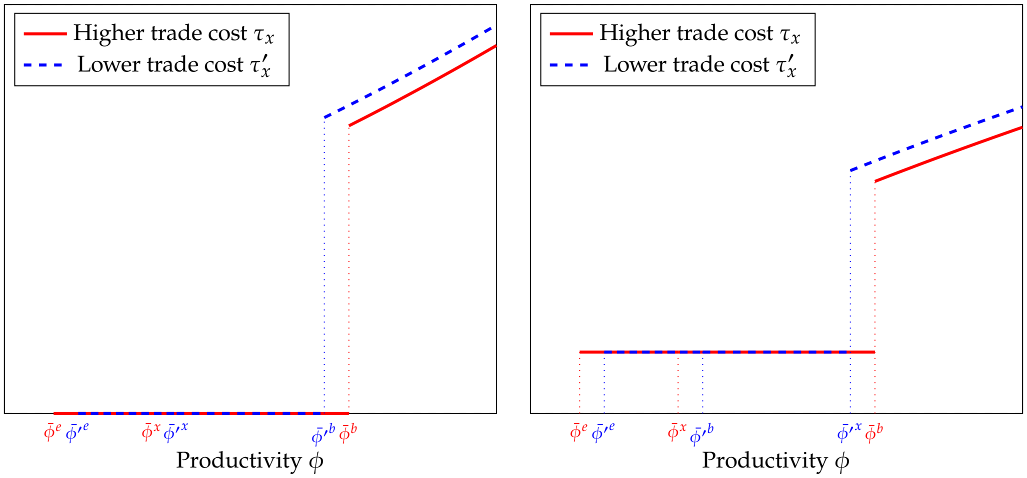
– Using the nonlinear solver, find $\{P^{(0)}, E^{(0)}, w_f^{(0)}, P_f^{(0)}, E_f^{(0)}\}$ that satisfies the above five non-linear equations (Equations (B.4), (B.5), (B.6), (B.7)).

Step 4. Evaluate the moments computed from the model and compare these moments to the data counterparts.

Step 5. I first look for a range of plausible values of parameters using grid search. I repeat steps 1-4 for a given grid.

Step 6. Once I find a range of plausible values of parameters, I find the parameter that minimizes the objective function subject to this range using the constrained nonlinear optimization algorithm where the constraint is given by step 3.

B.4 Additional Figures and Tables



A. Lobbying expenditure, $w\kappa\frac{b}{\eta}$ B. Output distortion, τ^y

Figure B2: Lower trade costs lead exporters to increase their lobbying efforts.

Notes. This figure illustrates changes in firm lobbying and output distortions depending on their productivity level and changes in the entry, export, and lobbying cutoffs when trade costs become lower. This figure considers a special case in which the lobbying cutoff is higher than the export cutoff. Holding τ and η constant, Panels A and B plot firm lobbying expenditures and output distortions depending on their productivity levels. The x-axes are productivity ϕ.

Table B1: Robustness. Estimation Results for the Parameter θ

Robustness	ETR		MRPK		Alternative Functional Form							
Dep.	$\ln 1 - \text{ETR}_{i,t+1}$		$\ln \frac{w_{nj,t+1}L_{i,t+1}}{K_{i,t+1}}$		$\ln 1/\text{TFPR}_{it}$		$\ln \text{Sale}_{it}$		$\ln 1/\text{TFPR}_{it}$		$\ln \text{Sale}_{it}$	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$\Delta \ln Lobby_{it}$	−0.003	0.059**	0.002	−0.065								
	(0.003)	(0.028)	(0.003)	(0.054)								
$\Delta \mathbb{1}[Lobby_{it} > 0]$					−0.025	1.052***	0.528***	3.651***				
					(0.060)	(0.370)	(0.147)	(0.723)				
$\Delta \text{asinh}(Lobby_{it})$									−0.002	0.082***	0.048***	0.286***
									(0.005)	(0.030)	(0.012)	(0.055)
KP-F		12.46		12.46		14.86		14.86		12.59		12.59
AR		7.37		1.04		13.21		14.17		13.21		14.17
AR p-val		< 0.01		0.31		< 0.01		< 0.01		< 0.01		< 0.01
N	1,206	1,206	1,206	1,206	1,206	1,206	1,206	1,206	1,206	1,206	1,206	1,206

Notes. Standard errors are clustered at the state level. * p<0.1; ** p<0.05; *** p<0.01. This table reports the OLS and IV estimates of Equations (3.1) and (3.2). The dependent variables are the cash effective tax rates in columns 1-2, log wage bill divided by capital in columns 3-4, log inverse of TFPR in columns 5-6 and 9-10, and sales in columns 7-8 and 11-12, respectively. All specifications include corporate income tax, job creation tax credit, investment tax credit, R&D tax credit, property tax abatement, and transfers from the federal government, changes in state-industry wages, the initial lobbying status, and SIC 4-digit fixed effects. KP-F is the Kleibergen-Paap F-statistics. AR and AR p-val are the Anderson-Rubin test statistics and its p-value.