Lobbying, Trade, and Endogenous Misallocation*

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Abstract

This paper studies the impact of lobbying on resource misallocation under initial distortions. To quantitatively assess aggregate impacts of lobbying, I develop a model of heterogeneous firms that can lobby to decrease their output tax. This lobbying effort can either magnify or mitigate an initial level of misallocation depending on how more productive firms are initially taxed. If more productive firms are burdened by a higher exogenous tax, they can lobby to overcome the initial tax burden, increasing aggregate total factor productivity (TFP). International trade can also affect TFP influences from lobbying as exporters increase their lobbying expenditures due to complementarities between market size and gains from a lower tax post-lobbying. Key parameters of the model are identified from the observable moments in the data. The parameters are estimated using reduced-form instrumental variables techniques and structurally using firm-level data. I quantitatively find that lobbying can increase the TFP of the US by 5-8% when compared to other economies with the same level of initial exogenous tax, but where lobbying is not allowed. However, when opening to trade, positive TFP gains from lobbying are decreased by 0.15% because of too great an increase in lobbying expenditures by exporters.

JEL Codes: D21, D22, D24, D72, F14, F61, L60, P45, P48

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1 Introduction

The economic consequences of firms’ political engagement have received much attention in both politics and academic research due to an abundance of evidence that politically active firms spend large sums of money to influence the policy-making process (Roosevelt, 1910; Zingales, 2017).\footnote{The debate on the influence of special interests on the US politics has a long history. In his speech given in Kansas in 1910, Theodore Roosevelt, the 26th president of the US, said that “...Exactly as the special interests of cotton and slavery threatened our political integrity before the Civil War, so now the great special business interests too often control and corrupt the men and methods of government for their own profit. We must drive the special interests out of politics...” (Roosevelt, 1910).} According to the Lobbying Disclosure Act (1995), firms spent $3.51 billion on lobbying alone in 2019. Larger firms spend more on lobbying, a trend that is even more pronounced with the advent of superstar firms brought on by globalization. Given this phenomenon, globalization has intensified the debate over firms’ political power. How much does lobbying affect overall resource allocation of an economy?

This paper examines the effects of corporate lobbying on aggregate total factor productivity (TFP). It is commonly believed that lobbying decreases the aggregate TFP of an economy because resources are allocated on the basis of a firm’s political connections rather than its productivity. If there are no distortions initially, this is trivially true. In this paper, however, in contrast to this conventional wisdom, I argue that when an economy is subject to initial distortions, it is possible for lobbying to improve aggregate TFP in a second-best setting.\footnote{Lobbying may decrease TFP if special interests provide pecuniary benefits to policymakers in exchange for favorable policies (Grossman and Helpman, 1994; Krueger, 1974). However, lobbying may transmit information when politicians are under informational friction of the true state of the economy (Milgrom and Roberts, 1986). Grossman and Helpman (2001) summarizes the literature well.} Based on the quantitative framework and firm-level data, this paper shows that this is indeed possible and that lobbying can increase the aggregate TFP of the US.

The natural question is why initial distortions should be considered when examining the aggregate impacts of lobbying. There are two reasons for this. First, the required quarterly reports of lobbying activities, through which lobbyists have been disclosing their lobbying activities for clients since the Lobbying Disclosure Act (1995), reveal that many firms lobby for specific acts, bills, laws, or regulations, which are modeled as distortions in the standard economic models. Second, these distortions, which have been well documented in the recent literature, are pervasive in many countries. It is well known that in a second-best world with initial distortions, anything can happen, so there may be some concern that the positive effects of lobbying in this paper are achieved by imposing arbitrary initial distortions. However, the results of the paper are derived under the initial distortions that are directly inferred from the data rather than chosen in an ad hoc fashion, which is in line with the recent misallocation literature.

To quantitatively examine the aggregate impacts of lobbying on TFP, I develop a general equilibrium
model of heterogeneous firms that can lobby to decrease firm-specific output taxes. In the model, a firm’s output tax consists of exogenous and endogenous lobbying components. The exogenous components correspond to idiosyncratic distortions à la Hsieh and Klenow (2009). Firms take the exogenous components as given and make lobbying decisions that further affect output taxes through lobbying-induced policy benefits. Using the decomposition of the total factor revenue productivity (TFPR) (Hsieh and Klenow, 2009), the model allows me to separately identify the exogenous and lobbying components of output taxes from the data. Importantly, the model provides conditions under which lobbying can either increase or decrease TFP and does not impose a-priori the direction of the effect of lobbying on TFP. This leaves open the question of how lobbying affects aggregate TFP, which is an empirical question to be verified from data.

I analytically characterize the conditions under which lobbying increases or decreases the TFP of an economy. How can lobbying improve TFP, a phenomenon that stands in contrast to conventional wisdom? The key condition for this depends on how a firm’s productivity and its exogenous tax are jointly distributed in an economy. When more productive firms are exogenously taxed higher, lobbying can improve TFP as a second-best policy, because more productive firms can lobby to overcome the initial tax burden, leading to improvements in the resource allocation of an economy. For example, policymakers, unaware of the true state of the economy, may impose higher taxes than the socially optimal level, but firms may lobby against higher taxation because higher taxes decrease their profits. On the other hand, when more productive firms are initially taxed less, lobbying leads to taxes on these firms that are even lower than the initial level, resulting in the allocation excessive resources to lobbying firms, which in turn exacerbates misallocation. Whether more productive firms are more taxed depends on the covariance between firms’ productivity and exogenous output taxes. The positive covariance implies that firms with higher productivity are initially more taxed and vice versa.

Because firms’ productivity and exogenous taxes are unobservable, it is not trivial to identify the covariance between firms’ productivity and exogenous output taxes. However, I show that this unobservable covariance can be identified from the observable moments from the data. Specifically, I show a one-to-one relationship between the unobservable covariance between firms’ productivity and exogenous taxes and the covariance between firms’ lobbying expenditures and exogenous taxes and I show that this is the observable moment from the data. To compute this covariance between firms’ lobbying expenditures and exogenous taxes, I have to measure exogenous taxes from the data. To do so, following Hsieh and Klenow (2009), I first measure the overall output taxes inclusive of both lobbying and exogenous components. Then, using firms’ lobbying expenditures, I separately identify exogenous taxes as the total tax net of the lobbying components. Once I measure the exogenous

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3Size-dependent policies are one example of policies that make more productive firms face higher tax (Guner et al., 2008; Garicano et al., 2016).
taxes, I can compute the covariance between firms’ lobbying expenditures and exogenous taxes.

How does the covariance between firms’ lobbying expenditures and exogenous taxes identify the covariance between firms’ productivity and exogenous taxes? Because of the complementarity between a firm’s size and gains from a lower tax post-lobbying, either higher productivity or lower exogenous tax increases lobbying expenditures; thus, lobbying expenditures increase in productivity but decreasing in exogenous taxes. Because exogenous taxes can be computed from the data, using these monotonic relationships between firms’ lobbying expenditures and productivity and exogenous taxes, I can infer the covariance between productivity and exogenous taxes from the covariance between lobbying expenditures and exogenous taxes. Using Compustat, I find that the covariance between lobbying expenditures and exogenous taxes is negative in the US, indirectly implying that more productive firms are initially more taxed in the US.

Using Compustat data, I structurally estimate the model using the instrumental variable approach and the method of moments to identify the key parameters of the model. With these estimated parameters, I quantitatively find that more productive firms tend to face a higher exogenous tax in the US and that lobbying can increase the TFP of the US economy by 5%-8% and increase welfare by a similar magnitude.

Given the link between lobbying and TFP, the market size effect induced by international trade can affect the TFP influences of lobbying by increasing the lobbying expenditures of exporters and decreasing the lobbying expenditures of non-exporters. Because of the complementarity between market size and gains from a lower tax post-lobbying, exporters have more incentives to participate in lobbying than non-exporters. Thus, when opening to trade, non-exporters decrease, but exporters increase lobbying expenditures, leading to divergences in their lobbying practices.

The effect of trade on lobbying is supported by reduced-form empirical findings. Using recent Chinese import exposure (Autor et al., 2013), which is interpreted as an exogenous market size loss to US firms, I find that market size is an important determinant behind a firm’s lobbying decisions. Only small and medium-sized firms that experience larger market size losses with increased foreign competition decrease their lobbying expenditures with the rise in Chinese import exposure. When opening to trade, the positive TFP gains from lobbying decrease by 0.15%. This is because the increased market size induced by trade causes exporters to spend excessive amounts on lobbying, allocating too many resources to these lobbying exporters. This increased concentration of resources among exporters decreases positive TFP gains from lobbying.

**Related Literature.** This paper is aligned with the literature on firm-level resource misallocation pioneered by Hsieh and Klenow (2009) and Restuccia and Rogerson (2008). While many papers have examined specific factors behind resource misallocation, this paper specifically examines lobbying as a
source of resource misallocation. The most closely related papers in the literature are Arayavechkit et al. (2017) and Huneeus and Kim (2018) which also developed general equilibrium models and quantitatively assessed the impact of lobbying. In contrast to their work, I analytically characterize the conditions under which lobbying increases aggregate TFP as the second-best under firm-specific initial distortions and consider the implications of lobbying in an open economy.

I also contribute to empirical studies on corporate lobbying. While many papers have empirically studied lobbying in the U.S, the quantitative implications of lobbying have been less studied. Using the novel instrumental variable approach, at the micro-level, I find large private returns to lobbying in line with the literature (Richter et al., 2009; Kang, 2016; Kim, 2017). At the macro-level, however, I find that lobbying can increase the aggregate TFP of the US. This result emphasizes the importance of understanding the general equilibrium effects of lobbying. In the trade literature, while some studies have investigated the influence of special interest groups on trade policy, using recent Chinese import exposure, I provide a novel empirical finding that market size changes induced by international trade are an important factor behind firms’ lobbying decisions.

Finally, this paper contributes to the literature on the ways in which distortions interact with the impacts of international trade. Domestic distortions such as domestic institutions, contracting frictions, and imperfect competition can affect gains from trade. Unlike the previous studies, this paper studies lobbying, one aspect of the political system, as a source of domestic distortions and examines the joint implications of lobbying and international trade. While Berthou et al. (2018), Costa-Scottini (2018), Bai et al. (2019), and Chung (2019) examine gains from trade in the presence of firm-specific exogenous distortions, I treat distortions as an endogenous outcome of lobbying.

The remainder of this paper proceeds as follows. Section 2 outlines the quantitative model and derives key theoretical results. Section 3 discusses how the key parameters of the model are identified and quantitatively assesses the effects of lobbying on TFP and welfare. Section 4 presents empirical evidence on the effects of import exposure on firms’ lobbying behavior and quantitatively assesses how international trade can affect the level of misallocation through lobbying. Section 5 concludes the paper.

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4Examples in the literature are Buera et al. (2011), Midrigan and Xu (2014), Moll (2014), and Copinath et al. (2017) for financial frictions; Fajgelbaum et al. (2019) for tax; Edmond et al. (2015) for a firm’s market power; Guner et al. (2008), Lafontaine and Sivadasan (2009), Petrin and Sivadasan (2013), and Garicano et al. (2016) for labor regulation.

5See Igan et al. (2011); Blanes i Vidal et al. (2012); Bertrand et al. (2014); Kerr et al. (2014)

6For example, Grossman and Helpman (1994); Goldberg and Maggi (1999); Bombardini (2008); Bombardini and Trebbi (2012); Kim (2017); Blanga-Gubbay et al. (2020) study trade policy and special interests.

7Important contributions include Levechenko (2007); Nunn (2007); Do and Levechenko (2009); Levechenko (2013) on institution; Khandelwal et al. (2013) on state-owned enterprise; Edmond et al. (2015) on imperfect competition; Manova (2013) on financial friction.
2 Theoretical Framework

I construct a general equilibrium heterogeneous firm model with lobbying. There are two potentially asymmetric countries, Home and Foreign, denoted by the subscripts $h$ and $f$. Each country is populated by $L_h$ identical households, which supply a unit of labor inelastically and earn wage $w_h$. A representative consumer in each country chooses the amount of final goods consumption $C_h$ to maximize utility subject to their budget constraints.

Final Goods Producers. A final good $Q_h$ is produced by a representative final goods producer under perfect competition. A final goods producer combines intermediate varieties available in the country through a constant elasticity of substitution (CES) aggregator:

$$Q_h = \left[ \int_{\omega \in \Omega_h \cup \Omega^*_h} q(\omega)^{\frac{1-\sigma}{\sigma}} \right]^{\frac{\sigma}{\sigma-1}},$$

where each variety is denoted as $\omega$, $\sigma$ is the elasticity of substitution, and $q$ is the quantity of each variety. $\Omega_h$ and $\Omega^*_h$ are the set of domestic and foreign varieties available in country $h$, which are endogenously determined in the economy. The ideal price index is

$$P_h = \left[ \int_{\omega \in \Omega_h} p(\omega)^{1-\sigma} + \int_{\omega \in \Omega^*_h} p^*(\omega)^{1-\sigma} \right]^{\frac{1}{1-\sigma}},$$

where $p$ and $p^*$ are prices charged by domestic and foreign intermediate goods producers.

Intermediate Goods Producers and Lobbying. There is a fixed mass of intermediate goods producers $M_h$ in each country. They are monopolistically competitive. Labor is the only factor of input for production. The production function for each variety is

$$y(\omega) = \phi(\omega)l(\omega),$$

where $y$ is output, $\phi$ is productivity, and $l$ is the labor input. The production of each variety requires fixed production costs $f_h$ in units of labor, so the total labor used for production is $y/\phi + f_h$. Intermediate goods producers can export after incurring fixed export costs $f^e_h$ in units of domestic labor (Melitz, 2003). They also incur iceberg trade costs $\tau_x \geq 1$ when exporting, so delivering one unit of a good to a foreign country requires $\tau_x$ units. Iceberg trade costs are symmetric across countries.

Intermediate goods producers are subject to domestic output wedges $\tau^Y$. Output wedges are interpreted as taxes in the model, where $1 - \tau^Y$ is the firm-specific tax rate.\footnote{Output tax rate is $1 - \tau^Y$, because $1 - \text{tax rate} = \tau^Y$. If $\tau^Y > 1$, firms are subsidized and if $\tau^Y < 1$, firms are}
in lobbying amounts (or output tax is decreasing in lobbying expenditures). Thus, if a producer increases its lobbying amounts, it will be taxed less or subsidized more proportionately to its revenues. I assume that the output wedges have the following functional form:

\[
\tau^Y(\omega) = \frac{1}{\epsilon(\omega)} \times (1 + b(\omega)^{\theta_h}),
\]

where \(b\) is the amount of lobbying chosen by an intermediate goods producer, \(1/\epsilon\) is a stochastic wedge drawn from the given distribution, and \(\theta_h\) is a country-specific parameter. \(\tau^Y\) is composed of two components: (1) exogenous and (2) lobbying components. \(1/\epsilon\) is the exogenous component à la Hsieh and Klenow (2009), capturing exogenous distortions that are not related to lobbying. Firms take \(1/\epsilon\) exogenously given and make a lobbying decision. \((1 + b)^{\theta_h}\) is the lobbying component, where \(b\) is in the unit of domestic final goods. \(\theta_h\) is one of the key parameters of the model, which captures how effectively lobbying increases output wedges.\(^9\) With higher values of \(\theta_j\), the same amount of lobbying can increase the output wedges by larger magnitude. However, if \(\theta_h = 0\), lobbying cannot affect the output wedges, so no firms participate in lobbying.

Firms incur fixed costs \(f_h^\eta\) to participate in lobbying, which is also in the unit of final domestic goods.\(^10\) Because of stochastic \(\eta\), each firm has a different level of fixed costs of lobbying.\(^11\) A higher \(\eta\) indicates that firms have to pay higher fixed costs to participate in lobbying. Once a firm decides to participate in lobbying, the total lobbying cost is the sum of the variable and fixed costs of lobbying:

\[
P_h(b + f_h^\eta).\]

The total cost of lobbying is redistributed to domestic consumers through lump-sum transfers.\(^12\)

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9. \(\theta_h\) may reflect the quality of the institution or political system of country \(h\). For example, \(\theta_h\) will be higher in countries where corruption is prevalent.

10. The fixed cost of lobbying rationalizes the pattern of the firm-level data in which only a fraction of firms (13.7% on average) participate in lobbying. The existence of fixed and sunk costs of lobbying is well documented in Kerr et al. (2014).

11. The stochastic component of the fixed cost of lobbying \(\eta\) explains the pattern of the data that some small-sized firms spend sizable lobbying expenditure. Although firms size and lobbying expenditures are highly correlated, firm size alone cannot fully explain some small firms participating in lobbying. Without \(\eta\), firm size and lobbying expenditure are perfectly correlated. The relationship between size and lobbying expenditure is documented in greater detail in Online Appendix Section C. For example, a firm may have lower fixed costs of lobbying (low \(\eta\)) if the CEO is well-connected with local politicians or a firm is located near K Street in Washington D.C.

12. This is consistent with the current lobbying market of the US, in which firms hire lobbyists to influence the policy-making process and lobbyists use their earnings to consume goods. Assuming that the total cost of lobbying is redistributed back to domestic consumers, I implicitly assume that there is no resource wasted in the lobbying process. If parts of the lobbying expenditures are pure wastes, there will be a larger welfare loss. Esteban and Ray (2006) considers lobbying a costly signal.
impose restrictions on $\theta_h$ and $\sigma$ as follows:  

**Assumption 1.** $\theta_h$ and $\sigma$ satisfy (i) $0 < 1 - \theta_h \sigma < 1$, and (ii) $\sigma > 1$.

Intermediate goods producers are heterogeneous across three dimensions: productivity $\phi$, exogenous output wedges $1/\epsilon$, and stochastic fixed costs of lobbying $\eta$. $(\phi, \epsilon, \eta)$ is drawn from a joint distribution $F_h(\phi, \epsilon, \eta)$ with the arbitrary correlation structure between the pairs among $\phi$, $\epsilon$ and $\eta$. Each draw is independent across firms.

An intermediate goods producer takes the demand function in domestic and foreign markets as given and maximizes its profits. An intermediate goods producer solves the following maximization problem:

$$
\pi = \max_{b, p, p^x, q, q^x} \frac{(1 + b)^{\theta_h}}{\epsilon} pq - \frac{w_h}{\phi} q - w f_h - x \left\{ \frac{(1 + b)^{\theta_h}}{\epsilon} p^x q^x - \frac{w_h}{\phi} q^x - w f^x \right\} - P_h b - P_h f^h \eta \left\{ b > 0 \right\},
$$

subject to $q = p^{-\sigma} \int \sigma^{-1} E_h$, $q^x = (p^x)^{-\sigma} \int \sigma^{-1} E_f$, $x \in \{0, 1\}$, (2.1)

where $E_k$ is the total consumer expenditure of country $k$, $x$ is a binary export decision, $p^x$ is the export price, and $q^x$ is the export quantity.

**Equilibrium.** The government budget is balanced and the total amount of tax revenue is transferred to consumers in lump-sum:

$$
T_h = \int_{\omega \in \Omega^L_h} \left( 1 - \frac{1}{\epsilon(\omega)} \right) \left( p(\omega) q(\omega) + x(\omega) p^x(\omega) q^x(\omega) \right) d\omega
+ \int_{\omega \in \Omega^L_h} \left( 1 - \frac{(1 + b(\omega))^{\theta_h}}{\epsilon(\omega)} \right) \left( p(\omega) q(\omega) + x(\omega) p^x(\omega) q^x(\omega) \right) d\omega + P_h \int_{\omega \in \Omega^L_h} \left( b(\omega) + f^h \eta(\omega) \right) d\omega,
$$

where $\Omega^L_h$ is country $h$’s set of intermediate goods producers participating in lobbying. The first two terms on the right-hand side are the tax revenues from non-lobbying and lobbying firms respectively. The last term is the total lobbying expenditure of lobbying firms.

Goods market-clearing implies that

$$
P_h C_h = E_h = w_h L_h + \Pi_h + T_h,
$$

The parametric restrictions guarantee that firms do not lobby infinite amounts. If $1 - \theta \sigma > 1$, the output wedges decrease too quickly with an increase in lobbying amounts $b$. Technically, this is the second-order condition of a firm’s maximization problem. The assumption is also empirically supported from the estimate of $\theta_h$ in Section 3.3, which is discussed later in the paper. With the estimate of $\theta_h$ around 0.09-0.11, the assumption is satisfied with the commonly used values for the elasticity of substitution in the literature.
where \( C_h \) is the final good consumption by households and \( \Pi_h \) is the dividend income from their portfolio. Each household only owns a portfolio of domestic firms, so \( \Pi_h \) is equal to the aggregate profits of domestic firms. Labor market clearing is \( L_h = \int_{\omega \in \Omega_h} (l(\omega) + f_h + x(\omega)f_{h}^x)d\omega \) and balanced trade condition implies that \( \int_{\omega \in \Omega_h} p^x(\omega)q^x(\omega)d\omega = \int_{\omega \in \Omega_f} p^x(\omega)q^x(\omega)d\omega. \)

A competitive equilibrium is formally defined as

**Definition 1.** A competitive equilibrium of the economy is defined as (a) a list of wages \( \{w_k\}_{k \in \{h, f\}} \), (b) functions \( \{p(\omega), p^x(\omega), q(\omega), q^x(\omega), x(\omega), l(\omega), b(\omega), \tau^y(\omega)\}_{\omega \in \Omega_k, k \in \{h, f\}} \), (c) aggregate price indices \( \{P_k\}_{k \in \{h, f\}} \), and (d) lump-sum government transfers \( \{T_k\}_{k \in \{h, f\}} \) such that (i) a representative household maximizes utility subject to its budget constraint; (ii) firms maximize profits; (iii) the labor market clearing conditions are satisfied; (iv) the goods market clearing conditions are satisfied; (v) the government budgets are balanced; and (vi) trade is balanced in both countries.

**Equilibrium Properties.** The model nests the two standard models in the literature, Melitz (2003) and Hsieh and Klenow (2009). As \( \theta_h \to 0 \) and \( \text{Var}(1/\epsilon) \to 0 \), the model becomes the Melitz model without any friction. If \( \theta_h \to 0 \) (or \( f^b_h \to \infty \)), in which no firms lobby at all, the model becomes the two-country open economy version of the Hsieh and Klenow (HK) model with exogenous wedges.

I first consider profits conditional on not lobbying. Firms charge constant mark-up \( \mu = \sigma/(\sigma - 1) \) over their marginal costs and choose to export if profits in the foreign market are sufficiently large to cover the fixed costs of exporting. Profits are obtained as the variable profits minus the fixed costs of production and exports. Profits conditional on not lobbying are expressed as

\[
\pi(0; \phi, \epsilon, \eta) = \max_{x \in \{0,1\}} \left\{ \pi^d(0; \phi, \epsilon, \eta) + x \pi^x(0; \phi, \epsilon, \eta) \right\},
\]

where \( \pi^d(0; \phi, \epsilon, \eta) \) are profits conditional on not lobbying in the domestic market:

\[
\pi^d(0; \phi, \epsilon, \eta) = \frac{1}{\sigma} \left( \frac{\mu w_h}{\phi} \right)^{1-\sigma} \left( \frac{1}{\epsilon} \right)^{\sigma} P_h^{\sigma-1} E_h - w_h f_h,
\]

and \( \pi^x(0; \phi, \epsilon, \eta) \) are profits conditional on not lobbying in the foreign market:

\[
\pi^x(0; \phi, \epsilon, \eta) = \frac{1}{\sigma} \left( \frac{\tau_x w_h}{\phi} \right)^{1-\sigma} \left( \frac{1}{\epsilon} \right)^{\sigma} P_f^{\sigma-1} E_f - w_h f^x_h.
\]

\( \tilde{\pi}^d_h(0; \phi, \epsilon, \eta) \) and \( \tilde{\pi}^x(0; \phi, \epsilon, \eta) \) are the variable profits conditional on not lobbying in domestic and foreign markets.
Once a firm decides to participate in lobbying, the optimal lobbying expenditures are characterized by a firm’s first-order condition with respect to \( b \). The optimal lobbying amounts for non-exporters and exporters can be written in terms of variable profits conditional on not lobbying, aggregate variables, and model parameters. The optimal amounts of lobbying for non-exporters and exporters, \( b^{d*} \) and \( b^{x*} \), are expressed as

\[
\begin{align*}
 b^{d*} &= C_h^1 \tilde{\pi}^d(0; \phi, \epsilon, \eta) \left( \frac{1}{\theta_h \sigma} \right)^{\frac{1}{1-\theta_h \sigma}} - 1, \\
 C_h^1 &= \left( \frac{\theta_h \sigma}{P_h} \right)^{\frac{1}{1-\theta_h \sigma}}, \\
 b^{x*} &= C_h^1 \{ \tilde{\pi}^d(0; \phi, \epsilon, \eta) + \tilde{\pi}^x(0; \phi, \epsilon, \eta) \} \left( \frac{1}{\theta_h \sigma} \right)^{\frac{1}{1-\theta_h \sigma}} - 1,
\end{align*}
\] (2.3)

Substituting Equation (2.3) into Equation (2.1), the profits conditional on lobbying for non-exporters are expressed as

\[
\begin{align*}
\pi^d(b^{d*}; \phi, \epsilon, \eta) &= C_h^2 \tilde{\pi}^d(0; \phi, \epsilon, \eta) \left( \frac{1}{\theta_h \sigma} \right)^{\frac{1}{1-\theta_h \sigma}} - w_h f_h - P_h[f_h^h \eta - 1], \\
C_h^2 &= (C_h^1)^{\theta_h \sigma} - C_h^1
\end{align*}
\] (2.4)

and profits conditional on lobbying for exporters are expressed as

\[
\begin{align*}
\pi^x(b^{x*}; \phi, \epsilon, \eta) &= C_h^2 \{ \tilde{\pi}^d(0; \phi, \epsilon, \eta) + \tilde{\pi}^x(0; \phi, \epsilon, \eta) \} \left( \frac{1}{\theta_h \sigma} \right)^{\frac{1}{1-\theta_h \sigma}} - w_h f_h - w_h f_h^x - P_h[f_h^h \eta - 1].
\end{align*}
\] (2.5)

The benefits of lobbying are higher revenues from lower taxes (or higher wedges). Because lobbying exponentiates the variable profits conditional on not lobbying to the power of \( 1/(1-\theta_h \sigma) \), firms with higher productivity or output wedges get larger benefits from lobbying.

Lobbying and exporting decisions are jointly determined.\textsuperscript{14} With lobbying and exporting choices, a firm has four possible options and compares the total profits of each option. A firm’s final profit is determined as the maximum of the four options:

\[
\pi(\phi, \epsilon, \eta) = \max \left\{ \pi^d(0; \phi, \epsilon, \eta), \pi^d(0; \phi, \epsilon, \eta) + \pi^x(0; \phi, \epsilon, \eta), \pi^d(b^{d*}; \phi, \epsilon, \eta), \pi^x(b^{x*}; \phi, \epsilon, \eta) \right\},
\]

where the terms inside the bracket are non-lobbying non-exporters’ profits, non-lobbying exporters’ profits, lobbying non-exporters’ profits, and lobbying exporters’ profits respectively.

With the fixed costs of lobbying, lobbying decisions are characterized by a cutoff productivity. The

\textsuperscript{14}For example, firms with low productivity (low \( \phi \)) and low fixed costs of lobbying (low \( \eta \)) may exist that are not productive enough to be exporters without lobbying, but can be profitable in exporting after lobbying.
unique cutoff productivity $\phi_b^*$ is determined by

$$
\max \left\{ \pi^d(0; \phi_b^*(\epsilon, \eta), \epsilon, \eta), \pi^d(0; \phi_b^*(\epsilon, \eta), \epsilon, \eta) + \pi^x(0; \phi_b^*(\epsilon, \eta), \epsilon, \eta) \right\}
= \max \left\{ \pi^d(b^d_\epsilon; \phi_b^*(\epsilon, \eta), \epsilon, \eta), \pi^x(b^x_\epsilon; \phi_b^*(\epsilon, \eta), \epsilon, \eta) \right\}, \quad (2.6)
$$

where the left-hand side is the maximum profit conditional on not lobbying and the right-hand side is the maximum profit conditional on lobbying. Only firms with productivity above $\phi_b^*(\epsilon, \eta)$ participate in lobbying. The cutoff decreases in both $1/\epsilon$ and $\eta$.

Similarly, the fixed costs of exporting characterize the unique cutoff productivity of exporting $\phi_x^*$:

$$
\max \left\{ \pi^d(0; \phi_x^*(\epsilon, \eta), \epsilon, \eta) + \pi^x(0; \phi_x^*(\epsilon, \eta), \epsilon, \eta), \pi^x(b^x_\epsilon; \phi_x^*(\epsilon, \eta), \epsilon, \eta) \right\}
= \max \left\{ \pi^d(0; \phi_x^*(\epsilon, \eta), \epsilon, \eta), \pi^d(b^d_\epsilon; \phi_x^*(\epsilon, \eta), \epsilon, \eta) \right\}, \quad (2.7)
$$

where the left-hand side is the maximum profit conditional on exporting and the right-hand side is the maximum profit conditional on not exporting.

**Proposition 1.** *Given Assumption 1,*

(i) *A firm’s optimal lobbying amounts and profits conditional on lobbying, characterized by Equation (2.3), (2.4) and (2.5), are increasing in productivity $\phi$, exogenous output wedges $1/\epsilon$, and market size $P_h^\alpha - 1 E_h + x P_f^\alpha - 1 E_f$;*

and (ii) *there exists a unique cutoff productivity of lobbying $\phi_b^*(\epsilon, \eta)$, determined by Equation (2.6), which increases in exogenous output wedges $1/\epsilon$ and decreases in stochastic fixed costs of lobbying $\eta$.*

Proposition 1 states that higher productivity, higher exogenous wedges, or larger market size are complementary to lobbying. Firms with higher productivity or higher exogenous wedges spend more on lobbying and are more likely to participate in lobbying. In addition, larger market size increases the firms’ overall level of lobbying.

### 2.1 Analytical Results: Aggregate TFP

To develop an intuition for the mechanism behind the TFP improving effect of lobbying, I analytically characterize the effect of lobbying on aggregate TFP in a simpler environment. TFP is defined as the output per capita. To obtain the analytical results, a number of simplifying assumptions are imposed. I consider a closed economy in which the fixed costs of lobbying and production are zero, so every firm participates in lobbying and production in this environment. I also assume that $(\epsilon, \eta)$ follows a joint log-normal distribution:
Assumption 2. (i) \((\phi, \epsilon)\) follows a joint log-normal distribution, (ii) \(f^b = 0\), and (iii) \(\tau_x = \infty\).

I compare the three economies. The first economy is the efficient economy in which there are no distortions, and lobbying is not allowed (Melitz, 2003). In this economy, resources are allocated based on a firm’s productivity, yielding an efficient outcome. In the second economy, the exogenous wedge economy, the exogenous output wedges are the only source of distortions (Hsieh and Klenow, 2009). In this economy, resources are allocated based on both productivity and exogenous wedges. In the third economy, the lobbying economy, firms can lobby to increase their output wedges, so distortions are endogenously determined by a firm’s decision. The aggregate TFPs of each economy are derived in the following proposition.

Proposition 2. Under Assumption 1 and 2,
(i) the aggregate TFP of the efficient economy, \(TFP_{eff}\), is

\[
\log(TFP_{eff}) = C + \mathbb{E}[\log \phi] + \frac{(\sigma - 1)}{2} \text{Var}(\log \phi), \tag{2.8}
\]

(ii) the aggregate TFP of the exogenous wedge economy, \(TFP_{exo}\), is

\[
\log(TFP_{exo}) = C + \mathbb{E}[\log \phi] + \frac{(\sigma - 1)}{2} \text{Var}(\log \phi) - \frac{\sigma}{2} \text{Var}(\log 1/\epsilon), \tag{2.9}
\]

and (iii) the aggregate TFP of the lobbying economy, \(TFP_{endo}\), is

\[
\log(TFP_{endo}) = C + \mathbb{E}[\log \phi] + \left(\frac{(\sigma[(1 - \theta)^2 - 1] + 1)}{(1 - \theta \sigma)^2}\right) \times \frac{(\sigma - 1)}{2} \text{Var}(\log \phi) \\
- \times \frac{1}{(1 - \theta \sigma)^2} \times \frac{\sigma}{2} \text{Var}(\log 1/\epsilon) - \frac{(\sigma - 1)(\sigma \theta)}{(1 - \theta \sigma)^2} \times \text{Cov}(\log \phi, \log 1/\epsilon), \tag{2.10}
\]

where \(C = \log M^{1/(\sigma - 1)}\).

The TFP of the efficient economy is expressed by Equation (2.8). The TFP increases in the average productivity \(\mathbb{E}[\log \phi]\) and the variance of productivity \(\text{Var}(\log \phi)\). The effect of variance of productivity depends on the elasticity of substitution. With a higher variance of productivity, firms with higher productivity are more likely to operate in the economy and provide their goods at a lower price. If goods become more substitutable, the final goods producer is more likely to substitute for
a variety at a lower price, increasing the positive effects of the variance of productivity.

When compared to the efficient economy, in the exogenous wedge economy, the variance of the exogenous wedges $\text{Var} (\log 1 / \epsilon)$ appears as a new term in the TFP expressed in Equation (2.9). As the dispersion of idiosyncratic distortion becomes larger, resources are more likely to be allocated to firms with low productivity but with higher output wedges. Therefore, TFP decreases in the variance of the dispersion of the wedge. A higher elasticity of substitution amplifies the negative effect of the variance of the wedges because a final goods producer is more likely to substitute for a variety charged at lower prices charged by firms with higher output wedges. The covariance between productivity and output wedges does not enter the expression, which is an artifact of the joint log-normality assumption.\footnote{Hoppenhain (2014) discusses the impact of the correlation between productivity and distortion on the aggregate TFP. A marginal increase in correlation decreases TFP. However, as the TFP level gets lower, there is overall less demand for total employment. This frees up employment, and they are reallocated uniformly across all firms as general equilibrium effects. Under the joint log-normality assumption, these two effects exactly offset each other.}

When compared to the TFP of the exogenous wedge economy, the three new terms are introduced in the TFP of the lobbying economy in Equation (2.10), which are labeled as concentration, amplification, and covariance effects. The concentration effect implies that lobbying diminishes the positive effects of the productivity variance. This is because firms with higher productivity lobby more, distorting resource allocation. Similarly, because firms with higher exogenous output wedges also lobby more, lobbying amplifies the negative effect of the variance of the wedges, captured by the amplification effect.

The covariance effect has the most important TFP implications in the second-best world. Depending on the sign of the covariance effect, lobbying can improve TFP over the exogenous wedge economy as the second best. If more productive firms are initially subject to a higher tax (or a lower output wedge), which is captured by the negative covariance, they can lobby to decrease the initial tax burden. To examine the implications of the covariance effect, I summarize the relationships between the TFPs of the three different economies using the following proposition.

**Proposition 3.** Under Assumption 1 and 2,
(i) As $\theta \to 0$, $\text{TFP}_{\text{endo}} \to \text{TFP}_{\text{exo}}$ and as $\text{Var}(\log 1 / \epsilon) \to 0$, $\text{TFP}_{\text{exo}} \to \text{TFP}_{\text{eff}}$;
(ii) $\text{TFP}_{\text{eff}} \geq \text{TFP}_{\text{endo}}$ and $\text{TFP}_{\text{eff}} \geq \text{TFP}_{\text{exo}}$;
and (iii) lobbying can be TFP improving as the second-best policy, that is, $\text{TFP}_{\text{exo}} < \text{TFP}_{\text{endo}}$ under certain conditions. The necessary condition is $\text{Cov}(\log \phi, \log 1 / \epsilon) < 0$.

Lobbying always decreases TFP when compared to the efficient economy (Proposition 3(ii)). However, TFP can increase over the exogenous wedge economy under certain conditions through the covariance effect (Proposition 3(iii)). The necessary condition is $\text{Cov}(\log \phi, \log 1 / \epsilon) < 0$, the con-
dition under which more productive firms are initially subject to a lower output wedge (or higher output tax). With negative covariance, more productive firms can overcome a higher output tax that is initially imposed through lobbying, increasing aggregate TFP. However, if the covariance effect takes positive values, because lobbying allocates resources excessively toward large lobbying firms, lobbying always amplifies the initial level of resource misallocation. \( \text{Cov}(\log \phi, \log 1/\epsilon) \) is the key statistic of the model, which has to be verified from microdata to understand the TFP implications of lobbying.

Trade can affect aggregate TFP through lobbying channels, although the direction is ambiguous. Suppose more productive firms are subject to higher taxes initially, and there is a decrease in trade costs. An increase in market size induced by trade can increase TFP through the covariance effect by inducing more productive exporters to lobby more. However, other directions are also possible. Because only exporters are better off from an increased market size, lobbying expenses can be more unequally concentrated among a few big exporters, making the concentration and amplification effects dominate the covariance effect.

3 Quantification

This section quantitatively assesses the impact of lobbying. I discuss how \( \text{Cov}(\phi, 1/\epsilon) \), the key condition for the welfare implications of lobbying, can be identified from the observable moments from the data. Using the instrumental variable (IV) strategy based on the institutional details of US politics, I structurally estimate \( \theta \), which governs how lobbying effectively increases output wedges. The remaining parameters are calibrated to the firm-level data and other data sources using the method of moments, allowing for heterogeneity in productivity, exogenous output wedges, and fixed costs of lobbying.\(^\text{16}\) I then evaluate the TFP and welfare implications of lobbying under different scenarios.

3.1 Data

I combine firm balance sheet data that include lobbying, trade, and sector-level databases. I match firm-level balance sheet data to the lobbying database based on a firm’s name, and then the firm-level data is matched to the trade and sector-level data according to a firm’s industry affiliation.

**Lobbying and Firm-Level Data.** I construct the main firm-level database by merging the lobbying data obtained from the Center for Responsive Politics (CRP) with Compustat, which covers

\(^\text{16}\)I choose the model with a fixed mass of firms as the baseline for two reasons. First, Compustat only covers big firms in the US. The free entry assumption is inconsistent with this feature of the data. Second, although the entry effect of lobbying is also an interesting issue, the main focus of this paper is the effect of lobbying given the firm-specific exogenous tax across firms. I also show that my quantitative results are robust under the free entry assumption.
Table 1: Descriptive Statistics

| Sales ($1M) | Lobbying Amounts ($1K) | $1[Lobby_{it} > 0]$ | $1[Lobby_{it} > 0] 
eq 1[Lobby_{it-1} > 0]$ |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
</tr>
<tr>
<td>1980.4</td>
<td>188.1</td>
<td>0.137</td>
<td>0.080</td>
</tr>
<tr>
<td>(11055.7)</td>
<td>(1387.5)</td>
<td>(0.344)</td>
<td>(0.271)</td>
</tr>
</tbody>
</table>

Notes. This table provides descriptive statistics of the main data set. There are 39,692 firm-year level observations with unique 4989 firms. Standard deviations are reported in parentheses. The sample period is 1998-2015.

Public firms listed on the North American stock markets. The sample period is from 1998 to 2015. The lobbying data became publicly available in 1998 after the Lobbying Disclosure Act (LDA) (1995). LDA requires active registered lobbyists to file activity reports each quarter. Each report contains various information on a firm’s lobbying expenditures, such as total lobbying expenditures, issue areas, and a brief description of lobbying activities. I restrict my sample to the manufacturing sector.

Descriptive statistics of the raw data are presented in Table 1. Columns (1) and (2) report the average sales and average lobbying expenditures. In column (3), about 13% of firm-year level observations have lobbied positive amounts of lobbying out of the total observations. Column (4) reports the percentage of extensive margin changes. Only about 8% of the total observations changed the lobbying status during the sample period, indicating that lobbying status is persistent.

Industry and Trade Data. Bilateral trade data are extracted from the UN Comtrade at the 6-digit HS product level. I convert 6-digit HS codes into 4-digit SIC codes using Pierce and Schott’s (2012) concordance. Following Autor et al. (2013), I aggregate at a slightly higher level so that each industry code is matched with at least one six-digit HS code. Industry data comes from the NBER Center for Economic Studies Manufacturing Industry Database for 1971-2009. The industry and trade data are matched with the firm-level data using a firm’s SIC 4-digit codes and headquartered states. For some firms that report only 2-digit or 3-digit SIC codes, I take the average across 4-digit SIC codes and then match at the aggregated level.

3.2 Identification of $Cov(\phi, 1/\epsilon)$

The direction of the impact of lobbying on aggregate TFP depends on $Cov(\log \phi, \log 1/\epsilon)$, where $\phi$ and $1/\epsilon$ are not directly observable from the data. However, I show that (1) the covariance
between log of the lobbying expenditures and log of exogenous wedges $Cov(\log(1+b), \log 1/\epsilon)$ is the identifying moment for $Cov(\log \phi, \log 1/\epsilon)$ and (2) $Cov(\log(1+b), \log 1/\epsilon)$ can be computed from the data (Nakamura and Steinsson, 2018).

I first describe how to back out $\log 1/\epsilon$ from the data and then how to compute $Cov(\log(1+b), \log 1/\epsilon)$. Following Hsieh and Klenow (2009), firms’ overall output wedges inclusive of both lobbying and exogenous components are identified from the measured revenue total factor productivity (TFPR)\(^{17}\):

$$TFPR_{it} = \frac{1}{MRPL_{it}} = \left(\frac{Value-Added_{it}}{Employment_{it}}\right)^{-1} = (1 + b_{it})^\theta \times \frac{1}{\epsilon_{it}}.$$ 

Given the estimate of $\theta$ and the data on lobbying expenditures $b$, after dividing the TFPR by $(1+b)^\theta$, I can separately identify the lobbying components $(1+b)^\theta$ and the exogenous components $1/\epsilon$ from the measured TFPR. Then, after measuring $(1+b)^\theta$ and $1/\epsilon$ from the data in the previous step, the empirical moment of the following object can be computed:

$$Cov(Data(\log(1+b)), Data(\log 1/\epsilon)),$$

which is the identifying moment of $Cov(\log \phi, \log 1/\epsilon)$.

How can $Cov(\log(1+b), \log 1/\epsilon)$ be the identifying moment for $Cov(\log \phi, \log 1/\epsilon)$? The amount of lobbying $b$ increases in both $\phi$ and $1/\epsilon$. To infer $Cov(\log \phi, \log 1/\epsilon)$, I use these monotonic relationships and $1/\epsilon$ backed out from the data. Holding $\phi$ constant, firms with higher $1/\epsilon$ (or lower tax) lobby more, so $\log(1+b)$ and $1/\epsilon$ are positively correlated. However, as $Cov(\log \phi, \log 1/\epsilon)$ becomes more negative, because firms with higher $\phi$ also lobby more, this positive relationship between $\log(1+b)$ and $1/\epsilon$ is weakened. For the sufficiently negative values of $Cov(\log \phi, \log 1/\epsilon)$, which is the necessary condition of the TFP improving effects, $Cov(\log(1+b), \log 1/\epsilon)$ can take negative values. In fact, the more negative $Cov(\log \phi, \log 1/\epsilon)$ is, the more negative $Cov(\log(1+b), \log 1/\epsilon)$ becomes.

From this monotonic relationship, I can infer the sign and magnitude of $Cov(\log(1+b), \log 1/\epsilon)$. The following proposition summarizes this.

**Proposition 4. (Identifying Moment)** Under Assumption 1 and 2(i, iii),

(i) when $f^b = 0$ and in closed economy,
(a) $\text{Cov} (\log(1+b), \log 1/\epsilon)$ is expressed as

$$\text{Cov} (\log(1+b), \log 1/\epsilon) = \frac{\sigma - 1}{1 - \theta \sigma} \times \text{Cov} (\log \phi, \log 1/\epsilon) + \frac{\sigma}{1 - \theta \sigma} \times \text{Var} (\log 1/\epsilon),$$

where

- $\text{Cov} (\log(1+b), \log 1/\epsilon)$ is computed from the data and takes negative values only when the necessary condition of the TFP improving effects is satisfied, that is, when $\text{Cov} (\log \phi, \log 1/\epsilon)$ is negative. Therefore, if $\text{Cov} (\log(1+b), \log 1/\epsilon)$ computed from the data takes negative values, I can indirectly infer that more productive firms are more taxed.

In an open economy with positive fixed costs of lobbying and export, Proposition 4(ii) states that although the unconditional covariance $\text{Cov} (\log \phi, \log 1/\epsilon)$ cannot be directly computed without further information on other aggregate endogenous variables and fixed costs of lobbying, the covariance conditional on participating in lobbying or exporting $\text{Cov} (\log \phi, \log 1/\epsilon|\phi \geq \bar{\phi}(\epsilon, \eta), x^* = x')$ can be inferred from the data. This proposition implies that $\text{Cov} (\log(1+b), \log 1/\epsilon)$ can be informative on the unconditional covariance $\text{Cov} (\log \phi, \log 1/\epsilon)$ through its information regarding the conditional covariance.

---

18 Note that $\{\phi \geq \bar{\phi}(\epsilon, \eta), x^* = 1\}$ and $\{\phi \geq \bar{\phi}(\epsilon, \eta), x^* = 0\}$ are equivalent to $\{\phi \geq \bar{\phi}(\epsilon, \eta), \phi \geq \bar{\phi}^*(\epsilon, \eta)\}$ and $\{\phi \geq \bar{\phi}(\epsilon, \eta), \phi \leq \bar{\phi}^*(\epsilon, \eta)\}$. 

16
3.3 Estimation of $\theta$ using the Instrumental Variable Strategy

I assume that output wedges take the following form: for firm $i$ in sector $j$ at time $t$,

$$\tau^Y = \exp(X_{it}'\beta + \delta_i + \delta_{jt}) \times \frac{(1 + b_{it})^\theta}{\epsilon_{it}},$$

where $X_{it}$ are observable characteristics, and $\delta_i$ and $\delta_{jt}$ are firm and sector-time fixed effects, respectively. The inverse of the marginal revenue of product of labor (MRPL) is proportional to output wedges:

$$\frac{1}{MRPL_{it}} = \frac{w_{it}L_{it}}{Value\ Added_{it}} \propto \left( \exp(X_{it}'\beta + \delta_i + \delta_{jt}) \times \frac{(1 + b_{it})^\theta}{\epsilon_{it}} \right), \quad (3.1)$$

where MRPL is measured as value-added divided by wage bills.\(^{19}\)

I introduce an additional dimension of heterogeneity in the variable costs of lobbying. I assume that to spend lobbying amount of $b$, a firm has to pay $Z_{it}b$ amount of variable costs, where $Z_{it}$ is a firm-specific observable cost shifter. I use $Z_{it}$ as an instrumental variable to consistently estimate $\theta$, dealing with the endogeneity problem which is discussed later in the paper. This allows firms to have different levels of variable costs, depending on $Z_{it}$.\(^{20}\) Taking the log on both sides of Equation (3.1), I can derive the following estimable regression model: \(^{21}\)

$$\log 1/MRPL_{i,t+1} = \theta \log(1 + b_{it}^*) + X_{it}'\beta + \delta_i + \delta_{jt} + \log 1/\epsilon_{it},$$

where $b_{it}^* = b(\phi_{it}, \epsilon_{it}, \eta_{it}, Z_{it}). \quad (3.2)$

With the additional heterogeneity in the variable costs of lobbying, the optimal lobbying expenditures also depend on $Z_{it}$.

Because $1/\epsilon$ appears as the structural error term in Equation (3.2), the OLS estimates suffer from the endogeneity problem. Because lobbying is a function of $1/\epsilon$, $\log(1 + b^*)$ is correlated with the error term. In addition, a potential correlation between $\phi$ and $1/\epsilon$ can cause $\log(1 + b^*)$ to be correlated with the error term. Because the correlation between $\phi$ and $1/\epsilon$ has important TFP implications in the model, assuming independence between $\phi$ and $1/\epsilon$ leads to both omitted variable

---

\(^{19}\)Value-added is calculated as sales multiplied with sectoral value-added shares and the wage bills are calculated as employment multiplied with sector-state specific wage rate. Sectoral value-added shares are calculated from NBER-CES Manufacturing database. The wage rate is obtained from the US Census County Business Pattern data. If labor markets are segmented, firms may face different wages depending on their industry affiliations and location. In such a case, the regression results may be driven by variation in wages rather than variations in output wedges. Dividing value-added by wage bill mitigates this concern.

\(^{20}\)In the model described in Section 2, all firms have the same level of variable costs of lobbying, that is, $Z_{it} = 1$, $\forall i$. With additional heterogeneity of $Z_{it}$, the total cost of lobbying of firm $i$ is $P_{it}(Z_{it}b_{it} + f^b\eta_{it})$.

\(^{21}\)b is in the unit of final goods in the model but the data only reports the total lobbying expenditures $Pb$. To map the model to the data, I assume that at the equilibrium, $P$ is normalized as 1, implying that the lobbying expenditures reported in the data can be interpreted in terms of the unit of final goods.
bias econometrically and misleading TFP implications theoretically.

3.3.1 Instrumental Variable Strategy

I instrument for lobbying using the state-level time-varying appointment of a congress member as chairperson of the appropriations committees of the Senate or House of Representatives. An appointment as a chairperson in congressional committees is determined by a complicated political process. The data on membership on all congressional committees are obtained from Stewart and Woon (2017).

Institutional Setting. A local congress member’s appointment as a chairperson of the appropriations committees works as an observable cost-shifter of lobbying. The appropriations committees are in charge of discretionary spending, giving the Appropriation committees larger power than any other congressional committee and making them more prone to be lobbied.\textsuperscript{22} With budget responsibilities, the chairperson of the appropriations committees, has greater power than any other members of the committees and often allocates more federal spending to the state in which the chairperson represents.\textsuperscript{23} With an increase in potential grants and federal contracts opportunities through discretionary spending, local politicians who are chairpersons in the appropriations committees can increase the efficiency of lobbying of local firms in the same state as local politicians. Because the nomination of the chairperson of congressional committees is determined by seniority, the nomination of the chairperson of the appropriations committees is exogenous to the economic conditions of individual states or firms.\textsuperscript{24}.

IV Regression Results. I estimate Equation (3.2) in the first difference with IV. The samples were averaged over six years.\textsuperscript{25} The IV is the average of a dummy variable that equals one if the state congressman is the chairperson in the appropriations committees in either Senate or House for six years. To control for the state-common effects of the nomination of chairpersonship, I control detailed state-level tax incentives and transfers from the federal government.\textsuperscript{26} Columns (1)-(3) of Table 2 report the regression results. In column (3), dummies indicating quantiles of a firm’s

\textsuperscript{22}See Stewart and Groseclose (1999), Blanes i Vidal et al. (2012), and Berry and Fowler (2018).

\textsuperscript{23}Berry and Fowler (2016) finds that the chairs or the import positions of the appropriations subcommittees receive larger amounts of money from its subcommittee’s programs than other congress members. Aghion et al. (2009), Cohen et al. (2011), and Aghion et al. (2019) find that local earmarks or federal expenditures on education increase once local congress members become the chair of the important committees in Congress.

\textsuperscript{24}A change of chairpersonship is associated with the unexpected loss of reelection, retirement, or death of the current chair (Aghion et al., 2009; Cohen et al., 2011)

\textsuperscript{25}This mitigates the potential seasonality of lobbying expenditures caused by political cycles and measurement errors of MRPL.

\textsuperscript{26}State-level tax incentives are obtained from Bartik (2018). Specifically, I control corporate income taxes, job creation tax credits, investment tax credits, R&D tax credits, property tax abatement. The transfers from the federal government are obtained from the US Census.
Table 2: Estimating $\theta$

<table>
<thead>
<tr>
<th>Dep.</th>
<th>log($1/MRPL$)</th>
<th>log($1-ETR$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS</td>
<td>IV</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>log($1+Lobby$)</td>
<td>-0.004</td>
<td>0.092***</td>
</tr>
<tr>
<td></td>
<td>(0.005)</td>
<td>(0.032)</td>
</tr>
<tr>
<td>KP-F</td>
<td>.</td>
<td>31.81</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>State Control</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Firm Control</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>1216</td>
<td>1216</td>
</tr>
</tbody>
</table>

Notes. This table reports OLS and IV estimates of Equation (3.2). The dependent variable is the log of the inverse of $MRPL$ in columns (1)-(3), and the dependent variable is log($1-ETR$) in columns (4)-(6). $ETR$ is defined in Equation (3.3). The OLS estimates are reported in columns (1) and (4). The IV estimates are reported in columns (2), (3), (5), and (6). The IV is the average of a dummy variable equals one if a congress member of the state where a firm is headquartered becomes a chair of the Appropriate Committee in the House or Senate over six years. State control includes corporate income tax, job creation tax credit, investment tax credit, R&D tax credit, property tax abatement, and transfers from the federal government. Firm control includes dummies indicating quantiles of a firm’s initial sales. KP-F is Kleibergen-Paap F-statistics. The samples are averaged over six years. Standard errors are clustered at the state level. * $p<0.1$; ** $p<0.05$; *** $p<0.01$.

Initial sales are controlled, allowing for possible heterogeneous trends in output wedges depending on a firm’s size. Once the endogeneity problem is corrected using IV, I obtain significantly positive coefficients with strong first-stage results. A 1% increase in lobbying was associated with a 0.9-1% increase in output wedges.

The direction of bias in the OLS estimate can be interpreted through the lens of the model. When comparing the OLS and IV estimates in Table 2, the OLS estimate is downward-biased. The direction of bias has implications for the underlying correlation between productivity and output wedges. Holding $\phi$ and $\eta$ constant, log($1+b$) is positively correlated with the error term log($1/\epsilon$), making the estimated coefficient be biased upward. However, when Cov(log($\phi$), log($1/\epsilon$)) is sufficiently negative, which is the necessary condition for lobbying to improve TFP, log($1+Lobby$) can be negatively correlated with the error term, giving the OLS estimate a downward bias. I show that this is indeed the case in Section 3.5.

27 The first stage results are reported in Online Appendix Table D3.
Additional Robustness Checks. I extend the model to include two production factors: labor and capital.\textsuperscript{28} Lobbying has a statistically significant relationship with MRPL but not with marginal revenue product of capital (MRPK). These results are reported in Online Appendix Table D1. I also conduct an event study to check whether the appointment of the chairperson has pre-trends in lobbying expenditures.\textsuperscript{29} The pre-trends can detect potential spurious correlations arising from pre-existing confounding factors or reverse causality problems. These results are reported in Online Appendix Figure D1. I find no pre-trends in the appointment, supporting the exclusion restriction of the IV.

External Validity. If the model is misspecified, it is problematic to infer the MRPL as a firm-specific wedge.\textsuperscript{30} To examine whether the findings are robust to model misspecification, I use the cash effective tax rate (ETR) developed by Dyreng et al. (2008, 2017) as an alternative proxy for firm-specific wedges.\textsuperscript{31} The ETR captures a firm’s long-run tax avoidance activities, such as tax and investment credits. The ETR is constructed directly from the data rather than relying on the structure of the model. The ETR is defined as

\[
ETR_{ht} = \frac{\sum_{h=1}^{6} TXPD_{ht-h} - \sum_{h=1}^{6} (PI_{ht-h} - SPI_{ht-h})}{\sum_{h=1}^{6} (PI_{ht-h} - SPI_{ht-h})}.
\]

where TXPD\(_{ht}\), PI\(_{ht}\) and SPI\(_{ht}\) are the cash taxes paid, the pre-tax income and the special items, averaged over six years.\textsuperscript{32} I use \(\log(1 - ETR)\) as the alternative dependent variable, consistent with the output wedges measured by the inverse of the MRPL.\textsuperscript{33} Columns (4)-(6) of Table 2 report the regression results. The estimated coefficients are qualitatively and quantitatively similar to \(\log(1/MRPL)\).\textsuperscript{34}

3.4 Calibration

The two countries Home and Foreign are calibrated to the data corresponding to the US and the rest of the world. I assume that (log \(\phi\), log \(1/\epsilon\)) of the US follows a joint log-normal distribution:

\[
\begin{pmatrix}
\log \phi \\
\log 1/\epsilon
\end{pmatrix}
\sim N
\left(
\begin{pmatrix}
\mu_{US} \\
0
\end{pmatrix},
\begin{pmatrix}
\sigma_\phi & \rho \\
\rho & \sigma_\epsilon
\end{pmatrix}
\right)
\]

\textsuperscript{28}See Online Appendix Section D.2 for more detail.
\textsuperscript{29}See Online Appendix Section D.1 for more detail.
\textsuperscript{30}For example, although there is no firm-specific exogenous wedge, Askar et al. (2014) and David and Venkateswaran (2019) show that frictions of input adjustment can result in the dispersion of MRPL and MRPK.
\textsuperscript{31}Arayavechkit et al. (2017) similarly use this measure and shows that this measure is correlated with MRPK.
\textsuperscript{32}Special items represent unusual or nonrecurring items presented above taxes by the company. Following Hanlon and Slemrod (2009), I reset ETR to zero for a minimum and 0.5 for a maximum to mitigate the effect of outliers.
\textsuperscript{33}The ETR is interpreted as firm-specific taxes, so \(1 - ETR\) can be mapped to the output wedges in the model.
\textsuperscript{34}The results are robust to different transformation of ETR and different winsorization schemes. The results are reported in Online Appendix Table D2.
where the mean of $1/\epsilon$ is normalized to zero. $\sigma_\phi$ and $\sigma_\epsilon$ are standard deviation of $\log \phi$ and $\log 1/\epsilon$, and $\rho$ is the correlation between $\log \phi$ and $\log 1/\epsilon$. Given the focus of the model, I deliberately focus on the correlation between $\phi$ and $1/\epsilon$ and assume that $\eta$ is independently distributed with $\phi$ and $1/\epsilon$. $\eta$ is also log-normally distributed with a mean of zero and a standard deviation of $\sigma_\eta$.

Given the absence of micro-level data of Foreign and that Foreign affects the US only through the aggregate variables, I assume that foreign firms cannot lobby and Foreign has no distortions, and I take $\sigma_f^f$, $f$, and $f_x$ of Foreign to be the same as those of the US.

$\{\theta, \sigma, L^US, L^f, \mu_{US}, \mu_f, \tau_x, M^e_{US}\}$ were calibrated externally. I set $\theta$ to 0.9, which is the baseline estimate in Table 2. The relative labor of Foreign to US $L^f/L^US$ is set to be 7.2 to match the relative labor force from the Penn World Table (PWT) (Feenstra et al., 2015). The relative mean of the US productivity to Foreign productivity $\mu_{US}/\mu_f$ is calibrated to be 3.5 to match the relative GDP per capita from the PWT. I set the elasticity of substitution as 3 following Hsieh and Klenow (2009). I set the symmetric iceberg trade costs $\tau_x$ to be 1.7 following Anderson and Van Wincoop (2004). The exogenous firm mass of the US $M^e_{US}$ is normalized to 1.

The remaining parameters $\Theta = \{\sigma_\phi, \sigma_\epsilon, f^b, \sigma_\eta, \rho, f^US_f, M^e_f, f^F\}$ are calibrated jointly using the method of moments to match the model moments with the empirical moments from the data. I choose the moments that are relevant and informative about the underlying parameters. The standard deviation of productivity $\sigma_\phi$ is set to match the sales distribution of Compustat. Five bins were constructed based on the four percentiles: 75th (p75), 50th (p50), 25th (p25), and 5th (p5). I fit the overall standard deviation of sales and the mean of the log sales of each bin. $\sigma_\epsilon$ is fitted to the standard deviation of $1/\epsilon$ that are backed out from the regression in Equation (3.2). I fit $\rho$ to match the covariance between $\log(1+b)$ and output wedges, the identifying moment in Proposition 4. The fixed costs of lobbying $f^b$ and standard deviation $\sigma_\eta$ are calibrated to match the share of lobbying firms in the different sales bins. $f^b$ is identified by the overall share of lobbying firms. $\sigma_\eta$.

---

35The mean of $\eta$ is not separately identifiable with $f^b$.

36To construct labor and aggregate productivity level of Foreign, I choose the top 15 trading partners in 2006: Canada, Mexico, China, Japan, Germany, United Kingdom, South Korea, Taiwan, France, Malaysia, Italy, Netherlands, Venezuela, Brazil, and Ireland. Then, I aggregate up import, export, GDP, and labor of these countries.

37More precisely, the parameters minimize the following objective function:

$$\hat{\Theta} = \arg \min_\Theta \{(m - m(\Theta))'W(m - m(\Theta))\}, \quad \text{subject to} \quad L(\Theta) = 0,$$

where $m$ and $m(\Theta)$ are empirical and model moments, $W$ is the weighting matrix, and $L(\Theta) = 0$ is the set of constraints imposed by the equilibrium conditions. Following Su and Judd (2012), I solve the constrained minimization problem that minimizes the distance between empirical and model moments subject to the constraints imposed by a set of equilibrium conditions described in the previous section. I set $W$ to be a diagonal matrix whose component is the inverse of the empirical moments to eliminate measurement units. The solution to the problem is not guaranteed to be the global minimum. Therefore, I solve the constrained minimization problem multiple times with different starting points to deal with the local minimum problem. The equilibrium conditions are described in more detail in Online Appendix Section E.1.

38I divide firms into four bins based on the quartiles of the sales distribution and calculate the fraction of lobbying firms in the bins of the fourth and third quartiles.
### Table 3: Model Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Identifying Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Externally calibrated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma$</td>
<td>3</td>
<td>Hsieh and Klenow (2009)</td>
</tr>
<tr>
<td>$L_f/L_{US}$</td>
<td>7.2</td>
<td>Relative labor of Foreign to the US (PWT)</td>
</tr>
<tr>
<td>$\mu_{US}/\mu_f$</td>
<td>3.5</td>
<td>Relative GDP per capita (PWT)</td>
</tr>
<tr>
<td>$\tau_x$</td>
<td>1.7</td>
<td>Anderson and Van Wincoop (2004)</td>
</tr>
<tr>
<td>$\theta$</td>
<td>0.09</td>
<td>Own estimate</td>
</tr>
<tr>
<td><strong>Internally estimated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\sigma_\phi$</td>
<td>1.95</td>
<td>Std. of log(Sale), Sales dist.</td>
</tr>
<tr>
<td>$\sigma_\tau$</td>
<td>0.84</td>
<td>Std. of MRPL</td>
</tr>
<tr>
<td>$f^b$</td>
<td>6.6</td>
<td>Lobbying expenditures &amp; sales dist.</td>
</tr>
<tr>
<td>$\sigma_\eta$</td>
<td>3.1</td>
<td>Lobbying expenditures &amp; sales dist.</td>
</tr>
<tr>
<td>$\rho$</td>
<td>-0.88</td>
<td>Cov. between log(1 + b) and log 1/$\epsilon$</td>
</tr>
<tr>
<td>$f_x$</td>
<td>0.06</td>
<td>Fraction of firms exporting (Bernard et al., 2007)</td>
</tr>
<tr>
<td>$f^f$</td>
<td>1e-4</td>
<td>Sales dist.</td>
</tr>
<tr>
<td>$M_{US}^f$</td>
<td>1</td>
<td>Normalization</td>
</tr>
<tr>
<td>$M_f^f$</td>
<td>2e-5</td>
<td>US export share (PWT)</td>
</tr>
</tbody>
</table>

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

is identified by the fraction of small-sized firms that are lobbying. In the model, the pattern of many small-sized firms lobbying relative to their sales is rationalized by the high variance of $\eta$. Without this high variance of $\eta$, sales become highly correlated with lobbying expenditures and the model cannot predict small-sized firms' lobbying. I fit the fixed costs of production using the difference between the mean of log sales of firms with sales between p25 and p50 and the mean of log sales of firms with sales below p5.

Because the fixed costs of production only affect the production decisions of small-sized firms, this moment can pin down the parameter.

**Model Fit.** Table 3 reports internally estimated and externally chosen parameters. Table 4 reports the model fit. The data moments are well-approximated in the model. Panel A of Figure 1 graphically illustrates the identifying moment observed in the data, the negative covariance between log(1 + b) and log 1/$\epsilon$ for firm-year level observations with positive amounts of lobbying. The negative covariance implies that log $\phi$ and log 1/$\epsilon$ are likely to be negatively correlated in the underlying distribution. In Panel B of Figure 1, using the model-generated data, I plot the same figure with Panel A. The model reproduces the identifying moment observed in the data.
Table 4: Data and Model Moments

<table>
<thead>
<tr>
<th>Target Moments</th>
<th>Data (2005)</th>
<th>Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of lobbying firms (sales above p90)</td>
<td>0.57</td>
<td>0.57</td>
</tr>
<tr>
<td>Share of lobbying firms (sales between p90 and p75)</td>
<td>0.23</td>
<td>0.15</td>
</tr>
<tr>
<td>Std. of log sales</td>
<td>2.87</td>
<td>2.69</td>
</tr>
<tr>
<td>Mean (Sale ≥ p75) - lowest 5% Sales</td>
<td>10.16</td>
<td>8.79</td>
</tr>
<tr>
<td>Mean (P75 ≥ Sale &gt; p50) - lowest 5% Sales</td>
<td>7.94</td>
<td>6.10</td>
</tr>
<tr>
<td>Mean (P50 ≥ Sale &gt; p25) - lowest 5% Sales</td>
<td>6.13</td>
<td>4.42</td>
</tr>
<tr>
<td>Mean (P25 ≥ Sale &gt; p5) - lowest 5% Sales</td>
<td>3.70</td>
<td>2.50</td>
</tr>
<tr>
<td>Std of TFPR</td>
<td>1.24</td>
<td>0.85</td>
</tr>
<tr>
<td>Std of $1/\epsilon$</td>
<td>1.11</td>
<td>0.83</td>
</tr>
<tr>
<td>Cov. log$(1 + b)$ and $1/\epsilon$</td>
<td>-0.36</td>
<td>-0.34</td>
</tr>
<tr>
<td>Share of exporting firms</td>
<td>0.18</td>
<td>0.15</td>
</tr>
<tr>
<td>Export share of GDP</td>
<td>0.11</td>
<td>0.11</td>
</tr>
</tbody>
</table>

Notes. All the moments except for share of exporting firms and export share of GDP are calculated from Compustat and the lobbying database. Share of exporting firms is from Bernard et al. (2007). Export share of GDP is from the PWT.

3.5 Quantitative Results

Decomposition of the measured TFPR. The observed TFPR dispersion is commonly used to measure the extent of misallocation in an economy.\(^{39}\) At efficient equilibrium, firms equate their TFPR to the common wage, and there should be no TFPR dispersion within industry. With output wedges, however, firms do not always equate their TFPR to wages, resulting in TFPR dispersion.

The observed TFPR dispersion can be decomposed as

$$Var\left(\log\left(\frac{TFPR_{it}}{TFPR_{jt}}\right)\right) = Var\left(\log\left(\frac{1/MRPL_{it}}{TFPR_{jt}}\right)\right) = Var\left(\log\left(\frac{1 + b_{it}}{\log\hat{\epsilon}_{it}}\right)\right)$$

$$= Var\left(\log\frac{1}{\hat{\epsilon}_{it}}\right) + \theta^2 Var\left(\log(1 + b_{it})\right) + 2\theta Cov\left(\log(1 + b_{it}), \log 1/\hat{\epsilon}_{it}\right),$$

$$\hat{\epsilon}_{it} = TFPR_{jt} \times \epsilon_{it}, \ (3A)$$

\(^{39}\)The dispersion of TFPR is equivalent to aggregate TFP under the assumptions presented in Hsieh and Klenow (2009). These assumptions include the Cobb-Douglas production function, CES demand structure with monopolistic competition, exogenous firm mass, and closed economy. If these assumptions are violated, the dispersion is not directly mapped to the aggregate TFP and becomes a reduced form measure for the aggregate TFP.
Panel A. Data, $\beta = -0.36$

Panel B. Model Fit, $\beta = -0.34$

**Figure 1:** Identifying Moment. Covariance between $\log(1 + b)$ and $\log 1/\epsilon$. Data and Model Fit

**Notes.** X and Y-axis represent $\log(1 + b)$ and $\log 1/\epsilon$ backed out from the data. Each dot in Panels A and B is firm-year observation with positive amounts of lobbying from the actual and model-generated data. The red line represents linear fit with 99% confidence interval. The slope coefficients $\beta$ are reported at the bottom. $\log(1 + b)$ and $\log 1/\epsilon$ are demeaned in both figures. The distributions at the top and the right are histograms and their associated kernel density estimates of $\log(1 + b)$ and $\log 1/\epsilon$.

where $1/\epsilon_{jt}$ is an exogenous output wedge backed out from the data, normalized by the industry-level TFPR ($TFPR_{jt}$). The industry-level TFPR is obtained as the mean of TFPR across firms weighted by sales. The normalization differences out any sector-level distortions that are common across firms, which makes firms across different sectors comparable.

The observed overall dispersion can be decomposed into three components: (1) HK, (2) lobbying, and (3) covariance dispersion. HK dispersion is induced by exogenous wedges (Hsieh and Klenow, 2009). If $\log(1/\epsilon) = 0$ for all firms, HK dispersion becomes zero. Without endogenous lobbying, this was the only source of dispersion. The question is whether lobbying mitigates or amplifies this pre-existing exogenous HK dispersion. Lobbying introduces two additional sources: lobbying, and covariance dispersion. The lobbying dispersion is always positive, so the lobbying dispersion always amplifies HK dispersion and increases the overall dispersion. Whether lobbying can mitigate HK dispersion depends on covariance dispersion. Covariance dispersion can take either negative or positive values. If the covariance dispersion is sufficiently negative, it can offset the lobbying dispersion and make the overall observed dispersion even smaller than the HK dispersion. However, if the covariance dispersion is positive, it will amplify the overall dispersion.
dispersion is positive, lobbying makes the overall dispersion larger than the HK dispersion.

The decomposition results are shown in Figure 2. The HK dispersion is larger than the overall TFPR dispersion observed in the data and, even though the lobbying dispersion is always positive, the covariance dispersion is sufficiently negative to decrease the initial HK dispersion.\footnote{Across the sample period, the mean observed variance of TFPR is 0.6. Note that this is slightly larger than Hsieh and Klenow (2009) in which they use Census establishment data. The averages of the covariance, lobbying, and HK dispersion are -0.45, -0.17, and 0.86, respectively. The average correlation between log(1 + b) and log 1/\(\epsilon\) across the sample period is about -0.1.} This implies that among publicly traded firms, more productive firms tend to face a higher level of exogenous tax (or a lower level of output wedges). Lobbying decreases the HK dispersion induced by exogenous output wedges to the observed TFPR dispersion level, which is an average reduction of approximately 30\%.\footnote{If the covariance dispersion were less negative than -0.17, lobbying would have increased the dispersion of TFPR.} Another observation is that the covariance dispersion is becoming more negative, implying that more productive firms are more highly taxed recently.

**TFP and Welfare.** I examine the effect of lobbying on TFP and welfare using the quantitative model. TFP is defined as real GDP per capita, which requires a producer price index (PPI). PPI is defined as $PPI = (\int_{\omega \in \Omega_{US}} p(\omega)^{1-\sigma} d\omega)^{1/(1-\sigma)}$ where $\Omega_{US}$ is the set of domestic intermediate producers available in the US.\footnote{Burstein and Cravino (2015) discusses issues regarding measurement of price index and real GDP in open economy.}
Table 5: Welfare and TFP Loss relative to the Efficient Economy

<table>
<thead>
<tr>
<th></th>
<th>TFP</th>
<th>Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Loss (%); Lobbying channel (%); Misallocation channel (%)</td>
<td>Total Loss (%); Lobbying channel (%); Misallocation channel (%)</td>
</tr>
<tr>
<td>Panel A. Baseline</td>
<td>-80.50; 8.07; -88.57</td>
<td>-80.83; 8.11; -88.95</td>
</tr>
<tr>
<td>Panel B. Free Entry</td>
<td>-79.60; 5.81; -85.41</td>
<td>-70.51; 4.95; -75.64</td>
</tr>
<tr>
<td>Panel C. $\theta = 0.075$</td>
<td>-79.86; 8.71; -56.00</td>
<td>-80.19; 8.75; -88.95</td>
</tr>
<tr>
<td>Panel D. $\theta = 0.045$</td>
<td>-81.30; 7.27; -88.57</td>
<td>-81.64; 7.30; -88.95</td>
</tr>
<tr>
<td>Panel E. $\theta = 0.11$</td>
<td>-83.08; 5.49; -88.57</td>
<td>-83.43; 5.52; -88.95</td>
</tr>
</tbody>
</table>

Notes. This table presents the decomposition results from Equation (3.5). In Panel A, the baseline calibrated parameters are used. In Panels B, C, and D, $\theta$ is set to be 0.075, 0.045, and 0.11. Each value is multiplied by 100. In the closed economy, TFP and welfare are identical. In Panel E, free entry condition is imposed. The results are based on the calibrated parameters reported in Table 3.

When compared to the efficient economy, the TFP and welfare loss in the lobbying economy can be decomposed into two channels: lobbying and misallocation channels:

$$\log Y_{lobby} - \log Y_{eff} = (\log Y_{lobby} - \log Y_{exo}) + (\log Y_{exo} - \log Y_{eff})$$  \hspace{1cm} (3.5)

where $Y$ stands for either TFP or welfare, and subscripts $lobby$, $exo$ and $eff$ denote the lobbying, exogenous wedge, and efficient economies, respectively. The lobbying channel measures the gain or loss of the lobbying economy relative to the exogenous wedge economy. The misallocation channel measures the loss of the exogenous wedge economy relative to the efficient economy. If the lobbying channel is positive, lobbying increases TFP or welfare over the exogenous wedge economy. However, if the lobbying channel is negative, it exacerbates the TFP or welfare loss of the exogenous wedge economy.

Panel A of Table 5 reports the decomposition results. In the lobbying economy, the overall TFP and welfare loss relative to the efficient economy are -80.5 and -80.83%, respectively. The lobbying
Panel A. Correlation between $\phi$ and $1/\epsilon$, $\rho$

Panel B. Standard deviation of $\phi$, $\sigma_{\phi}$

Panel C. Standard deviation of $1/\epsilon$, $\sigma_{\epsilon}$

Panel D. Standard deviation of $\eta$, $\sigma_{\eta}$

Figure 3: TFP. Exogenous Wedge Economy vs. Lobbying Economy

Notes. This figure displays the relative TFP level of the exogenous wedge and lobbying economies to the efficient economy. The blue solid (red dotted) line is the TFP of the lobbying (exogenous wedge) economy divided by the TFP in the efficient economy. The vertical line represents the calibrated parameter. The results are based on the calibrated parameters reported in Table 3.

channel is 8.07% for TFP and 8.11% for welfare, implying that when lobbying is not allowed, TFP and welfare could have decreased by 8.07% and 8.11%, respectively. In Panel B, I conduct the same analysis under the free-entry condition. The entry cost is normalized to 1 in Home and the entry cost of Foreign is set to 0.14 following Bollard et al. (2016), so that entry cost is proportional to GDP per capita. Under the free-entry condition, the lobbying channel is 5.81% for TFP and 4.95% for welfare, slightly lower than the baseline results in Panel A. Panels C, D, and E report the results with different values of $\theta$. In Panel C, I set $\theta = 0.75$ which is the estimate when using $\log(1-ETR)$ in columns (3)-(4) of Table 2. In Panel D, I set $\theta = 0.045$ and in Panel E, I set $\theta = 0.11$. The results are robust for a wide range of $\theta$.

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43 Bollard et al. (2016) finds that entry cost increases with productivity. I set the Foreign’s entry cost to be 0.14 ($=1/7.2$), where 1/7.2 is the US and top 15 trading countries’ population ratio.

44 Under the free-entry condition, lobbying by a few big firms may block small firms’ entry, which may lower the
Sensitivity Analysis. I examine the relative TFP of the endogenous and exogenous wedge economies to the efficient economy while varying one parameter and holding other parameters constant. The results for $\rho$, $\sigma_\phi$, $\sigma_\epsilon$, and $\sigma_\eta$ are reported in Panels A, B, C, and D of Figure 3. The blue solid and red dashed lines represent the relative TFP of the lobbying and exogenous wedge economies, and the vertical black line represents the calibrated parameter values. As the model predicts, Panel A shows that lobbying can mitigate misallocation from the exogenous wedge for a sufficiently low value of $\rho$ near the calibrated value, but the concentration and amplification effects begin to dominate above -0.8. Panel B shows that the gains from lobbying become larger when productivity is more dispersed. Holding $\rho$ fixed, higher $\sigma_\phi$ indicates that more productive firms are more likely to face a higher exogenous tax, which gives more room for lobbying to improve TFP. Panel C illustrates that as $\sigma_\epsilon$ increases, lobbying worsens the economy through the amplification effect. Lastly, in Panel D, as $\sigma_\eta$ increases, lobbying decreases gains from lobbying because less productive firms can participate in lobbying if they draw low fixed costs of lobbying.\footnote{In Panel D, the TFP of the exogenous wedge is irrelevant to values of $\sigma_\eta$, so the red dashed line is flat.}

4 Globalization

This section first provides empirical evidence that the recent China shock affected firms’ lobbying decisions and then quantitatively assesses the impact of globalization on aggregate TFP through lobbying channels.

4.1 Empirical Evidence regarding Globalization and Lobbying

I provide empirical evidence that a decrease in market size decreases the lobbying of small- and medium-sized firms. I use the recent rise in Chinese import exposure as an exogenous shock to US firms’ market size (Autor et al., 2013; Acemoglu et al., 2016). China’s productivity growth and a decrease in bilateral trade costs with the US have dramatically increased US imports from China after China joined the WTO in 2001.\footnote{For more on Chinese import exposure, see Autor et al. (2013); Acemoglu et al. (2016); di Giovanni et al. (2014); Pierce and Schott (2016); Handley and Limão (2017).} Following Acemoglu et al. (2016), Chinese import exposure is defined as follows:

$$China_{j,t}^{oc,im} = 100 \times \frac{IM_{j,t}^{oc,im}}{Y_{j,t}^{US} + IM_{j,t}^{US} - EX_{j,t}^{US}}$$

for industry $j$ at time $t$. $IM_{j,t}^{oc,im}$ is the sum of imports of other developed countries from China.\footnote{Following Autor et al. (2013), these high-income countries include Australia, Denmark, Finland, Germany, Japan, New Zealand, Spain, and Switzerland.} The denominator is the initial US domestic absorption at the start of the sample period, which is the sum of gross output $GO_{j,t}^{US}$ and the total exports $EX_{j,t}^{US}$ minus the total imports $IM_{j,t}^{US}$. $China_{j,t}^{oc,im}$ gains from lobbying.
Figure 4: Trade-Induced Market Size Changes and Lobbying

Notes. The figure illustrates the average of log one plus lobbying of each group. Log one plus lobbying is residualized on firm and time fixed effects. Firms are grouped based on the medians of the distributions of Chinese import exposure defined in Equation (4.1) and the initial sales. If import exposure of a firm’s industry is above or below the median exposure across industries, it is categorized as “High China” or “Low China.” If a firm’s initial sales are above or below the median with 4-digit SIC code, it is labeled as “Big” or “Small.” China’s accession to the WTO in 2001 is denoted as the black dotted line.

captures the exogenous market decrease of US firms driven by the China supply shock orthogonal to the US domestic demand shocks or firm-level conditions.

Figure 4 summarizes the main empirical findings. Based on the medians of import exposure and initial sales, firms are divided into four groups, as shown in Figure 4. The initial sales level is used as a proxy for firm size. Figure 4 shows that the gap in lobbying between large and small firms is rising only in industries that are more exposed to import exposure after China joined the WTO. This indicates that the import shock has heterogeneous effects on lobbying, depending on firm size.

The graphical results are confirmed by the following long difference regression model: for a firm $i$
of industry \( j \) at year \( t \)

\[
\Delta y_{it} = \beta_1 \Delta \text{China}^{oc,im}_{jt} + \beta_2 \log(Sale_{it0}) \times \Delta \text{China}^{oc,im}_{jt} + \delta_t + \delta_i + \Delta \epsilon_{it},
\]

where \( y_{it} \) is a dependent variable and \( \text{China}^{oc,im}_{jt} \) is the import shock defined in Equation (4.1).\(^{49}\) I use three main dependent variables: log one plus lobbying, inverse hyperbolic sine transformation of lobbying expenditures \((\text{asinh}(\text{Lobby}))\), and a dummy variable of positive lobbying multiplied by 100.\(^{50}\) The dummy dependent variable captures the extensive margin of lobbying. I control the interaction term between the log of the initial sales and Chinese import exposure to allow for heterogeneous effects of the China shock on firms of different sizes. I normalize the initial sales by the minimum value within 4-digit SIC industry so that \( \beta_1 \) can be interpreted as the effect of the import exposure on the firm with the minimum initial sales. I control for firm and time fixed effects to account for firm-specific trends and macroeconomic shocks. Given that lobbying is a long-term investment and may change alongside US political cycles, I average the samples over six years following the six-year terms of US senators.\(^{51}\) All standard errors are clustered on 3-digit SIC industries. This allows an arbitrary correlation between the error terms of firms in the same 3-digit code.

Panel A of Table 6 reports these results. The dependent variable is log one plus lobbying in columns (1) and (2), \( \text{asinh}(\text{Lobby}) \) in columns (3) and (4), and a dummy variable of positive lobbying in columns (5) and (6). In columns (2), (4), and (6), I control for state-specific time fixed effects to account for omitted confounding factors at the state level. Across specifications, I find sizable heterogeneous responses to import exposure. In columns (1) and (3), for the firm at the 25th percentile of the initial sales distribution, one standard deviation of the import shock increases 0.4 standard deviation of the log of one plus lobbying and a similar magnitude for \( \text{asinh}(\text{Lobby}) \). However, firms whose initial sales are above the 75th percentile are not affected by import shocks.\(^{52}\) Regarding the extensive margin in column (5), one standard deviation of the import exposure decreases a firm’s probability of lobbying by 37\% but has negligible effects on firms whose initial sales exceed the 75th percentile. When controlling for state-specific time fixed effects in columns (2), (4), and (6), the

\(^{49}\)Unlike Acemoglu et al. (2016) where \( \text{China}^{oc,im}_{jt} \) is used as an instrumental variable, I estimate the model in a reduced-form for two reasons, because the focus is to examine the reduced form relationship between market size and lobbying rather than giving a structural interpretation to the regression model.

\(^{50}\)Using a log of one plus lobbying can be misleading as it imposes strong functional form. The inverse hyperbolic sine function is defined as \( \log(x + \sqrt{x^2 + 1}) \). This is well-defined at zero and parallels the natural logarithm for positive values (Card and Della Vigna, 2020). I multiplied the dummy dependent variable by 100 so that the estimated coefficient can be interpreted as the percentage changes.

\(^{51}\)For example, lobbying can decrease near the end of a senator’s terms of office because of uncertainty regarding the results of the next election.

\(^{52}\)This is calculated as \( 35 \times (4.66 \times 0.01 - 0.089) / 3.74 \) where 35 and 3.74 are the standard deviations of the import exposure and log of one plus lobbying. 4.66 is the initial sales level at the 25th percentile normalized by the minimum sales within industry.
coefficients retain the same signs and remain within the standard error of the baseline results in columns (1), (3), and (5).

The empirical finding is consistent with the complementarity between market size and a firm’s lobbying expenditure, as stated in Proposition 1. This proposition implies that firms in industries that are more exposed to the China import shock decrease their lobbying on average because of decreases in market size and the effects are heterogeneous across firms depending on their size.

**Export Exposure.** In addition to US imports from China, US exports to China increased after China became a member of the WTO. If market size is an important determinant of lobbying, an increase in exports should increase a firm’s lobbying expenditures in the direction opposite to the import exposure. To examine the effect of an increase in exports on a firm’s lobbying, I additionally control for the US export exposure and its interaction with firm size, similar to the import exposure. Following Feenstra et al. (2019), I define US export exposure as the relative export intensity:

\[ \text{China}_{jt}^{oc,ex} = \frac{EX_{jt}^{oc,ex}}{GO_{jt}^{US}}, \]  

(4.3)

where \( EX_{jt}^{oc,ex} \) is defined as the sum of eight developed countries’ exports relative to the US gross output of the industry at the start of the sample period, analogous to the import exposure measure.

Panel B of Table 6 reports the results when controlling for export exposure. The estimated coefficients of import exposure and its interaction have a larger magnitude and are estimated more precisely than the estimates without controlling for export exposure. The heterogeneous effects of export exposure are in the opposite direction to import exposure, which is consistent with the market size effect. This effect predicts that marginal firms that were unable to export initially but could enter the Chinese market after a substantial reduction in bilateral trade costs may receive the largest benefit from market expansion due to extensive margin changes. The estimated coefficient of the interaction term in column (1) implies that one standard deviation increase of export exposure increases lobbying of a firm at the 25th and 75th percentile by 0.22 and 0.07 standard deviation of log one plus lobbying, decreasing their gap by 0.15 standard deviation. In column (3), I obtained a similar magnitude for \( \text{asinh}(\text{Lobby}) \). For the extensive margin of lobbying in column (5), export exposure has zero effect for the firm at the 75th percentile but increases the probability of lobbying for a firm at the 25th percentile by 6%. When controlling for state-specific time fixed effects in columns (2), (4), and (6), the estimated coefficients retain the same sign and all remain within the standard error of the baseline results.

\[^{53}\text{Feenstra et al. (2019) finds that the expansion of the US exports to China increased the number of jobs of the US.}\]
Non-Trade-Related Lobbying. If firms systematically change their lobbying patterns against trade with China, the empirical results may be driven by trade-related lobbying activities rather than the market size effect. I provide evidence that the results in Panel A are not driven by trade-related lobbying.\footnote{Suppose special interests lobby to influence an incumbent government’s trade policy against rising Chinese import competition. In such cases, the regression results may be driven by political factors rather than market size.} I conduct the same analysis with non-trade-related lobbying expenditures. To identify whether a firm’s lobbying is related to trade, I use the general issue codes and summaries of lobbying activities, which are required to be reported by the Lobbying Disclosure Act. First, lobbying is classified as trade-related lobbying if its issue code is either TAR or TRD, where TAR covers general trade-related issues except for tariffs, and TRD covers issues related to tariffs.\footnote{TAR was added in 2009. Before 2009, TAR covered both general trade-related issues and tariff-related issues. On many occasions, multiple issues are covered by one report, and only the total expenditures are reported per each report. In this case, lobbying expenditures per each issue are not separately identifiable from the total expenditures, so I obtain the lobbying expenditure per issue as the total expenditure divided by the number of issues. Online Appendix Figure A1 and A2 display how lobbying expenditures, general issue codes, and summaries are reported in the lobbying reports.} Second, I also count any lobbying reports that mention “China” in their summary as trade-related lobbying because firms may lobby to increase trade barriers against Chinese imports using domestic policies that are seemingly non-trade-related. For example, firms may lobby for the strengthening of intellectual property rights or environmental regulations against Chinese firms, which may not be reported as trade-related issues in lobbying reports. Non-trade-related lobbying expenditures are obtained as the total lobbying expenditures minus the total amount of trade-related lobbying expenditures. Panel C of Table 6 reports these results. The estimated coefficients are qualitatively and quantitatively similar to the results of Panel A up to two decimals, implying that the results are unlikely to be driven by trade-related lobbying activities.\footnote{In Online Appendix Table B3, I run the same regression with trade-related lobbying as dependent variables. I find no significant effects of the import and export exposure on trade-related lobbying.}

Non-Parametric Regressions. The interaction term implies that heterogeneous effects are linear in the log of initial sales. This imposed linearity can be misleading if the effects are highly nonlinear. To examine whether the results are driven by the functional form assumption, instead of using the linear interaction term, I use interaction terms between Chinese import exposure and a dummy of a group of firms defined based on the tercile of the initial sales distribution within each industry, which may capture nonlinearity more flexibly than the linear interaction term. The specifications are as follows.

\begin{equation}
\triangle y_{it} = \sum_{q=1}^{3} \beta^q D^q_i \times \triangle \text{China}_{jt}^{oc,im} + \delta_i + \delta_t + \triangle \epsilon_{it}, \tag{4.4}
\end{equation}

where $D^q_i$ is a dummy variable for each group $q = 1, 2, 3$ defined based on the tercile. $\beta^q$ captures the average heterogeneous effects for each group.
### Table 6: Market Size and Lobbying

<table>
<thead>
<tr>
<th>Dep.</th>
<th>( \log(1 + \text{Lobby}) )</th>
<th>( \text{asinh}(\text{Lobby}) )</th>
<th>( 100 \times 1[\text{Lobby} &gt; 0] )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
</tr>
</tbody>
</table>

**Panel A. Baseline**

<table>
<thead>
<tr>
<th></th>
<th>( \Delta \text{China}<em>{oc,im}^\text{jt} \times \log(\text{Sale}</em>{it}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{China}_{oc,im}^\text{jt} )</td>
<td>-0.079** \hspace{1cm} -0.089** \hspace{1cm} -0.084* \hspace{1cm} -0.094** \hspace{1cm} 0.674* \hspace{1cm} 0.749**</td>
</tr>
<tr>
<td></td>
<td>(0.041) \hspace{1cm} (0.040) \hspace{1cm} (0.043) \hspace{1cm} (0.042) \hspace{1cm} (0.349) \hspace{1cm} (0.339)</td>
</tr>
</tbody>
</table>

**Panel B. Export Exposure**

<table>
<thead>
<tr>
<th></th>
<th>( \Delta \text{China}<em>{oc,im}^\text{jt} \times \log(\text{Sale}</em>{it}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{China}_{oc,im}^\text{jt} )</td>
<td>-0.167*** \hspace{1cm} -0.165*** \hspace{1cm} -0.176*** \hspace{1cm} -0.175*** \hspace{1cm} -1.378*** \hspace{1cm} -1.358***</td>
</tr>
<tr>
<td></td>
<td>(0.026) \hspace{1cm} (0.031) \hspace{1cm} (0.028) \hspace{1cm} (0.033) \hspace{1cm} (0.240) \hspace{1cm} (0.278)</td>
</tr>
</tbody>
</table>

**Panel C. Non-Trade-Related Lobbying**

<table>
<thead>
<tr>
<th></th>
<th>( \Delta \text{China}<em>{oc,im}^\text{jt} \times \log(\text{Sale}</em>{it}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{China}_{oc,im}^\text{jt} )</td>
<td>-0.080** \hspace{1cm} -0.091** \hspace{1cm} -0.085** \hspace{1cm} -0.096** \hspace{1cm} -0.665** \hspace{1cm} -0.743**</td>
</tr>
<tr>
<td></td>
<td>(0.039) \hspace{1cm} (0.038) \hspace{1cm} (0.041) \hspace{1cm} (0.040) \hspace{1cm} (0.333) \hspace{1cm} (0.327)</td>
</tr>
</tbody>
</table>

**Panel D. Non-Parametric Regressions**

<table>
<thead>
<tr>
<th></th>
<th>( \Delta \text{China}<em>{oc,im}^\text{jt} \times \log(\text{Sale}</em>{it}) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( D^1 \times \text{China}_{oc,im}^\text{jt} )</td>
<td>-0.077* \hspace{1cm} -0.082** \hspace{1cm} -0.081* \hspace{1cm} -0.088** \hspace{1cm} -0.684** \hspace{1cm} -0.745**</td>
</tr>
<tr>
<td></td>
<td>(0.040) \hspace{1cm} (0.039) \hspace{1cm} (0.042) \hspace{1cm} (0.042) \hspace{1cm} (0.334) \hspace{1cm} (0.329)</td>
</tr>
<tr>
<td>( D^2 \times \text{China}_{oc,im}^\text{jt} )</td>
<td>-0.004 \hspace{1cm} -0.001 \hspace{1cm} -0.004 \hspace{1cm} -0.001 \hspace{1cm} -0.022 \hspace{1cm} 0.001</td>
</tr>
<tr>
<td></td>
<td>(0.027) \hspace{1cm} (0.032) \hspace{1cm} (0.028) \hspace{1cm} (0.034) \hspace{1cm} (0.239) \hspace{1cm} (0.289)</td>
</tr>
<tr>
<td>( D^3 \times \text{China}_{oc,im}^\text{jt} )</td>
<td>0.031 \hspace{1cm} 0.018 \hspace{1cm} 0.032 \hspace{1cm} 0.018 \hspace{1cm} 0.170 \hspace{1cm} 0.051</td>
</tr>
<tr>
<td></td>
<td>(0.031) \hspace{1cm} (0.033) \hspace{1cm} (0.033) \hspace{1cm} (0.035) \hspace{1cm} (0.263) \hspace{1cm} (0.277)</td>
</tr>
</tbody>
</table>

Firm FE | Y | Y | Y | Y | Y | Y
Time FE | Y | N | Y | N | Y | N
State × Time FE | N | Y | N | Y | N | Y

**Notes.** Panel A, B and C of the table reports results from estimating Equation (4.2) using OLS. Panel D reports results from estimating Equation (4.4) using OLS. The dependent variables are log one plus lobbying expenditures in columns (1) and (2), the inverse hyperbolic sine transformation of lobbying expenditures in columns (3) and (4) and a dummy variable of positive lobbying expenditures multiplied by 100 in columns (5) and (6). In Panel C, I use non-trade-related lobbying expenditures as dependent variables. \( \text{China}_{oc,im}^\text{jt} \) and \( \text{China}_{oc,ex}^\text{jt} \) are defined in Equation (4.1) and (4.3). In all specifications, firm fixed effects are controlled. Samples are averaged over six years. Robust standard errors are reported in parentheses and clustered on 3-digit SIC industries. * p<0.1; ** p<0.05; *** p<0.01.
The results are reported in Panel D of Table 6. Only the bottom group below the lowest tercile was negatively affected by the import shock. The estimated coefficients in columns (1) and (3) imply that a one standard deviation increase in the import shock decreases 0.75 standard deviation of the log of one plus lobbying and a similar magnitude for \(asinh(Lobby)\). The coefficient in column (5) indicates that a one standard deviation increase in the import exposure decreased the probability of lobbying by 26% for the bottom group. When controlling state-specific fixed effects in columns (2), (4), and (6), the estimated coefficients all have the same sign and stay within the standard error of the results of columns (1), (3), and (5).

**Additional Robustness Checks.** I provide a battery of robustness checks. I run the analysis without averaging the sample and using initial employment or capital as alternative proxies for firm size. The results are reported in Panels A and B of Online Appendix Table B2. The estimated coefficients are consistent with the baseline specification.

### 4.2 Quantitative Analysis

**Gains from Trade.** TFP gains from trade in the lobbying economy can be decomposed as follows:

\[
\begin{align*}
\log(TFP^T_{lobby}) - \log(TFP^A_{lobby}) &= \left\{ \log(TFP^T_{exo}) - \log(TFP^A_{exo}) \right\} \\
&\quad + \left\{ \log(TFP^T_{lobby}) - \log(TFP^T_{exo}) \right\} - \left\{ \log(TFP^A_{lobby}) - \log(TFP^A_{exo}) \right\}.
\end{align*}
\]

(4.5)

where the superscripts \(T\) and \(A\) denote the opening of trade and autarky, respectively. TFP gains from trade in the lobbying economy are the sum of the following three terms: (1) gains from trade in the exogenous wedge economy, (2) gains or losses from lobbying in the open economy, and (3) gains or losses from lobbying in autarky. The simple algebra shows that the difference between gains from trade in the lobbying and exogenous wedge economy is the difference between gains from lobbying of the lobbying economy in the open economy and autarky. The difference between gains from lobbying in the open economy and autarky measures the extent to which opening to trade affects the TFP influences of lobbying. If opening to trade increases the TFP influences of lobbying, gains from trade in the lobbying economy would be larger than those in the exogenous wedge economy, and vice versa.

Table 7 reports on TFP and welfare gains from trade in the different economies, comparing the
Table 7: International Trade and Lobbying. Opening to Trade

<table>
<thead>
<tr>
<th>Panel A. Opening to Trade, $\tau_x = \infty \Rightarrow \tau_x = 1.7$</th>
<th>Panel B. Before and After Chinese import exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lobbying Economy (A)</strong></td>
<td><strong>Exogenous Wedge Economy (B)</strong></td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>TFP (%)</td>
<td>4.40</td>
</tr>
<tr>
<td>Welfare (%)</td>
<td>3.30</td>
</tr>
<tr>
<td>TFP (%)</td>
<td>2.77</td>
</tr>
<tr>
<td>Welfare (%)</td>
<td>2.29</td>
</tr>
</tbody>
</table>

Notes. This table presents gains from trade in different economies. Panel A reports changes of welfare and TFP when opening to trade. Panel B reports changes of welfare and TFP before and after Chinese import exposure. Column (4) reports the difference of TFP and welfare gains between the lobbying and exogenous wedge economies. All the results are based on the calibrated parameters reported in Table 3.

autarky to the open economy with calibrated parameters. Compared to the autarky, the opening of trade increases TFP by 4.40%, 4.55%, and 2.88% in the lobbying, exogenous wedge, and efficient economies. In both distorted economies, gains from trade are larger than gains from trade in the efficient economy. The difference between gains from lobbying in the autarky and the open economy is reported in column (4). When compared to the autarky, the gains from lobbying decrease by 0.15% because the concentration and amplification effects are exacerbated in the open economy. Welfare can be decomposed in the same way, and there is a -0.12% reduction in welfare gains from lobbying in the open economy relative to the autarky.

The China Shock. I evaluate the impact of the China shock on the aggregate TFP and welfare. The China shock is modeled as an increase in the mean level of Foreign productivity $\mu_F$. I fit $\mu_F$ to the changes in the US import share with the 15 main trading countries. The manufacturing import share to GDP rose from 0.13 to 0.17 during the sample period, more than 55% of the increase from an increase in imports from China. In the China shock counterfactual, I set $\mu_F$ 45% higher so that the model fits the 30% increase in import share (0.17/0.13). Panel B in Table 7 presents these results. Welfare and TFP gains of the lobbying economy are larger than those of the efficient economy. Chinese import exposure increased TFP and welfare by 2.77% and 2.29%, respectively.

57 Bai et al. (2019) and Berthou et al. (2018) also show that idiosyncratic distortions can affect the gains from trade. Using the microdata in China Bai et al. (2019) finds a TFP loss when trade is liberalized.
58 In the simulated data based on the model with the baseline parameters, the variance of $\log(1 + Lobby)$ is 2.22 and 2.26 in the autarky and the open economy. The variance under the open economy is 1.5% higher, implying that lobbying expenditure across firms becomes unequal after opening to trade. As lobbying expenditures become more unequally distributed, this may lead to too much input concentrated toward big-sized lobbying firms, exacerbating the concentration and amplification effects.
However, its quantitative impact on gains from lobbying is negligible.

5 Conclusion

This paper evaluates the effects of lobbying on resource misallocation and aggregate TFP. I theoretically characterize the conditions under which lobbying increases or decreases TFP and provide a quantitative framework to evaluate the impacts of lobbying under initial distortions. The model allows me to disentangle the effect of initial distortions and lobbying and quantify the effect of lobbying on aggregate TFP and welfare. Lobbying can improve TFP when more productive firms initially face a higher exogenous output tax because, in such cases, they can lobby to overcome the initial tax burden. From the firm-level data, I quantitatively find that lobbying may increase the aggregate TFP of the US economy by 5%-8%. In addition, I find that international trade may affect a firm’s lobbying decision through the market size effect and, in turn, aggregate TFP. I provide the empirical finding that the recent China shock decreased small-sized firms’ lobbying. I quantitatively find that opening to trade may decrease the positive TFP influence of lobbying by 0.15%. Although lobbying is seemingly distortionary at the micro-level, the aggregate implication can differ from conventional wisdom, emphasizing the importance of considering the general equilibrium effects of lobbying.

However, these quantitative results should be considered carefully. Compustat only covers publicly traded firms, so the data might not represent the entire US economy. Also, the model does not incorporate other important features of lobbying, such as strategic behaviors between firms and increasing barriers to entry by incumbents. Therefore, the quantitative TFP implications of the model should be considered as the upper bound, and it should be noted that the actual welfare effect is lower than the numbers reported here. I leave incorporating other features to future research.
References


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Appendix A  Construction of Data

Balance Sheet Data. Firms’ balance sheet data comes from Compustat. The empirical analysis excludes:

1. firms in industries other than manufacturing (SIC $\notin [20, 40])$.
2. firms that are not incorporated in the US.
3. firm-year observations whose labor, capital, or sales data are missing.
4. firm-year observations with negative values of labor, capital, or sales.
5. Firm-year pair with top and bottom 0.5% of MRPL: I drop these outlier samples not to make my results be driven by outliers following Hsieh and Klenow (2009).

Lobbying Data. Lobbying data is publicly available since LDA (1995). Firms have to report their lobbying expenditure semi-annually from 1998 to 2007 and quarterly after 2007. The Center for Responsive Politics constructed the lobbying database based on these reports. I downloaded lobbying data from the Center for Responsive Politics. According to the LDA (1995), the “lobbying activities” are lobbying contacts and efforts in support of such contacts, including preparation and planning activities, research, and other background work that is intended, at the time it is performed, for use in contacts and coordination with the lobbying activities of others.

An example of lobbying reports are displayed in Figure A1 and A2. This is the report by Apple Inc in the third quarter of 2020. In Figure A1, the total lobbying expenditures are reported. In Figure A2, general issue area code is reported, which I use to construct the non-trade-related lobbying expenditures. In this example, Apple Inc lobbied for tax-related issues.

Trade Data. Sector-level trade data come from Comtrade. I covert HS 6-digit to SIC 4-digit using the conversion from Pierce and Schott (2012) and Acemoglu et al. (2016).

Industry-Level Data. Industry-level data comes from NBER-CES manufacturing data. The NBER-CES manufacturing data has detailed information on industry-level variables at SIC 4-digit code such as gross output or value-added. Using the gross output data, I construct domestic absorption with imports and exports data from Comtrade. I also obtain value-added shares at the industry level by dividing value-added by gross output.

Congressional Committee Assignment. I obtain congressional committee assignment data from Stewart and Woon (2017).
**Wage Data.** I obtain 3-digit SIC industry-level wage data within each state from the Census of Business Pattern. I convert the 3-digit NAICS codes to the 3-digit SIC code. The constructed wage data is then matched with the firm-level data based on firms’ headquarter locations and industry affiliation.

**State-Level Tax.** I obtain state-level tax data from the Panel Database on Incentives and Taxes (PDIT) database (Bartik, 2018). It has detailed information on corporate income tax, job creation tax credit, investment tax credit, R&D tax credit, and property tax abatement.

**Effective Tax Rates.** The cash effective tax rates (ETR) developed by Dyreng et al. (2008) is defined as

\[ ETR_{it} = \frac{\sum_{h=1}^{6} TXPD_{i,t-h}}{\sum_{h=1}^{6} (PI_{i,t-h} - SPI_{i,t-h})}, \]  

where \( TXPD \) is cash tax paid (Item 317), \( PI \) is pretax income (Item 122) and \( SPI \) is special items (Item 12) from Compustat.

Following Dyreng et al. (2017) and Hanlon and Slemrod (2009),

1. samples should have non-missing and non-negative values of TXPD, PI, and SPI.
2. if ETR is larger than 0.5, I reset them to 0.5 to reduce the effect of outlier samples.

I average each variable over six years and calculate the long-run ETR. It is shown in Dyreng et al. (2008) that the long-run average is more reliable.

**Name-Matching.** I matched firms’ names in Compustat to parent firms’ names in the lobbying database. The matching step is described as follows. The matching is done year by year.

- Step 1: Match a firm’s name based on their exact name without any modifications.
- Step 2: For the names not matched in the step 1, unify abbreviations and then match the remaining names. For example, “Incorporated” is converted into “INC.”
- Step 3: For the names not matched in the step 2, Match a firm’s name after dropping out abbreviations.
- Step 4: For the names not matched in the step 3, I use the fuzz-name matching algorithm. I calculate the fuzz ratio that measures the similarity between two different names with the fuzz-name matching algorithm. I keep the matched pair if their fuzz ratio is above 95 and the name is composed of more than 20 letters. These two criteria increase the accuracy of matching.
**Figure A1:** The Lobbying Report by Apple Inc. in 2020, Total Lobbying Expenditures

---

1. **Registrant Name**
   - Organization/Lobbying Firm
   - Self Employed Individual
   - The Glover Park Group LLC

2. **Address**
   - Address1: 1025 F Street NW
   - Address2: 9th Floor
   - City: Washington
   - State: DC
   - Zip Code: 20004
   - Country: USA

3. **Principals of business (if different than line 2)**
   - City
   - State
   - Zip Code
   - Country

4a. **Contact Name**
   - Mr. Joel Johnson
5. **Telephone Number**
   - 2023370808
6. **E-mail**
   - joelj@agp.com
7. **Client Name**
   - Self
   - Check if client is a state or local government or instrumentality
   - Apple, Inc.

8. **Type of Report**
   - Year: 2020
   - Q1 (1/1 - 3/31)
   - Q2 (4/1 - 6/30)
   - Q3 (7/1 - 9/30)
   - Q4 (10/1 - 12/31)

9. **Check if this filing amends a previously filed version of this report**
10. **Check if this is a termination report**
11. **No Lobbying Issue Activity**

---

### INCOME OR EXPENSES - YOU MUST COMPLETE EITHER LINE 12 OR LINE 13

12. **Lobbying Income**
   - Related to lobbying activities for this reporting period:
   - Less than $5,000
   - $5,000 or more
   - $40,000.00

   Provide a good faith estimate, rounded to the nearest $10,000, of all lobbying related income for the client (including all payments to the registrant by any other entity for lobbying activities on behalf of the client).

13. **Organizations**
   - EXPENSE related to lobbying activities for this reporting period:
   - Less than $5,000
   - $5,000 or more
   - $____________

14. **Reporting Method**
   - Check box to indicate expense accounting method. See instructions for description of options.
   - Method A: Reporting amounts using LDA definitions only
   - Method B: Reporting amounts under section 6033(5)(b) of the Internal Revenue Code
   - Method C: Reporting amounts under section 162(e) of the Internal Revenue Code

---

**Signature**

Digitally Signed By: Nicole Dade

**Date**

10/19/2020
11:22:17 AM

https://lda.senate.gov/files/public/filing/2fb2eb27-82ed-4c88-abe4-b74f0c5adedfprint/1/6
**LOBBYING ACTIVITY.** Select as many codes as necessary to reflect the general issue areas in which the registrant engaged in lobbying on behalf of the client during the reporting period. Using a separate page for each code, provide information as requested. Add additional page(s) as needed.

15. General issue area code TAX

16. Specific lobbying issues

| Issues related to tax, trade, technology and broadband. |

17. House(s) of Congress and Federal agencies

| Check if None |

| U.S. SENATE, U.S. HOUSE OF REPRESENTATIVES |

18. Name of each individual who acted as a lobbyist in this issue area

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Suffix</th>
<th>Covered Official Position (if applicable)</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joel</td>
<td>Johnson</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rusn</td>
<td>Krogh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dougg</td>
<td>Rothschild</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jack</td>
<td>Krumholtz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rob</td>
<td>Feldman</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paul</td>
<td>Potter</td>
<td></td>
<td>Special Adviser to the Director, Federal Housing Finance Agency; Deputy Assistant Secretary, Department of the Treasury; Special Assistant, Department of the Treasury; Legislative Assistant, House of Representatives, Office of Rep. Jesse Jackson Jr.</td>
<td></td>
</tr>
<tr>
<td>Megan</td>
<td>Moore</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

19. Interest of each foreign entity in the specific issues listed on line 16 above

| Check if None |

---

**Figure A2:** The Lobbying Report by Apple Inc in 2020, General Issue Codes
Appendix B  Additional Results on the China Shock and Lobbying

B.1 Additional Robustness Checks

| Dep. | log(1 + Lobby) | asinh(Lobby) | 100 × 1[|Lobby| > 0] |
|------|----------------|--------------|---------------------|
|      | (1)            | (2)          | (3)                 | (4)                 | (5)                | (6)                 |

### Panel A. Baseline

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China$^{im,jt}$</td>
<td>-0.018*</td>
<td>-0.018**</td>
<td>-0.019*</td>
<td>-0.019**</td>
<td>-0.151*</td>
<td>-0.153*</td>
</tr>
<tr>
<td></td>
<td>(0.009)</td>
<td>(0.009)</td>
<td>(0.010)</td>
<td>(0.010)</td>
<td>(0.089)</td>
<td>(0.087)</td>
</tr>
<tr>
<td>ΔChina$^{oc,im}$</td>
<td>0.002**</td>
<td>0.002**</td>
<td>0.002**</td>
<td>0.002**</td>
<td>0.019**</td>
<td>0.019**</td>
</tr>
<tr>
<td>× log(Sale$^{it}_0$)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.009)</td>
<td>(0.009)</td>
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</table>

### Panel B. Export Exposure

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
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<td>China$^{im,jt}$</td>
<td>-0.028**</td>
<td>-0.028**</td>
<td>-0.029**</td>
<td>-0.030**</td>
<td>-0.234**</td>
<td>-0.240**</td>
</tr>
<tr>
<td></td>
<td>(0.012)</td>
<td>(0.011)</td>
<td>(0.012)</td>
<td>(0.012)</td>
<td>(0.112)</td>
<td>(0.112)</td>
</tr>
<tr>
<td>China$^{oc,jt}$</td>
<td>0.004***</td>
<td>0.004***</td>
<td>0.004***</td>
<td>0.004***</td>
<td>0.029**</td>
<td>0.030**</td>
</tr>
<tr>
<td>× log(Sale$^{it}_0$)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.001)</td>
<td>(0.012)</td>
<td>(0.012)</td>
</tr>
</tbody>
</table>

Notes. Panel A, B and C of the table report results from estimating Equation (4.2) using OLS. Panel D reports results from estimating Equation (4.4) using OLS. The dependent variables are log one plus lobbying expenditures in columns (1) and (2), the inverse hyperbolic sine transformation of lobbying expenditures in columns (3) and (4), and a dummy variable of positive lobbying expenditures multiplied by 100 in columns (5) and (6). In Panel C, I use non-trade-related lobbying expenditures as dependent variables. China$^{oc,im}$ and China$^{oc,ex}$ are defined in Equation (4.1) and (4.3). Robust standard errors are reported in parentheses and clustered on 3-digit SIC industries. * p<0.1; ** p<0.05; *** p<0.01.
Table B2: Robustness. Different Proxies for Initial Size, Market Size and Lobbying

<table>
<thead>
<tr>
<th>Dep.</th>
<th>$\log(1 + \text{Lobby})$</th>
<th>$\text{asinh}(\text{Lobby})$</th>
<th>$100 \times 1[\text{Lobby} &gt; 0]$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(6)</td>
</tr>
</tbody>
</table>

**Panel A. Initial Level of Employment**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{China}_{oc,jt}^{im}$</td>
<td>$-0.084^{**}$</td>
<td>$-0.100^{**}$</td>
<td>$-0.088^{**}$</td>
<td>$-0.105^{**}$</td>
<td>$-0.648^*$</td>
<td>$-0.771^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.041)</td>
<td>(0.043)</td>
<td>(0.043)</td>
<td>(0.045)</td>
<td>(0.328)</td>
<td>(0.340)</td>
</tr>
<tr>
<td>$\log(\text{Empit}_0)$</td>
<td>$0.017^{**}$</td>
<td>$0.019^{**}$</td>
<td>$0.018^{**}$</td>
<td>$0.020^{**}$</td>
<td>$0.124^{**}$</td>
<td>$0.135^{**}$</td>
</tr>
<tr>
<td>$\times \Delta \text{China}_{jt}^{oc,im}$</td>
<td>(0.007)</td>
<td>(0.008)</td>
<td>(0.008)</td>
<td>(0.009)</td>
<td>(0.055)</td>
<td>(0.061)</td>
</tr>
</tbody>
</table>

**Panel B. Initial Level of Capital**

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{China}_{oc,jt}^{im}$</td>
<td>$-0.094^{**}$</td>
<td>$-0.112^{**}$</td>
<td>$-0.099^{**}$</td>
<td>$-0.118^{**}$</td>
<td>$-0.762^{**}$</td>
<td>$-0.909^{**}$</td>
</tr>
<tr>
<td></td>
<td>(0.045)</td>
<td>(0.050)</td>
<td>(0.048)</td>
<td>(0.053)</td>
<td>(0.375)</td>
<td>(0.405)</td>
</tr>
<tr>
<td>$\log(\text{Capital}_{it0})$</td>
<td>$0.014^{***}$</td>
<td>$0.016^{**}$</td>
<td>$0.015^{***}$</td>
<td>$0.017^{**}$</td>
<td>$0.109^{**}$</td>
<td>$0.121^{**}$</td>
</tr>
<tr>
<td>$\times \Delta \text{China}_{jt}^{oc,im}$</td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.043)</td>
<td>(0.049)</td>
</tr>
</tbody>
</table>

| Firm FE | Y | Y | Y | Y | Y | Y |
| Time FE | Y | N | Y | N | Y | N |
| State $\times$ Time FE | N | Y | N | Y | N | Y |
| N       | 2798 | 2744 | 2798 | 2744 | 2798 | 2744 |

Notes. Panel A and B the table reports results from estimating Equation (4.2) using OLS. The dependent variables are log one plus lobbying expenditures in columns (1) and (2), the inverse hyperbolic sine transformation of lobbying expenditures in columns (3) and (4) and a dummy variable of positive lobbying expenditures multiplied by 100 in columns (5) and (6). $\text{China}_{oc,jt}^{im}$ and $\text{China}_{jt}^{oc,ex}$ are defined in Equation (4.1) and (4.3). Capital is measured by $\text{ppcgt}$ from Compustat. The samples are averaged over six years. Robust standard errors are reported in parentheses and clustered on 3-digit SIC industries. * $p<0.1$; ** $p<0.05$; *** $p<0.01$. 

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### Table B3: Robustness. Trade-Related Lobbying Expenditures as the Dependent Variable. Market Size and Lobbying

<table>
<thead>
<tr>
<th>Dep.</th>
<th>log(1 + Lobby)</th>
<th>asinh(Lobby)</th>
<th>$100 \times 1[Lobby &gt; 0]$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Panel A. Baseline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$China_{im,jt}$</td>
<td>0.010</td>
<td>0.008</td>
<td>0.010</td>
</tr>
<tr>
<td>$log(Sale_{jt})$</td>
<td>(0.025)</td>
<td>(0.027)</td>
<td>(0.025)</td>
</tr>
<tr>
<td>$\times \Delta China_{oc,im,jt}$</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>$log(Sale_{jt})$</td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Panel B. Export Exposure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$China_{oc,im,jt}$</td>
<td>-0.012</td>
<td>-0.018</td>
<td>-0.012</td>
</tr>
<tr>
<td>$log(Sale_{jt})$</td>
<td>(0.037)</td>
<td>(0.041)</td>
<td>(0.037)</td>
</tr>
<tr>
<td>$\times \Delta China_{oc,im,jt}$</td>
<td>0.003</td>
<td>0.003</td>
<td>0.003</td>
</tr>
<tr>
<td>$China_{oc,im,jt}$</td>
<td>(0.005)</td>
<td>(0.006)</td>
<td>(0.005)</td>
</tr>
<tr>
<td>log($Sale_{jt}$)</td>
<td>0.013</td>
<td>0.016</td>
<td>0.013</td>
</tr>
<tr>
<td>$\times \Delta China_{oc,im,jt}$</td>
<td>(0.012)</td>
<td>(0.013)</td>
<td>(0.012)</td>
</tr>
<tr>
<td>Panel C. Non-Parametric Regressions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$Q_1China_{oc,im,jt}$</td>
<td>0.002</td>
<td>-0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>$Q_2China_{oc,im,jt}$</td>
<td>(0.004)</td>
<td>(0.006)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>$Q_3China_{oc,im,jt}$</td>
<td>0.001</td>
<td>-0.001</td>
<td>-0.002</td>
</tr>
<tr>
<td>$Q_2China_{oc,im,jt}$</td>
<td>(0.010)</td>
<td>(0.012)</td>
<td>(0.010)</td>
</tr>
<tr>
<td>$Q_3China_{oc,im,jt}$</td>
<td>0.017</td>
<td>0.013</td>
<td>0.017</td>
</tr>
<tr>
<td>$Q_4China_{oc,im,jt}$</td>
<td>(0.020)</td>
<td>(0.023)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Firm FE</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Time FE</td>
<td>Y</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>State $\times$ Time FE</td>
<td>N</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>2798</td>
<td>2744</td>
<td>2798</td>
</tr>
</tbody>
</table>

**Notes.** Panels A, B and C of the table reports results from estimating Equation (4.2) using OLS. Panel C reports results from estimating Equation (4.4) using OLS. The dependent variables are log one plus trade-related lobbying expenditures in columns (1) and (2), the inverse hyperbolic sine transformation of trade-related lobbying expenditures in columns (3) and (4) and a dummy variable of positive trade-related lobbying expenditures multiplied by 100 in columns (5) and (6). $China_{im,jt}$ and $China_{oc,ex,jt}$ are defined in Equation (4.1) and (4.3). The samples are averaged over six years. Robust standard errors are reported in parentheses and clustered on 3-digit SIC industries. * p<0.1; ** p<0.05; *** p<0.01.
B.2 Structural Interpretation of Chinese import exposure Regression

In this section, I show that regression model in Section 4.1 can be structurally derived from the model framework in Section 2. A firm’s lobbying expenditure is expressed as follows: for firm $i$, country $c$ and time $t$,

$$1 + b^*(\phi, \epsilon, \eta) = C^1 \prod_{c = 0}^{\sigma} \left( \frac{\sigma}{\sigma - 1} w_{\tau_{ct}} \right) \left( \frac{1}{\epsilon} \right) \left( \frac{1}{\phi} \right) P_{ct}^{\sigma - 1} E_{ct}^\sigma, \quad (B.1)$$

where $\Omega_{it}$ is a set of country firm $i$ is exporting, and $C^1$ is a constant common to all lobbying firms, $\tau_{ct}$ is an iceberg trade cost to export to country $c$. $\Omega_{it}$ is endogenously determined by firm’s productivity, idiosyncratic tax and stochastic fixed costs of lobbying. Firms with higher productivity or higher output wedges will enter more foreign markets, because they can make profits even after incurring fixed costs of exporting. Also, there can be firms with lower fixed cost of lobbying who can make profits in foreign markets post-lobbying. $P_{ct}^{\sigma - 1} E_{ct}$ measures the size of market in country $c$ at time $t$.

Taking log on Equation (B.1), I can derive the following regression model

$$\log(1 + b^*) = \text{Constant} + \frac{\theta \sigma}{1 - \theta \sigma} \left( \sum_{c \in \Omega_{it}} \tau_{ct}^{1 - \sigma} P_{ct}^{\sigma - 1} E_{ct} \right) + \frac{\theta \sigma}{1 - \theta \sigma} (\sigma - 1) \log \phi - \sigma \log \epsilon) \quad (B.2)$$

which is analogous in Equation (4.2). In the regression model in Equation (4.2), $\text{China}_{oc,im}^{\sigma,im}$ and its interaction term with a firm’s size is a proxy for market size effects. Depending on a firm’s size, a firm’ lobbying expenditures are differentially affected by the China shock because of different market size. The identifying assumption is that Chinese import exposure is uncorrelated with the error term which is a function of a firm’s productivity and exogenous output wedge.
Appendix C  Additional Evidence on Firm Heterogeneity

This section shows that firm size alone cannot explain lobbying patterns observed in the data, although they are highly correlated. In Figure C1, each dot represents a firm-year level observation with positive amounts of lobbying. Within each industry and year, firms are divided into two groups based on the median of the sales distribution. Firms above or below the median are colored blue or red.

Figure C1: Additional Fact. Firm Size and Heterogeneity

Notes. Each dot represents firm-year observation with positive lobbying amounts. X-axis and Y-axis plot the residuals of the log of sale and lobbying on 4-digit SIC and year fixed effects respectively. I divided firms into two groups based on whether their sale is above the median or not within each industry-year.

Table C1 reports the descriptive statistics of sales and lobbying amounts of firms with different quartiles based on initial sales within industry.⁵⁹ Firms with larger sizes tend to lobby more at both intensive and extensive margins. About 32% of the group above the third quartile lobbied, but only 5% of the group below the first quartile lobbied. However, it still shows that size alone does not fully explain the pattern of lobbying. It is pretty common for firms below the third quartile to participate in lobbying, and their total sum of lobbying is non-negligible. The total sum of lobbying expenditures by the largest group and the remainings are $6.3 and $1.2 billion across the sample period. About 20% of the total lobbying expenditure comes from small or medium-sized firms. This implies an additional dimension of heterogeneity other than productivity. Considering heterogeneity can be important for TFP implications.

⁵⁹The number of firms of each group is not the same, because the quartiles are defined based on the initial sales.
<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lobbying</td>
<td>697.2</td>
<td>78.67</td>
<td>25.13</td>
<td>10.70</td>
</tr>
<tr>
<td></td>
<td>(2725.6)</td>
<td>(745.3)</td>
<td>(209.9)</td>
<td>(87.79)</td>
</tr>
<tr>
<td>1[Lobby &gt; 0]</td>
<td>0.312</td>
<td>0.121</td>
<td>0.0817</td>
<td>0.0561</td>
</tr>
<tr>
<td></td>
<td>(0.463)</td>
<td>(0.326)</td>
<td>(0.274)</td>
<td>(0.230)</td>
</tr>
<tr>
<td>Sales</td>
<td>6843.9</td>
<td>1159.9</td>
<td>387.1</td>
<td>109.7</td>
</tr>
<tr>
<td></td>
<td>(21810.8)</td>
<td>(4814.7)</td>
<td>(1469.4)</td>
<td>(752.6)</td>
</tr>
<tr>
<td>N</td>
<td>9060</td>
<td>9940</td>
<td>10099</td>
<td>10593</td>
</tr>
</tbody>
</table>

Notes. This table reports the descriptive statistics of lobbying for each group. Firms are grouped by the quartiles based on their initial sales within a 4-digit SIC industry. The group with the largest and smallest size are denoted as Q1 and Q4. Standard deviation is reported in parentheses.
Appendix D Additional Results for Estimating $\theta$

D.1 Discussions on Exclusion Restrictions

Suppose the chairperson IV satisfies the relevance condition, so the IV is significantly correlated with the lobbying expenditures in the first stage. A natural concern is that the first stage results may reflect spurious correlations rather than causality. Although the exclusion restriction is fundamentally untestable, an event study can detect spurious correlations caused by reverse causality problems and preexisting confounding factors by checking pre-trends.\textsuperscript{60} I conduct an event study to examine whether there are preexisting trends in lobbying expenditures before a local congressman’s appointment of the chairperson on the Appropriation Committee. If there were reverse causality problems or preexisting confounding factors, it would violate the parallel trend assumption. The reverse causality problem can be detected if an increase in lobbying expenditures leads to the appointment. Also, if there were preexisting confounding factors, they may show up as differential pre-trends.

Figure D1: Event Study. Lobbying and Appointment as the Chairperson of the Appropriations Committees

Notes. The Panels A and B present event study coefficients $\beta_\tau$ in Equation (D.1). The dependent variable is log of one plus lobbying in Panel A and a dummy of positive lobbying in Panel B. The coefficient in $t-1$ is normalized to be zero. In both panels, firm and sector-year fixed effects are controlled. Standard errors are clustered on 3-digit SIC industries. The vertical lines show the 95% confidence intervals.

I estimate the following event study regression:

$$y_{it} = \sum_{\tau=-4}^{4} \beta_\tau Chair_{i,\tau} + \delta_i + \delta_{jt} + \epsilon_{it},$$

(D.1)

\textsuperscript{60}Reverse causality problem, for example, can arise if a firm lobbies to make a local congressman to be appointed as the chairperson.
where the dependent variables are log one plus lobbying or a dummy of positive lobbying multiplied 100. \(Chair_{i,t-\tau}\) is the event study variables which is defined as \(Chair_{i,\tau} := 1[t = \tau_i^{Chair} + \tau]\) where \(\tau_i^{Chair}\) is the year when a local congress member of the state in which firm \(i\) is headquartered is appointed as the chairperson and \(1[.\) is the indicator function. \(Chair_{i,-1}\) is normalized to be zero, so \(\beta_{i,\tau}\) 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 \(\delta_i\) and sector-time fixed effects \(\delta_{jt}\) are controlled to absorb time-invariant unobservables and sectoral shocks. Standard errors are clustered on state-level.

Figure D1 illustrates estimated coefficients \(\beta_{\tau}\) in Equation (D.1). Prior to the appointment, there are no pre-trends in lobbying expenditures, but once a local congressman becomes the chairperson, firms start increasing their lobbying expenditures. The evidence of no pre-trends in lobbying expenditures indicates that the first-stage correlation is not driven by reverse causality problems or preexisting omitted confounding factors, which bolsters the support of the identifying assumption of the instrumental variable. After the appointment, the log one plus lobbying increases by 0.1 standard deviations, and the probability of lobbying increases by 2% relative to one year before the appointment.

D.2 Extension to Capital Wedge

**Extension: Capital Wedge.** The model can incorporate firm-specific capital wedges with capital as an additional factor of production. Firms’ production function is Cobb-Douglas with labor and capital:

\[
y = \phi k^\alpha l^{1-\alpha}.
\]

There are output and capital wedges. Capital wedges raise marginal product of capital relative to marginal product of labor. Firms can increase output wedges and decrease capital wedges through lobbying. I assume the functional form of output and capital wedges as follows:

\[
\tau^y = \frac{(1 + b_y)^{\theta_y}}{\epsilon_y}, \\
\tau^k = \frac{(1 + b_k)^{-\theta_k}}{\epsilon_k},
\]

where \(\epsilon_y\) and \(\epsilon_k\) are idiosyncratic output and capital wedges. \(\theta_y\) and \(\theta_k\) are the parameters that capture how lobbying effectively increases and decreases output and capital wedges respectively.

Firm’s maximization problem is

\[
\pi = \max_{b_y,b_k,p,q,l,k} pq - \frac{(1 + b_y)^{-\theta_y}}{\epsilon_y}wl - \frac{(1 + b_k)^{-\theta_k}}{\epsilon_k}rk - f^b 1[b_y + b_k \geq 0] \quad (D.2)
\]
subject to $q = p^{-\sigma}P^{\sigma-1}E$ where $q$ is the demand that firm faces. Solving the model, I can derive two following regression models

$$\log MRPL_{i,t+1} = \log \frac{Sale_{it}}{L_{it}} = -\theta_y \log(1 + b_y) + \epsilon_{it}$$  \hspace{1cm} (D.3)

and

$$\log \frac{MRPK}{MRPL} = \log \frac{L_{it}}{K_{it}} = -\theta_k \log(1 + b_k) + \epsilon_{it}.$$  \hspace{1cm} (D.4)

The data only reports the total expenditure $b_y + b_k$, but not $b_y$ and $b_k$ separately. However, with the Cobb-Douglas production function, $b_y$ and $b_k$ are proportional to the total lobbying expenditure plus some constant term, that is, $1 + b_y = C_y(2 + b_y + b_k)$ and $1 + b_k = C_k(2 + b_y + b_k)$, where $C_y$ and $C_k$ consist of the model parameters.\(^{61}\) Therefore, I can still recover $\theta_y$ and $\theta_k$ using the total expenditure of lobbying observed from the data.

I estimate the following regressions in long differences using the chairperson IV:

$$\log(\frac{Sale}{Emp})_{i,t+1} = \theta_y \log(2 + b_{it}) + \tilde{X}_{it}'\beta + \tilde{\delta}_i + \tilde{\delta}_j + \underbrace{w_{it}^{\delta}}_{=\log(1/\epsilon_{it}^{\delta})}$$

$$\log(\frac{Emp}{Capital})_{i,t+1} = \theta_k \log(2 + b_{it}) + \tilde{X}_{it}'\beta + \tilde{\delta}_i + \tilde{\delta}_j + \underbrace{w_{it}^{k}}_{=\log(1/\epsilon_{it}^{k})},$$  \hspace{1cm} (D.5)

where $\tilde{\delta}$ are fixed effects. I control the same set of fixed effects and firm-level controls with the baseline regression model. I also control 4-digit industry-specific fixed effects and firm fixed effects. The estimated $\theta_k$ are reported in columns (1)-(3) of Table D1. Across different specifications, the estimated coefficients are statistically insignificant. In columns (4)-(6), I use $\log(\frac{Sale}{K})$ as an alternative dependent variable, but the estimated coefficients are also statistically insignificant.

### D.3 Additional Robustness Checks

$ETR$ is an imperfect proxy for firm-specific tax rates, so the transformation into $\log(1 - ETR)$ may magnify measurement errors. To show that this is not the issue, I conduct the same analysis with a log of ETR as an alternative dependent variable. The results are reported in columns (1)-(3) of Table D2. Instead of setting ETR to 0.5 at a maximum, I reset 1 at a maximum and run the analysis to examine whether different winsorization schemes drive the results. The estimated coefficients reported in columns (4)-(6) of Table D2 show that the results are robust to different functional forms of dependent variables and winsorization schemes.

\(^{61}\)Specifically, $C_y = \theta_y \sigma / (\theta_y \sigma - \theta_k \alpha)$ and $C_k = -\theta_k \alpha / (\theta_y \sigma - \theta_k \alpha)$.  

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Table D1: Robustness. MRPK. Recovering $\theta$

<table>
<thead>
<tr>
<th>Dep.</th>
<th>log($wL/K$)</th>
<th>log($Sale/K$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS (1)</td>
<td>IV (2)</td>
</tr>
<tr>
<td>log($1 + Lobby$)</td>
<td>-0.011 (0.007)</td>
<td>0.016 (0.027)</td>
</tr>
<tr>
<td>KP-F</td>
<td>31.81</td>
<td>26.90</td>
</tr>
<tr>
<td>Industry $\times$ Time FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Firm Control</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>1216</td>
<td>1216</td>
</tr>
</tbody>
</table>

Notes. This table reports OLS and IV estimates of Equation (3.2). The dependent variable is a labor-capital ratio in columns (1)-(3), and the dependent variable is a log of MRPK in columns (4)-(6). The OLS estimates are reported in columns (1) and (4). The IV estimates are reported in columns (2), (3), (5), and (6). The IV is a dummy variable which equals one if a congressman of the state where a firm is headquartered in becomes a chair of the Appropriate Committee in the House or Senate. Firm control includes dummies indicating quantiles of a firm’s initial sales. KP-F is Kleibergen-Paap F-statistics. The samples are averaged over six years. Standard errors are clustered at the state-level. * p<0.1; ** p<0.05; *** p<0.01.
Table D2: Recovering θ. Robustness. Different ETR Measures.

<table>
<thead>
<tr>
<th>Dep.</th>
<th>log(ETR)</th>
<th>log(ETR1)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OLS (1)</td>
<td>IV (2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV (3)</td>
</tr>
<tr>
<td>log(1 + Lobby)</td>
<td>0.017 *(0.016)</td>
<td>-0.193** (0.090)</td>
</tr>
<tr>
<td>KP-F</td>
<td></td>
<td>.</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>State Control</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Firm Control</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>N</td>
<td>873</td>
<td>873</td>
</tr>
</tbody>
</table>

Notes. This table reports OLS and IV estimates of Equation (3.2). The dependent variable is log of ETR in columns (1)-(3) and the dependent variable is log of ETR that was winsorized at 1 instead of 0.5. $ETR$ is defined in Equation (3.3). The OLS estimates are reported in columns (1) and (4). The IV estimates are reported in columns (2), (3), (5) and (6). The IV is a dummy variable which is equal to one if a congressman of the state where a firm is headquartered in becomes a chair of the Appropriate Committee in the House or Senate. Firm control includes dummies indicating quantiles of a firm’s initial sales. The samples are averaged over six years. Standard errors are clustered at state-level. * p<0.1; ** p<0.05; *** p<0.01.
### Table D3: First Stage Results

<table>
<thead>
<tr>
<th>Second Stage Dep.</th>
<th>log(1/MRPL)</th>
<th>log(1 − ETR)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
</tr>
<tr>
<td>Chairperson IV</td>
<td>0.942***</td>
<td>0.836***</td>
</tr>
<tr>
<td></td>
<td>(0.167)</td>
<td>(0.161)</td>
</tr>
<tr>
<td>Industry FE</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>State Control</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Firm Control</td>
<td>N</td>
<td>Y</td>
</tr>
<tr>
<td>N</td>
<td>1216</td>
<td>1216</td>
</tr>
</tbody>
</table>

Notes. This table reports the first stage results of the IV estimates of Equation (3.2). The dependent variable is log one plus lobbying. Firm control includes dummies indicating quantiles of a firm’s initial sales. Standard errors are clustered at state-level. * p<0.1; ** p<0.05; *** p<0.01.
Appendix E  Quantitative Appendix

E.1 Calibration Procedure

This section describes the calibration procedure using the method of moments. Parameters $\Theta$ minimize the following constrained maximization problem

$$\hat{\Theta} = \text{argmin}_{\Theta} \{ (\mathbf{m} - \mathbf{m}(\Theta))' W (\mathbf{m} - \mathbf{m}(\Theta)) \} \quad \text{subject to } L(\Theta) = 0$$

where $\mathbf{m}$ and $\mathbf{m}(\Theta)$ are empirical and model moments, $W$ is the weighting matrix, and $L(\Theta)$ is the constraint imposed by the equilibrium conditions.

The constraints $L(\Theta) = 0$ are as follows:

- **(Balanced trade)**
  $$\int_{\omega \in \Omega_h} p^x(\omega) q^x(\omega) d\omega = \int_{\omega \in \Omega_f} p^x(\omega) q^x(\omega) d\omega$$

- **(Labor market clearing of country $h$)**
  $$\int_{\omega \in \Omega_h} l(\omega) d\omega = L_h$$

- **(Labor market clearing of country $f$)**
  $$\int_{\omega \in \Omega_f} l(\omega) d\omega = L_f$$

- **(Goods market clearing of country $h$)**
  $$E_h = w_h L_h + \Pi_h + T_h$$

- **(Goods market clearing of country $f$)**
  $$E_f = w_f L_f + \Pi_f + T_f$$

I set $W$ to be a diagonal matrix whose component is the inverse of the empirical moments to eliminate measurement units. The solution to the problem is not guaranteed to be the global minimum. Therefore, I solve the constrained minimization problem multiple times with different starting points to deal with the local minimum problem.
Appendix F  Mathematical Derivation

F.1 Derivation of optimal amounts of lobbying and profits.

I derive expressions for a firm’s optimal amounts of lobbying and profits conditional on lobbying.

I first characterize non-exporters’ optimal amounts of lobbying and profits. Conditional on spending lobbying amounts of \( b \), a firm’s output wedge is given by \( \frac{(1+b)^{\theta_h}}{e} \). Under monopolistic competition with CES demand, a firm charges constant mark up. A firm’s profit is

\[
\pi_d(b; \phi, \epsilon, \eta) = \frac{1}{\sigma} \left( \frac{\sigma}{\sigma - 1} \left( \frac{w_h}{\phi} \right)^{1-\sigma} \left( \frac{(1+b)^{\theta_h}}{e} \right) \right) P_h^{\sigma-1} E_h - P_h b - P_h f_h^b \tag{F.1}
\]

where \( \tilde{\pi}_d(0; \phi, \epsilon, \eta) \) is variable profits conditional on not lobbying. A firm chooses the optimal amounts of lobbying that maximizes profits in the above equation, which is characterized by the first-order condition (FOC). Taking the derivative with respect to \( b \),

\[
P_h = \theta_h \sigma \tilde{\pi}(0; \phi, \epsilon, \eta)(1 + b)^{\theta_h \sigma - 1}
\]

Form the above equation, I can obtain that

\[
b^*_d = \left( \frac{\theta_h \sigma}{P_h} \right)^{\frac{1}{1-\theta_h \sigma}} \tilde{\pi}_d(0; \phi, \epsilon, \eta)^{\frac{1}{1-\theta_h \sigma}} - 1 \tag{F.2}
\]

After substituting the optimal amounts of lobbying in Equation (F.2) into (F.1), I obtain that

\[
\pi_d(b^*_d; \phi, \epsilon, \eta) = C_h \tilde{\pi}_d(0; \phi, \epsilon, \eta)^{\frac{1}{1-\theta_h \sigma}} - w_h f_h - P_h [f_h^b \eta - 1].
\]

Now consider an exporter. An exporter’s profit is

\[
\pi_x(b; \phi, \epsilon, \eta) = \sum_{k=h,f} \left[ \frac{1}{\sigma} \left( \frac{\sigma}{\sigma - 1} \left( \frac{\tau_{hk} w_h}{\phi} \right)^{1-\sigma} P_k^{\sigma-1} E_k \right) \times \left( \frac{(1+b)^{\theta_h}}{e} \right) \right] - P_h b - P_h f_h^b - w_h f_h^x \tag{F.3}
\]

Taking the first-order condition with respect to \( b \), I obtain that

\[
b^*_x = \left( \frac{\theta_h \sigma}{P_h} \right)^{\frac{1}{1-\theta_h \sigma}} (\tilde{\pi}_d(0; \phi, \epsilon, \eta) + \tilde{\pi}_x(0; \phi, \epsilon, \eta))^{\frac{1}{1-\theta_h \sigma}} - 1. \tag{F.4}
\]
After substitution the optimal amounts of lobbying in the above equation into Equation (F.3), an exporter’s profit is derived as follows:

\[ \pi^x(b^x, \phi, \epsilon, \eta) = C^2_h(\tilde{\pi}^d(0; \phi, \epsilon, \eta) + \tilde{\pi}^x(0; \phi, \epsilon, \eta))^{\frac{1}{1-\theta_n}} - w_h f_h - P_h f_h^{\eta - 1}. \]
F.2 Proof of Proposition 1

The fact that lobbying is increasing in variable profits and variable profits are increasing in \( \phi, 1/\epsilon, P_h^{\sigma-1}E_h + x(P_f^s)^{\sigma-1}E_f \) proves Proposition 1(i).

For given \((\epsilon, \eta)\), there exists a unique cutoff productivity because \( \tilde{\pi}(b^*; \phi, \epsilon, \eta) = \tilde{\pi}(0; \phi, \epsilon, \eta)^{1/(1-\theta\sigma)} \) and \( 1 - \theta\sigma < 1 \) under Assumption 1. Therefore, \( \tilde{\pi}(b^*; \phi, \epsilon, \eta) \) is increasing in \( \phi \) much faster, implying that for a given level of fixed costs of lobbying \( f_h^b \eta \), a firm with \( \phi > \tilde{\phi}^b(\epsilon, \eta) \) will participate in lobbying. Because a firm with higher \( 1/\epsilon \) has larger tax gains post lobbying and a firm with lower \( \eta \) has lower fixed costs of lobbying, \( \tilde{\phi}^b(\epsilon, \eta) \) is increasing in \( 1/\epsilon \) and decreasing in \( \eta \).

F.3 Proof of Proposition 2

Because the results of Proposition 2 are under the closed economy assumption, I omit subscripts. I first provide two useful formula for the proofs of Proposition 2.

**Useful Formula 1.** Suppose \( Y_1 \) and \( Y_2 \) follow joint normal distribution and \( X_h = e^{Y_h} \) for \( i = 1, 2 \). Then,

\[
\int \int X_1 X_2 dF_{X_1}dF_{X_2} = \int \int e^{Y_1+Y_2} dF_{Y_1}dF_{Y_2} = \mathbb{E}[e^{Y_1+Y_2}]
\]

Using that \( Y_1 + Y_2 \sim N(\mu_1 + \mu_2, \sigma_1^2 + \sigma_2^2 + 2\rho\sigma_1\sigma_2) \), I obtain

\[
e^{Y_1+Y_2} \sim \log N(\mu_1 + \mu_2, \sigma_1^2 + \sigma_2^2 + 2\rho\sigma_1\sigma_2).
\]

Then,

\[
\mathbb{E}[X_1 X_2] = \mathbb{E}[e^{Y_1+Y_2}] = e^{\mu_1 + \mu_2 + \frac{1}{2}(\sigma_1^2 + \sigma_2^2 + 2\rho\sigma_1\sigma_2)} \tag{F.5}
\]

**Useful Formula 2.** TFP of the aggregate economy is defined as \( TFP = \frac{Y}{L} \) which can be rewritten as

\[
\frac{1}{TFP} = \frac{L}{Y} = \int \frac{l(\omega)d\omega}{Y} = \int \frac{y(\omega)}{Y \phi(\omega)} d\omega = \int \frac{1}{\phi(\omega)} \left( \frac{p(\omega)}{P} \right)^{-\sigma} d\omega
\]

Firm’s optimal pricing is

\[
p = \frac{\sigma}{\sigma - 1} \frac{w}{\phi} \left( \frac{(1+b)^\theta}{\epsilon} \right)^{-1}
\]

By substituting the above equation, I obtain the first useful formula:

\[
TFP = \frac{\int \phi^{\sigma-1}(\frac{(1+b)^\theta}{\epsilon})^{\sigma-1} - \sigma}{\int \phi^{\sigma-1}(\frac{(1+b)^\theta}{\epsilon})^\sigma} \tag{F.6}
\]
**Proof of Proposition 2(i) (The Efficient Economy).** If there were no distortions, applying Equation (F.6), the TFP in the efficient economy reduces to

\[ TFP_{eff} = M^{\frac{1}{\sigma-1}} \left[ \int \phi^{\sigma-1} \frac{1}{\sigma-1} \right]. \quad (F.7) \]

Applying Equation (F.5), I obtain the second useful formula:

\[ \log(TFP_{eff}) = \frac{1}{\sigma-1} \log M + \mathbb{E}[\log \phi] + \frac{(\sigma-1)}{2} \text{Var}(\log \phi). \]

**Proof of Proposition 2(ii) (The Exogenous Wedge Economy).** If there were only exogenous distortions, applying Equation (F.6), the TFP in the exogenous wedge economy reduces to

\[ TFP_{exo} = M^{\frac{1}{\sigma-1}} \left[ \int \phi^{\sigma-1} \frac{1}{\sigma-1} \right] - \frac{\sigma}{\sigma-1} \int \phi^{\sigma-1} \frac{1}{\sigma}. \]

The numerator and the denominator are expressed as follows:

\[ (B) = \log\left[ \int \phi^{\sigma-1} \frac{1}{\epsilon} \right] - \frac{\sigma}{\sigma-1} \int \phi \frac{1}{\sigma} \]

\[ = \frac{\sigma}{\sigma-1} \left[ (\sigma-1)\mathbb{E}[\log \phi] + (1-\sigma)\mathbb{E}[\log \frac{1}{\epsilon}] + \frac{(\sigma-1)^2}{2} \text{Var}(\log \phi) + \frac{(\sigma-1)^2}{2} \text{Var}(\log \frac{1}{\epsilon}) \right. \]

\[ + \sigma(\sigma-1)\text{Cov}(\log \phi, \log \frac{1}{\epsilon}) \right] \]

\[ = \sigma \mathbb{E}[\log \phi] - \sigma \mathbb{E}[\log \frac{1}{\epsilon}] + \frac{\sigma(\sigma-1)}{2} \text{Var}(\log \phi) - \frac{(\sigma-1)\sigma}{2} \text{Var}(\log \frac{1}{\epsilon}) + (\sigma-1)\sigma \text{Cov}(\log \phi, \log \frac{1}{\epsilon}), \]

and

\[ (A) = \log \int \phi^{\sigma-1} \frac{1}{\epsilon} \]

\[ = (\sigma-1)\mathbb{E}[\log \phi] - \sigma \mathbb{E}[\log \frac{1}{\epsilon}] + \frac{(\sigma-1)^2}{2} \text{Var}(\log \phi) + \frac{\sigma^2}{2} \text{Var}(\log \frac{1}{\epsilon}) - (\sigma-1)\sigma \text{Cov}(\log \phi, \log \frac{1}{\epsilon}). \]

Subtracting (B) from (A),

\[ \log(TFP_{exo}) = \frac{1}{\sigma-1} \log M + \mathbb{E}[\log \phi] + \frac{(\sigma-1)}{2} \text{Var}(\log \phi) - \frac{\sigma}{2} \text{Var}(\log \frac{1}{\epsilon}). \quad (F.8) \]
Proof of Proposition 2(iii) (The Lobbying Economy). Applying Equation (F.6), the TFP in the lobbying economy reduces to

$$TFP_{endo} = M \sigma^{-1} \frac{\int \phi^{\sigma - 1} \left( \frac{(1 + b)^{\theta}}{\epsilon} \right)^{\sigma - 1} \frac{1}{1 - \sigma}}{\int \phi^{\sigma - 1} \left( \frac{(1 + b)^{\theta}}{\epsilon} \right)^{\sigma}}.$$

Define

$$\tilde{C} = \frac{\sigma \theta}{P} \left( \frac{\sigma}{1 - \sigma} \right)^{1 - \sigma} P^{\sigma - 1} E \left[ \frac{1}{1 - \sigma} \right].$$

The numerator and the denominator are expressed as follows:

$$(B) = \log \left[ \int \phi^{\sigma - 1} \left( \frac{(1 + b)^{\theta}}{\epsilon} \right)^{\sigma - 1} \frac{1}{1 - \sigma} \right] = \sigma \log \tilde{C} + \frac{\sigma}{1 - \theta \sigma} \left[ \log \phi \frac{\sigma}{1 - \theta} - \log \frac{1}{\epsilon} \right]$$

$$+ \frac{1}{2} \frac{(\sigma - 1)^2}{(1 - \theta \sigma)^2} Var(\log \phi) + \frac{1}{2} \frac{(\sigma - 1)^2}{(1 - \theta \sigma)^2} Var(\log \frac{1}{\epsilon})$$

$$+ \frac{\sigma (1 - \sigma)(1 - \theta)}{(1 - \theta \sigma)^2} Cov(\log \phi, \log \frac{1}{\epsilon}).$$

$$(A) = \log \int \phi^{\sigma - 1} \left( \frac{(1 + b)^{\theta}}{\epsilon} \right)^{\sigma} = \sigma \theta \log \tilde{C} + \log \int \phi^{\frac{\sigma - 1}{1 - \theta \sigma}} \left( \frac{1}{\epsilon} \right)^{\frac{\sigma - 1}{1 - \theta \sigma}}$$

$$= \sigma \log \tilde{C} + \frac{\sigma}{1 - \theta \sigma} \log \phi + \frac{\sigma}{1 - \theta \sigma} \log \frac{1}{\epsilon}$$

$$+ \frac{1}{2} \frac{(\sigma - 1)^2}{(1 - \theta \sigma)^2} Var(\log \phi) + \frac{1}{2} \frac{(\sigma - 1)^2}{(1 - \theta \sigma)^2} Var(\log \frac{1}{\epsilon})$$

$$+ \frac{(\sigma - 1)\sigma}{(1 - \theta \sigma)^2} Cov(\log \phi, \log \frac{1}{\epsilon}).$$

Subtracting (B) from (A),

$$\log TFP_{endo} = \log \phi + \frac{(\sigma - 1)}{2} \left( \frac{(\sigma(1 - \theta)^2 - 1) + 1}{(1 - \theta \sigma)^2} \right) Var(\log \phi)$$

$$- \frac{\sigma \theta^2}{2} \frac{1}{(1 - \theta \sigma)^2} Var(\log \frac{1}{\epsilon}) - \frac{(\sigma - 1)\sigma \theta}{(1 - \theta \sigma)^2} Cov(\log \phi, \log \frac{1}{\epsilon}).$$

Under Assumption 1(i), \(\frac{1}{(1 - \theta \sigma)^2} > 1\) and \(\frac{(\sigma - 1)\sigma \theta}{(1 - \theta \sigma)^2} > 0\) hold. To show that \(\frac{(\sigma(1 - \theta)^2 - 1) + 1}{(1 - \theta \sigma)^2} < 1\), note
that
\[
\left( \frac{(\sigma[(1-\theta)^2-1]+1)}{(1-\theta\sigma)^2} \right) < 1 \Leftrightarrow \sigma[(1-\theta)^2-1]+1 < (1-\theta\sigma)^2 \\
\Leftrightarrow \sigma[\theta^2-2\theta] < \theta^2\sigma^2-2\theta\sigma \\
\Leftrightarrow 1 < \sigma,
\]
where the last inequality holds under Assumption 1.

F.4 Proof of Proposition 3

Proof of Proposition 3(i). This comes from Equation (F.7), (F.8) and (F.9).

Proof of Proposition 3(ii). \( \log TFP_{eff} \geq \log TFP_{exo} \) is trivial. It remains to show that \( \log TFP_{eff} \geq \log TFP_{endo} \). Taking the difference between \( \log TFP_{eff} \) and \( \log TFP_{endo} \), I can obtain that

\[
\log TFP_{eff} - \log TFP_{endo} = \left( \frac{\sigma-1}{2} \right) \left[ 1 - \frac{1+\sigma[(1-\theta)^2-1]}{(1-\theta\sigma)^2} \right] Var(\log \phi) \\
+ \frac{\sigma}{2} \frac{1}{(1-\theta\sigma)^2} Var(\log \frac{1}{\epsilon}) + \left( \frac{(\sigma-1)\sigma\theta}{(1-\theta\sigma)^2} \times \right. \\
\left. Cov(\log \phi, \log \frac{1}{\epsilon}) \right] \\
= Corr(\log \phi, \log \frac{1}{\epsilon}) \sqrt{Var(\log \phi)} \sqrt{Var(\log \frac{1}{\epsilon})} \\
\geq \frac{\sigma}{2(1-\theta\sigma)^2} \left[ \theta^2(\sigma-1)^2 Var(\log \phi) - 2(\sigma-1)\theta \sqrt{Var(\log \phi)} \sqrt{Var(\log \frac{1}{\epsilon})} + Var(\log \frac{1}{\epsilon}) \right] \\
= \frac{\sigma}{2(1-\theta\sigma)^2} \left( \theta(\sigma-1)\sqrt{Var(\log \phi)} - \sqrt{Var(\log \frac{1}{\epsilon})} \right)^2 \geq 0,
\]
where the last inequality comes from that correlation between two random variables are bounded below by \(-1\).

Proof of Proposition 3(iii). Note that

\[
\log TFP_{endo} \geq \log TFP_{exo} \\
\Leftrightarrow -2(\sigma-1)Cov(\log \phi, \log \frac{1}{\epsilon}) \geq \theta(\sigma-1)^2 Var(\log \phi) + (2-\theta\sigma)Var(\log \frac{1}{\epsilon}).
\]
The above inequality holds only if $Cov(\log \phi, \log \frac{1}{\epsilon}) < 0$.

**F.5 Proof of Proposition 4**

Note that $Cov(\log(1 + b), \log \frac{1}{\epsilon})$ can be written as

$$Cov(\log(1 + b), \log \frac{1}{\epsilon}) = \mathbb{E}[\log(1 + b) \log \frac{1}{\epsilon}] - \mathbb{E}[\log(1 + b)]\mathbb{E}[\log \frac{1}{\epsilon}]. \tag{F.10}$$

**Proof of Proposition 4(i).** I omit the subscripts that are used to denote for countries. Under Assumption 1 and 2, every firm is lobbying, so $\mathbb{P}[b \geq 0] = 1$. Note that the optimal lobbying expenditures in closed economy are

$$1 + b^* = C^1_h \frac{1}{\sigma} \left( \frac{w}{\phi} \right)^{1-\sigma} \left( \frac{1}{\epsilon} \right)^\sigma P^\sigma - 1 E.$$

$\mathbb{E}[\log(1 + b) \log 1/\epsilon]$ is expressed as

$$\mathbb{E}[\log(1 + b) \log 1/\epsilon] = \frac{\sigma - 1}{1 - \theta \sigma} \mathbb{E}[\log \phi \log 1/\epsilon] + \frac{\sigma}{1 - \theta \sigma} \mathbb{E}[(\log 1/\epsilon)^2]$$

$$+ \frac{1}{1 - \theta \sigma} \mathbb{E}[\log 1/\epsilon] \left[ C^1_h + \log \left( \frac{1}{\sigma} (\mu w)^{1-\sigma} \right) + \log(P^\sigma - 1 E) \right]. \tag{F.11}$$

$\mathbb{E}[\log(1 + b)]\mathbb{E}[\log 1/\epsilon]$ is written as

$$\mathbb{E}[\log(1 + b)]\mathbb{E}[\log 1/\epsilon] = \frac{\sigma - 1}{1 - \theta \sigma} \mathbb{E}[\log \phi] \mathbb{E}[\log 1/\epsilon] + \frac{\sigma}{1 - \theta \sigma} (\mathbb{E}[\log 1/\epsilon])^2$$

$$+ \frac{1}{1 - \theta \sigma} \mathbb{E}[1/\epsilon] \left[ C^1_h + \log \left( \frac{1}{\sigma} (\mu w)^{1-\sigma} \right) + \log(P^\sigma - 1 E) \right]. \tag{F.12}$$

Substituting Equation (F.11) and (F.12) into Equation (F.10), I can obtain that

$$Cov(\log(1 + b) \log 1/\epsilon) = \mathbb{E}[\log(1 + b) \log \frac{1}{\epsilon}] - \mathbb{E}[\log(1 + b)]\mathbb{E}[\log \frac{1}{\epsilon}]$$

$$= \frac{\sigma - 1}{1 - \theta \sigma} \left( \mathbb{E}[\log \phi, \frac{1}{\epsilon}] - \mathbb{E}[\log \phi] \mathbb{E}[\log 1/\epsilon] \right) + \frac{\sigma}{1 - \theta \sigma} \left( \mathbb{E}[(\log 1/\epsilon)^2] - \mathbb{E}[\log 1/\epsilon]^2 \right),$$

which is equivalent to $Cov(\log \phi, \log 1/\epsilon) + \frac{\sigma}{1-\theta \sigma} Var(\log \frac{1}{\epsilon})$. 

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Proof of Proposition 4(ii). For notational convenience, I omit subscripts $h$. $E[\log(1 + b) \log \frac{1}{\epsilon}]$ can be written as

\[
E[\log(1 + b) \log \frac{1}{\epsilon}] = \mathbb{P}[b \geq 0, x = 1]E[\log(1 + b) \log \frac{1}{\epsilon} | b \geq 0, x = 1] + \mathbb{P}[b \geq 0, x = 0]E[\log(1 + b) \log \frac{1}{\epsilon} | b \geq 0, x = 0]
\]

\[
+ \mathbb{P}[b = 0, x = 1]E[\log(1 + b) \log \frac{1}{\epsilon} | b = 0, x = 1] + \mathbb{P}[b = 0, x = 0]E[\log(1 + b) \log \frac{1}{\epsilon} | b = 0, x = 0].
\]

where the last equality holds, because conditional on $b = 0$, $E[\log(1 + b) \log \frac{1}{\epsilon} | b = 0, x = 1] = 0$ and $E[\log(1 + b) \log \frac{1}{\epsilon} | b = 0, x = 0] = 0$ hold. Similarly, $E[\log(1 + b)]E[\log \frac{1}{\epsilon}]$ can be written as

\[
E[\log(1 + b)]E[\log \frac{1}{\epsilon}] = \mathbb{P}[b \geq 0, x = 1]E[\log(1 + b) | b \geq 0, x = 1] + \mathbb{P}[b \geq 0, x = 0]E[\log(1 + b) | b \geq 0, x = 0],
\]

Using Equation (F.13) and (F.14), $\text{Cov}(\log(1 + b), \log \frac{1}{\epsilon})$ can be expressed as

\[
\text{Cov}(\log(1 + b), \log \frac{1}{\epsilon}) = \sum_{x' \in \{0, 1\}} \mathbb{P}[b \geq 0, x = x'] \left( E[\log(1 + b) | b \geq 0, x = x'] - E[\log(1 + b) | b \geq 0, x = x'] \right). \tag{F.15}
\]

Also, note that the optimal lobbying expenditures are

\[
1 + b^* (\phi, \epsilon, \eta) = C_h \left[ \frac{1}{\sigma} \left( \frac{w}{\phi} \right) \left( \frac{1}{\epsilon} \right)^{1 - \sigma} (P^{\sigma - 1} E + x^* (\phi, \epsilon, \eta) \tau_x^{1 - \sigma} P_f^{\sigma - 1} F_f) \right]^{\frac{1}{1 - \theta \sigma}}, \tag{F.16}
\]

where $x^* (\phi, \epsilon, \eta)$ is a firm’s optimal decision to export to Foreign after incurring the fixed costs of exporting.

Using Equation (F.16), $E[\log(1 + b) \log \frac{1}{\epsilon} | b \geq 0, x = x']$ is computed as

\[
E[\log(1 + b) \log \frac{1}{\epsilon} | b \geq 0, x = x']
\]

\[
= \frac{\sigma - 1}{1 - \theta \sigma} E[\log \phi \log \frac{1}{\epsilon} | b \geq 0, x = x'] + \frac{\sigma}{1 - \theta \sigma} E[(\log \frac{1}{\epsilon})^2 | b \geq 0, x = x']
\]

\[
+ \frac{1}{1 - \theta \sigma} \log \left( C_h \left[ \frac{1}{\sigma} \left( \frac{w}{\phi} \right) \left( \frac{1}{\epsilon} \right)^{1 - \sigma} (P^{\sigma - 1} E + x^* \tau_x^{1 - \sigma} P_f^{\sigma - 1} F_f) \right] \right) \times E[\log \frac{1}{\epsilon} | b \geq 0, x = x']. \tag{F.17}
\]
Similarly, \( E[\log(1 + b)|b \geq 0, x = x']\|E[\log 1/\epsilon|b \geq 0, x = x'] \) is computed as

\[
E[\log(1 + b)|b \geq 0, x = x']E[\log 1/\epsilon|b \geq 0, x = x'] = \sigma - \frac{1}{1 - \theta \sigma}E[\log \phi|b \geq 0, x = x']E[\log 1/\epsilon|b \geq 0, x = x'] + \frac{\sigma}{1 - \theta \sigma}(E[\log 1/\epsilon|b \geq 0, x = x'])^2
\]

\[
+ \frac{1}{1 - \theta \sigma} \log \left( \frac{C_1 \sigma - \theta \sigma}{P_1 \sigma - \theta \sigma} \right) \times E[\log 1/\epsilon|b \geq 0, x = x'] \]  

Substituting Equation (F.17) and (F.18) into Equation (F.15), I can obtain

\[
Cov(log(1 + b), log 1/\epsilon) = \sum_{x' \in \{0, 1\}} P[b \geq 0, x = x']
\]

\[
\times \left[ (E[\log \phi log 1/\epsilon|b \geq 0, x = x'] - E[\log \phi|b \geq 0, x = x']E[\log 1/\epsilon|b \geq 0, x = x'])
\]

\[
+ (E[(log 1/\epsilon)^2|b \geq 0, x = x'] - E[log 1/\epsilon|b \geq 0, x = x'])^2 \right], \]  

which is equivalent to

\[
Cov(log(1 + b), log 1/\epsilon) = \sum_{x' \in \{0, 1\}} P[b \geq 0, x = x']
\]

\[
\times \left( \frac{\sigma - 1}{1 - \theta \sigma} Cov(log \phi, log 1/\epsilon|b \geq 0, x = x') + \frac{\sigma}{1 - \theta \sigma} Var(log 1/\epsilon|b \geq 0, x = x') \right). \]  

The events \( \{b \geq 0, x = 1\} \) and \( \{b \geq 0, x = 0\} \) are equivalent to \( \{\phi \geq \bar{\phi}(\epsilon, \eta), \phi \geq \bar{\phi}^x(\epsilon, \eta)\} \) and \( \{\phi \geq \bar{\phi}(\epsilon, \eta), \phi \leq \bar{\phi}^x(\epsilon, \eta)\} \), where \( \bar{\phi}(\epsilon, \eta) \) and \( \bar{\phi}^x(\epsilon, \eta) \) are the cutoffs for participating in lobbying and exporting defined in Equation (2.6) and (2.7).