Domestic political competition and binding overhang in developing countries

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Abstract

Governments, especially in developing countries, routinely practice binding overhang (i.e. setting applied tariffs below their binding WTO commitments) and frequently move the applied tariff for a given product up and down over the business cycle. Indeed, counter to conventional wisdom, applied tariffs are pro-cyclical in developing countries. We explain this phenomenon using a dynamic theory of lobbying. The government is captured by import-competing industries (or exporters), whose applied tariff concessions in response to lobbying threats by exporters (import-competing industries) cause fluctuations in applied tariffs and, thus, binding overhang. Applied tariffs are pro-cyclical when the government is captured by import-competing industries because these industries concede lower tariffs to exporters during recessions given recessions lower the opportunity cost of lobbying and thereby generate a stronger lobbying threat.

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1 Introduction

A striking feature of WTO tariff commitments within the GATT is the lack of commitment to specific tariff levels. Rather, countries commit to upper bounds on tariffs which are known as tariff bindings. As such, countries retain flexibility when setting actual tariffs which are known as applied tariffs. A country does not violate its GATT commitments by unilaterally

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raising their applied tariffs as long as they remain below the tariff binding. Recent papers (e.g. Nicita et al. (2013) and Beshkar et al. (2014)) have begun to empirically document the widespread phenomena of "binding overhang" which is the situation where countries set their applied tariff below the tariff binding. This is a particularly important phenomena in developing countries which, as noted by Bchir et al. (2006) and Nicita et al. (2013), commonly set their tariff bindings far above their applied tariffs at the conclusion of the 1994 Uruguay Round. Moreover, Lake and Linask (2015) document that not only do developing countries typically have larger binding overhang than developed countries, but they are also more inclined to use the greater flexibility therein to move the applied tariff for a given product up and down over time.

Motivated by terms of trade externalities, recent papers have emphasized the role of market power when analyzing the theoretical and empirical determinants of binding overhang (Beshkar et al. (2014) and Nicita et al. (2013)). The role of import surges and the share of imports sourced from preferential trade agreement partners have also received attention in the broader recent literature on the theoretical and empirical determinants of tariff setting and, by implication, binding overhang (Bown and Crowley (2013b), Ludema and Mayda (2013) and Groppo and Piermartini (2014)). However, these papers do not investigate the role of the business cycle in shaping the temporal pattern of applied tariff fluctuations and, in turn, the temporal pattern of binding overhang. In contrast, the central focus of our paper is the role played by the business cycle in shaping the temporal fluctuations of applied tariffs and binding overhang in developing countries.

Conventional wisdom has long said that applied tariffs are counter-cyclical; that is, countries will raise applied tariffs (resulting in lower binding overhang) during recessions and lower applied tariffs (resulting in higher binding overhang) during expansions. A wealth of examples include Takacs (1981, p.687), Gallarotti (1985, p.157), Cassing et al. (1986, p.843), Rodrik (1995, p.687), Bagwell and Staiger (2003, p.1), Costinot (2009, p.1011) and Bown and Crowley (2013a, p.50). However, using data on over 5000 products for a sample of 72 developed and developing countries between 2000 and 2011, Lake and Linask (2015) find that applied tariffs are pro-cyclical, and thus binding overhang is counter cyclical, even after controlling for the host of aforementioned variables that have been emphasized in the recent literature.[1] Moreover, they find that binding overhang and applied tariffs are acyclical in developed countries. That is, counter-cyclical binding overhang and pro-cyclical applied tariffs are completely driven by developing countries.

In this paper, we present, to the best of our knowledge, the first theoretical model in the

[1]While they do not find evidence that applied tariffs are pro-cyclical, recent work by Gawande et al. (2011), Rose (2013) and Kee et al. (2013) has found evidence that applied tariffs are acyclical.

literature that attempts to explain the counter-cyclical nature of binding overhang and the pro-cyclical nature of applied tariffs in developing countries. In our setup, the government (or policy-making organ) may be captured by either import-competing interests or exporter interests and implements the nominated applied tariff of the group by whom it is captured. In each period, the incumbent group, i.e. the group who has captured the government and is dictating applied tariffs, faces the threat that they will be displaced by the opposing group lobbying the government. To mitigate this lobbying threat posed by the opposing group, an incumbent group may nominate an applied tariff different from its optimal tariff that would be implemented in the absence of any lobbying threat.

The counter-cyclicality of binding overhang and the pro-cyclicality of applied tariffs emerges in equilibrium when import-competing interests are the incumbent group. The key feature of the model that drives this result is the time-varying opportunity cost of lobbying and, specifically, that the opportunity cost of lobbying is pro-cyclical. The intuitive idea is that using scarce resources for lobbying is more attractive during recessions. Recessions are associated with negative productivity shocks or depressed prices resulting from low demand, and either of these will reduce the marginal revenue product of using resources to produce output. Given this pro-cyclical opportunity cost of lobbying, recessions bring a stronger lobbying threat from the opposing group. Consequently the incumbent group moves the applied tariff away from its own ideal tariff and towards the ideal tariff of the opposing group in order to preemptively mitigate the lobbying threat of the opposing group. Thus, having captured the government, import-competing interests nominate lower applied tariffs during recessions in order to mitigate the strong exporter lobbying threat but nominate higher applied tariffs during booms when the exporter lobbying threat is weak. That is, applied tariffs are pro-cyclical, and binding overhang is counter-cyclical, when import-competing interests are the incumbent group dictating tariffs.

In the core version of the model, we model lobbying by the opposing group as destroying a fraction of the economy's resources which is motivated by the seminal work of Krueger (1974) and Bhagwati (1982) and also by the model of Acemoglu and Robinson (2001). We then extend the simple version of the model to allow import-competing interests and exporter interests to simultaneously and strategically choose an amount of labor for lobbying with the residual labor being used to produce output. In this extension, a recession not only directly affects economic output via the productivity shock but also indirectly affects output via the amount of the residual labor that remains for productive activity after lobbying takes place. Nevertheless, the key insight in this setup remains that the opportunity cost of lobbying should be lower during recessions and hence tariffs remain pro-cyclical when import-competing interests dictate tariff policy. Thus, our results extend to different formalizations

of lobbying with the key requirement being that the opportunity cost of lobbying is pro-cyclical.

More broadly, the idea that a group has a lower opportunity cost of initiating conflict in times where it is facing less favorable economic conditions is deeply rooted in the civil war literature. For example, Blattman and Miguel (2010, p.12) argue in their review of the literature that "Their [Chassang and Padro-i Miquel (2009)] key insight is that transient economic shocks increase the immediate incentives to fight but not the discounted present value of victory. The model thus implies that in dire economic circumstances groups predate upon one another since they have less to lose than in periods where the returns to production are higher." Blattman and Miguel (2010) also discuss empirical evidence consistent with this perspective including Collier and Hoeffler (1998), Collier and Hoeffler (2004) and Miguel et al. (2004).

In summary, through its emphasis on the role of lobbying and domestic political competition, our model allows us to make two distinct contributions. First, the model produces an explanation for the empirically documented counter-cyclicality of binding overhang and pro-cyclicality of applied tariffs in developing countries. Second, the model provides a structural foundation for a random domestic political pressure variable that, as we discuss below, often rationalizes the existence of binding overhang in the current literature.

With its focus on the temporal variation in tariffs and overhang, our paper complements the theoretical literature analyzing the cyclicality of tariffs. A prominent example is Bagwell and Staiger (2003) whose explanation is based on a model of self-enforcing trade agreements that neutralize terms of trade externalities.[2] In the presence of persistent business cycles and pro-cyclical trade volumes, the cost of deviating from a reciprocal trade agreement is higher during booms which allows more liberal trade policy during booms. Interestingly, the motivation for Bagwell and Staiger (2003, p.1) in exploring an explanation based on terms of trade externalities is that, in their view, the conventional wisdom behind counter-cyclical applied tariffs is incomplete. This conventional wisdom has it that recessions cause import-competing firms to lobby harder for protection and then policy makers respond by raising tariffs. However, this account ignores the role of lobbying by non-import-competing sectors that prefer lower tariffs, such as export sectors or sectors that rely on imported intermediate inputs. By explicitly modeling the interaction between import-competing and export interests, our model directly addresses the flaw identified by Bagwell and Staiger regarding domestic political economy mechanisms explaining the cyclicality of tariffs.

[2]The literature includes other explanations such as maintaining budget balances (Hansen (1990)); the cyclicality of firm entry incentives (McKeown (1983) and Gallarotti (1985)); and the larger marginal employment impact of tariffs when unemployment is higher (Costinot (2009)).

Because of our focus on the determinants of binding overhang, our paper fits into the literature proposing explanations for the existence of binding overhang. Indeed, our paper contributes directly to this literature by providing a structural foundation for the existence of a random political pressure variable, which plays a key role in one of the two main explanations in the literature. Within the terms of trade theory of trade agreements, Bagwell and Staiger (2005), Bagwell (2009), Amador and Bagwell (2013) and Beshkar et al. (2014) have shown that binding overhang emerges as a natural feature of an optimal trade agreement when countries possess private information about a random political pressure variable that represents their time-varying preference for protectionism. While countries value the ability to internalize terms of trade externalities through committing to lower tariffs, they also value the flexibility to adjust tariffs in response to realized political pressure. Imperfect information plays an important role because it makes state contingent agreements infeasible. By interpreting the strength of the lobbying threat in our paper as the random political pressure variable, our model gives a structural foundation for this random political pressure variable and provides an interpretation for how it drives the dynamics of binding overhang. The second explanation in the literature for binding overhang is provided by Horn et al. (2010) who show that binding overhang emerges as a feature of an optimal incomplete contract in a costly contracting environment because of the state contingent nature of binding overhang.

Rather than focus on explanations for the existence of binding overhang, other papers have focused instead on the implications of binding overhang for various phenomena. By looking at how the relationship between market power and applied tariffs depends on the level of binding overhang, Nicita et al. (2013) find evidence that countries may set applied tariffs in a non-cooperative way when binding overhang is high but in a cooperative way when binding overhang is low. Further, Nicita et al. (2013) find evidence that the fear of retaliation could rationalize this different behavior. Francois and Martin (2004), Sala et al. (2010), Handley and Limão (2012) and Handley (2014) emphasize that tariff bindings, and hence the existence of binding overhang, reduce uncertainty about future tariff policy. Together, these papers provide theoretical and empirical evidence that reduced uncertainty affects exports through the intensive margin and also by encouraging firms to enter export markets. Maggi and Rodriguez-Clare (1998) show how the possibility of binding overhang, even though it does not arise in equilibrium, induces ex-post lobbying by import-competing firms which, by reducing the return to capital, eliminates an ex–ante over–investment problem in the protected sector.

The remainder of the paper proceeds as follows. Section 2 presents our empirical motivations. Section 3 presents the basic theoretical model. Section 4 works through the equilib-

rium analysis and Section 5 works through some extensions to the basic model. Section 6 concludes.

2 Empirical observations

The theoretical model is motivated by three empirical observations: i) developing countries have significantly more flexibility to vary their applied tariffs over time, ii) developing countries are much more likely to move the applied tariff for a given product up and down over time and iii) contrary to the conventional wisdom that applied tariffs are counter-cyclical, applied tariffs are pro-cyclical in developing countries but acyclical in developed countries. Our model provides a theoretical explanation for the facts that temporal variation of applied tariffs, and thus binding overhang, is a regular occurrence in developing countries and this variation is at least partly driven by the business cycle.

The three empirical observations stated above have been documented by Lake and Linask (2015) using a sample of more than 5000 products over the period 2000-2009 for 72 countries (51 developing, 16 developed and 5 who are developed and developing at different points over the sample). Their sample consists of over 1.8 million observations and we use this sample below.[3] Table A1 in the Appendix lists the countries in the sample, Table A2 describes the variables used in the regression analysis below and the source of these data, and Table A3 presents summary statistics for the sample.[4]

Table A3 illustrates the flexibility that developing countries have in varying their applied tariffs. Here, $\tau_{i,j,t}$ denotes the MFN applied tariff of country i on product j in year t and $\bar{\tau}_{i,j,.t}$ denotes the analogous tariff binding with $v_{i,j,t} = \bar{\tau}_{i,j,t} - \tau_{i,j,t}$ denoting the binding overhang. While developing countries have both higher applied tariffs and tariff bindings than developed countries, the higher tariff bindings dominate and lead to a mean binding overhang of 19.92% in developing countries compared to 6.7% in developed countries. Indeed, only 2.2% of developing country observations have zero tariff bindings, and thus zero flexibility by construction, whereas 26.6% of developing country observations have zero tariff bindings. Further, Table 1 illustrates that developing countries are much more likely to exploit this flexibility. Over 30% of country-product pairs in developing countries see the applied tariff

[3] As described in more detail in Lake and Linask (2015), the following country-product observations are excluded before arriving at our final sample of $1,811,008$ observations: i) observations during the phase-in period of the Uruguay Round or the Information Technology Agreement, ii) observations where the tariff binding changes over the sample period, iii) observations where the magnitude of the applied tariff change lies in the top 1% of applied tariff increases of the top 1% of applied tariff decreases, iv) observations with negative overhang and v) observations where the applied tariff moves below the tariff binding after it had previously moved above the tariff binding.

[4] These tables largely coincide with Tables A1-A3 in Lake and Linask (2015).

both increase and decrease over the sample period which is much higher than the 7.9% of country-product pairs that see these fluctuations in developed countries. Thus, developing countries not only have more flexibility than developed countries to use their applied tariffs but they actually exploit this flexibility.

Before presenting the regression analysis showing applied tariffs are pro-cyclical in developing countries, we first illustrate the idea in a scatterplot. To highlight the features of the data that drive our regression results, the scatterplot only includes country-product pairs where the applied tariff moves up and down over the sample period and only includes observations within these country-product pairs where the applied tariff changed relative to the prior year. For these observations, Figure 1 plots the difference between a country's applied tariff $\tau_{i,j,t}$ and its average over the sample period $(\frac{1}{10}\sum_{t=2000}^{2009}\tau_{i,j,t})$ against the difference between a country's lagged business cycle $BC_{i,t-1}$ and its average over the sample period $(\frac{1}{10}\sum_{t=2000}^{2009}BC_{i,t-1})$. The measure of the business cycle here is the cyclical component obtained after detrending log real GDP using the Hodrick-Prescott filter (as in Rose (2013)).[5] The figure also shows the OLS regression line where $\tau_{i,j,t}-\frac{1}{10}\sum_{t=2000}^{2009}\tau_{i,j,t}$ is the dependent variable and $BC_{i,t-1}-\frac{1}{10}\sum_{t=2000}^{2009}BC_{i,t-1}$ is the explanatory variable. The positive slope of the OLS regression line suggests that a country's applied tariff $\tau_{i,j,t}$ tends to be above its sample average when the country's lagged business cycle $BC_{i,t-1}$ is also above its sample average. That is, the OLS regression line suggests applied tariffs are pro-cyclical.

Table 2 presents the regression results which include a number of additional control variables. The dependent variable is binding overhang in Panel A and the applied tariff in Panel B. Column (1) is the baseline specification with columns (2)-(3) presenting two robustness specifications. All regressions use the following control variables that have been emphasized in the recent literature as important determinants of applied tariffs and binding overhang: market power at the country-product level ($MP_{i,j}$; see, e.g., Bagwell and Staiger (2011), Ludema and Mayda (2013), Nicita et al. (2013) and Beshkar et al. (2014)), the share of product level imports sourced from preferential trade agreement partners ($PTA\_IM_{i,j,t}$; see, e.g., Ludema and Mayda (2013)) and lagged import surges at the country-product level as well as their volatility ($\Delta IM_{i,j,t-1}$ and $sd\Delta IM_{i,j,t-1}$; see, e.g., Bagwell and Staiger (1990) and Bown and Crowley (2013b)). All regressions also control for contemporaneous log real per capita GDP ($y_{i,t}$) as well as year fixed effects and country-sector fixed effects where a sector is equivalent to a 4-digit HS category.

The results clearly show that binding overhang is counter-cyclical in developing countries

[5] As described in Lake and Linask (2015), we collect GDP data that, for many countries, stretches from 1960 to 2013 (also see Table A1). For data purposes, we treat EU membership as time-invariant and consisting of the 15 EU members as of 1999. To compute EU real GDP in any given year, we aggregate the real GDP of these 15 countries.

and acyclical in developed countries whereas applied tariffs are pro-cyclical in developing countries but acyclical in developed countries. Indeed, as one might expect given binding overhang is merely the tariff binding less the applied tariff, the absolute value of the point estimates for the business cycle coefficient are nearly identical across the overhang and applied tariff specifications. These results are robust to numerous robustness exercises explored extensively in Lake and Linask (2015), two of which are included here: agricultural products are excluded in column (2) and only original WTO members are included in column (3).

3 Model

3.1 Structure of the economy

The economy is an infinite horizon economy with three groups of agents: exporters (X) who produce an exportable good, importers (M) who produce an import-competing good, and workers. Production uses labor and a factor specific to each sector.[6] Exporters and importers, but not workers, own the specific factors. In our model, workers do not lobby and hence are irrelevant except for providing a mechanism for redistribution of income between importers and exporters that we explain below.[7] The economy takes world prices as given and is thus a small economy. The units of measurement are normalized so that the world price of each good is 1, and we let the exportable good be the numeraire good.

We assume the economy faces business cycle fluctuations that are realized as productivity shocks. We could equivalently interpret business cycle fluctuations as arising from domestic aggregate demand shocks because this would also depress the marginal revenue product of labor in each sector, which is the critical feature of the business cycle from our perspective. Specifically, there are two states of the economy, a "high" state (H) and a "low" state (L) denoted by A_ω where $\omega \in \{H, L\}$. Equivalently, we interpret the high state as the boom state and the low state as the recession state. The high state occurs with probability $1 - \pi$ and the low state with probability π. The economy's potential real aggregate income (in units of the exportable) is given by

$$A_\omega \bar{Y} \text{ where } A_\omega = \begin{cases} 1 \text{ if } \omega = H \\ a < 1 \text{ if } \omega = L. \end{cases} \tag{1}$$

That is, productivity uncertainty generates business cycle fluctuations. We use the termin-

[6] For example, the specific factors can be thought of as land in the exportable sector and capital in the importable sector.

[7] Among others, Findlay and Wellisz (1982) and Grossman and Helpman (1994) also assume specific factor owners engage in political activity (i.e. lobbying or campaign contributions) but workers do not.

ology of "potential" aggregate income here because, as explained below, realized aggregate income may fall below its potential as a result of lobbying or the efficiency costs of tariffs. Since a low a corresponds to more severe productivity shocks, $\frac{1}{a}$ represents the severity of negative productivity shocks.

The applied tariff, denoted τ, mediates distribution of the economy's real aggregate income. Specifically, the one-period indirect utility of group $i \in \{X, M\}$ is given by

$$\mu_i(\tau, A_\omega) = \begin{cases} \alpha_i(\tau) A_\omega \bar{Y} \equiv u_i(\tau, A_\omega) & \text{if lobbying does not take place} \\ \phi \cdot u_i(\tau, A_\omega) & \text{if lobbying takes place} \end{cases} \tag{2}$$

with group i's intertemporal preferences taking the form $\mathrm{E}_{t_0} \sum_{t=t_0}^{\infty} \beta^{t-t_0} \mu_i(\tau_t, A_\omega)$. $\alpha_i(\tau)$ is the parameter that mediates the distribution of income between importers and exporters and depends on the tariff. We assume $\alpha_X(\tau) + \alpha_M(\tau) \leq 1$. In the specific factors model, a higher tariff redistributes income from exporters to importers. In response to the increased marginal revenue product of labor in the importable sector, a higher demand for labor in the importable sector bids up the wage and induces labor flows from the exportable to the importable sector. This increases (decreases) the real income of importers (exporters) via increasing (decreasing) the marginal revenue product of the factor specific to the importable (exportable) sector. To this end, $\alpha'_M(\tau) > 0$ and $\alpha'_X(\tau) < 0$.

Importantly, our results do not depend upon whether $\alpha_X(\tau) + \alpha_M(\tau) = 1$ or $\alpha_X(\tau) + \alpha_M(\tau) < 1$. Indeed, $\alpha_X(\tau) + \alpha_M(\tau) < 1$ is natural given workers receive some part of national income. However, $\alpha_X(\tau) + \alpha_M(\tau) < 1$ also allows for the efficiency costs of tariffs which can be represented by $\alpha'_X(\tau) + \alpha'_M(\tau) < 0$. Even in the presence of efficiency costs of tariffs, we maintain the assumption $\alpha'_M(\tau) > 0$ which ensures the positive income redistribution effect for importers outweighs the negative efficiency cost of a higher tariff.

The central idea of our model is that we view the government as captured by either importers or exporters who then dictate applied tariff setting. The group not currently in control of tariff-setting can gain control via costly lobbying efforts.[8] We will model the opposing group's ability to capture the government in various ways. In our main analysis, we adopt the simplest approach (motivated by the seminal work of Krueger (1974) and Bhagwati (1982) who view lobbying as a "directly unproductive activity" that moves the economy inside the production possibilities frontier) and assume that lobbying destroys a proportion $1 - \phi$ of indirect utility in the period when lobbying takes place. In this setup, ϕ represents the efficiency of lobbying so a higher ϕ means lobbying is less costly. While this

[8] As in Grossman and Helpman (1994) and Acemoglu and Robinson (2001), we essentially assume away any collective action problems that undermine the lobbying ability of exporters and importers (see Acemoglu and Robinson (2001, p.941 and footnote 4) for a simple supporting structural foundation).

specification of lobbying implies lobbying is equally costly for both groups regardless of which group lobbies, our subsequent analysis only relies on lobbying being costly for both groups and not that it is equally costly. Indeed, the cost imposed on the group not lobbying can be arbitrarily small.[9] Moreover, in Section 5.2 we adopt a different specification of lobbying whereby the group not in control chooses whether to initiate a lobbying war and each group must then decide on how much labor to use for the different activities of lobbying and production. Thus, our main results in Section 4 generalize beyond the simplified lobbying setting.

The crucial feature of our lobbying cost formulation, regardless of the specific modeling approach, is that the opportunity cost of lobbying depends on the state of the economy. Specifically, the current period opportunity cost of lobbying is lower during recessions than booms. Intuitively, business cycle fluctuations imply that using productive resources for lobbying rather than goods production is more attractive when the economy is suffering from a negative productivity shock. As discussed in the introduction, the idea that a group has a lower opportunity cost of initiating conflict in times where it is facing less favorable economic conditions is deeply rooted in the civil war literature.

3.2 Role of lobbying and stages within each period

At the beginning of period one, we assume that the government is captured by importers and there is an exogenous tariff binding, $\bar{\tau}_1 > 0$. The assumption of importers having captured the government at the beginning of the game is motivated by the existence of GATT and the WTO as institutions whose mission is to orchestrate lower global tariffs.[10] While Beshkar et al. (2014) place emphasis on endogenizing the tariff binding, Nicita et al. (2013) describe how an exogenous tariff binding is consistent with historical evidence for many developing countries. Specifically, they describe how larger developed countries played an active role in actually negotiating their tariff bindings whereas developing countries tended to submit very high and somewhat arbitrarily chosen tariff bindings and their submissions often took place *after* the conclusion of the Uruguay Round. Thus, given our interest in the tariff-setting behavior of developing countries and the *termporal* fluctuations in binding overhang, we treat the tariff binding as exogenous and focus on temporal fluctuations in applied tariffs.

Generically, we denote the group who has captured the government at the beginning of period t by group i and the other group by group i'. The following describes the timing of

[9] Note that, even if only one group lobbies, the higher demand for labor will push up the wage paid by both sectors.

[10] The need for reduction of tariffs suggests that import-competing industries have sufficient influence over trade policy to result in these high tariffs.

events within any period.

1. The shock to the economy A_ω is realized. If $\bar{\tau}_t = 0$, production and consumption take place and the period ends.

2. If $\bar{\tau}_t > 0$, group i decides whether to cede control of the government to group i' or not cede control which is denoted $\gamma_i = 1$ and $\gamma_i = 0$ respectively.

   (a) If group i does not cede control, it nominates an applied tariff τ.

   (b) If group i cedes control, group i' nominates an applied tariff τ.

3. If group i chooses not to cede control in Stage 2, group i' chooses whether to lobby or not which is denoted by $\rho_{i'} = 1$ and $\rho_{i'} = 0$ respectively.

   (a) If group i' lobbies, it captures the government and nominates an applied tariff τ and a tariff binding $\bar{\tau}$.

4. The government implements the nominated applied tariff and, if relevant, the nominated tariff binding of the group who has captured the government.

5. Production and consumption take place.

While groups do not lobby simultaneously in this formulation of our model (we address simultaneous lobbying in Section 5.2), the sequential lobbying process still generates strategic interaction. In particular, there are two ways that group i can preemptively avoid lobbying by group i'. First, group i can alter their nominated tariff away from their ideal tariff and towards the ideal tariff of group i'. That is, importers (exporters) can lower (raise) the tariff below the tariff binding (above zero). Second, group i can cede control of the government, and hence applied tariff setting, to group i'. In both cases, by avoiding lobbying, group i prevents an even worse outcome where group i' sets both the tariff binding and the applied tariff. Indeed, importer's ability to cede control of the government fundamentally affects the nature of the game. Absent this possibility, exporter control of the government would be synonymous with a zero tariff binding and zero applied tariffs forever given it is optimal for exporters to nominate a zero tariff binding conditional on lobbying. However, the possibility of importers ceding control of applied tariff setting may be enough to prevent exporters from lobbying (thereby preventing a permanent zero tariff binding) and thus allow the possibility of non-zero tariffs when exporters control applied tariff setting.

As indicated above in Stage 3, our model assumes lobbying is always successful when it takes place. However, this is not necessary for our results. In Section 5.1, we show that our results are qualitatively unaffected if lobbying in Stage 3 is unsuccessful with some exogenous probability $q < 1$.

3.3 States, strategies and equilibrium concept

Given the infinite horizon game with each period characterized by the stages just described, we solve for a pure strategy Markov perfect equilibrium. Except for the recurrent states where the tariff binding is zero, i.e. $\bar{\tau} = 0$, we describe each state as a triple that consists of the shock to the economy, the group who has captured the government and the tariff binding. So $\Theta = \{(A_\omega, X, \bar{\tau}), (A_\omega, M, \bar{\tau}), \ (A_\omega, \bar{\tau} = 0) \mid \omega = H, L \text{ and } \bar{\tau} \in (0, \bar{\tau}_0]\}$ denotes the set of possible states.[11] For ease of exposition, we separate the states into three groups: $\Theta_{\bar{\tau}=0} = \{(A_L, \bar{\tau} = 0), (A_H, \bar{\tau} = 0)\}$ which denotes states where the tariff binding is zero, and $\Theta_i = \{(A_L, i, \bar{\tau}), (A_H, i, \bar{\tau}) \mid \bar{\tau} \in (0, \bar{\tau}_0]\}$ for $i = X, M$ which denotes states in which exporters or importers have captured the government.

Given the actions that each player can take in the stages described in the previous subsection, a strategy for player j is a function that specifies the actions taken by player j for each state $\theta \in \Theta$.[12] When player j begins the period as the opposing group, it conditions its actions on those already taken by the other group within the period. We let s_j denote a strategy for player j and $s = (s_j, s_{j'})$ denote the strategy profile. Let $\xi(\theta, \theta' \mid s)$ be the transition probability from state θ to state θ' conditional upon the strategy profile s and consider a strategy profile $s^* = \left(s_j^*, s_{j'}^*\right)$ in light of the following Bellman equations:

$$V_j(\theta) = \max_{s_j} \left\{ \mu_j \left(\tau\left(\left(s_j, s_{j'}^*\right), \theta\right), A_\omega, \left(s_j, s_{j'}^*\right)\right) + \beta \sum_{\theta' \in \Theta} \xi\left(\theta, \theta', \left(s_j, s_{j'}^*\right)\right) V_j(\theta') \right\}$$

$$V_{j'}(\theta) = \max_{s_{j'}} \left\{ \mu_{j'} \left(\tau\left(\left(s_j^*, s_{j'}\right), \theta\right), A_\omega, \left(s_j^*, s_{j'}\right)\right) + \beta \sum_{\theta' \in \Theta} \xi\left(\theta, \theta', \left(s_j^*, s_{j'}\right)\right) V_{j'}(\theta') \right\}.$$

Then, $s^* = \left(s_j^*, s_{j'}^*\right)$ is a Markov perfect equilibrium if s_j^* solves $V_j(\theta)$ for all $\theta \in \Theta$ and $s_{j'}^*$ solves $V_{j'}(\theta)$ for all $\theta \in \Theta$.

In our subsequent analysis, we restrict attention to certain states and certain types of strategies. We restrict attention to states where the tariff binding is equal to either zero or the exogenous tariff binding at the beginning of the game. We do this for two reasons. First, if exporters lobby then they must nominate a zero tariff binding because i) the opportunity cost of lobbying is independent of the nominated tariff binding and ii) exporters' continuation payoff is maximized once the tariff binding is zero. Second, since importers prefer a higher tariff and WTO rules prohibit the tariff binding from increasing, importers will only lobby

[11] Because there is no possibility of setting a higher applied tariff when the tariff binding is 0, it no longer matters whether importers or exporters have captured the government.

[12] As described in Section 3.2, the set of possible actions includes whether to cede control or not (γ), whether to lobby or not (ρ), a nominated applied tariff, and a nominated tariff binding.

for a lower tariff binding if it preemptively prevents exporter lobbying. However, we assume the tariff binding is such that importers never want to lobby for a lower tariff binding.[13] We also restrict our attention to those strategies satisfying two properties. First, like just described, exporters nominate a zero tariff binding and importers nominating the status quo tariff binding after lobbying. Second, the lobbying group nominates its ideal applied tariff in a period that it successfully lobbies the government. Indeed, this is optimal given the nominated applied tariff affects neither who controls tariff-setting in the current period nor the state in the following period.

Given the reduction in the state space and the strategy space, Figure 1 depicts the relationship between state transitions and player actions. When $\theta \in \Theta_M$ and importers do not cede control ($\gamma_M = 0$), the resulting state depends on whether exporters lobby. If exporters lobby ($\rho_X = 1$), the government implements a zero tariff binding which, by WTO rules, remains in place forever and the economy moves to the recurrent class of states $\Theta_{\bar{\tau}=0}$. If exporters do not lobby ($\rho_X = 0$), importers maintain control of the government. When $\theta \in \Theta_M$ and importers cede control ($\gamma_M = 1$), then exporters capture the government and the economy moves to Θ_X. Like that just described, when $\theta \in \Theta_X$ and exporters do not cede control ($\gamma_X = 0$) then the resulting state depends on whether importers lobby. If importers lobby ($\rho_M = 1$), they capture the government again and the economy moves back to Θ_M. But, if importers do not lobby ($\rho_M = 0$) then exporters maintain control of the government. Finally, when $\theta \in \Theta_X$ and exporters cede control ($\gamma_X = 1$) then importers capture the government and the economy moves back to Θ_M.

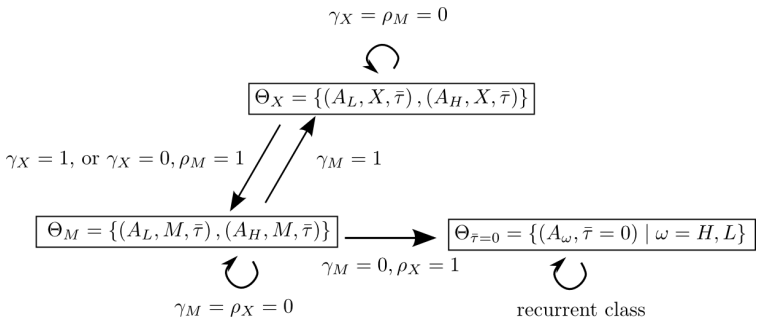

Figure 1: State transitions

[13] Essentially, we assume that the tariff binding itself has already been set such that any mutual gains importers and exporters could derive from lowering the tariff binding have been exploited.

4 Equilibrium analysis: business cycle fluctuations

When importers are in control of tariff-setting, they want to prevent lobbying by exporters whenever possible because exporter lobbying results in a zero tariff binding and, thus, a permanent zero applied tariff. Section 4.2 analyzes the conditions under which exporters will not lobby. In particular, we focus on two actions by importers that can preempt lobbying by exporters: setting a lower applied tariff and ceding control of tariff-setting. In Section 4.1 we first establish that importers always prefer the former whenever it is possible. In turn, they resort to the latter only when they are unable to set the applied tariff low enough to prevent lobbying by exporters. If importers do cede control, then exporters do not lobby since they have already been granted control. In Section 4.2 we then characterize the preemptive tariffs that importers must set to prevent exporter lobbying. Section 4.3 performs a similar analysis for the case when importers have ceded control and exporters thus control tariff-setting.

4.1 The incentive to maintain control of the government

We first present an assumption that guarantees importers and exporters *want* to maintain control of the government whenever they can preemptively avoid lobbying by the opposing group.[14] Further, the assumption ensures importers *can* maintain control during booms and that exporters *can* maintain control during booms and recessions. Thus, importers (exporters) will not cede control to exporters (importers) if they can instead avoid opposition lobbying by setting lower (higher) applied tariffs.

We introduce some notation before presenting the assumption. Let $\tau^*_{L,M}$ and $\tau^*_{H,M}$ be the equilibrium tariffs that importers set in recessions and booms, respectively, when they are in control of tariff-setting; $\tau^*_{L,X}$ and $\tau^*_{H,X}$ are the analogous tariffs when exporters are in control of tariff-setting. Ignoring the constraints $\tau \geq 0$ and $\tau \leq \bar{\tau}$, let $\tilde{\tau}_{L,M}$ and $\tilde{\tau}_{H,M}$ denote the maximum tariffs that importers can set during recessions and booms and still avoid exporter lobbying; $\tilde{\tau}_{L,X}$ and $\tilde{\tau}_{H,X}$ denote the analogous minimum tariffs that exporters can set during recessions and booms and still avoid importer lobbying.[15] Further, let $\delta_{\omega,i}(\tau_0, \tau_1) \equiv u_i(\tau_1, A_\omega) - u_i(\tau_0, A_\omega)$ denote the change in group i's payoff due to the tariff changing from τ_0 to τ_1 when the state of the economy is ω.

Assumption 1. *i)* $\tilde{\tau}_{H,M} \geq 0$ *and* $\tilde{\tau}_{L,M} < \bar{\tau}$

ii) $\tilde{\tau}_{H,X} \leq \bar{\tau}$ *and* $\tilde{\tau}_{L,X} \in (0, \bar{\tau}]$

iii) $\delta_{L,X}\left(\tau^*_{L,X}, \bar{\tau}\right) + \delta_{L,X}\left(\tau^*_{L,X}, 0\right) < 0$

[14] One scenario that would ensure importers want to maintain control is that, when in control of tariff-setting, exporters set tariffs that are higher than those set by importers.

[15] Equations (8) and (13) define the relationship between the equilibrium tariffs $\tau^*_{\omega,i}$ and the tariffs $\tilde{\tau}_{\omega,i}$.

iv) $\pi\delta_{L,M}\left(\tau^*_{L,X},\tau^*_{L,M}\right)+(1-\pi)\,\delta_{H,M}\left(\tau^*_{H,X},\tau^*_{H,M}\right)>0$
v) $\pi\delta_{L,X}\left(0,\tau^*_{L,X}\right)+(1-\pi)\,\delta_{H,X}\left(\tau^*_{H,M},\tau^*_{H,X}\right)>0$

Part i) of Assumption 1 does two things. First, given applied tariffs cannot be negative, $\tilde{\tau}_{H,M}\geq 0$ ensures importers *can* maintain control during booms. Second, noting that $\tilde{\tau}_{H,M}>\tilde{\tau}_{L,M}$ will follow later, $\tilde{\tau}_{L,M}<\bar{\tau}$ ensures importers cannot always maintain control by setting the applied tariff equal to the tariff binding. Thus, part i) allows the possibility that, in equilibrium, the model can match the stylized facts presented in Section 2. Part ii) of Assumption 1 also does two things. First, given the tariff binding $\bar{\tau}$, $\tilde{\tau}_{H,X}\leq\bar{\tau}$ and $\tilde{\tau}_{L,X}\leq\bar{\tau}$ ensure exporters *can* maintain control of tariff setting once they obtain control. Second, noting that $\tilde{\tau}_{H,X}<\tilde{\tau}_{L,X}$ will follow later, $\tilde{\tau}_{L,X}>0$ ensures exporters cannot do so by always setting a zero applied tariff. Since exporters can only obtain control after importers have control, this helps rule out the possibility of control cycling between importers and exporters.[16] Part iii) also helps rule this out by requiring that exporters cannot gain from ceding control in the current period and regaining control in the subsequent period.[17]

Regardless of whether importers or exporters dictate applied tariff setting, ceding control is costly in the current period because the opposing group will set its ideal applied tariff in the current period upon gaining control. Thus, a sufficient condition ensuring that the dictating group *wants* to maintain control when possible is that its continuation payoff from maintaining control exceeds its continuation value from the opposing group having control ($W_i(i)>W_i(i')$ in terms of later notation). Parts iv) and v) of Assumption 1 ensure this is true.

4.2 When importers dictate applied tariff setting

Since the game begins with importers having captured the government (and Section 4.1 ensures that they prefer to retain control), we begin by deriving conditions whereby exporters will not lobby regardless of the state of the economy. These conditions depend on the applied tariff set by importers, and therefore the tariff chosen by importers helps determine whether these conditions are met or not. To this end, let $\theta\in\Theta_M$ and $\gamma_M=0$ so that importers dictate tariff setting and have not ceded control. Let $V_X(\theta\mid\rho_X=0,\gamma_M=0)$ and $V_X(\theta\mid\rho_X=1,\gamma_M=0)$ denote the choice-specific value functions of exporters and $W_i(\bar{\tau}=0)$

[16] Allowing the possibility of control continually shifting between importers and exporters does not affect the analysis in Section 4.2. However, allowing this possibility would create two cases to consider upon importers ceding control: i) the case considered in Section 4.3 where exporters maintain control and ii) the case where control continually switches between importers and exporters.

[17] To see this, note that $\delta_{L,X}\left(\tau^*_{L,X},\bar{\tau}\right)\leq 0$ is the one period loss suffered by exporters when ceding control to importers and $\delta_{L,X}\left(\tau^*_{L,X},0\right)\geq 0$ is the one period gain for exporters when importers cede control to exporters.

denote the expected continuation payoff to player i given $\theta \in \Theta_{\bar{\tau}=0}$ and prior to realization of $A_\omega \in \{A_H, A_L\}$. Similarly denote $W_i(X)$ and $W_i(M)$ given $\theta \in \Theta_X$ and $\theta \in \Theta_M$. That is, $W_i(\cdot)$ are ex-ante value functions. Then,

$$\begin{aligned} V_X(\theta \mid \rho_X = 1, \gamma_M = 0) &= \phi u_X(0, A_\omega) + \beta W_X(\bar{\tau} = 0) \text{ and} \\ V_X(\theta \mid \rho_X = 0, \gamma_M = 0) &= u_X(\tau_{\omega,M}, A_\omega) + \beta W_X(M) \end{aligned}$$

represent the exporter payoffs associated with lobbying and not lobbying given that importers have not ceded control.

Naturally, exporters lobby if and only if $V_X(\theta \mid \rho_X = 1, \gamma_M = 0) > V_X(\theta \mid \rho_X = 0, \gamma_M = 0)$. Thus, exporters' no–lobbying condition given some $\theta \in \Theta_M$ is

$$\underbrace{u_X(\tau_{\omega,M}, A_\omega) - \phi u_X(0, A_\omega)}_{\text{opportunity cost of lobbying}} - \beta \underbrace{[W_X(\bar{\tau} = 0) - W_X(M)]}_{\text{future value of lobbying}} \geq 0. \tag{3}$$

Even though $u_X(0, A_\omega) \geq u_X(\tau_{\omega,M}, A_\omega)$, lobbying destroys a proportion $(1 - \phi)$ of exporters' indirect utility. As such, $u_X(\tau_{\omega,M}, A_\omega) - \phi u_X(0, A_\omega)$ represents the indirect utility that exporters forego in the current period because of lobbying. Throughout the paper we assume that the opportunity cost of lobbying is positive. On the other hand, $W_X(\bar{\tau} = 0) - W_X(M)$ represents the future value of lobbying because it captures the change in exporters' expected continuation payoff because of lobbying. Thus, (3) says exporters lobby if and only if the opportunity cost of lobbying is less than the future value of lobbying.

Two important observations emerge from the no-lobbying condition (3). First, the one shot deviation principle says a strategy of not lobbying in any state of the economy is optimal if and only if it is never profitable to lobby in any single period. We are interested in the conditions under which exporters will not lobby in either state of the economy. Equation (3) therefore applies in both booms and recessions and $W_X(M)$ embodies the notion that exporters never lobby in any future period, regardless of the state of the economy.

Second, the opportunity cost of lobbying is lower during booms than recessions for a given tariff τ. This follows because, given the definition of indirect utility in (2), $u_X(\tau, A_L) - \phi u_X(0, A_L) = a[u_X(\tau, A_H) - \phi u_X(0, A_H)]$ where $a < 1$. As discussed earlier, this captures the intuitive idea that recessions arise because of negative productivity shocks and thus it is more attractive to use resources for lobbying purposes when resources are less productive in terms of producing output.

The square bracketed term in (3) represents the future value of lobbying; in particular, the increased continuation payoff resulting from an infinitely lived zero applied tariff. Since $\Theta_{\bar{\tau}=0}$ is a recurrent class then

$$\begin{aligned} W_X(\bar{\tau}=0) &= [\pi u_X(0,A_L)+(1-\pi)u_X(0,A_H)]+\beta W_X(\bar{\tau}=0) \\ \Rightarrow W_X(\bar{\tau}=0) &= \tfrac{1}{1-\beta}(\pi a+(1-\pi))u_X(0,A_H). \end{aligned} \tag{4}$$

For the purposes of (3), we can also write

$$\begin{aligned} W_X(M) &= [\pi u_X(\tau_{L,M},A_L)+(1-\pi)u_X(\tau_{H,M},A_H)]+\beta W_X(M) \\ \Rightarrow W_X(M) &= \tfrac{1}{1-\beta}[\pi a u_X(\tau_{L,M},A_H)+(1-\pi)u_X(\tau_{H,M},A_H)]. \end{aligned} \tag{5}$$

Thus, combining (4) and (5), the exporter future value of lobbying is given by

$$W_X(\bar{\tau}=0)-W_X(M)=\frac{1}{1-\beta}[\pi a\delta_{H,X}(\tau_{L,M},0)+(1-\pi)\delta_{H,X}(\tau_{H,M},0)]. \tag{6}$$

That is, the future value of lobbying for exporters derives from having a zero applied tariff in every subsequent period rather than facing the applied tariffs imposed by importers. Given (6) and (3), exporters never lobby regardless of the state of the economy when the following no-lobbying conditions hold for $\omega = H, L$:

$$(1-\phi)u_X(0,A_\omega)-\delta_{\omega,X}(\tau_{\omega,M},0)-\beta[W_X(\bar{\tau}=0)-W_X(M)]\equiv f_{\omega,X}\geq 0. \tag{7}$$

Note that the opportunity cost of lobbying has been divided into two components to highlight that lobbying destroys a proportion of exporter indirect utility but also orchestrates redistribution from importers to exporters because exporters set a zero applied tariff in the period where lobbying takes place.

While the opportunity cost of lobbying is lower during recessions, as discussed above, the future value of lobbying does not depend on whether lobbying takes place in a boom or recession. This has the important implication that, all else equal, exporters' no-lobbying condition during recessions is tighter (i.e. the lobbying threat is stronger) than during booms. Thus, importers must set different applied tariffs in booms and recessions in order to prevent exporters lobbying in booms and recessions. In particular, to offset the stronger lobbying threat during recessions, the applied tariff in recessions must be more attractive to exporters than the applied tariff in booms. This generates lower tariffs in recessions than booms because these lower tariffs mitigate the stronger lobbying threat by increasing the opportunity cost of lobbying (see (3) and (7)) and decreasing the future value of lobbying (see (6)). Thus, when importers maintain control of the government and therefore dictate applied tariffs, applied tariffs are pro-cyclical and, in turn, binding overhang is counter-cyclical.

Figure 2 illustrates the problem faced by importers when preventing exporter lobbying.

Remembering that the no-lobbying condition in either state of the economy depends on the tariffs set in both states of the economy, each no-lobbying condition is represented by a locus in $\tau_{L,M} - \tau_{H,M}$ space. In particular, tariffs lying above the $f_{\omega,X} = 0$ locus indicate tariffs where the no-lobbying condition is violated in the state of the economy ω.[18] Each locus is downward sloping because a lower $\tau_{H,M}$ can accompany a higher $\tau_{L,M}$ and still leave the future value of lobbying unaffected and therefore $f_{\omega,X} = 0$. However, the recession no-lobbying contour curve is steeper than the boom no-lobbying contour curve: a larger increase in $\tau_{H,M}$ can accompany a given decrease in $\tau_{L,M}$ under the recession no-lobbying condition relative to the boom no-lobbying condition.[19] This is for two reasons. First, a lower $\tau_{L,M}$ relaxes the exporter no-lobbying condition more under recessions than booms because $\tau_{L,M}$ affects both the opportunity cost and the future value of lobbying in recessions but only the latter in booms. Second, a higher $\tau_{H,M}$ tightens the exporter no-lobbying condition less in recessions than booms because $\tau_{H,M}$ affects both the opportunity cost and the future value of lobbying in booms but only the latter in recessions.

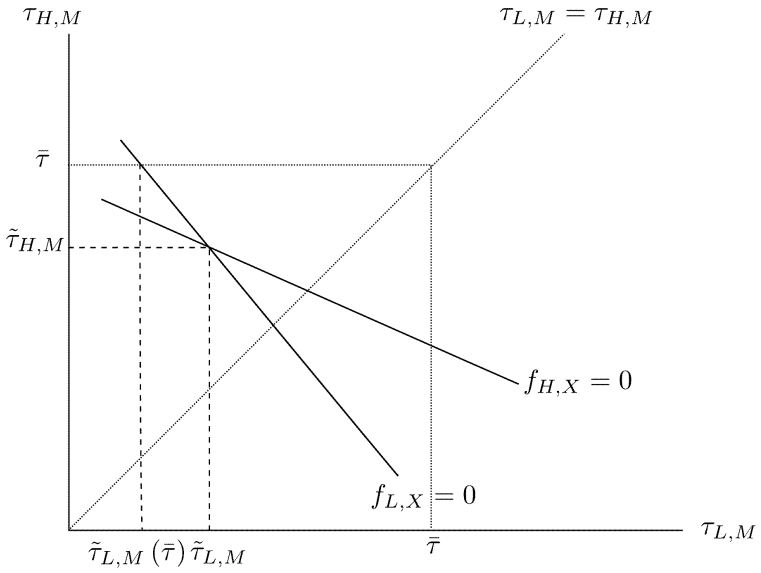

Figure 2: Exporter no-lobbying conditions

The intersection of the two contour curves yields the maximum tariffs, denoted $\tilde{\tau}_{H,M}$ and $\tilde{\tau}_{L,M}$, that importers could set in booms and recessions while still preventing exporters from lobbying in both booms and recessions. As discussed above, the fact that the opportunity

[18] Each locus defines a combination of tariffs that prevent lobbying in the current state not only in the current period but any future period.

[19] Specifically, letting superscripts denote partial derivatives with respect to the given variable, we have $0 > \left.\frac{\partial \tau_{H,M}}{\partial \tau_{L,M}}\right|_{f_{H,X}=0} = -\frac{\lambda_1 a}{(1+\lambda_2)} \frac{\delta_{H,X}^{\tau_{L,M}}(\tau_{L,M},0)}{\delta_{H,X}^{\tau_{H,M}}(\tau_{H,M},0)} > \left.\frac{\partial \tau_{H,M}}{\partial \tau_{L,M}}\right|_{f_{L,X}=0} = -\frac{(1+\lambda_1)a}{\lambda_2} \frac{\delta_{H,X}^{\tau_{L,M}}(\tau_{L,M},0)}{\delta_{H,X}^{\tau_{H,M}}(\tau_{H,M},0)}$ where $\lambda_1 \equiv \frac{\beta}{1-\beta}\pi$ and $\lambda_2 \equiv \frac{\beta}{1-\beta}(1-\pi)$.

cost of lobbying is lower during recessions for any given tariff implies that the no-lobbying condition is slacker in recessions than booms and thus yields $\tilde{\tau}_{L,M} < \tilde{\tau}_{H,M}$. That is, tariffs are pro-cyclical and, hence, binding overhang is counter-cyclical. This is the key result of our analysis, and it is presented formally in Proposition 1 below.

Naturally, real world institutional features constrain the preemptive tariffs that importers set. First, WTO rules constrain importers to set $\tau_{H,M} \leq \bar{\tau}$. Notice that importers could prevent exporter lobbying in booms by setting an applied tariff in excess of the tariff binding $\bar{\tau}$ if the $f_{H,X} = 0$ locus in Figure 2 was higher to the extent that it intersected the $f_{L,X} = 0$ locus above $\tau_{H,M} = \bar{\tau}$. In this case, the applied tariff set by importers in recessions would be that denoted by $\tilde{\tau}_{L,M}(\bar{\tau})$ in Figure 2.[20] Second, import tariffs must be non-negative. Thus, importers can only prevent exporter lobbying in booms and recessions if the intersection of the no-lobbying loci yields $\tilde{\tau}_{L,M} \geq 0$ and $\tilde{\tau}_{H,M} \geq 0$; otherwise, exporters will lobby in some state of the economy even if importers set a zero applied tariff.[21] Letting $\tau^*_{L,M}$ and $\tau^*_{H,M}$ denote the equilibrium tariffs that importers set in booms and recessions, we then have:

$$\tau^*_{L,M} = \begin{cases} \tilde{\tau}_{L,M} \text{ if } 0 \leq \tilde{\tau}_{L,M}, \tilde{\tau}_{H,M} \leq \bar{\tau} \\ \tilde{\tau}_{L,M}(\bar{\tau}) \text{ if } 0 \leq \tilde{\tau}_{L,M} \leq \bar{\tau} < \tilde{\tau}_{H,M} \\ 0 \text{ if } \tilde{\tau}_{L,M} < 0 \end{cases}, \text{ and } \tau^*_{H,M} = \begin{cases} \bar{\tau} \text{ if } \tilde{\tau}_{H,M} > \bar{\tau} \\ \tilde{\tau}_{H,M} \text{ if } \tilde{\tau}_{H,M} \leq \bar{\tau} \end{cases}. \quad (8)$$

Assumption 1 and the foregoing analysis produce the following Lemma:

Lemma 1. *Under Assumption 1, the only situation where a group will cede control of tariff setting is when importers control applied tariff setting and a recession occurs. In this situation, importers cede control if and only if the exporter no-lobbying condition fails for* $\tau_{L,M} = 0$.

And, given Lemma 1, the main result of our paper now follows.

Proposition 1. *When importers maintain control of the government during booms and recessions then applied tariffs are pro-cyclical and binding overhang is counter-cyclical. This cyclicality is strengthened when recessions are more severe. Further, importers are more likely to maintain control of the government when recessions are less severe, when recessions are more frequent and when lobbying is less efficient.*

[20] In this situation, WTO rules constrain the tariff in booms so that it is lower than it needs to be to prevent lobbying. But, the tariff in recessions $\tilde{\tau}_{L,M}(\bar{\tau})$ is still as high as possible such that it prevents lobbying by exporters.

[21] Once the no-lobbying condition of exporters is violated during recessions then, as discussed in the following section, importers will cede control of the government to exporters. In turn, this will alter the functional form of $f_{H,X}$ in (3) because $W_X(M)$ must then embody that importers cede control to exporters during recessions rather than importers maintaining control forever.

As discussed above, applied tariffs are pro-cyclical and binding overhang is counter-cyclical when importers dictate applied tariff setting. The intuition is simple: recessions lower the opportunity cost of exporter lobbying and importers therefore concede lower applied tariffs to prevent exporter lobbying in the face of a stronger exporter lobbying threat. However, Proposition 1 also highlights two further results: the aforementioned cyclicality is strengthened when recessions are more severe and the ability of importers to maintain control of tariff setting is strengthened when recessions are less severe or more frequent and when lobbying is less efficient.

How do economic conditions affect the ability of importers to prevent exporter lobbying? Ultimately, the answer depends on how economic conditions affect the strength of the exporter lobbying threat. In either state of the economy, a change in a parameter representing economic conditions (i.e. a, π, ϕ) has both a direct and an indirect effect on the exporter lobbying threat. Given a state of the economy ω, each parameter can directly affect both the opportunity cost of lobbying and the future value of lobbying, and thus has a direct effect on the exporter lobbying threat.[22] The indirect effect emerges because changes in the preemptive tariff in the other state of the economy will, in turn, affect the attractiveness of lobbying in the present state of the economy.[23] The two effects, which may or may not move in the same direction, are summarized in Table 3 where D denotes the direct effect and I denotes the indirect effect.

The direct and indirect effects of more severe recessions, i.e. a lower a, move in the same direction. In booms, a lower a reduces the future value of exporter lobbying by lowering the present discounted value of future income (see (6)). Thus, the direct effect of a lower a during booms is to shift the $f_{H,X} = 0$ locus upward (see (7)). That is, for a given $\tau_{L,M}$, importers can raise $\tau_{H,M}$ and still avoid exporter lobbying during booms. In recessions, the same effect of a lower a is present but this is outweighed by the fact that a lower a reduces exporters' opportunity cost of lobbying. Thus, the direct effect of a lower a during recessions is to strengthen the exporter lobbying threat and shift the $f_{L,X} = 0$ locus shifts leftward. That is, for a given $\tau_{H,M}$, exporters must set a lower $\tau_{L,M}$ to avoid exporter lobbying during recessions.

The indirect effects reinforce these direct effects. First, on account of the direct effect that lowered $\tau_{L,M}$, the future value of exporter lobbying falls during booms (see (6)). In turn, this relaxes the exporter no-lobbying condition during booms and allows a higher $\tau_{H,M}$. Second, on account of the direct effect that raised $\tau_{H,M}$, the future value of exporter lobbying

[22] This is captured by the shift in the $f_{\omega,X} = 0$ locus and the associated effect on $\tau_{\omega,M}$ holding fixed the importer tariff in the other state of the economy $\omega' \neq \omega$.

[23] This is captured by the shift in the $f_{\omega',X} = 0$ locus.

	$\downarrow a$			$\downarrow \pi$			$\uparrow \phi$		
	D	I	Net	D	I	Net	D	I	Net
$\tau_{H,M}$	$+$	$+$	$+$	$-$	$+$	$-$	$-$	$+$	$-$
$\tau_{L,M}$	$-$	$-$	$-$	$-$	$+$	$-$	$-$	$+$	$+/-$

Table 3: Direct (D) and indirect (I) effects of changing economic conditions on tariffs set by importers

rises during recessions (see (6)). In turn, this tightens the exporter no-lobbying condition during recessions and forces a lower $\tau_{L,M}$ (see (7)). Thus, more severe recessions increase $\tau_{H,M}$ and lower $\tau_{L,M}$ which strengthens the pro-cyclicality of applied tariffs and strengthens the counter-cyclicality of binding overhang. Further, sufficiently severe recessions could force $\tau_{L,M} < 0$ in which case importers have to cede control in recessions to avoid exporter lobbying.

The direct and indirect effect of less frequent recessions, i.e. a lower π, move in opposite directions. Nevertheless, in Appendix C we show that the direct effect dominates. The direct effect of less frequent recessions is to increase the present discounted value of future income which strengthens the exporter lobbying threat. In turn, each $f_{\omega,X} = 0$ locus shifts leftward which, all else equal, lowers $\tau_{\omega,M}$. For the indirect effect, a lower $\tau_{\omega',M}$ reduces the future value of lobbying when the state of the economy is $\omega \neq \omega'$ and, in turn, the weaker exporter lobbying threat induces importers to raise $\tau_{\omega,M}$. However, we show in Appendix C that this indirect effect is outweighed by the direct effect. Thus, less frequent recessions require importers to lower $\tau_{H,M}$ and $\tau_{L,M}$. Indeed, given that $\tau_{H,M} > \tau_{L,M}$, sufficiently infrequent recessions can lead to $\tau_{L,M} < 0$ meaning that importers must cede control in recessions in order to prevent exporter lobbying.

Finally, importers may not be able to avoid exporter lobbying when lobbying is sufficiently efficient, i.e. ϕ is sufficiently high. When lobbying is more efficient, there are fewer productive resources wasted and, thus, the opportunity cost of lobbying is lower in booms and recessions (see (7)). The direct effect of this strengthening of the exporter lobbying threat shifts the no-lobbying loci leftward. In Appendix C, we show that $\tau_{H,M}$ must fall but the effect on $\tau_{L,M}$ is, in general, ambiguous. The intuitive direct effect is present: the stronger exporter lobbying threat on account of more efficient lobbying lowers $\tau_{L,M}$ for any given $\tau_{H,M}$. However, there is also an indirect effect on $\tau_{L,M}$ because the lower $\tau_{H,M}$ means exporters now receive tariff concessions during booms which mitigates the exporter lobbying threat during recessions. In general, which effect dominates is indeterminate. However, given $\tau_{H,M} > \tau_{L,M}$, continual increases in lobbying efficiency must eventually cause $\tau_{L,M}$ to fall. As such, sufficiently efficient lobbying can lead to $\tau_{L,M} < 0$ meaning importers can no longer preemptively avoid

exporter lobbying.

4.3 When exporters dictate applied tariff setting

As explained in the previous section, economic conditions may dictate that the only way importers can prevent exporter lobbying is by ceding control of applied tariff setting. Lemma 1 says this may happen in recessions but not booms with Proposition 1 saying the economic conditions leading to importers ceding control are sufficiently severe recessions, sufficiently infrequent recessions and sufficiently efficient lobbying. Thus, we now analyze how applied tariffs and binding overhang respond to business cycle fluctuations when exporters control the government. Note that, given ceding control is optimal if the opposing group will lobby regardless of the applied tariff, Lemma 1 says exporters will maintain control of the government in booms and recessions once importers cede control in a recession.

Following similar logic to that underlying the exporter no-lobbying conditions of the previous section, importers will not lobby regardless of the state of the economy if the following no-lobbying conditions hold for $\omega = H, L$:

$$\underbrace{u_M(\tau_{\omega,X}, A_\omega) - \phi u_M(\bar{\tau}, A_\omega)}_{\text{opportunity cost of lobbying}} - \beta \underbrace{[W_M(M) - W_M(X)]}_{\text{future value of lobbying}} \geq 0. \tag{9}$$

The interpretation of (9) follows that of (3). In particular, $u_M(\tau, A_L) - \phi u_M(\bar{\tau}, A_L) = a[u_M(\tau, A_H) - \phi u_X(\bar{\tau}, A_H)]$ and thus, given $a < 1$, the opportunity cost of lobbying during recessions is lower than during booms for a given tariff τ.

Further, the one shot deviation principle says a strategy of not lobbying in either booms or recessions is optimal for importers if and only if it is unprofitable to lobby in any single period. Thus, for the purposes of (9), we can treat $W_M(X)$ as embodying that importers never lobby in any future period. Therefore,

$$W_M(X) = \frac{1}{1-\beta}\left[\pi a u_M(\tau_{L,X}, A_H) + (1-\pi) u_M(\tau_{H,X}, A_H)\right]. \tag{10}$$

Moreover, given the implications of Lemma 1 discussed at the beginning of this subsection:

$$\begin{aligned} W_M(M) &= \pi\left[u_M(0, A_L) + \beta W_M(X)\right] + (1-\pi)\left[u_M(\tau_{H,M}, A_H) + \beta W_M(M)\right] \\ \Rightarrow W_M(M) - W_M(X) &= \tfrac{1}{1-\beta(1-\pi)}\left[-\pi a \delta_{H,M}(0, \tau_{L,X}) + (1-\pi)\left(\delta_{H,M}(\tau_{H,X}, \tau_{H,M})\right)\right]. \end{aligned} \tag{11}$$

That is, the future value of lobbying consists of two components. The second component says importers benefit from being able to set $\tau_{H,M}$ rather than face $\tau_{H,X}$ during booms. But, the first component says importers are hurt by the fact they will cede control in recessions

and face a tariff of 0 whereas they would face a recession tariff of $\tau_{L,X} \geq 0$ if exporters have control.[24]

Given the expression for importers' future value of lobbying in (11), the importer no-lobbying conditions in booms and recessions are

$$(1-\phi)\, u_M\left(\bar{\tau}, A_\omega\right) - \delta_{\omega,M}\left(\tau_{\omega,X}, \bar{\tau}\right) - \beta\left[W_M\left(M\right) - W_M\left(X\right)\right] \equiv f_{\omega,M} \geq 0 \tag{12}$$

for $\omega = H, L$. The importer no-lobbying conditions in (12) are analogous to the exporter no-lobbying conditions (7). In particular, while the opportunity cost of lobbying is lower during recessions, as discussed above, the future value of lobbying does not depend on whether lobbying takes place in a boom or recession. Thus, all else equal, importers' no-lobbying condition during recessions is tighter than during booms and, in turn, exporters must set higher tariffs in recessions relative to booms in order to prevent importer lobbying. That is, when exporters maintain control of the government and thus dictate applied tariffs, applied tariffs are counter-cyclical and, in turn, binding overhang is pro-cyclical. This is our main result of the current section, which is stated formally in the following proposition.

Proposition 2. *When the economy is subject to business cycle fluctuations and exporters maintain control of the government during booms and recessions, applied tariffs are counter-cyclical and binding overhang is pro-cyclical.*

Figure 3 illustrates the problem faced by exporters when attempting to prevent importer lobbying by depicting the importer no-lobbying loci. Like Figure 2, each locus is downward sloping and the no-lobbying locus is steeper during recessions than booms.[25] If the $f_{H,M}$ locus were lower to the extent that it intersected the $f_{L,M}$ locus below $\tau_{H,M} = 0$ then exporters could prevent importer lobbying by setting a negative applied tariff. However, given the institutional constraint that tariffs must be non-negative, exporters must set $\tau_{H,M} = 0$ in this case and, in turn, the tariff they set in recessions is denoted by $\tau_{L,X} = \tilde{\tau}_{L,X}\left(0\right)$ in Figure 3. Moreover, exporters can prevent importer lobbying in recessions and booms because part ii) of Assumption 1 says the intersection of the no-lobbying loci yields $\tilde{\tau}_{L,X} \leq \bar{\tau}$ and $\tilde{\tau}_{H,M} \leq \bar{\tau}$.[26]

However, unlike the exporter no-lobbying conditions in (7) which only contain the two

[24] Recall that exporters have tariff-setting control because importers ceded it during a recession. Since this was profitable in a previous recession, it will be profitable in any future recession. Hence, importers will always cede control during a recession and thus face the 0 tariff set by exporters in that period.

[25] Formally, letting superscripts denote partial derivatives with respect to a given variable, $0 > \frac{\partial \tau_{H,X}}{\partial \tau_{L,X}}\Big|_{f_{H,M}=0} = -\left[\lambda_4 \delta^{\tau_{H,X}}_{H,M}\left(\tau_{H,X}, \tau_{H,M}\right) + \delta^{\tau_{H,X}}_{H,M}\left(\tau_{H,X}, \bar{\tau}\right)\right]^{-1}\left[\lambda_3 a \delta^{\tau_{L,X}}_{H,M}\left(0, \tau_{L,X}\right)\right] > \frac{\partial \tau_{H,X}}{\partial \tau_{L,X}}\Big|_{f_{H,M}=0} = -\left[\lambda_4 \delta^{\tau_{H,X}}_{H,M}\left(\tau_{H,X}, \tau_{H,M}\right)\right]^{-1}\left[\lambda_3 a \delta^{\tau_{L,X}}_{H,M}\left(0, \tau_{L,X}\right) + a \delta^{\tau_{L,X}}_{H,M}\left(\tau_{L,X}, \bar{\tau}\right)\right]$ where $\lambda_3 \equiv \frac{\beta\pi}{1-\beta(1-\pi)}$ and $\lambda_4 \equiv$

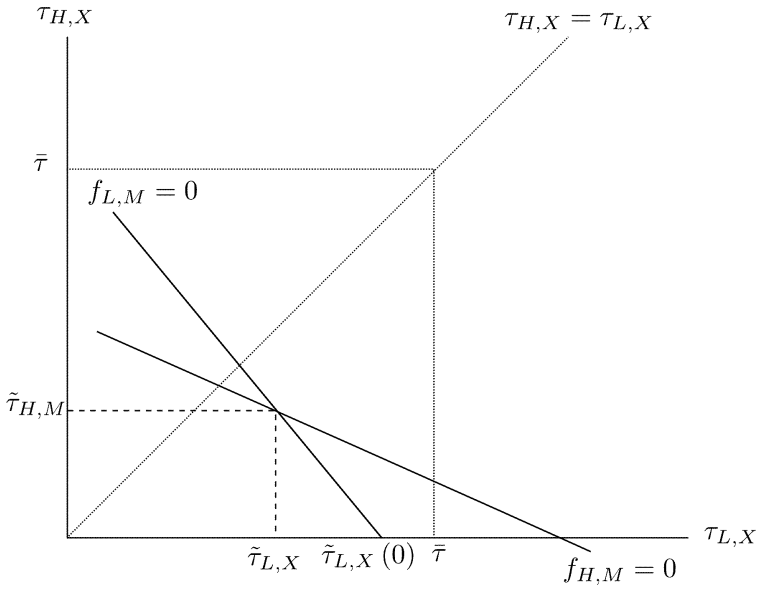

Figure 3: Importer no-lobbying conditions

endogenous variables $\tau_{H,M}$ and $\tau_{L,M}$, the importer no-lobbying conditions in (12) contain not only the two analogous endogenous variables $\tau_{H,X}$ and $\tau_{L,X}$ but also a third endogenous variable $\tau_{H,M}$. The intersection of the no-lobbying loci in Figure 3 for the equilibrium value of $\tau_{H,M}$ implicit in (8) yields the minimum tariffs, $\tilde{\tau}_{H,X}$ and $\tilde{\tau}_{L,X}$, that exporters could set in booms and recessions and still prevent importer lobbying. Thus, the equilibrium tariffs set by exporters are given by:

$$\tau^*_{L,X} = \begin{cases} \tilde{\tau}_{L,X} \text{ if } 0 \leq \tilde{\tau}_{L,X}, \tilde{\tau}_{H,X} \leq \bar{\tau} \\ \tilde{\tau}_{L,X}(0) \text{ if } \tilde{\tau}_{H,X} < 0 \leq \tilde{\tau}_{L,X} \leq \bar{\tau} \end{cases}, \text{ and } \tau^*_{H,X} = \begin{cases} 0 \text{ if } \tilde{\tau}_{H,X} < 0 \\ \tilde{\tau}_{H,X} \text{ if } \tilde{\tau}_{H,X} \geq 0 \end{cases}. \quad (13)$$

In terms of the effect of economic conditions on the strength of the importer no-lobbying threat, the direct and indirect effects discussed with regards to the exporter lobbying threat are again present and work in an identical manner.[27] That is, if a change in a parameter strengthens the exporter lobbying threat via the direct or indirect effect then the same will hold true for the importer lobbying threat via similar logic. These effects are summarized in Table 4 with the direct effect denoted D and the indirect effect denoted I_1.

However, the presence of the third endogenous variable $\tau_{H,M}$ in the importer no-lobbying conditions creates a second indirect effect, denoted I_2 in Table 4. This second effect arises

$\frac{\beta(1-\pi)}{1-\beta(1-\pi)}$.

[26] In the case of $\tilde{\tau}_{\omega,X} > \bar{\tau}$, importers would lobby when the state of the economy was ω even if exporters set the applied tariff equal to the tariff binding. This would create a situation where control of tariff setting would continually shift between importers and exporters. We do not analyze this case.

[27] See Appendix C for comparative statics when exporters have control of the government.

	$\downarrow a$				$\downarrow \pi$				$\uparrow \phi$			
	D	I_1	I_2	Net	D	I_1	I_2	Net	D	I_1	I_2	Net
$\tau_{H,X}$	$-$	$-$	$+$	$+/-$	$+$	$-$	$+/-$	$+/-$	$+$	$-$	$-$	$+/-$
$\tau_{L,X}$	$+$	$+$	$+$	$+$	$+$	$-$	$+/-$	$+/-$	$+$	$-$	$-$	$+/-$

Table 4: Direct (D), 1st indirect (I_1) and 2nd indirect (I_2) effects of changing economic conditions on tariffs when exporters dictate applied tariffs

because changes in economic conditions affect $\tau_{H,M}$ when importers dictate applied tariff setting which, in turn, affects the strength of the importer lobbying threat when exporters dictate applied tariff setting. With more severe recessions, $\tau_{H,M}$ rises when importers dictate applied tariff setting (see Table 3) which increases importers' future value of lobbying when exporters dictate applied tariff setting. In turn, $\tau_{H,X}$ and $\tau_{L,X}$ rise. Thus, as Table 4 shows, more severe recessions raise $\tau_{L,X}$ overall but have an ambiguous effect on $\tau_{H,X}$.

When importers dictate tariff setting, more efficient lobbying strengthens the exporter lobbying threat. In turn, the importer lobbying threat is weaker when exporters dictate tariff setting. Thus, as Table 4 shows, the second indirect effect is negative and the overall effect of more efficient lobbying has an ambiguous effect on the tariffs set by exporters. Moreover, the sign of the second indirect effect regarding less frequent recessions is ambiguous as is the overall effect. While there are many ambiguities in Table 4, it is useful to remember that these ambiguities (except that of ϕ on $\tau_{L,X}$) arise entirely because of this second indirect effect.

5 Discussion

5.1 Probabilistic lobbying success

So far we have assumed that the opposing group captures the government if it chooses to lobby. However, this assumption can easily be relaxed. Instead, suppose that lobbying by the opposing group is unsuccessful with some exogenous probability q. That is, lobbying is successful with probability $1-q$. In the event of unsuccessful lobbying by group i', group i retains control of setting the applied tariff, and the tariff binding remains unchanged.

Following earlier logic, the exporter no-lobbying conditions in (3) now become

$$\underbrace{(1-\phi)\,u_X\left(0,A_\omega\right)-(1-\phi q)\,\delta_{\omega,X}\left(\tau_{\omega,M},0\right)}_{\text{Expected opportunity cost of lobbying}}-\beta\underbrace{(1-q)\left[W_X\left(\bar{\tau}=0\right)-W_X\left(M\right)\right]}_{\text{Expected future value of lobbying}}\equiv f_{\omega,X}\geq 0 \tag{14}$$

for $\omega = H, L$. These no-lobbying conditions have the familiar form from earlier sections.

Notice that the possibility of unsuccessful lobbying has two effects on the no-lobbying conditions. First, the expected opportunity cost of lobbying is higher due to the $\phi q \delta_{\omega,X}(\tau_{\omega,M}, 0)$ term. This term represents the fact that the applied tariff remains at $\tau_{\omega,M}$ rather than falling to zero if lobbying is unsuccessful even though the costs of lobbying are still incurred. Second, the expected future value of lobbying falls because the gain $W_X(\bar{\tau} = 0) - W_X(M)$ is now only realized upon lobbying with probability $1 - q$. Thus, the possibility of unsuccessful lobbying relaxes the no-lobbying conditions and allows importers to raise preemptive tariffs. Nevertheless, like in earlier sections, the opportunity cost of lobbying is lower in recessions than booms meaning importers must concede lower tariffs in recessions than booms in order to prevent exporter lobbying. Hence, our main result in Proposition 1 remains: applied tariffs are pro-cyclical and binding overhang is counter-cyclical when importers dictate applied tariffs.

Similarly, following earlier logic, the importer no-lobbying conditions in (12) now become

$$\underbrace{(1-\phi)\, u_M(\bar{\tau}, A_\omega) - (1-\phi q)\, \delta_{\omega,M}(\tau_{\omega,X}, \bar{\tau})}_{\text{Expected opportunity cost of lobbying}} - \beta \underbrace{(1-q)\left[W_M(M) - W_M(X)\right]}_{\text{Expected future value of lobbying}} \equiv f_{\omega,M} \geq 0 \tag{15}$$

for $\omega = H, L$. As just described in the case of exporter lobbying, (15) shows that the possibility of unsuccessful lobbying increases the expected opportunity cost of lobbying and lowers the expected future value of lobbying. Thus, the possibility of unsuccessful lobbying relaxes the no-lobbying conditions. Nevertheless, as described in the previous paragraph, the possibility of unsuccessful lobbying still leaves the opportunity cost of lobbying lower in recessions than booms. Thus, exporters must concede higher tariffs in recessions than booms in order to prevent importer lobbying and the result in Proposition 2 remains: applied tariffs are counter-cyclical and binding overhang is pro-cyclical.

5.2 Simultaneous lobbying

In our basic model, the only group that lobbied was the opposing group. However, we now extend our analysis to the case of simultaneous lobbying. The main insights from Section 4 still emerge: because the opportunity cost of lobbying is lower during recessions than booms then, all else equal, the preemptive tariff that importers set during recessions is lower than the tariff that importers set during booms (see Proposition 1).

Specifically, consider the case where importers are dictating applied tariffs and exporters are the opposing group with the following modification to Stage 3 of the game (see Section 3.2): exporters must first decide whether to initiate a lobbying war and then, if a lobbying war is initiated, importers and exporters simultaneously choose an amount of labor to

hire for lobbying. As in Section 3.2, if exporters win the lobbying war then they capture the government and thereby nominate an applied tariff for the current period and a new tariff binding. Alternatively, if exporters are unsuccessful in winning the lobbying war then importers maintain capture of the government and nominate the applied tariff $\tau_{\omega,M}$.

Letting $L_{\omega,i,R}$ denote the amount of labor used for lobbying (or, equivalently, "rent-seeking") by group $i \in \{X, M\}$ when the state of the economy is $\omega \in \{H, L\}$, we let the probability that importers win the lobbying war, and hence maintain control of the government, be

$$q\left(L_{\omega,M,R}, L_{\omega,X,R}\right) = \frac{L_{\omega,M,R}}{L_{\omega,R}} \tag{16}$$

where $L_{\omega,R} = L_{\omega,M,R} + L_{\omega,X,R}$. That is, $q(\cdot)$ is the endogenous probability of unsuccessful lobbying by exporters. After the applied tariff, and potentially the tariff binding, is implemented by the government then each group i hires an amount of production labor $L_i\left(w\left(\tau, L_{\omega,R}\right)\right)$ at the equilibrium production wage $w\left(\tau, L_{\omega,R}\right)$.

Given that exporters initiate a lobbying war, their optimal choice of labor for lobbying is determined by the following optimization problem:[28]

$$\begin{aligned} &\max_{L_{\omega,X,R}} \left(1 - q\left(L_{\omega,X,R}, L_{\omega,M,R}\right)\right)\left[u_X\left(0, A_\omega, L_X\left(w\left(0, L_{\omega,R}\right)\right)\right) + \beta W_X\left(\bar{\tau} = 0\right)\right] \\ &+q\left(L_{\omega,X,R}, L_{\omega,M,R}\right)\left[u_X\left(\bar{\tau}, A_\omega, L_X\left(w\left(\bar{\tau}, L_{\omega,R}\right)\right)\right) + \beta W_X\left(M\right)\right]. \end{aligned} \tag{17}$$

The one period payoff for group i is $u_i\left(\tau, A_\omega, L_i, L_{\omega,i,R}\right) = p_i F_i\left(L_i, K_i\right) - w\left(\tau, L_{\omega,R}\right) L_i - w_{\omega,R} L_{\omega,i,R} = p_i F_i^K\left(L_i, K_i\right) K_i - w_{\omega,R} L_{\omega,i,R}$ where i) p_i is the domestic price of the good produced by group i, ii) $F_i(\cdot)$ is the constant returns to scale production function for output of group i which is proportional to the aggregate productivity parameter A_ω and depends on labor and the endowment of capital specific to sector i, iii) $F_i^K(\cdot)$ is the marginal product of the capital specific to sector i and iv) $w_{\omega,R}$ denotes the equilibrium wage paid to labor used for lobbying given the state of the economy ω.[29] Solving the first order conditions associated with exporters' choice of lobbying $L_{\omega,X,R}$ (see (17)) and importers' choice of lobbying $L_{\omega,M,R}$,

[28] Importers solve an analogous optimization problem with the appropriate substitutions: $\max_{L_{\omega,M,R}} \left(1 - q\left(L_{\omega,X,R}, L_{\omega,M,R}\right)\right)\left[u_M\left(0, A_\omega, L_M\left(0, L_{\omega,R}\right)\right) + \beta W_M\left(\bar{\tau} = 0\right)\right] + q\left(L_{\omega,X,R}, L_{\omega,M,R}\right)\left[u_M\left(\bar{\tau}, A_\omega, L_M\left(\bar{\tau}, L_{\omega,R}\right)\right) + \beta W_M\left(M\right)\right]$.

[29] Note that there are three wage variables for each state of the economy $\omega = H, L$: the wage paid to labor hired for lobbying $w_{\omega,R}$, the wage paid to production labor if importers win the lobbying war $w\left(\bar{\tau}, L_{\omega,R}\right)$, and the wage paid to production labor if exporters win the lobbying war $w\left(0, L_{\omega,R}\right)$. These wages are related via the equilibrium condition that workers are indifferent between being hired for production or lobbying: $w_{\omega,R} = q\left(L_{\omega,M,R}, L_{\omega,X,R}\right) w\left(\bar{\tau}, L_{\omega,R}\right) + \left(1 - q\left(L_{\omega,M,R}, L_{\omega,X,R}\right)\right) w\left(0, L_{\omega,R}\right)$.

we find that

$$q_i(\cdot) = \frac{1}{1+v} \text{ where } v \equiv \frac{\delta_{\omega,X}(\bar{\tau},0) + \beta\left[W_X(\bar{\tau}=0) - W_X(M)\right]}{\delta_{\omega,M}(0,\bar{\tau}) + \beta\left[W_M(M) - W_M(\bar{\tau}=0)\right]}. \tag{18}$$

That is, the equilibrium probability of exporters being unsuccessful in winning the lobbying war is inversely related to the the value they place on winning the lobbying war relative to the value that importers place on winning the lobbying war (see Appendix A for a derivation of $q(\cdot)$ and a complete description of the labor market).

Exporters do not initiate a lobbying war if

$$\begin{aligned} u_X\left(\tau_{\omega,M}, A_\omega, L_X^{NR}\right) + \beta W_X(M) \quad \geq \quad & (1-q(\cdot))\left[u_X\left(0, A_\omega, L_i\left(w\left(0, L_{\omega,R}\right)\right)\right) + \beta W_X(X)\right] \\ & + q(\cdot)\left[u_X\left(\bar{\tau}, A_\omega, L_i\left(w\left(\bar{\tau}, L_{\omega,R}\right)\right)\right) + \beta W_X(M)\right] \end{aligned}$$

where L_X^{NR} denotes the production labor hired by exporters in the absence of a lobbying war. This reduces to

$$\begin{aligned} & \underbrace{u_X\left(\tau_{\omega,M}, A_\omega, L_X^{NR}\right) - (1-q(\cdot))\, u_X\left(0, A_\omega, L_X\left(w\left(0,\cdot\right)\right)\right) - q(\cdot)\, u_X\left(\overline{\tau}, A_\omega, L_X\left(w\left(\overline{\tau},\cdot\right)\right)\right)}_{\text{Expected opportunity cost of lobbying}} \\ \geq \quad & \beta \underbrace{(1-q(\cdot))\left[W_X(X) - W_X(M)\right]}_{\text{Expected future value of lobbying}}. \end{aligned}$$

So again we have the familiar formulation that lobbying does not take place when the (expected) opportunity cost of lobbying exceeds the (expected) future value of lobbying.

Two key questions now follow. Is the exporter no-lobbying condition tighter, i.e. the exporter lobbying threat stronger, during recessions than booms because of a lower opportunity cost of lobbying? And, if so, do pro-cyclical tariffs emerge as a result of importers dealing with the stronger exporter lobbying threat by setting lower tariffs in recessions than booms? In previous sections, the answer to both questions was yes.

In Sections 4.2, 4.3, and 5.1, the opportunity cost of lobbying was proportional to A_ω (see, e.g., equations (2) and (7)) and thus lower during recessions. This was interpreted as a "direct productivity effect": labor was less productive during recessions which increased the attractiveness of using scarce labor resources for non-production purposes. Implicitly, the model setup said that recessions did not affect the allocation of labor between the import and export sectors regardless of whether lobbying took place and, in turn, recessions did not affect the allocation of labor between lobbying and the production of output. The fact that the production functions are now explicitly proportional to the aggregate productivity parameter A_ω implies that recessions do not affect the allocation of labor between the import

and export sectors for *fixed* levels of lobbying.[30] Thus, for fixed lobbying and hence fixed $q(\cdot)$, the direct productivity effect still implies that the opportunity cost of lobbying is lower in recessions than booms. Therefore, all else equal, importers still face a stronger exporter lobbying threat in recessions than booms in the presence of simultaneous lobbying.

However, the difference between earlier sections and the current simultaneous lobbying setup is that recessions can affect the allocation of labor between lobbying and production. In turn, recessions can affect the relative lobbying efforts of importers and exporters and thus the probability that exporters win the lobbying war. Conditional on a lobbying war taking place, the effect of recessions on the level of lobbying is ambiguous. On one hand, the downward pressure on wages during recessions lowers the marginal cost of hiring labor for lobbying. However, by lowering the marginal product of capital, the recession also lowers the marginal benefit of ensuring the applied tariff is 0 in the current period rather than $\bar{\tau}$.[31] Thus, conditional on a lobbying war, it is unclear whether a recession creates stronger or weaker incentives to hire labor for lobbying. Further, it is thus unclear how a recession affects the exporter no-lobbying conditions via the probability of exporters winning a lobbying war. Therefore, the direct productivity effect that was the driving force behind earlier results remains the key insight when comparing the opportunity cost of lobbying between booms and recessions.

The second question noted above is whether importers deal with a stronger exporter lobbying threat in recessions relative to booms by setting lower applied tariffs in recessions than booms. A lower $\tau_{L,M}$ affects the no-lobbying conditions through three avenues: directly via the opportunity cost and the future value of lobbying, indirectly via the probability of winning a lobbying war, and indirectly via the effect on the level of production labor. The main effect is the same as in previous sections: with a fixed labor allocation (between importers and exporters as well as between production and lobbying) and a fixed $q(\cdot)$, importers neutralize the stronger lobbying threat of exporters in recessions relative to booms by setting the recession tariff $\tau_{L,M}$ lower than the boom tariff $\tau_{H,M}$ because this raises the opportunity cost and lowers the future value of exporter lobbying.

But a lower $\tau_{L,M}$ could also affect both the probability of winning the lobbying war and also the amount of labor used for production. Equation (18) shows that the impact

[30] To see this, note that labor market equilibrium requires that the marginal revenue product of labor equalize between the import and export sectors. In other words, the ratio of the marginal revenue products across sectors must equal 1; since the production functions are proportional to A_ω, this holds regardless of the value of A_ω and thus regardless of whether the current period is a recession or boom.

[31] These offsetting forces can be seen in Appendix A where (19) gives the FOC for exporters choice of lobbying conditional on a lobbying war taking place. The lower marginal benefit in the text refers to $\delta_{L,X}(\bar{\tau},0) < \delta_{H,X}(\bar{\tau},0)$ when comparing the right hand side of (19) between booms and recessions given $F_i^K(\cdot)$ is proportional to A_ω.

on $q(\cdot)$ is ambiguous because a lower $\tau_{L,M}$ lowers the future value of winning the lobbying war for both importers and exporters: exporters now gain less by forcing the tariff to zero and importers lose less if exporters force the tariff to zero. Finally, since a lower $\tau_{L,M}$ reduces the future value of lobbying, the marginal benefit of lobbying falls.[32] All else equal, this reduces the lobbying that takes place in a lobbying war, resulting in higher levels of production. The higher level of output reduces the opportunity cost of lobbying and thus partially mitigates the main effect outlined in the previous paragraph whereby a lower $\tau_{L,M}$ works to eliminate the exporter lobbying threat by raising the opportunity cost of lobbying. Therefore, allowing for simultaneous lobbying should actually increase the extent to which importers need to lower $\tau_{L,M}$ in order to prevent exporter lobbying. That is, if anything, simultaneous lobbying appears to increase the degree of tariff pro-cyclicality.

6 Conclusion

This paper contributes to a small but growing literature that analyzes why countries set their applied tariffs below the tariff bindings negotiated in the WTO. Rather than modify or extend the traditional terms of trade-based model of trade agreements, we develop a novel, dynamic, single-country model emphasizing domestic political competition. Viewing the government as being captured by either the interests of the importer-competing or export sectors, tariff fluctuations naturally emerge as a means for the group who has captured the government to mitigate the time-varying lobbying threat of the opposing group. As a result, binding overhang emerges in equilibrium. This framework allows us to make two distinct contributions.

First, we show that when import-competing interests have captured the government and are dictating applied tariffs, binding overhang is counter-cyclical and applied tariffs are pro-cyclical. This result matches our empirical observations that binding overhang is counter-cyclical in developing countries, where importers have a significant degree of influence over tariff policy. Further, to our knowledge, ours is the first theory to explain the pro-cyclicality of applied tariffs. The key intuition is simple: the opportunity cost of lobbying by exporters is lower during recessions because recessions are associated with lower productivity and so using labor for lobbying rather than producing output is relatively attractive during recessions. Thus, importers preemptively nominate lower applied tariffs during recessions to prevent exporters from lobbying and gaining influence over tariff-setting.

Our second contribution is that we provide a structural interpretation for the existence of

[32] See equation (19) in Appendix A and note that the lower $\tau_{L,M}$ does not affect the opportunity cost of lobbying in booms or recessions.

a random political pressure variable in terms of trade-based models of trade agreements. Such models generate binding overhang in equilibrium because exogenous *ex post* random political pressure generates *ex ante* demand for flexibility in applied tariff setting. However, we develop a model where the dynamics of domestic political competition, based on time varying opportunity costs of lobbying, lead to lobbying threats whose intensity endogenously varies over time. The time varying intensity of lobbying threats drives the dynamic fluctuations in binding overhang and can be interpreted as a random political pressure variable.

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Appendix

A Simultaneous lobbying

Derivation of endogenous $q(\cdot)$

Before solving the exporters' optimization problem in (17), note that i) $\frac{\partial W_X(\cdot)}{\partial L_{\omega,X,R}} = 0$ because the only link between $L_{\omega,X,R}$ and the continuation payoff is via the probability of winning the current period lobbying war and ii) exporters take wages as given. Thus, the first order condition to (17) is

$$w_{\omega,R} = -\frac{\partial q(.)}{\partial L_{\omega,R,X}}\left[u_X(0, A_\omega, L_X) + \beta W_X(\bar{\tau} = 0)\right] + \frac{\partial q(.)}{\partial L_{\omega,R,X}}\left[u_i(\bar{\tau}, A_\omega, L_X) + \beta W_X(M)\right]$$

which simplifies to

$$w_{\omega,R} = -\frac{\partial q(.)}{\partial L_{\omega,R,X}}\left[\delta_{\omega,X}(\bar{\tau}, 0) + \beta\left[W_X(\bar{\tau} = 0) - W_X(M)\right]\right]. \tag{19}$$

Analogously, we have the following for importers:

$$w_{\omega,R} = \frac{\partial q(.)}{\partial L_{\omega,R,M}}\left[\delta_{\omega,M}(0, \bar{\tau}) + \beta\left[W_M(M) - W_M(\bar{\tau} = 0)\right]\right]. \tag{20}$$

And we also have

$$\frac{\partial q(.)}{\partial L_{\omega,R,X}} = \frac{-L_{\omega,M,R}}{\left(L_{\omega,M,R} + L_{\omega,X,R}\right)^2} < 0 \text{ and } \frac{\partial q(.)}{\partial L_{\omega,M,X}} = \frac{L_{\omega,X,R}}{\left(L_{\omega,M,R} + L_{\omega,X,R}\right)^2} > 0. \tag{21}$$

Thus, (18) follows by equating the FOCs (19) and (20) and then using (21).

Labour market equilibrium

For each state of the economy $\omega = H, L$, there are 10 endogenous variables that characterize the labor market equilibrium when a lobbying war takes place: importer lobbying $L_{\omega,M,R}$; exporter lobbying $L_{\omega,X,R}$; labor used by exporters to produce output when exporters win the lobbying war, i.e. $L_X(w(0, L_{\omega,R}))$, and when importers win the lobbying war, i.e. $L_X(w(\bar{\tau}, L_{\omega,R}))$; labor used by importers to produce output when exporters win the lobbying war, i.e. $L_M(w(0, L_{\omega,R}))$, and when importers win the lobbying war, i.e. $L_M(w(\bar{\tau}, L_{\omega,R}))$; wages paid to labor hired for lobbying $w_{\omega,R}$; wages paid to labor hired for production of output when exporters win the lobbying war, i.e. $w(0, L_{\omega,R})$, and when importers win the lobbying war, i.e. $w(\bar{\tau}, L_{\omega,R})$; the probability that exporters are unsuccessful in winning the lobbying war $q(L_{\omega,M,R}, L_{\omega,X,R})$.

For each state of the economy $\omega = H, L$, we have 10 equations to solve the 10 endogenous variables. First, we have the 2 FOCs for $L_{\omega,M,R}$ and $L_{\omega,X,R}$ given by (19) and (20). Second, we have the 2 FOCs for production labor when exporters win the lobbying war, i.e. $L_X\left(w\left(0, L_{\omega,R}\right)\right)$ and $L_M\left(w\left(0, L_{\omega,R}\right)\right)$, whereby the wage must equal the marginal revenue product of labor. Third, we have the 2 FOCs for production labor when importers win the lobbying war, i.e. $L_X\left(w\left(\bar{\tau}, L_{\omega,R}\right)\right)$ and $L_M\left(w\left(\bar{\tau}, L_{\omega,R}\right)\right)$, whereby the wage must equal the marginal revenue product of labor. Fourth, we have the two full employment conditions $\bar{L} = L_{\omega,R} + L_X\left(w\left(\tau, L_{\omega,R}\right)\right) + L_M\left(w\left(\tau, L_{\omega,R}\right)\right)$ corresponding to whether exporters win the lobbying war, i.e. $\tau = 0$, or importers win the lobbying war, i.e. $\tau = \bar{\tau}$. Fifth, we have the condition whereby workers are indifferent between being hired for lobbying or production: $w_{\omega,R} = q\left(L_{\omega,M,R}, L_{\omega,X,R}\right) w\left(\bar{\tau}, L_{\omega,R}\right) + \left(1 - q\left(L_{\omega,M,R}, L_{\omega,X,R}\right)\right) w\left(0, L_{\omega,R}\right)$. Finally, we have (16) which defines the probability exporters will be unsuccessful in winning the lobbying war.

B Proofs

Proof of Lemma 1

Consider a strategy profile where players never cede control if they can maintain control by nominating an applied tariff such that the no-lobbying condition of the opposing group holds. We will show there is no profitable one-shot deviation whereby the dictating group cedes control in the current period but never cedes control again. Thus, by the one shot deviation principle, it is optimal to maintain control where possible.

We begin by supposing exporters have control. Will exporters deviate and cede control? Noting that only ceding control in booms is not optimal for importers (because $\tau^*_{H,M} > \tau^*_{L,M}$ and $a < 1$ imply that $u_M\left(0, A_L\right) - u_M\left(\tau^*_{L,M}, A_L\right) + \beta\left[W_M\left(X\right) - W_M\left(M\right)\right] > u_M\left(0, A_H\right) - u_M\left(\tau^*_{H,M}, A_H\right) + \beta\left[W_M\left(X\right) - W_M\left(M\right)\right]$), there are two subcases to consider. First, suppose importers cede control in recessions and booms. Thus, exporters will regain control in the following period if they cede control in the current period and hence, given that $\tau^*_{L,X} > \tau^*_{H,X}$, the maximum gain from the one-shot deviation is $\delta_{L,X}\left(\tau^*_{L,X}, \bar{\tau}\right) + \delta_{L,X}\left(\tau^*_{L,X}, 0\right)$. In turn, a sufficient condition for the one-shot deviation to be unprofitable is $\delta_{L,X}\left(\tau^*_{L,X}, \bar{\tau}\right) + \delta_{L,X}\left(\tau^*_{L,X}, 0\right) < 0$ which is part iii) of Assumption 1. Second, suppose importers cede control only in recessions. By ignoring discounting, the following is an upper bound on the exporter expected benefit of the one-shot deviation when the state of the economy is ω: $\Delta \equiv -\delta_{\omega,X}\left(\bar{\tau}, \tau^*_{\omega,X}\right) - \left(\frac{1}{\pi} - 1\right)\delta_{H,X}\left(\tau^*_{H,M}, \tau^*_{H,X}\right) + \delta_{L,X}\left(\tau^*_{L,X}, 0\right)$.[33] Thus, rearranging

[33] The interpretation of the terms in Δ is as follows: i) the first term reflects the lost payoff due to ceding control in the current period, ii) the second terms reflects the change in the payoff associated with the

$\Delta < 0$ yields the following sufficient condition for the one-shot deviation to be unprofitable: $\pi\delta_{L,X}\left(0, \tau^*_{L,X}\right) + (1-\pi)\,\delta_X\left(\tau^*_{H,M}, \tau^*_{H,X}\right) > 0$ which is part v) of Assumption 1. Therefore, given part ii) of Assumption 1, exporters never cede control.

Now suppose importers have control. Note, ceding control is costly for importers: exporters nominate a zero tariff in the current period if importers cede control and $u_M\left(\tau^*_{\omega,M}, A_\omega\right) \geq u_M\left(0, A_\omega\right)$. Given we have established exporters never cede control, then the importer continuation payoff from ceding control is $W_M(X) = \frac{1}{1-\beta}\left[\pi u_M\left(\tau^*_{L,X}, A_L\right) + (1-\pi)\,u_M\left(\tau^*_{H,X}, A_H\right)\right]$ and ceding control is unprofitable if $W_M(M) - W_M(X) > 0$. If importers can maintain control in booms and recessions then $W_M(M) \geq \frac{1}{1-\beta}\left[\pi u_M\left(\tau^*_{L,M}, A_L\right) + (1-\pi)\,u_M\left(\tau^*_{H,M}, A_H\right)\right]$. Thus, ceding control is not optimal if $\pi\delta_{L,M}\left(\tau^*_{L,X}, \tau^*_{L,M}\right) + (1-\pi)\,\delta_{H,M}\left(\tau^*_{H,X}, \tau^*_{H,M}\right) > 0$ which is part iv) of Assumption 1. If importers cannot maintain control in recessions, then never ceding control in booms implies $W_M(M) - W_M(X)$ is given by (11). In turn, ceding control during booms is not optimal if $\pi\delta_{L,M}\left(\tau^*_{L,X}, 0\right) + (1-\pi)\,\delta_{H,M}\left(\tau^*_{H,X}, \tau^*_{H,M}\right) > 0$ which is part iv) of Assumption 1 with $\tau^*_{L,M} = 0$.

Finally, part i) of Assumption 1 implies importers may not be able to maintain control in recessions. In this case, i.e. when $\tau^*_{L,M} < 0$, it is optimal for importers to cede control because otherwise exporters will lobby and a zero tariff binding will follow and we have $W_M(X) - W_M(\bar{\tau} = 0) = \frac{1}{1-\beta}\left[\pi\delta_{L,M}\left(0, \tau^*_{L,X}\right) + (1-\pi)\,\delta_{H,M}\left(0, \tau^*_{H,X}\right)\right] > 0$.■

Proof of Proposition 1

Lemma 1 implies importers maintain control of tariff setting when possible. In this case, by construction, their optimal tariffs are given by (8). Note that the future value of exporter lobbying (see (6)) is independent of the current period state of the economy ω. Moreover, the opportunity cost of exporter lobbying (see (3)) is lower in recessions than booms for a given tariff τ because $u_X(\tau, A_L) - \phi u_X(0, A_L) = a\left[u_X(\tau, A_H) - \phi u_X(0, A_H)\right]$ and $a < 1$. Thus, $f_{H,X} > f_{L,X}$ for a given tariff τ and, in turn, $f_{H,X} = f_{L,X} = 0$ requires $\tau_{L,M} < \tau_{H,M}$ given $\frac{\partial f_{\omega,X}}{\partial \tau} < 0$. Hence, applied tariffs are pro-cyclical and binding overhang is counter-cyclical.

For the degree of cyclicality and the likelihood of importers maintaining control of the government, we rely on the comparative statics derived in Appendix C (see (28)). The degree of cyclicality is increasing in the severity of recessions because $\frac{\partial\left(\tau_{H,M} - \tau_{L,M}\right)}{\partial a} < 0$ since $\frac{\partial \tau_{H,M}}{\partial a} < 0 < \frac{\partial \tau_{L,M}}{\partial a}$. Moreover, importers are more likely to maintain control of the government, i.e. $\tilde{\tau}_{L,M} > 0$, under the conditions described in the proposition because $\frac{\partial \tau_{L,M}}{\partial a} > 0$, $\frac{\partial \tau_{L,M}}{\partial \pi} > 0$, $\frac{\partial \tau_{H,M}}{\partial \phi} < 0$ and $\frac{\partial \tau_{L,M}}{\partial \phi} \lesseqgtr 0$. Note, $\frac{\partial \tau_{H,M}}{\partial \phi} < 0$ and $\tilde{\tau}_{H,M} > \tilde{\tau}_{L,M}$ implies that, all else equal, $\tilde{\tau}_{L,M} < 0$ is possible once ϕ is sufficiently large even if $\frac{\partial \tau_{L,M}}{\partial \phi} > 0$ for some range of ϕ.

Proof of Proposition 2

expected number of booms until importers cede control in the next recession, iii) the third term reflects the payoff gained when importers cede control in the next recession.

Lemma 1 implies importers maintain control of tariff setting when possible. In this case, by construction, their optimal tariffs are given by (13). Note that the future value of importer lobbying (see (11)) is independent of the current period state of the economy ω. Moreover, the opportunity cost of importer lobbying (see (9)) is lower in recessions than booms for a given tariff τ because $u_M(\tau, A_L) - \phi u_M(\bar{\tau}, A_L) = a[u_M(\tau, A_H) - \phi u_M(\bar{\tau}, A_H)]$ and $a < 1$. Thus, $f_{H,M} > f_{L,M}$ for a given tariff τ and, in turn, $f_{H,M} = f_{L,M} = 0$ requires $\tau_{L,X} > \tau_{H,X}$ given $\frac{\partial f_{\omega,M}}{\partial \tau} > 0$. Hence, applied tariffs are counter-cyclical and binding overhang is pro-cyclical.■

C Comparative statics

C.1 Importer control

Totally differentiating the no-lobbying conditions, we have

$$\begin{bmatrix} f_{H,X}^{\tau_{H,M}} & f_{H,X}^{\tau_{L,M}} \\ f_{L,X}^{\tau_{H,M}} & f_{L,X}^{\tau_{L,M}} \end{bmatrix} \begin{bmatrix} d\tau_{H,M} \\ d\tau_{L,M} \end{bmatrix} + \begin{bmatrix} f_{H,X}^{x} \\ f_{L,X}^{x} \end{bmatrix} dx = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

where x is a parameter of interest and superscripts denote partial derivatives (for example, $f_{H,X}^{\tau_{L,M}} \equiv \frac{\partial f_{H,X}}{\partial \tau_{L,M}}$). This can be written more compactly as

$$A \begin{bmatrix} d\tau_{H,M} \\ d\tau_{L,M} \end{bmatrix} + F dx = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

so that, using standard matrix notation,

$$\frac{\partial \tau_{H,M}}{\partial x} = \frac{A_{12}F_2 - A_{22}F_1}{A_{11}A_{22} - A_{12}A_{21}} \text{ and } \frac{\partial \tau_{L,M}}{\partial x} = -\left[\frac{A_{11}F_2 - A_{21}F_1}{A_{11}A_{22} - A_{12}A_{21}}\right]. \tag{22}$$

Note that

$$A_{11} = -(1+\lambda_2)\,\delta_{H,X}^{\tau_{H,M}}(\tau_{H,M}, 0) < A_{21} = -\lambda_2 \delta_{H,X}^{\tau_{H,M}}(\tau_{H,M}, 0) < 0 \tag{23}$$

$$A_{22} = -(1+\lambda_1)\,a\delta_{H,X}^{\tau_{L,M}}(\tau_{L,M}, 0) < A_{12} = -\lambda_1 a \delta_{H,X}^{\tau_{L,M}}(\tau_{L,M}, 0) < 0 \tag{24}$$

$$F_1 = f_{H,X}^{a} = -\lambda_1 \delta_{H,X}(\tau_{L,M}, 0) < 0 < F_2 = f_{L,X}^{a} = \frac{1}{a}\lambda_2 \delta_{H,X}(\tau_{H,M}, 0) \tag{25}$$

$$F_1 = f_{H,X}^{\pi} = F_2 = f_{L,X}^{\pi} = -\frac{\beta}{1-\beta}\left[a\delta_{H,X}(\tau_{L,M}, 0) - \delta_{H,X}(\tau_{H,M}, 0)\right] > 0 \tag{26}$$

$$F_1 = f_{H,X}^{\phi} = -u_X(0, A_H) < F_2 = f_{L,X}^{\phi} = -a u_X(0, A_H) < 0 \tag{27}$$

where $\lambda_1 \equiv \frac{\beta}{1-\beta}\pi$ and $\lambda_2 \equiv \frac{\beta}{1-\beta}(1-\pi)$ and where (26) relies on $\tau_{L,M} < \tau_{H,M}$ and $a < 1$. Thus, using (23)-(27) in (22) yields

$$\frac{\partial \tau_{H,M}}{\partial a} < 0 < \frac{\partial \tau_{L,M}}{\partial a}, \frac{\partial \tau_{H,M}}{\partial \pi} = \frac{\partial \tau_{L,M}}{\partial \pi} > 0 \text{ and } \frac{\partial \tau_{H,M}}{\partial \phi} < 0 \text{ but } \frac{\partial \tau_{L,M}}{\partial \phi} \lesseqgtr 0. \tag{28}$$

C.2 Exporter control

Unlike the exporter no-lobbying conditions (7) that only depended on the endogenous variables $\tau_{H,M}$ and $\tau_{L,M}$, the importer no-lobbying conditions (12) depend on the endogenous variables $\tau_{H,X}$, $\tau_{L,X}$ and $\tau_{H,M}$. Further, given Lemma 1, importers cede control in recessions while exporters maintain control in recessions and booms. Thus, exporters no-lobbying condition in booms when importers have control is given by

$$(1-\phi)\, u_X(0, A_H) - \delta_{H,X}(\tau_{H,M}, 0) - \beta\left[W_X(\bar{\tau}=0) - W_X(M)\right] \equiv f_{H,X} \geq 0 \tag{29}$$

where

$$\begin{aligned}
W_X(\bar{\tau}=0) &= \pi\left[a u_X(0, A_H) + \beta W_X(\bar{\tau}=0)\right] + (1-\pi)\left[u_X(0, A_H) + \beta W_X(\bar{\tau}=0)\right] && (30)\\
W_X(M) &= \pi\left[a u_X(0, A_H) + \beta W_X(X)\right] + (1-\pi)\left[u_X(\tau_{H,M}, A_H) + \beta W_X(M)\right] && (31)\\
W_X(X) &= \frac{1}{1-\beta}\left[\pi a u_X(\tau_{L,X}, A_H) + (1-\pi)\, u_X(\tau_{H,X}, A_H)\right] && (32)
\end{aligned}$$

and hence

$$W_X(\bar{\tau}=0) - W_X(M) = \frac{1}{1-\beta(1-\pi)}\left[\delta_{H,X}(\tau_{H,M}, A_H) + \beta\pi\left(W_X(\bar{\tau}=0) - W_X(X)\right)\right] \tag{33}$$

where

$$W_X(\bar{\tau}=0) - W_X(X) = \frac{1}{1-\beta}\left[\pi a \delta_{H,X}(\tau_{L,X}, 0) + (1-\pi)\,\delta_{H,X}(\tau_{H,X}, 0)\right]. \tag{34}$$

Totally differentiating the no-lobbying conditions (12) and (29), we have

$$\begin{bmatrix} f_{H,X}^{\tau_{H,M}} & f_{H,X}^{\tau_{H,X}} & f_{H,X}^{\tau_{L,X}} \\ f_{H,M}^{\tau_{H,M}} & f_{H,M}^{\tau_{H,X}} & f_{H,M}^{\tau_{L,X}} \\ f_{L,M}^{\tau_{H,M}} & f_{L,M}^{\tau_{H,X}} & f_{L,M}^{\tau_{L,X}} \end{bmatrix} \begin{bmatrix} d\tau_{H,M} \\ d\tau_{H,X} \\ d\tau_{L,X} \end{bmatrix} + \begin{bmatrix} f_{H,X}^{x} \\ f_{H,M}^{x} \\ f_{L,M}^{x} \end{bmatrix} dx = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

where x is a parameter of interest and superscripts denote partial derivatives (for example,

$f_{H,X}^{\tau_{H,M}} \equiv \frac{\partial f_{H,X}}{\partial \tau_{H,M}}$). This can be written more compactly as

$$A \begin{bmatrix} d\tau_{H,M} \\ d\tau_{H,X} \\ d\tau_{L,X} \end{bmatrix} + Fdx = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

where, using standard matrix notation, we have i) $A_{11}, A_{12}, A_{13} < 0$, ii) $A_{21} = A_{31} < 0$, iii) $A_{22} > A_{32} > 0$ and iv) $A_{33} > A_{23} > 0$. Thus, using standard matrix notation, we have:

$$\frac{\partial \tau_{H,X}}{\partial x} = \varphi_{H,D}F_2 + \varphi_{H,I_1}F_3 + \varphi_{H,I_2}F_1 \text{ and } \frac{\partial \tau_{L,X}}{\partial x} = \varphi_{L,D}F_3 + \varphi_{L,I_1}F_2 + \varphi_{L,I_2}F_1. \quad (35)$$

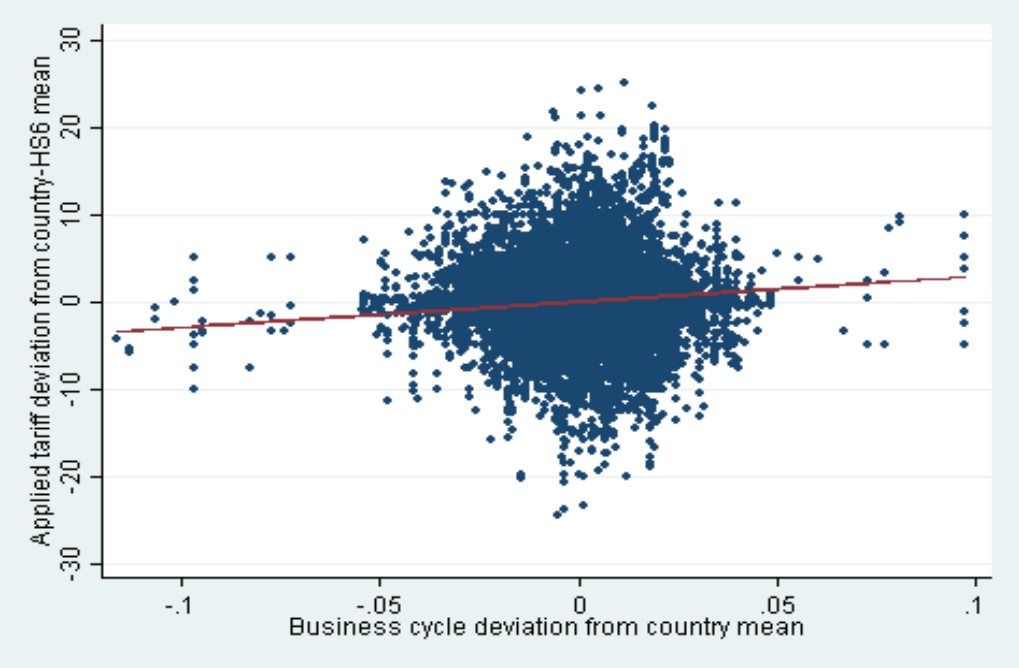
The "direct" effects of the parameter x on $\tau_{H,X}$ and $\tau_{L,X}$ depend on $\varphi_{H,D} < 0$ and $\varphi_{L,D} < 0$. The indirect effect of a parameter x on $\tau_{H,X}$ due to the direct effect of x on $\tau_{L,X}$ (and vice versa) depends on $\varphi_{H,I_1} > 0$ (and $\varphi_{L,I_1} > 0$). The indirect effect of a parameter x on $\tau_{H,X}$ (and $\tau_{L,X}$) due to the direct effect of x on $\tau_{H,M}$ depends on $\varphi_{H,I_2} > 0$ (and $\varphi_{L,I_2} > 0$). The expressions for these various terms are:

$$\begin{aligned}
\varphi_{H,D} &\equiv \Delta^{-1} \cdot (A_{13}A_{31} - A_{11}A_{33}) < 0 \text{ and } \varphi_{L,D} \equiv -\Delta^{-1} \cdot (A_{11}A_{22} - A_{12}A_{21}) < 0 \quad (36)\\
\varphi_{H,I_1} &\equiv \Delta^{-1} \cdot (A_{11}A_{33} - A_{13}A_{21}) > 0 \text{ and } \varphi_{L,I_1} \equiv -\Delta^{-1} \cdot (A_{12}A_{31} - A_{11}A_{32}) > 0 \quad (37)\\
\varphi_{H,I_2} &\equiv \Delta^{-1} \cdot (A_{21}A_{33} - A_{23}A_{31}) > 0 \text{ and } \varphi_{L,I_2} \equiv -\Delta^{-1} \cdot (A_{21}A_{32} - A_{22}A_{31}) > 0 \quad (38)\\
\Delta &\equiv A_{11}(A_{22}A_{33} - A_{23}A_{32}) + A_{12}A_{21}(A_{23} - A_{33}) + A_{13}A_{21}(A_{32} - A_{22}) < 0. \quad (39)
\end{aligned}$$

Given $f_{H,X}^a, f_{H,M}^a < 0 < f_{L,M}^a$, we have $\frac{\partial \tau_{L,X}}{\partial a} < 0$ but $\frac{\partial \tau_{H,X}}{\partial a} \lesseqgtr 0$ because $\varphi_{H,D}F_2 + \varphi_{H,I_1}F_3 > 0$ but $\varphi_{H,I_2}F_1 < 0$. Given $f_{H,X}^\pi \gtreqless 0$ and $f_{H,M}^\pi = f_{L,M}^\pi > 0$, we have $\frac{\partial \tau_{H,X}}{\partial \pi}, \frac{\partial \tau_{L,X}}{\partial \pi} \lesseqgtr 0$ because $\varphi_{H,D}F_2 + \varphi_{H,I_1}F_3, \varphi_{L,D}F_3 + \varphi_{L,I_1}F_2 < 0$ but $\varphi_{\omega,I_2}F_1 > 0$. Given $f_{H,X}^\phi, f_{H,M}^\phi, f_{L,M}^\phi < 0$, we have $\frac{\partial \tau_{H,X}}{\partial \phi}, \frac{\partial \tau_{L,X}}{\partial \phi} \lesseqgtr 0$ because $\varphi_{H,D}F_2, \varphi_{L,D}F_3 > 0$ but $\varphi_{H,I_1}F_3, \varphi_{L,I_1}F_2 < 0$ and $\varphi_{\omega,I_2}F_1 < 0$.

D Tables and figures

Figure 1: A scatterplot suggesting applied tariff pro-cyclicality



Notes: The sample used takes that described in Section 2 and excludes missing overhang observations, observations from country-product clusters where the applied tariff did not move up and down over the sample period, and observations where the applied tariff did not change relative to the prior year.

Table 1: Frequency of applied tariff changes at country-product level

	Developing		Developed	
	N	**%**	**N**	**%**
Applied tariff only decreases	46,080	38.23	22,206	34.50
Applied tariff always unchaged	34,995	29.03	33,733	52.40
Applied tariff only increases	2,859	2.37	3,350	5.20
Applied tariff increaases and decreases	36,605	30.37	5,083	7.90
Total	120,539	100	64,372	100

Notes: The sample used is that described in Section 2 but excluding observations with misssing overhang (due to either missing applied tariff or missing tariff binding).

Table 2: Cyclicality of overhang and applied tariffs

Panel A: Cyclicality of overhang

	Developing			Developed		
	(1)	(2)	(3)	(4)	(5)	(6)
$BC_{i,t-1}$	-15.1640†	-16.0428†	-21.9732*	-1.9563	-1.9267	-2.0414
	6.1957	6.4737	7.5462	2.227	2.466	2.5043
$MP_{i,j}$	0.0085	0.0088	0.0131	-0.012	-0.0083	-0.0136
	0.0074	0.0065	0.0095	0.0092	0.0082	0.0095
$PTA\_IM_{i,j,t}$	-0.5744*	-0.5893*	-0.6530*	-0.0174	-0.1996	-0.0357
	0.1334	0.1376	0.1464	0.1664	0.1246	0.1751
$\Delta IM_{i,j,t-1}$	0.0575†	0.0516†	0.0662	0.0015	0.0011	0.0013
	0.0252	0.023	0.0453	0.0017	0.0016	0.0017
$sd\Delta IM_{i,j,t-1}$	-0.0592	-0.0673	-0.04	-0.007	-0.0063	-0.0047
	0.0556	0.0548	0.0768	0.0047	0.0044	0.004
$y_{i,t}$	6.4139†	6.7858†	12.4456†	-0.7609	-0.7876	-0.8047
	3.1158	3.2948	4.9293	0.5914	0.6324	0.6174
N	836140	774805	708391	306758	274293	291661
Country-HS4 FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Panel B: Cyclicality of applied tariff

	Developing			Developed		
	(1)	(2)	(3)	(4)	(5)	(6)
$BC_{i,t-1}$	15.4595†	16.3937†	22.2200*	2.0222	1.979	2.0068
	6.2045	6.4896	7.5545	2.2047	2.4247	2.4785
$MP_{i,j}$	-0.0081	-0.006	-0.0125†	0.0308	-0.0094†	0.0319
	0.0057	0.0056	0.0064	0.0379	0.0045	0.0394
$PTA\_IM_{i,j,t}$	0.7022*	0.7158*	0.7718*	0.2844*	0.2462*	0.2994*
	0.1269	0.1321	0.1382	0.0795	0.075	0.0833
$\Delta IM_{i,j,t-1}$	-0.041	-0.0369	-0.0629	0.0028	0.001	0.0025
	0.029	0.0276	0.0457	0.0031	0.0027	0.003
$sd\Delta IM_{i,j,t-1}$	-0.1024†	-0.0970†	-0.1436*	-0.0015	-0.006	-0.0015
	0.0485	0.0486	0.0503	0.0086	0.0054	0.0087
$y_{i,t}$	-6.6449†	-7.0331†	-12.6428†	0.904	0.9417	1.0448‡
	3.0972	3.2779	4.9264	0.5499	0.5841	0.5688
N	836140	774805	708391	306758	274293	291661
Country-HS4 FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample in column (1) is identical to that desrcibed in Section 2. Two-way clustered standard errors are used by clustering at the country-year and country-HS4 level. Column (2) excludes agricultural products. Column (3) excludes new WTO members. See Table A1 for countries and details regarding WTO membership and level of development. See Table A2 for variable definitions and data sources.
‡ p<0.10, † p<0.05, * p<0.01

Table A1: Countries in our dataset

Developed (16)

All tariff years and all GDP years (8)

Australia, Canada, European Union, Israel, Japan, Norway, Singapore, United States

Only missing GDP years (6)

Brunei (1960-1973), Hong Kong (1960-1964), Macao (1960-1981), New Zealand (1960-1976), Switzerland (1960-1979), Saudi Arabia (1960-1968; joined WTO 12/11/2005)

Only missing tariff years (1)

Iceland (2002)

Missing GDP years and tariff years (1)

Qatar (1960-1969; 2000-2001)

Developing (51)

All tariff years and all GDP years (23)

Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Guatemala, Honduras, Indonesia, Madagascar Malaysia, Mexico, Nicaragua, Papua New Guinea, Paraguay, Peru, Philippines, South Africa, Togo, Turkey, Venezuela, China (joined WTO 12/11/2001), Panama (joined WTO 9/6/1997)

Only missing GDP years (10)

Cuba (1960-1969, 2013), Egypt (1960-1964), El Salvador (1960-1964), Macedonia FYR (1960-1989; joined WTO 4/4/2003), Mongolia (1960-1980; joined WTO 1/29/1997), Albania (1960-1979; joined WTO 9/8/2000), Georgia (1960-1964, joined WTO 6/14/2000), Jordan (1960-1974, joined WTO 4/11/2000), Ecuador (1960-1964; joined WTO 1/21/1996), Nepal (1960; joined WTO 4/23/2004)

Only missing tariff years (14)

Bangladesh (2001), Cameroon (2000), Central African Republic (2000), Cote d'Ivoire (2000), Gabon (2006), Ghana (2005-2006), Guyana (2004-2005), India (2003), Kenya (2003), Niger (2000) Senegal (2000), Sri Lanka (2002), Uruguay (2003), Zambia (2000)

Missing GDP and tariff years (4)

Mali (1960-1967; 2000-01), Mauritius (1960-1976; 2003), Tunisia (1960-1965; 2001, 2007) Thailand (1960-1964; 2002)

Developed and developing (5)

Antigua & Barbuda (developing 2000-2001, 2003-2004, 2009; developed 2002,2005-2008; missing tariff years 1960-1975)
Bahrain (developing 2000; developed 2001-2009; missing GDP years 1960-1979)
Korea (developing 2000; developed 2001-2009)
Oman (developing 2000-2006; developed 2007-2009; joined WTO 11/9/2000)
Trinidad & Tobago (developing 2001-2005; developed 2006-2008; missing tariff years 2000, 2009)

Notes: Unless otherwise noted, years in parenthesis indicate missing years. Level of development source: http://siteresources.worldbank.org/DATASTATISTICS/Resources/OGHIST.xls with developed = high-income and developing = not high-income. New WTO member definition based on Beshkar et. al. (2014) with new members included in our regressions in their first full year of WTO membership. All tariff years = 2000-2009 and all GDP years = 1960-2013.

Table A2: Variable definitions and sources

Variable	Description	Source
Tariff variables		
$\tau_{i,j,t}$	Applied tariff of country i on product j in year t	WTO Integrated Database and UNCTAD TRAINS database (http://wits.worldbank.org/)
$\bar{\tau}_{i,j,t}$	Tariff binding of country i on product j in year t	WTO Integrated Database (http://wits.worldbank.org/) and new member accession schedules (http://www.wto.org/english/tratop_e/schedules_e/goods_schedules_table_e.htm)
$v_{i,j,t}$	Tariff binding less applied tariff for country i on product j in year t	
Covariates		
$BC_{i,t-1}$	Cyclical component in year t-1 of country i's log real GDP using Hodrick Prescott filter with real GDP measured in local currency units	World Bank's World Development Indicators (http://data.worldbank.org/data-catalog/world-development-indicators); UN National Accounts Main Aggregates Database (http://unstats.un.org/unsd/snaama/introduction.asp); Penn World Tables (https://pwt.sas.upenn.edu/)
$y_{i,t}$	Log per capital real GDP measured in 2005 US$	
$MP_{i,j}$	Natural log of $1/e_{i,j}$ where $e_{i,j}$ is the export supply elasticity of product j from the perspective of the importer i	Nicita et. al (2013)
$PTA\_IM_{i,j,t}$	Weighted share of country i's imports of product j in year t sourced from countries who are FTA or CU partners of country i. The (time-invariant) weights use import shares in product j from a year prior to country i appearing in sample.	COMTRADE (http://wits.worldbank.org/); NSF-Kellogg Institute Data Base on Economic Integration Agreements (http://kellogg.nd.edu/faculty/fellows/bergstrand.shtml)
$\Delta IM_{i,j,t-1}$	Change in country i imports of product j between years t-1 and t-2 (measured in 000's million 2010 USD)	COMTRADE (http://wits.worldbank.org/); http://data.worldbank.org/indicator/FP.CPI.TOTL
$sd\Delta IM_{i,j,t-1}$	Standard deviation of $\Delta IM_{i,j,t-1}$ over the sample period	
Other		
$Unbound_{i.j}$	= 1 if country i has no tariff binding on product j in yeat t and = 0 otherwise	WTO Integrated Database (http://wits.worldbank.org/)
Zero tariff binding	= 1 if country i's tariff binding on product j in yeat t is zero and = 0 otherwise	

Table A3: Summary statistics

	Developing					Developed				
	N	**Mean**	**St. Dev.**	**Min.**	**Max.**	**N**	**Mean**	**St. Dev.**	**Min.**	**Max.**
Tariff variables										
$\tau_{i,j,t}$	1217020	10.136	14.729	0	3000	589350	3.281	9.153	0	800
$\bar{\tau}_{i,j,t}$	969715	29.644	22.472	0	3000	511587	10.300	17.311	0	800
$v_{i,j,t}$	966334	19.921	16.965	0	1485	510330	6.698	12.554	0	340
Covariates										
$BC_{i,t-1}$	1220401	0.0010	0.020	-0.135	0.0844	590607	0.0027	0.018	-0.064	0.0885
$y_{i,t}$	1220401	7.795	0.908	5.518	9.83	590607	10.335	0.404	9.262	11.12
$MP_{i,j}$	1220401	-3.216	2.507	-11.401	20.73	590607	-1.832	3.758	-11.043	21.72
$PTA\_IM_{i,j,t}$	1220401	0.178	0.298	0	1	590607	0.186	0.288	0	1
$\Delta IM_{i,j,t-1}$	1086244	0.013	0.564	-47.147	252.63	530469	0.0438	1.41128	-184.63	350.3455
$sd\Delta IM_{i,j,t-1}$	1163325	0.041	0.414	0	84.11	565399	0.14371	1.3028	0	159.5553
Other										
$Unbound_{i.j}$	1220401	0.205	0.404	0	1	590607	0.134	0.340	0	1
Zero tariff binding	1220401	0.022	0.148	0	1	590607	0.266	0.442	0	1

Notes: See Table A2 for a description of the variables and their source.