Can Protective Tariffs Induce Industrial Consolidations? Theory and Evidence from the Great Merger Movement

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Abstract

In the late 19th century United States, trusts emerged across a wide range of industries amid high-tariff protectionism. Since then, economists have debated the relationship between protective tariffs and industrial consolidations. However, beyond the anecdotal, empirical evidence linking the two remains scarce. I revisit the question in the context of the Great Merger Movement of the late 19th and early 20th century. I construct a new dataset of consolidations in manufacturing industries, drawing extensively on historical sources to classify them at a detailed product level. My empirical strategy exploits two sources of variation. First, I leverage changes in tariff policy driven by party turnover as a source of plausibly exogenous variation in tariff levels. Second, I measure industry exposure to tariff changes using industries' dutiable status and import intensity. I find that industries more strongly affected by tariff changes experienced greater surges in consolidations following tariff increases. To make sense of these findings, I build an incentive-constrained coalitional model of endogenous market structure that allows for the presence of import competition. I show that, in industries where the price of imports acts as an effective ceiling for domestic producers, higher tariffs can indeed strengthen incentives to merge and induce consolidation.

Keywords: Horizontal integration, coalition formation, market structure, tariffs, import competition, great merger movement.

JEL Codes: D43, L22, N61

1 Introduction

It is well established that exposure to foreign competition can discipline imperfectly competitive domestic markets, especially in contexts with weak antitrust policies. By varying barriers such as quotas and tariffs, a country's trade policy can strengthen or weaken this disciplining effect of trade. It follows that changes in trade policy may induce changes in market structure, particularly within industries more strongly exposed to import competition. These changes in market structure can occur along several margins of adjustment, including firm entry, exit, and internal expansion. Prior work has documented, for example, how episodes of trade liberalization lead to the exit of lower-productivity firms and the expansion of higher-productivity ones (Pavcnik (2002), Bloom et al. (2015)).

However, beyond the entry, exit, and internal growth of firms, changes in market structure often occur through the recombination of incumbent firms—e.g., via mergers and acquisitions—a dimension that has been relatively less explored in the literature. Furthermore, while much of the literature has focused on the effects of trade liberalization on market structure, the effects of protectionist policies—which have become increasingly relevant in recent years—remain understudied.

In this paper, I examine whether protective tariffs can induce industrial consolidations. To do so, I look back at the Great Merger Movement of the late 19th and early 20th century United States, an unprecedented wave of horizontal combinations that affected a wide range of industries and took place within a context of weak antitrust enforcement and strong protectionism. It is estimated that, between 1895 and 1904, more than 1800 firms disappeared into such combinations (Lamoreaux (1988)), with merging firms representing as much as one half of U.S. manufacturing capacity (Bittlingmayer (1985)). What role, if any, did the high protective tariffs of the time have in triggering or reinforcing the merger movement that led to the rise of trusts? The potential link between the two certainly did not go unnoticed by contemporaries, with some going as far as to proclaim that "the tariff is the mother of the trusts".[1] While such claims sparked much debate at the time, both in academic and political circles, no clear consensus emerged and, beyond the anecdotal, evidence of a causal link between tariffs and consolidations remains scarce.

There are at least two reasons why this might be so. First, the question poses an empirical challenge. Where does one derive plausibly exogenous variation in tariff levels? The wave of consolidations was concentrated in a fairly short period of time, with relatively high protective tariffs throughout. Moreover, making cross-industry comparisons is complicated by the fact that industry tariff rates are endogenous, being particularly prone to lobbying (Grossman and Helpman (1994); Rodrik (1995)). Second, evidence of a causal link between tariffs and consolidations, if it holds, would present somewhat of a puzzle from the perspective of standard economic theory. Indeed, it is clear that high tariffs benefit domestic producers engaged in imperfect competition within a *given* market structure. It is not immediately clear, however, whether increases in tariff levels might *induce* changes in market structure via consolidations.

To overcome the empirical challenge of identifying a causal effect of tariffs on consolidations, I employ a strategy that combines two sources of variation. First, I exploit an institutional feature unique to the time period: given that changes in tariff policy required the approval of three levels of government—the House of Representatives, the Senate, and the President— and that support for higher or lower tariff rates was almost perfectly split along party lines, the approval and overall direction of new tariff acts was entirely determined by one party having joint control over the three levels of government. Leveraging party turnover following contested general elections as a source of exogenous changes in tariff policy, I am thus able to isolate plausibly exogenous variation in tariff levels over time without directly relying on industry-specific changes in tariff rates, which may be endogenous. Second, I exploit cross-industry variation in exposure to such tariff changes, which I measure using data on industries' dutiable status and pre-tariff-change import intensity.

[1]The phrase was most famously stated by Henry Havemayer, the industrialist behind the formation of the Sugar Trust, testifying before the U.S. Industrial Commission in 1899 (Eichner (2019)).

Combining both sources of variation, I use a two-way-fixed-effects setup together with an instrumental variables approach to examine whether tariff increases resulted in an increased probability of consolidation in more-tariff-exposed relative to less-tariff-exposed industries. Across specifications, my results suggest a positive causal effect of tariff increases on industrial consolidations.

To make sense of these findings, I follow a coalitional approach to market structure, which allows me to account for changes in firm boundaries in response to tariff changes. Drawing on recent work by Legros, Newman and Udvari (2024), I build an incentive-constrained coalitional model of endogenous market structure for a homogeneous-good industry. Producers subject to internal contracting imperfections can either stand alone, acting as price-takers, or join together to form large oligopoly-competing firms. By consolidating the industry into a smaller number of oligopoly firms, producers can always raise industry profits and obtain higher payoffs. This tendency towards monopolization, however, is constrained by a hold-out force: a producer can always stand outside of the oligopoly, selling at a high price without contributing to its sustainment. Absent internal contracting imperfections, this hold-out force would dominate and no oligopoly would be sustainable. As pointed out as early as Stigler (1950), while every producer would eagerly encourage others to consolidate and restrict output, they would each prefer to stand alone themselves and free-ride off the high price. However, with internal contracting imperfections restricting the set of viable production choices, both for producers operating inside and outside of the oligopoly, it no longer follows that standing outside the oligopoly is always preferable. Balancing these two forces, monopolization and hold-out, the equilibrium market structure in this baseline model is given by the most concentrated symmetric oligopoly up to a no-holdout constraint.

I extend the framework in Legros, Newman and Udvari (2024) to allow for import competition while preserving the parsimony of their baseline model. Treating foreign and domestic varieties as perfect substitutes, and assuming a perfectly elastic foreign supply, the tariff-inclusive price of imports sets a price ceiling for domestic producers. While the limit to stable consolidation in the absence of import competition is set by a binding no-holdout constraint, under effective import competition it is instead set by the tariff-inclusive price of imports. A binding price ceiling induces the formation of an oligopoly that restricts industry output just enough to match it. By raising the price ceiling, a tariff increase presents an opportunity for domestic producers to consolidate and raise industry profits without it undermining the stability of the oligopoly. While intuitive, this prediction is in stark contrast with standard models of endogenous market structure that emphasize firm *entry*, as opposed to firm *formation*, as the relevant margin of adjustment. As both margins may matter in practice, I further extend my model to allow for both the free entry of producers in an initial stage, and the joining together of producers in a subsequent firm-formation stage. The standard intuition that higher industry profits should invite entry continues to hold within this setup, yet it does not undermine the result that a higher price-ceiling leads to industry consolidation: a tariff increase can result in both more producers *and* a more consolidated industry.

My theoretical framework allows me to account for industry-wide rearrangements in firm boundaries, as opposed to focusing on the incentives to merge for pairs of firms—such as in the theoretical literature on the "merger paradox" (Salant et al. (1983); Perry and Porter (1985))— or on acquisitions (Srinivasan (2020))—a form of rearrangement in firm boundaries more prevalent in modern contexts. This is meant to reflect the nature of industrial combinations during the Great Merger Movement. They involved an oftentimes large number of rival producers in the same industry, with the resulting corporation controlling a sizeable share of the domestic market. These were generally symmetric combinations, sometimes facilitated by an organizer and financier, with no one firm "acquiring" the others (Banerjee and Eckard (2001)). Consolidations of this nature were widespread across manufacturing industries, ranging from woolen goods and tinplate to cutlery and bicycles. Moreover, consolidations often took place in industries where competitors had previously tried to sustain collusionary agreements (Bittlingmayer (1985)).

Changes in antitrust policy leading up to the consolidations of the Great Merger Movement have received much attention as a potential explanation for their sudden prevalence. It has been argued that the Sherman Antitrust Act of 1890, as it was interpreted in the years after its introduction, effectively targeted collusion and price-fixing agreements, while leaving consolidation, even industry-wide consolidations, as a legal and viable option for firms. Bittlingmayer (1985) argues that this, together with key antitrust cases brought against cartels during the 1890's, can partly explain the timing of consolidations. Only after 1901, with the assassination of President McKinley, and 1902, with President Roosevelt's first antitrust suit, did the government's tolerant stance towards consolidation change (Baker et al. (2023)).

Changes in state incoporporation laws have also been highlighted as an important factor leading up to the Great Merger Movement. In the early 1880s, New Jersey changed incorporation laws to allow businesses to hold stock in other corporations and operate across state lines, a precedent soon followed by other states. These changes were a necessary condition for the industry-wide combinations that followed. In addition, the capital needed to execute industry-wide combinations required a sufficiently developed financial market. These two conditions, having been met by the late 1880s, have been pointed to as explanations for the timing of the Great Merger Movement (see, for instance, Stigler (1950)).

A remaining potential driver of the Great Merger Movement that has been relatively overlooked in modern analyses, but that was fiercely debated in the years that followed, was the high protective tariff. The Papers and Proceedings of the Nineteenth Annual Meeting of the American Economic Association, published in 1907, featured four articles that were devoted exclusively to the issue. To some, it was indisputable that high tariffs both contributed to the formation of trusts and allowed them to reap excessive profits. In addition to providing concrete evidence of tariffs directly influencing the formation of consolidations in specific cases, Holt (1907) highlights the timing of surges in consolidations. These surges occurred after the two protective tariff acts of the period—the McKinley Act of 1890 and the Dingley Act of 1897—with a brief interruption between 1894 and 1897, when tariffs were lowered by the Wilson-Gorman Act.

On the other hand, to the skeptics of any causal link between protective tariffs and trust formation, the question seemed to be resolved by two simple observations. First, trusts had been formed in tariff-protected and non-tariff-protected industries alike, and second, trusts also rose to prominence around the same time in England, which lacked the high protective tariffs of the United States (Clarke (1907); Gardner et al. (1907)). Of course, the fact that consolidations were observed in both protected and non-protected industries, as well as in low-tariff and high-tariff contexts alike, does not in itself rule out the possibility that high protective tariffs had a causal effect on consolidations. The question we would really like to answer is whether industries affected by such protection had more (or less) consolidations than they would have otherwise had in its absence. We do not observe that counterfactual scenario. However, leveraging changes in trade policy throughout the period, we can examine whether industries that were more likely to be affected by tariff increases saw a relatively greater surge in consolidation activity in their aftermath.

The empirical part of this paper seeks to answer to this question. To do so, I construct a novel dataset using historical data on consolidations, foreign trade, and tariff laws. My data on consolidations comes from Moody (1904), who compiles and reports information on large industrial combinations prior to 1904. I focus on mergers reflecting horizontal integration in manufacturing industries between 1887 and 1902.

My empirical strategy requires classifying consolidations by whether they happen in industries producing importable and dutiable goods and, within those that do, recording the industry's import intensity and average tariff rate. To identify the main goods produced by consolidating firms, I rely on information from Moody (1904), as well as Moody's Manual of Corporation Securities (Moody (1902, 1903)) and other historical sources, including newspaper articles, company records, and industry publications. The resulting classification of consolidations at a detailed product level allows me to match them to data on dutiable status, imports and exports, and tariff rates from the *Statistical Abstract of the United States* and the original tariff acts (McKinley Act of 1890, Wilson-Gorman Act of 1894, Dingley Act of 1897).

My focus is on the timing of consolidations across industries. Across empirical specifications, I estimate the effect of changes in tariff levels, and industry exposure to such changes, on the probability that an industry has a consolidation in a given year. My empirical strategy requires identifying substantial changes in industry tariff rates that stem from statutory changes. For this, I rely on tariff changes following the introduction of one of the three tariff acts of the period.

Tariff changes can directly affect industry market structure by altering the degree of import competition faced by domestic producers. To identify cross-industry variation in exposure to tariff changes, I first classify industries by whether they produce importable and dutiable goods. Industries producing goods that are free of duty are unaffected by general tariff rate changes. Similarly, industries producing goods subject to duty but facing no import competition in practice, regardless of the duty rate, are also unaffected by tariff changes. Among industries that are, in principle, exposed to changes in tariff rates, I use their pre-tariff-change import intensity to identify variation in exposure.

Following a two-way-fixed-effects setup, I start by examining whether industries relatively more exposed to tariff changes, as measured prior to a tariff act, experienced a relatively higher surge in consolidation activity following substantial increases to their tariff rate. Across specifications, I consistently find evidence of a positive effect of tariff increases on consolidations in industries facing import competition. However, industry-specific tariff changes are not exogenous and, as such, incorporating them directly in my estimation raises endogeneity concerns and may lead to biased estimates. This might happen if, for instance, industries treated with a tariff change are also differentially affected by other government policies or by macroeconomic shocks, or if they differ in unobserved time-varying characteristics that are correlated with consolidation activity.

To address this concern, I follow an instrumental variables strategy. My strategy relies on the unique institutional feature of the time period that I have alluded to before. Given that support for higher (lower) tariffs was almost perfectly split along party lines, and given that changes in tariff policy required the approval of both houses of Congress and the Presidency, the timing and overall direction of new tariff acts was fully determined by Republican or Democrat control over government. The Republican-led governments of 1890 and 1897 raised tariff rates for most manufactured goods, while the Democrat-led government of 1894 lowered them. I thus rely on changes in tariff policy induced by party turnover following contested elections, a plausibly exogenous source of variation in tariff levels, to instrument industry-specific tariff changes. The results following this IV approach lend further support to the finding that tariff increases resulted in an increased probability of consolidation in more-tariff-exposed relative to less-tariff-exposed industries.

This main finding is robust to the use of different time windows for treatment, varying percentage-change cutoffs to define tariff increases and decreases, and the inclusion or exclusion of non-importable goods. My main specifications incorporate tariff changes spanning all three of the tariff acts of the time period. To further examine the responses following the introduction of each of the tariff acts, I restrict the sample to industry-year observations within the periods immediately before and after each act. I find that my main finding is not driven by any single tariff policy change.

Given the IV strategy and the plausible exogeneity of policy changes, the main remaining concern is that the measure of pre-tariff-change tariff exposure might not only capture the sensitivity of an industry to tariff changes, but could also be correlated with other factors affecting consolidation trends. All of my specifications include tariff exposure separately as a control, assuaging the concern. However, to further examine this, I test whether pre-tariff-change import intensity is predictive of industry tariff changes for each of the tariff acts in the sample. If it is, it could suggest that incoming governments favored or punished producers in more import-intensive industries, potentially also in ways other than just through tariff protection. I find that this is not the case, in line with the interpretation that trade protection granted by the government during this time responded to lobbying and specific political interests, as opposed to a clear industrial policy seeking to favor infant industries most vulnerable to import competition (Irwin (2017)).

Another potential concern is that other time-varying factors, such as macroeconomic shocks, may differentially affect more import-intensive industries, biasing my estimates. Of particular interest is the Panic of 1893, which may also explain the slowdown in consolidations 1894-1897 before the spike in 1898 following economic recovery. In this sense, it is reassuring that my findings are not driven by the responses to any single tariff act, and that the effects estimated for the McKinley Act of 1890 and the Dingley Act of 1897 follow the same overall pattern.

1.1 Related Literature

My paper contributes to three strands of literature. First is a theoretical literature on endogenous market structure, and the implications of restrictions on domestic producers on equilibrium market structure. An early literature on incentives to merge focused on the optimality of pairwise mergers in a Cournot-competition setting (Salant et al. (1983); Perry and Porter (1985)). A more recent literature has taken a coalitional approach to modeling firm boundaries. Following a coalitional approach in which producers face contracting imperfections, recent work by Legros, Newman and Udvari (2024) shows that an oligopoly may arise even in the absence of significant economies of scale. My paper studies the implications of introducing import competition in such a framework, finding that tariff increases can induce consolidation.

Though not directly motivated by import competition, an earlier theoretical literature has studied the implications of introducing price caps in a Cournot competition model (Earle et al. (2007); Grimm and Zottl (2010)). Closest to my work, Reynolds and Rietzke (2018) embed price-capped Cournot competition in an endogenous entry model and find that, under simple assumptions, increases in the price cap lead to firm entry. By incorporating both an entry and a firm-formation margin, my work shows that a higher price cap can lead to both more producers and a lower number of firms via consolidation.

Second, I contribute to a literature studying the implications of trade policy on market structure and competition in domestic markets. Consistent with Besley et al. (2021), my results highlight trade as a disciplining force for domestic producers, particularly within contexts of weak antitrust enforcement. A voluminous literature has studied the effects of trade policy on industry and firm characteristics and found, mostly in modern contexts, that trade liberalization leads to increased revenue productivity, both through reallocation of economic activity to more productive firms and through within-firm improvements (De Loecker and Goldberg (2014); Goldberg and Pavcnik (2016)). Within this literature, a number of theoretical (Melitz (2003); Melitz and Ottaviano (2008)) and empirical (Pavcnik (2002); Bloom et al. (2015)) papers have directly explored the effects of trade-liberalization on market structure, generally finding that removal of trade barriers can lead to the exit of lower-productivity domestic producers and the expansion of higher-productivity ones.

This literature has mostly focused on the effects of trade liberalization, as opposed to protectionist policies. Though in the wake of the 2018 US-China trade war there has been renewed interest in studying the economic effects of protectionist policies (Fajgelbaum et al. (2019); Fajgelbaum and Khandelwal (2022)), evidence of direct effects of protectionist policies on market structure remains scarce. An exception, related to the time period I study, is Klein and Meissner (2024). They find evidence of a negative effect of protective tariffs on average productivity, as well as some evidence that higher tariffs lead to a greater number of establishments in certain industries. As they point out, this is generally consistent with Melitz (2003). As should be clear from my theoretical framework, it is also not inconsistent with my findings. Higher tariffs can lead to both the entry of new producers, increasing the number of establishments in an industry, as well as greater industry consolidation.

The aforementioned literature has focused on entry, exit, and internal expansion as the margins of market structure adjustment to changes in trade policy. An exception is Srinivasan (2020), which finds evidence of a positive effect of tariff decreases on acquisitions in the U.S. between 1998 and 2014. The changes in firm boundaries studied in my paper are of a different nature. They concern industry-wide consolidations, often conducted with the express purpose of monopolization, that are feasible only in a context of lax antitrust policy.

Finally, my paper contributes to a literature in economic and business history aimed at understanding the causes of the Great Merger Movement. An early literature immediately following the merger wave actively debated the role played by tariffs in the formation of trusts (Clarke (1907); Holt (1907); Flux (1907); Gardner et al. (1907)). Subsequent literature paid less attention to tariffs, instead focusing on the role of antitrust, incorporation laws, economies of scale, and financial development (Stigler (1950); Bittlingmayer (1985); O Brien (1988)). These explanations have been complemented by detailed industry studies which, in some cases, point to the role of large fixed costs of production and fluctuations in demand in motivating price-fixing agreements and consolidation (Lamoreaux (1988); Eichner (2019)). I contribute to this literature by re-examining the role of protective tariffs in the Great Merger Movement, providing evidence of a causal effect of tariff increases on consolidations, and making sense of this finding within a model of endogenous market structure.

2 Data Construction and Empirical Strategy

I am interested in identifying the effect of tariff changes on industrial consolidations. To do so, I construct a novel dataset using historical data on consolidations, foreign trade, and tariff laws. My empirical strategy combines two sources of variation. First, I identify cross-industry variation in exposure to tariff changes using information on the dutiable and importable status of goods, as well as their import intensity. Second, I identify substantial changes in industry tariff rates over time. To circumvent endogeneity concerns associated with industry-specific tariff changes, I follow an instrumental variables approach leveraging changes in tariff policy that are driven by party turnover following contested elections. In this section, I further describe the data sources, variables, and methodology used in my empirical analysis.

2.1 Data Sources

2.1.1 Industrial Consolidations

My data on consolidations comes from Moody (1904). Moody compiles and reports information on large industrial combinations prior to 1904. My focus is on horizontal integration within narrowly-defined industries for tradeable goods. I exclude combinations of firms in transportation, mining, public utilities, and financial services, as well as combinations corresponding to vertical or lateral integration. The sample used in my analysis consists of consolidations in manufacturing industries between 1887 and 1902.

As stated before, a typical feature of the industrial consolidations of the time period is that they resulted from the horizontal integration of a (oftentimes large) number of firms operating within the same industry. They were usually not, as is more common in modern contexts, the result of a single dominant firm acquiring smaller competitors or branching out into related industries. Consolidations were executed by the creation of a new corporation, commonly referred to as a "trust". For each consolidation, Moody reports the year of incorporation of the resulting trust. I take this as the year in which the consolidation was effected.

My empirical strategy requires classifying consolidations by whether they happen in industries producing importable and dutiable goods and, within those that do, recording the industry's import intensity and average tariff rate. I identify, for each consolidation in my sample, the main goods produced by the merging firms and the resulting corporation. For some consolidations, this information is provided by Moody (1904), though with varying degrees of detail. To complete and refine this information, I draw on Moody's Manual of Corporation Securities (Moody (1902, 1903)), as well as other historical sources, including newspaper articles, company records, and industry publications.

My sample concerns combinations corresponding to the horizontal integration of companies operating in the same industry. The resulting corporations most often produce a single product, or a range of similar products: e.g. tanned leather, tinware, rubber boots and shoes, brick and tile, cutlery, photography film and cameras, electric batteries, etc. For those that produce more than one type of good, I identify the principal good from descriptions of the corporation offered by Moody or other sources. The resulting classification of consolidations at a detailed product level allows me to match them to data on dutiable status, imports and exports, and tariff rates. This data is described below.

2.1.2 Industry Imports, Exports, Tariff Rates and Dutiable Status

Data on the dutiable status of goods comes from the *Statistical Abstract of the United States* (SA) and from the original tariff acts (McKinley Act of 1890, Wilson-Gorman Act of 1894, Dingley Act of 1897), obtained from Congress statutes. The SA also reports import and export dollar values by article and year. This data is reported for years ending June 30th.

For broad industry categories of "principal commodities", the SA reports the dollar value of imports, duty collected, and the corresponding ad-valorem equivalent average duty rate. This broad industry categorization is not exhaustive, as it covers most, but not all, imported goods. Table 5 in Appendix A) shows duty rates for these categories for selected years. Since ad-valorem equivalent tariff rates are not reported at a more disaggregated level, I impute detailed-industry tariff rates from these broad-industry rates. I further discuss this procedure, and its potential drawbacks, when I describe the main variables used in my analysis.

2.1.3 Sample

My dataset contains 197 consolidations in manufacturing industries between 1887 and 1902. For the purpose of my analysis, I am interested in whether or not a given industry consolidated in a given year; several mergers reported in the same industry and year are taken as indication of a single industry consolidation. To focus on the timing of consolidations across industries that had at least one consolidation throughout the time period, I use my sample of consolidations to construct a balanced industry-year panel dataset, where each detailed industry i appears each year between 1887 and 1902. There are 111 unique industries in the dataset.

Throughout my analysis, I use two samples from this dataset. The *main sample* includes all detailed industries that fall into one of the broad-industry categories for which ad-valorem tariff rates are reported in the SA. The *full sample* contains all detailed industries, including those without tariff data. From both samples, I exclude industries with changes in dutiable status between 1887 and 1902.[2]

2.2 Variables and Descriptive Statistics

2.2.1 Industry Consolidations

My focus is on the timing of consolidations across industries. Across empirical specifications, I estimate the effect of changes in tariff levels, and industry exposure to such changes, on the probability that an industry has a consolidation in a given year. My dependent variable of interest, $Cons_{it}$, is a dummy variable equal to one if industry i had a consolidation in year t.

2.2.2 Changes in Tariff Law and Industry Tariff Rates

My empirical strategy relies on identifying substantial changes in industry tariff rates that stem from statutory changes. As data for detailed-industry tariff rates is not reported in the SA, I impute rates from the corresponding broad-industry rates. Doing so raises the issue that changes in broad-industry rates may not solely reflect statutory changes. The ad-valorem equivalent duty rate for a broad industry is a weighted average of the ad-valorem

[2] There are only two such industries: Asphalt and Lumber. Their inclusion does not significantly alter any of my results.

equivalent duty rates of articles it contains. Changes in a broad industry's rate over time may reflect statutory changes in tariff rates, but also changes in the composition of imports within that category. Moreover, for goods with a specific (per-unit) duty, they may additionally reflect changes in the pre-tariff price of imports.

To capture changes stemming from statutory changes, I rely only on substantial changes in broad-industry tariff rates following the introduction of one of the three tariff acts of the period: McKinley Act of 1890, Wilson-Gorman Act of 1894, or Dingley Act of 1897. For each broad industry, I calculate the percentage change in the ad-valorem equivalent tariff rate following a tariff act using the change in the rate from the last pre-tariff-act year to the first full post-tariff-act year.

For example, the McKinley Act of 1890 introduced duty rate changes effective October 6, 1890. Meanwhile, industry import values, duty collected, and the corresponding ad-valorem equivalent rates from the SA are reported for years ending June 30. As a result, average industry rates for 1891 reflect statutory rates from both before and after the 1890 act. 1892 is the first year where duty rates exclusively reflect the new law, while 1890 is the last year exclusively reflecting the prior law. The percentage change in the tariff rate following the 1890 law for broad industry j is thus defined as $\frac{rate_{j,1892} - rate_{j,1890}}{rate_{j,1890}} \times 100$.

For detailed industry i in year t, the variable $TariffChange_{it}$ is defined as follows. If the year t is within a time window—to be specified below—following a tariff act, then $TariffChange_{it}$ is equal to the percentage change in the rate for the corresponding broad industry following that tariff act. If t is not within that time window following an act, $TariffChange_{it} = 0$. I define $TariffChange_{it}$ in this way to isolate changes stemming from changes in statutory rates as much as possible.

I my empirical specifications, I use indicators for whether an industry's change in tariff rate is above a certain cutoff. $Increase_{it} = 1$ if $TariffChange_{it} > x$, where $x \in \{5, 10, 20\}$. Similarly, $Decrease_{it} = 1$ if $TariffChange_{it} < y$, where $y \in \{-5, -10, -20\}$. By construction, $Increase_{it}$ and $Decrease_{it}$ equal zero for years not within the time window following a tariff act.

I consider two possible time windows for estimating the effect of industry tariff changes. The two-year window starts the year after a tariff act, and ends the following year. The full-period window includes all years following an act up until the introduction of the next one. That is, 1891-1894 for the 1890 McKinley act, 1895-1897 for the 1894 Wilson-Gorman act, and 1898-1902 for the 1897 Dingley act. Across specifications, I report results using both time windows.

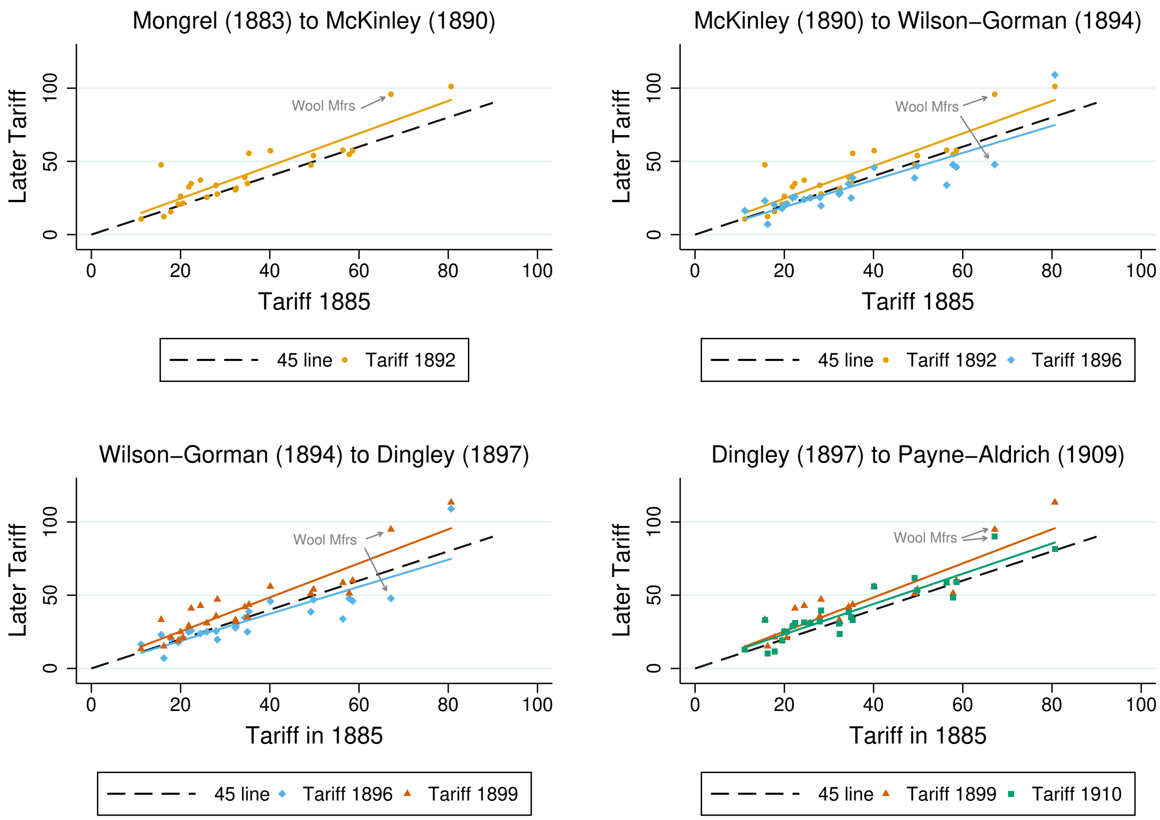
The approach outlined above is warranted only if the average rate changes for broad industries are generally indicative of the changes for the detailed industries they contain. Examining duty rate changes for a number of articles directly using the tariff laws suggests that this was generally the case. There are, however, a few notable exceptions. In particular, the ad-valorem equivalent rate for "Sugar, confectionery, and molasses" saw a large decrease following the 1890 act (see Table 5 in Appendix A), due entirely to raw sugar—one of the major imports and sources of government revenue of the time—being put on the free list.[3] In this case, the change in the broad-industry tariff rate does not reflect those for the detailed industries belonging to it in my sample (refined sugar; confectionery), which did not fall following 1890. For this reason, I exclude these detailed industries from my main sample, and only include them in the analysis that uses the full sample, which does not directly incorporate industry tariff changes.

Figure 2.1 illustrates changes in ad-valorem equivalent rates for broad industry categories following the tariff acts of 1890, 1894, 1897, and 1909.[4] In each graph, 1885 tariff rates on the x axis and the 45 degree line provide a reference point. Despite protective tariffs for manufactured goods being relatively high throughout the entire period, Figure 2.1 shows

[3]The rationale for this move, according to Taussig (1905), was to counteract a high government surplus and to gain popular support for the McKinley Act, which increased rates for most manufactured goods. The tariff on raw sugar did not make sense from a protective standpoint, as there was little potential for domestic production. Its move to the free list was nonetheless complemented with a subsidy for domestic producers of raw sugar in the form of a bounty in proportion to unrefined sugar imports.

[4]Sugar is excluded for the reasons stated above. Rice and unmanufactured wool are excluded as they are not manufactured goods. Distilled spirits is excluded as its high rates would bias the fitted lines and make the graphs hard to read.

Figure 2.1: Changes in Average Tariff Rates by Industry (1885-1910)



Notes: Plots show the average ad-valorem equivalent tariff rates by broad industry category. For each industry, average rates are calculated as government revenue over the dollar value of imports two years after the passage of each act (one year after in the case of the 1909 Act). Industries excluded are: sugar, rice, unmanufactured wool, and distilled spirits.

that the tariff acts of 1890, 1894, and 1897 induced substantial variation in tariff levels over time. Moreover, the changes for most manufactured goods following each of the acts went in the same overall direction. Wool manufactures serves as a good illustration for the trade policies of the period. Its average rate increased from 67% in 1885 to 96% in 1892, following the McKinley 1890 Act; then decreased to 48% in 1896, following the 1894 Wilson-Gorman Act; then increased to 95% in 1899, following the Dingley 1897 Act; and finally fell slightly to 90% in 1910, following the Payne-Aldrich Act. Though not all to the same extent, most manufacturing industries followed a similar pattern. Summary statistics in Table 7 in

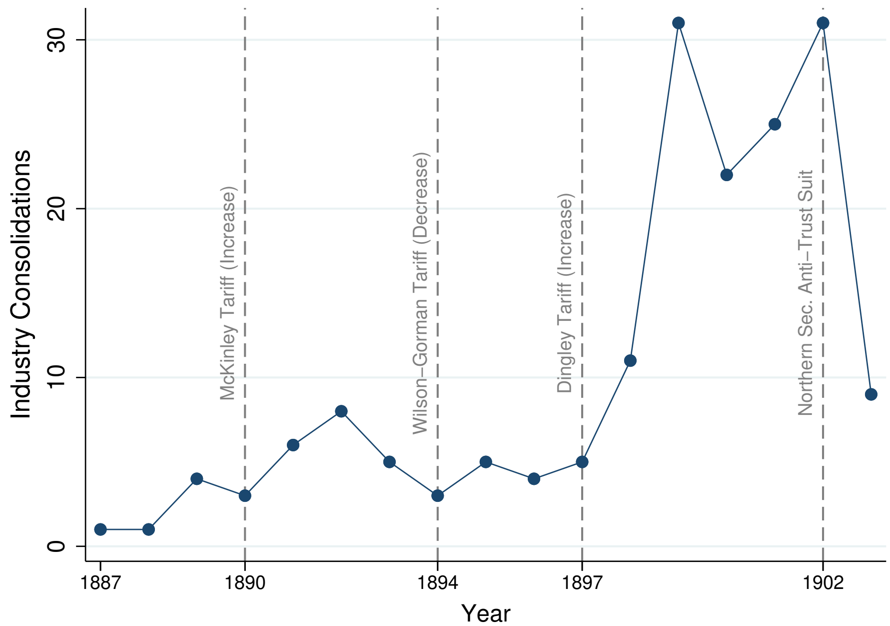
Appendix A) show that, out of 82 detailed industries in the main sample corresponding to one of the broad industry categories reported in the SA, 70% saw an increase of at least 10% in tariff rate after the 1890 Act, relative to only 6% that saw a decrease. For the 1894 Act, these numbers are 6% and 87% respectively, indicating a stark reversal in the direction of tariff changes. For the 1897 Act, they are 54% and 0%, in many cases restoring the rates set by the 1890 Act.

The patterns observed in Figure 2.1 and Table 7 confirm what I have alluded to before regarding trade policy in this period. Given that support for higher (lower) tariffs was almost perfectly split along party lines (see Figure B.1 in Appendix B), and given that changes in tariff policy required the approval of both houses of Congress and the Presidency, the timing and overall direction of new tariff acts was fully determined by Republican or Democrat control over government. As shown in Figure B.2 in Appendix B, the 1890, 1894 and 1897 acts all followed contested general elections where one of the parties gained control of the three levels of government. The Republican-led governments of 1890 and 1897 raised tariff rates for most manufactured goods, while the Democrat-led government of 1894 lowered them.

Figure 2.2 plots industry consolidations 1887-1903, marking the periods defined by the 1890, 1894, and 1897 tariff acts. I also mark 1902, the year of President Roosevelt's first antitrust suit, as the endpoint of my analysis.[5] As is apparent from Figure 2.2, there was a large wave of consolidations 1898-1902, following the introduction of the 1897 Dingley Act. This is what most authors refer to as the great merger wave of the turn of the 20th century. However, there is significant variation in consolidation activity throughout the entire time period, with a prior, smaller wave starting around 1891, after the 1890 McKinley Act. Of course, the time trend on its own is not evidence of a causal effect of tariff changes on consolidation activity. The goal is to determine whether industries that saw substantial rate

[5] McKinley's assassination in 1901 and Roosevelt's first antitrust suit in 1902 signaled the stark change in attitudes towards large consolidations that would follow (Baker et al. (2023)). My analysis is therefore restricted to the years 1887-1902, for which the characterization of the context as one of lax antitrust enforcement, in which industry rivals faced few legal constraints to consolidation, is most warranted.

Figure 2.2: Industry Consolidations by Year (1887-1903)



increases had more subsequent consolidations than they would have had in their absence. A key challenge in doing so is that industry-specific changes in tariff rates are not, in general, exogenous. Throughout this period, they were often the result of lobbying or served special political interests (Irwin (2017)). In estimating the effect of tariff changes on consolidations, using industry-specific changes therefore raises endogeneity concerns, and may result in biased estimates if treated and non-treated industries differ in unobserved time-varying characteristics correlated with consolidation activity.

To circumvent these concerns, in my strategy I follow an instrumental variables approach—outlined in Section 2.3—where I rely on the changes in tariff policy induced by party turnover as a source of plausibly exogenous variation in tariff levels without directly relying on industry-specific tariff levels. For this, I define the variables $RepAct_t$ and $DemAct_t$ as dummy variables, $= 1$ if year t lies within the time window following a Republican-led (Democrat-led) tariff act. Given the patterns of trade policy described above, $RepAct_t$ and $DemAct_t$ are good predictors of whether an industry faced a recent tariff increase (or decrease) in a given year, indicated by the variables $Increase_{it}$ and $Decrease_{it}$ respectively.

However, relying on the variation in tariff levels captured by $RepAct_t$ and $DemAct_t$ alone requires identifying some other source of cross-industry variation. To this end, the following subsection introduces a measure of industry exposure to tariff changes.

2.2.3 Industry Exposure to Tariff Changes

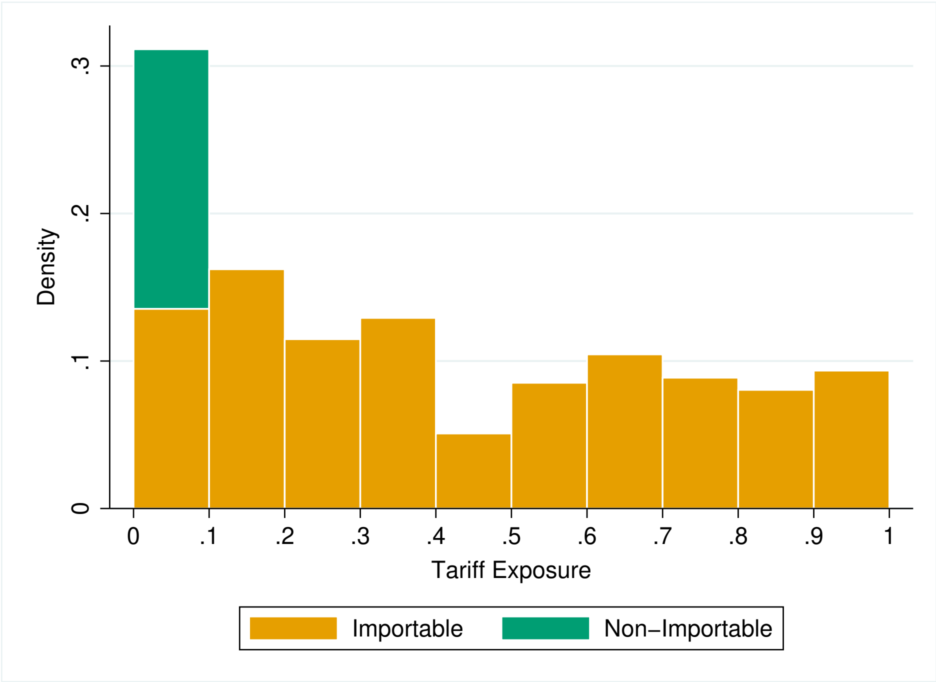
Tariff changes can directly affect industry market structure by altering the import competition faced by domestic producers. Industries producing goods that are free of duty are unaffected by general tariff rate changes. Similarly, industries producing goods subject to duty but facing no import competition in practice, regardless of the duty rate, are also unaffected by tariff changes. In line with this, I construct two variables to capture industry variation in exposure to tariff changes.

The first variable, $TariffExposed_i$, is binary. Industries are classified as tariff-exposed if they produce goods that are both importable and dutiable. To determine whether goods are importable, I follow several steps. First, a good is classified as importable if it, or the category of goods under which it clearly falls, appears in the Statistical Abstract imports data. If not, I determine whether the good might not have been feasibly importable at the time, owing to scale, physical characteristics, or it being a product of a recent U.S. technological development. This identifies whether domestic producers in the industry are, in principle, subject to import competition. If the good is also dutiable, then it is tariff-exposed. $TariffExposed_i$ is indexed by i only, as the main and full samples only include industries with constant dutiable status over time.

Within the set of tariff-exposed industries, some are likely more sensitive to changes in tariff levels than others, depending on the extent to which they face import competition in practice. To account for this, I construct the variable $TariffExposure_{it}$, which incorporates data on industry trade flows. In general, I expect sensitivity to tariff changes to increase with an industry's import intensity.

$ImportIntensity_{it}$ represents industry i's pre-tariff-change import intensity: the share of

Figure 2.3: Histogram of the Industry Tariff Exposure



imports in its total foreign trade (imports plus exports) during a year preceding the most recent tariff change. For example, for $t = 1898$, under the high-tariff period of the 1897 Dingley Tariff, $ImportIntensity_{it}$ uses 1896 trade data for industry i.

$TariffExposure_{it}$ is then defined as $Dutiable_i \times ImportIntensity_{it}$. For industries producing goods that are free of duty or not importable, $TariffExposure_{it} = 0$. For industries producing goods that are dutiable and importable, $TariffExposure_{it} = ImportIntensity_{it}$. In the latter case, the use of lagged trade data circumvents concerns arising from the fact that industry trade flows respond to changes in tariff levels.

$TariffExposure_{it}$ ranges from 0 to 1. Figure 2.3 shows the histogram of $TariffExposure_{it}$ using all industry-year observations in the full sample. A value of 0 indicates an industry that is duty-free, not importable, or importable but not imported in practice and therefore not sensitive to tariff changes. Values close to 1 indicate dutiable goods that are imported but not exported, suggesting high exposure to import competition and tariff changes. A value of 0.5 corresponds to industries with balanced trade. Highlighted in green are observations corresponding to non-importable industries. As these industries might, in principle, differ from others in ways that may bias my estimates, I present results with and without these industries across all specifications.

2.3 Empirical Strategy

I seek to assess whether tariff changes during the late 19th century had a causal effects on industrial consolidations. In this section, I describe my empirical strategy, making reference to the dataset and variables outlined above. The following section presents the main results.

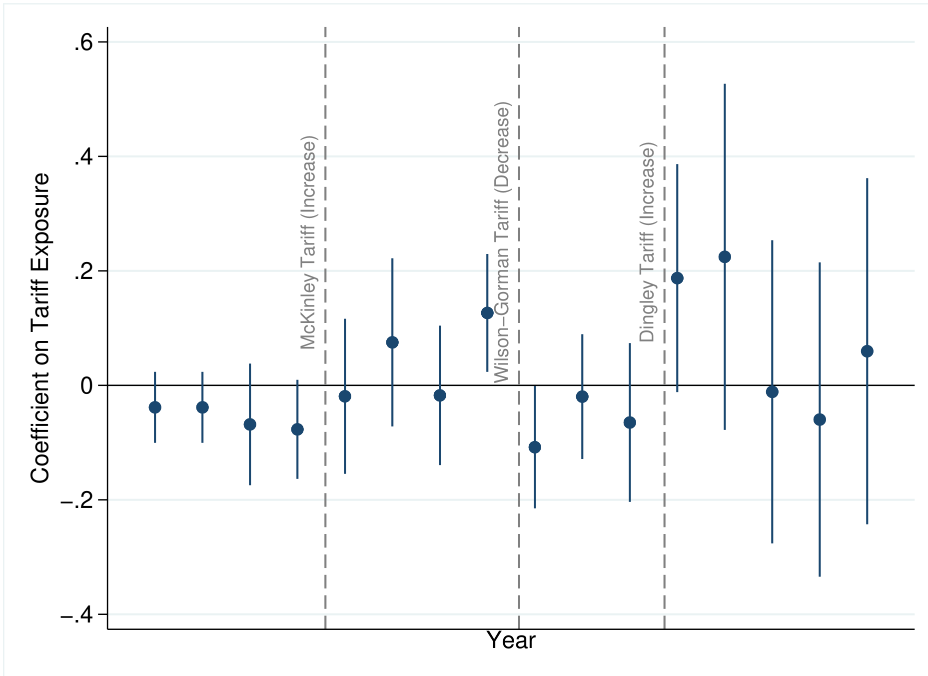
My strategy combines the two sources of variation described in the preceding section: changes in trade policy over time, and cross-industry variation in exposure to tariff changes. Figure 2.4 plots, by year, the estimated coefficients of a linear regression of $Cons_{it}$ on $TariffExposure_{it}$. The estimates suggest an increased probability of consolidation in more-tariff-exposed relative to less-tariff-exposed industries in years following a general tariff increase.

To assess this, my empirical specifications incorporate the interaction between tariff changes and tariff exposure. The OLS specification, which directly incorporates industry-specific indicators for substantial tariff increases and decreases, is given as follows:

$$Cons_{it} = \begin{array}{c} \beta_1 TariffExposure_{it} + \beta_2 Increase_{it} + \beta_3 Decrease_{it} + \\ \beta_4 (T.Exposure_{it} \times Incr_{it}) + \beta_5 (T.Exposure_{it} \times Decr_{it}) + \\ \delta_i + \delta_t + \varepsilon_{it} \end{array} \tag{2.1}$$

The coefficients of interest, β_4 and β_5, capture the differential effect of a tariff increase (decrease) on industries relatively more exposed to tariff changes. With the inclusion of industry and year fixed effects, the estimates in this two-way fixed effects specification are derived from difference-in-difference comparisons of treated and non-treated industries at several points in time, with the interaction terms capturing the intensity of treatment. The

Figure 2.4: Industry Tariff Exposure and Probability of Consolidation, by Year



Notes: The plot shows, separately for each year, the estimated coefficient of a linear regression of $Cons_{it}$ on $TariffExposure_{it}$. Vertical lines display 95% confidence intervals.

main identifying assumption underlying (2.1) is that treatment (whether an industry faces a substantial tariff increase or decrease), and the intensity of treatment (the interaction with an industry's exposure to tariff changes), are not correlated with time-varying factors that are themselves correlated with consolidation activity. Given the hypothesis that tariff increases can trigger consolidations in industries facing import competition, my main prediction is $\beta_4 > 0$, which would indicate that tariff increases resulted in an increased probability of consolidation for more-tariff-exposed relative to less-tariff-exposed industries.

As I have alluded to before, industry-specific tariff changes are not exogenous. The OLS approach in (2.1) is therefore subject to endogeneity concerns, and may lead to biased estimates. This might happen if, for instance, industries treated with a tariff change are also differentially affected by other government policies or by macroeconomic shocks, or if they differ in unobserved time-varying characteristics that are correlated with consolidation activity. To address this concern, I follow an instrumental variables strategy exploiting the changes in tariff policy induced by party turnover, captured by variables $RepAct_t$ and $DemAct_t$. Specifically, given that $RepAct_t$ is a good predictor of whether an industry has faced a recent tariff increase, I use $TariffExposure_{it} \times RepAct_t$ as an instrument for $TariffExposure_{it} \times Increase_{it}$. Similarly, I use $TariffExposure_{it} \times DemAct_t$ as an instrument for $TariffExposure_{it} \times Decrease_{it}$.[6] The reduced-form specification for the 2SLS model is stated in equation (2.2) below. Note that $RepAct_t$ and $DemAct_t$ are not separately included, as they are captured in the year fixed effects.

$$\begin{aligned} Cons_{it} = \quad & \gamma_1 TariffExposure_{it} + \gamma_2 (TariffExposure_{it} \times RepAct_t) + \\ & \gamma_3 (TariffExposure_{it} \times DemAct_{it}) + \delta_i + \delta_t + \varepsilon_{it} \end{aligned} \tag{2.2}$$

The idea behind the IV approach is that $TariffExposure_{it} \times RepAct_t$ captures relevant variation in $TariffExposure_{it} \times Increase_{it}$ without being subject to the endogeneity concerns stemming from $Increase_{it}$. Endogeneity concerns may remain, however, if $TariffExposure_{it}$ (measured using industry i's pre-tariff-change import intensity) is itself correlated with $Increase_{it}$. In the discussion following my results, I show that this is not the case, as import intensity is not predictive of tariff changes. Nonetheless, it could still be the case that $TariffExposure_{it}$ affects trends in consolidation activity directly, and not only through determining an industry's sensitivity to tariff changes. I further address this concern, and discuss alternative mechanisms, following my results.

The OLS and IV results for this main empirical specification are presented in Table 1. The corresponding first-stage and reduced-form results are in Appendix B. In Table 1, the percentage-change cutoffs used to define $Increase_{it}$ and $Decrease_{it}$ are 10%. Results with 5% and 20% cutoffs are also reported in Appendix B. Table 1 includes results using two different time-windows for estimating effects of tariff changes (two-year and full-

[6] An alternate two-stage approach is to instrument $Increase_{it}$ and $Decrease_{it}$ with $RepAct_t$ and $DemAct_t$ only, and then use predicted values from the first stage ($\hat{Increase}_{it}$ and $\hat{Decrease}_{it}$) to run a second-stage regression including the interaction terms $TariffExposure_{it} \times \hat{Increase}_{it}$ and $TariffExposure_{it} \times \hat{Decrease}_{it}$. Both approaches lead to similar results for my main specification.

period windows). When using full-period time windows, I exclude variables $Decrease_{it}$ and $TariffExposure_{it} \times Decrease_{it}$ from (2.1). In this case, estimates come from comparing consolidations in more-exposed relative to less-exposed industries in the two periods following Republican-led tariff acts (1891-1894 and 1898-1902) versus the other two periods of relatively lower tariffs (1887-1890 and 1894-1897). Finally, as industries producing non-importable goods might, in principle, differ from others in ways that could bias results, I show all results with and without their inclusion.

The estimated coefficients in my main specification are weighted averages of difference-in-differences comparisons at different points in time. I further examine the responses after each tariff act in isolation. For each act, I follow the same model specified in (2.1) and (2.2), but the sample is restricted to industry-year observations within the periods immediately before and after the tariff act. This allows me to verify that the estimated effects in my main results are not driven by one period in particular. These results are presented in Table 2.

Finally, I complement the results of my main specification by extending the analysis to the full sample, which includes industries without tariff rates reported in the SA. In this case, I can only estimate the reduced-form equation (2.2). For this full sample, I also run a version of equation (2.2) that incorporates the binary measure $TariffExposed_i$, which simply indicates whether an industry produces goods that are importable and dutiable. This binary measure abstracts from the variation in tariff exposure within importable and dutiable industries coming from differences in import intensity. This specification is given by equation (2.3) below. Note that (2.3) excludes $RepAct_t$, as it is captured by year fixed effects, and $TariffExposed_i$, as it is captured by industry fixed effects.

$$\begin{aligned} Cons_{it} = \quad & \varphi_1(RepAct_t \times T.Exposed_i) + \\ & \varphi_2(DemAct_{it} \times T.Exposed_i) + \delta_i + \delta_t + \varepsilon_{it} \end{aligned} \tag{2.3}$$

Results using the full industry sample are shown in Table 3. I show results varying the time window for treatment, and for both the full and main samples.

3 Empirical Results

Section 3.1 shows OLS and IV results from my main model, which uses the main industry sample and incorporates data on industry tariff changes. Across specifications, I find consistent evidence that tariff increases result in an increased probability of consolidation in more-tariff-exposed relative to less-tariff-exposed industries. This main finding is robust to different time windows, varying percentage-change cutoffs, and the inclusion or exclusion of non-importable goods. Moreover, pre-post analysis of responses to each tariff act are consistent with the predictions, and show that the main results are not exclusively driven by any single tariff policy change. Section 3.2 extends the analysis to the full sample of industries, including those with unavailable tariff data. In spite of this limitation, reduced-form estimates show results qualitatively similar to those in Section 3.1. Section 3.3 discusses the results, addressing potential identification concerns and alternative mechanisms.

3.1 Industry tariff changes, exposure to tariff changes, and consolidation

Table 1 shows results from the 2SLS estimation outlined in equations (2.1) and (2.2). Table in Appendix B shows results from the corresponding reduced-form and first-stage regressions. The percentage-change cutoff used to define industry rate increases and decreases is 10%. Tables 9-12 in Appendix B show corresponding results for 5% and 20% cutoffs.

In Panel A, treatment variables $Increase_{it}$ and $Decrease_{it}$ are defined using a two-year window, thus capturing the effects of tariff changes on consolidation activity in the two years immediately following a tariff act. Consistent with my prediction, the estimated coefficients on the interaction term $TariffExposure_{it} \times Increase_{it}$ is positive and highly significant. The IV estimation reported in column 2 shows that, for industries having seen a tariff increase of more than 10 percent within the last two years, having a one standard deviation (0.3801) higher tariff exposure prior to the tariff change results in a $0.3801 \times 0.185 = 0.07$ higher change in the probability of consolidation. Restricting the sample to industries producing importable goods only, the corresponding value using estimates in column 4 is 0.089. This is almost an 100% increase with respect to the unconditional probability of consolidation across all industries and time periods in the sample (0.0945), indicating a large effect of tariff increases on consolidation activity in industries more highly exposed to import competition.

The IV estimates for $TariffExposure_{it} \times Increase_{it}$ in columns 2 and 4 are slightly lower than the corresponding estimates in columns 1 and 3. This suggests a small positive bias in the OLS results, which could reflect several things. First, it could indicate that an industry's ability to lobby successfully for tariff hikes is positively correlated with a pre-existing tendency towards industry coordination and consolidation. This seems unlikely, however, as it is more plausible that industries that already consolidated, and not those aiming to consolidate in the near future, would be more effective at lobbying. Second, it could reflect that industries that saw a substantial tariff increase were treated differently by the incoming government in ways other than just tariff protection and that positively influenced their consolidation activity. Either scenario would reflect a more positive counterfactual trend for treated industries, biasing the OLS estimate upwards. The IV estimate corrects for this potential bias in the OLS estimates, as it does not directly incorporate the variation in industry-level tariff changes, but rather relies on time-variation in tariff levels that are common across industries.

The negative coefficient on $Increase_{it}$ should be interpreted with caution. It indicates the relative increase in the probability of consolidation for industries that saw a rate increase of at least 10% within the past two years and have $TariffExposure_{it} = 0$. There are, however, no such industries. This negative intercept comes from extrapolating the linear relation between tariff exposure and probability of consolidation for industries with a $> 10\%$ increase. For most industries with $Increase_{it} = 1$, the predicted effect of the increase on the

Table 1: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation

	Main Sample		Importables Only	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A: Two-Year Window				
Tariff Exposure	-0.155	-0.153	-0.0974	-0.111
	(0.112)	(0.122)	(0.0944)	(0.107)
Tariff Increase (> 10%)	-0.0787**		-0.0727*	
	(0.0353)		(0.0372)	
Tariff Decrease (> 10%)	0.0200		0.0371	
	(0.0429)		(0.0553)	
Tariff Exposure × Tariff Increase	0.237***	0.185***	0.222***	0.197***
	(0.0535)	(0.0494)	(0.0558)	(0.0575)
Tariff Exposure × Tariff Decrease	-0.0434	-0.0484	-0.0484	-0.0606
	(0.0499)	(0.0433)	(0.0506)	(0.0557)
Panel B: Full-Period Window				
Tariff Exposure	-0.164	-0.203*	-0.0943	-0.137
	(0.104)	(0.120)	(0.0802)	(0.0942)
Tariff Increase (> 10%)	-0.0681**		-0.0768**	
	(0.0312)		(0.0326)	
Tariff Exposure × Tariff Increase	0.139**	0.173***	0.122*	0.134*
	(0.0628)	(0.0588)	(0.0626)	(0.0696)
Year Fixed Effects	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES
Industries	98	98	82	82
Industry-Year Observations	1568	1568	1312	1312
Mean Dep Var	0.0912	0.0912	0.0945	0.0945
SD Tariff Exposure	0.3195	0.3195	0.2972	0.2972
K-P F-stat (Panel A)		25.54		21.93
K-P F-stat (Panel B)		57.76		47.46

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 10 (lower than -10) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0. The corresponding reduced-form and first-stage regressions a reported in Table 8.

probability of consolidation, $\beta_2 Increase_{it} + \beta_4(TariffExposure_{it} \times Increase_{it})$, is strictly positive.

To examine whether the effects estimated in Panel A are persistent, Panel B shows results using a full-period time window. The estimated coefficient for the interaction term in columns 2 and 4 is still large and significant, though slightly smaller than in Panel A. This suggests that the effect in the initial years following a policy change is not fully offset in subsequent years, indicating that tariff changes do not simply alter the timing of consolidations across more and less tariff-exposed industries, but do affect the overall level of consolidation for more-exposed industries

Tables 9-12 in Appendix B show corresponding results for 5% and 20% cutoffs. The estimate for $TariffExposure_{it} \times Increase_{it}$ is slightly smaller when using 5% cutoffs, and slightly larger with 20% cutoffs, consistent with the magnitude of the effect of a tariff increase on the probability of consolidation being increasing in the size of the tariff increase. Bear in mind, though, that 5% is a small enough change that it might pick up rate changes stemming from variation in foreign prices or in the composition of imports, and not simply statutory changes in rates. On the other hand, the instruments using the 20% cutoff have a weaker first stage.

Table 2 shows results from estimating the 2SLS model from (2.1) and (2.2) separately for each tariff act, in each case restricting the sample to industry-year observations within the periods immediately before and after a given tariff act. Columns 1-2, and 5-6, show the effects of the McKinley 1890 and Dingley 1897 acts respectively. Both Republican-led acts increased rates for most manufacturing industries. The estimated coefficient of interest is positive in both cases, though less significant for the first act. This could well reflect the fact that there were fewer consolidations in earlier years, complicating the identification of an effect through comparing more- vs less-exposed industries. For the Democrat-led Wilson-Gorman Act of 1894, the coefficient on $TariffExposure_{it} \times Decrease_{it}$ is negative and significant, consistent with the overall hypothesis that higher tariffs result in more consolidations in

Table 2: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation (Before and After Each Tariff Act)

	Mongrel to McKinley		McKinley to Wilson-Gorman		Wilson-Gorman to Dingley	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-Year Window						
Tariff Exposure	0.0911	0.111	-0.0955	-0.108	-0.309	-0.302
	(0.0711)	(0.0737)	(0.190)	(0.181)	(0.202)	(0.212)
Tariff Increase (> 10%)	-0.0355				-0.0700	
	(0.0300)				(0.0743)	
Tariff Exposure × Tariff Increase	0.126**	0.0725			0.313**	0.295***
	(0.0526)	(0.0804)			(0.129)	(0.0789)
Tariff Decrease (> 10%)			0.0441			
			(0.0344)			
Tariff Exposure × Tariff Decrease			-0.101**	-0.0832*		
			(0.0456)	(0.0488)		
Panel B: Full-Period Window						
Tariff Exposure	0.110	0.0293	-0.102	-0.116	-0.316	-0.297
	(0.0801)	(0.0967)	(0.184)	(0.185)	(0.195)	(0.234)
Tariff Increase (> 10%)	0.0001				-0.0540	
	(0.0271)				(0.0563)	
Tariff Exposure × Tariff Increase	0.0383	0.159**			0.170*	0.178**
	(0.0438)	(0.0753)			(0.0982)	(0.0762)
Tariff Decrease (> 10%)			0.0248			
			(0.0250)			
Tariff Exposure × Tariff Decrease			-0.107*	-0.105**		
			(0.0578)	(0.0477)		
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Industries	98	98	98	98	98	98
Industry-Year Observations	784	784	686	686	784	784
Mean Dep Var	0.0319	0.0319	0.0423	0.0423	0.151	0.151
SD Tariff Exposure	0.3276	0.3276	0.3254	0.3254	0.3108	0.3108
K-P F-stat (Panel A)		10.73		647.1		39.32
K-P F-stat (Panel B)		10.65		526.7		36.83

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 10 (lower than -10) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) Mongrel Act: 1887-1890, (2) McKinley Act: 1891-1894, (3) Wilson-Gorman Act: 1895-1897, (4) Dingley Act: 1898-1902. Columns 1 and 2 include industry-year observations within periods (1) and (2); columns 3 and 4 within periods (2) and (3); columns 5 and 6 within periods (3) and (4). Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0.

industries more exposed to import competition.

3.2 Tariff acts, industry exposure to tariff changes, and consolidations

Panel A in Table 3 shows results for the reduced-form specification (2.2) using both the full and the main sample. Panel B shows the corresponding results for specification (2.3), replacing the continuous measure $TariffExposure_{it}$ with the binary variable $TariffExposed_i$, which simply indicates if an industry produces importable and dutiable goods.

All results are in line with the OLS and IV results for the main sample in Table 1. However, as is expected given that these are reduced-form regressions, the estimates are muted compared to the IV estimates. In particular, the estimates in Panel A using the Full Sample are smaller and not statistically significant. This is partly driven by the inclusion of industries corresponding to clays, earths, and construction materials in the full sample. Such industries produce goods traded at a more local level, as opposed to most other manufacturing industries in the sample. Given this, their consolidation dynamics might respond to local shocks in ways that could bias the estimates. Table 15 in the appendix shows results for Table 3 excluding such industries. Finally, the results in Panel B show that the effects of tariff changes on consolidations are not offset by later years, but instead continue to hold when including all years in each tariff regime.

3.3 Discussion

I now turn to addressing remaining identification concerns, and discussing alternative explanations for the results presented.

As already discussed, the IV strategy is intended to correct for the potential endogeneity of industry tariff changes. While industry-specific changes are subject to lobbying, the IV strategy relies on policy changes common to all industries. However, reverse causaility

Table 3: Tariff Law Changes, Industry Tariff Exposure, and Probability of Consolidation

	Full Sample			Main Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-Year Window						
Tariff Exposure		-0.129	-0.104		-0.118	-0.0720
		(0.0817)	(0.0754)		(0.117)	(0.102)
Tariff Exposure × Republican Tariff Act		0.0746	0.0675		0.130***	0.140***
		(0.0552)	(0.0678)		(0.0420)	(0.0482)
Tariff Exposure × Democrat Tariff Act		-0.0175	-0.0289		-0.0441	-0.0597
		(0.0481)	(0.0591)		(0.0428)	(0.0574)
Tariff Exposed × Republican Tariff Act	0.0364			0.0407		
	(0.0272)			(0.0278)		
Tariff Exposed × Democrat Tariff Act	-0.0326			-0.0440		
	(0.0465)			(0.0454)		
Panel B: Full-Period Window						
Tariff Exposure		-0.174**	-0.145**		-0.146	-0.0936
		(0.0747)	(0.0660)		(0.107)	(0.0878)
Tariff Exposure × Republican Tariff Act		0.116***	0.0934*		0.123***	0.0972*
		(0.0382)	(0.0482)		(0.0427)	(0.0537)
Tariff Exposed × Republican Tariff Act	0.107***			0.113***		
	(0.0350)			(0.0344)		
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Importable Industries Only	-	-	YES	-	-	YES
Industries	111	111	95	98	98	82
Industry-Year Observations	1776	1776	1520	1568	1568	1312
Mean Dep Var	0.0929	0.0929	0.0961	0.0912	0.0912	0.0945
SD Tariff Exposure	0.3175	0.3175	0.2982	0.3195	0.3195	0.2972

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Rep Tariff Act (Dem Tariff Act) is a dummy variable, =1 if a Republican-led (Democrat-led) Tariff Act was introduced within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0. Tariff Exposed is a dummy variable, =1 if industry produces importable and dutiable goods.

concerns may remain if the timing and overall direction of the tariff acts themselves is correlated with the lobbying power of more-tariff-exposed firms (relative to less-tariff-exposed firms) at a given point in time. The fact that the tariff acts of 1890, 1894 and 1897 follow highly contested general elections in which either Republicans or Democrats regained control of the Congress and Presidency, and these being necessary conditions to pass significant changes to tariff law, allays this concern. The tight margins of victory for the winning party makes it unlikely that one party's control over Congress and the presidency, and the resulting tariff legislation, directly reflected the greater strength (or lack thereof) of more-tariff-exposed (relative to less-tariff-exposed) industrialists at that moment.

Given the IV strategy and the plausible exogeneity of policy changes, the main remaining concern is that the measure of pre-tariff-change tariff exposure might not only capture the sensitivity of an industry to tariff changes, but could also be correlated with other factors affecting consolidation trends. For instance, it could be that entering Republican governments were more favorable to industrial consolidations in more import-intensive relative to less import-intensive manufacturing industries, or favored import-intensive industries in such a way that made them more likely to consolidate. The first scenario is unlikely, given that the governments of the time, both Republican and Democrat, did not seek to prevent or break up industry consolidations. This only started to change after 1902, following Roosevelt's first antitrust suit (Baker et al. (2023)).

The second scenario remains a potential confounder. All of my specifications include tariff exposure separately as a control, assuaging the concern. However, to further examine this, I test whether pre-tariff-change import intensity is predictive of industry tariff changes for each of the tariff acts in the sample. If it is, then it could suggest that Republican governments favored more import-intensive industries, potentially also in ways other than just through tariff protection. Table 4 shows these results. It is reassuring to see that the actual tariff changes were not determined by the extent to which an industry faced foreign competition, as captured by import intensity before the act. This is in line with the interpretation that

Table 4: Import Intensity Does Not Predict Industry Tariff Changes

		Increase			Decrease		
Dependent Variables:	% Change	> 5%	> 10%	> 20%	> 5%	> 10%	> 20%
Panel A: McKinley Act (1890)							
Import Intensity	-30.15	-0.165	-0.248	-0.206	0.0902	-0.121	
	(22.96)	(0.239)	(0.249)	(0.263)	(0.218)	(0.135)	
Observations	80	80	80	80	80	80	
R-squared	0.049	0.014	0.027	0.018	0.006	0.023	
Panel B: Wilson-Gorman Act (1894)							
Import Intensity	8.072	-0.0469	-0.0469	-0.0469	0.114	0.176	-0.151
	(10.16)	(0.0729)	(0.0729)	(0.0729)	(0.111)	(0.151)	(0.276)
Observations	80	80	80	80	80	80	80
R-squared	0.011	0.003	0.003	0.003	0.015	0.025	0.009
Panel C: Dingley Act (1897)							
Import Intensity	11.48	0.0202	0.627*	0.142			
	(16.60)	(0.151)	(0.310)	(0.341)			
Observations	80	80	80	80			
R-squared	0.020	0.000	0.127	0.007			

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Includes all industries in the main sample that produce importable and dutiable goods. Import intensity, ranging from 0 to 1, is measured in a year prior to the tariff act. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff changes are calculated as the percentage change in the duty rate between the first full year after the Act and the last full year prior to the Act. Increase (Decrease) is a dummy variable, =1 if the industry had a percentage increase (decrease) in tariff rate greater than 5, 10 and 20 respectively. Estimates left blank indicate there were no industries with the corresponding decrease in tariff rates in that period.

trade protection granted by the government, sometimes in response to lobbying efforts, was fairly idiosyncratic. It was dependent on relations between government and industry leaders, and did not reflect a clear industrial policy seeking to favor infant industries most vulnerable to import competition (Irwin (2017)).

Finally, there are concerns related to other time-varying factors that may differentially affect more import-intensive industries, such as macroeconomic shocks. Of particular interest is the Panic of 1893, which might explain the slowdown in consolidations 1894-1897 before the spike in 1898 following economic recovery. Though this is a valid concern, it is reassuring that my findings are not driven by the responses to any single tariff act, and that the effects estimated for the McKinley Act of 1890 and the Dingley Act of 1897 follow the same overall pattern, as shown in Table 2.

4 Theoretical Framework

Motivated by the finding that increases in tariffs can induce industrial consolidations, this section introduces a theoretical framework in which market structure evolves endogenously in response to changes in trade policy. I follow a coalitional approach, which allows me to examine responses to tariff changes through changes in firm boundaries. I show that, for industries facing import competition, higher tariffs can indeed trigger industry consolidation.

Building on Legros, Newman and Udvari (2024), I construct an incentive-constrained coalitional model of endogenous market structure. This baseline model concerns a homogeneous-good industry, where producers that are subject to internal contracting imperfections can either operate on their own or join together to form larger firms that then engage in Cournot competition. In either case, producers face a restricted set of incentive-compatible production choices. The equilibrium market structure equates the value of operating inside versus outside of an oligopoly, yielding the most concentrated oligopoly structure up to a no-holdout constraint.

I extend this framework to incorporate import competition while preserving the parsimony of the baseline model. Treating foreign and domestic varieties as perfect substitutes, and assuming a perfectly elastic foreign supply, the tariff-inclusive price of imports sets a price ceiling for domestic producers. When binding, the price ceiling induces the formation of an oligopoly that restricts industry output just enough to match it. The oligopoly that forms under import competition is less concentrated, and extracts lower markups, than the one that arises in its absence. In this sense, trade disciplines domestic producers. A higher tariff raises the price ceiling, presenting an opportunity for producers to increase prices and achieve higher surplus through consolidation.

Of course, higher producer surplus invites entry, which may undermine incentives to consolidate in the first place. I further extend the model to incorporate an initial entry stage, prior to firm formation, in which potential producers can pay a sunk cost to enter the market. While this margin of adjustment guarantees zero net-surplus for producers in equilibrium, it need not affect the equilibrium number of oligopoly firms that emerges from the subsequent firm-formation stage. I show that, following a tariff increase, the higher industry profits afforded by a higher price ceiling lead to both increased entry *and* a more consolidated industry.

Section 4.1 introduces the baseline model and characterizes the equilibrium. Section 4.2 studies the model in the presence of import competition and establishes comparative statics results with respect to tariff changes. Section 4.3 further extends the model to allow for entry. Sections 4.4 and 4.5 summarize and discuss the theoretical results.

4.1 Baseline Model

4.1.1 Industry Primitives and Production

The baseline model is a special case of the framework introduced in Legros, Newman and Udvari (2024) (hereafter, LNU). It concerns endogenous market structure in an industry for a homogeneous good. Demand for the good is linear, with inverse demand given by $P(Q) = A - bQ$.

Production is carried out by a large number of identical, capacity-constrained production units that are small relative to product demand. Each productive unit is comprised of several self-interested constituents (e.g. partners) that jointly own an indivisible asset. To reflect the composite nature of productive units, I refer to them as *partnerships*. There is a continuum of partnerships, indexed $p \in [0, M]$. For now, $M > 0$ is fixed. In section 4.3, when I introduce free entry of producers, M will be allowed to vary.

A partnership's output is denoted as $x \in [0, 1]$, where $x \leq 1$ reflects a capacity constraint. To produce x, partners incur in a monetary cost cx, as well as a strictly increasing and strictly convex private effort cost ϕx^2, where $c, \phi \geq 0$. Given output x and price P, a partnership's joint surplus is $Px - cx - \phi x^2$. The first-best choice of x given P is $x^{FB} = \min\left\{\frac{P-c}{2\phi}, 1\right\}$. This first best, however, is not necessarily feasible. Production depends on the joint effort of all partners, but each partner incurs in a private cost of providing their individual effort. This creates an incentive problem that, in the presence of internal contracting imperfections, cannot be resolved via a contract.[7]

If partners were to choose effort levels independently, for instance by specifying a profit-sharing rule and then maximizing individual surplus, the resulting choices would lead to underprovision of effort relative to the first best. Instead, LNU resort to a different second-best solution to the incentive problem: introducing third-party authority. In this, they follow the approach in Hart and Holmstrom (2010) and Legros and Newman (2013). Partners can confer authority over production choices to a profit-motivated manager, who prioritizes effort provision while disregarding private costs.

If the productivity gains afforded by third-party authority are large relative to the increased private costs, authority will be the preferred ownership structure. For simplicity, the model effectively assumes this is the case by requiring that partnerships confer authority to a third-party manager in order to produce.

4.1.2 Partnerships, Managers, and Firms

In line with the property-rights approach to the theory of the firm, authority over non-contractible production choices is granted by asset ownership. To confer authority, partners must sell their indivisible asset to a manager. There is a large measure of managers i with zero opportunity costs. Managers are in abundance with respect to partnerships, which guarantees they make zero profits in equilibrium. They make production choices to maximize monetary profits. Among profit-equivalent alternatives, managers break ties by minimizing

[7] I refer the reader to Legros, Newman and Udvari (2024) for a micro-foundation of partnership production and surplus. Assuming symmetric and strictly convex private effort costs for each partner, we may express monetary profits and private effort costs for the partnership as a whole in the reduced form given above, regardless of ownership structure.

the aggregate private effort costs of partners under their control. This "minimum blowback" assumption can be viewed, for instance, as managers minimizing the hassle of dealing with partners' complaints.

A key innovation of LNU is that they allow for a single manager to control anything from one partnership to the entire population of partnerships, thus using the notion of authority as a building block for market structure. Output aggregates linearly across the partnerships controlled by a single manager, with no added cost of managing a potentially large number of them.

A *firm* is the union of assets owned by a single manager. Denote by E_i the set of all partnerships p that are controlled by manager i. I refer to a firm that consists of a manager controlling a single partnership as a *stand-alone (SA) firm.* As it is infinitesimal relative to product demand, the output of a SA firm has no influence on market price, so managers of SA firms behave as price-takers. When a firm consists of a manager controlling a positive measure of partnerships, I call it an *oligopoly corporation.* Such a firm may take advantage of its market power, competing oligopolistically with other positive-measure corporations.

A market structure is a partition ω of the interval of partnerships, where each element of the partition denotes a firm. Two types of structures are of particular interest. First, a perfectly competitive market structure is a partition in which all firms are stand-alone firms and thus have zero-measure. Second, a symmetric oligopoly structure is one in which partnerships are split into n large firms of equal and positive measure. To keep the characterization of the equilibrium as simple as possible, I treat the number of firms n as continuous.

4.1.3 Timing, Competition, and Equilibrium Concepts

The baseline model proceeds in three stages. First, managers make offers to individual partnerships to buy their assets, to which partnerships respond. Managers obtain authority to choose output x for each partnership under their control. Firms are thus formed, inducing a partition of the interval of partnerships. Second, given the resulting market structure, firms compete in the product market. Managers of stand-alone firms behave as price-takers, choosing x while taking P as given. Managers of oligopoly corporations, aware of their influence on the product price, engage in Cournot competition. Finally, managers impose their production decisions on partnerships, production takes place, partners bear their private costs, and managers obtain monetary profits and make the agreed-upon asset payments to partners.

The offers made by managers in the firm-formation stage specify, for each partnership that would be under a manager's control, an uncontingent asset payment and an output quantity. Denote an offer by manager i as $\alpha_i = (a_i, x_i)$, where $a_i : E_i \to \mathbb{R}_+$ is a function specifying an asset payment $a_i(p)$ for each $p \in E_i$, and $x_i : E_i \to [0, 1]$ is a function specifying a required output quantity for each $p \in E_i$. While $a_i : E_i \to \mathbb{R}_+$ is assumed to be contractible, $x_i : E_i \to [0, 1]$ is non-contractible. A manager cannot commit to imposing a certain production decision, implying in particular that first-best production choices need not be attainable. Instead, credible offers are restricted to those that specify incentive-compatible production choices, meaning that they must be consistent with managers' optimizing behavior in the subsequent competition stage.

A *configuration* is a pair (ω, α), where α is a set of offers and ω is the market structure induced by the offers. Managers and partners perfectly anticipate the ensuing equilibrium in the competition stage and the resulting monetary profits and private effort costs. Given this, a configuration is admissible if it satisfies three conditions. The first is a participation constraint: all managers and partners must make non-negative surplus. The second is an incentive-compatibility constraint: manager output requirements specified in α must be consistent with their optimal production choices in the competition stage. Third, given that a partnership always has the option of producing as a stand-alone firm, potentially free-riding from the price sustained by oligopoly corporations, an admissible configuration must also satisfy a no-holdout constraint: the surplus that partners obtain within an oligopoly corporation must be no less than what they would obtain in a stand-alone firm.

As we will see, admissible configurations are in general not unique, but they do place lower and upper bounds on the number of oligopoly corporations that may form in equilibrium. However, not all admissible configurations are stable, in the sense that some players may have incentives to deviate and give rise to a new configuration where they are better off. LNU employ a "farsighted stability" concept to rule out unstable configurations. Roughly, a stable configuration is one in which it is not possible for players to reorganize themselves, through a sequence of deviations, into a different market structure that is also admissible and where the deviating players at every step along the sequence end up being strictly better off. The main result in LNU shows that the set of stable, admissible configurations exists and is essentially unique. That result continues to hold for the version of the model presented here.

4.1.4 Characterizing the Equilibrium

In any equilibrium configuration, (1) all managers obtain zero net profits, (2) all positive-measure firms are of equal size, and (3) all partnerships obtain the same surplus. The first condition follows from the fact that managers are in abundance with respect to the measure of partnerships, and they have zero opportunity costs. The second and third follow from the fact that, given the strict convexity of private effort costs, any configuration with non-symmetric firms, or where partnerships do not all obtain the same surplus, could trigger a sequence of deviations leading to a corresponding symmetric configuration in which all deviating partnerships are strictly better off.

To characterize the equilibrium, I therefore restrict my attention to symmetric oligopoly market structures, where partnerships are evenly split between n oligopoly corporations. For the version of the model presented here, where n is treated as continuous, this implies that each manager of an oligopoly corporation has authority over a measure $\frac{M}{n}$ of partnerships.

Given a symmetric market structure with n corporations, the Cournot competition stage proceeds as follows. Manager i maximizes monetary profits disregarding private effort costs, therefore solving $\max_{q_i \in \left[0, \frac{M}{n}\right]} P\left(q_i, q_{-i}\right) q_i - c q_i$. With inverse demand $P(Q) = A - bQ$, the standard expressions for price and firm-output in the unique symmetric Cournot equilibrium are

$$P^C(n) = \frac{A + cn}{n+1}$$

$$q^C(n) = \frac{1}{n+1} \frac{A - c}{b}$$

To ensure that oligopoly corporations choose production quantities strictly below capacity constraints, I impose the following restriction on parameters:

$$[A1]: \ \frac{A - c}{b} < M$$

[A1] requires total industry capacity not be small with respect to the size of demand. The manager of an oligopoly corporation will therefore require output from each of the partnerships under their control to equal

$$\begin{aligned} x_O(n) &= \frac{n}{M} q^C(n) \\ &= \frac{1}{M} \frac{n}{n+1} \frac{A - c}{b} \end{aligned}$$

Given the equilibrium of the Cournot-competition stage, I now examine for which set of market structures the equilibrium conditions in the firm-formation stage hold. The no-holdout condition requires that, given the surplus that a partnership obtains within an oligopoly corporation, they would not be strictly better off if they instead operate outside of the oligopoly as a stand-alone firm. Note that, in either case, partnerships are subject to authority. Just like the managers of oligopoly corporations, the manager of a stand-alone firm disregards private effort costs in making production decisions. However, unlike their oligopolistic counterparts, a SA manager holds no market power and behaves as a price-taker.

As long as the market price P covers the constant marginal cost c, a SA manager maximizes monetary profits by imposing partnership production up to the capacity constraint: $x_{SA} = 1$. On the other hand, given [A1], partnership production in an oligopoly corporation, $x_O(n)$, is strictly below capacity. A trade-off thus emerges. Partners have a choice between operating in a SA firm—being overworked but maximizing monetary profits—, or joining a large oligopoly corporation—trading off monetary profits for reduced effort costs. The latter "quieter life" is the subsidy that oligopoly managers incidentally grant partners under their control, not because they internalize their private effort costs, but because their strategic use of market power leads them to restrict output to increase oligopoly profits. Without this excludable subsidy, the sustainment of the high oligopoly price, a public good, would not be possible.

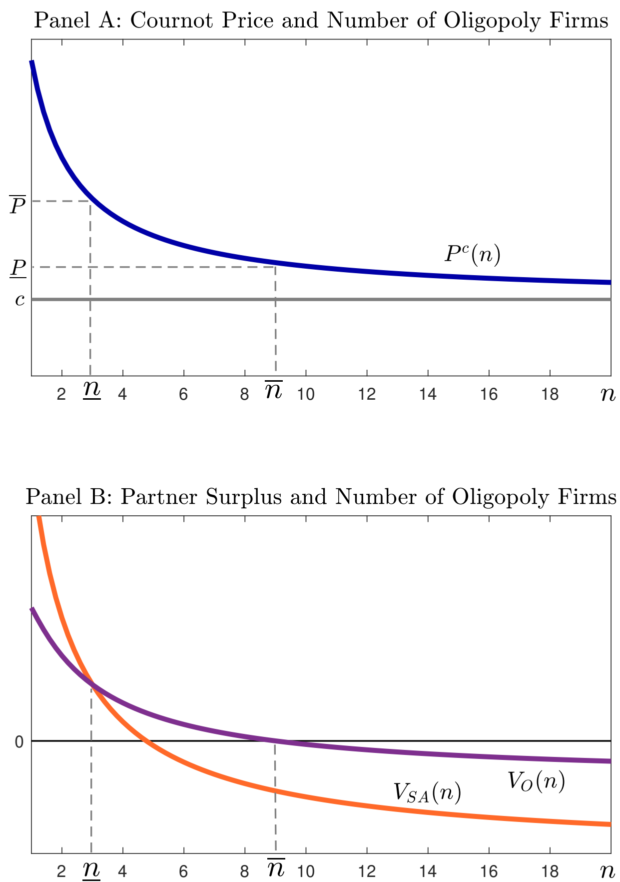
As managers make zero profits in equilibrium, and since they treat all partnerships under their control equally, a partnership's surplus given a required output quantity x and market price P is $Px - cx - \phi x^2$. Substituting the optimal production choices of managers in the competition stage, the surplus of partnerships in stand-alone (SA) firms and oligopoly (O) corporations given a symmetric market structure with n oligopoly corporations are as follows:

$$V_{SA}(n) = \frac{A - c}{n + 1} - \phi$$

$$V_O(n) = \frac{n}{(n+1)^2} \frac{(A-c)^2}{Mb} - \phi \left[\frac{n}{n+1} \frac{A-c}{Mb} \right]^2$$

Figure 4.1 illustrates the equilibrium market structure in the baseline model. Panel A plots the Cournot equilibrium price, $P^C(n)$, as a function of the number of oligopoly corporations n. As is standard, the price is decreasing in the number of corporations, and converges to the constant marginal cost c as n grows arbitrarily large. Panel B plots the corresponding partnership surplus functions V_{SA} and V_O. For low values of n, the oligopoly sustains a high price $P^C(n)$ by maintaining relatively low industry output (and therefore low partnership production requirements). The relatively high monetary benefit of standing

Figure 4.1: Cournot Price and Equilibrium Market Structure



outside the oligopoly, and relatively low effort-saving benefit of being inside, are reflected by the fact that $V_{SA}(n) > V_O(n)$ for low enough n. Conversely, for high values of n, the lower price $P^C(n)$ and higher industry (and partnership) output tilt the balance in favor of being inside the oligopoly, with $V_O(n) > V_{SA}(n)$ for sufficiently high n.

An admissible configuration requires partnerships obtain non-negative surplus. This places an upper bound $\overline{n} = \frac{Mb}{\phi}$ on the number of oligopoly corporations, where $V_O(\overline{n}) = 0$. Admissible configurations also require the no-holdout condition to hold: $V_O(n) \geq V_{SA}(n)$. This places a lower bound $\underline{n}$ on the number of oligopoly corporations, where $V_O(\underline{n}) = V_{SA}(\underline{n})$, given by

$$\underline{n} = \frac{A - c - \phi}{\phi(1 + \frac{A-c}{Mb})}$$

Any symmetric oligopoly with $n \in [\underline{n}, \overline{n}]$ forms part of an admissible configuration. Not all admissible configurations, however, are stable. Recall that stability requires it not be possible for managers and partners to reorganize themselves, via a sequence of deviations, into a different market structure that is also admissible and where deviating partners are strictly better off. If $n > \underline{n}$, so the no-holdout constraint does not bind, then players can deviate into a new, more concentrated oligopoly configuration that is still admissible and where all partnerships achieve strictly higher surplus. The unique market structure predicted by the baseline model is therefore $\underline{n}$, the most concentrated symmetric oligopoly up to the no-holdout constraint.

4.2 Incorporating Import Competition

4.2.1 Domestic and Foreign Varieties

I extend the baseline model by allowing the presence of import competition in the homogeneous-good industry. Domestic and foreign varieties of the good are perfect substitutes for consumers. For simplicity, I assume consumers opt for the domestic variety if the two prices are exactly equal, but otherwise buy the least expensive variety.

Supply of the foreign variety is perfectly elastic, with world price given by P^W. This simplifying assumption allows for modeling import competition as setting a price cap for domestic producers, which preserves the tractability of the baseline model. Given an ad-valorem tariff τ on imported goods, the tariff-inclusive price of the foreign variety is $\hat{P} = (1 + \tau)P^W$.

The price-capped demand for the domestic variety is given by

$$Q(P;\hat{P}) = \begin{cases} 0 & \text{if } P > \hat{P} \\ \frac{A-P}{b} & \text{if } P \leq \hat{P} \end{cases}$$

with the corresponding price-capped inverse demand being $P(Q;\hat{P}) = min\{\hat{P}, A - bQ\}$. We may re-express the price-capped inverse demand for the domestic variety as

$$P(Q;\hat{P}) = \begin{cases} \hat{P} & \text{if } Q \leq \hat{Q} \\ A - bQ & \text{if } Q > \hat{Q} \end{cases}$$

where $\hat{Q} \equiv \frac{A-\hat{P}}{b}$ denotes the highest level of output of the domestic variety inducing a price equal to $\hat{P}$. For a given number of oligopoly corporations n, let $\hat{q} = \frac{\hat{Q}}{n}$.

4.2.2 Price-capped Cournot Competition

I now consider how the presence of a price cap alters the equilibrium price and production choices in the Cournot competition stage for a given market structure. As before, we restrict our attention to symmetric oligopoly market structures, where each of the n managers controls $\frac{M}{n}$ partnerships. Having characterized the equilibrium in this price-capped Cournot game, I then examine its implications for the equilibrium market structure arising in the firm-formation stage.

For a given manager i, let $y = \sum_{j \neq i} q_j$ denote the output of other firms, and let $\pi_i(q_i, y)$ denote firm i's profit given (q_i, y) in the absence of a price cap. That is, $\pi_i(q_i, y) = (A - bq_i - by)\, q_i - cq_i$. Let $\hat{\pi}_i(q_i, y)$ denote firm i's profit given (q_i, y) with price cap $\hat{P}$. That is, $\hat{\pi}_i(q_i, y) = \left[\min\left\{A - bq_i - by, \hat{P}\right\}\right] q_i - cq_i$. Manager i solves $\max_{q_i \in [0, \frac{M}{n}]} \hat{\pi}_i(q_i, y)$. Proposition 1 characterizes the unique symmetric equilibrium of the price-capped Cournot game.[8]

[8]An analogous result holds for any log-concave inverse demand. See, for instance, Proposition 2 in

Proposition 1. *Let $\hat{P} \in [c, A]$. Then $q_i(n) = \min\left\{\frac{M}{n}, \max\left\{\hat{q}, q^C(n)\right\}\right\}$ $\forall i$ is the unique symmetric equilibrium of the price-capped Cournot game, where*

$$\hat{q} \equiv \frac{A - \hat{P}}{nb}$$

$$q^C(n) = \frac{1}{(n+1)} \frac{A-c}{b}$$

If the measure of partnerships M is large enough (e.g. if it satisfies [A1]), the price-capped Cournot firm output is strictly below the capacity constraint $\frac{M}{n}$ for any n, and is given by $\max\left\{\hat{q}, q^C(n)\right\}$. For a given market structure, a price cap $\hat{P}$ is binding only if it is below the price that would arise in its absence. For the case of a symmetric oligopoly with n corporations, this is the case if $\hat{P} < P^C(n) = \frac{A+cn}{n+1}$. Proposition 1 states that, given a price cap $\hat{P} \in [c, A]$, the unique symmetric equilibrium of the unrestricted Cournot game continues to hold for all $\hat{P} \geq P^C(n)$, which implies $\hat{q} \leq q^C(n)$. If, on the other hand, the price cap is binding, with $\hat{P} < P^C(n)$, then the unique symmetric equilibrium is such that industry output exactly matches price $\hat{P}$. That is, $n\hat{q} = \hat{Q} \equiv \frac{A-\hat{P}}{b}$.

4.2.3 Equilibrium Market Structure Under Import Competition

The extent to which import competition restricts the domestic market depends on the marginal cost c at which domestic firms produce, the price cap $\hat{P}$ (determined by the world price P^W and the tariff τ), and the number of domestic firms n. If the tariff-inclusive price $\hat{P}$ is below c, domestic producers can only operate at a loss, and the entire demand is therefore met by foreign supply. If, on the other hand, $\hat{P} > c$, which can always be guaranteed with a sufficiently high tariff τ, whether or not $\hat{P}$ is binding depends on the level of competition in the domestic market. In this setup, this is captured simply by the number of oligopoly firms n. For each $\hat{P} \in (c, A)$, there exists a unique threshold $\hat{n} > 0$ such that $\hat{P} \leq P^C(n) \Leftrightarrow n \leq \hat{n} \equiv \frac{A-\hat{P}}{\hat{P}-c}$. A price of imports $\hat{P} > c$ will not be binding in a competitive

Reynolds and Rietzke (2018).

domestic market where prices are sufficiently close to marginal costs to begin with.

Recall that the equilibrium market structure in the baseline model, absent import competition, is given by $\underline{n}$, the most concentrated oligopoly up to a no-holdout constraint. Figure 4.1 above illustrates this. $V_O(n)$ increases as n decreases, raising the Cournot price and the resulting industry profits. The equilibrium $\underline{n}$ maximizes $V_O(n)$ subject to the constraint $V_O(n) \geq V_{SA}(n)$.

The incorporation of import competition, and the resulting equilibrium in the price-capped Cournot stage, have the effect of capping partnership surplus (both within oligopoly and in stand-alone firms). This is illustrated in Figure 4.2. As in the baseline model, managers of stand-alone firms impose $x = 1$ as long as $P > c$, and managers of oligopoly corporations split the burden of production evenly across partnerships under their control.

For $n > \hat{n}$, $\hat{P}$ is not binding, so surplus functions are as in the baseline model. For all $n \leq \hat{n}$, the price cap $\hat{P}$ becomes binding, and equilibrium industry output remains fixed at $\hat{Q}$. As n decreases, each firm must produce more to sustain $\hat{Q}$ (equilibrium firm output is $\hat{q} \equiv \frac{A-\hat{P}}{nb} = \frac{\hat{Q}}{n}$), but partnership production $\hat{x} = \frac{\hat{q}}{M/n} = \frac{A-\hat{P}}{Mb}$ remains constant. Within this range, partnership-level outcomes do not vary; all that changes is how partnerships are grouped together into firms. As managers' usual incentives to restrict output are constrained by the price cap, the grouping of partners into more or less firms is of no consequence.

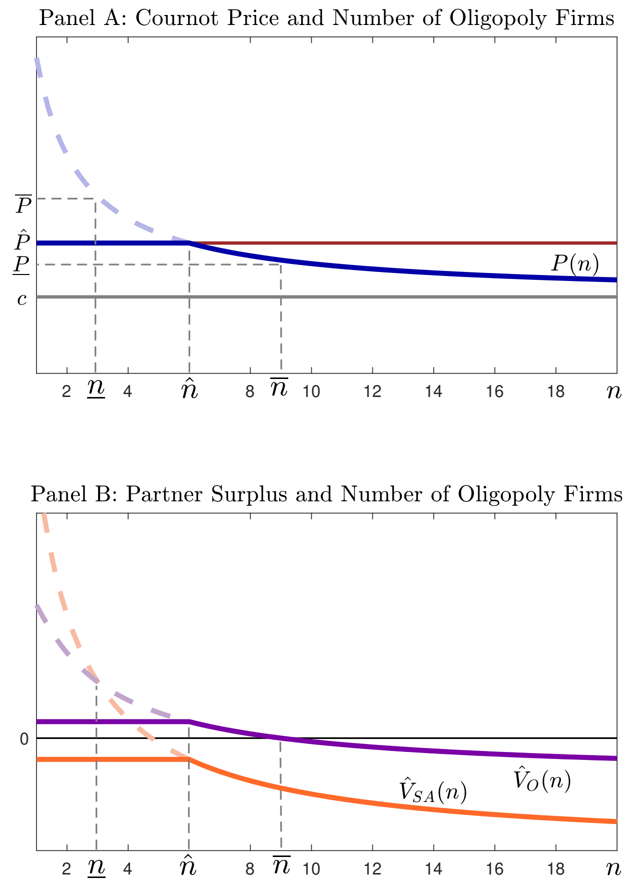
The surplus of partnerships in stand-alone (SA) firms and oligopoly (O) corporations given a symmetric market structure with n oligopoly corporations are now given by:

$$\hat{V_o}(n) = \begin{cases} V_o(\hat{n}) & \text{if } n \leq \hat{n} \\ V_o(n) & \text{if } n > \hat{n} \end{cases}$$

$$\hat{V_{SA}}(n) = \begin{cases} V_{SA}(\hat{n}) & \text{if } n \leq \hat{n} \\ V_{SA}(n) & \text{if } n > \hat{n} \end{cases}$$

where $V_o(n)$ and $V_{SA}(n)$ are the unrestricted surplus functions from the baseline model.

Figure 4.2: Cournot Price and Equilibrium Market Structure with Import Competition



As in the baseline model, the equilibrium market structure maximizes surplus for partnerships within oligopoly corporations, in this case $\hat{V}_o(n)$, subject to the no-holdout constraint $\hat{V}_o(n) \geq \hat{V_{SA}}(n)$. However, with a binding price cap $\hat{P}$, the no-holdout constraint need not be binding, as is illustrated in Panel B.

A binding price cap will generally result in an interval of n that maximizes $\hat{V}_o(n)$. I further refine the notion of equilibrium by focusing on the least-concentrated among surplus-equivalent equilibrium market structures. This refinement reflects the "minimum blowback" assumption for managers as, among profit-equivalent configurations, managers are strictly better off in the least concentrated one, where they each manage a smaller measure of partnerships.

Recall that $\overline{P}$ and $\underline{P}$ denote the Cournot equilibrium prices for $\underline{n}$ and $\overline{n}$ respectively. $\underline{P}$ is the lowest Cournot price such that partnerships in oligopoly corporations make non-negative surplus. For $\hat{P} < \underline{P}$, there is no domestic production and demand is fulfilled by foreign supply. Proposition 2 characterizes the equilibrium market structure in the presence of import competition. I impose the following weaker version of [A1], which is enough to guarantee that capacity constraints are not binding for the equilibrium oligopoly.

$$[A1^{*}]: \ M > \max\left\{\frac{A-\hat{P}}{b}, \frac{A-c-2\phi}{b}\right\}$$

Proposition 2. *Let $\hat{P} \in [\underline{P}, A]$ and suppose [A1*]. Then the unique equilibrium market structure under import competition is a symmetric oligopoly with $n^{*}(\hat{P})$ corporations, where*

$$n^{*}(\hat{P}) = \begin{cases} \underline{n} & \textit{if } \hat{P} > \overline{P} \\ \hat{n} & \textit{if } \hat{P} \in [\underline{P}, \overline{P}] \end{cases}$$

The characterization of the equilibrium market structure in the presence of a price cap $\hat{P}$ straightforwardly extends the equilibrium of the baseline model. A high enough cap, such that $\hat{P} > \overline{P}$, leaves the equilibrium number of firms $\underline{n}$ unaffected, and the no-holdout constraint binds. For $\underline{P} \leq \hat{P} \leq \overline{P}$, the cap binds and induces the formation of an oligopoly just concentrated enough to sustain price $\hat{P}$, with the number of firms given by $\hat{n} \equiv \frac{A-\hat{P}}{\hat{P}-c}$

4.2.4 Market Structure Response to Changes in Tariffs

I now turn to the main question of interest. What is the effect of a tariff increase on equilibrium market structure? The model of endogenous market structure considered here is static, not explicitly incorporating firm dynamics. To answer the question, I study the comparative statics of the equilibrium with respect to changes in the tariff rate τ.

Recall that the price cap in this model is the tariff-inclusive price of imports: $\hat{P} =$

$(1+\tau)P^W$. From Proposition 2, it follows that marginal changes in τ affect market structure only if $\hat{P} = (1+\tau)P^W \in [\underline{P}, \overline{P}]$. For $\hat{P}$ in that binding range, we have

$$n^*(\hat{P}) = \hat{n} \equiv \frac{A - (1+\tau)P^W}{(1+\tau)P^W - c}$$

Observe that $\hat{n}$ is decreasing in $\hat{P}$, and therefore in τ, with

$$\hat{n}'(\tau) = -\frac{P^W(A-c)}{[(1+\tau)P^W - c]^2} < 0$$

As can be inferred from Figure 4.2, a higher price ceiling lowers the threshold number of firms below which partnership surplus is capped. A tariff increase $\tau_1 > \tau_0$ thus presents an opportunity to increase industry profits and partnership surplus through consolidation, resulting in $n^*(\hat{P}(\tau_1)) = \hat{n}_1 < \hat{n}_0 = n^*(\hat{P}(\tau_0))$.

Though intuitive, this simple comparative statics result is in contrast with standard models of endogenous market structure, such as endogenous entry models with a price-capped Cournot stage (see, for instance, Reynolds and Rietzke (2018)). In such models, the margin through which industry structure adjusts is *firm entry*, as opposed to *firm formation*. There, firms are taken as a primitive—a unitary, profit-maximizing entity— and equilibrium entry is obtained through a zero net-profit condition. A higher (binding) price cap increases Cournot industry profits, inviting entry of additional firms until zero net-profits are restored.

By contrast, in the coalitional approach, the set of *producers* (partnerships) in the industry is fixed, and the number of *firms* results from how producers are joined together through common authority. Since, in equilibrium, industry profits are evenly split among producers in the industry, producers will aim to consolidate as much as possible. In the absence of import competition, the limit to sustainable consolidation is set by a no-holdout constraint. Under import competition, the limit is set by the tariff-inclusive price of imports. A higher price ceiling creates an opportunity for producers to consolidate further, raising the industry profits that are then split equally among them.

In reality, however, it is natural to expect that, in the absence of barriers, increased producer surplus may lead to entry. The question then becomes whether the comparative statics analyzed here continue to hold once we allow for this additional margin of adjustment.

4.3 Allowing for Free Entry

This section extends the framework introduced so far to allow for free entry of *partnerships. Firms*, on the other hand, remain the product of the coming together of such partnerships in equilibrium.

So far, I have assumed that the measure of partnerships in the industry, M, remains fixed. I now allow M to vary, reflecting the entry decisions of potential partnerships in an initial entry stage, prior to the firm-formation stage. Potential entrants face a sunk entry cost $F > 0$. They have a zero-surplus outside option, implying that partnerships will enter the market as long as equilibrium partnership net surplus is non-negative.[9]

Let $n^*(M)$ denote the equilibrium number of firms in the model without entry given a measure M of partnerships, and let $V(M) \equiv V_O(n^*(M), M)$ be the resulting partnership surplus. The equilibrium market structure is now given by a pair (n^*, M^*), where $n^* \equiv n^*(M^*)$, satisfying a zero net-surplus condition: $V(M^*) = F$. Due to the convexity of private effort costs ϕx^2, the oligopoly surplus function $V_O(n, M)$ is non-monotonic in M for a fixed n, which may result in multiple values of M that solve $V(M) = F$. As is standard, I restrict my attention to stable solutions, i.e. M^* for which (i) $V(M^*) = F$ and (ii) $V(M)$ is strictly decreasing within an interval around M^*.

If the entry cost F is prohibitively high, no measure of partnerships can enter the industry and obtain non-negative surplus. I impose the following parameter restrictions: $2(F + \phi) < A - c$ (assumption [A2]) and $F < \phi$ (assumption [A3]). Proposition 3 characterizes the equilibrium.

[9]LNU consider a similar extension, but in a setup that does not incorporate import competition. Their focus is on comparative statics with respect to changes in the size of product demand.

Proposition 3. *Let $\hat{P} \in [c + 2\sqrt{F\phi}, A]$ and suppose [A2] and [A3]. Then the unique equilibrium market structure under import competition and free entry is a symmetric oligopoly with $M^*(\hat{P})$ active partnerships equally split into $n^*(\hat{P})$ corporations, where*

$$(n^*(\hat{P}), M^*(\hat{P})) = \begin{cases} (\tilde{n}, \tilde{M}) & \text{if } \hat{P} > c + \phi + F \\ (\hat{n}, \hat{M}) & \text{if } \hat{P} \leq c + \phi + F \end{cases}$$

with

$$\tilde{n} = \frac{A - c - \phi - F}{\phi + F}$$

$$\tilde{M} = \frac{\phi(A - c - \phi - F)}{Fb}$$

$$\hat{n} = \frac{A - \hat{P}}{\hat{P} - c}$$

$$\hat{M} = \frac{(A - \hat{P})\left(\hat{P} - c + \left((\hat{P} - c)^2 - 4F\phi\right)^{1/2}\right)}{2Fb}$$

To make sense of Proposition 3, first consider the equilibrium in the model with free entry but without import competition. Starting with the Cournot stage, and working backwards, note that the measure of partnerships M does not alter the decisions of managers (as long as capacity constraints are not binding). In a symmetric oligopoly Cournot game given n equally-sized corporations, firm-level output $q^C(n)$ is as before, independent of M. What does vary with M, however, is the production requirement for partnerships, $x(n, M) = \frac{q^C(n)}{M/n}$.

As before, the equilibrium in the Cournot stage induces partnership surplus function $V_O(n, M)$, where I now highlight its dependence on both n and M. The surplus of stand-alone partnerships, on the other hand, is unresponsive to M. As before, the equilibrium in the firm-formation stage requires $V_O(n, M) = V_{SA}(n)$. For a given M, this is satisfied for $n = \underline{n}(M)$, where

$$\underline{n}(M) = \frac{A - c - \phi}{\phi(1 + \frac{A-c}{Mb})}$$

is as before, and I now emphasize its dependence on M.

Finally, given equilibrium firm-formation, the measure of entering partnerships must adjust to guarantee zero net-surplus, with equilibrium M^* satisfying: $V_O(\underline{n}(M^*), M^*) = V_{SA}(\underline{n}(M^*) = F$. This yields the equilibrium market structure $(n^*, M^*) = (\tilde{n}, \tilde{M})$, with $\tilde{n}$ and $\tilde{M}$ as given in Proposition 3. Note that both the number of firms and the measure of partnerships in equilibrium are decreasing in the fixed entry cost. Also note that $\tilde{n}$ yields an equilibrium price $\tilde{P} = c + \phi + F$.

Introducing import competition affects equilibrium market structure whenever the tariff-inclusive price of imports $\hat{P}$ is below the price that arises in its absence, in this case, $\hat{P} < \tilde{P} = c + \phi + F$. As in the model without entry, a binding $\hat{P}$ yields an equilibrium number of firms $\hat{n} \equiv \frac{A-\hat{P}}{\hat{P}-c}$ such that the Cournot price exactly matches the ceiling, where $\hat{n} > \tilde{n} > 1$. For this less-concentrated equilibrium in the firm-formation stage, the measure M must adjust to satisfy $\hat{V}_O(\hat{n}(\hat{P}), M^*) = F$. As long as $\hat{P}$ is not too low relative to productions costs, in which case domestic producers are not able to survive import competition, the measure $\hat{M}$ stated in Proposition 3 is well-defined and ensures this equality.

Comparative statics in the model with import competition and free entry are as follows. For import prices within the binding range, $\hat{P} \in [c + 2\sqrt{F\phi}, \phi + F + c]$, raising τ (and therefore $\hat{P}$) lowers the number of equilibrium firms $\hat{n}$, reflecting industry consolidation and consistent with the comparative statics analyzed before. What about equilibrium entry? Consider a tariff increase $\tau_1 > \tau_0$. Starting from an equilibrium $(\hat{n}(\tau_0), \hat{M}(\tau_0))$, the higher industry profits afforded by the price increase, upon which incumbent firms capitalize by consolidating, with $\hat{n}(\tau_1) < \hat{n}(\tau_0)$, would lead to strictly positive net surplus for partnerships given the initial measure of producers, $\hat{V}_O(\hat{n}(\tau_1), \hat{M}(\tau_0)) > F$. This would indeed lead to entry of new producers, so that $\hat{M}(\tau_1) > \hat{M}(\tau_0)$, until the zero net-surplus condition is restored: $\hat{V}_O(\hat{n}(\tau_1), \hat{M}(\tau_0)) = F$. A tariff increase leads to both the entry of new producers *and* greater industry consolidation.

4.4 Summary

Introducing import competition within a stylized incentive-constrained coalitional model of endogenous market structure, the framework outlined above provides an intuitive explanation for why tariff increases can lead to industry consolidation. In industries where the tariff-inclusive price of imports acts as a binding price cap for domestic producers, raising the cap presents an opportunity to raise industry profits and producer surplus via consolidation, without affecting the stability of the oligopoly.

This simple prediction stands in contrast with models of endogenous market structure where the margin of adjustment is *firm entry*, as opposed to *firm formation* (see, for instance, Reynolds and Rietzke (2018)). In such models, zero net profits for firms imply that the higher industry profits afforded by a higher price cap must be met with increased firm entry.[10]

In a coalitional model, market structure evolves via changes in firm boundaries. Producers in an industry can stand alone or join together to form larger firms that then compete oligopolistically. Broadly stated, the equilibrium market structure that arises balances two countervailing forces. On the one hand, a more concentrated oligopoly attains higher industry profits, implying that producers will aim to consolidate as much as possible. On the other hand, how concentrated an oligopoly can be while maintaining its stability is constrained by a hold-out force: producers can always stand outside the oligopoly, potentially free-riding off of a high oligopoly price without submitting themselves to the restrictions of oligopoly firms.

In the absence of internal contracting imperfections, or large economies of scale, the hold-out force dominates and no oligopoly is sustainable. But in the presence of contracting imperfections, standing outside the oligopoly is not always preferable. In my baseline model, which follows Legros, Newman and Udvari (2024), partnerships rely on third-party authority as a second-best solution to their incentive problems. This affects the set of feasible produc-

[10]This unambiguous comparative statics result holds in an endogenous entry model where marginal costs are constant and demand is deterministic (see Propositions 1 and 2 in Reynolds and Rietzke (2018)), which corresponds with the setup of my model. Relaxing either assumption leads to less clear-cut predictions.

tion choices for producers inside *and* outside the oligopoly in such a way that the holdout force need not compromise the stability of a given oligopoly.

The equilibrium in the baseline model is given by the most concentrated symmetric oligopoly up to a no-holdout constraint. In contrast, a standard endogenous entry model predicts the least concentrated oligopoly up to a non-negative net profit constraint. Introducing import competition via a price-ceiling, the two frameworks lead to opposite comparative statics predictions. However, comparing the predictions of the two approaches directly is not entirely warranted. Indeed, their definition of what a firm is, and of the margin through which market structure evolves, is distinct.

In reality, market structure evolves through entry, exit, *and* changes in the boundaries across firms. The full version of my model accommodates this by allowing both the free entry of producers in an initial stage, and the joining together of producers in a subsequent firm-formation stage. The standard intuition that higher industry profits should invite entry continues to hold within this setup, yet it does not undermine the result that a higher price-ceiling leads to industry consolidation. A tariff increase results in both more producers *and* a more consolidated industry.

4.5 Discussion

I now turn to discussing some of the assumptions underlying my analysis. First, I have introduced import competition by assuming perfect substitutability of foreign and domestic varieties, as well as a perfectly elastic foreign supply. This enables me to model the price of imports as setting a price ceiling for domestic producers. Though this may be reasonable for certain industries, and indeed corresponds to testimony of certain industrialists' behavior from the time period,[11] it does not adequately reflect the fact that domestic demand for manufactured goods was commonly met by both domestic and imported varieties. Though

[11] Testifying to the House Committee on Manufactures in 1888, Henry Havemeyer, the industrialist behind the Sugar Trust, stated that the trust set its price to match the international (London) price of refined sugar plus the protective tariff (Eichner (2019)).

outside the scope of this paper, allowing for differentiated domestic and foreign varieties, dropping the assumption of constant and common marginal production costs for domestic producers, or allowing a finite elasticity of foreign supply, could all result in an equilibrium with positive consumption of imported and domestic products.

Second, the baseline model assumes that corporations linearly aggregate the output of partnerships under their control, with no efficiency gains or costs of controlling a potentially large number of producers. The model's prediction of an oligopoly as the equilibrium market structure does not depend on scale economies, either at the partnership or at the corporation level, but is instead the result of equating payoffs inside and outside of oligopoly corporations, which are determined by the incentives of profit-maximizing (but effort-cost-ignoring) managers. At the cost of tractability, one could potentially introduce efficiency gains or losses for larger corporations, which would respectively tilt the balance in favor or against industry consolidation.

Finally, the framework presented here is static, relying on comparative statics to analyze responses to tariff changes. A richer framework might incorporate firm dynamics, which could have significant implications if, for instance, entering producers incur fixed operating costs and face changing demand. Such a framework would explicitly account for producers' exit decisions in addition to entry and firm-formation. Among other challenges, a dynamic version of the model would require accounting for the temporal aspect of contracts. Such an extension is beyond the scope of this paper, but it offers a promising avenue for future research.

5 Conclusion

In contexts with lax antitrust policy, trade can serve as an important disciplining force on domestic producers. It is easy to see how high-tariff protectionism might benefit a given set of domestic producers engaged in imperfect competition. By providing a shield from foreign competition, higher tariffs raise the price ceiling set by imports, allowing oligopoly firms to set a higher price. It is not immediately clear, however, whether high tariffs also create incentives for domestic producers to merge, potentially resulting in a more consolidated industry.

Using data from the Great Merger Movement of the late 19th century United States, I examine whether tariff increases can indeed induce industrial consolidations. To do so, I employ an empirical strategy that combines plausibly exogenous variation in trade policy with cross-industry variation in exposure to tariff changes. Across specifications, I find consistent evidence of a positive effect of tariff increases on consolidation activity in industries facing import competition. While this finding is not easily accommodated within models of endogenous market structure that emphasize firm entry, I show that it can be rationalized within a coalitional approach to market structure. Building an incentive-constrained coalitional model of endogenous market structure that allows for the presence of import competition, I show that tariff increases can lead to both entry and consolidation.

My theoretical analysis suggests that a coalitional approach to market structure offers a valuable avenue for comprehending industry-wide shifts in firm boundaries. Overall, my findings contribute to our understanding of the Great Merger Movement, highlighting a potential driver of consolidations that, while actively debated in its aftermath, has been less emphasized in modern studies. Beyond the historical context, I believe this paper also yields valuable insights for other contexts with a combination of weak antitrust enforcement and protectionist policies.

A Data Construction and Descriptive Statistics

Table 5: Average Duty Rates by Broad Industry Category, Selected Years

	1885	1892	1896	1899	1910
Animals	20.0	26.2	20.0	25.0	25.3
Breadstuffs	15.7	47.7	23.0	32.3	33.0
Chemicals, drugs, dyes, and medicines	32.4	31.4	28.8	31.7	23.4
Cotton, manufactures of	40.1	57.3	45.8	56.0	56.0
Earthen, stone, and china ware	56.4	57.7	33.8	58.5	58.5
Fibers, vegetable and textile grasses (Unmanufactured)	16.3	12.3	7.0	15.2	10.2
Fibers, vegetable and textile grasses (Manufactures of)	34.4	39.1	34.6	42.0	38.7
Fish	19.5	20.8	17.9	19.0	19.1
Fruits, including nuts	28.2	27.7	19.7	47.1	39.7
Furs, and manufactures of	20.5	21.5	20.7	20.9	25.3
Glass, and manufactures of	58.6	57.2	46.1	60.1	58.9
Iron and steel, and manufactures of	35.3	55.5	38.8	43.6	33.0
Jewelry and precious stones	11.2	10.6	16.4	12.3	13.0
Leather, and manufactures of	28.0	33.7	25.5	35.7	32.0
Liquors (Malt liquors)	49.2	47.5	38.7	51.1	61.7
Liquors (Distilled spirits)	157.1	171.3	125.1	140.4	126.1
Liquors (Wines)	57.8	54.7	47.7	51.3	48.3
Meat and dairy products	22.4	34.9	25.9	41.0	31.0
Oils, animal, mineral, and vegetable	25.9	25.6	25.0	31.0	31.0
Paints, pigments, and colors	32.3	30.6	27.7	33.0	30.7
Paper, and manufactures of	21.8	32.6	25.1	29.1	29.0
Rice	75.9	54.9	51.9	63.7	35.0
Silk, manufactures of	49.8	54.0	47.0	54.0	53.4
Sugar, confectionery, and molasses	70.2	19.6	41.0	75.9	52.3
Tobacco, and manufactures of	80.7	101.1	109.1	113.4	81.6
Toys	35.0	35.0	25.0	35.0	35.0
Vegetables	24.5	37.2	23.9	42.8	31.5
Wood, and manufactures of	17.8	15.7	20.3	21.3	11.4
Wool (Unmanufactured)	33.4	44.1	0.0	47.3	44.3
Wool (Manufactures of)	67.2	95.8	47.8	94.9	90.1

Note: The U.S. Statistical Abstracts (1890-1910) report dollar value of imports, government duty collected, and ad-valorem equivalent duty rates for the industry categories listed above. These correspond to the ”principal commodities and classes of commodities entered for consumption”. The industry list is not exhaustive, as not all imported articles fall into one of the categories.

Table 6: Summary Statistics (Industries, Consolidations, and Tariff Exposure)

	Main Sample		Full Sample	
	All	Importables Only	All	Importables Only
Observations				
Industries	98	82	111	95
Industry-year pairs	1568	1312	1776	1520
Consolidations				
Consolidations (Mean)	0.0912	0.0945	0.0929	0.0961
Tariff Exposure				
Tariff Exposed (Mean)	0.8163	0.9756	0.8378	0.9789
Tariff Exposure (Mean)	0.3801	0.4542	0.3827	0.4471
Tariff Exposure (SD)	0.3195	0.2972	0.3175	0.2982
Import Intensity (Mean)		0.4626		0.4544
Import Intensity (SD)		0.2897		0.2920

Table 7: Summary Statistics (Industry Tariff Rate Changes by Tariff Act)

	McKinley Act (1890)		Wilson-Gorman Act (1894)		Dingley Act (1897)	
	All	Importables Only	All	Importables Only	All	Importables Only
Tariff Change (Mean)	37.1239	44.3676	-22.4122	-26.7853	17.9143	21.4098
Tariff Change (SD)	41.2037	41.3249	22.1199	21.6184	22.5827	22.1291
Increase >5%	0.6327	0.7561	0.0510	0.0610	0.7041	0.8415
Increase >10%	0.5816	0.6951	0.0510	0.0610	0.4490	0.5366
Increase >20%	0.5612	0.6707	0.0510	0.0610	0.2551	0.3049
Decrease >5%	0.1224	0.1463	0.7551	0.9024	0.0000	0.0000
Decrease >10%	0.0510	0.0610	0.7245	0.8659	0.0000	0.0000
Decrease >20%	0.0000	0.0000	0.5918	0.7073	0.0000	0.0000

B Additional Tables and Figures

Figure B.1: Party Support for Trade Liberalization.

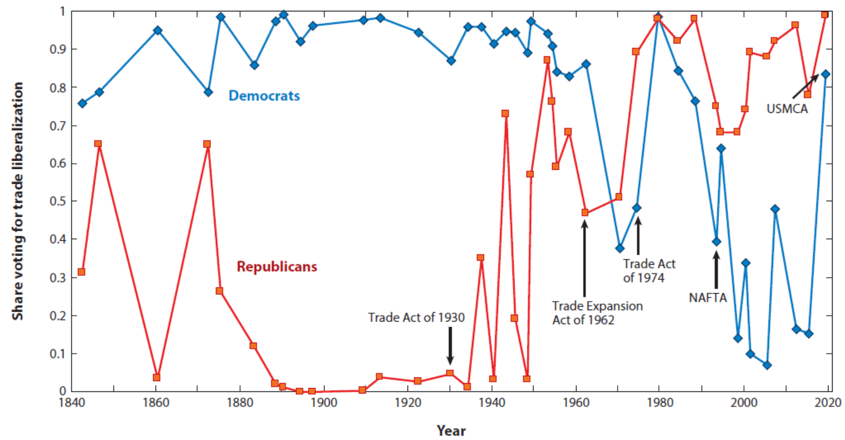
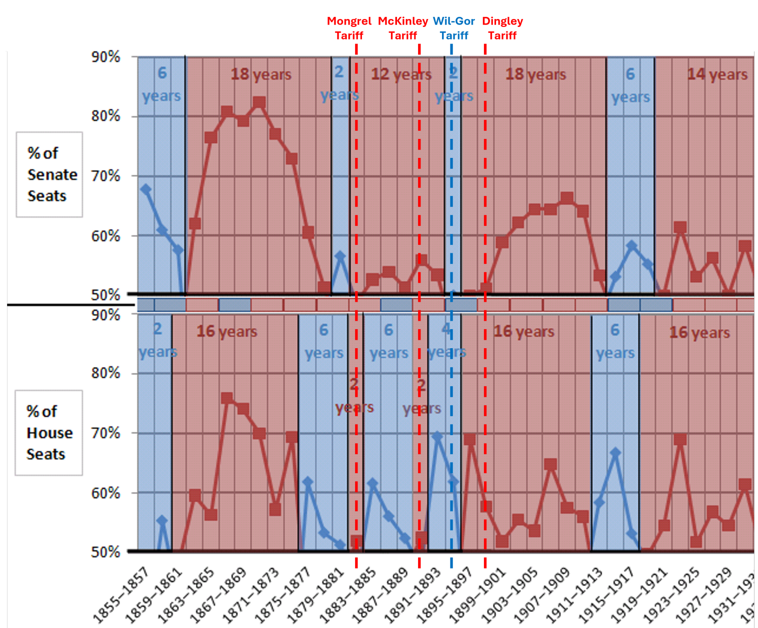


Figure 4

Share of party voting for lower trade barriers in the House of Representatives, 1890–2019. Figure adapted with permission from Irwin (2017, p. 658) and updated to include vote on the US–Canada–Mexico (USMCA) agreement.

Notes: Figure 4 from Irwin (2020).

Figure B.2: Party Control and Tariff Acts.



Notes: Taken and adapted from ChrisnHouston, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons.

Table 8: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation. Reduced-Form and First-Stage Regressions for Table 1 (10% Cutoff for Tariff Changes)

	Main Sample			Importables Only		
Dependent Variables	RF	FS1	FS2	RF	FS1	FS2
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-Year Window						
Tariff Exposure × Republican Tariff Act	0.130***	0.699***	-0.00562	0.140***	0.708***	-0.0147
	(0.0434)	(0.0963)	(0.00763)	(0.0498)	(0.105)	(0.0176)
Tariff Exposure × Democrat Tariff Act	-0.0441	0.0149	0.967***	-0.0597	0.00104	0.988***
	(0.0442)	(0.0243)	(0.0347)	(0.0593)	(0.0239)	(0.0352)
Tariff Exposure	-0.118	0.179**	-0.0556	-0.0720	0.179**	-0.0544
	(0.121)	(0.0876)	(0.0766)	(0.106)	(0.0876)	(0.0757)
Panel B: Full-Period Window						
Tariff Exposure × Republican Tariff Act	0.123***	0.713***		0.0972*	0.728***	
	(0.0441)	(0.0939)		(0.0555)	(0.106)	
Tariff Exposure	-0.146	0.332*		-0.0936	0.324*	
	(0.111)	(0.174)		(0.0907)	(0.173)	
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Industries	98	98	98	82	82	82
Industry-Year Observations	1568	1568	1568	1312	1312	1312
Mean Dep Var	0.0912	0.0638	0.0483	0.0945	0.0762	0.0577

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Columns 1 and 4 correspond to reduced-form regressions, where the dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Columns 2 and 5 correspond to first-stage regressions where the dependent variable is Tariff Exposure × Tariff Increase. Columns 3 and 6 correspond to first-stage regressions where the dependent variable is Tariff Exposure × Tariff Decrease. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 10 (lower than -10) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Rep Act (Dem Act) is a dummy variable, =1 if a Republican-led (Democrat-led) Tariff Act was introduced within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0.

Table 9: Industry Tariff Changes, Tariff Exposure, and Prob. of Consolidation (5% Cutoff for Industry Tariff Changes)

	Main Sample		Importables Only	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A: Two-Year Window				
Tariff Exposure	-0.149	-0.140	-0.0916	-0.100
	(0.115)	(0.112)	(0.0993)	(0.0989)
Tariff Increase (> 5%)	-0.0303		-0.0131	
	(0.0321)		(0.0541)	
Tariff Decrease (> 5%)	0.0326		0.0768	
	(0.0419)		(0.0730)	
Tariff Exposure × Tariff Increase	0.213***	0.174***	0.213***	0.191***
	(0.0447)	(0.0457)	(0.0450)	(0.0513)
Tariff Exposure × Tariff Decrease	-0.0327	-0.0471	-0.0344	-0.0591
	(0.0464)	(0.0423)	(0.0460)	(0.0548)
Panel B: Full-Period Window				
Tariff Exposure	-0.114	-0.170*	-0.0766	-0.115
	(0.0915)	(0.101)	(0.0810)	(0.0822)
Tariff Increase (> 5%)	0.0456		0.0262	
	(0.0293)		(0.0277)	
Tariff Exposure × Tariff Increase	0.0559	0.157***	0.0562	0.124*
	(0.0591)	(0.0522)	(0.0590)	(0.0637)
Year Fixed Effects	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES
Industries	98	98	82	82
Industry-Year Observations	1568	1568	1312	1312
Mean Dep Var	0.0912	0.0912	0.0945	0.0945
K-P F-stat (Panel A)		29.89		23.88
K-P F-stat (Panel B)		75.28		58.02

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 5 (lower than -5) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0. The corresponding reduced-form and first-stage regressions a reported in Table 10.

Table 10: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation. Reduced-Form and First-Stage Regressions for Table 9 (5% Cutoff for Tariff Changes)

	Main Sample			Importables Only		
Dependent Variables	RF (1)	FS1 (2)	FS2 (3)	RF (4)	FS1 (5)	FS2 (6)
Panel A: Two-Year Window						
Tariff Exposure × Republican Tariff Act	0.130***	0.772***	0.0928	0.140***	0.762***	0.0939
	(0.0434)	(0.0974)	(0.0853)	(0.0498)	(0.109)	(0.0963)
Tariff Exposure × Democrat Tariff Act	-0.0441	0.0142	0.988***	-0.0597	-0.00114	1.006***
	(0.0442)	(0.0239)	(0.0220)	(0.0593)	(0.0217)	(0.0218)
Tariff Exposure	-0.118	0.103	-0.0966	-0.0720	0.115*	-0.107
	(0.121)	(0.0664)	(0.0826)	(0.106)	(0.0679)	(0.0857)
Panel B: Full-Period Window						
Tariff Exposure × Republican Tariff Act	0.123***	0.786***		0.0972*	0.783***	
	(0.0441)	(0.0906)		(0.0555)	(0.103)	
Tariff Exposure	-0.146	0.155		-0.0936	0.173	
	(0.111)	(0.110)		(0.0907)	(0.114)	
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Industries	98	98	98	82	82	82
Industry-Year Observations	1568	1568	1568	1312	1312	1312
Mean Dep Var	0.0912	0.0760	0.0559	0.0945	0.0909	0.0668

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Columns 1 and 4 correspond to reduced-form regressions, where the dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Columns 2 and 5 correspond to first-stage regressions where the dependent variable is Tariff Exposure × Tariff Increase. Columns 3 and 6 correspond to first-stage regressions where the dependent variable is Tariff Exposure × Tariff Decrease. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 5 (lower than -5) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Rep Act (Dem Act) is a dummy variable, =1 if a Republican-led (Democrat-led) Tariff Act was introduced within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0.

Table 11: Industry Tariff Changes, Tariff Exposure, and Prob. of Consolidation. 20% Cutoff for Industry Tariff Changes)

	Main Sample		Importables Only	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Panel A: Two-Year Window				
Tariff Exposure	-0.149	-0.164	-0.0952	-0.117
	(0.110)	(0.119)	(0.0931)	(0.104)
Tariff Increase (> 20%)	-0.0889***		-0.0826**	
	(0.0300)		(0.0346)	
Tariff Decrease (> 20%)	-0.0301		-0.0325	
	(0.0299)		(0.0384)	
Tariff Exposure × Tariff Increase	0.247***	0.246***	0.239***	0.264***
	(0.0535)	(0.0797)	(0.0572)	(0.0945)
Tariff Exposure × Tariff Decrease	-0.0157	-0.0754	-0.0211	-0.0992
	(0.0352)	(0.0671)	(0.0360)	(0.0908)
Panel B: Full-Period Window				
Tariff Exposure	-0.174	-0.237**	-0.113	-0.157*
	(0.105)	(0.116)	(0.0824)	(0.0896)
Tariff Increase (> 20%)	-0.0580*		-0.0603*	
	(0.0296)		(0.0313)	
Tariff Exposure × Tariff Increase	0.161**	0.232***	0.151**	0.180*
	(0.0635)	(0.0835)	(0.0630)	(0.0921)
Year Fixed Effects	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES
Industries	98	98	82	82
Industry-Year Observations	1568	1568	1312	1312
Mean Dep Var	0.0912	0.0912	0.0945	0.0945
K-P F-stat (Panel A)		7.162		5.600
K-P F-stat (Panel B)		14.74		11.79

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 20 (lower than -20) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0. The corresponding reduced-form and first-stage regressions a reported in Table 12.

Table 12: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation. Reduced-Form and First-Stage Regressions for Table 11 (20% Cutoff for Tariff Changes)

	Main Sample			Importables Only		
Dependent Variables	RF (1)	FS1 (2)	FS2 (3)	RF (4)	FS1 (5)	FS2 (6)
Panel A: Two-Year Window						
Tariff Exposure × Republican Tariff Act	0.130***	0.529***	0.00264**	0.140***	0.532***	0.00255
	(0.0434)	(0.140)	(0.00134)	(0.0498)	(0.159)	(0.00166)
Tariff Exposure × Democrat Tariff Act	-0.0441	0.0168	0.639***	-0.0597	0.00416	0.613***
	(0.0442)	(0.0227)	(0.178)	(0.0593)	(0.0207)	(0.202)
Tariff Exposure	-0.118	0.206*	0.0592	-0.0720	0.194*	0.0596
	(0.121)	(0.113)	(0.0645)	(0.106)	(0.105)	(0.0663)
Panel B: Full-Period Window						
Tariff Exposure × Republican Tariff Act	0.123***	0.533***		0.0972*	0.541***	
	(0.0441)	(0.139)		(0.0555)	(0.158)	
Tariff Exposure	-0.146	0.392*		-0.0936	0.356*	
	(0.111)	(0.234)		(0.0907)	(0.212)	
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Industries	98	98	98	82	82	82
Industry-Year Observations	1568	1568	1568	1312	1312	1312
Mean Dep Var	0.0912	0.0489	0.0354	0.0945	0.0584	0.0424

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Columns 1 and 4 correspond to reduced-form regressions, where the dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Columns 2 and 5 correspond to first-stage regressions where the dependent variable is Tariff Exposure × Tariff Increase. Columns 3 and 6 correspond to first-stage regressions where the dependent variable is Tariff Exposure × Tariff Decrease. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 20 (lower than -20) happening within the previous two years (for Panel A) or at the start of current the period (for Panel B). Rep Act (Dem Act) is a dummy variable, =1 if a Republican-led (Democrat-led) Tariff Act was introduced within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0.

Table 13: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation. (Before and After Each Tariff Act, 5% Cutoff for Tariff Changes)

	Mongrel to McKinley		McKinley to Wilson-Gorman		Wilson-Gorman to Dingley	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-Year Window						
Tariff Exposure	0.0868	0.117	-0.0955	-0.112	-0.278	-0.253
	(0.0725)	(0.0769)	(0.193)	(0.179)	(0.199)	(0.183)
Tariff Increase (> 5%)	-0.0368				-0.0424	
	(0.0293)				(0.0567)	
Tariff Exposure × Tariff Increase	0.130**	0.0630			0.303***	0.277***
	(0.0472)	(0.0690)			(0.0881)	(0.0715)
Tariff Decrease (> 5%)			0.0397			
			(0.0341)			
Tariff Exposure × Tariff Decrease			-0.109**	-0.0881*		
			(0.0426)	(0.0519)		
Panel B: Full-Period Window						
Tariff Exposure	0.124	0.0547	-0.0981	-0.124	-0.154	-0.223
	(0.0823)	(0.0807)	(0.187)	(0.187)	(0.177)	(0.192)
Tariff Increase (> 5%)	0.0256				0.0554	
	(0.0259)				(0.0449)	
Tariff Exposure × Tariff Increase	0.0453	0.137**			0.0777	0.169**
	(0.0391)	(0.0597)			(0.0815)	(0.0749)
Tariff Decrease (> 5%)			0.0267			
			(0.0260)			
Tariff Exposure × Tariff Decrease			-0.100	-0.127**		
			(0.0626)	(0.0626)		
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Industries	98	98	98	98	98	98
Industry-Year Observations	784	784	686	686	784	784
Mean Dep Var	0.0319	0.0319	0.0423	0.0423	0.151	0.151
K-P F-stat (Panel A)		15.20		163.7		95.41
K-P F-stat (Panel B)		14.93		20.33		79.95

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 5 (lower than -5) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) Mongrel Act: 1887-1890, (2) McKinley Act: 1891-1894, (3) Wilson-Gorman Act: 1895-1897, (4) Dingley Act: 1898-1902. Columns 1 and 2 include industry-year observations within periods (1) and (2); columns 3 and 4 within periods (2) and (3); columns 5 and 6 within periods (3) and (4). Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0.

Table 14: Industry Tariff Changes, Tariff Exposure, and Probability of Consolidation. (Before and After Each Tariff Act, 20% Cutoff for Tariff Changes)

	Mongrel to McKinley		McKinley to Wilson-Gorman		Wilson-Gorman to Dingley	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-Year Window						
Tariff Exposure	0.0976	0.117	-0.0958	-0.0889	-0.320	-0.373**
	(0.0706)	(0.0737)	(0.189)	(0.185)	(0.196)	(0.188)
Tariff Increase (> 20%)	-0.0343				-0.0856	
	(0.0291)				(0.0744)	
Tariff Exposure × Tariff Increase	0.129**	0.0733			0.333**	0.535**
	(0.0535)	(0.0810)			(0.154)	(0.236)
Tariff Decrease (> 20%)			0.0100			
			(0.0363)			
Tariff Exposure × Tariff Decrease			-0.0697**	-0.125		
			(0.0308)	(0.0799)		
Panel B: Full-Period Window						
Tariff Exposure	0.117	0.0542	-0.0878	-0.0751	-0.337*	-0.390*
	(0.0800)	(0.0849)	(0.180)	(0.182)	(0.190)	(0.202)
Tariff Increase (> 20%)	0.00264				-0.0300	
	(0.0266)				(0.0470)	
Tariff Exposure × Tariff Increase	0.0383	0.159**			0.197*	0.321***
	(0.0441)	(0.0754)			(0.101)	(0.119)
Tariff Decrease (> 20%)			0.0212			
			(0.0310)			
Tariff Exposure × Tariff Decrease			-0.0890	-0.158*		
			(0.0678)	(0.0825)		
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Industries	98	98	98	98	98	98
Industry-Year Observations	784	784	686	686	784	784
Mean Dep Var	0.0319	0.0319	0.0423	0.0423	0.151	0.151
K-P F-stat (Panel A)		10.47		11.84		6.242
K-P F-stat (Panel B)		10.49		11.76		5.869

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Industry tariff rates are imputed from broad-industry average tariff rates. Tariff Increase (Tariff Decrease) is a dummy variable, =1 if the industry had a percentage change in tariff rate greater than 20 (lower than -20) happening within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) Mongrel Act: 1887-1890, (2) McKinley Act: 1891-1894, (3) Wilson-Gorman Act: 1895-1897, (4) Dingley Act: 1898-1902. Columns 1 and 2 include industry-year observations within periods (1) and (2); columns 3 and 4 within periods (2) and (3); columns 5 and 6 within periods (3) and (4). Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0.

Table 15: Tariff Law Changes, Industry Tariff Exposure, and Probability of Consolidation. (Excluding Clays, Earths, and Construction Materials)

	Full Sample			Main Sample		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Two-Year Window						
Tariff Exposure		-0.153*	-0.129		-0.118	-0.0720
		(0.0867)	(0.0805)		(0.117)	(0.102)
Tariff Exposure × Republican Tariff Act		0.0998**	0.0953		0.130***	0.140***
		(0.0474)	(0.0600)		(0.0420)	(0.0482)
Tariff Exposure × Democrat Tariff Act		-0.0457	-0.0640		-0.0441	-0.0597
		(0.0416)	(0.0534)		(0.0428)	(0.0574)
Tariff Exposed × Republican Tariff Act	0.0433			0.0407		
	(0.0270)			(0.0278)		
Tariff Exposed × Democrat Tariff Act	-0.0385			-0.0440		
	(0.0455)			(0.0454)		
Panel B: Full-Period Window						
Tariff Exposure		-0.191**	-0.161**		-0.146	-0.0936
		(0.0801)	(0.0728)		(0.107)	(0.0878)
Tariff Exposure × Republican Tariff Act		0.115***	0.0926*		0.123***	0.0972*
		(0.0396)	(0.0498)		(0.0427)	(0.0537)
Tariff Exposed × Republican Tariff Act	0.106***			0.113***		
	(0.0356)			(0.0344)		
Year Fixed Effects	YES	YES	YES	YES	YES	YES
Industry Fixed Effects	YES	YES	YES	YES	YES	YES
Importable Industries Only	-	-	YES	-	-	YES
Industries	107	107	91	98	98	82
Industry-Year Observations	1712	1712	1456	1568	1568	1312
Mean Dep Var	0.0905	0.0905	0.0934	0.0912	0.0912	0.0945

Note: Robust standard errors clustered at the broad-industry level, denoting *** (1%), ** (5%) and * (10%) significance. Dependent variable is a dummy variable, =1 if a consolidation happened in the given year. Rep Tariff Act (Dem Tariff Act) is a dummy variable, =1 if a Republican-led (Democrat-led) Tariff Act was introduced within the previous two years (for Panel A) or at the start of the current period (for Panel B). Periods other than the first start the year after a tariff act: (1) 1887-1890, (2) 1891-1894, (3) 1895-1897, (4) 1898-1902. Tariff Exposure ranges from 0 to 1. For industries producing importable and dutiable goods, it equals the industry's import intensity in a year prior to the most recent tariff act; for industries producing non-importable or non-dutiable goods, it equals 0. Tariff Exposed is a dummy variable, =1 if industry produces importable and dutiable goods. Industries producing articles classified as clays, earths, and construction materials are not in main sample, and are also excluded from the full sample in this table.

C Proofs

Proof of Proposition 1

Proof. If $\frac{M}{n} \geq \max\left\{q^C, \hat{q}\right\}$, then there are two cases to consider. First, suppose $q^C > \hat{q}$. In this case, the price cap $\hat{P}$ is above P^C, the price induced by the symmetric Cournot equilibrium without the price cap. Let $y^C = (n-1)q^C$. Then q^C maximizes $\pi_i(q_i, y^C)$ and, since $\pi_i(q_i, y) \geq \hat{\pi}_i(q_i, y)$ for all (q_i, y), q^C also maximizes $\hat{\pi}_i(q_i, y^C)$. So the equilibrium without price caps ($q_i = q^C$ for all i) is still a symmetric equilibrium.

Now, suppose $q^C < \hat{q}$. Given $\hat{y} = (n-1)\hat{q}$, producing $q_i = \hat{q}$ induces aggregate output $\hat{Q}$ and price $\hat{P} < P^C$. Since $c < \hat{P}$, $\hat{\pi}_i(\hat{q}, \hat{y}) = (\hat{P} - c)\hat{q} > 0$. Does i has incentives to deviate? If $q_i < \hat{q}$, i lowers output while leaving price unchanged, so lowers its profits. So consider some $q_i^* > \hat{q}_i$. Note that $\pi_i(q_i, y)$ is concave in q_i for any y such that $A - by > c$. The unique best response to y in the absence of a price cap is $q_i = \frac{A-by-c}{2b} > 0$, which is decreasing in y. As q^C is the best response to y^C, and $y^C < \hat{y}$, the best response to $\hat{y}$ is less than $q^C < \hat{q} < q_i^*$. By concavity of $\pi_i(q_i, \hat{y})$, this implies $\pi_i(\hat{q}, \hat{y}) \geq \pi_i(q_i^*, \hat{y})$, and therefore $\hat{\pi}_i(\hat{q}, \hat{y}) \geq \hat{\pi}_i(q_i^*, \hat{y})$.

If $\frac{M}{n} < \max\left\{q^C, \hat{q}\right\}$, a similar argument establishes $q_i = \frac{M}{n}$ for all i as the equilibrium. □

Proof of Proposition 2

Proof. The equilibrium in the price-capped Cournot competition stage (outlined in Proposition 1) does not change the approach to characterizing the set of admissible configurations followed in LNU. As in the baseline model, these must satisfy (1) all managers obtain zero profits, (2) all positive-measure firms are of equal size, and (3) all partnerships obtain the same surplus, which means we can restrict attention to symmetric oligopoly structures where n managers control corporations of size $\frac{M}{n}$.

Given the price-capped surplus functions $\hat{V}_O(n)$ and $\hat{V}_{SA}(n)$ induced by the Cournot equilibrium and conditions 1-3, the set of admissible configurations includes all symmetric oligopoly market structures satisfying $\hat{V}_O(n) \geq 0$ and $\hat{V}_O(n) \geq \hat{V}_{SA}(n)$. Among these, the stable configurations are the ones that maximize oligopoly surplus $\hat{V}_O(n)$.

In the case of a non-binding $\hat{P}$, with $\hat{P} > \overline{P}$, the unique surplus-maximizing admissible market structure is $\underline{n}$, which corresponds to the equilibrium in the baseline model. In this case, $x_O(\underline{n}) < 1$ is guaranteed by $M > \frac{A-c-2\phi}{b}$, which is implied by [A1*]. For $\hat{P} < \underline{P}$, $\hat{V}_O(n) < 0$ for all n, so no symmetric oligopoly satisfies non-negative surplus for oligopoly partnerships.

For $\underline{P} \leq \hat{P} \leq \overline{P}$, we have that $\underline{n} \leq \hat{n} \leq \overline{n}$. For all $n \leq \hat{n}$, $\hat{V}_O(n) = V_O(\hat{n}) > 0$, as $V_O(n)$ is strictly decreasing in n and $V_O(\overline{n}) = 0$. For $n > \hat{n}$, $\hat{V}_O(n) = V_O(n)$ is strictly decreasing in n, with $\hat{V}_O(\overline{n}) = V_O(\overline{n}) = 0$. Therefore, the condition $\hat{V}_O(n) \geq 0$ is satisfied for all $n \leq \overline{n}$. Moreover, since $\underline{n} \leq \hat{n}$ and $V_O(n) > V_{SA}(n)$ for all $n > \underline{n}$, it follows that $\hat{V}_O(n) \geq \hat{V}_{SA}(n)$ for all n. Thus, the set of admissible symmetric oligopoly structures when $\underline{P} \leq \hat{P} \leq \overline{P}$ is given by the set $[1, \overline{n}]$. Among these, the set of stable structures is $[1, \hat{n}]$, where $\hat{V}_O(n)$ is maximal. Finally, within the stable set, the equilibrium refinement leads to the unique equilibrium market structure $\hat{n}$, the least-concentrated oligopoly within the set of surplus-maximizing admissible structures. In this case, $x_O(\hat{n}) < 1$ is guaranteed by $M > \frac{A-\hat{P}}{b}$, which is also implied by [A1*]. □

Proof of Proposition 3

Proof. Fix $A, b, c, \phi, F > 0$ and $\hat{P} \in (c + 2\sqrt{F\phi}, A)$ satisfying [A2] and [A3]. The proof procedes as follows. I first determine, given any measure of partnerships M, the partnership surplus that would result from the ensuing equilibrium market structure $n^*(M)$ as characterized by Proposition 2. This yields a function $V(M) \equiv V_O(n^*(M), M)$. Equilibrium entry is then given by a measure M^* satisfying (i) $V(M^*) = F$ and (ii) $V(M)$ is strictly decreasing within an interval around M^*. I then establish that the unique equilibrium measure of partnerships and number of firms are given by $(n^*(\hat{P}), M^*(\hat{P}))$ as stated in Proposition 3.

Take any $M > 0$. Restrict attention to M satisfying [A1*], which ensures that partnership capacity constraints are not binding in the resulting equilibrium market structure.

By Proposition 2, the equilibrium market structure given a price cap $\hat{P}$ and a measure of partnerships M is a symmetric oligopoly with $n^*(M;\hat{P})$ corporations, given by

$$n^*(M;\hat{P}) = \begin{cases} \underline{n} & \text{if } \hat{P} > \overline{P} \\ \hat{n} & \text{if } \underline{P} \leq \hat{P} \leq \overline{P} \end{cases}$$

where $\underline{n}$ is the equilibrium number of firms in the absence of a price cap, $\hat{n}$ is the equilibrium number of firms under a binding price cap, and $\overline{P}$ and $\underline{P}$ are the Cournot prices corresponding to $\underline{n}$ and $\overline{n}$. These are given by

$$\hat{n} = \frac{A - \hat{P}}{\hat{P} - c}$$

$$\underline{n} = \frac{A - c - \phi}{\phi(1 + \frac{A-c}{Mb})}$$

$$\overline{n} = \frac{Mb}{\phi}$$

$$\overline{P} \equiv P^C(\underline{n}) = \frac{A\phi + Mb(c + \phi)}{Mb + \phi}$$

$$\underline{P} \equiv P^C(\overline{n}) = \frac{A\phi + Mbc}{Mb + \phi}$$

Note that $\underline{n}$ and $\overline{n}$, and the corresponding prices $\overline{P}$ and $\underline{P}$, depend on M, while $\hat{n}$ does not. The aim is to characterize $V(M) \equiv V_O(n^*(M), M)$. Given $\hat{P}$ and M, if $\hat{P} > \overline{P}(M)$, the price cap does not bind and the equilibrium market structure is $\underline{n}(M)$, so that the resulting surplus is $V(M) = V_O(\underline{n}(M), M)$. If, on the other hand, $\underline{P}(M) \leq \hat{P} \leq \overline{P}(M)$, the price cap is binding, and the equilibrium market structure is $\hat{n}$, with $V(M) = V_O(\hat{n}, M)$. Finally, if $\hat{P} < \underline{P}(M)$, oligopoly corporations cannot make non-negative surplus, so there is no domestic production and $V(M) = 0$. To describe how $V(M)$ varies with M, and to determine the values of M such that $V(M) = F$, it is conventient to express $V(M)$ in terms of cutoff values of M given $\hat{P}$. To do so, I split the analysis into two cases: $\hat{P} > \phi + c$ and $\hat{P} \leq \phi + c$.

First, assume that $\hat{P} > \phi + c$. It follows that $\hat{P} > \underline{P}(M) \Leftrightarrow M > \frac{\phi(A-\hat{P})}{b(\hat{P}-c)} \equiv M_0$ and $\hat{P} > \overline{P}(M) \Leftrightarrow M > \frac{\phi(A-\hat{P})}{b(\hat{P}-c-\phi)} \equiv M_1$, where $M_0 < M_1$. We can thus re-express $n^*(M;\hat{P})$ in this case as

$$n^*(M) = \begin{cases} \underline{n} & \text{if } M_1 < M \\ \hat{n} & \text{if } M_0 \leq M \leq M_1 \end{cases}$$

Note that [A1] rules out $M < M_0$ given $\hat{P} > \phi + c$. The resulting equilibrium-surplus function $V(M) \equiv V_O(n^*(M), M)$ is then

$$V(M) = \begin{cases} V_O(\underline{n}(M), M) & \text{if } M_1 < M \\ V_O(\hat{n}, M) & \text{if } M_0 \leq M \leq M_1 \end{cases}$$

with $V_O(\underline{n}(M), M) = V_O(\hat{n}, M)$ at the crossing point $M = M_1$.

To describe $V(M)$, let us examine $V_O(\underline{n}(M), M)$ and $V_O(\hat{n}, M)$. Substituting $n = \underline{n}(M)$ into $V_O(n, M)$, we obtain

$$V_O(\underline{n}(M), M) = \frac{\phi(A - c - \phi)}{\phi + Mb}$$

which is strictly decreasing in M. For any $F \in (0, A - c - \phi)$, there is a unique $\tilde{M}$ such that $V_O(\underline{n}(\tilde{M}), \tilde{M}) = F$, where

$$\tilde{M} = \frac{\phi(A - c - \phi - F)}{Fb}$$

and $\tilde{M} > 0$ by [A2].

Substituting $n = \hat{n}$ into $V_O(n, M)$, we obtain

$$V_O(\hat{n}, M) = (\hat{P} - c)\frac{(A - \hat{P})}{bM} - \phi \left(\frac{A - \hat{P}}{bM} \right)^2$$

One can show that $V_O(\hat{n}, M)$ is strictly increasing in M within the interval $(0, 2M_0)$, crossing zero at M_0 and attaining a unique maximum at $2M_0$, and is strictly decreasing in M beyond $2M_0$. We have assumed that the price cap satisfies

$$\hat{P} > c + 2\sqrt{F\phi} \Longleftrightarrow F < \frac{(\hat{P}-c)^2}{4\phi}$$

Then, for any $0 < F < \frac{(\hat{P}-c)^2}{4\phi}$, there are two values of M such that $V_O(\hat{n}, M) = F$:

$$\hat{M}_- = \frac{(A-\hat{P})\left(\hat{P}-c-\sqrt{(\hat{P}-c)^2-4F\phi}\right)}{2Fb}$$

$$\hat{M} = \frac{(A-\hat{P})\left(\hat{P}-c+\sqrt{(\hat{P}-c)^2-4F\phi}\right)}{2Fb}$$

where $M_0 < \hat{M}_- < 2M_0 < \hat{M}$.

We are now ready to show that the statement in Proposition 3 holds for the case where $\hat{P} > \phi + c$. There are two subcases to consider: $\hat{P} > c + \phi + F$ and $\hat{P} \leq c + \phi + F$. First, suppose $\hat{P} > c + \phi + F$. We must show that $\tilde{M}$ is the unique M^* satisfying both (i) $V(M^*) = F$ and (ii) $V(M)$ is strictly decreasing within an interval around M^*. By the analysis above, the three candidate solutions to $V(M) = F$ are $\tilde{M}$, $\hat{M}$, and $\hat{M}_-$. First consider $\tilde{M}$. Note that $\hat{P} > c + \phi + F$ implies $\tilde{M} > M_1$:

$$\tilde{M} \equiv \frac{\phi(A-c-\phi-F)}{Fb} > \frac{\phi(A-\hat{P})}{b(\hat{P}-c-\phi)} \equiv M_1$$

$$\Longleftrightarrow (\hat{P}-c-\phi)(A-c-\phi-F) > F(A-\hat{P})$$

which holds given that $\hat{P} - c - \phi > F$ and $A - c - \phi - F > A - \hat{P}$.

Since $\tilde{M} > M_1$, we have that $n^*(\tilde{M}) = \underline{n}(\tilde{M})$ and $V(\tilde{M}) = V_O(\underline{n}(\tilde{M}), \tilde{M}) = F$. Moreover, since $V_O(\underline{n}(M), M)$ is strictly decreasing in M, it follows that $V(M)$ is strictly decreasing within an interval around $\tilde{M}$. Define

$$\tilde{n} \equiv \underline{n}(\tilde{M}) = \frac{A - c - \phi - F}{\phi + F}$$

We have thus established that $(\tilde{n}, \tilde{M})$ is an equilibrium market structure in this case. We now show that it is the unique equilibrium by ruling out $\hat{M}$ and $\hat{M}_{-}$. First, we establish that $\hat{P} > c + \phi + F$ implies $\hat{M} > M_1$:

$$\hat{M} \equiv \frac{(A - \hat{P})\left(\hat{P} - c + \sqrt{(\hat{P} - c)^2 - 4F\phi}\right)}{2Fb} > \frac{\phi(A - \hat{P})}{b(\hat{P} - c - \phi)} \equiv M_1$$

$$\iff \hat{P} - c + \sqrt{(\hat{P} - c)^2 - 4F\phi} > \frac{2F\phi}{\hat{P} - c - \phi}$$

Now, since $\hat{P} - c - \phi > F$, we have that

$$2\phi > \frac{2F\phi}{\hat{P} - c - \phi}$$

so it suffices to show that

$$\hat{P} - c + \sqrt{(\hat{P} - c)^2 - 4F\phi} > 2\phi$$

$$\iff \sqrt{(\hat{P} - c)^2 - 4F\phi} > 2\phi - (\hat{P} - c)$$

If $\hat{P} > 2\phi + c$, then the inequality must hold as the LHS is non-negative and the RHS is negative. If $\hat{P} \leq 2\phi + c$, squaring both sides gives

$$(\hat{P} - c)^2 - 4F\phi > 4\phi^2 + (\hat{P} - c)^2 - 4\phi(\hat{P} - c)$$

$$\iff 4\phi(\hat{P} - c - \phi - F) > 0$$

which holds given $\hat{P} - c - \phi > F$. Therefore, $\hat{M} > M_1$. Then, by the definition of $V(M)$, we have that $V(\hat{M}) = V_O(\underline{n}(\hat{M}), \hat{M}) \neq V_O(\hat{n}, \hat{M}) = F$, ruling out $\hat{M}$ as a solution to $V(M) = F$. Finally, if $V(\hat{M}_-) = V_O(\hat{n}, \hat{M}_-) = F$, note that since $\hat{M}_- < 2M_0$, $V_O(\hat{n}, M)$ is strictly increasing in around $\hat{M}_-$, so that $V(M)$ is not strictly decreasing around $\hat{M}_-$, ruling out $\hat{M}_-$ as an equilibrium measure. This establishes $(\tilde{n}, \tilde{M})$ as the unique equilibrium market structure when $\hat{P} > c + \phi + F$.

For the next subcase, suppose $c + \phi < \hat{P} \leq c + \phi + F$, and again consider the three candidate solutions $\tilde{M}$, $\hat{M}$ and $\hat{M}_-$. An analysis analogous to the one above establishes that, in this case, $\hat{M} < M_1$ and $\tilde{M} < M_1$. Then $V(\hat{M}) = V_O(\hat{n}, \hat{M}) = F$, with $V(M) = V_O(\hat{n}, M)$ strictly decreasing in an interval around $\hat{M}$ given that $\hat{M} > 2M_0$. This establishes $(\hat{n}, \hat{M})$ as an equilibrium. To rule out $\tilde{M}$, observe that $V(\tilde{M}) = V_O(\hat{n}, \tilde{M}) \neq V_O(\underline{n}(\tilde{M}), \tilde{M}) = F$. Finally, the same argument as above rules out $\hat{M}_-$ as an equilibrium measure. This establishes $(\hat{n}, \hat{M})$ as the unique equilibrium market structure when $c + \phi < \hat{P} \leq c + \phi + F$. This finishes the analysis for $\hat{P} > c + \phi$.

Now, suppose $\hat{P} \leq c + \phi$. Observe that, in this case, $\hat{P} \leq \overline{P}$ for all values of M:

$$\hat{P} \leq \frac{A\phi + Mb(c + \phi)}{Mb + \phi} \equiv \overline{P}$$

$$\iff Mb(\hat{P} - c - \phi) \leq \phi(A - \hat{P})$$

The inequality holds for any M given that $\hat{P} - c - \phi \leq 0$ and $\phi(A - \hat{P}) > 0$. This implies that the price cap $\hat{P}$ is binding regardless of M. As for the lower threshold $\underline{P}$, we have that $\hat{P} > \underline{P} \Leftrightarrow M > \frac{\phi(A - \hat{P})}{b(\hat{P} - c)} \equiv M_0$ as before. Therefore, the equilibrium number of firms given M is $n^*(M) = \hat{n}$ for all $M_0 \leq M$. As before, for $M < M_0$, oligopoly corporations cannot attain non-negative surplus, so that domestic production shuts down. We thus have that, if

$\hat{P} \leq c + \phi$, the equilibrium-surplus function given M is

$$V(M) = \begin{cases} V_O(\hat{n}, M) & \text{if } M_0 \leq M \\ 0 & \text{if } M < M_0 \end{cases}$$

In this case, $\hat{P} \leq c+\phi < c+\phi+F$, so all that remains is to establish that $(\hat{n}, \hat{M})$ is the unique equilibrium. As shown above, $\hat{P} > c+2\sqrt{F\phi}$ guarantees that, for any such $F > 0$, $\hat{M}_{-}$ and $\hat{M}$ are the values for which $V(M) = V_O(\hat{n}, M) = F$, where $M_0 < \hat{M}_{-} < 2M_0 < \hat{M}$. As before, we rule out $\hat{M}_{-}$ since $V(M)$ is strictly increasing in an interval around $\hat{M}_{-}$, leaving $(\hat{n}, \hat{M})$ as the unique equilibrium. Finally, note that any price cap lower than $c+2\sqrt{F\phi} < c+\phi$ would imply that $V(M) < F$ for all $M > 0$, in which case there does not exist an equilibrium M^* such that $V(M^*) = V_O(n^*(M^*), M^*) = F$.

To conclude the proof, we must verify that in equilibrium, $n^* \geq 1$ and partnership output is below the capacity constraint, i.e. $x^* \equiv x_O(n^*, M^*) \leq 1$. If $\hat{P} > c + \phi + F$, the unique equilibrium is $(\tilde{n}, \tilde{M})$ and $x^* \equiv x_O(\tilde{n}, \tilde{M})$. Observe that $\tilde{n} \geq 1 \iff A - c \geq 2(\phi + F)$, which is guaranteed by [A2]. On the other hand, $x^* \equiv x_O(\tilde{n}, \tilde{M})$ simplifies to $x^* = \frac{F}{\phi}$, with $x^* \leq 1$ by [A3]. If $\hat{P} \leq c + \phi + F$, the unique equilibrium is $(\hat{n}, \hat{M})$ and $x^* \equiv x_O(\hat{n}, \hat{M})$. Observe that $\hat{n} \geq \tilde{n} \geq 1$, where the first inequality follows from $\hat{P} \leq c + \phi + F$. On the other hand, $x^* \equiv x_O(\hat{n}, \hat{M}) = \frac{A-\hat{P}}{b\hat{M}} \leq 1 \iff \frac{A-\hat{P}}{b} \leq \hat{M}$. We have established above that $\hat{M} > 2M_0$, and $2M_0 \geq \frac{A-\hat{P}}{b} \iff 2\phi + c \geq \hat{P}$, which must be true since $\hat{P} \leq c + \phi + F$ and $F \leq \phi$ by [A3]. Thus, $x^* \equiv x_O(\hat{n}, \hat{M}) \leq 1$. This concludes the proof. □

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