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Industry Cost Structures and Tying Arrangements

I. Introduction

Some of the earliest antitrust cases discuss the legality of attempting to sell multiple products together, s*ee e.g., Henry v. A.B. Dick Co.*, 224 U.S. 1 (1912); *Heaton-Peninsular Button-Fastener Co. v. Eureka Specialty Co.*, 65 Fed 619 (C.C.W.D. Mich. 1895), yet the problem of separating legal and illegal tying arrangements remains timeless. A tying arrangement exists when a seller conditions the purchase of one product on the purchase of another. One of the most prominent antitrust controversies of today, the FTC's challenge of Microsoft's acquisition of video game company Activision-Blizzard, is based in large part on tying grounds, with the FTC alleging that Microsoft is attempting to build market power in the video game market that it can then apply to the video game console market through tying exclusive availability of games to specific console systems.[1] Despite their common occurrence in case law and importance in business, tying arrangements remain only moderately understood and have been subject to significant dispute and evolution over the course of antitrust history. Tying arrangement doctrine is currently at a relative ebb from the *per se* illegality of the 1940s through 1970s but still gives relatively expansive powers to the courts to strike down tying agreements in cases where substantial market power exists in the tied product. This paper explores the history of tying arrangements and asks whether current doctrine, which finds some tying arrangements

[1] "Microsoft produces its own first-party video game titles. Microsoft has acquired over ten third-party studios and their titles in recent years to expand its offerings. Microsoft has frequently made those acquired titles exclusive to its own consoles and/or subscription services, eliminating the opportunity for consumers to play those titles on rival products or services. By taking games exclusive, Microsoft strengthens the position of its console and subscription service products relative to competitors." Complaint at 3 ¶ 9, *In the Matter of Microsoft Corp. v. Activision-Blizzard, Inc.*, No. 9412 (FTC Dec. 8, 2022), https://www.ftc.gov/system/files/ftc_gov/pdf/D09412MicrosoftActivisionAdministrativeComplaintPublicVersionFinal.pdf.

but not others to be anticompetitive, accurately reflects economic realities and furthers the goals of antitrust policy and law. In particular, the analysis begins by examining how cost structures in a market can create anticompetitive risks in two markets for independent goods before focusing on whether the relationship between the tying and tied products should impact how we view tying's legality. I conclude by suggesting that the Court's current rule around tying arrangements (requiring market power and a showing of forced changes in consumer behavior) is incomplete because it fails to consider the indirect impacts that tying arrangements can have on consumers by pushing other producers out of business and thus indirectly forcing consumers to change behavior by limiting their options.

II. The Court's Approach to Tying

Like much of American antitrust doctrine, rules around tying arrangements have undergone several waves of evolution and have been generated through a dialogue between the Supreme Court and Congress. The best current articulation for the illegality of tying arrangements is found in *Jefferson Parish Hosp. Dist. No. 2 v. Hyde*:

> [T]he essential characteristic of an invalid tying arrangement lies in the seller's exploitation of its control over the tying product [described elsewhere in the opinion as "market power"] to force the buyer into the purchase of a tied product that the buyer either did not want at all, or might have preferred to purchase elsewhere on different terms. 466 U.S. 2, 12 (1984) (edits added).

Jefferson Parish Hospital requires several conditions to be met to find an illegal tying arrangement: (1) the seller has market power or control over the tying product and (2) that the seller "forces" the buyer to buy a second product on less favorable terms by (3) using its power in the initial market. Although this current formulation of the rule simplifies and rationalizes past tying arrangement doctrine, past doctrine is important both as instruction for filling out the substance of each of these conditions (e.g., what does it mean to have "control over the tying product"?) and to understand alternative approaches the law could take in this area. Given that the purpose of this paper is to ask whether current law is correct in understanding some tying arrangements but not others as anticompetitive, alternative understandings can provide an opportunity for comparison once we begin the analysis. Although tying arrangements are vertical restraints and thus less obviously abusive than horizontal agreements, the Supreme Court has historically invalidated many of them under the Sherman Act §§ 1 and 2 and Clayton Act § 3. This is because the Court views tying arrangements as allowing companies to apply market power that they have in one market to another market where they may have less, thus furthering the expansion of monopoly power and restraints on trade that antitrust laws were meant to protect against. *See, e.g.*, *International Salt Co. v. United States*, 332 U.S. 392, 395–96 (1947).

Much of the Court's original tying arrangement doctrine was developed out of Chief Justice Edward Douglass White's dissent in *Henry v. A.B. Dick Co.,* where he argued that allowing a patent holder to tie the sale of unpatented products to the sale of a patented product unjustifiably extended the market power of the patent holder, harming the public. 224 U.S. 1, 49-73 (1912) (White, C.J. dissenting). White was concerned with the tension between the governmental grant of market power under intellectual property laws and the desire to avoid concentrations and abuse of market power under the Sherman Act. In response to the majority in

A.B. Dick Co., Congress passed § 3 of the Clayton Act dealing with exclusivity contracts and tying arrangements, which the Court subsequently read to have overruled *A.B. Dick Co.* and to have endorsed White's opposition to tying arrangements for both patented and unpatented goods. *See Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 517 (1917). Like many other antitrust rules, doctrine evolved over time towards a *per se* rule against tying arrangements. *Standard Oil Co. of California v. United States*, 337 U.S. 293, 305 (1949) ("Tying agreements serve hardly any purpose beyond the suppression of competition."); *Fortner Enterprises, Inc. v. United States Steel Corp.*, 394 U.S. 495, 498–499 (1969) *(Fortner I)* ("[A]t least when certain prerequisites are met, [tying] arrangements… are illegal in and of themselves, and no specific showing of unreasonable competitive effect is required.").

As with other areas of antitrust law, by the latter part of the 20th century, the Court began to shift its views to become more accepting of tying arrangements. *See Fortner I*, U.S. 495 (dissents); *Illinois Tool Works*, 547 U.S. at 36 (citing *United States Steel Corp. v. Fortner Enterprises, Inc.*, 429 U.S. 610, 622 (1977) *(Fortner II)*) ("plaintiff's failure of proof on the issue of market power was fatal to its case"); *Illinois Tool Works*, 547 U.S. at 36 (discussing Court's repeated rejection of the idea from *Fortner I* that "[t]ying arrangements serve hardly any purpose beyond the suppression of competition"). The Court came to believe that tying arrangements, like other vertical restrictions, were less harmful to the free competition that antitrust laws meant to protect than mid-century caselaw suggested. Thus, by the time of *Jefferson Parish Hospital*, the Court was ready to fully overrule the *per se* rule against tying arrangements tentatively endorsed in *Fortner I* in favor of a more exacting requirement that courts find both "market power" and "forcing" to invalidate tying arrangements. *See Jefferson Parish Hospital*, 466 U.S. at 13–14 ("[W]e have condemned tying arrangements when the seller has some special ability—

usually called 'market power'—to force a purchaser to do something that he would not do in a competitive market… When 'forcing' occurs, our cases have found the tying arrangement to be unlawful.").

Before modeling the competitive effects of tying arrangements, we need to consider two characteristics of the Court's tying arrangement doctrine. First, does it matter the market power in the tying product comes from? Although tying arrangements scrutinized by the Supreme Court have often appeared in the context of market power created by patent or other intellectual property law, market power in a tied product can come from a variety of sources. *See, e.g.*, *Northern Pac. Ry. Co. v. United States*, 356 U.S. 1 (1958) (regulatory); *International Salt Co. v. United States*, 332 U.S. 392 (1947) (patent); *Jefferson Parish Hospital*, 466 U.S. (geographic); *c.f. United States v. United Shoe Machinery Corp.*, 110 F.Supp. 295 (D.C.Mass. 1953) (quality and innovation). Under the Court's current doctrine, any showing of market power in the tying product can support finding the tying arrangement illegal regardless of the source of the market power. *See Jefferson Parish Hospital*, 466 U.S. at 13–14 (requiring only that market power exists to force change in behavior). Despite the prevalence of patent-related market power in the Court's past cases, the analysis in this paper focuses primarily on market cost structures and their role in enabling market power for tied products. This focus is consistent with the Court's shift in recent years from a presumption of market power in patent cases (which had made it easier to bring tying cases where patent market power was present) to a requiring a general showing of market power regardless of source, *see Illinois Tool Works Inc. v. Independent Ink, Inc.*, 547 U.S. 28, 31 (2006) ("We conclude that the mere fact that a tying product is patented does not support… a presumption" of market power). In addition, the Court's historic focus on government-granted market power leaves it vulnerable to ignoring the types of market power

that businesses leverage on a regular basis. As demonstrated in the analysis below, firm and industry cost structures can tell us something about how tied markets interact and the potential for mischief by firms using tying arrangements for a broad range of types of market power. As discussed below, this analysis is crucial as any source of market power can contribute to tying misbehavior so long as the market power exists.

Second, how are the tied products related to each other? In some cases, the products are complements (in that buying one with the other creates additional value for the customer) or could even be considered subproducts (where both products must be combined to give the consumer any value at all) and in others they could be considered substitutes (in that consumers would prefer to buy one but not the other). *See, e.g., Illinois Tool Works*, 547 U.S. (complements); *Jefferson Parish Hospital*, 466 U.S. at 43 (O'Connor, J. concurring in the judgment) (subproducts); *United States v. Loew's, Inc.*, 371 U.S. 38 (1962) (substitutes). Example cases are illustrative.

One of the most prominent examples of the Court considering a tying arrangement was the case of *International Salt Co. v. United States*. 332 U.S. International Salt had achieved a monopoly over the sale of specific machinery relevant to dissolving rock salt into brine via patents but included terms in its leases that required customers to buy the unpatented salt used in the patented machines from International Salt (in some cases with a strict exclusivity clause and in others with a price-matching clause).[2] The Court, in an opinion written by Justice Jackson, found that the lease condition that lessees buy unpatented salt from International Salt was a restraint on trade and abuse of market power not allowed by the Sherman Act or patent law

[2] An example tying clause from the case states as follows:

> …that the said [machine] shall be used for dissolving and converting into brine only those grades of rock salt purchased by the Lessee from the Lessor at prices and upon terms and conditions hereafter agreed upon… *International Salt Co. v. United States*, 332 U.S. 392, 394 fn. 5 (1947).

because it tied the salt market to the machine market and thus unlawfully extended International Salt's market power:

> [P]atents confer a limited monopoly of the invention they reward. From them appellant derives a right to restrain others from making, vending or using the patented machines. But the patents confer no right to restrain use of, or trade in, unpatented salt. By contracting to close this market for salt against competition, International has engaged in a restraint of trade for which its patents afford no immunity from the anti-trust laws. *Id.* at 395–96.

International Salt is a classic example of a tying arrangement between goods that are highly complementary or that may even be necessary to consume together. Without the input material of the rock salt, International Salt's machines for creating brine for industrial processing are worthless.[3] Another example of a commonly tied product in this family is printers and printer cartridges, and many other complementary consumer goods are bundled together in the same way (though often without the exclusivity or conditioning required to be a tying arrangement). *See Illinois Tool Works*, 547 U.S. (printers and ink cartridges); *International Business Machines Corporation v. United States*, 298 U.S. 131 (1936) (*IBM*) (punch cards for computers). In these cases, the consumer might get incremental value from receiving more of either good (though the exact value will vary—e.g., in *IBM* more computers might allow for faster processing of programs whereas more punch cards might allow for more programs), but also may prefer to

[3] We might also think that some of these products look more like subproducts in practice, with purchase of one of the products (a platform/machine) creating a baseline maximum level of throughput and the other product (the input good) allowing the customer to produce more on the machine up to a given capacity. This is explored infra ___.

have a more balanced mix of the goods to maximize their utility, potentially creating a function like $U(x, y) = \sqrt{axy}$.

One might argue that many commonly tied products are not what are traditionally thought of as complementary products but are two subproducts that come together to form a single good. This type of tying arrangement was best explored in Justice O'Connor's dissent in *Jefferson Parish Hospital*. *See* 466 U.S. at 32-47 (O'Connor, J. concurring in the judgment). In that case, the Court considered whether a hospital with market power in the hospital services market would be able to use that power to acquire market power in the market for anesthesiological services by tying the provision of the hospital's surgery services to similar provision of anesthesiology. *Id.* at 42-43. Despite market power in hospital services and a risk that the hospital would be able to translate its market power to anesthesiology, O'Connor argued that surgical and anesthesiological services were both subproducts of a larger surgery-with-anesthesia product. As a result, "there [was] no sound economic reason for treating surgery and anesthesia as separate service [because] patients are interested in purchasing anesthesia only in conjunction with hospital services, so the Hospital can acquire no *additional* market power by selling the two services together." *Id.* at 43. In practice, these types of goods will likely be best represented by a utility function like $U(x, y) = \min(ax, by)$.

The clearest example of substitutable products being tied together is *United States v. Loew's, Inc.*, where the Supreme Court considered the practice of "block booking" where movie distributors sold broadcast licenses for bundles of movies of varying quality. 371 U.S. 38 (1962). Within these "block booking" bundles were movies that were highly valuable to consumers and movies that consumers might be entirely uninterested in. As the Court explained:

> To get 'Treasure of the Sierra Madre,' 'Casablanca,' 'Johnny Belinda,' 'Sergeant York,' and 'The Man Who Came to Dinner,' among others, [the customer] also had to take such films as 'Nancy Drew Troubleshooter,' 'Tugboat Annie Sails Again,' 'Kid Nightingale,' 'Gorilla Man,' and 'Tear Gas Squad.' *Id.* at 41-42.

In *Loew's*, the relevant high- and low-quality movies were either independent goods or potentially directly substitutable, in that television stations had a limited amount of time to show movies, and showing a bad movie would take away time from a good movie. Because the consumer might get less value from purchasing the different movies as part of a bundle, one might rightfully ask what value the purchaser or the consumer gets from bundling substitutes together. *C.f. Broadcast Music, Inc. v. Columbia Broadcasting System, Inc.*, 441 U.S. 1 (1979) (both consumers and producers do gain some value from the availability of blanket musical licensing products due to high transaction costs of licensing individual songs or plays).

III. Cost Structures and Market Power

To understand antitrust policy, we also need to consider its adversarial nature with respect to businesses, where clever leaders are always seeking to identify new ways to create competitive advantages that may or may not have anticompetitive effects.[4] In his classic book *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, Michael E. Porter argues that competitive strategy in business is built on top of industry structure and identifies six structural sources of "barriers to entry" that create market power and competitive advantage. Michael E. Porter, Competitive Strategy: Techniques for Analyzing Industries and Competitors

[4] Indeed, this is often the history of the Supreme Court's antitrust doctrine, where a new type of creative economic technique for creating market power will arise, and the Court will need to decide whether antitrust laws prevent it.

27-32 (1980) These are: (1) economies of scale created by large fixed costs, (2) product differentiation, (3) requirements of large financial resources to compete, (4) switching costs for consumers, (5) access to distribution channels, and (6) cost advantages independent of scale (proprietary technology, government regulation, geographic advantage, etc.).[5] *Id.*; *see also* Jonathan A. Knee, The Curse of the Mogul: What's Wrong With the World's Leading Media Companies 36-45 (2011) (simplifying to four sources of competitive advantage: (1) scale, (2) customer captivity, (3) cost, and (4) government regulation). Although all these sources of competitive advantage and market power may be relevant for antitrust analysis, this analysis focuses primarily scale and cost advantages (though a similar analysis could be done for supply-side sources of competitive advantage) as industry cost structures can have a significant impact on the number of viable firms in an industry as well as their market power and allow for relatively simple modeling and discussion of competitive concerns. For example, the cost structure of a classic natural monopoly industry (e.g., wired telecom services or a railroad) contains huge fixed costs and insignificant variable costs. Once Telecom A has run a wire to a home, it can provide a telephone connection at almost zero marginal cost. However, any Telecom B that wants to compete with Telecom A will face the threat of Telecom A reducing its price to its marginal costs upon a competitor's entry, thus making it impossible to justify investing in setting up a competitor. *See* Tim Wu, The Master Switch: The Rise and Fall of

[5] One concrete example of (6) is control over a specific input resource required to compete in an industry (as in the following example from U.S. Steel-related Congressional testimony):

> Mr. Schwab. I do not believe there will be any great development in iron and steel by new companies, but rather development by the companies now in the business.
> The Chairman. Now, explain that to us.
> Mr. Schwab. For the reason that the possibility of a new company getting a sufficiently large supply of raw materials would make it exceedingly difficult if not impossible.

Donald O. Parsons and Edward John Ray, *The United States Steel Consolidation: The Creation of Market Control*, 18(1) *The Journal of Law and Economics*. 181, 198 (1975).

Information Empires 45-60 (2011) (discussing Theodore Vail and sources of first Bell monopoly). Such analysis of cost structure is not limited only to natural monopolies, as all industries (no matter their size) have some mixture of fixed and variable costs and as a result will see some equilibrium quantity of firms competing in the market. Indeed, the cost structure of a specific industry can inform us about the number of firms that will compete in a market in equilibrium. *See, e.g.,* Rene Manes, A New Dimension to Breakeven Analysis, 4(1) J. Accounting Research 87 (1966). The remainder of this section discusses a relatively simple model to show how under specific market cost structure conditions, tying two products together can create a problematic augmentation of the scope of a producer's market power. I then compare the results of this model to the outcomes that would be achieved under the Court's current tying doctrine to evaluate the correctness of that doctrine.

Independent Markets and Hypothetical Cost Structures

Let us start with the case of a simple market for two independent goods (goods where consumption of one does not impact consumption of the other). For example, machinery (g_1) and services (g_2).[6] In our simplest hypothetical market, the market for machinery will clear when $100\ g_1$ are sold to customers, and consumers are willing to pay up to 3.5 per unit to clear the market $U = \min(3.5g_1, 350)$. The cost structure of a firm making machinery is represented by:

$$C_i = 100 + 1 * Q_i$$

To understand the competitive landscape of this market independent of potential tying arrangements, let us examine the overall market cost structures for one-, two-, and three-firm

[6] Idea drawn from complementary goods tying arrangement in *United States v. United Shoe Machinery Corp.*, 110 F.Supp. 295 (D.C.Mass. 1953).

versions of this market. To begin with, let us assume that collectively, firms will produce enough machines to clear the market:

$$Q_{total} = \sum Q_i = 100$$

Next, we can sum the costs of all firms in the market C_i in order to get the total cost for the market C_{total}. The equation below solves for C_{total} where n is the number of participating firms in the market, and applies the formula to $n = \{1, 2, 3\}$:

$$C_{total} = \sum C_i = \sum (100 + 1 * Q_i) = \sum 100 + \sum Q_i = n * 100 + 100$$

$$C^1_{total} = 1 * 100 + 100 = 200$$

$$C^2_{total} = 2 * 100 + 100 = 300$$

$$C^3_{total} = 3 * 100 + 100 = 400$$

The maximum revenue across the market if the price was set at 3.5 would be $R_{potential} = 3.5 * Q_{total} = 350$. The potential profits for each industry structure thus follow:[7]

$$\pi^1_{potential} = R_{potential} - C^1_{total} = 350 - 200 = 150$$

$$\pi^2_{potential} = R_{potential} - C^2_{total} = 350 - 300 = 50$$

$$\pi^3_{potential} = R_{potential} - C^3_{total} = 350 - 400 = -50$$

If we assume that firms will enter in the long run as long as market participants are each able to cover their total cost of production and charge a price between that required for them to break even and the market clearing maximum price, we would expect this market to support two firms

[7] These profits are only potential, and whether they could be captured by the participants would depend on whether market participants are able to cooperate in setting prices. It is possible that participants would cut prices to their marginal cost to try to win market share and drive out their competitors before increasing to charge the monopoly price. This initial simplified model is only meant to illustrate the broad concept of how firms' cost structures can impact their breakeven market shares and later models will improve on this. However, these numbers should be accurate in the long run maybe because firms will enter and exit and adjust prices until they reach this equilibrium. See https://www.forbes.com/advisor/in/investing/calculate-break-even-point/

with a one-firm market encouraging a new firm to enter and a three-firm market requiring a firm to exit to avoid market losses. In our expected two-firm market structure, the best firms could do for themselves would involve cooperating to share the profit of 50, and there would be a risk to firms of price competition as marginal cost in this hypothetical is below both the shared monopolist price and the breakeven price for the firms. If such price competition occurred, consumers would likely see gains, and it is possible that consumers would achieve long-run surplus. In the long run, given the competitive nature of the industry, we would expect firms to charge somewhere in the range of the monopolist and breakeven prices $[3.0, 3.5]$ per unit and capture and share between $[0, 50]$ of profit. If duopolist firms make a non-zero profit, they may negotiate over how to split this profit, but the distribution of this profit and the amount of profit made in the industry have no impact on total surplus, only redistribution between the two firms and between producers and consumers.

Now let us imagine an independent good such as services and see how tying in this complementary market might impact the overall cost structure and profits in new combined market. Like the market for machinery, let us assume that the market for services clears when 100 g_2 are sold to consumers, and that consumers are willing to pay up to 1 per unit of services $U = \min(g_2, 100)$. Let us assume a different cost structure for firms in the market with only fixed costs:[8]

$$C_i = 100$$

Looking at the combined industry cost structure across multiple potential numbers of n firms:

$$C_{total} = \sum C_i = \sum 100 = n * 100$$

[8] For example, imagine a services market cost structure that requires heavy fixed salary costs to staff, but no variable costs in providing those services once staff is hired.

Given consumers' lower value and willingness to pay for these services, $R_{potential} = 1 * Q_{total} = 100$. Conducting a similar potential profit analysis, we see that the long-run equilibrium number of firms in this market will be 1, with a long-run economic profit of 0.[9]

$$\pi^1_{potential} = R_{potential} - C^1_{total} = 100 - 100 = 0$$

$$\pi^2_{potential} = R_{potential} - C^2_{total} = 100 - 200 = -100$$

$$\pi^3_{potential} = R_{potential} - C^3_{total} = 100 - 300 = -200$$

Thus, without tying, we would expect to see two separate markets, in machinery (with a duopoly making between $[0, 50]$ of profit) and in services (with a single firm making no economic profit).

The Effects of Tying

Imagine that one of the firms (Firm A) in the machinery market also owns the sole firm in the services market.[10] In our initial model, products were sold independently and thus customers of the other firm (Firm B) in the machinery market were able to be customers of Firm A in the services market. In our new scenario, Firm A has decided to tie its services and machinery products together into a single offering and only offers its services to customers of its machines. What will happen to the customers of Firm B? In large part it will depend on whether all customers have the same purchasing desires. If the people interested in purchasing g_1 and g_2 are different, then by tying the goods together, Firm A is effectively increasing the cost without providing additional corresponding utility. However, imagine that all members of society have

[9] Firms will still enter markets so long as economic profit in the market is greater than or equal to 0.
[10] As will become evident from the model below, Firm A might have an incentive (even a strong incentive) to go out and purchase the services company if allowed to do so and the company is not already under its own control or that of a competitor.

similar desires (in that everyone is interested in buying g_1 up to a price of 3.5 and g_2 up to a price of 1). In this case, consumers interested in access to the utility that they would gain from purchasing g_2 will have no choice but to buy both their machinery and services from Firm A. Firm A will be able to continue to charge the same prices in each market that it did previously but consumers will shift their purchasing of g_1 to Firm A in order to also have the opportunity to purchase g_2. In essence, Firm A will have created a new g_3 of combined machine and services with a market clearing quantity of 100 g_3 and a maximum market clearing price of 4.5.[11] In the new g_3 market, individual firms now have the following cost function adding the two cost functions of a firm participating in the markets for g_1 and g_2:

$$C_i = 100 + 1 * Q_i + 100 = 200 + 1 * Q_i$$

Looking at the combined industry cost structure across multiple potential numbers of n firms:

$$C_{total} = \sum C_i = \sum (200 + 1 * Q_i) = \sum 200 + \sum Q_i = n * 200 + 100$$

$$C_{total}^1 = 1 * 200 + 100 = 300$$

$$C_{total}^2 = 2 * 200 + 100 = 500$$

$$C_{total}^3 = 3 * 200 + 100 = 700$$

Using the combined maximum market clearing price of 4.5, we calculate an industry potential revenue of $R_{potential} = 4.5 * Q_{total} = 450$. Unlike in the long-run equilibrium market for machinery, we see that the market equilibrium in the market for the combined good is now only one firm, with that one firm able to capture a monopoly profit of 150 without the risk of entry from another firm.

[11] The combined market clearing price of the machinery and services goods. The firm's ability to convert independent markets into a combined market through tying may also depend in part on demand-side competitive advantage factors like product differentiation and quality.

$$\pi^1_{potential} = R_{potential} - C^1_{total} = 450 - 300 = 150$$

$$\pi^2_{potential} = R_{potential} - C^2_{total} = 450 - 500 = -50$$

$$\pi^3_{potential} = R_{potential} - C^3_{total} = 450 - 700 = -250$$

As a result, consumers have lost any opportunity for price competition that previously existed in the market for g_1 as all surplus is now distributed to Firm A as monopoly profit.

Although this simplified model tells us relatively little about social surplus, a relatively simple modification shows that tying can lead to inefficiencies. Imagine instead of a market-clearing price of 1 per unit of services, customers only valued services at 0.5. Because the fixed cost of offering any services is 100, and the value that consumers receive is only 50, an efficient market would contain no services because offering services would lead to a social loss of -50. The ideal social outcome would simply be consumers living without services because they are not worth the cost. However, with tying, a firm would be willing to offer services if doing so allowed it to create a new bundled product category and change market definition to our combined g_3. Firms and the market would retain the cost functions for g_3 calculated above but would have an altered potential market revenue function of $R_{potential} = 4 * Q_{total} = 400$. As a result, the market profits by industry structure would be as follows:

$$\pi^1_{potential} = R_{potential} - C^1_{total} = 400 - 300 = 100$$

$$\pi^2_{potential} = R_{potential} - C^2_{total} = 400 - 500 = -100$$

$$\pi^3_{potential} = R_{potential} - C^3_{total} = 400 - 700 = -300$$

Because industry profits in the one-firm market tied market would be higher than a firm's potential profits in the untied duopoly market for machinery, where a firm could at most capture a profit of 50 if it was both able to cooperate with its duopolist competitor to maximize industry profits and then negotiate for the entirety of those industry profits with the competitor, the firm

would have an incentive to begin producing inefficient services goods which it could tie to its machine goods, thus reducing overall social welfare.

This simple model shows that by tying products, firms are able under specific circumstances to adjust the required cost structure of a given market to make it more difficult (or even economically impossible) for other firms to compete and may have incentives to produce socially inefficient products in order to capture the benefits of a redefined market where they have additional market power. The next section examines how the relationships between the tied and tying goods may change whether tying arrangements are harmful.

IV. Relationships Between Goods

Having shown that tying arrangements can in some circumstances create consumer and societal harms for independent goods, the question remains of whether the relationship between goods influences the potential harm of tying arrangements. We may be able to think generally about the utility consumers get from consuming two separate products through an equation like $U(x,y) = f(x) + g(y) + h(x,y)$, where $f(x), g(y)$ are the independent utility generated by consumption of each of those goods and $h(x,y)$ is an adjustment to the consumer's utility created by the interaction of consuming both. We know from our model above that tying arrangements can be problematic if $h(x,y) = 0$, and it remains to examine whether this conclusion changes for other forms of $h(x,y)$.[12] This analysis shows that successful tying of complementary products can lead to bigger gains for a hypothetical tied monopolist if the firm can maintain market power and that complementary tying may be easier to sell to consumers, but that successful tying of substitutable products is more likely to give a firm market power in the

[12] In particularly, we look at the gradient $\nabla h(x,y)$ because we care about how this interactive term changes as x and y increase.

tied market. First, however, we consider the special problem of component goods or subproducts, which I describe as "natural tying" as tying for these goods makes no difference in market outcomes.

Component Goods/Subproducts

We can model a component goods market as one where consumers have utility functions of the form $U = \min(ax, by)$.[13] As a result, consumers will always want to consumer the goods in a fixed proportion to each other (e.g., someone buying a car will always want one engine for every four tires on a new car). These types of goods are commonly bundled and sold together today, and bundling can no doubt reduce transaction and choice costs for consumers. Imagine, for example, if every time you bought a complex product like a car, if you not only had to choose the type of car but also select among the hundreds or thousands of component parts. Having the manufacturer decide which sparkplug and key fob to build the car with reduces the cost to consumers of selecting a car, and it also reduces the production costs by allowing manufacturers to produce standardized models at scale.[14] Does this type of bundling (particularly if consumers are not given the alternative of choosing different components) create net economic costs for society?[15] *C.f. Broadcast Music, Inc. v. Columbia Broadcasting System, Inc.*, 441 U.S. 1 (1979) (bundled music licensing is not blocked by antitrust laws due to transaction cost benefits).

[13] See supra ___. In our $h(x, y)$ format we can think of component goods as only having an $h(x, y)$ term with no $f(x)$ or $g(y)$ terms.
[14] *See, e.g.*, apocryphal Henry Ford quote: "Any customer can have a car painted any color that he wants so long as it is black."
[15] Although this paper primarily focuses on social costs rather than corresponding social benefits that might be available from tying (particularly reduced costs from standardization and tying subproducts) due to the difficulties of modeling those benefits, sound antitrust law will take into account both sides of the social leger.

In the case of subproducts, there is effectively no standalone value for each component good, which is to say that consuming more x without the corresponding proportion of additional y will lead to no gain in consumer utility (if I already have one car engine and four wheels, a second engine does not give me any additional value). As a result, producers of both goods in effect can exercise their full market power in their respective market, regardless of market power or behavior in the other market. If the market for car engines is a monopoly, then the engine manufacturer will be able to set a monopoly price and quantity that the distributor will be forced to pass along to the consumer. Indeed, we could rewrite $U(x, y) = \min(ax, by)$ as $U(z) = z$ where z is the bundle of goods $\{\frac{x}{a}, \frac{y}{b}\}$. One could describe this situation as "natural tying," because the structure of consumer desires alone will make subproducts behave as if they are tied, regardless of whether there is an explicit tying arrangement in place. Because this type of market will naturally tend towards behaving as if it were tied (thus giving a firm with power in one market potential leverage over the other), antitrust law will need to attack these types of market abuses by addressing concentrated market power directly (e.g., breaking up a monopoly in the engine market rather than attempting to invalidate bundles of subproducts).[16]

The reduced transaction costs of tying in these cases provide social benefits, and there is no non-tied alternative that would reduce social costs. As a result, the Court's threshold requirement in tying cases that there must be a "coherent economic basis for treating the [tied] products as distinct" is a reasonable way to refuse cases with tying arrangements that create no incremental harm to consumers beyond that which the market would dictate. *Jefferson Parish Hospital*, 466 U.S. at 41 (O'Connor, J. concurring in the judgment). If anything, the common

[16] Although subproducts markets may have a tendency towards tying, this will only occur if a producer is able to gain market power in one of the markets (e.g., with multiple tire manufacturer options and multiple engine manufacturer options bundled together for consumer convenience, the overall market for cars would still behave as if it were not tied).

bundled sales of subproducts, concerns of judicial economy, and the minimal risk of harm from tying in component goods cases would suggest that antitrust law should be even more hesitant to invalidate tying agreements in component goods cases (possibly requiring the challenging party to prove the goods are separate and increasing skepticism of antitrust claims in these cases generally).

Complementary Goods

If complementary but not component goods are tied together, the economic analysis of tying shifts. Let us use the hypothetical example goods of peanut butter and jelly. If I am making sandwiches, I might get some additional value from more peanut butter, even in the absence of more jelly. However, if I have *way* more peanut butter than I have jelly, I may not get that much additional value from the incremental peanut butter and might get a lot of value from more jelly. This could lead to a utility function like $U(x,y) = \sqrt{axy}$.[17] Using our function $h(x,y)$, we would find the gradient of the interactive term $\nabla h(x,y) > 0$ for complementary goods. We sometimes see complementary goods bundled and sold together[18] but often see them sold separately as well. If a firm were to sell complementary goods as part of a tying arrangement conditioning the sale of one good on another, would that create negative effects on consumers or the market?

The answer is mixed. It may be easier for the producer to convert the market from two separate markets for complementary goods into a market for tied goods if consumers want to buy both goods together. However, the increased utility created from consumption of both goods may

[17] Note that we might think there is a more generalized version of this utility function $U(x,y) = ax^n y^m$ where $n, m \leq 1$.
[18] *See, e.g.*, https://www.amazon.com/Smuckers-Goober-Strawberry-Flavors-Kosher/dp/B0BKY3M42S/

make it harder for a producer dealing in both to maintain market power created by high fixed costs in a single market. As discussed above,[19] a market with fully tied products allows producers to leverage their market power to gain profit in other markets. In the case of complementary goods, not only would a tied monopoly producer be able to potentially be able to capture monopoly profit on $f(x)$ and $g(y)$ but would also be able to capture the additional utility of $h(x, y)$. However, the increased surplus in the market could also be large enough to overcome the deterrent against market entrants created by high fixed costs. As a result, analysis of tying in complementary goods cases will be a highly fact-specific analysis.

Returning to our example of machinery and services markets above, a firm could potentially use its greater power in the less lucrative services market to secure benefits from the more lucrative machinery market while forcing out competitors through its advantage of scale or cost efficiencies. Imagine we have an additional $h(g_1, g_2) = \sqrt{g_1 g_2} - 1$ (this provides up to 99 additional utility if both 100 g_1 and g_2 are produced). Who would be able to capture this additional utility: the consumer, producers of g_1, or producers of g_2? If there are two producers in the market for g_1, their ability to capture this new surplus depends on their ability to cooperate against the consumer and producers of g_2 (in the same way that generating any profit in the baseline example requires cooperation). Consumers will be willing to purchase at any prices reflecting their utility function, and thus their ability to capture this profit is limited by firms' market power (as consumers cannot cooperate to set prices). As a result, if there is no tying, there will remain only one firm selling g_2, and that firm will be able to capture the entire $h(g_1, g_2) =$

[19] See supra ___ discussing the ability to transplant market power between goods if producer can create a larger meta-market for competition.

99 additional surplus as monopoly profit because the 99 of additional revenue is insufficient to support a second firm with fixed costs of 100 from entering the market.

However, imagine the services firm now attempts to tie the sale of services to that of machinery. In the independent goods case, this allowed it to leverage its market power in services to drive other firms out of the machinery market and monopolize both markets. Due to the interaction term, the total surplus available across the combined g_3 market has increased to 549. As a result, the combined tied market now can support the fixed and variable costs for two firms producing a combined 100 g_3 with cost function:[20]

$$C_i = 100 + 1 * Q_i + 100 = 200 + 1 * Q_i$$

$$\sum C_i = 2 * 200 + 1 * Q_i = 400 + 1 * 100 = 500$$

As a result, tying does not allow monopoly profit extension over both markets and creates fewer antitrust concerns. We could rerun this analysis with a $h(g_1, g_2) = \sqrt{g_1 g_2} - 51$ to show that complementary goods *could* lead to greater anticompetitive losses from tying instead.

The most important question, then, in considering antitrust enforcement against tying arrangements is whether the combined cost and utility structures of the market allow for the extension of monopoly power, which is a possible but not certain outcome in cases of complementary goods. Applying these learnings to existing antitrust doctrine for tying arrangements, we see that the fact-specific approach that the Court takes to non-subproduct tying cases is well suited for evaluating agreements that may be either pro- or anti-competitive. As in other cases, the Court should do more to consider producer-side impacts of tying arrangements

[20] See supra ____

and whether changes to the market landscape will be able to indirectly meet the Court's current "forcing" standard.

Substitute Goods

Finally, how does tying of substitutable goods affect consumer surplus and market dynamics? Substitutable goods are those where consumption of one makes the consumer less interested in consuming the other. The classic example of a substitutable goods tying arrangement is *United States v. Loew's, Inc.* where a movie distributor used market power created by its licenses for high-quality movies to force theaters to also purchase licenses for low-quality movies. 371 U.S. If the purchase of one type of movie actively makes the consumer less interested in the other because with only a limited number of broadcast hours each day buying one movie will crowd out another, then we might see a more extreme utility function looking something like $U(x,y) = \frac{ax}{y+1} + \frac{by}{x+1}$. In this case, the consumer would prefer to purchase all (or mostly) x or all (or mostly) y rather than have a more even split in consumption. Purchasing both x and y may be actively harmful for both the customer's utility and the producer's potential profit (which is a share of the consumer's utility—their ultimate willingness to pay). Given the potential reduced utility of tying consumption of x and y if the goods are substitutes (the market for combined consumption is smaller than either individual market), the logical question is why producers like Loew's would engage in this behavior and whether our cost structure models could potentially explain their actions.

As in other cases, we can think generally about tying substitutable products by considering how specific types of $h(x,y)$ would change our baseline model of tying for independent products. For substitutable products, $\nabla h(x,y) < 0$ as higher levels of consumption

of one good make increases in consumption of the other good less appealing. In much the same way that $h(x, y)$ may make the tied or independent markets for x and y preferable from an antitrust perspective for complementary goods, tying arrangements for substitutable goods may be either pro- or anticompetitive depending on the industry's cost structure. However, tying arrangements for substitutable products are generally more concerning because the depression of overall utility that comes from consumption of both goods together may help to increase the relative size of the combined fixed costs needed to compete in the market. As the market shrinks, fixed costs become much more important as a share of overall costs, thus changing the breakeven analysis and forcing other firms out of the market because the market can only support a smaller number of firms.[21] This may be true even if there is not monopoly power in the market for either tied good. However, substitutable goods may often be less conducive to tying because the consumers of the goods may be entirely distinct (as in the case of Nancy Drew Troubleshooter and Treasure of the Sierra Madre). As a result, the willingness to purchase both goods together and pay a price that allows the firm to make a profit may be limited to some specific types of goods. Therefore, tying substitutable products will be most effective if consumers gain utility from both goods.

In a competitive market where consumption of one good crowds out the other, we would expect to see consumers to prefer to consume mostly one type of good, and consume a small amount of the second good only to the extent that the costs of producing the more popular good are very high (for example increasing marginal costs or very high total costs). These markets would structurally seem especially vulnerable to tying because the reduced total utility increases

[21] Note that complementary goods *tend* to have the opposite effect, but in both cases, this is uncertain due to the requirement that industries have an integer number of firms. If the industry's cost structure is right near a tipping point between two different numbers of firms, then tying may produce counterintuitive effects.

the relevance of fixed costs as compared to total revenue. However, there are countervailing considerations created by a potential unwillingness of customers to buy both goods together and potential for fully independent groups of consumers buying each good. In this type of case where consumers make non-uniform purchases, tying may not be as effective, as firms may be able to make more money by selling each good separately. Although tying arrangement case law on substitute goods seems to be less common, the ruling in *Loew's* invalidating the distributor's bundling of substitute good movies is consistent with the economic conclusions of this paper. In general, substitutable goods tying is perhaps best covered by current tying doctrine because any tied substitute goods will include "forcing" as consumers will not want to consume the goods together. However, improved doctrine might be more skeptical even without a showing of market power in the separate markets if tying allows the company to gain power in the combined market.

V. Conclusion

This paper shows the importance of market cost structures for understanding market power and the potential relevance of the relationship between tied goods for developing sound policies about the legality of tying arrangements. Tying can create economic losses for society by allowing firms to expand market power over multiple markets, but it only does so if certain market conditions exist. In particular, tying arrangements are harmful if they force consumers to buy products that they would not buy in a competitive market (as in the case of *Loew's* tying of substitute goods) or if they force out firms that would be able to compete in an untied market (as in the case of our hypothetical machinery and services conglomerate). These costs can be offset by benefits (such as reduced transaction costs from bundled sales). This learning largely supports

the current doctrine which holds tying arrangements as not *per se* illegal but treats them with skepticism and requires a fact-specific analysis of whether the tied markets allow market power to be transplanted across markets. However, the current Court doctrine requiring only "market power" and "forcing" is incomplete, as "forcing" suggests that courts focus on the first-order effects that tying has on consumer choice and behavior. *See Jefferson Parish Hospital*, 466 U.S. at 13–14. A more complete and economically consistent doctrine would look both at direct effects to force consumers to make undesirable decisions and indirect effects created by forcing out competitors that would otherwise be competing in the market, which is possible in all different types of markets and goods relationships. Additionally, more robust doctrine might shift burdens of proof and levels of scrutiny based on the relationship between tied products, with courts being especially skeptical of arrangements for tied bundles of substitutable goods, because cost structures might create benefits from tying in these types of cases without independent monopoly power. Future papers could attempt to expand and generalize this model to understand the precise conditions under which firm cost structures create negative side effects for tying and attempt to formulate more specific rules for courts to use to enforce tying principles.[22]

[22] The Lagrangian math required to do so is too complex for a paper of this length and requires a mathematical competency that the author no longer possesses.