

Vertical Most-Favored-Nation Restraints and Credit Card No-Surcharge Rules

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Abstract

A vertical most-favored-nation (vMFN) restraint prohibits a retailer from charging more for one supplier's product than for rivals' products. For credit card services, this restraint takes the form of a no-surcharge rule: the credit card company prohibits the retailer from surcharging transactions using the company's card. This article develops a theory of vMFN restraints and applies it to credit cards. The vMFN clause harms competition among upstream suppliers, which raises price to a level even greater than the monopoly price. The vMFN clause can also be used to extract surplus from customers of products supplied competitively. Applying the theory to credit card antitrust cases, we find that the two-sided nature of the market does not mandate a new set of competition policy principles, contrary to the decision in *Ohio v. American Express*. Indeed, the economic literature on credit card networks as two-sided platforms rediscovers established principles of price theory.

1. Introduction

This article presents a theory of vertical most-favored-nation (vMFN) restraint and then applies the theory to the credit card industry. A vMFN restraint is a contractual clause that prevents a multiproduct retailer from charging more for one supplier's product than for the products of rival suppliers.¹ In the market for

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¹ The vertical most-favored-nation (vMFN) clause differs from a conventional MFN clause in that it is a contract between the supplier and a retailer that places a restriction on the parameters of a contract between the retailer and a third party, the consumer. A conventional MFN clause places

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credit card services, this restraint takes the form of a no-surcharge rule: retailers cannot charge more for purchases made with one credit card than for purchases made with other credit cards, cash, or debit cards. An even stronger restraint is American Express's (AmEx's) nondiscrimination provision, or no-steering restraint. The nondiscrimination provision prohibits the merchant from using any means of encouraging consumers to adopt another card or transaction method, including even the truthful revelation of the merchant's costs.

While vMFN restraints have been used in a number of markets, such as the markets for airline travel, the most important has been the market for credit card services. Credit cards were used for \$10.8 trillion in transactions in 2015 (HSN Consultants 2016, p. 9), more than 10 percent of the world's gross domestic product. The need for a clearer understanding of the competitive impact of the no-surcharge restraint is reflected in the enormous range of public policies on the restraint. In the European Union, surcharges are allowed but have been limited since March 2015 (European Commission 2015). Canadian competition authorities challenged no-surcharge rules, unsuccessfully, in 2010 (*Comm'r of Competition v. Visa Canada Corp. & MasterCard Int'l Inc.*, 2013 Comp. Trib. 10).² The US Department of Justice reached an agreement with Visa and MasterCard in 2010 that prohibited credit card restraints against some means of steering a customer from one credit card or method of transaction to another. But the agreement allowed no-surcharge rules: it prevented Visa and MasterCard from imposing restraints on steering customers toward another transaction method except for the most direct method of steering: using the price system.³ Subsequently, the Department of Justice prevailed in the district court in a case involving extension of the conditions of the agreement with Visa and MasterCard to AmEx as well. This decision was reversed on appeal to the Second Circuit Court, and this reversal was affirmed in a recent Supreme Court decision (*Ohio v. American Express*, 585 U.S. ___ [2018], affirming the appellate court decision; *United States v. American Express Co.*, 838 F.3d 179 [2nd Cir. 2016], overturning the district court decision; *United States v. American Express Co.*, 88 F. Supp. 3d 143 [E.D.N.Y. 2015]; for brevity, we refer to the three cases as *AmEx*). At the state level in the United States, many states not only allow no-surcharge rules but insist on them, enforcing no-surcharge rules as a matter of law. In short, the range in policies on this vertical restraint stretches from laws that prohibit no-surcharge restraints to laws

restrictions on the terms of future transactions between the contracting parties. (For example, a buyer may be guaranteed the supplier's best price.) A vMFN clause is sometimes known as a price parity restraint.

² The authors appeared as experts for the Commissioner of Competition in this case.

³ "Visa/MasterCard may contract with merchants not to surcharge: Nothing in the settlement proposal prohibits Visa/MasterCard from contracting with merchants not to surcharge if: the agreement is for a fixed duration; the agreement is not subject to an evergreen clause; the agreement is individually negotiated with the merchant or a group of merchants organized pursuant to the proposed settlement and other applicable law; and the agreement is supported by independent consideration" (Exhibit A in *U.S. and Plaintiff States v. American Express Co.*, Civil Action No. CV-10-4496 [E.D.N.Y. filed October 4, 2010] [<https://www.justice.gov/atr/case-document/file/485851/download>]).

that impose no-surcharge rules. It is hard to imagine a more incoherent set of policies on an antitrust issue.

We develop the general theory of the vMFN restraint in a setting in which competing upstream suppliers of differentiated products sell through a set of common retailers.⁴ This framework fits the conditions of sale for many products and in particular is a reasonable description of the competition among Visa, MasterCard, and AmEx, the largest credit card service suppliers in North America and Europe. We initially impose a must-carry restriction on retailers, in assuming that a retailer finds it profitable to carry all of the products in the market. This allows us to focus on the impact of the restraint on the main source of competition in such markets: consumers' ability to substitute away from a product at the point of sale as its retail price is increased. The adoption by the upstream firms of the vMFN clause not only eliminates competition but results in a price even higher than the monopoly level. The agreement changes products from substitutes into complements, and as Cournot (1838) points out, in the case of complementary products, noncooperative pricing yields prices that are even higher than the joint profit-maximizing level. Prices may be so high under the agreement that the firms, not just consumers, are worse off as a result of voluntary adoption of the vMFN clause.

We examine the application of vMFN restraints not just where there is a limited number of upstream suppliers of a differentiated product (for example, credit card services) but also where there is an alternative product available to merchants at a competitive price. In the context of credit cards, this alternative product is cash. The vMFN restraint can enable the limited number of firms providing the differentiated products to leverage their market power to extract surplus from customers of the competitive product. In the application of our theory to credit card markets, the result is that credit card companies can extract surplus from cash customers.⁵ Surprisingly, the use of the restraint to extract surplus from cash customers can also harm credit card customers.⁶

A credit card network is a canonical two-sided market in that both cardholders and merchants must be attracted to the network for it to succeed.⁷ This perspective on credit cards has been enormously influential in the economic literature and has been viewed—both in the literature and in the appellate court and Supreme Court decisions in *AmEx*—as essential to understanding the impact of vertical restraints. We show that this reasoning is false. Despite its two-sided property, one

⁴ A vMFN agreement is a contract that references rivals. See Morton (2013).

⁵ Under some no-surcharge restraints and in some jurisdictions, merchants are allowed to offer a subsidy to cash customers but not a surcharge to credit card customers. We explain why the subsidy on cash is not a perfect substitute for a surcharge on credit cards.

⁶ In reality, a credit card company faces competition from other credit card companies and cash simultaneously. We analyze these types of competition in separate models so as to highlight the effects of each.

⁷ A more precise definition is from Rochet and Tirole (2006, p. 664): “[A] market is two-sided if the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side by an equal amount; in other words, the price structure matters, and platforms must design it so as to bring both sides on board.”

can analyze a credit card market using the vertical structure of a one-sided market. Retailers pay wholesale prices for credit card services, which they can pass on to consumers in the form of surcharges where allowed; the credit card company and card issuers determine the quality of the service through rewards and other benefits. Labeling cardholders' benefits as a (negative) price does not change the underlying economics. The economics of balancing prices on the two sides of the credit card market is equivalent to the standard economics of balancing price and promotion. Formally, we show that the expression for the optimal interchange fee in the economic theory of credit card networks is mathematically equivalent to the Dorfman-Steiner theorem (Dorfman and Steiner 1954) that solves for the optimal mix of price and promotion in any market. When a vertical restraint suppresses competition among credit card companies in the fees charged to merchants, one can label the consequent increase in cardholders' benefits as a shift in the relative price on the two sides of the market—but this is simply the insight of Stigler (1968) that the elimination of price competition in a market will provoke more intense competition in nonprice dimensions.

Our perspective makes clear how one should proceed in an antitrust case involving credit cards. In a conventional antitrust case involving a vertical restraint (for example, resale price maintenance), the antitrust rule is the following: the plaintiff must show that the conduct at issue restricts competition in some way (for example, raises prices); then the defendant must show evidence of an offsetting procompetitive feature of the vertical restraint (for example, that it encourages promotion); then the burden shifts back to the plaintiff to show that the procompetitive benefits could have been achieved with a less restrictive contract.⁸ The two-sided nature of the credit card market should not alter the antitrust treatment of the no-surcharge restraint in credit card networks. If demonstrating that a vertical restraint restricts price competition is enough to meet the government's burden in the first stage of a conventional vertical restraint case, then it logically follows that in a credit card case involving no-surcharge restraints, the complete elimination of price competition among upstream suppliers should also meet the burden.

Antitrust analysis in a two-sided market such as credit cards is not just an academic issue. In *AmEx*, the Supreme Court rejected the district court's decision that AmEx's no-steering restraints harmed competition. The district court had based its decision on the fact that after the plaintiff (the US government) had shown an anticompetitive effect at the merchant level, AmEx had failed to meet its burden to provide a procompetitive justification (taking into account the cardholders' side of the market) that the court could then balance against the competitive harm. The appellate court ruled that the district court had erred in requiring the government to show (in the first step of the legal test) only that retailers were harmed by the no-steering rule without also considering how cardholders' rewards were affected. A proper antitrust analysis, according to the appellate

⁸ We present the legal test more precisely below.

court, must “consider the two-sided net price accounting for the effects of the [restraints] on both merchants and cardholders” (*American Express Co.*, 2016 WL 5349734, 54 [2d Cir. September 26, 2016]). The Supreme Court agreed with the appellate court. Given the Supreme Court’s ruling, there is now a different antitrust standard for examining vertical restraints in one-sided versus two-sided markets. We explain that no economic justification exists for this difference in antitrust rules, consistent with the dissenting opinion of Justice Stephen Breyer.

Ours is the simplest possible theory that captures the anticompetitive impact of no-surcharge rules. The papers in the sizable literature on credit card economics closest to ours, in that they consider no-surcharge rules, are Rochet and Tirole (2002), Wright (2004), and Schwartz and Vincent (2006). These papers incorporate, variously, market power on the part of issuers and market power in the form of a differentiated duopoly or monopoly at the retail level in addition to the market power on the part of the (single) credit card company. The papers also deal with consumers’ decisions to adopt cards, merchants’ decisions to honor cards, merchants’ decisions to surcharge, and the decision to impose no-surcharge rules.⁹ Our vMFN-clause model is more focused, incorporating for the most part market power only for providers of credit card services. Boik and Corts (2016) investigate the effects of price parity rules imposed by duopolist platforms on which buyers and sellers can transact. Credit cards could be interpreted as platforms for transactions in the Boik-Corts duopoly model, whereas in our model credit cards are a service offered through the competitive retailers. However, Boik and Corts incorporate market power not only for upstream suppliers but for a monopoly retailer as well, thereby commingling the effects of market power of retailers with the market power of firms imposing the vertical restraint. Moreover, our theory incorporates a competitive fringe (cash) that is essential for application to credit cards; Boik and Corts do not claim applicability of their model to the no-surcharge rule in credit card markets.¹⁰ Edelman and Wright (2015) also consider the impact of a restriction that retailers’ prices be the same for all upstream goods but in a more complex model with a specific monopolistically competitive structure for the retail sector that once again incorporates the assumption that retailers have price-setting power. Our simpler model allows a clear characterization of the effects of the vertical restraint at issue. It also allows us to establish logical parallels between the two-sided approach to credit card markets and price theory in a conventional one-sided market with promotion.

This article is organized as follows. In Section 2 we develop the theory of a vMFN restraint imposed by competing upstream suppliers selling differentiated products through common retailers. We then extend the theory to incorporate the possibility that one product is supplied by a competitive fringe, to capture the idea of credit card companies using a no-surcharge rule to leverage their mar-

⁹ Schwartz and Vincent (2006) have an exogenous partition of customers into cash and credit card customers.

¹⁰ Liu, Sibley, and Zhao (2017) extend the Boik-Corts model of linear demand and a monopoly retailer to the case of asymmetric upstream manufacturers.

ket power over consumers using cash. In Section 3, we apply the theory to credit card markets, first showing that the two-sided theory of credit card markets is to a large extent a reformulation, or relabeling, of established price theory. Section 4 applies our perspective to competition policy, with a focus on the recent *AmEx* cases. Section 5 summarizes our insights.

2. The Economics of Vertical Most-Favored-Nation Restraints

In this section we first examine how a market with a vMFN restraint operates when there are several firms producing differentiated products. For simplicity, we focus on a duopoly, but all of our results apply when there are more than two firms. We then add a competitive product to the model. We extend the model further by examining the effect of allowing nonprice competition, for example, promotion. Finally, we discuss the implications of the general model for antitrust policy toward vMFN restraints. The appendices contain more detailed discussion and proofs.

2.1. Competition When Firms Produce Differentiated Products

We start with a model in which upstream firms producing differentiated products compete with vMFN restraints. We show that the vMFN clauses raise the prices to consumers even beyond the prices that a monopolist of all the differentiated products would charge.¹¹ In the context of credit cards, the reader should think of the competition among AmEx, Visa, and MasterCard as being suppressed, which results in higher fees to merchants for credit card services as a consequence of the no-surcharge rule. We adopt a duopoly model for simplicity, but our results extend directly to any oligopoly.

2.1.1. Assumptions

Two upstream suppliers each provide a differentiated product to consumers through a common set of retailers. The suppliers produce at unit cost c and charge wholesale prices (w_1, w_2) to retailers, where the index refers to supplier 1 or 2. Retailers face no costs other than the wholesale price. The retail market is competitive, which implies that retailers earn no profits. Demand functions for the two products are $q_1(p_1, p_2)$ and $q_2(p_1, p_2)$, where p_i is the price of product i . These demand curves are assumed to satisfy standard conditions for uniqueness of equilibrium in Bertrand competition and for concavity of profit functions. These standard conditions include the inequality $\partial q_1 / \partial p_2 < -\partial q_1 / \partial p_1$. For simplicity, the demand functions are also assumed to be symmetric.

We consider the following game. The two upstream suppliers decide simultaneously whether to adopt a vMFN restraint. Then these suppliers set wholesale prices. The retailers then simultaneously set a pair of retail prices for the two

¹¹ Even firms may be worse off as a result of the voluntary adoption by each firm of the vMFN restraint, in a type of prisoner's dilemma.

products subject to any vertical restraint on prices. We initially set aside the option of retailers to drop a product, adopting instead a must-carry assumption. Finally, the retail market clears at the prices set by retailers.

To motivate the must-carry assumption, we note that in our application to credit cards, when surcharges are available a credit card company faces five main sources of competitive discipline against increasing fees to merchants. First, consumers at the point of sale can switch to another credit card, or to cash or a debit card, when a higher merchant fee is passed through to consumers in the form of a higher surcharge for using a particular card. Most consumers who use credit cards carry more than one. Second, merchants are free to refuse to accept a credit card. Alternatively, if merchants do not want to forgo the business of those who insist on using a particular card, they can encourage the use of a different card or cash. Third, consumers can choose to shop at a different store. Fourth, consumers can forgo or reduce the purchase of a final product if its price, including surcharges, rises. Fifth, consumers can decide not to carry the company's credit card.

Of these sources of competition, the first is surely the strongest in practice: when a higher merchant fee is passed on to consumers via a higher surcharge, a consumer can simply switch credit cards at the point of sale to purchase the identical good at a lower price. In developing the general model of vMFN clauses, we therefore focus on the first source of competition, that arising from the ability of consumers to switch products. We initially suppress the second source of demand elasticity entirely by assuming that retailers must carry the products being considered. We relax the must-carry assumption later in this section but note here that in the context of credit cards, the vast majority of retailers (by volume) accept all major credit cards in the United States.

2.1.2. Equilibrium

Under the assumptions described, consider first the retail market equilibrium in prices conditional on the choices of including vMFN clauses (or not) by the upstream suppliers and wholesale prices (w_1, w_2) . If neither supplier imposes a vMFN clause, then competitive retailers simply pass on wholesale prices as retail prices, $(p_1, p_2) = (w_1, w_2)$. If the vMFN restraint is imposed by both suppliers, then—given the symmetry in demand—the retail prices equal $(w_1 + w_2)/2$, since this is the uniform price that yields no profits. Suppose that only one supplier sets a vMFN restraint. Then, given the pair of wholesale prices (w_1, w_2) , if the supplier imposing the vMFN constraint is the one with the lower wholesale price, the constraint is not binding and is therefore irrelevant. The retailers set $(p_1, p_2) = (w_1, w_2)$. On the other hand, if the supplier imposing the vMFN restraint is the firm with the higher price, then the common retailer price for both goods is $p = (w_1 + w_2)/2$. In short, if the supplier with the higher price has not imposed a vMFN clause, the retail prices are $(p_1, p_2) = (w_1, w_2)$; if the supplier with the higher price has imposed a vMFN clause, the retail price is $p = (w_1 + w_2)/2$.

We move next to the wholesale pricing game, conditional on the suppliers'

choices on vMFN clauses. Let the wholesale pricing subgames be indexed by (0, 0), (1, 1), (1, 0), (0, 1), depending on whether neither, both, or one of the suppliers has adopted the vMFN restraint. We start by comparing the (0, 0) pricing subgame with the (1, 1) subgame, then move on to solving the entire game.

The (0, 0) Pricing Subgame. The (0, 0) pricing subgame is simply the Bertrand game. The Bertrand wholesale price (and retail price) common to both products is the price w that solves the following equation:

$$w = \arg \max_{w_1} (w_1 - c)q_1(w_1, w).$$

The first-order condition characterizing the Bertrand wholesale price is standard:¹²

$$(w - c) \frac{\partial q_1}{\partial p_1}(w, w) + q_1(w, w) = 0. \quad (1)$$

The (1, 1) Pricing Subgame. In the (1, 1) subgame, following the adoption of the restraint by both firms, the profit function of supplier 1 (incorporating downstream retailers' equilibrium responses) is given by

$$\pi_1^{11}(w_1, w_2) = (w_1 - c)q_1\left[\frac{(w_1, w_2)}{2}, \frac{(w_1, w_2)}{2}\right],$$

and the function is similar for supplier 2. The equilibrium wholesale price, which is then the common retail price, solves the following equation:

$$w = \arg \max_{w_1} (w_1 - c)q\left[\frac{(w_1 + w)}{2}, \frac{(w_1 + w)}{2}\right].$$

This yields the following first-order condition (evaluated at a common wholesale price w):

$$(w - c) \left[\frac{1}{2} \frac{\partial q_1}{\partial p_1}(w, w) + \frac{1}{2} \frac{\partial q_1}{\partial p_2}(w, w) \right] + q_1(w, w) = 0. \quad (2)$$

Comparing the Equilibria in the (0, 0) and (1, 1) Pricing Subgames. By comparing the equilibria in the (0, 0) and (1, 1) subgames, we establish that the adoption of the vMFN restraint raises prices. This increase results in a price beyond the price that a multiproduct monopolist would charge.

To understand the incentive to raise prices under vMFN clauses, however, we start by examining the marginal gain to either firm from increasing its price above the (0, 0) equilibrium level once vMFN clauses are established.¹³ This mar-

¹² In the following, $\partial q_1 / \partial p_1(w, w)$ represents the derivative of q_1 with respect to its first argument, evaluated at (w, w) .

¹³ This measure is the upward pricing pressure induced by the restraint, to use the term in Farrell and Shapiro (2010). Farrell and Shapiro normalize the merged firm's profit derivative by dividing by $\partial q_1 / \partial w_1$; we omit this normalization.

ginal gain, $\partial\pi_1^{11}/\partial w_1$, is given by subtracting the left-hand side of equation (1) from that of equation (2):

$$\left. \frac{\partial\pi_1^{11}}{\partial w_1} \right|_{(w^0, w^0)} = (w^0 - c) \left(-\frac{1}{2} \frac{\partial q_1}{\partial p_1} \right) + (w^0 - c) \left(\frac{1}{2} \frac{\partial q_1}{\partial p_2} \right) > 0. \quad (3)$$

Both of the effects in equation (3) are positive. The cost-externalization effect captured by the first term on the right-hand side is the benefit from raising the wholesale price that accrues to a supplier from the fact that retailers pass on only half of any upstream price increase to retail consumers of the upstream firm's product. If a firm raises its wholesale price by \$1, its consumers bear a price increase of only \$.50, as half of the cost is externalized to consumers of the rival product. The diversion effect in the second term on the right-hand side is the benefit that the supplier gains from the fact that raising its wholesale price automatically raises the retail price of its rival, which causes a diversion of demand toward its own product. Both of these effects operate to raise a firm's marginal gain from raising its wholesale price. Hence, both wholesale prices increase as a result of the vertical restraint. The effects combine to make the adoption of the vMFN clause even more anticompetitive than perfect collusion.

Proposition 1. The equilibrium price in the (1, 1) pricing subgame (i) exceeds the equilibrium price in the (0, 0) pricing subgame and (ii) exceeds the perfectly collusive price.

Proposition 1.i has been proved; for the proof of proposition 1.ii, see Appendix A. This involves the evaluation of $\partial\pi_1^{11}/\partial w_1$ at the perfectly collusive price. At the collusive outcome, the diversion effect is internalized, but the cost-externalization effect leads to an incentive for a further price increase. Note that the cost-externalization effect is unrelated to substitutability of the products.

The move to a price higher than the perfectly collusive price under the vMFN clause can be understood in terms of a switch from substitute products to complements. Under the vMFN restraint, products 1 and 2 become complements in terms of the wholesale prices (w_1, w_2) rather than substitutes: an increase in the price w_1 leads to a drop in q_2 since the retail price of firm 2 increases.¹⁴ Non-cooperative prices set by producers of complementary products always exceed the collusive price, just as noncooperative prices set by producers of substitutes are less than the collusive price. The vMFN restraint, in other words, introduces into the market Cournot's problem of complements (Cournot 1838). It follows immediately from proposition 1 that the adoption of the vMFN restraint by both firms makes consumers worse off by raising the retail price. Proposition 2 illustrates why vMFN restraints matter even though retailers might say that they have no effect on their pricing decisions.

¹⁴ The equal increase in the retail price of firm 1 raises demand for the product of firm 2, but not enough to offset the own-price effect.

Proposition 2. Under the assumption of symmetry, the vMFN restraint is not binding on any retailer in equilibrium.

The proof of proposition 2 follows directly from the observation that the vMFN restraint is not binding on equilibrium retailers' pricing decisions because the wholesale prices are equal in equilibrium and demand is symmetric. An individual retailer would not, in equilibrium, choose to set retail prices differently for the two products.

In assessing the importance of a vertical restraint, it is tempting to inquire as to the extent to which the restraint constrains retailers' actions.¹⁵ A restraint that has little impact on retailers' decisions might seem to have little impact in the market. This reasoning is wrong. Proposition 2 shows that each retailer would not perceive any impact of the restraint on its pricing decision. The impact of the vMFN clause is entirely through the constraint on retailers' pricing out of equilibrium: the impact that the restraint would have if wholesale prices were unequal. An implication of this observation is that one should not rely on retailers' testimony that the vMFN restraint is not important in deciding whether the restraint is anti-competitive.

For policy analysis of the vMFN restraint in a duopoly market in which both firms are observed to have adopted vMFN clauses, comparison of the (1, 1) and the (0, 0) subgames is enough to conclude that the vMFN clause harms consumers. The move from the (1, 1) equilibrium to the (0, 0) equilibrium could be induced by a prohibition of vMFN clauses. Any other subgame and the full game including the decisions to adopt vMFN clauses or not are, strictly speaking, irrelevant.

Of course, from the perspective of positive economics, we want to understand whether the theory predicts that the restraints will be adopted, as they generally are in reality when they are allowed. In the Online Appendix, we complete the solution to the vMFN-clause game. We find that, with a linear demand system, adoption of the vMFN restraint is a dominant strategy on the part of each firm. Whether or not the rival adopts the restraint, it is in the interest of an individual firm to adopt it. When the products are not close substitutes, adopting the restraint makes the firms worse off, and we have a prisoner's dilemma. The empirically relevant case in terms of markets in which the restraint has been observed, however, is the case of close substitutes.¹⁶

To summarize the main point of this section, the vMFN clause raises prices not just to the perfectly collusive level but beyond it. The restraints involve not

¹⁵ For example, one might speculate that in the agreement with Visa and MasterCard mentioned in Section 1, the US Department of Justice might have allowed no-surcharge rules on the basis that retailers did not report the rules as being costly.

¹⁶ The diversion effect, naturally, depends on the cross elasticity of demand. But the cost-externalization effect does not. Even two firms selling completely independent products through the same set of retailers are induced to raise price by the vMFN clause. Since these firms would set price to maximize collective profit in the absence of any vMFN agreements, this means that the situation of firms signing the vMFN contract is potentially harmful not just to consumers but to the firms themselves.

simply a diversion effect but a cost-externalization effect. The competing products are changed to complements under the restraints. Noncooperative pricing of complementary products always raises price above perfectly collusive levels. The harm to competition from vMFN clauses is even worse when one recognizes that a vMFN clause reduces the incentive of a new firm to enter with low wholesale prices. Because the vMFN clause prevents those low wholesale prices from being reflected in low retail prices, the ability to enter with low prices is curtailed or eliminated.

This model applies directly to competition among credit cards for merchants. The wholesale price in this model is the fee that a credit card company charges merchants for honoring its card. Our model of price competition among firms, however, misses two important features of credit card markets. The first feature is the competition that credit card companies face not from other credit card companies but from consumers' ability to use cash (or debit). We extend our model in Section 2.2 to include a competitively supplied (and differentiated) good that competes with the products offered by firms with market power. In the application to credit card markets, the competitive product will represent the option to use cash.

The second feature of credit card markets that is not captured in the model in this section is the benefits to cardholders. (To anticipate the two-sided platform language of credit cards, we have so far developed prices on only one side of the market, ignoring the other side.) Integrating nonprice competition into our discussion in Section 2.3 will link this theory to the economic structure of credit card markets.

2.2. Adding a Competitively Supplied Good

We extend our model in this section to allow for the presence of a competitive fringe producing a substitute for the differentiated products. This is the theory that we need for the application in Section 3 to credit card no-surcharge rules when some customers use cash. Because the key point is to illustrate the harm from a vMFN clause to customers of the competitive good, it is sufficient for us to focus on the case of a monopoly with a competitive fringe, though it should be clear that the same type of results apply if the monopolist is replaced by oligopolists.

We develop the theory in this section for the general case of a vMFN clause adopted by a monopolist and competitive fringe supplying a substitute product through a common set of retailers. We show that when we maintain the must-carry assumption, the vMFN clause allows the monopolist to leverage its market power to exploit the customers of the competitive good. We then relax the must-carry assumption to understand the disciplining impact on the monopolist's strategy choices of retailers' option to drop the monopoly product. To sensibly address this issue, we find that we must also relax the assumption that retailers are competitive. For ease of exposition, we describe the model and its insights here; formal development and proofs are in Appendix B.

2.2.1. Maintaining the Must-Carry Assumption

Consider a monopolist, producing good 1, facing a competitive fringe producing good 2. Both products are produced at the same constant cost, which we normalize to 0. Both firms supply consumers through a common set of competitive retailers, which face no costs apart from wholesale prices. The demands for the two products, 1 and 2, are $q_1(p_1, p_2)$ and $q_2(p_1, p_2)$. The monopolist contemplates offering a vMFN clause. The monopolist's objective is to maximize the profit that it obtains from good 1. A more useful way of framing the monopolist's objective, however, is to recognize that it maximizes industry profits: the fringe firms and the retailers (the only other firms in the industry) earn no profits as competitive suppliers, so all industry profits must accrue to the monopolist. The industry profits can be expressed as a function of retail prices: $\pi(p_1, p_2) = p_1 q_1(p_1, p_2) + p_2 q_2(p_1, p_2)$. The monopolist's strategy can thus be expressed as the choice between the following two constraints: with a vMFN clause, the objective is to maximize $\pi(p_1, p_2)$ subject to the constraint $p_1 = p_2$; without a vMFN clause, the objective is to maximize $\pi(p_1, p_2)$ subject to the constraint $p_2 = 0$.

Our first result (proposition B1 in Appendix B) is that under the assumptions listed, the vMFN restraint is always profitable. This result is clear. Whatever the optimal price p_1^* without the vMFN constraint, the monopolist has the option under the vMFN constraint of setting both prices equal to p_1^* . This increases the flow of profits from both goods.

If the elasticities of demand for the monopoly good and the competitively supplied good are identical at each price, then the vMFN constraint, $p_1 = p_2$, is not binding. The monopolist in this case is able to completely leverage its monopoly from its own good to the entire industry. If the elasticities of demand differ (for example, the demand for the competitive good is more elastic), then the optimal price under the vMFN restraint is a compromise between the multiproduct monopolist's optimal price for each good. The vMFN restraint still allows the monopolist to leverage its monopoly power in this case but not so fully as to achieve maximum industry profits.

What is the impact of the vMFN restraint on consumers? Consumers of the competitive good are clearly worse off as a result of the restraint, since they face a higher price. One might speculate that the consumers of the monopoly good must face a lower price under the restraint because the vMFN clause involves a transfer from customers of the competitive good to customers of the monopoly good, as the retail cost of the monopoly good is shared across all consumers. This turns out to be false. The monopolist's consumers may face higher prices under the vMFN constraint because the competitive discipline of low competitive prices is dampened as the price of the competitive good rises (proposition B2).¹⁷

¹⁷ Moreover, as we discuss below, the vMFN clause dampens the incentive for a firm to enter with low wholesale prices, which further harms the monopolist's customers.

2.2.2. Relaxing the Must-Carry Assumption

In many markets, it is not a good description of reality to assume that retailers must carry all products. A retailer has the option of dropping the product of a firm that imposes a vMFN restraint and may not suffer significantly if it drops the product. To what extent does this option constrain the ability of the monopolist to leverage its market power over the customers of the competitive fringe?

Our first observation is that if we retain the assumption of competitive retailers, then the option to drop the monopolist's product completely eliminates the leveraging power of the restraint. The vMFN restraint is no longer profitable, because if the monopolist attempted to use the restraint with the effect of increasing the price (above 0 in our model), retailers specializing in the competitive product would emerge, and no retailers would benefit from retaining both products. To explain why we even observe vMFN clauses when retailers have the option to drop the product, we therefore need to relax our assumption of competitive retailers.

Accordingly, we adopt the following model. We assume that a monopolist upstream faces a competitive fringe supplying a substitute product at a price of 0 and that the retail sector downstream is a symmetric duopoly. The monopolist and the fringe firms supply final consumers through the duopoly retailers. The monopolist offers each retailer a contract to carry its product, a contract that includes a wholesale price and possibly a vMFN restraint. We also allow the contract to contain fixed-fee transfers between the contracting parties, again to keep the framework as simple as possible. The contract must be attractive enough for each retailer to accept it. That is, the monopolist offers each retailer a contract that meets the retailer's participation constraint, which reflects the profit that the retailer could make by rejecting the contract.

The first question to address is whether a monopolist facing a competitive fringe always gains from offering retailers a contract with a vMFN clause, as was the case with the must-carry assumption. As shown in Appendix B, the monopolist in fact does not always find the restraint profitable—even in the case in which the monopolized good and the competitively supplied good have the same elasticity at each price (propositions A3 and A4 in Appendix A). One would expect the restraint to be profitable in this case because with symmetric demand it is feasible for the monopolist to offer a contract with a vMFN clause that maximizes total industry profits (the industry includes the retailers and the suppliers). The contract need only contain the vMFN restraint and the wholesale price that elicits (as the retailers' response) the retail price p^* that maximizes total industry profits. Maximizing total industry profits and then sharing with the retailers the gain in profits with an appropriate fixed fee would seem to be superior to the monopolist not using the vMFN clause.

To see that this intuition is false and that the vMFN clause is not always profitable, consider the following. The manufacturer must design the vMFN contract to be acceptable to both retailers in the sense that {accept, accept} is a Nash equi-

librium in the retailers' acceptance decisions given the contract. The fixed fee, in other words, must be low enough to deter either retailer from deviating unilaterally from {accept, accept}. Suppose that the monopolist starts with a low value of w and then raises w to elicit a higher retail price p and therefore higher industry profits. In raising w , the monopolist is increasing each retailer's profit from deviating unilaterally by rejecting the contract: if a retailer refuses the contract, it will be facing a rival retailer that has a higher variable wholesale price and that (following the vMFN contract) charges the same price for both goods. This is a more profitable position for the deviating retailer. The manufacturer, as it raises w to either retailer to elicit higher industry profits, must therefore compensate the other retailer by lowering the fixed fee to meet the retailer's participation constraint. Each retailer's option to deviate when the must-carry assumption is relaxed means that the monopolist must offer an increased share of rents to retailers as it designs the contract to elicit greater industry profits. In Appendix B, we show that this discipline imposed by the retailer's option to reject the contract can be strong enough that the restraint is not profitable.¹⁸

The second question the model answers is the impact of the restraint on customers of the competitive good (for example, cash customers in the case of credit cards). Just as in Section 2.1, where we adopted the must-carry assumption for retailers, customers of the competitive good are always worse off as a result of the vMFN clause. Customers of the competitive good must share the higher wholesale cost of the monopolized good, as it is passed through to a high common price for both goods at the retail level—instead of benefiting from purchasing a retail good that is supplied upstream at a price of 0. Another way of looking at the effect of the vMFN clause is that it is a coordination device for raising the price of the competitive good toward the perfectly collusive, joint-profit-maximizing price for that good; the gains in profit from doing so are shared with retailers via the fixed fee. Consumers of the competitive good are made worse off with the higher price.

The final question that the model answers is the impact of the vMFN clause, when it is profitable, on prices paid by consumers of the monopolized good. One might think that the restraint must always benefit such consumers because it implements a subsidy from customers of the competitive good to customers of the monopolized good by spreading the cost of the monopolized good across all customers. In fact, just as under the must-carry assumption, we find that even the customers of the monopolized good can be worse off with the vMFN clause. Intuitively, as the retail price of the competitive good rises with the vMFN clause, the competitive discipline on the wholesale pricing of the monopolized good is weakened, which potentially leads to a higher retail price even for the monopolized good.

¹⁸ A closely related idea is developed by Inderst and Shaffer (forthcoming) in the general context of contracting in supply chains.

The effect of the vMFN clause on entry incentives, while not in our formal models, is also important for understanding the full competitive impact of this restraint. An entrant into a market typically adopts a strategy of low wholesale pricing to attract demand as retailers respond to its low wholesale price by setting a low retail price. As a result of this low retail price, consumers of the higher-priced goods switch to the entrant's product, which creates competitive pressure for the other suppliers to lower their wholesale prices. For this low-wholesale-price entry strategy to succeed, retailers must be free to respond to the low wholesale price of the entrant with a low retail price and thereby present consumers with a retail price differential between the high-priced goods and the entrant's product. The vMFN clause prevents this response by retailers to the entrant's low wholesale price. The restraint thus deprives all consumers of the full benefit of competition from the entrant. In this sense, the restraint interferes with the competitive process, which harms all consumers. Retailers, of course, remain free to drop the products of any firm imposing the vMFN restraint in order to carry an entrant's product. But a key source of competitive discipline, the ability of consumers to switch products at the point of sale, is eliminated entirely. In our application to the credit card services market, the entry-constraining effect of the vMFN clause is particularly important.

2.3. Incorporating Nonprice Competition

The models in the preceding sections capture the price effects of the vMFN clause. To complete the theory for application to credit card service markets, we must consider the impact on nonprice competition as well. It is the relation between price and nonprice competition that will link the general theory of the vMFN restraint to our application, two-sided credit card networks. We draw on two well-established economic principles of nonprice competition that are immediately applicable to our models. The first pertains to the use of nonprice competition to influence demand. In any of our models, suppose that demand $Q(p, A)$ facing a firm depends not just on its price p but also on its expenditure on promotion A . (Throughout, we use "promotion" as a shorthand for advertising and direct benefits to consumers, for example, quality or rewards.) Then the firm in equilibrium will balance the two instruments, price and promotion, to attract demand to satisfy the Dorfman-Steiner theorem:

$$\frac{A}{pQ} = \frac{\eta_A}{\eta_p}, \quad (4)$$

where η_A and η_p are elasticities of demand with respect to promotion and price.¹⁹ The more sensitive demand is to promotion relative to price, the more the firm relies on promotion to attract demand.²⁰

¹⁹ The theorem follows from the first-order conditions in the maximization of profit, $\pi = (p - c)Q(p, A) - A$ with respect to p and A .

²⁰ We use this result below to show the equivalence of equilibrium in two-sided markets to that in one-sided markets with promotion.

Our second principle pertains to the impact of the vMFN clause when non-price competition is incorporated into the model. The vMFN clause eliminates price competition, just as perfect collusion would, and in fact raises price even higher. Stigler (1968) points out that when firms successfully raise price as a result of collusion but do not collude on nonprice dimensions, competition involving nonprice dimensions will be intensified. In response to an elevated price, cartel members will compete more intensively on nonprice dimensions, and that will erode at least some of the profits from the cartel. If an increase in a nonprice dimension is nearly equivalent to a decrease in price, in terms of both buyers' preferences and cost to the firm, then the cartel's profits will be nearly dissipated. The Stigler principle applies not just to collusion but to any mechanism that eliminates price competition, in our case the adoption of a vMFN clause by firms with market power.

To illustrate this in the simplest way, suppose that the symmetric demands for the two firms in the duopoly model of Section 2.2 are separable in prices and promotion: $Q_1(p_1, A_1; p_2, A_2) = h(A_1, A_2)g(p_1, p_2)$ and similarly for firm 2 with a symmetric demand. (The separability amounts to an assumption that an increase in promotion selects a new set of consumers of identical elasticities as existing consumers and is a common assumption in the economics of advertising.) Then the equilibrium prices in the duopoly model are identical to those that would be established if $h(A_1, A_2)$ were equal to 1. This means that we can think of the equilibrium in the model extended to include nonprice competition in two stages. First, the prices are established as in our previous model conditional on promotion for both firms. (The equilibrium prices are independent of the level of promotion.) Second, the equilibrium level of promotion is determined by the Dorfman-Steiner theorem, given the equilibrium prices. The first-order condition for promotion (for firm 1) sets the marginal benefit of expenditure on promotion equal to 1:

$$\frac{\partial Q_1}{\partial A_1} = (p_1 - c) \frac{\partial h}{\partial A_1} = 1. \quad (5)$$

The price in this first-order condition for promotion is predetermined, and the first-order condition determines promotion—whether the price is determined via the Bertrand equilibrium without the vMFN restraint or with the vMFN restraint. A symmetric equilibrium in promotion, (A, A) , is a value A that satisfies equation (5) with the derivatives evaluated at (A, A) . Total differentiation of equation (5) yields proposition 3.

Proposition 3. Under the assumption of separability in demand, a vMFN restraint, by increasing price, raises the level of promotion A .

As the proposition suggests, and consistent with Stigler's insight, we generally should expect that any conduct that raises prices—including the use of vMFN clauses—will also stimulate nonprice competition.

2.4. Implications for Antitrust Policy

Our theory of vMFN clauses yields the following five economic principles. First, the adoption of vMFN clauses by oligopolists producing differentiated products restricts price competition, thereby raising wholesale and retail prices. Second, the use of the vMFN restraint will intensify nonprice competition among the oligopolists as they respond to the incentives created by the increased wholesale price. Third, when a competitive fringe offers a substitute product, a firm with market power can profit from using a vMFN clause to leverage its market power over the consumers of the competitive product. Fourth, when the vMFN clause is adopted to leverage market power in this way, consumers of the competitive product face higher prices. The oligopolists' consumers may also face higher prices. Fifth, the use of a vMFN clause can inhibit entry into the market by a firm with low prices. A firm adopting a low wholesale price will not garner additional sales from merchants bound by a vMFN clause since those merchants cannot pass on the lower wholesale price in the form of a lower retail price. By inhibiting entry in this way, the vMFN clause harms all consumers.

While we discuss antitrust implications in more detail below in the context of the *AmEx* case, we can usefully outline here two general points about the applicability of the antitrust laws to vMFN clauses. First, because a vMFN clause is a vertical restraint, the applicable antitrust law is the law on vertical restraints. An understanding of those legal principles is therefore essential to an understanding of how the antitrust laws should apply to vMFN clauses. One of the most important vertical restraints is resale price maintenance, which can in some cases serve as a device to suppress upstream competition among suppliers, such as acting as a facilitating device for cartels' pricing (Telser 1960). If the evidence supports this role for resale price maintenance, then the restraint will be found in violation of the Sherman Act (*Leegin Creative Leather Products, Inc. v. PSKS, Inc.*, 551 U.S. 877 [2007]). In such a setting, as Stigler (1964) points out is true for any cartel, there is a heightened incentive to increase nonprice promotion as a result of the price elevation. Empirical evidence, however, supports the hypothesis that resale price maintenance is most often used by an individual supplier not as a device to facilitate cartel pricing (see, for example, Ippolito 1991) but instead as a device to encourage promotion at the retail level and thereby to enhance competition among suppliers. By protecting retailers' margins, resale price maintenance enhances the incentives for retailers to provide promotion, for a variety of reasons, including Telser's well-known free-riding explanation (Telser 1960; for alternative explanations, see Klein 2009; Winter 1993). Between the anticompetitive and procompetitive effects in an antitrust case, the allocation of burdens of proof is as follows. Once the plaintiff has demonstrated competitive harm from a vertical restraint, such as a higher retail price, the burden falls on the defendant to show that the benefits of enhanced promotion make the restraint procompetitive on net.

The second point to keep in mind in understanding the applicability of antitrust law to vMFN clauses is the sharp contrast between resale price maintenance

and the vMFN vertical restraint. Resale price maintenance is a restriction on the price competition among downstream retailers of a single supplier's product, which can enhance the ability of the supplier to compete with other suppliers by increasing retailers' promotion of the seller's product. Competition among upstream suppliers can thus increase with resale price maintenance. The vMFN restraint has the opposite effect, as we have shown: it suppresses competition among upstream suppliers. Promotion increases with the adoption of vMFN clauses by firms in a market—but simply as a Stiglerian by-product of the suppression of price competition among suppliers, as would occur in a cartel.

3. Application to Credit Card Markets

This section applies our theory of vMFN clauses to a vertical restraint in the credit card industry. We first briefly describe the credit card industry and some industry-specific terms so that the reader can connect our analysis seamlessly to the economic literature on credit cards, which has relied on the interpretation of credit card services as involving two-sided platforms. We characterize restrictions in the credit card industry such as the no-surcharge rule to vMFN clauses. We then apply our theory to show that supposedly unique features of two-sided markets in general, and credit cards in particular, are not unique. Instead, these features follow from a standard analysis of price and promotion based on the Dorfman-Steiner theorem. Contrary to claims in the economic literature that two-sided platforms require a new set of economic principles, we show that established economic principles are the right guide for antitrust policy.

3.1. Credit Card Services and Platforms

This section describes the cash flows, including fees, in the credit card industry. This description allows us to contrast our interpretation with the economic literature's interpretation of the same cash flows.

Any credit card system is a two-sided platform in that it brings together agents on two sides of transactions: cardholders who use the cards to make purchases and merchants that honor the cards. Credit card companies operate with one of two systems; AmEx has a closed, or three-party, system in which the credit card company issues cards and provides cardholder services and merchant services on the respective sides of the platform. When a customer uses an AmEx card to buy a \$100 item, AmEx pays the merchant \$100 and in return obtains the right to bill the cardholder; AmEx also receives a fee from the merchant. Some of the funds AmEx receives are used to promote the card, which may include giving the cardholder rewards. Visa and MasterCard are AmEx's primary competitors, but they have a different organizational structure than AmEx. The difference complicates the description of payment flows but has little to do with the underlying economics of the model presented here.²¹ Visa and MasterCard operate as a four-party

²¹ Visa and MasterCard were once joint ventures. Our description is based on their current organizational form.

system.²² This system differs from AmEx's system in that it involves decentralization of the cardholder side of the business to issuer banks and intermediation on the merchant side of the business via merchant, or acquiring, banks. Issuing banks issue cards and pay rewards to cardholders, promote their credit cards, pay a network fee to Visa or MasterCard, and receive a fee, called an interchange fee, from the acquiring bank. Acquiring banks deal with merchants, pay merchants to acquire their receivables, and charge merchants a fee; acquiring banks pay issuers the interchange fee and pay Visa or MasterCard a network fee. Visa and MasterCard each choose their network fees and the interchange fee for their own network.

To illustrate the cash flows involved in a four-party system, consider a credit card transaction for \$100. After the transaction, the cardholder has an account payable of \$100 to the issuing bank; the merchant has an account receivable. The merchant's bank acquires the account receivable (hence the name "acquirer" assigned to the merchant's bank), and the acquirer pays the merchant \$100 for the account receivable. The acquirer collects this amount from the issuer, which then collects payment of \$100 at the end of the month from the cardholder. In addition to these cash flows are the various credit card fees, namely, the network fees and interchange fees, which are of course our central concern. We illustrate in Figure 1 typical values for some fees associated with a \$100 transaction. We assume in Figure 1 that merchants are free to surcharge consumer-cardholders (and, for simplicity, that the surcharge is a full pass-through of the merchants' fees). As shown in Figure 1, the acquirer pays a network fee of \$.10 to the credit card company and an interchange fee of \$2.00 to the issuer. The acquirer's total cost of \$2.10 is passed on to the merchant, along with a fee of \$.05 to cover the acquirer's cost. The merchant then passes on the \$2.15 cost to the consumer via a surcharge. The issuer receives the interchange fee; pays the issuer network fee, also \$.10; uses some of the funds to cover the costs of its issuing services; uses some funds to cover the costs of promotion and consumers' rewards, such as travel insurance, air miles, or cash back; and retains the balance as profits.²³

3.2. *No-Surcharge Rules as Vertical Most-Favored-Nation Clauses*

The no-surcharge restriction imposed on merchants in their contracts with credit card companies, and the stronger nondiscrimination provision in AmEx contracts, are vMFN clauses. Under the AmEx contract, for example, the merchant is allowed to honor other credit cards but cannot charge more for an AmEx transaction than for transactions with the other cards or cash. That is, the mer-

²² Although it is called a four-party system, the network involves five parties: the customer, the merchant, the acquiring bank, the issuing bank, and the credit card company (for example, Visa).

²³ The cash flows of a three-party American Express (AmEx) system are simpler to describe than those of the four-party system described here. The AmEx system does not involve an interchange fee since AmEx provides both issuing and acquirer services. The fees in this example are meant to be only illustrative. The source for several of the fees in described in note 26 of Carlton and Winter (2017) and is also available in the Online Appendix.

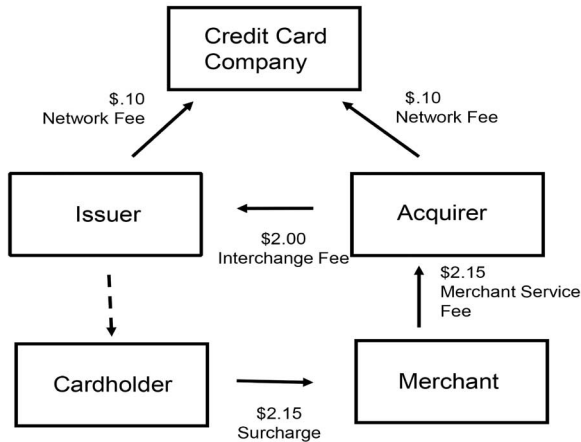


Figure 1. Flow of funds in a credit card transaction with surcharge fees

merchant cannot surcharge to pass on to credit card users the merchant fee that it must pay to receive its \$100 in Figure 1. If the merchant could surcharge, then credit cards with higher merchant fees would be surcharged more. Competition among credit card companies in merchant fees—that is, in the wholesale price that they charge merchants for their services—would drive down merchant fees. This competition is foreclosed by the no-surcharge rules for the same reason that vMFN clauses eliminate competition in our general vMFN-clause model. A credit card company such as AmEx, Visa, or MasterCard cannot capture a greater share of transactions by reducing its wholesale price (merchant fee) if this price cannot be reflected in a lower retail price (lower surcharge) for its service.

With merchants forced to charge the same price for all types of transactions, including cash, the resulting higher merchant fees become incorporated in higher retail product prices. All consumers, including consumers paying cash, pay higher retail prices as a result of no-surcharge rules. From our theory of vMFN clauses, we predict promotion (cardholders' benefits) to increase as a result of vMFN clauses, as these restraints raise wholesale margins by eliminating price competition among credit card companies. This is simply the Stiglerian increase in non-price competition that accompanies any elimination of price competition.

3.3. *The Two-Sided Approach to Credit Card Networks*

The economic literature stresses the two-sided nature of the credit card market and suggests that special economic principles apply to these markets.²⁴ The implication is that the antitrust laws that apply to one-sided markets must be adapted.

²⁴ Although we follow the literature in using the term “two-sided markets,” we note that the more precise terminology is that credit card markets involve two-sided credit card platforms. By the use of the term “two-sided markets,” we are not necessarily referring to a relevant antitrust market as that term is used in antitrust law.

We outline in this section the accepted two-sided economic theory of credit card markets. We then show that the principles discussed in the economics literature on credit cards are equivalent to well-established principles valid for any market. The two-sidedness of the market offers no conceptual barriers to the application of traditional economic principles to an antitrust analysis.

For simplicity of exposition, and in keeping with the economics literature on credit cards, we discuss the economics of credit card platforms in terms of a four-party system.²⁵ With regard to the cash flows in Figure 1, denote the interchange fee a and the network fees paid by the acquirer and issuer f_1 and f_2 , respectively. These three parameters contain only two degrees of freedom; that is, there is one dimension of redundancy. The prices to the two sides of the market are all that matter for payoffs to any agent in the network: the price to the acquirer/merchant side of the market for each dollar of transactions is $p_1 = f_1 + a$, and the price to the issuer/cardholder side is $p_2 = f_2 - a$. The price paid by the acquirer is passed on to the merchant along with a small charge, g , to cover the costs of intermediation. The market for acquirers' services is generally taken to be competitive; we will simply assume that acquirers' costs are 0 apart from fees; the merchant therefore pays the acquirer a fee that covers the acquirer's fees: $m = f_1 + a$. This fee is passed on to the cardholder in the form of a surcharge, where surcharges are allowed.

The issuer's price, $f_1 - a$, is negative. It is used to finance promotion and cardholders' benefits, including air miles, travel insurance, the basic service of offering zero-interest credit for bills paid on time, and cash-back awards. The two-sided market approach to credit card networks postulates that the demand for credit card services, as measured by the total dollar value of transactions, can be written as²⁶

$$q(p_1, p_2) = q(f_1 + a, f_2 - a). \quad (6)$$

The more promotion and benefits to cardholders via a lower (more negative) price for issuers, the higher the demand for credit card transactions because cardholders are attracted by sales promotion undertaken by the issuer. The lower the merchant's fee, the higher the demand because more merchants are attracted to the card, which leads to greater coverage and more opportunities for cardholders to use the card.

The credit card company sets the fees f_1 , f_2 , and a of the credit card network to maximize its profit:

$$\pi = (f_1 + f_2 - c) \times q(f_1 + a, f_2 - a), \quad (7)$$

²⁵ As explained above, although AmEx is a three-party system, its economics are the same as the four-party system with respect to the model developed here.

²⁶ Note that the following reduced-form expression of demand encompasses the endogeneity of the number of merchants offering the credit card and the dependence of demand, on each side of the market, on the number of agents joining the network on the other side of the market.

where c is the cost to the credit card company per dollar of transaction. The demand function (6) is assumed to yield a strictly concave profit function.²⁷

The separability of this profit function implies immediately that, all else being equal, the profit-maximizing value of the interchange fee a maximizes quantity, that is, the volume of transactions, given the network fees.

Proposition 4. At given values for the network fees f_1 and f_2 , the profit-maximizing interchange fee a^* maximizes the volume of transactions: $q(f_1 + a, f_2 - a)$.

The credit card company must balance prices on two sides of the market to maximize quantity, which it will do whatever its level of market power.²⁸ An interchange fee that is too high will discourage merchants from carrying the card. An interchange fee that is too low will not fund as many benefits to attract consumers. In other words, as the literature has stressed, it is wrong to focus only on the level of total fees, $f_1 + f_2$. Instead, to understand how the industry operates, one must also consider relative prices on each side of the market. This is taken to be the essence of a two-sided transactions market (Rochet and Tirole 2006). A market is two-sided if the sum of the fees on the two sides is not a sufficient statistic to determine the effect of the fees on consumers.

Maximizing profit is equivalent to maximizing output with respect to the interchange fee, holding network fees constant. This maximization yields the following necessary condition for the optimal interchange fee (see, for example, Emch and Thompson 2006). Let ε_1 and ε_2 be the elasticities of q with respect to p_1 and p_2 :

$$\frac{\varepsilon_1}{p_1} = \frac{\varepsilon_2}{p_2}. \quad (8)$$

Given that the interchange fee chosen by a rational credit card company maximizes output, all else equal, it might be hard to see how an excessive interchange fee could possibly present a competition policy concern. High interchange fees

²⁷ The assumption of strict concavity incorporates an assumption of nonneutrality of the interchange rate. If the interchange fee were neutral, then the demand function would be constant along the line $\{p_1 + \Delta, p_2 - \Delta\}$ as Δ changes (and therefore would not be strictly concave). We omit discussion of the neutrality of the interchange fee in this article but note that it is an active issue in the credit card literature. Contractual terms such as a no-surcharge rule can affect the neutrality of the no-surcharge rule. See Carlton and Frankel (1995) and Gans and King (2003) for analysis of interchange neutrality. For simplicity, we ignore the role that the member banks play in influencing the setting of the interchange fee. Also, for simplicity, we ignore the possibility of merchants differentially surcharging individual issuers within the same network (for example, placing different surcharges on the Visa credit card issued by bank 1 and bank 2), though our analysis would apply there too.

²⁸ This description incorporates an important assumption: that the interchange fee a is non-neutral. Suppose that cash-back benefits were a perfect substitute to consumers for a decrease in credit card surcharges. That is, suppose that an increase in the surcharge of 10 basis points would be offset perfectly for the consumer by a 10-basis-point cash-back benefit on the credit card bill. Then, as numerous articles point out, changes in the interchange fee would have no effect on net payoffs to parties in the network: an increase in the interchange fee would lead to equal and offsetting increases in the surcharge and cash-back benefits.

are not necessarily a consequence of the exercise of market power. Klein et al. (2006, p. 575) capture the literature's perspective on the interchange fee:

[I]nterchange fees are not a measure of payment card system market power. Interchange fees influence relative prices paid by cardholders and merchants, not the total price of a payment card system, that is, the sum of the prices paid by cardholders and merchants. The market power of a payment system determines the ability of the payment system to charge a total price above costs, but has no predictable effect on relative prices. The relative prices paid by cardholders and merchants are determined by two-sided market balancing considerations. Accordingly, the level of interchange fees has no particular relationship to the presence or absence of market power. In fact, the economic effect of balancing . . . through interchange fees . . . is to maximize payment system output rather than to exercise market power by restricting output.

The literature on credit card economics is entirely correct in its statement that for each credit card company, the choice of interchange fee maximizes the company's total transactions, *ceteris paribus*. We show in Section 3.4, however, that this does not distinguish the credit card market from any other market. The key is that the interchange fee is the revenue per unit sold that is allocated to issuers to induce promotion. And the output-maximization principle is not in tension with our finding that the vMFN clause leads to an anticompetitive increase in prices (merchant fees) in this market.

3.4. *Do Two-Sided Platforms Require a New Set of Principles?*

At the core of the literature on the economics of credit cards is the idea that prices p_1 and p_2 on the two sides of a credit card platform must be balanced. If the optimality condition (eq. [A1]) is not achieved, then the structure of the prices is suboptimal, and neither profit nor quantity (holding constant network fees) is maximized. The economic literature has failed to recognize that this balancing principle is simply a reexpression of the Dorfman-Steiner theorem on the balancing of price and nonprice instruments to attract demand, with nonprice reinterpreted to mean promotion and benefits to cardholders.

Proposition 5. The characterization of the optimal interchange fee in equation (8) is equivalent to the Dorfman-Steiner theorem shown in equation (4).

Proposition 5 is proved in Appendix A. The intuition underlying the proposition is simple: balancing the two sides of the two-sided market is identical to balancing the price and promotion decisions of the credit card company. The definition of "price" to cardholders as the negative of cardholders' benefits (via $p_2 = f_2 - a$) is simply a relabeling. An increase in the interchange fee raises promotion in return for a higher price, and the optimal interchange fee must be therefore governed by the Dorfman-Steiner theorem.

Nor is the quantity-maximizing property of the interchange fee unique. The Dorfman-Steiner problem in any market can be formulated in terms of volume maximization. Consider a firm in any market facing demand $Q(p, A)$, where A is

total promotion. Define $\tilde{q}(p, a)$ to be demand as a function of price and promotional expenditure per unit a .²⁹ Note that $A = aq$. Suppose (for simplicity) that the firm's unit cost is constant. Denote $x \equiv p - a - c$. We can write the firm's profits as $\pi(p, a) = (p - a - c)\tilde{q}(p, a)$. With a simple change in variables, substituting $p = x + a + c$, we can write profits as a function $\tilde{\pi}(x, a) \equiv x\tilde{q}(x + a + c, a)$. Given the separability of $\tilde{\pi}(x, a)$, the profit-maximizing choice of a is the quantity-maximizing choice of a , conditional on x . Solving the problem leads to proposition 6.

Proposition 6. For any firm facing demand that depends on p and A , the optimal expenditure on promotion per unit quantity a , holding constant $x \equiv p - a - c$, maximizes output. Solving this output-maximizing problem yields the Dorfman-Steiner theorem.

We have established that there is nothing special about the economics of a two-sided credit card platform as compared with a one-sided market with promotion. We now apply this insight to an economic analysis of the antitrust issues in the *AmEx* case.

4. Implications for Antitrust: American Express

The theory that we have presented applies directly to antitrust issues in cases involving vMFN clauses. The most prominent case is *AmEx*, recently decided by the Supreme Court. The restraint at issue in *AmEx* is a no-steering rule prohibiting any method by retailers of steering customers to use other credit cards or transaction methods, whether by surcharging AmEx cards or persuading consumers to choose alternatives to AmEx cards. This restraint encompasses the no-surcharge rule.³⁰ Any vMFN restraint, including the one in *AmEx*, is assessed under US law according to the antitrust principles involving vertical restraints. This section reviews briefly the law on vertical restraints and summarizes the *AmEx* decisions. We then assess the economic reasoning in the decisions of the appellate court and Supreme Court, using the economic analysis we developed in prior sections.

The legal treatment of vertical restraints in the United States involves a rule-of-reason test. To summarize,

Courts apply the rule of reason using a three-step burden-shifting framework. First, a plaintiff bears the initial burden of demonstrating that a defendant's challenged behavior "had an *actual* adverse effect on competition." . . . Examples of actual anticompetitive effects include reduced output, decreased quality, and supracompetitive pricing. . . . Once the plaintiff satisfies its initial burden to prove anticompetitive effects, the burden shifts to the defendant to offer evidence of any [net] pro-competitive effects of the restraint at issue. . . . If the defendant can provide such proof, then "the burden shifts back to the plaintiff[] to prove that any legitimate competitive benefits offered by defendant[] could have

²⁹ That is, define $\tilde{q}(p, a)$ implicitly as the solution to $q - Q(p, aq) = 0$.

³⁰ The no-steering rules are sometimes referred to as nondiscrimination provisions.

been achieved through less restrictive means. (*United States v. American Express Co.*, 838 F.3d 179, 194, 195 [2nd Cir. 2016], references omitted)

The three-step-rule legal test, especially the second step, has a solid basis in economics for restraints like vMFN clauses. The defendant is best informed about its own business and therefore about any procompetitive effects of the restraint. It is thus efficient to place the burden on the defendant in the second step.

The district court in *AmEx* found that the plaintiff, the US government, had met its burden in the first step of the legal test by demonstrating competitive harm from the no-steering rule: “[B]y preventing merchants from steering additional charge volume to their least expensive network, for example, the [non-discrimination provisions] short-circuit the ordinary price-setting mechanism in the network services market by removing the competitive ‘reward’ for networks offering merchants a lower price for acceptance services. The result is an absence of price competition among American Express and its rival networks” (*United States v. American Express Co.*, 88 F. Supp. 3d 143, 151 [E.D. N.Y. 2015]).

In the second step of the legal test, the district court considered, and rejected, various free-riding defenses for the no-steering restraint that AmEx had put forth in its attempt to convince the court that there were procompetitive justifications for the restraint. Thus, the district court based its decision on a finding that after the plaintiff (the United States) had shown a restriction on competition, AmEx had failed to meet its burden to provide a procompetitive justification that offset the competitive harm.

The appellate court overturned the district court’s decision. The appellate court ruled that the district court had erred in the first step by requiring the plaintiff to show that only retailers (or competition affecting retailers) were harmed by the no-surcharge rule. The Supreme Court agreed. A proper antitrust analysis, according to the appellate court (and endorsed by the Supreme Court), must “consider the two-sided net price accounting for the effects of the [restraints] on both merchants and cardholders” (*United States v. American Express Co.*, 838 F.3d 179, 204). This is a clear embrace by the court of the terminology of the economic literature on two-sided markets, which the court cites frequently in its decision. Cardholders’ benefits were treated as a negative price to cardholders, and the court determined that the adverse impact of the restraint on the net price in the market (the sum of the merchant’s fee minus the rewards to consumers) is the burden of the plaintiff in the first step.

We now use the economic reasoning developed here to analyze the *AmEx* decisions. As a general matter, Justice Breyer’s dissent in the Supreme Court’s decision closely aligns with our analysis. From our perspective, the higher merchant fees and constraints on entry that the district court attributed to AmEx’s no-steering restraint should have sufficed to meet the plaintiff’s burden of establishing competitive harm in the first step. The restraint raised the price to merchants from what it would have been in the absence of the restraint. As Justice Breyer stated in his dissent,

As a result of the provisions, the District Court found, American Express was able to raise merchant prices repeatedly without any significant loss of business, because merchants were unable to respond to such price increases by encouraging shoppers to pay with other cards. . . . The provisions also meant that competitors like Discover had little incentive to lower their merchant prices, because doing so did not lead to any additional market share. . . . The provisions thereby “suppress[ed] [American Express’] . . . competitors’ incentives to offer lower prices . . . resulting in higher profit-maximizing prices across the network services market.” . . . Consumers throughout the economy paid higher retail prices as a result, and they were denied the opportunity to accept incentives that merchants might otherwise have offered to use less-expensive cards. . . . I should think that, considering step 1 alone, there is little more that need be said. (*Ohio v. American Express*, 585 U.S. ___, Breyer, J., dissenting, p. 9, references omitted)

Procompetitive benefits associated with the higher prices to merchants resulting from the AmEx restraints are an appropriate burden for the defendant in the second step of the legal test, by the economic reasoning set out above, namely, that the defendant, not the plaintiff, is the party best situated to explain the procompetitive effects of its restraints.³¹

In adopting the terminology of the two-sided market literature, the appellate court defined cardholders’ benefits to be a (negative) price to cardholders. But this was merely a relabeling of promotional benefits. With this relabeling, AmEx’s no-steering restraint was determined to have two price effects: an increase in price to merchants and a decrease in price to cardholders. The appellate court and Supreme Court could then find that evidence of higher prices to merchants did not meet the plaintiff’s burden in the first step because such evidence does not take into account the net price paid by merchants and cardholders. By labeling cardholders’ benefits as a price, the Court shifted the burden of determining whether these benefits offset the higher merchant prices from the defendant, in the second step of the legal test, to the plaintiff, in the first step.

Thus, through the adoption of the language of two-sided markets, which we have shown embodies the same economic principles as a one-sided market for credit card services in which we treat rewards to cardholders as promotions, the appellate court reallocated burdens. The court required the plaintiff to carry the burden of establishing the overall effect of the vertical restraint in the first stage of the analysis. Semantics, not economic reasoning, led the court to err and adopt a different test for one-sided and two-sided markets.

The appellate court and Supreme Court misused the two-sided market economic analysis that they relied on so extensively. The appellate court claimed,

³¹ In oral argument before the Court, the defendant’s counsel argued that the government had failed to meet the burden of showing that the pro-competitive effects of the practice did not outweigh the anticompetitive effects (in the terminology adopted by the defendants, that the net price in this two-sided market had increased as a result of the restraint). Justice Sonia Sotomayor had precisely the correct response: “Well, isn’t that what the rule of reason does by putting this at step 2? The government is never going to know that. It doesn’t know your business model. . . . If you want to argue pro-competitive effects, you show it. It’s not up to the government to show . . . there’s a benefit that outweighs the price stifling. . . . I mean, I’ve never heard of such a thing. If you think there’s pro-competitive effects, you prove it” (585 U.S. ___, transcript of oral argument, p. 51).

as we have noted, that a proper analysis must consider the two-sided net price. Yet nothing in the theory of two-sided markets suggests that only the sum of the prices on each side of the market matters for competition. Indeed, the Rochet and Tirole (2002) definition of two-sided markets is that the sum of prices on each side is not a sufficient statistic for understanding market operations. The appellate court cited the Rochet-Tirole definition of two-sided markets (838 F.3d 185, n.3) and claimed to rely on the Rochet-Tirole theory, but then the appellate court and the Supreme Court adopted a criterion (the net price) that completely ignores the key insight of Rochet and Tirole, which is that the prices on each side of the market, not just their sum, matter.³²

The Supreme Court made an additional economic error as, once again, Justice Breyer points out (585 U.S. ___, Breyer, J., dissenting, p. 9). The Supreme Court and appellate court ignored the finding of the district court that the evidence showed that the AmEx restraints inhibited entry, specifically the entry of the Discover credit card. This interference with entry harms the competitive process regardless of whether one uses a one-sided or two-sided lens to analyze the market. This evidence of harm to the competitive process by itself should have been dispositive of the central issue, at the first step of the legal analysis, of whether the plaintiff had shown harm to competition.

The Supreme Court's reliance on the concept of a two-sided market or platform in its *AmEx* decision leaves us with a different antitrust standard for examining vertical restraints in one-sided versus two-sided markets. Our economic analysis shows that there is no basis for a difference in standards between two-sided and one-sided markets. This is a potentially severe problem: the Supreme Court uses a very broad definition of two-sided markets in its decision—so broad that the definition could capture almost any market. Not only does the decision establish an ill-founded difference between antitrust laws for two-sided markets and antitrust laws for conventional markets, but it adds uncertainty to the law because the boundary in the law between the two-sided and conventional markets is left so vague.

5. Conclusion

The theory of vMFN restraints developed in this article supports two general conclusions. First, a vMFN clause can be anticompetitive in suppressing competition between oligopolistic rivals, in allowing these oligopolists to leverage their

³² Justice Breyer explains this flaw in the court's use of two-sided market analysis: "[T]he majority defines 'two-sided transaction platforms' much more broadly than the economists do. As the economists who coined the term explain, if a 'two-sided market' meant simply that a firm connects two different groups of customers via a platform, then 'pretty much any market would be two-sided, since buyers and sellers need to be brought together for markets to exist and gains from trade to be realized.' Rochet & Tirole, *Two-Sided Markets: A Progress Report*, 37 *RAND J. Econ.* 645, 646 (2006). The defining feature of a 'two-sided market,' according to these economists, is that 'the platform can affect the volume of transactions by charging more to one side of the market and reducing the price paid by the other side by an equal amount.' *Id.*, at 664–665. . . . That requirement appears nowhere in the majority's definition" (585 U.S. ___, Breyer, J., dissenting, pp. 19–20).

market power over a competitive fringe and in impeding the entry of firms with a lower price. Second, the theory applies directly to the no-surcharge rule for credit cards, notwithstanding the two-sided nature of credit card platforms.

The two-sidedness of credit card markets does not require a new set of economic principles for assessing competition policy because the difference between the credit card setting and a conventional one-sided market is essentially a matter of labeling. We show that important claims about two-sided markets, such as the claim that interchange fees maximize output, are in fact the same as the features of one-sided markets with promotion. The reasoning used by the appellate court and the Supreme Court in *AmEx* to exonerate AmEx's use of a no-steering rule and to justify a departure from the usual litigation procedure for evaluation of vertical restrictions in one-sided markets lacks economic foundation. Creating different legal rules for the same economic conduct depending on whether the market is described as one-sided or two-sided is a mistake that could lead to widespread confusion in the evaluation of vertical restraints.

Appendix A

Proofs

A1. Proof of Proposition 1.ii

Proposition 1. The equilibrium price in the (1, 1) pricing subgame (i) exceeds the equilibrium price in the (0, 0) pricing subgame and (ii) exceeds the perfectly collusive price.

Proof. To prove proposition 1.ii, let the joint profits of the two suppliers be $\tilde{\pi}(w_1, w_2) = (w_1 - c)q_1(w_1, w_2) + (w_2 - c)q_2(w_1, w_2)$. The marginal impact on the joint profits of an increase in w_1 is, in general,

$$\frac{\partial \tilde{\pi}}{\partial w_1} = (w_1 - c) \left(\frac{\partial q_1}{\partial p_1} \right) + q_1 + (w_2 - c) \left(\frac{\partial q_2}{\partial p_1} \right). \quad (\text{A1})$$

At the collusive price p^* , this first-order condition is 0. Subtracting the first-order condition (A1) from the first-order condition for profit maximization in the (1, 1) game and using $\partial q_2 / \partial p_1 < -\partial q_1 / \partial p_1$ yields

$$\left. \frac{\partial \pi_1^{11}}{\partial w_1} \right|_{(w^*, w^*)} = \frac{1}{2}(w^* - c) \left(-\frac{\partial q_1}{\partial p_1} - \frac{\partial q_2}{\partial p_1} \right) > 0. \quad (\text{A2})$$

This demonstrates that at the collusive price there is an incentive to raise price in the (1, 1) game and therefore, given the concavity of π_1^{11} , that the equilibrium price of the (1, 1) game exceeds the collusive price.

A2. Proof of Proposition 5

Proposition 5. The characterization of the optimal interchange fee in equation (8) is equivalent to the Dorfman-Steiner theorem shown in equation (4).

Proof. The Dorfman-Steiner theorem in equation (4) involves elasticities of the demand function $Q(p, A)$ with respect to price p and total promotion A . The characterization of the optimal interchange fee in equation (8) involves elasticities of demand $q(p_1, p_2)$ with respect to p_1 and p_2 . In equation (8), $-p_2$ is the amount paid to issuers to promote the card. Total promotion is therefore $-p_2q$. This corresponds to A in equation (4). In addition, p_1 in equation (8) corresponds to p in equation (4). Substituting $A = -p_2q$ into the left-hand side of equation (4) yields $p_2/p_1 = \eta_A/\eta_p$. Since equation (8) is equivalent to $p_2/p_1 = \varepsilon_2/\varepsilon_1$, to prove the proposition we must show that

$$\frac{\eta_A}{\eta_p} = \frac{\varepsilon_2}{\varepsilon_1} \quad (\text{A3})$$

or

$$\frac{\partial Q/\partial A}{\partial Q/\partial p} \times \frac{A}{p} = \frac{\partial q/\partial p_2}{\partial q/\partial p_1} \times \frac{p_2}{p_1}. \quad (\text{A4})$$

Since $A = -p_2q$ and $p_1 = p$, this in turn is equivalent to showing that

$$\frac{\partial Q/\partial A}{\partial Q/\partial p} = \frac{\partial q/\partial p_2}{\partial q/\partial p_1} \times \frac{1}{q}. \quad (\text{A5})$$

In short, to prove the proposition, we must show that equation (A5) is true. Note that given the demand function $q(p_1, p_2)$, the demand function $Q(p, A)$ can be defined implicitly as the solution to $Q - q(p, A/Q) = 0$. Define the left-hand side of this equation $F(p, Q, A)$. With the implicit function theorem applied to $F(p, Q, A) = 0$, it follows that

$$\frac{\partial Q(p, A)/\partial A}{\partial Q(p, A)/\partial p} = \frac{-(\partial F/\partial A) / (\partial F/\partial Q)}{-(\partial F/\partial p) / (\partial F/\partial Q)} = \frac{\partial F/\partial A}{\partial F/\partial p} = \frac{\partial q/\partial p_2 \times (1/q)}{\partial q/\partial p_1}, \quad (\text{A6})$$

which is identical to equation (A5).

Appendix B

The Monopoly-Competitive Fringe Model

B1. Maintaining the Must-Carry Assumption

A monopolist produces good 1 at no cost, facing competition from a competitive fringe of suppliers, which produces a substitute good 2, also at no cost. All producers supply through a common set of retailers, which must carry the monopolist's product. The retailers face no costs and pass through wholesale prices

one-for-one. Retailers facing no vMFN restraint set retail prices $(p_1, p_2) = (w, 0)$, and retailers facing a vMFN restraint set retail prices (p, p) , where p is a common price yielding no retail profits.

The monopolist's profits are given by $\pi_m = wq_1(p_1, p_2)$. The competitive fringe offers its product at a price of 0 and earns no profits. The downstream retailers' total profits are $\pi_r = (p_1 - w)q_1(p_1, p_2) + p_2q_2(p_1, p_2)$. From these expressions, we can express total industry profits (which equal total revenues) as

$$\pi(p_1, p_2) = \pi_m + \pi_r = p_1q_1(p_1, p_2) + p_2q_2(p_1, p_2).$$

With $\pi_r = 0$, we have $\pi_m = \pi(p_1, p_2)$. The monopolist's objective is to maximize industry profits.

The adoption of a vMFN clause is a choice by the monopolist to maximize $\pi(p_1, p_2)$ subject to the constraint that $p_1 = p_2$, since the monopolist can implement any common retailer price p by setting w such that retailer profits $(p - w)q_1(p, p) + pq_2(p, p) = 0$. The decision not to adopt a vMFN clause yields maximum profits $\pi(p_1, p_2)$, subject to the constraint that $p_2 = 0$.

Proposition B1. Under the assumptions listed, a vMFN restraint is always profitable.

Proof. Let the optimal price under the choice of no vMFN clause be p_1^* . Then one option for the monopolist is to implement (p_1^*, p_1^*) via the vMFN restraint. We have $q_1(p_1^*, p_1^*) > q_1(p_1^*, 0)$ since the goods are substitutes. It follows that

$$\begin{aligned} \pi(p_1^*, p_1^*) &= p_1^*q_1(p_1^*, p_1^*) + p_1^*q_2(p_1^*, p_1^*) \\ &> p_1^*q_1(p_1^*, p_1^*) > p_1^*q_1(p_1^*, 0) = \pi(p_1^*, 0). \end{aligned}$$

That is, the profits under the vMFN restraint with p_1^* exceed the maximum profits without the vMFN restraint. Q.E.D.

It is obvious that if the demand elasticities for goods 1 and 2 are identical at each price, then maximum industry profits can be achieved via the vMFN constraint. This is the case because the vMFN constraint $p_1 = p_2$ is not binding.

We turn to the impact of the restraint on prices. By way of motivation, consider the case in which the consumers of the two goods are distinct. The competitive-good customers are invariably harmed as the price of their good rises. It might appear that the monopolist's consumers are better off under the vMFN clause because under symmetry of demands only part of any wholesale price w is passed on. In fact, under a standard assumption, the prices of both products rise. Assume that Π is concave and that $\Pi(p_1, p_2)$ is supermodular, that is, that $\Pi_{12} > 0$.³³ To investigate the impact of the vMFN restraint on p_1 , note that the first-order conditions for the optimal price under no vMFN restraint imply that $\Pi_1^1(p^*, 0) = 0$.

³³ The assumption of supermodularity is equivalent to the assumption that if Π^1 and Π^2 accrued to separate, competing agents, the resulting Bertrand game would have upward-sloping reaction functions. Linear demand satisfies the assumptions of supermodularity and concavity of profits.

(Subscripts refer to derivatives evaluated at the given arguments.) The marginal impact on profit of an increase in price, starting from p^* , is

$$\begin{aligned} \left. \frac{d\Pi(p, p)}{dp} \right|_{p=p^*} &= 2 \left. \frac{d\Pi^1(p, p)}{dp} \right|_{p=p^*} = 2\Pi_1^1(p^*, p^*) + 2\Pi_2^1(p^*, p^*) \\ &= 2 \left[\Pi_1^1(p^*, 0) + \int_0^{p^*} \Pi_{12}(p^*, s) ds + \Pi_2^1(p^*, p^*) \right]. \end{aligned} \quad (\text{B1})$$

Of the three terms in the brackets in the second line of equation (B1), the first term is 0 by the first-order condition defining p^* as the optimal non-vMFN price, the integral is positive by the assumption of supermodularity, and the last term is positive because the goods are substitutes. Thus, there is an incentive to raise price above p^* under the vMFN clause. In summary, we have proposition B2.

Proposition B2. In the case in which the must-carry assumption holds and demands are symmetric, if Π is concave and supermodular, then the prices of both goods rise when the vMFN clause is imposed.

B2. Relaxing the Must-Carry Assumption

As discussed in the text, to explain an incentive to impose a vMFN restraint when retailers are free to drop the monopolist's product, we must incorporate retailers' market power. We do so by adopting the assumption that the downstream retail sector consists of a symmetric duopoly. The retail prices for the monopoly product at the two retailers are (p_{11}, p_{12}) , and the retail prices of the competitive good are (p_{21}, p_{22}) . The wholesale contract is a two-part price and is (w, f) , consisting of a variable price w and a fixed fee f ; there is possibly a vMFN restraint that $p_{1i} = p_{2i}$ for each retailer i .

To simplify notation, we assume that the products are independent in demand.³⁴ The demands for the monopoly product at the two retailers are $q^{11}(p_{11}, p_{12})$ and $q^{12}(p_{11}, p_{12})$, and the demands for the competitively supplied product are $q^{21}(p_{21}, p_{22})$ and $q^{22}(p_{21}, p_{22})$. We assume that, in terms of the profits earned on the competitive good by the two firms, the prices are strategic complements. This is a standard condition, satisfied by linear demand for example.

We consider the following game: the monopolist offers the same contract to both retailers, a contract that includes a variable price w and a fixed fee f and that may or may not include a vMFN restraint. The two retailers simultaneously choose whether to accept the monopolist's contract. Finally, the retailers simultaneously set prices. A retailer that has rejected the monopolist's product sells only the competitively supplied good, a retailer that has accepted a vMFN contract sets a single price for both goods, and a retailer that has accepted a non-vMFN contract sells both goods, setting the price for each.

³⁴ This simplifying assumption has no impact on our main results.

We adopt conditions on demand such that the Nash equilibria in prices exist for the pricing subgame following each combination of acceptance decisions: (1) both retailers accept a vMFN contract and compete in the common price for both goods; (2) one retailer accepts a vMFN contract while the other retailer rejects the vMFN contract, so the first retailer sells both goods at a common price while the second retailer, in rejecting the contract, sells only the competitively supplied good; (3) a non-vMFN contract is accepted by both retailers; (4) a non-vMFN contract is accepted by only one retailer; (5) both retailers reject a contract and compete in prices for the competitively supplied good only.

We set out the prices and profits in the equilibria from the first four of these pricing subgames.³⁵ Subgames 2 and 4, involving a single retailer rejecting an offer, are important because the profit of the rejecting retailer in these subgames determines the level of profit that the monopolist must leave with each retailer to meet the retailer's participation constraint in any contract offer. We set out the prices and profits from particular pricing subgames as follows.

1. *Both Retailers Accept a Vertical Most-Favored-Nation Contract.* In this subgame, the profit (gross of the fixed fee) of retailer 1 given w and retail prices $(p_{11}, p_{12}; p_{21}, p_{22})$ is $(p_{11} - w)q^{11}(p_{11}, p_{12}) + p_{21}q^{21}(p_{21}, p_{22})$. The equilibrium price, denoted $p_v(w)$, is the solution in p to the following first-order equation for retailer 1, evaluated at $p_{12} = p_{22} = p$:³⁶

$$q^{11}(p, p) + (p - w) \frac{\partial q^{11}}{\partial p_{11}}(p, p) + q^{21}(p, p) + p \frac{\partial q^{21}}{\partial p_{21}}(p, p) = 0. \quad (\text{B2})$$

The gross profit earned by each retailer in this subgame is $\pi_v(w) = (p_v - w)q^{11}(p_v, p_v) + p_v q^{21}(p_v, p_v)$.

2. *One Retailer Rejects and One Retailer Accepts a Vertical Most-Favored-Nation Contract.* In this subgame, retailer 1 chooses a single price for the competitive good, and retailer 2 chooses a single price for both goods. The equilibrium values of these prices, $p^R(w)$ and $p^A(w)$, solve a pair of first-order conditions (for retailers 1 and 2, respectively). These first-order conditions are from the maximization of the profits of retailer 1, $\pi_R = p^R q^{21}(p^R, p^A)$, and the profits of retailer 2, $\pi_A = (p^A - w)q^{12}(\infty, p^A) + p^A q^{22}(p^R, p^A)$:³⁷

$$\begin{aligned} q^{21}(p^R, p^A) + p^R \frac{\partial q^{21}}{\partial p^R}(p^R, p^A) &= 0 \\ q^{12}(\infty, p^A) + (p^A - w) \frac{\partial q^{12}(\infty, p^A)}{\partial p^A} + q^{22}(p^R, p^A) + p^A \frac{\partial q^{22}(p^R, p^A)}{\partial p^A} &= 0. \end{aligned} \quad (\text{B3})$$

Denote the profits for firm 1, the rejecting firm in this pricing subgame, $\pi_R^*(w)$.

³⁵ The fifth subgame is irrelevant.

³⁶ In equation (B2), the derivatives are the derivative of demand with respect to the first argument, evaluated at (p, p) . The other equations have similar derivatives.

³⁷ In the expression for the profits of retailer 2, we use the fact that, for a retailer, not offering the monopolist's good is the same as offering it at an infinite price.

Using the strategic complementarity of p^{21} and p^{22} , it is straightforward to show from the system of equations (B3) that $\partial\pi_R^*(w)/\partial w > 0$. The firm rejecting the vMFN contract benefits from a higher w because its rival, which must set the same price for both goods, will respond to a higher w by setting a higher common price for both goods.

3. *Both Retailers Accept a Non-Vertical Most-Favored-Nation Contract.* This is a standard Bertrand game with the two firms competing in the two goods given the wholesale price w for the first good. We denote the equilibrium retail prices in this game $[b_1(w), b_2(w)]$ and the profit for each firm in this pricing subgame $\pi_B^*(w)$.

4. *One Retailer Rejects a Non-Vertical Most-Favored-Nation Contract.* Because of the independence of demand, the rejecting retailer simply earns the profit from competing for the competitively supplied good alone as a Bertrand duopolist. This profit is independent of w , and we denote it π_{B2}^* . Denote the industry profits at symmetric retail prices for the two goods (p_1, p_2) as $\Pi(p_1, p_2) = 2[p_1q^{11}(p_1, p_2) + p_2q^{21}(p_1, p_2)]$.

Similar to the model with the must-carry assumption, we can formulate the monopolist's decision to impose a vMFN restraint as a choice between two maximization problems. The non-vMFN profits are the maximum industry profits over w , with $(p_1, p_2) = [b_1(w), b_2(w)]$ minus the share of profits that must be left with each retailer (via the choice of f) to elicit its acceptance of the contract. This problem is

$$\max_w \Pi[b_1(w), b_2(w)] - 2\pi_{B2}^*.$$

The profits that the monopolist attains from the vMFN restraint are given by

$$\max_w \Pi[p_v(w), p_v(w)] - 2\pi_R^*(w). \quad (\text{B4})$$

Propositions B3 and B4 capture the key point of this section: the option of retailers to drop the monopolist's product will discipline the monopolist's pricing under vMFN restraint, which reduces the profit from adopting the vMFN clause—possibly to the extent of eliminating the incentive for the restraint. Even in the case in which the elasticity of demand for the two products is the same at each price—so total industry profits can be achieved with the vMFN restraint and shared with retailers via reductions in fixed fees—the restraint may be unprofitable.

Proposition B3. If the elasticities of demand for the two products are the same at each price, then the vMFN clause allows the maximization of total industry profits, which can be shared among the monopolist and the retailers via the lump-sum transfers. This outcome, while feasible, is never optimal.

When the elasticities are identical for the two products at each price, maximum industry profits are obtained when the price for each good is p^* , defined as the price at which the elasticity of demand is 1. (Recall that the monopolist and retailer costs are 0.) This can be achieved by setting $w = w^* = p_v^{-1}(p^*)$. (Since

the function $p_v(w)$ is monotonically increasing, it is invertible.) From expression (B4) for the optimal choice of w under the vMFN restraint and the fact that $\partial\pi_R^*(w)/\partial w > 0$, it can be shown that the optimal choice of w is less than w^* . The need to share an increasing amount of the industry profits with retailers as w rises (because of the retailers' profit from deviating from the {accept, accept} equilibrium choices) eliminates the incentive to achieve maximum industry profits.

Proposition B4. In the model as described, the vMFN restraint is profitable under some conditions but not under other conditions.

We prove proposition B4 with a parameterized example that also illustrates in an intuitive way the conditions under which the vMFN restraint is and is not profitable when retailers can drop the monopolist's product. To present the parameterized example, we assume that distinct groups of consumers demand each product. The downstream retail market is a Hotelling line. The consumers are located along a unit line segment, with the retailers selling from each end of the line. At each point along the line, the demand curves for the two products, as functions of prices (including transportation costs), are³⁸

$$q_1 = 1 - p_1 \tag{B5}$$

and

$$q_2 = a - p_2. \tag{B6}$$

Consumers pay a travel cost t to travel to either retailer; the price that enters the demand curve includes the travel cost. Consumers purchase from the retailer whose price inclusive of travel costs is lower or do not purchase at all.

In this example, the exogenous parameters are a pair (a, t) . We omit the algebra of the solution to the model (which includes mixed strategies for some parameters) and simply present, in Figure B1, the sets of parameters (a, t) for which the vMFN restraint is and is not profitable.³⁹ The figure also indicates the parameter values for which the vMFN restraint raises prices by more than 10 percent.⁴⁰

The numerical results show that when a and t are very high or t is very low, then a vMFN restraint cannot be profitable. This is consistent with the intuition from the model. First, when a and t are high, then the two retailers are close to local monopolists. There is therefore little benefit to total supply chain profits from using a vMFN restraint to raise the competitive-good price. But there are costs: imposing on the supply chain a single price for both goods will reduce total supply chain profits, since the profit-maximizing price for the competitively supplied good is higher. The vMFN restraint is therefore not profitable. Second, when t is

³⁸ Equations (B5) and (B6) are a completely general parameterization of independent linear demands, given the freedom to choose units of quantities and currency.

³⁹ The algorithm and the Matlab code implementing the algorithm for deriving the equilibrium in the parameterized example are provided in the Online Appendix.

⁴⁰ Over much of the parameter space, the impact on prices is very small and switches between a negative and a positive effect. We restrict Figure B1 to depicting parameter values for which the vMFN restraint has a substantial positive impact on prices.

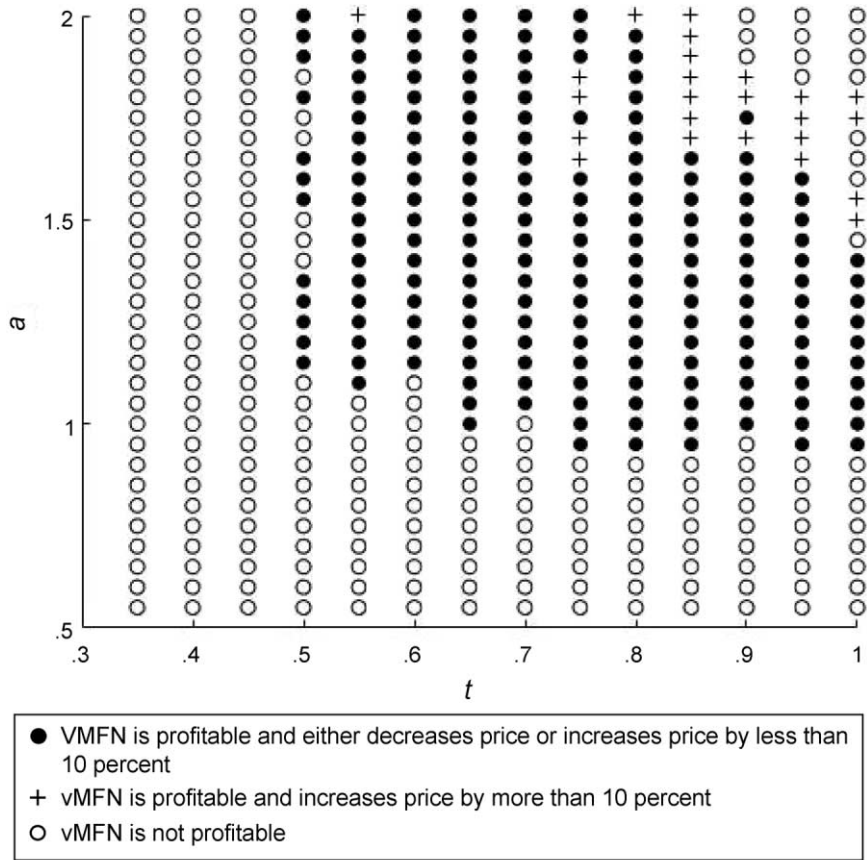


Figure B1. Profitability of vertical most-favored-nation clause

very low, the profit available to a retailer from deviating from {accept, accept}—and pricing the competitive good slightly below the price that the other retailer would set for both goods—is high because the deviating retailer can capture a greater share of the entire set of retail customers. This high profit from deviating forces the manufacturer to share a large portion of the profits under a vMFN restraint with each retailer to meet the retailer’s participation constraint, and this makes a vMFN clause unprofitable. Between the two regions, in which we know a priori that a vMFN restraint is unprofitable, Figure B1 shows a range of parameters over which a vMFN restraint generates an increase in profits.⁴¹ In short, the example confirms that a vMFN restraint can be profitable in a setting in which re-

⁴¹ The results identifying areas of positive price increases were sensitive to the approximations used in the simulation and to slight changes in the parameters. Because we want to identify areas of positive price increases where we have confidence that the price increase is not an artifact of our approximations, we use a 10 percent cutoff to identify areas of positive price increases.

tailers have the option to drop the vMFN product—but the retailers' option may discipline the monopolist's pricing under the vMFN clause to the extent that the restraint is not profitable.

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