

ANTITRUST POLICY IN AFTERMARKETS

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Many recent antitrust cases concern aftermarkets: markets for goods or services used together with durable equipment but purchased after the consumer has invested in the equipment. Examples include computer parts, software upgrades, repair manuals, and training. Durable goods manufacturers are often the dominant providers of aftermarket products. The cases involve a variety of alleged anticompetitive aftermarket behaviors by durable goods manufacturers, especially ties between proprietary and non-proprietary aftermarket services. For example, equipment maintenance has been tied to: parts;¹ software upgrades;² diagnostic software and manuals;³ engineering changes and timing diagrams;⁴ and emergency service calls.⁵ In all of the cases, the plaintiffs allege that customers are "locked in" by their prior investment in the manufacturer's

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¹ See, e.g., *Eastman Kodak Co. v. Image Technical Servs., Inc.* 112 S. Ct. 2072 (1992); *Electronics in Medicine v. Picker Int'l*, Case No. H89-3283 (S.D. Tex. 1989); *Imaging Equip. Servs. v. Picker Int'l*, Case No. 87-2828-WF (D. Mass. 1987).

² See, e.g., *Virtual Maintenance, Inc. v. Prime Computer, Inc.*, 957 F.2d 1318 (6th Cir.), vacated, 113 S. Ct. 314 (1992) (*Virtual I*), on remand, 995 F.2d 1324 (6th Cir. 1993) (*Virtual II*); *Systemcare, Inc. v. Wang Laboratories, Inc.* 787 F. Supp. 179 (D. Colo. 1992); *Comm-Tract Corp. v. Northern Telecom, Inc.*, No. 90-13088-WF (D. Mass. 1990).

³ See, e.g., *Datasat Co. v. Unisys Corp.*, No. 92-1442-G (S.D. Cal. 1992); *Grumman Systems Support Corp. v. Data General Corp.*, No. 88-0033-S (D. Mass. 1988); *Imaging Equip. Servs. v. Picker Int'l*, Case No. 87-2828-WF (D. Mass. 1987).

⁴ See, e.g., *Grumman Systems Support Corp. v. Data General Corp.*, No. 88-0033-S (D. Mass. 1988).

⁵ See, e.g., *HyPoint Tech., Inc. v. Hewlett-Packard Co.*, 949 F.2d 874 (6th Cir. 1991); *Comm-Tract Corp. v. Northern Telecom, Inc.*, No. 90-13088-WF (D. Mass. 1990).

proprietary equipment brand, and thus are limited (to a greater or lesser degree) to aftermarket products specifically compatible with that brand.

These cases involve many standard antitrust issues. For example, in a case where the manufacturer ties the availability of proprietary parts to the purchase of service (labor) from the manufacturer, the standard tying question arises: When can a firm with monopoly power over a proprietary product increase its monopoly profits by tying the proprietary product to another product? This question has been extensively addressed elsewhere.⁶ What is novel in aftermarket cases is not the interactions between various different aftermarket products, but the interactions between the aftermarkets and the market for the original sale of the durable equipment.

It is this relationship *between* aftermarkets and the original equipment market on which we focus. In particular, we address three questions:

(1) Is it possible for a manufacturer to exercise market power profitably in aftermarkets if the primary equipment market is competitive? What effect does less than perfect competition in the equipment market have on aftermarket performance?

(2) How much are consumers harmed overall by supracompetitive pricing in aftermarkets if competition in the primary market forces equipment price reductions?

(3) If constraints on the link between equipment pricing and aftermarket pricing lead to consumer harm, is contract law the proper tool for policy response?

We conclude that a manufacturer can profitably exercise market power in the aftermarket and will set an effective aftermarket price that is higher than the competitive level; consumers are harmed to some degree by this outcome; and that contracts often are not practically feasible to protect consumers.⁷

We show in Part I that manufacturers will, in general, find it optimal to charge supracompetitive aftermarket prices, even though it costs them some sales in the primary market. This is true even if the manufacturer expects to be in business for many years and considers the effect of aftermarket prices on future equipment sales. Indeed, the result holds

⁶ See, e.g., Michael Whinston, *Tying, Foreclosure and Exclusion*, 80 AM. ECON. REV. 837 (1990) (showing how tying can increase profits through strategic entry deterrence). See JEAN TIROLE, *THE THEORY OF INDUSTRIAL ORGANIZATION* 333-35 (1988), for a textbook discussion of a number of other roles for tying.

⁷ These conclusions hold under quite general assumptions. The minor caveats are detailed in the sections below.

so long as completely contingent long-term contracts are economically infeasible. We discuss why such perfect contracts are, in fact, rarely feasible in Part III.

Competition in the primary market will have the effect of reducing equipment prices as aftermarket prices rise, so that sellers break even overall. But we show in Part II that, in general, consumers are still harmed by the deviations from cost-based prices for aftermarket goods. Even when consumers are well informed and the equipment market is long-lived so sellers have an incentive to build a reputation, consumers are still worse off than they would be if there were no market power in the aftermarket.⁸ How much consumers suffer is a factual question, the answer to which will vary on a case-by-case basis; we describe a number of factors that affect how large the harm is likely to be in any specific case. Thus, when the conditions for aftermarket power are met, we expect to see some consumer harm in virtually all cases, although not always enough harm to warrant antitrust remedy.

The third question, whether contract law or antitrust law will be more useful in remedying the problem, is less amenable to simple economic modeling. The social return to costly adjudication in an antitrust court depends on the size of consumer harm and the effectiveness of available contractual remedies, both of which are factual questions. We do note, however, that contracting effectiveness depends heavily on the Supreme Court's central observation in *Kodak*: information is costly and necessarily imperfect and uncertain for such complex, long-lived equipment as the aftermarket cases feature. These information imperfections tend to make perfect, complete contracting infeasible and thus make contract law less useful in aftermarket cases.⁹

Whether antitrust remedy is appropriate in a given case, of course, depends on the ways in which the firm exploits its aftermarket power. Charging high prices for proprietary parts, for example, would usually not be an antitrust violation. Using leverage from a legitimate parts monopoly to obtain monopoly control of maintenance (through tying, refusal to deal, and other devices) may provoke legitimate antitrust concern. We do not attempt to analyze the antitrust status of different types of aftermarket actions; that is a standard problem. Our purpose, rather,

⁸ Only if the equipment and the aftermarket products are purchased in strictly fixed proportions do consumers suffer no harm. This is not likely to be true. See *infra* Part II.

⁹ Joseph Farrell & Carl Shapiro, *Optimal Contracts with Lock-In*, 79 AM. ECON. REV. 51 (1989) (showing that consumers can actually be worse off with a long-term contract than without if the contract does not cover all significant dimensions).

is to develop a general economic theory of the possibility of antitrust violation.

Our theoretical conclusions are quite strong. Under most plausible circumstances, a manufacturer of durable equipment will find it rational to act anticompetitively in aftermarkets (given some proprietary advantage); overall, consumers will be harmed; and the conditions that tend to make the harm great also tend to reduce the effectiveness of contractual remedies. Consequently, although the appropriateness of antitrust remedy will vary from case to case, economic analysis clearly permits a role for antitrust scrutiny.

I. WILL COMPETITIVE MANUFACTURERS CHARGE ABOVE-COST AFTERMARKET PRICES?

A. THE SUPREME COURT'S VIEW

In its decision in *Eastman Kodak Co. v. Image Technical Services, Inc.*, the Supreme Court recognized the possibility of rational anticompetitive behavior in aftermarkets when the original equipment market is competitive.¹⁰ The Court noted that firms operating in both an equipment market and an aftermarket face a trade-off: while above-competitive pricing in the aftermarket may reduce future profits through lost customers, it also raises current profits in the aftermarket from locked-in customers. The Court argued that it could not presume that the lost future profits from lower equipment sales will outweigh the gain in current profits from supracompetitive pricing in the aftermarket.

The Court majority argued that even if competition in the equipment market theoretically prevents the use of market power in the aftermarket, market imperfections, in particular imperfect information and switching costs, can prevent economic theory from describing reality. If consumers do not have perfect information (for example, if they don't know the prices that other firms charge or it is costly to obtain such information), then a reputation is not as effective because consumers are less likely to know that there are firms with lower prices. Switching costs also limit the disciplining effect of equipment market competition on the aftermarket because consumers are locked in. In the presence of switching costs, consumers will pay supracompetitive aftermarket prices as long as the price premium is less than the switching costs. While the facts of an individual case may prove that it would not be profitable in a particular

¹⁰ 112 S. Ct. 2072 (1992); see also *Virtual Maintenance Inc. v. Prime Computer, Inc.*, 113 S. Ct. 314 (1992) (remanded to the Sixth Circuit on the same grounds).

instance, the Court stated that economic theory alone cannot rule out such behavior.¹¹

Thus, the Court in *Kodak* held that aftermarket tying cases must be examined on the facts, case-by-case. In so holding, the Court emphasized that "market imperfections can keep economic theories about how consumers will react from mirroring reality."¹² The Court is correct that the above-mentioned imperfections will affect the degree of aftermarket exploitation that is possible. However, the emphasis on imperfections is much too accepting of the economic arguments the defendants have proffered. Economic theory does not support the argument that strong primary market competition will discipline aftermarket behavior, even without market imperfections. In fact, firms will rationally engage in above-cost aftermarket pricing even if the equipment market is very competitive, all parties are well informed, and demand in the market is stable. Supracompetitive prices for proprietary aftermarket goods and services will occur so long as there is an inability to contract for these goods and services at the time of purchase.

B. ECONOMIC MODEL

We address the issue of whether competition in the equipment market will discipline aftermarket pricing in the simplest possible setting in order to highlight the manufacturer's incentives.¹³ We then discuss how more realistic conditions affect our conclusions.

A variety of monopolistic practices have been alleged, but to focus attention on the relevant issues we consider generic monopoly pricing in proprietary aftermarkets. Of course, if the manufacturer exercises market power simply by raising price, antitrust laws are not invoked. However, the supracompetitive aftermarket profits attract entry, at which point the manufacturer has an incentive to exclude competition in the

¹¹ The Supreme Court was addressing a ruling of summary judgment. Kodak requested summary judgment before discovery was complete, arguing that, based on economic theory, competition in the equipment market precluded anticompetitive behavior in the aftermarket. The Supreme Court ruled that the possibility of anticompetitive behavior (that is, whether an aftermarket can be a "relevant market") is a factual question, and that the issue should go to trial after full discovery. Justice Scalia's dissent also emphasized the role of market imperfections, though in his opinion imperfect information and switching costs were not sufficient to prevent competition in the equipment market from disciplining aftermarkets. 112 S. Ct. at 2097. See *infra* Part IV, for a discussion of a case in which the facts have already been heard in trial.

¹² *Id.* at 2078.

¹³ A formal model of pricing in a proprietary aftermarket is presented in Severin Borenstein, Jeffrey MacKie-Mason & Janet Netz, *Market Power in Proprietary Aftermarkets* (unpublished manuscript 1994).

aftermarket. Indeed, virtually all of the cases have been brought by aftermarket firms that allege anticompetitive behavior on the part of the equipment manufacturer, especially in the form of tie-ins. Our results carry over to tying and other exclusionary aftermarket practices that effectively result in higher aftermarket prices to consumers.

To keep the discussion simple we begin by assuming that consumers are well informed: they know current prices and are able to use that information to form an estimate of the life-cycle cost of their purchases (including equipment and aftermarket products and services). These extreme, simplifying assumptions focus attention on the situations in which it would seem least likely to find aftermarket power. We also assume that the market for equipment has many competing sellers, each with a brand that is equally appealing to consumers.¹⁴ We assume, however, that the aftermarket product is proprietary, so each equipment manufacturer has a complete monopoly over the sale of aftermarket products for its equipment brand. Finally, we assume that each firm acts to maximize the present discounted value of all present and future profits to the firm, so it takes into account the effect of its decisions on its contemporaneous profits and on all of its future profits.¹⁵

Relaxing these assumptions (by incorporating the common market imperfections discussed by the Supreme Court in *Kodak*, for instance) serves to strengthen our conclusions. It is on the basis of developing our results under such unfavorable assumptions that we claim they are strong and quite general.

A firm selling both equipment and an associated proprietary aftermarket product faces a trade-off when it sets its aftermarket price. A higher price will allow it to earn more profits (up to a point) on aftermarket sales to consumers who have already purchased the equipment. On the other hand, a higher aftermarket price will also reduce sales of the equipment because potential buyers will take into account this higher expected cost of purchasing the associated aftermarket products. Defendants in antitrust aftermarket cases and the dissenting opinion of the Supreme Court in *Kodak* have argued that if the equipment market is sufficiently competitive, then the latter effect—which is often referred

¹⁴ Thus, we are assuming the same market conditions that were posited by Justice Scalia in his *Kodak* dissent, rather than the imperfect market conditions relied on by the majority. 112 S. Ct. at 2097.

¹⁵ By “discounting,” we mean that the firm values one dollar of income earned in the future less than it values a dollar earned today. It should do so because a dollar earned today can be invested and earn interest, giving the firm more than a dollar in the future. It is common to assume that the discount rate is approximately equal to the interest rate that the firm faces.

to as a reputation effect—will overwhelm the former effect—referred to as customer “lock-in”—and firms will set prices for the proprietary aftermarket good at competitive levels.

There is, however, no economic basis for this conclusion. In fact, the profit-maximizing firm that faces this trade-off will price above marginal cost in the aftermarket. For at least a small increase in price from marginal cost, the increased aftermarket profits earned on customers who have already purchased the equipment will exceed the losses from the resulting decline in reputation, and thus in future equipment sales. Further, this trade-off persists over the long term, as long as firms apply a positive discount rate to the value of future profits.

The simple (but not entirely correct) intuition is this: the manufacturer does not lose profits on new customers because it lowers the equipment price to compensate them for higher aftermarket prices.¹⁶ But the manufacturer makes profits on existing customers because they have already bought their equipment and do not get compensated for the higher aftermarket prices.¹⁷ Essentially, the manufacturer can discriminate against locked-in customers without (necessarily) losing new customers: competition in the new equipment market does not protect existing customers because they have already purchased the equipment.¹⁸

The complete theory is more complicated because the policy of combining high aftermarket prices with low equipment prices may not fully compensate new equipment customers. As a starting point, suppose new purchasers of equipment bought the same amount of the aftermarket product at the supracompetitive price as they would at the competitive price. If the quantity demanded of the aftermarket product did not change as the aftermarket price rose, then the total price of the entire system—equipment plus aftermarket product—could be held constant simply by adjusting downward the equipment price to offset a supracompetitive aftermarket price. Since, by assumption, the quantities purchased of equipment and service are unchanged, the seller's profit and new equipment buyer's net benefit would then also be the same as they would be with competitive aftermarket pricing (and the associated higher equipment prices). Raising the aftermarket price will affect consumer benefits

¹⁶ New customers are those in the market to buy a piece of equipment. Some of these “new” customers will be customers who have purchased equipment previously and who are now replacing or upgrading old equipment.

¹⁷ Existing customers refers to those who currently own a piece of equipment and are hence locked-in to the aftermarket of that particular manufacturer.

¹⁸ This “discrimination” does not require that the manufacturer knows which customers are new and which already own equipment. The discrimination results automatically when the price of equipment is reduced and the aftermarket price is raised.

and seller profits from new equipment sales only if it causes consumers to buy less of the aftermarket product.¹⁹

Of course, in reality, a high aftermarket price does reduce consumption of the aftermarket good and thus reduces the benefits of owning the equipment. For instance, a high price for copier toner will reduce the number of copies made on each machine regardless of the price of the copying machine. However, the loss in profits earned from new equipment buyers when the firm raises the aftermarket price and lowers the equipment price commensurately comes only from the change in purchases of the aftermarket product.

In contrast, the gain in profits from raising the aftermarket price to customers who have already purchased the equipment occurs on every aftermarket unit sold to them.²⁰ Overall, a small increase in the aftermarket price raises profits on every aftermarket unit sold to existing customers, while lowering profits only on the change in aftermarket units sold to new customers. The analogous technical argument shows that overall profits will increase by raising the aftermarket price at least a little above marginal cost and offsetting that increase for new buyers by lowering the price of the equipment. How far the manufacturer can profitably raise the aftermarket price depends on the characteristics of the particular markets and customer demands.

It might appear that we are describing a short-run game here: firms can exploit currently locked-in customers, but all future customers for new equipment (and follow-on aftermarket products) are protected by competition in the equipment market. This is incorrect. We are allowing for an infinite number of future periods of new equipment purchasing, and the result is that the service price is above the competitive level (incremental cost) in every period. Furthermore, consumers are aware that the firm will follow this pricing strategy, so it is not a failure of reputation that causes the problem.²¹

What is happening that leads to this inefficient market outcome under free-entry (for equipment), complete information, and rational fore-

¹⁹ In fact, we are making two further simplifying assumptions: potential aftermarket competitors will offer the same products or services as the manufacturer, and they will have the same production costs. We discuss below the additional harm to consumers if excluded competitors could have achieved lower costs or increased the variety of aftermarket products and qualities.

²⁰ Notice that we are postulating that the manufacturer raises the aftermarket prices to all consumers, and thus the manufacturer does not need to be able to identify new and existing consumers. We are simply dividing the analysis of the effect on profits between the two types of consumers.

²¹ See *infra* Part I.C, for our discussion of the role of reputation.

sight? Competition merely ensures that firms will earn zero excess profits. This will be true because firms will raise aftermarket prices but lower equipment prices correspondingly until net combined profits are zero. However, in any given period, for all time, the firm has some "currently" locked-in customers. The trade-off described above always gives the firm the incentive to raise current service prices above the competitive level. Only fully contingent, complete long-term contracts could remove this incentive. Thus, period after period, new buyers get a below-cost price on equipment and a supracompetitive price on service. Since all future customers get a price break on equipment, does this prevent consumer harm from the above-cost aftermarket price? No: consumer welfare is lower in every period than it would be if both equipment and the aftermarket goods were priced competitively (at cost) because the consumer purchases less of the aftermarket product and hence gets less value from the equipment.

The argument that firms will price proprietary aftermarket products above the competitive level does not rely on any assumption about the degree of competition in the equipment market. In fact, the level of competition in the equipment market may have little or no impact on the mark up of proprietary aftermarket products.²² This makes sense because a firm has two decision variables that it can adjust to maximize profits: the equipment price and the aftermarket price. The equipment price affects the firm's competitiveness in attracting new (and repeat) buyers, but is not relevant to incumbent owners of the equipment who purchase only the aftermarket product. The aftermarket price, however, affects both potential new buyers and incumbent owners. Thus, the firm will use the aftermarket price to strike the optimal balance between profiting on customers who have already bought the equipment and maintaining a low-aftermarket-price reputation to attract new customers. It will then adjust the equipment price up or down as the intensity of competition among equipment manufacturers changes. More severe competition in the primary market will drive down the equipment price, but it does not necessarily change the trade-off that the firm faces in pricing the proprietary aftermarket product. Firms may even price equipment below cost in order to "buy" market share that will yield profits from high aftermarket prices. Thus, while competition in the equipment market lowers equipment prices and profits, it will not drive aftermarket prices to competitive levels.

²² Borenstein, MacKie-Mason & Netz, *supra* note 13, analyze a standard model of imperfect competition that is extended to include a proprietary aftermarket good. In that model, we show that the equilibrium price of the aftermarket good is independent of the degree of substitutability among equipment brands, even as the primary market becomes, in the limit, perfectly competitive.

It has been suggested that the need for a reputation for low-price aftermarket products means that firms can only exercise market power by surprising customers with changes in aftermarket prices and policies.²³ The possibility of ex post customer surprise is not necessary for the existence of aftermarket power, though it does enhance that power. The results explained above show that firms should always price their proprietary aftermarket products above "competitive" levels. Consumers anticipate these aftermarket prices, and their expectations are fulfilled.

C. BUILDING AND MAINTAINING A REPUTATION

It would seem that both firms and consumers could be better off if firms committed to charging competitive aftermarket prices. Of course, in a free-entry equilibrium the manufacturers earn zero profits in any case. However, when both prices deviate from cost (the equipment price is below cost and the aftermarket price above cost), consumers are harmed: they will tend to buy less than a socially desirable amount of the aftermarket product.²⁴ If both prices could be set competitively, consumers would be made better off, and firms would try to raise profits by competing to bring these benefits to consumers.

For example, suppose that a consumer would buy ten units of the aftermarket product for use with her equipment if the aftermarket price were \$50. If the aftermarket price were instead set at \$35, then the consumer would benefit by more than the \$150 she saves on the 10 units, because she would now buy more than 10 units. Presumably, the consumer is getting some value from the additional units she buys when the aftermarket price declines. As a result, the firm could accompany the aftermarket price cut with an equipment price increase of at least a little more than \$150 and leave consumers, and the firm, better off.²⁵

So, why doesn't some firm simply make a commitment to charge a competitive price for the aftermarket product and then maintain its reputation by doing so?²⁶ The problem with such a commitment is that it ignores the profits to be earned from customers who already own equipment. As explained above, at any point in time the firm will balance the gain in profits from its locked-in customers against any loss in future

²³ See, e.g., Carl Shapiro & David Teece, *Systems Competition and Aftermarkets: An Economic Analysis of Kodak*, 39 ANTITRUST BULL. 135 (1994); see also *Kodak*, 112 S. Ct. at 2098 (Scalia, J., dissenting).

²⁴ See *infra* Part I.D., for a further discussion of this and other harms to consumers.

²⁵ If the equipment market were perfectly competitive, firms would make zero economic profits in either scenario, but at any rate would be no worse off.

²⁶ We continue to ignore information imperfections, so we assume that consumers can verify that a price is equal to its competitive level.

profits. This will be true regardless of the degree of competition in the primary market.

If a firm's installed base increases relative to its expected future equipment sales, then the value of a reputation for low aftermarket prices declines and the incentive to raise aftermarket prices rises. If the prospects for future equipment sales begin to fade, then so do the future profits the firm expects on its equipment sales if it protects its reputation. Similarly, if the profit margin on future equipment sales is expected to be small due to increasing competition, then building and protecting a reputation is less likely to maximize profits. Given the time it takes to build a reputation, and the rapid rate of entry and exit among high-tech firms, there may be little gain in future equipment profits as a result of building a reputation for low service pricing. Consider, for example, two recent defendants, Wang and Prime Computer.²⁷ Due to hardware and software obsolescence, both experienced a rapid loss of sales for their proprietary minicomputers and eventually left the hardware manufacturing business. Preserving a reputation for low hardware service pricing was probably not worth much to these companies.²⁸

If a firm does choose to build a reputation for low aftermarket prices, then each period of reputation-building is a period in which the firm forgoes profits from above-competitive service pricing to its incumbent equipment owners. The larger the base of customers who have already purchased the equipment, the larger the profit the firm forgoes when it builds or maintains a low-aftermarket-price reputation. A successful equipment firm faces an ever-increasing opportunity cost of maintaining its reputation for low aftermarket prices because a successful manufacturer will have a larger base of installed customers. Thus, even if consumers believed that the current low aftermarket prices would continue forever, declining profits in the equipment market or a significant base of equipment owners would eventually induce the profit-maximizing firm to break with its commitment.

To better grasp the balancing between high aftermarket prices that reap profits from customers who have already purchased the equipment and low aftermarket prices that tend to increase future equipment sales, consider what would happen if a manufacturer had a very high discount rate, e.g., if it faced an extremely high interest rate. In that case, future

²⁷ Both Prime (*Virtual I* and *Virtual II*, *supra* note 2) and Wang (*Systemcare v. Wang*, 787 F. Supp. 179 (D. Colo. 1992)) were accused of exploiting their aftermarket power by tying hardware maintenance to proprietary software services and products.

²⁸ Joseph Kattan, *Market Power in the Presence of an Installed Base*, 62 ANTITRUST L.J. 1 (1993) (emphasizing the fact that aftermarket power is strengthened when a firm's equipment manufacturing business is in decline).

profits would be much less valuable than current profits, so the firm would be more inclined to charge high aftermarket prices and earn high profits from current owners of its equipment, even at the cost of reputation and future sales. A reputation strategy of lower aftermarket prices would reduce the present value of future profits: although it would generate higher future sales, the discounted value of each future sale would be lower than the value of a current sale. In the extreme case of a firm that totally discounts future profits, it would maximize its current period profits by selling aftermarket products at full monopoly prices.

The effect of a high discount rate is similar to that of a declining market: future profits have less effect on current decisions. If the number of equipment buyers were declining by 50 percent every period, the firm would have a greater incentive to charge high aftermarket prices than if the equipment market were growing. In a growing market, the reputation value would be greater relative to the profits that could be earned by exploiting incumbent equipment owners.

The effect of growth rates may be why so many of the aftermarket antitrust cases have been against firms with declining markets for their original equipment. Many defendants argue that their low profits demonstrate they could not be exercising aftermarket power. This conclusion does not follow. In fact, a firm with low or negative equipment profits has a relatively greater incentive to raise aftermarket prices above the competitive level.²⁹ If a firm is likely to be exiting the industry soon, then it will want to earn the maximum profits possible from selling aftermarket products to the remaining owners of its equipment.

While a declining market or declining equipment profits enhance the incentive to raise aftermarket price, the incentive is still present in a stable market. Even if equipment demand is expected to remain constant, profits in the future are of less value due to discounting. Only if expected profits from equipment are growing at a faster rate than the discount rate will a firm have the incentive to price the aftermarket product at (or below) the competitive level. While such rapid growth does occur at times, it is generally short-lived and is then followed by a period of slowly growing or declining equipment sales. If slower growth or declines in sales are forecast in the near future, then the incentive to raise aftermarket prices is likely to be present even if current growth is quite rapid. Still, this points out that the current and anticipated future growth rate

²⁹ Corporate and industry documents repeatedly show an increasing emphasis on raising service profitability at the same time that equipment profit margins are declining.

of the market is relevant information in analyzing the incentive for a firm to exercise market power in a proprietary aftermarket.

D. SWITCHING COSTS AND IMPERFECT INFORMATION

There are two avenues through which a manufacturer's anticompetitive aftermarket practices can reduce its future profits: by reducing sales to new customers and by losing incumbent owners of the manufacturer's equipment when they replace or upgrade equipment. Imperfect consumer information, such as about the price of aftermarket products, is more likely to affect the sensitivity of new customers to aftermarket practices. Switching costs—which include training users, rewriting custom software, translating archival company data to new formats, etc.—affect the choices of incumbent equipment users.

First consider existing customers. They tend to be well informed about the market, so their willingness to switch to another brand depends on the magnitude of their switching costs. If switching costs are high, manufacturers have some room to raise their aftermarket prices or impose other onerous conditions (such as ties) without substantially reducing future profits when their incumbent equipment owners replace or upgrade equipment. This is so because the customer weighs the gain from switching to a manufacturer with lower equipment or aftermarket prices against the cost of switching. The lower the cost of aftermarket policies relative to switching costs, the fewer customers the firm will lose due to high aftermarket prices.

Even if there were no costs to adapting to a new brand, such as software and data format conversion or retraining, high aftermarket prices would be rational. The manufacturer's aftermarket policies can create an opportunity cost of switching by lowering the market value of a customer's used equipment.³⁰ A customer that switches when the salvage value of its equipment is positive pays the net cost of the new brand of equipment less the used value of its old equipment. If the manufacturer raises aftermarket prices (or imposes other restrictive policies), the value of used equipment will fall correspondingly, because the purchaser of used equipment will have to pay the higher aftermarket prices. Thus, for example, a \$2000 increase in the present value of lifetime service costs will reduce used equipment prices by \$2000 and thus will raise the cost

³⁰ The purchase of aftermarket products for use in conjunction with the equipment is only relevant if the used equipment has a positive market value. It does not make sense, for example, to purchase service for a used machine unless the serviced machine will yield profits greater than the cost of service; such a machine would have a positive market value (that is, the firm is better off keeping—and servicing—the equipment than throwing it away).

of switching to another brand by \$2000: the owner bears the cost of the aftermarket policy whether it keeps its equipment or sells it to someone else. Thus, the equipment owner is unable to avoid the costs of supracompetitive aftermarket pricing, and the possibility of switching to another equipment brand does not solve the problem, as defendants argue.

Now consider the effect of aftermarket policies on new customers. Obviously, their sensitivity to aftermarket policies depends on the extent to which they are aware of them. Most of the cases involve high-technology products in rapidly evolving industries. Much of the incumbent customer base initially purchased their equipment before aftermarket policies were firm or reputations established. New suppliers and technological alternatives are constantly emerging. Customers may not be able to uncover the structure of aftermarket prices and policies for the many manufacturers and independent aftermarket providers—much less accurately forecast prices and policies over the lifetime of the durable equipment.³¹ As explained above, even if customers are fully aware of a manufacturer's anticompetitive aftermarket policies, the manufacturer will find it profitable to charge above-cost aftermarket prices. Further, the less well informed new customers are about aftermarket policies, the less those policies will affect customer demand, and the higher will be the firm's optimal aftermarket prices. In this sense, the *Kodak* majority was right to emphasize information imperfections: the greater the imperfections and the higher the cost of obtaining information, the greater the manufacturer's incentive to exploit aftermarket power. The ability to exercise market power in the first place, however, does not depend on information imperfections.

E. SUMMARY

Even under the most favorable assumptions—perfect competition in the equipment market and perfect information on the part of consumers—firms have the ability and incentive to price aftermarket products above cost. While a reputation for low-cost aftermarket products has some value, that value is limited: at every point in time, firms balance the gain in future profits from reputation-building against the cost in forgone current profits on customers who already own equipment. Thus, reputation effects will not result in competitive prices for proprietary aftermarket products. Imperfections in the operation of the equipment

³¹ We emphasize the importance of information about a wide variety of policies, many of which are less transparent than prices. Manufacturers can exert their market power in many ways other than merely raising prices, such as tying maintenance to software upgrades, parts, diagnostic software, or equipment upgrades. All of these and others have been alleged in pending cases.

market, such as imperfect consumer information about aftermarket policies or costs that incumbent equipment users bear if they switch brands, increase the extent to which aftermarket price will be above cost, but supracompetitive aftermarket prices will occur even if the equipment market has no such imperfections.

II. CONSUMER HARM FROM ANTICOMPETITIVE AFTERMARKET POLICIES

Some commentators have argued that even if aftermarket prices are supracompetitive, equipment market competition leads to offsetting low equipment prices, and thus the overall "system" price is set competitively.³² Obviously, this argument is only relevant to potential new customers, since customers who already own equipment are not compensated for aftermarket price increases through the lower equipment prices. More generally, however, the claim is also incorrect for potential new customers. The claim that consumers are unharmed because the overall price is unchanged is true only in the extreme case in which equipment and service are used in fixed proportions. In practice, the high aftermarket price will reduce the amount of use, and therefore value, that consumers will get out of the product.

For a true system—which has a fixed combination of components, including aftermarket products—the price of individual components is unimportant.³³ However, it is rarely the case that aftermarket products are used in fixed proportions with equipment. Consider computer maintenance service: customers will purchase different contracts, or no contracts, depending on the prices. For example, some customers will purchase a contract for 9-to-5 service on weekdays; others will purchase "24-by-7" service; yet others will purchase service on a time and materials basis. Different consumers will make different numbers of copies on copiers and thus will use different amounts of toner. Firms will differ in the number of terminals hooked to a minicomputer and therefore will demand different quantities of peripherals.

When aftermarket products are used in variable proportions with equipment, high aftermarket prices create a consumer loss regardless of the price of equipment. Consider photocopiers and their toner car-

³² See, e.g., Shapiro & Teece, *supra* note 23; Carl Shapiro, *Aftermarkets and Consumer Welfare: Making Sense of Kodak*, *infra* this issue, 63 ANTITRUST L.J. 483 (1995).

³³ If the aftermarket products and equipment are used in fixed proportions, that is, if one machine is used with a fixed quantity of the aftermarket products, then the combination is truly a "system." If the system price is determined by perfect competition in the equipment market, then the separate price for each component is unimportant and there is no meaningful aftermarket economic power.

tridges: if toner is priced above the competitive level, copier market competition may force manufacturers to lower copier prices to offset the supracompetitive toner profits. However, users will make fewer copies because the incremental per copy cost is higher. Given that the copier has been purchased, making fewer copies is a distortion to efficient use of the equipment. If the copier market is competitive and profits are always driven to zero, then producers will see no change in profits; the gain in profits from a higher aftermarket price will be competed away through a lower equipment price. Consumers bear the entire inefficiency as a reduction in the value of copiers. Thus, higher aftermarket prices, regardless of the price of equipment, directly harm consumers in one of the ways that monopoly behavior in general harms consumers: high prices lead to inefficiently low use of the product or service. The dead-weight loss from pricing the aftermarket good above marginal cost is borne entirely by consumers.

This is illustrated in Figure 1, which shows a consumer's demand for the aftermarket product given that the consumer owns the equipment. Pricing the aftermarket product above marginal cost lowers the consumer's surplus in the aftermarket by area *A* plus area *B*. Area *A* is profits to the manufacturer, so in a competitive market the price of the equipment is forced down by *A* and firms still break even. Area *B*, however, is surplus lost to both consumers and producers. Competition does not force down equipment prices by this additional amount, yet it is a reduction of consumer surplus from the amount the consumer would obtain if equipment were priced at marginal cost.

Higher aftermarket prices cause another particularly costly distortion that is often overlooked. The customer's decision on how long to keep an old machine repaired and running before replacing it with a new one is influenced by supracompetitive service prices.³⁴ If service prices are high, then equipment will be abandoned earlier than it would have been if service prices were competitive. The importance of this phenomenon has been demonstrated in some of the cases by evidence that manufacturers introduce price increases for parts and service on old equipment—or refuse to service old models altogether—specifically to induce customers to migrate to a newer model. These policies pre-supposed substantial customer switching costs, since the manufacturers assumed that enough customers would upgrade to the same equipment brand, rather than switching brands, to make it worthwhile to lose parts and maintenance sales on the already installed older equipment.

³⁴ In this case the variability in proportions comes both in the form of the amount of service applied per year to the equipment, as well as the number of years service is applied.

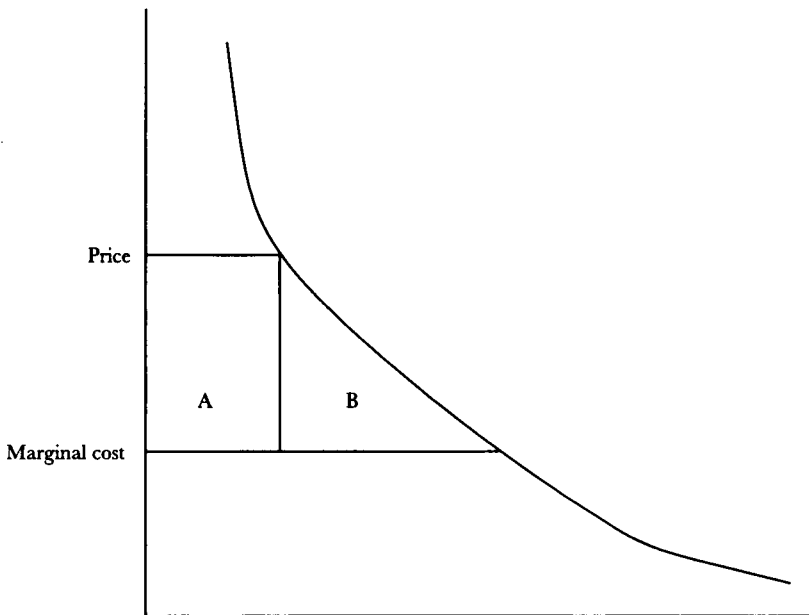


Figure 1. Area B is “deadweight loss”: consumer loss in aftermarket that is not compensated by price reduction in equipment market.

Of course, charging high prices is not in itself illegal. In the absence of barriers to entry, however, economic profits in the aftermarket should induce entry into the market.³⁵ Manufacturers may exclude aftermarket providers with lower costs, different service qualities, or different product variety to protect their profits, all of which create consumer harm. Such exclusion is especially likely in dynamic industries with rapidly developing technologies, as discussed below. The resulting loss of consumer welfare can be substantial, potentially much greater than the loss from a monopolist that simply sets price above its marginal costs.

Some economists have argued that it is in the manufacturer's interest to subcontract production of aftermarket products and services to others who have lower costs, thereby collecting the return on the intellectual property embodied in the aftermarket products, while at the same time

³⁵ If the product is proprietary, for example, computer software, then barriers to entry do exist. However, there are generally other aftermarkets that are not proprietary, for example, hardware maintenance. It has been alleged that equipment manufacturers react to entry in the nonproprietary aftermarkets with tie-ins to the proprietary product, thus harming competition in the nonproprietary aftermarket.

increasing the value of its equipment to consumers by lowering costs and increasing quality or variety in the provision of aftermarket products. In practice, however, firms with proprietary control over aftermarkets will rarely want to subcontract to alternative producers. One problem is the firm's inability to write contracts with those subcontractors that would prevent the subcontractors from going into business for themselves in competition with the manufacturer after receiving the necessary training and experience to enter the market.³⁶

Another problem with subcontracted aftermarket production is that the independence of a third-party aftermarket provider may offer consumers benefits that a subcontractor is unable to offer or that the manufacturer does not want to offer. For example, an independent maintenance provider may advise a customer on alternative brands of equipment to replace or upgrade old equipment, thereby lowering brand-switching costs by improving information.

If manufacturers could commit to competitive service market entry before they began selling equipment, they would do so: as discussed above, a credible commitment to low service prices is to everyone's advantage. However, firms only want to commit before they have an installed base. Once they have an installed base, they prefer to have a monopoly in the aftermarket. Since there is generally not enough aftermarket business to support independent service and parts companies until after a large installed base exists, the opportunity to create viable independent aftermarket competition does not arise until after the time when the manufacturer prefers monopoly control.

Consumers might also gain from having access to a variety of aftermarket quality choices. While some consumers may be willing to pay a higher price to obtain higher quality service, others prefer lower quality service in exchange for a lower price. However, it is probably not credible for the manufacturer to offer both "high-quality" and "low-quality" service under a single brand name. Independent providers may be necessary to obtain the optimal variety in an aftermarket.³⁷

³⁶ The seriousness of this problem is obvious in most of the aftermarket cases: independent aftermarket service companies are nearly always founded by former service employees of the manufacturer.

³⁷ Defendants often claim that only the manufacturer should provide service to prevent costly "fingerpointing," i.e., disagreements about whether the equipment manufacturer or the independent aftermarket provider is responsible for a problem. The problem with this defense is that it justifies a manufacturer that offers a low priced bundle of equipment plus aftermarket service as a choice to consumers, but it does not justify excluding rivals and forcing customers to accept such bundling without choice. Indeed, the Supreme Court said customers should be allowed "to make their own choice on these matters of quality." *Aspen Skiing Co. v. Aspen Highlands Skiing Corp.*, 472 U.S. 585, 610 (1985).

Thus, even if firms lower the equipment price while raising aftermarket prices, consumers are still harmed in a variety of ways. Consumers receive less value from their equipment, do not obtain possible cost reductions, and have fewer choices over variety and quality than is optimal.

III. CONTRACTUAL SOLUTIONS TO AFTERMARKET MARKET POWER

Several economists argue that consumers can protect themselves from anticompetitive aftermarket policies by writing contracts. Benjamin Klein has argued that although "holdups" of locked-in customers are sometimes possible, if customers are generally aware of the possibility they will take contractual actions to protect themselves before entering an agreement to make the original purchase.³⁸ To avoid anticompetitive aftermarket exploitation, however, consumers would need to write completely contingent contracts at the time they purchase equipment that would specify all aftermarket prices and policies in the future. Such perfect long-term contracts are generally not possible for a variety of reasons: equipment lives are long, the future is uncertain (especially for high-technology durable products like micrographic, computing, and telecommunications switching equipment), and there are many aftermarket policies the firm could use to raise profits as an alternative to a previously contracted price.³⁹ These problems remain whether or not the consumer can foresee the potential for policy changes.

One commonly used policy is tying of aftermarket products. In *Kodak* and many similar cases a proprietary aftermarket product was used to tie other products or services, which allegedly yielded supracompetitive returns by leveraging the firm's market power in one market into another market. That is, the manufacturer had a monopoly in a proprietary product (such as operating software), but faced competition in another aftermarket (such as hardware maintenance). To reduce competition in the maintenance market, the manufacturer could allow purchase of operating software only if the consumer also purchases hardware maintenance. Thus, monopoly power in software is extended to the maintenance market. Due to the multiplicity of possible restrictive policies

³⁸ Benjamin Klein, *Market Power in Antitrust: Economic Analysis After Kodak*, 3 SUP. CT. ECON. REV. 43 (1993).

³⁹ For example, as in most of the cases cited above, the manufacturer could tie one product to another, *see supra* notes 1–5. Manufacturers might also reduce the training or quality of service technicians on locked-in accounts; charge above-cost prices for aftermarket products and services associated with equipment upgrades; use lower quality replacement parts; reduce the amount of preventative maintenance; release engineering fixes as priced upgrades rather than as zero-cost field change orders; etc.

and the great uncertainty about future costs and technological developments in high-technology industries, it is very difficult if not impossible to write effective contracts at the time of equipment purchase that prevent such practices.

As an example, consider Klein's proposal that a "most favored customer" clause will yield an efficient market outcome. He argues that customers need not anticipate all contingencies, because they can protect themselves against ex post holdups by a contractual provision that guarantees they will receive the same terms as the most favored customer.⁴⁰ To the contrary, however, all customers may be treated identically and may have complete information about current and future prices, yet firms will still rationally charge above-cost aftermarket prices.⁴¹

To be fully protected, customers must be able to write contracts not only on variables such as price and performance terms, but also on the extent to which the firm permits or even encourages entry into the aftermarket by future competitors. In general, it will not be possible to write contracts between a customer and a manufacturer that ensures the manufacturer will permit or encourage the entry of lower-cost, quality-enhancing rivals. Thus, it is unreasonable to expect that enforceable contracts can be written that protect customers completely.

The "contractual protection" view suffers from an excessive reliance on theory. Contracting cannot rule out the possibility of inefficient outcomes in aftermarkets; its probability of success depends in any particular case on the relevant facts. A case-by-case factual analysis of contractual protection will be needed to determine whether they have protected, or can protect, consumers from market power in a particular aftermarket.

IV. VIRTUAL MAINTENANCE V. PRIME COMPUTER

While the Supreme Court decision in *Kodak* has set the framework for the relevant analysis, *Kodak* only concerns summary judgment. As Justice Blackmun made clear, "Kodak's arguments may prove to be correct."⁴² In a closely related case, *Virtual Maintenance v. Prime Computer*, a jury unanimously found that Prime Computer violated Section 1 of the Sher-

⁴⁰ Klein, *supra* note 38, at 51.

⁴¹ In practice, providing aftermarket services to customers of different sizes, in different locations, and with different needs will involve different costs and different customized terms. The complexity induced by the multiple dimensions of aftermarket services may render simple, uniform contractual protection infeasible.

⁴² 112 S. Ct. at 33.

man Act.⁴³ The Sixth Circuit reversed the decision, concluding that the aftermarket theories presented to the jury were erroneous as a matter of law.⁴⁴ The Supreme Court granted certiorari and remanded the case to the Sixth Circuit for reconsideration in light of the *Kodak* decision.⁴⁵ In its second opinion the Sixth Circuit concluded that the theory of potential aftermarket power was correct as a matter of law, and that the facts supported the theory.⁴⁶

Virtual is an important case because the alleged abuse of aftermarket power received a full hearing on the facts. Prime was a company that manufactured minicomputers with a proprietary architecture, known as Series 50 machines. In the aftermarkets, Prime offered Series 50 maintenance contracts and software support contracts that included upgrades to various proprietary software products. Virtual Maintenance is an independent company that wanted to compete for hardware maintenance of Series 50 minicomputers. Virtual found that Prime required customers to purchase hardware maintenance from Prime if they wanted to obtain essential software upgrades and support. As a result, Virtual was unable to sign maintenance customers.

Due to its geographic location and prior customer relationships, Virtual was particularly interested in customers who used their Prime computers to run a design program called PDGS. PDGS is owned by Ford Motor Company, which requires its outside design contractors to use it. However, PDGS ran only on Prime minicomputers, and Prime had the exclusive right from Ford to license PDGS and to set prices and terms. Ford released one or two PDGS upgrades each year that designers were required to obtain. Prime provided upgrades for about \$12,000 per year (per copy) to customers who also purchased Prime hardware maintenance. Otherwise, customers would have to pay about \$100,000 per copy annually for PDGS software upgrades.

The case illustrates the three main points of this article: Prime was able profitably to exploit its aftermarket power over locked-in customers

⁴³ No. 89-CV-71762-DT (E.D. Mich. 1990). One of the authors of this article, Jeffrey MacKie-Mason, testified as an expert witness on behalf of Virtual. The facts provided in this section are offered to illustrate the theoretical points made elsewhere in this article; it is not the authors' intent to re-try *Prime* or convince the reader that we have made a fully balanced presentation of the facts. Where factual assertions are not cited, they can be found in the district court trial testimony; the court did not enter its own findings of fact.

⁴⁴ 957 F.2d 1318 (6th Cir. 1992).

⁴⁵ 113 S. Ct. 314 (1992).

⁴⁶ 995 F.2d 1324, 1330 (6th Cir. 1993).

despite competition in the market for equipment sales; consumers were harmed by the exclusion of aftermarket competition in terms of both price and product choice; and ex ante contracting was not sufficient to avoid the aftermarket problem.⁴⁷

A. AFTERMARKET POWER IN *VIRTUAL*

Virtual alleged that Prime was illegally tying hardware maintenance to software upgrades and support. Prime had proprietary control over crucial software products, including the only operating system software that ran on Prime minicomputers and Ford's design software, PDGS. Customers who already owned Prime computers needed to obtain software upgrades and support or the value of their substantial investment in hardware, custom software, training, data, and designs would be effectively lost. Thus, it seemed clear that Prime had economic power over the tying products (software upgrades and support), one element of an illegal tie. Further, Prime seemed to be in a position to use this power adversely to impact competition in the hardware maintenance market. Indeed, essentially 100 percent of the maintenance on Series 50 minicomputers in the United States was performed by Prime.

Prime denied having economic power over locked-in customers for software. Prime argued that it could not raise hardware maintenance prices above competitive levels because doing so would be unprofitable overall: any profits gained on hardware maintenance would be less than those lost on equipment sales. Prime argued that equipment sales would be lost because the minicomputer market is quite competitive.⁴⁸ A tie without economic power is not an antitrust violation.

To address whether a firm has the potential profitably to raise prices above the competitive level, courts generally determine the relevant markets for analysis, then examine the firm's share of that market, the overall concentration of the market, and the effect of the firm's actions on competition in the market. Defendants usually argue for a broad market definition and then point out their small market share, while plaintiffs suggest narrower markets in which the defendant has a high share.

In *Virtual* there were two aftermarkets alleged by the plaintiff: upgrades and support for Prime proprietary software (the tying product

⁴⁷ While this case illustrates many of our points, we want to emphasize that our results apply to a much broader, more general set of circumstances than those represented by the facts of this case.

⁴⁸ The plaintiff did not contest the fact that the minicomputer market is competitive. Prime claimed to have only a 3% share of a worldwide market for computer systems. Memorandum in Support of Prime's Motion for Summary Judgment at 3, *Virtual*.

market) and Series 50 hardware maintenance (the tied product market).⁴⁹ Virtual asserted that these markets were separate from one another and separate from the original equipment market. Thus, the tie that Prime imposed allowed supracompetitive pricing in the hardware maintenance market, which harmed consumers. Prime responded that these aftermarkets were too narrow to be usefully considered as markets due to competition in the market for new equipment sales, and thus that the correctly defined market was the market for computer systems.

Prime's defense ignored the incentive that it had to exploit incumbent customers who were locked-in to its equipment. There was never much doubt that customers who already owned Series 50 equipment were locked-in to Prime, particularly those who had already licensed PDGS and were doing design work for Ford. Series 50 minicomputers were priced from \$100,000 to \$500,000. The initial PDGS license was about \$120,000 per machine, and several designers had ten or more licenses. In addition, design customers had invested years in training users and developing valuable contractual relationships and experience with Ford. Non-PDGS customers often had invested in developing custom software that could run only on the Series 50. Indeed, at trial, a Ford manager who was testifying as a witness for Prime stated that if Ford had to switch quickly to a different brand of computer it would be forced out of the car business.

In its first opinion, the Sixth Circuit did not recognize that with such a large, locked-in base of installed customers, Prime would face a balancing between profits on aftermarket products and profits on new equipment sales. The court placed all of the emphasis on the competition for equipment sales:

A customer's initial purchase of a particular manufacturer's product does not justify a limited market definition. Defining the market by customer demand *after* the customer has chosen a single supplier fails to take into account that the supplier . . . must compete with other similar suppliers to be designated the sole source in the first place.⁵⁰

Based on this reasoning, the Sixth Circuit panel reversed the jury verdict. After the Supreme Court's *Kodak* decision, however, the Sixth Circuit reversed itself, noting that high switching costs created a group of locked-

⁴⁹ It was demonstrated in trial that Prime imposed its tying conditions on all of its proprietary software products. There were over 100 of such products, including the operating system software that every customer needed to use its minicomputer. However, the appeals court restricted its consideration to the tie imposed on PDGS, and thus considered only market definitions limited to upgrades and support for design software and Ford-required design software. 995 F.2d at 1328.

⁵⁰ *Id.*

in customers over whom it might be profitable to exercise market power even if the market for new equipment sales were competitive. The court found that users were locked in by their prior investments in hardware, training, and software development, and that "Prime is able to exercise control over the sale of software support because of its exclusive distribution license from Ford, and Ford's requirement that its automotive design suppliers use the most current version of Prime's software support."⁵¹ The Court concluded that the proffered aftermarket was appropriate because there was a potential that exploiting those customers would be profitable for Prime.

Consistent with our earlier discussion of incentives to raise aftermarket prices, it emerged at trial in this case that aftermarket services and products were responsible for an increasing fraction of Prime's revenues and profits. The large installed customer base relative to potential new sales moved the balance between aftermarket and new equipment profits in favor of significant aftermarket exploitation.⁵²

B. HARM TO CONSUMERS

The factual record in *Virtual* provided evidence that consumers were harmed by the tie, both via effectively higher aftermarket prices and lack of a high-quality alternative. Software upgrade prices were 900 percent higher if not purchased through the tie, whereas if customers purchased hardware maintenance from Prime to get the lower tied price on software upgrades, they had to pay about 20 percent more than the maintenance prices offered by Virtual.⁵³ Furthermore, customers testified that they preferred Virtual's service but for the tie, and thus felt forced.⁵⁴

As explained above, when a manufacturer excludes competition from an aftermarket, the harm to customers may extend beyond high mark-

⁵¹ *Id.* at 1330.

⁵² Indeed, about two years after the trial, Prime changed its name to Computervision and halted all equipment manufacturing. However, at trial there was never any discussion of Prime as a declining company, or indication that Prime might be exploiting its aftermarket customers because it expected to be leaving the equipment business. Indeed, Prime repeatedly stated in its briefs before the district and appeals courts that it would not exploit aftermarket customers because to do so would affect its many years of expected future equipment sales. See, e.g., Memorandum in Support of Prime's Motion for Summary Judgment at 3, *Virtual*; Reply Brief of Defendant-Appellant Prime Computer, Inc. at 13, *Virtual*.

⁵³ 957 F.2d at 1322.

⁵⁴ Cf. *Jefferson Parish Hosp. Dist. No. 2 v. Hyde*, 466 U.S. 2, 12 (1984) (defining the ability to force the buyer to purchase an unwanted tied product as the "essential characteristic" of illegal tying arrangements).

ups. In particular, the manufacturer may limit the variety of products available, in terms of both quality and product characteristics. That appears to have been the case in *Virtual*. Virtual offered more flexible hours and days of coverage than Prime, allowing each client to negotiate customized terms. Virtual offered to provide more extensive preventative maintenance. Extensive evidence was presented that customers believed Virtual provided higher quality service than Prime (based on Virtual's prior service of non-Prime equipment). In addition, Virtual developed and promoted a disaster recovery service to differentiate itself from Prime.

Prime's exclusion of Virtual harmed customers in another way, as well. All PDGS users had Lundy graphics terminals attached to their Prime minicomputers. Virtual already maintained more than 50 percent of the Lundy terminals in the region. As Prime's witnesses argued at trial, many customers might prefer to have a single provider of hardware maintenance for their computers and peripherals in order to reduce fingerpointing and increase the efficiency of service provision. Excluding Virtual from the Prime Series 50 maintenance market denies customers the opportunity to obtain one-stop hardware maintenance from a preferred vendor.⁵⁵

C. WAS CONTRACTUAL PROTECTION A VIABLE ALTERNATIVE?

The possibility that customers could have protected themselves from aftermarket exploitation through fully contingent contracts signed at the time of the initial equipment purchase was not examined at trial.⁵⁶ However, some of Prime's other policies illustrate the difficulty of contractual protection for a complex, multidimensional product like computer maintenance.

From time to time, Prime would develop revisions to the microcode that controlled the fundamental operations of the computer.⁵⁷ Such revisions might fix a malfunction or improve functionality. Customers often view obtaining the latest microcode revisions as essential to efficient or correct operation of their equipment. For many years, Prime made microcode revisions available to all Series 50 customers for the cost of the media (about \$15). Customers could perform the simple installation task. Overnight delivery was available. However, around the time of

⁵⁵ Within a year of trial, Virtual had contracts to maintain slightly more than 50% of the Series 50 computers running PDGS that had been formerly maintained by Prime.

⁵⁶ The longest maintenance contract offered by Prime was for 3 years.

⁵⁷ Microcode runs at a more primitive level than an operating system; users do not usually interact with microcode directly.

Virtual's attempted entry, Prime changed the policy: customers with Prime maintenance would continue to receive the revisions as part of their maintenance contract. Nonmaintenance customers now had to pay \$2500, send in the board from their computer on which the microcode was to be installed, and wait up to thirty days for the board to be returned. Of course, in most cases a computer cannot function at all when one of its boards is missing.

Prime similarly changed its board repair policy at about the same time. For some time, if a single board component failed, a customer could receive an exchange board by overnight delivery, and Prime would repair the original board for a modest charge. Under the new policy, similar to the microcode policy, nonmaintenance customers had to mail in the board for repair without receiving an exchange, pay a minimum \$2500 board repair fee, and wait up to thirty days for the repair.

Prime's variety of policies illustrates the complexity that would be required in any contract that attempted to impose *ex ante*, long-term restrictions on a firm's ability to exploit aftermarket power. When a firm has legitimate economic power due to proprietary control of software or hardware design, for example, there are numerous and subtle ways in which that power can be extended to other markets.

D. SUMMARY

The *Virtual* record was never completed. In its second opinion, the Sixth Circuit remanded to the district court for a new trial because of a judicial error. This decision was on appeal to the Supreme Court when the parties settled. However, the Sixth Circuit concluded that sufficient evidence was presented at trial to support the claim that Prime could and did profitably exert economic power over an aftermarket, despite competition in the market for new equipment. Consumers were harmed not only through higher aftermarket prices, but also through a reduction in the variety of product characteristics and quality that was available. Finally, the complexity of the aftermarket service and maintenance products, as seen in the many dimensions through which Prime could impose anticompetitive policies, is consistent with our argument that completely contingent *ex ante* contracts are not a feasible mechanism for eliminating the exercise of aftermarket market power.

V. IMPLICATIONS FOR ANTITRUST POLICY AND PRACTICE

We have shown that competition in the equipment market does not discipline aftermarket prices, that consumers are harmed by the lack of aftermarket competition, and that contracts cannot necessarily protect

consumers. Since harm to the consumer caused by reduced output, exclusion of cost-reducing competition, and restrictions on product variety and quality are specifically the concerns of antitrust law, there appears to be a role for antitrust policy. Applying antitrust proscriptions to aftermarket practices such as tying and the foreclosure of competition can have procompetitive effects. If contracts and reputation are insufficient, a clear antitrust rule might provide an alternative commitment mechanism that moves pricing and other practices closer to their efficient, competitive ideal in both primary markets and aftermarkets. While we would not assert that all aftermarket strategies such as tying reduce competition or that all such strategies harm consumers, the theoretical and practical possibilities of these harmful outcomes make it prudent to consider each case on its individual merits.

Past cases have emphasized the degree of competition and the availability of information as determinants of the rationality of anticompetitive behavior in aftermarkets. In fact, anticompetitive behavior in aftermarkets will occur even with perfect competition and perfect information in the primary markets. Attention should be focused instead on the factors that determine the relative size of current profits to future profits. Our analysis highlights the following questions as relevant to the existence and magnitude of anticompetitive behavior:⁵⁸

- How important are current aftermarket profits relative to future equipment and aftermarket profits? The more important are current aftermarket profits, the less that reputation effects will moderate current aftermarket power. For example, is the market growing or declining? Does the firm have a short-term technological advantage, after which the business will become “commoditized” and profits reduced? Are systems evolving away from proprietary towards open architectures, thus reducing the extent to which future customers will be locked in?
- What is the magnitude of switching costs? The more “locked in” customers are, the higher are potential profits from raising price in the aftermarket.
- How sensitive is aftermarket demand to changes in price and other terms? Sensitivity to terms determines the degree of consumer loss from aftermarket market power.
- How important are long-term reputations for favorable aftermarket practices in the industry? Do firms tend to introduce unfavorable policy changes after the market has matured? Is there rapid entry

⁵⁸ See also Borenstein, MacKie-Mason & Netz, *supra* note 13; Kattan, *supra* note 28.

and exit by industry participants? How complete is information on the terms and costs of aftermarket services?

- How difficult is it for customers to write long-term contracts with equipment manufacturers that provide protection against aftermarket price increases and other policy changes? How many dimensions must be considered in protecting against future service and product policies?

These are some of the questions that need to be addressed in an economic analysis of alleged exercise aftermarket power. The answers will determine the trade-off firms face between current and future profits, and thus determine the degree to which firms will exercise market power in the aftermarket and the resulting impact on consumers.