AN ECONOMIC PERSPECTIVE ON THE ANTITRUST CASE AGAINST INTEL

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This study was commissioned by the Computer & Communications Industry Association (CCIA) as an independent economic assessment of the antitrust cases against Intel Corporation. The views and opinions expressed in this study are solely those of the authors and do not necessarily reflect the views and opinions of CCIA, its members, or any of the organizations with which the authors are or have previously been associated.

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EXECUTIVE SUMMARY

There has been much recent discussion about the on-going string of cases in the U.S. and abroad involving allegations that the Intel Corporation ("Intel") offered a variety of payments to computer manufacturers (often referred to as original equipment manufacturers, or "OEMs") in exchange for sourcing all or most of their microprocessor demand from Intel.[1] According to the allegations, these payments have enabled Intel to maintain its dominance over its only significant rival in microprocessors, AMD, and have therefore resulted in reduced competition and higher prices. The intensity of these discussions has only increased following the European Commission's decision this May to fine Intel €1.06 billion (approximately $1.5 billion) – its highest fine ever – for allegedly violating provisions of the EC Treaty that prohibit abusive conduct by dominant firms. The U.S. Federal Trade Commission also recently announced that it had opened an investigation into whether Intel's conduct harmed competition.

Intel has ardently defended its payments on the grounds that they are procompetitive and are likely to be passed on to consumers. Intel has further argued that because it charges prices that are above its cost, it has not engaged in predatory pricing, and that therefore there is no valid basis to the allegations or to the European Commission's recent decision.

As a matter of economic theory, it is clear that Intel's alleged conduct may be harmful to competition and consumers, and therefore should be carefully analyzed on an empirical basis. In this paper, we provide an economic framework with which to assess certain allegations against Intel. We are not privy to the confidential case materials and therefore are in no position to undertake a rigorous empirical application of this framework. Instead, we limit ourselves to a discussion of economic theory underlying the case – and a discussion of features of the microprocessor market that play an important role in the application of those theories.

At the heart of these allegations is a series of payments from Intel to OEMs that were allegedly conditional on the OEMs' achieving a certain threshold of microprocessor purchases from Intel. For example, Intel allegedly offered substantial rebates to Dell that were conditional on Dell purchasing microprocessors exclusively from Intel. Economists often refer to payments that are conditional on a customer's loyalty as "loyalty rewards." Intel allegedly also paid certain OEMs to delay their introduction of AMD-powered computers that were already designed and

[1] Microprocessors, such as the Intel Pentium, are semiconductor chips that serve as the "brains" of a computer.

threatened to retaliate against OEMs that purchased microprocessors from AMD by withholding rebate payments or delaying microprocessor shipments. In this paper, we focus on Intel's alleged loyalty rewards but note that, conceptually, its other alleged price and non-price acts can have similar effects on competition as loyalty rewards. To assess the competitive implications of Intel's business conduct, one need not focus on any particular action in isolation rather than on the totality of Intel's conduct and the combined impacts of those actions on competition.

The economic framework for assessing whether a defendant's loyalty rewards are anticompetitive consists of the following six steps:

Step 1 – Determine whether Intel has or is likely to have significant market power in the relevant market. The concern with loyalty rewards is that a firm with market power over some portion of a market may be able to lever it into other, more competitive, portions of the market. If Intel does not have market power to begin with, its use of loyalty rewards is highly unlikely to be anticompetitive. And if Intel does not have and is unlikely to have market power after its use of the challenged practices, then there is no anticompetitive effect (at least as yet).

Step 2 – Determine whether the loyalty rewards entail profit sacrifice by Intel on the "contestable" portion of its customers' demand. Loyalty rewards are more likely to satisfy the criteria for being anticompetitive when a defendant's rivals are unable to compete effectively for all of the market demand, either because rivals are capacity constrained or because the customer is unwilling entirely to forego purchasing from the defendant. Economists typically refer to the portion of demand for which rivals cannot effectively compete as "uncontestable," and the portion for which they can compete as "contestable." Because customers will purchase the uncontestable portion of market demand from the defendant (Intel) regardless, the loyalty program only affects customers' decisions on how much of the contestable portion to purchase from the defendant. Thus, the appropriate way to analyze a loyalty program is to allocate all of the loyalty rewards to the contestable share of the customers' purchases from the defendant, and then ask whether the resulting "average incremental price" entails the sacrifice of profits by the defendant *when considering the customers' contestable*

purchases in isolation.[2] The clearest case of such short-term profit sacrifice can be when the defendant's average incremental price is below its cost.[3] However, as a matter of economic theory, a firm may be able to exclude its rivals in an anticompetitive manner through prices for the contestable share of demand that are above the defendant's cost but below its short-term profit-maximizing level.

Step 3 – Determine whether Intel's loyalty rewards (and other alleged price and non-price exclusionary conduct) foreclose rivals from a significant share of the contestable portion of the market. Unless Intel's agreements involving loyalty rewards, when viewed in combination, foreclose rivals from a significant share of the contestable portion of the market, rivals and competition more generally are unlikely to be significantly harmed. For example, if Intel entered into a scheme that foreclosed AMD from one percent of the market, AMD's ability to compete likely would be barely affected – and thus, there would be no significant harm to competition. However, when examining the contestable portion of a market allegedly foreclosed by Intel's loyalty rewards, additional weight should be given to the foreclosure of key customers or segments that may influence the purchasing decisions of other customers.

Step 4 – Determine whether the market foreclosure resulting from the loyalty rewards significantly diminishes AMD's ability to compete. The mere fact of rivals losing sales does not necessarily imply a harm to competition or consumers. As the U.S. Supreme Court articulated, it is "axiomatic that the antitrust laws were passed for 'the protection of competition, not competitors.'"[4] It is necessary to show that the loss of foreclosed sales diminishes the rivals' ability to compete more generally. This could be true, for example, if the sales lost due to foreclosure prevent rivals from achieving sufficient economies of scale to compete effectively. Similarly, lost sales could deprive rivals of the cash flow necessary to finance R&D investment, which could result in diminished product offerings in the future.

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[2] If the rival can effectively compete to serve all customers' demand, then this step is equivalent to its counterpart in an economic analysis of predation. Ordover, Janusz and Robert Willig. "An Economic Definition of Predation: Pricing and Product Innovation." Yale Law Journal. Vol. 91. November 1981. pp. 8-53. ("Ordover/Willig")

[3] We discuss the relevant measure of the defendant's cost below.

[4] *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209. 1993. p. 224.

Step 5 – Determine whether the conduct allows Intel to maintain or significantly increase its market power. Even if established rivals' ability to compete has been reduced, the defendants' market power might not increase if entry into the market were easy and new rivals could competitively constrain the defendant. Conversely, if there are significant barriers to entry, a significant weakening of rivals is likely to lead to an increase in Intel's market power, which, all else equal, can be expected to result in higher prices or lower product quality.

Step 6 – Determine whether any expected anticompetitive effects are outweighed by any procompetitive benefits of the loyalty program. Loyalty rewards can have a number of procompetitive benefits, such as aligning the incentives of a manufacturer and its downstream customers in product development and promotion, or eliminating the double markup that often occurs when both the manufacturer and its downstream customers have market power in their respective markets. Loyalty rewards may be a form of pro-consumer volume discounts, where the loyalty provisions are needed to calibrate the thresholds for the discounts across disparate customers. An analysis of loyalty rewards should evaluate whether any such procompetitive benefits exist, whether they could have been achieved through less restrictive means, and, if not, whether these benefits outweigh the potential anticompetitive effects.

In what follows, we discuss this economic framework in greater detail and also identify a number of features of the microprocessor market that play an important role in the application of this framework to Intel's alleged conduct. It is our desire that this paper helps to clarify the elements that an empirical investigation needs to illuminate in order to reach the right conclusions for the public interest. For example, while we are not privy to the confidential version of the European Commission's decision, it appears as though the European Commission undertook an extensive empirical investigation and utilized a framework that may be broadly consistent with the economic framework described in this paper. It is ultimately through these investigations, as well as the private litigation matters, that an empirical assessment will be made whether Intel actually harmed competition and consumers.

I. BACKGROUND

a. Microprocessors

Microprocessors are the brains of a computer and are responsible for executing a menu of instructions and performing requested computations. Original equipment manufacturers, such as Dell, HP, etc., assemble microprocessors and other components (memory, optical drives, etc.) into a final computer product. There are three primary computer platforms: (i) desktop PCs, (ii) mobile PCs, and (iii) servers. Desktop PCs are stationary personal computers, while mobile PCs, commonly referred to as "laptops," are relatively small and designed to be portable (*e.g.*, use lower amounts of energy). Servers are designed to provide services to multiple users over a network, to manage large amounts of data, and to perform complex transactions. While there is differentiation both within and across computer platforms, each platform can roughly be divided into high-performance and value segments.

Microprocessors are created through a multi-step semiconductor fabrication process wherein electronic circuits are constructed on a silicon wafer (a thin slice of pure silicon crystal). Microprocessor fabrication is capital intensive: Intel spends 10-20 percent of its revenues on plants and equipment, and a new fabrication facility can cost up to $3 billion.[5]

b. Intel

Intel was founded in 1968 and rose to prominence following IBM's decision in the early 1980s to include Intel's microprocessor architecture as part of the original PC standards.

Microprocessors are defined by the body of machine language instructions (instruction set) that a computer can follow. As a result of Intel's early microprocessor naming convention, Intel's microprocessor architecture is characterized by the "x86" instruction set. The first IBM PC, released in 1981, contained a version of Intel's 86 microprocessor. Over the next decade, Intel released the 286, 386, and 486 microprocessors, and by the early 1990s was the dominant manufacturer of PC microprocessors.

In 1993, Intel introduced its first Pentium brand microprocessor and initiated an aggressive marketing campaign known as "Intel Inside." The "Intel Inside" campaign effectively linked

[5] Casadesus-Masanell, Ramon and David B. Yoffie. "Wintel: Cooperation or Conflict." Working Paper #05-083. 2005. p. 5. <http://www.hbs.edu/research/pdf/05-083.pdf>.

Intel microprocessors to branded PCs and made Intel a household name. Throughout the late 1990s and early 2000s, Intel released a new Pentium microprocessor every few years and also introduced a value-priced Celeron brand. More recently, in 2006, Intel launched its Core 2 Duo processor.[6]

Intel remains the dominant manufacturer of x86 microprocessors to this day. From 2000 to2008, its annual unit share of the US x86 microprocessor sector consistently exceeded 75 percent.[7] During this time, its average unit share in each of the three main market segments – desktop PCs, mobile PCs, and servers – was also above 75 percent.[8] Its average unit share among major OEMs, such as Dell, HP and IBM, was nearly 90 percent.[9]

c. Evolution of Competition from AMD

Following IBM's inclusion of Intel's x86 microprocessor architecture in the IBM PC, IBM sought to ensure that a second source of x86 microprocessors existed. As part of IBM's original contract with Intel, Intel was required to publish its technological standards and to license a competing manufacturer. Consequently, AMD, which had been established in 1969, abandoned its previously developed microprocessor architecture and agreed to become a second source of supply for x86 microprocessors. Cooperation between Intel and AMD did not last long, as Intel sought to become the sole-source supplier of its 386 microprocessor in 1984. AMD sued Intel for breach of contract and in 1992, after five years of litigation, AMD was awarded a permanent, nonexclusive and royalty-free license to the x86 instruction set. In 1995, AMD settled its remaining outstanding disputes with Intel and subsequently introduced its first independently designed x86 microprocessor, the AMD-K5. AMD introduced its second x86 microprocessor, the AMD-K6 in 1997.

The pace of competition between AMD and Intel greatly accelerated towards the end of the decade with the release of AMD's Athlon microprocessor, which in 2000 became the first chip to

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[6] "The Personal Computer Turns 25: Then and Now Technology Timeline." <http://www.intel.com/museum/archives/pctimeline.htm>.

[7] Gartner Dataquest, Personal Computer Quarterly Statistics United States Database. Intel's revenue shares are likely larger than its unit shares because its microprocessors are, on average, more expensive than AMD's.

[8] *Id.*

[9] *Id.* We define the major OEMs as: Acer, Dell, Fujitsu/Siemens, Gateway/eMachines, HP, IBM/Lenovo, NEC, Sony, and Toshiba.

break the 1 GHz speed barrier.[10] Another major technological breakthrough for AMD came in 2003 with the introduction of its Opteron microprocessor for servers. The Opteron microprocessor was innovative because it allowed the x86 architecture to accommodate 64-bit processing while at the same time allowing for 32-bit software to run. The introduction of this microprocessor was made even more significant by the fact that Intel's proprietary instruction set designed for 64-bit processing, utilized in the Itanium microprocessor, failed to meet industry expectations. AMD reached another innovation milestone in 2004 when it introduced the first dual-core x86 microprocessor.[11]

Despite its technology success over the past decade, AMD's unit share of the x86 microprocessor market has remained below 25 percent in every year of this decade.[12] Its unit share of sales to major OEMs during that time has also remained well below 25 percent and has averaged slightly above 10 percent.[13]

d. Recent Litigation

As outlined in AMD's 2005 Complaint, Intel is accused of having maintained its monopoly power and suppressed competition in the market for x86 microprocessors through the following actions:[14]

- Exclusive or near-exclusive deals with major customers;
- Rebates, allowances, and marketing development funds contingent on customers limiting or forgoing purchases from AMD;
- Retroactive first-dollar rebates designed to have the practical effect of denying customers the freedom to purchase any significant processor volume from AMD; and
- Retaliation against customers who introduced AMD-based platforms, particularly in strategic market segments.

In addition to the private litigation pending in the United States, Intel's allegedly anticompetitive conduct has been investigated in multiple international jurisdictions.

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[10] "History of AMD." 2009. <http://www.amd.com/us-en/Weblets/0,,7832_10554,00.html>.

[11] *Id.*

[12] Gartner Dataquest, Personal Computer Quarterly Statistics United States Database.

[13] *Id.*

[14] Complaint in *Advanced Micro Devices, Inc. vs. Intel Corporation*. United States District Court for the District of Delaware, Civil Action No. 05-441. p. 2. <http://www.amd.com/us-en/assets/content_type/DownloadableAssets/AMD-Intel_Full_Complaint.pdf>.

In March 2005, the Japanese Fair Trade Commission ("JFTC") found that Intel had bribed five OEMs with rebates and marketing development funds to refrain from adopting competitors' microprocessors.[15] Intel agreed to abide by the JFTC's recommendations and to modify certain practices.[16]

Similarly, following a three-year investigation, the Korean Fair Trade Commission ("KFTC") concluded in June 2008 that "Intel tried to exclude its competitor AMD…by providing various rebates to local…OEMs…contingent upon them not purchasing CPUs from AMD."[17] The KFTC reported that OEMs were coerced into buying expensive Intel microprocessors which resulted in higher consumer PC prices and reduced product choice and variety. Ultimately, the KFTC's economic analysis concluded that "with Intel's rebate practice intact, AMD would not be able to viably compete against Intel, even if it supplies its CPUs to OEMs for free."[18]

In May of this year, the European Commission ("EC") levied its highest fine ever (approximately $1.5 billion) for Intel's violation of the provisions of the EC Treaty that prohibit abusive conduct by dominant firms. The EC's decision found that Intel's conditional rebates (*i.e.*, loyalty rewards) and "naked exclusionary tactics" were part of a single strategy aimed at foreclosing AMD.[19] The framework described by the EC in its assessment of Intel's conduct seems to be broadly consistent with the framework articulated in this paper.[20]

The U.S. Federal Trade Commission also recently announced that it has opened an investigation into Intel's conduct.[21]

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[15] "The JFTC rendered a recommendation to Intel K.K." Japan Fair Trade Commission. p. 1. <http://www.jftc.go.jp/e-page/pressreleases/2005/March/050308intel.pdf>.

[16] Kawamoto, Dawn. "Intel to abide by Japan FTC recommendations." CNET News. March 31, 2005.<http://news.cnet.com/Intel-to-abide-by-Japan-FTC-recommendations/2100-1014_3-5649589.html>.

[17] "Intel's Abuse of Market Dominance." Korea Fair Trade Commission. p. 1. <http://eng.ftc.go.kr/bbs.do?command=getList&type_cd=18>.

[18] *Id.* p. 4.

[19] "Commission Decision of relating to a proceeding under Article 82 of the EC Treaty and Article 54 of the EEA Agreement." European Commission. COMP/C-3 /37.990 – Intel. May 13, 2009.

[20] We do not access to the full unredacted version of the EC decision; at this point, only a redacted version has been made public.

[21] Bartz, Diane. "U.S. Closer to Filing Complaint Against Intel: Sources." Reuters. October 23, 2009. < http://www.reuters.com/article/ousiv/idUSTRE59M4WM20091023>.

II. LOYALTY REWARDS – AN OVERVIEW

In this paper, we discuss the allegations that Intel engaged in anticompetitive conduct that had the effect of limiting AMD's ability to compete effectively and harming competition in the x86 microprocessor market (hereafter referred to as the "microprocessor market," for simplicity). We do not have access to confidential case materials and therefore do not attempt to assess whether Intel's conduct is or has actually been anticompetitive. Rather, we offer an economic perspective on a framework for analyzing the issues raised by Intel's business conduct – and identify the circumstances under which they *may* be anticompetitive.

As described above, Intel has allegedly maintained a dominant position and suppressed competition in the market for microprocessors through a number of different actions. The bulk of these alleged actions can be summarized as payments to OEMs that are conditional on the OEM achieving a certain threshold of microprocessor purchases from Intel.[22] Economists and antitrust practitioners often refer to such payments as "loyalty rewards," and a proper economic analysis of such payments is more complex than that of simple price reductions.

In the simplest case, a loyalty program has two components – the payment itself and a threshold of purchases for receiving that payment. The loyalty payment threshold can be based on the customer's purchase volume ("volume rewards") or on the share of a customer's purchases ("market share rewards"). A market share reward with a 100% threshold is sometimes referred to as an exclusivity payment.[23] The threshold may also depend on purchases of a single product or on purchases of multiple products ("single product" and "bundled" loyalty rewards, respectively). The loyalty payment itself can take several forms. One example is a simple rebate, another is a discount applied to all units purchased by the customer ("first-dollar

[22] Even some of the other allegations can be analyzed using a similar framework. For example, Intel allegedly paid OEMs to delay introductions of products powered by AMD microprocessors. Such payments are analytically similar to loyalty payments because they involve alleged payments for achieving a certain threshold of purchases from Intel, in this case, a 100 percent threshold (assuming the OEM did not sell any other products powered by AMD microprocessors) for some period of time. These can be thought of as somewhat analogous to loyalty payments, but may be worse from a competition perspective because the OEM and AMD have already invested in technology.

[23] If the payment is sufficiently large, an exclusivity payment effectively becomes an exclusive deal. Intel allegedly entered into a number of *de facto* exclusive deals with OEMs. Although there is a large body of economic literature devoted to exclusive dealing, our discussion does not focus specifically on exclusive dealing but rather on the broader framework applicable to loyalty rewards more generally, of which exclusive dealing is but one example.

discounts"), and a third is a discount that applies to all units purchased beyond the designated threshold. In this paper, we focus on single-product market share rewards in which the payment takes the form of a rebate or a first-dollar discount applied to all units, as these are the types of loyalty payments Intel allegedly used. As discussed below, these types of loyalty rewards may, in some circumstances, be used by a dominant firm anticompetitively to suppress or exclude smaller rivals from a market.

Intel has allegedly attempted to exclude AMD through a number of other practices besides the use of loyalty rewards. For example, Intel allegedly threatened retribution against OEMs that purchased microprocessors from AMD through a number of means including withholding rebate payments and delaying microprocessor shipments. Intel also allegedly paid certain OEMs to delay their introduction of AMD-powered computers that were already designed. Conceptually, these types of threats can have a similar effect on competition as loyalty rewards by creating a financial incentive for OEMs to purchase from Intel to the exclusion of AMD. As such, they can be analyzed using the loyalty payment framework described below. Intel has also allegedly paid retailers not to carry PCs powered by AMD's microprocessors. While we do not focus on such payments in this paper, they may also be anticompetitive in certain circumstances. A rigorous assessment of Intel's conduct should consider the combined effect of Intel's alleged price and non-price exclusionary practices.

a. Loyalty Rewards Should Be Analyzed Differently than Uniform Discounts

As a general principle, price reductions are usually procompetitive and are in fact thought to be one of the primary benefits of increased competition. A classic example of this benefit occurs when an entrenched monopolist is forced to reduce its prices to avoid loss of sales to a promising new entrant. However, in certain circumstances, these types of price reductions may actually harm competition. For example, prices may be lowered so much that they become "predatory" by driving a scarce rival out of the market. Similarly, loyalty rewards may, under some conditions, be used by a dominant firm to exclude an otherwise competitively capable rival.

To understand the conditions under which loyalty rewards of the type allegedly offered by Intel could be anticompetitive, it is useful first to consider the more straightforward case in which a dominant firm offers a customer an unconditional discount on all of the units purchased by that customer. In this scenario, the discount may be anticompetitive only if its profitability depends on a reduction in rivals' ability to compete effectively or on their exit from the market. Put

differently, as long as the dominant firm is not sacrificing short-run profits assuming the continued viability of its rivals, it should be judged as adopting conduct that is consistent with competition.[24] However, if the dominant firm's conduct is sacrificing short-run profits (*e.g.*, by pricing below its cost) under the assumption that rivals will remain competitively capable, this could be anticompetitive.[25]

The reasoning behind this test is that pricing at a level that is profitable only if rivals' ability to compete in the future has been diminished by the pricing does not constitute competition on the merits. For example, when a dominant firm prices below cost, its rivals may be forced to incur losses in order to make sales. If such rivals are financially constrained relative to the dominant firm, they may be forced to reduce their investment or exit the industry altogether. If sufficient entry and re-entry barriers exist, the dominant firm may subsequently be able to recoup its initial profit sacrifice through higher prices or reduced investment. The success of such a strategy is not dependent on the dominant firm's superior skill, foresight, or industry, but rather on having deeper pockets and on the assumed competitive harm the rival suffers from the conduct.

A showing that a dominant firm engaged in short-run profit sacrifice is a necessary but not sufficient condition for proving a harm to competition. A plaintiff claiming a harm to competition must also show that the dominant firm's prices did (or were likely to) induce the rival's exit and that competition was (or likely would be) significantly weakened as a result.[26] These two elements are tantamount to a showing that the dominant firm was (or likely would be) able to recoup its short-run sacrifice of profits through subsequent higher prices or reduced investment.[27] Showing that recoupment occurred or is likely is critical because otherwise consumers are unlikely to be harmed, even if certain rivals are harmed. Without recoupment, consumers would enjoy the benefits of low prices in the near term without having to face higher prices or lower product quality later. Also, without the anticipation of recoupment, the

[24] *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko, LLP*. (02-682), 540 U.S. 398 (2004). Section 3, stating "The unilateral termination of a voluntary (*and thus presumably profitable*) course of dealing suggested a willingness to forsake short-term profits to achieve an anticompetitive end."

[25] For a more thorough discussion of the profit-sacrifice test, see Ordover/Willig.

[26] It is possible, as a matter of economic theory, for there to be a harm to competition if the rival is weakened significantly in its ability to compete, instead of being forced to exit. In such a case, it is often necessary to show that the harmed firm is unable to achieve some significant economies of scale or scope due to the conduct.

[27] *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.* (92-466), 509 U.S. 209. 1993.

aggressive pricing is likely to have been motivated by a different incentive, and likely a more procompetitive one than the creation of profitable market power through diminution of a rival's ability to compete.

If rivals can effectively compete for all of a customer's purchases, an economic analysis of loyalty rewards is similar to the analysis of predatory pricing described above. For example, suppose that a customer wants to purchase 100 units of a good and that the dominant firm offers the customer a price of $10 per unit if the customer buys from both suppliers, and a loyalty payment of $2 per unit on all units if the customer buys exclusively from the dominant firm. Thus, the customer would pay an average price of $10 on its purchases from the dominant firm, unless it purchased from that firm exclusively, in which case it would pay an average price of $8. Now suppose that there is a rival selling an identical product. If the rival sets a price above $8, the customer will choose to purchase exclusively from the dominant firm. If the rival instead sets a price of $8 (or a shade below), and if all 100 units are "in play," then the customer will choose to buy exclusively from the rival.[28] Thus, given these details, the price against which the rival competes is the dominant firm's overall average price – in this example, $8. In such cases, a loyalty payment can be analyzed similarly to an across-the-board price reduction, *i.e.*, by asking whether the dominant firm's average price entails a short-run profit sacrifice.

An economic analysis of loyalty rewards diverges in some details from a predation analysis where rivals cannot effectively compete for all of a customer's purchases. This could occur, for example, because rivals are capacity constrained, or because the rivals' products are poor substitutes for the dominant firm's product for some portion of the customer's demand. Economists often refer to the portion of the market for which rivals can effectively compete as the "contestable portion" and the portion for which rivals cannot effectively compete as the "uncontestable portion."

To understand why the details of the analysis of loyalty rewards changes where a portion of the market is uncontestable, we return to our example from above, but instead assume that the customer can buy only 50 units from the rival. In this scenario, the dominant firm's average price is still $8, but the rival can no longer induce the customer to purchase from it by setting its price at or just below $8. To see why, consider the choice facing the customer if the rival sets its

[28] In fact, the rival could offer its own loyalty payment; as long as the average price after rewards associated with exclusivity were below $8, the customer would choose to buy from the rival.

price at $8: the customer can buy 50 units from the dominant firm for $10 each and 50 units from the rival for $8 each and pay a total of $900, or it can buy 100 units from the dominant firm and pay only $800. As a result, even though the rival matches the dominant firm's average price, the customer will not purchase from the rival. This example shows that an analysis of loyalty rewards differs in its details from, and is necessarily more complex than an analysis of alleged predatory uniform pricing.

The only difference between the previous two examples is that in the latter, the rival was assumed not to be able to compete effectively for all of the customer's demand. This assumption is critical; if the customer has to purchase at least 50 units from the dominant firm, then the loyalty payment is essentially an inducement to the customer to increase its purchases from the dominant firm from 50 units to 100 units. The inducement amounts to a $200 payment in exchange for the customer buying 50 additional units, which represents a payment of $4 per unit, not $2. Put differently, because the $2 payment applies to all 100 units when the dominant firm actually only needs to convince the customer to buy the additional 50 units, the effective payment is twice as large. A payment of $4 per unit leads to an effective price of $6 for the contestable 50 units, which is the price that a rival offering an identical product would have to meet or beat in order to make any sales to the customer. If this price were sufficiently low, rivals will be unable to compete profitably for the customer's contestable purchases. This example demonstrates that the mechanism through which a dominant firm can use loyalty rewards to exclude rivals can be characterized by the effective price it charges for the contestable portion of a customer's demand. This differs from the standard case of predatory pricing, in which exclusion occurs through a single price charged on all units purchased by a customer.

The preceding discussion illustrates how exclusion through loyalty rewards differs in its analytic details from standard predatory pricing. However, the mere fact that a competitor is excluded from a market does not equate to harm to competition. As the Supreme Court has often noted, the antitrust laws protect competition, not competitors.[29] In the next section, we lay out a generalized six-step economic framework for assessing loyalty rewards and identify several features of the microprocessor market that shape an assessment of Intel's alleged conduct in particular. As noted above, this framework is broadly consistent with the approach that seems to have been taken by the EC in its recent evaluation of Intel's conduct.

[29] *Brooke Group Ltd. v. Brown & Williamson Tobacco Corp.*, 509 U.S. 209. 1993. p. 224.

AN ECONOMIC FRAMEWORK FOR ASSESSING LOYALTY REWARDS

Step 1 – Determine Whether the Defendant Has Significant Market Power in the Relevant Market

Economists define market power as the ability to raise prices profitably above cost. A firm that does not and will not have market power in the relevant market will not be able to harm competition through the use of loyalty rewards.[30] Since most firms have at least some degree of market power (*i.e.*, price above marginal cost), in practice, loyalty rewards are a concern only if the defendant's market power at issue is *significant* market power. As discussed above, one condition for loyalty rewards to be exclusionary is that a portion of customers' demand is uncontestable. By definition, this portion of demand can be satisfied only by the defendant, which may enable it to charge a price significantly above its cost on the corresponding sales; as such, the defendant has significant market power.

We assume herein that Intel possesses significant market power in the microprocessor market. While we have not undertaken an empirical analysis of whether Intel has market power, it appears as though Intel has been the dominant producer of microprocessors for several decades. Although AMD has occasionally leapfrogged Intel technologically, at least for a time, Intel's share of microprocessors sold in the US has consistently remained above 75%, and its share in 2008 was 82%.[31] Intel has also seemed to demonstrate an ability consistently to charge prices above what seem to be pertinent measures of cost. Aside from the $1.5 billion dollar fine levied by the EC, Intel has remained profitable even during the current global recession.[32]

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[30] Loosely speaking, a relevant antitrust market delineates the domain in which one or more goods compete. It is described by a product or group of products and a geographic area. The relevant product market includes the set of products that are close substitutes for the product(s) on which the antitrust allegations are centered. The relevant geographic market comprises the area within which buyers of the relevant products are willing to substitute among suppliers. (See, e.g., U.S. Department of Justice & Federal Trade Commission, Horizontal Merger Guidelines April 2, 1992 (revised April 8, 1997), Section 1.) For the purpose of this paper, we assume the relevant market is the US market for x86 microprocessors.

[31] Gartner Dataquest, Personal Computer Quarterly Statistics United States Database.

[32] To be sure, the economics literature has shown that high and persistent profits, as well as varying profits among firms, are also consistent with competitive markets that perform well for consumers and social welfare. Firms may earn economic profits simply because they are more efficient, innovative, and entrepreneurial than their competitors. They may have accumulated valuable intangible assets that lower their costs of production or enhance demand for their

Step 2 – Determine Whether the Loyalty Rewards Entail Profit Sacrifice by the Defendant on the Contestable Portion of its Customers' Demand

Once it is established that the defendant has or likely will have significant market power, the next step in the framework is to assess the terms of the defendant's loyalty rewards. As discussed above, an antitrust assessment of loyalty rewards should focus on the defendant's "average incremental price," which refers to the price it charges for the contestable portion of demand after all loyalty rewards have been allocated to the contestable purchases. The relevant question is then whether the defendants' average incremental price would be profitable for the defendant only if it diminished the rivals' ability to compete or induced them irreversibly to exit the market altogether.

To understand why, remember that, by definition, the uncontestable portion of a customer's demand is devoted to the given supplier. A loyalty payment, regardless of the form it takes, is a payment to the customer in exchange for devoting a specified (or implied) share of the contestable portion of a customer's demand to the supplier offering the payment. As a result, the effective cost to the customer of allocating that share to the supplier offering the payment is the price it pays for those units minus the *entire* value of the loyalty payment. Combining this insight with the standard test for predatory pricing leads to the following test: allocate the entire loyalty payment to the contestable portion of demand, and then determine whether the resulting average incremental price entails short-run profit sacrifice by the defendant when looking only at the contestable portion of demand and assuming the continued viability of the rival. Alternatively, calculate what the customer would pay to the dominant supplier for the combined uncontestable and the contestable portions of demand, and subtract what the customer would pay for the uncontestable portion of demand alone. This difference divided by the number of units in the contestable portion of demand is the average incremental price charged for the contestable portion of demand. If this average incremental price is below the supplier's cost of providing these contestable units, then the loyalty program generating these data sacrifices profit. This

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products. Apparent profits may be normal returns on the value of such intangible assets. Some firms may be particularly adept at recognizing and taking advantage of unexplored market opportunities. Some firms may earn high economic profits as a result of taking on a substantial amount of risk. And some firms may earn high and persistent economic profits from luck – that is, some firms may be or have been in the "right place at the right time." *See, e.g.,* Fisher, Frank and JJ McGowan. "On the Misuse of Accounting Rates of Return to Infer Monopoly Profits." American Economic Review. Vol. 73, No. 1. March 1983. pp. 82-97.

follows since under these conditions, forgoing the contestable sales would save more costs than the relinquished revenues.

Returning to our earlier example, assume a customer demands 100 units, the first 50 of which are uncontestable, and the dominant firm offers the customer a price of $10 per unit with a loyalty payment of $2 per unit on all units if the customer buys exclusively from the dominant firm. Assume further that both the dominant firm and the rival have a cost of $8 per unit. Since the loyalty payment results in an average price of $8 per unit, it results in zero profit, but does not entail pricing below cost, on average. However, as discussed above, the dominant firm's average *incremental* price for the contestable portion of demand alone is $6, which is below its cost. To see why this pricing scheme entails profit sacrifice, suppose the dominant firm instead charged a price of $10 per unit for the first 50 units and a price of at least $8 per unit for the second 50 units. In that case, its average incremental price would be at least $8, which would equal or exceed its cost. It would earn $2 each on the first 50 units, and would not lose money on any additional sales. As a result, the dominant firm's profit would be at least $100, which is greater than the $0 profit it would earn under the original loyalty payment scheme. Hence, the original loyalty payment scheme entails profit sacrifice, which could be recouped by ensuring its rivals were diminished in their ability to compete.

The clearest case of profit sacrifice involving loyalty rewards entails the defendant's average incremental price below its average avoidable costs, where avoidable costs are defined as the costs the defendant could avoid by not producing the contestable volume of the good at issue.[33] Avoidable costs necessarily include all variable costs associated with the production of the product and may also include product-specific fixed costs, depending on the timing and nature of the alleged conduct relative to when the fixed costs were incurred. For example, if a defendant is alleged to have known when it invested in the development of a new product that it could not profitably recoup the fixed costs of that investment absent any consequent impact on its rivals' ability to compete, the defendant's R&D costs would be considered avoidable. If the product in question already existed when the defendant was alleged to have begun engaging in exclusionary conduct, then the fixed cost of developing the product would not be considered avoidable for the purposes of assessing that conduct. An average incremental price that is below the defendant's

[33] Baumol, William J. "Predation and the Logic of the Average Variable Cost Test." Journal of Law and Economics. Vol. 39, No. 1. April 2006. p. 49-72.

average avoidable costs is likely to entail profit sacrifice, because in such circumstances the defendant could do better by not serving the contestable portion of demand at all.[34]

Loyalty rewards may also be exclusionary where the average incremental price is above average avoidable cost. For example, a dominant firm may be able to exclude a smaller, less efficient, rival by charging an average incremental price above its own cost but below the cost of the rival. In doing so, the dominant firm may prevent the rival from potentially achieving sufficient scale to become as efficient as the dominant firm, if the rival had insufficient access to capital to fund its needed growth.[35] If charging such a price entails profit sacrifice on the part of the dominant firm – *i.e.*, if the dominant firm would have charged a higher price for the contestable portion of its demand absent the impact of lower prices on the rival's ability to compete – the conduct may well be exclusionary.[36]

Although we have to this point lumped together all loyalty reward programs, it is worth noting that the defendant's average incremental prices are more transparent for some forms of loyalty rewards than others. In particular, when the payment takes the form of a reduction in the price for each unit purchased beyond a certain threshold (*e.g.*, it is not retroactive), it is not necessary to know the contestable portion of a customer's demand in order to determine whether the supplier's average incremental price is below its average avoidable cost. This follows because

[34] There are certain types of promotional pricing that may be profit-enhancing assuming the continued viability of the rival, even if the average incremental price (*i.e.,* the promotional price) is below average avoidable costs.

[35] In an R&D-intensive industry, such as microprocessor manufacturing, a dominant firm may be able to exclude an otherwise competitively capable rival through average incremental prices that exceed the dominant firm's and its rival's costs. In particular, if rivals depend on profits to fund R&D investments, then incremental prices that are only slightly above costs may deprive rivals of the cash flow to invest sufficiently in R&D, thereby reducing their ability to compete effectively in the future. In contrast, the dominant firm's ability to finance R&D may not be significantly restricted by low profits on sales to the contestable portion of the market, if it can earn substantial profits on sales to the uncontestable portion of the market. Of course, such (partial) foreclosure may harm competition only if it entails profit sacrifice by the dominant firm.

[36] Hovenkamp, Herbert. "Antitrust and the Dominant Firm: Where Do We Stand?" p. 10. If the dominant firm were able to price discriminate perfectly on each unit sold, it could exclude a less efficient rival without sacrificing profits by setting the incremental price of each unit just below the level at which its customers might purchase from the rival (for identical products, this level would be just below the rival's costs). If perfect price discrimination is not possible; however, the dominant firm may face a tradeoff between higher expected profits on incremental sales on the one hand and lower (but still positive) profits on incremental sales, coupled with a greater likelihood of foreclosing the rival, on the other hand.

the supplier's incremental price for each unit is equal to its actual quoted price for that unit. One can just assess whether that price entails profit sacrifice.

However, if the payment is retroactive, such as the first-dollar discounts Intel has allegedly employed, it is necessary to determine the contestable portion of the customer's demand to estimate its average incremental price. For this type of payment, the average incremental price for the contestable portion of demand will be below the quoted price for those units because any discounts earned on the uncontestable share of demand should be "reallocated" to the contestable share when calculating the average incremental price. Similarly, the rebates or other lump-sum payments Intel has allegedly offered in exchange for achieving a certain purchasing threshold also require the fact finder to be able to identify with some accuracy the contestable portion of the customer's demand in order to determine the defendant's average incremental price. As with first-dollar discounts, lump sum loyalty payments always imply average incremental prices that are lower than the quoted prices. Because they require knowledge of the contestable portion of customers' demand, first-dollar discounts and lump-sum loyalty payments make it more difficult to tell whether average incremental prices entail profit sacrifice than do discounts that are only earned on each additional unit purchased beyond a given threshold.[37]

Estimating the contestable portion of demand is a critical part of an economic analysis of Intel's alleged conduct. As discussed above, unless Intel has engaged in below-cost predation – if it has, its profitability suggests this practice has not been widespread – Intel's alleged loyalty rewards are unlikely to be exclusionary unless the share of OEM demand over which AMD can

[37] There are some who have suggested that we should not attempt to apply the loyalty rewards only to the contestable portion of demand because that portion may be difficult to estimate. These commentators would prefer to analyze loyalty rewards in the same manner as predatory pricing – by comparing the average price across all units purchased by a customer from the defendant to the defendant's cost – even though they concede that, for the reasons described above, some instances of anticompetitive exclusion would not be detected under such an approach. Their argument is essentially: because it may be difficult to estimate the contestable portion of demand, the framework described in this paper could lead to *ex ante* uncertainty, which might make firms reluctant to offer loyalty rewards even in cases when they are unlikely to result in competitive harm. (Testimony of Joseph Kattan. Sherman Act Section 2 Joint Hearing, Understanding Single-Firm Behavior: Loyalty Discounts Session. U.S. Department of Justice. November 29, 2008. pp. 82-83.) We believe this view is misguided, in part because it entails such a weak test, but also because firms that are concerned that their loyalty rewards will be viewed as anticompetitive *ex post* always have the option of offering the more transparent form of loyalty rewards, in which payments are applied only to units purchased in excess of an explicit loyalty threshold.

effectively compete is limited. Although we do not have access to the confidential information necessary to estimate the contestable portion of demand for each OEM that allegedly received a loyalty payment from Intel, below we highlight several features of the microprocessor market that – if established to be significant – could be expected to limit the size of that contestable portion.

Capacity Constraints

A key question regarding contestability is whether AMD has sufficient manufacturing capacity to meet a major OEM's entire demand for microprocessors. As described above, if AMD can compete for a customer's entire demand, Intel's alleged loyalty rewards are unlikely to be anticompetitive as long as Intel's average price, net of any loyalty payments, is above its cost. However, if AMD can only meet 50% of the customer's needs, then the assessed loyalty payment of Intel will effectively be doubled. The less incremental share AMD can supply, the more significant the loyalty payment when applied only to this incremental share.

We do not have data on AMD's production capacity.[38] However, according to Gartner Dataquest, in each of the past five years, the two largest OEMs, Dell and HP, have each purchased more microprocessors than AMD has sold.[39] Moreover, even for smaller OEMs, it is likely to be insufficient merely to compare AMD's manufacturing capacity to the OEM's microprocessor demand because it may not be practical for AMD to devote its entire capacity to a single customer. For example, at the time of its negotiations with a given OEM, AMD may have already committed significant portions of its capacity to other customers. While Intel may only require a modest fraction of its capacity to meet all of a major OEM's demand, AMD, if it can meet that demand at all, is likely to need a substantial share of its capacity to do so.

If AMD cannot meet a major OEM's entire demand with its existing available manufacturing capacity, then a relevant question is whether AMD can expand its capacity in a timely and cost efficient manner. If so, it could bid for the OEM's entire demand and, if successful, meet that demand through capacity expansion. However, if capacity expansion is costly or cannot be undertaken in a timely manner, AMD will not be able to compete effectively for the OEM's

[38] In March 2009, AMD spun off its foundry business to create Global Foundries, which manufactures AMD's microprocessors and manufactures other third party semiconductor products. ("About Us." Global Foundries. < http://globalfoundries.com/about_us>.) Prior to that, AMD manufactured its own microprocessors.

[39] Gartner Dataquest, Personal Computer Quarterly Statistics United States Database.

entire demand. There are reasons to expect that capacity expansions in the microprocessor industry are indeed costly. Microprocessor manufacturing is a very capital-intensive industry. Microprocessor fabrication facilities ("fabs") can cost up to $3 billion[40] and take several years to build.[41] As a result, it would not be practical, or even possible, for AMD to construct a new fab in response to an order already received. Rather, the construction of a new fab would have to be undertaken in advance of securing OEM demand. However, because such construction is costly and there is no guarantee that the corresponding demand will materialize once it is built, it is necessarily a risky undertaking, and AMD may have difficulty securing financing for such capacity expansion. This is particularly true if, as discussed below, some portion of each customer's demand would remain uncontestable for demand-side reasons, and Intel's alleged loyalty rewards were therefore expected to remain effective.

It may be possible for AMD to expand its capacity in a more timely fashion by sub-contracting existing capacity from other manufacturers. Some AMD microprocessors are already manufactured by other suppliers,[42] but it may not be feasible or cost-effective to expand those relationships rapidly and by a sufficient magnitude to bridge the shortfall needed by AMD to meet a major OEM's entire demand. Additionally, there may be other business reasons why it is disadvantageous to expand capacity in this manner. For example, given the importance of "learning by doing" in semiconductor manufacturing, AMD may forego some of that learning if a significant portion of its microprocessors are manufactured by other firms. If sub-contracting manufacturing capacity is not feasible, timely, or cost effective or has other significant strategic drawbacks, AMD is likely to face capacity constraints when attempting to respond to Intel's loyalty rewards.

The Intel Brand

In addition to capacity constraints, there may be a number of demand-side factors that limit the share of each OEM's demand for which AMD can effectively compete. One such factor is that many of an OEM's customers are likely to exhibit loyalty to the Intel brand. Intel has been the

[40] Casadesus-Masanell, Ramon and David B. Yoffie. "Wintel: Cooperation or Conflict." Working Paper #05-083. 2005. p. 5.

[41] "Commission Decision of Relating to a Proceeding under Article 82 of the EC Treaty and Article 54 of the EEA Agreement." European Commission. May 13, 2009. p. 259, ¶ 859.

[42] "Sustainable Manufacturing and Operations." AMD. <http://www.amd.com/us/aboutamd/corporate-responsibility/environmental performance/Pages/operations.aspx>.

dominant microprocessor manufacturer since the early 1980s and has successfully marketed its microprocessors to end-users through its Intel Inside marketing campaign. In 2006, *Business Week* named Intel the fifth best-known company in the world,[43] and Peter Sealey, the former marketing head for Coca-Cola Co., called the Intel Inside campaign "one of the great ones, one of the most brilliant marketing strategies in the last ten years."[44] As a result, many consumers may believe that Intel microprocessors are superior to AMD microprocessors and therefore maintain a strong preference for Intel-powered PCs. To the extent this is true, OEMs would need to purchase at least some Intel microprocessors in order to compete for the Intel-loyal customers. AMD would therefore be unable to compete effectively for this portion of each OEM's demand.

Network Effects

The presence of indirect network effects in the market for microprocessors is another factor that may limit the share of OEMs' demand that AMD can effectively contest. A market is characterized by indirect network effects when increased usage of a particular product in the market leads to increased production of valuable complementary products, which results in an increase in the value of the original product. In the case of microprocessors, demand for a particular microprocessor depends in part on the availability of compatible components such as chipsets and motherboards. Manufacturers of these compatible components are more likely to design their products to work with the microprocessors that they expect to achieve the highest level of sales. OEMs may be reluctant to purchase all of their microprocessors from AMD because of the risk that insufficient compatible components will be available.

Switching Costs

A desire for standardization within enterprises may lead to switching costs that render uncontestable some portion of an OEM's demand at any given point in time. For example, there may be efficiency reasons for an enterprise to deploy a single model of PC among large groups of (or even all) employees. This type of standardization likely reduces set up, inventory, and maintenance costs.[45] If the benefits of standardizing on PCs (or servers for that matter) are

[43] "Inside Intel." Business Week. January 9, 2006.

[44] King, Ian. "Intel Drops Logo After 37 Years to Move Beyond PCs." December 30, 2005. <http://www.bloomberg.com/apps/news?pid=10000103&sid=akzZ3AK.DOHo>.

[45] There may be logistical benefits as well. For example, if employees spend time in more than one of an enterprise's offices, standardization ensures that their laptops will plug into the docking station at any of the desks in other offices.

significant, once an enterprise chooses to purchase a given PC model, it will be locked into purchasing that model for new hires and replacing broken PCs until that point in time when the enterprise opts to replace the model altogether. Because Intel consistently has enjoyed a microprocessor market share of over 75%, any such lock-in effect will strongly favor Intel. That is, because most of the PCs used by enterprises today are powered by Intel microprocessors, more enterprises are likely to be locked into PCs with Intel microprocessors than to PCs with AMD microprocessors. The share of enterprise PC and server purchases locked into Intel microprocessors at any given point in time cannot be contested effectively by AMD.

Demand for the "Industry Standard"

Another factor that may limit the share of OEMs' demand that is contestable is that enterprise IT administrators may be reluctant to take risks by not purchasing the "industry standard" products, particularly for more mission critical tasks. Because they are more-widely used, Intel chips have been more extensively market "tested." Additionally, IT administrators may believe that if the products they purchase cause problems, they are less likely to be blamed, or even lose their jobs, if they have purchased servers or PCs powered by a known entity such as Intel rather than a smaller player, such as AMD. This may lead many large enterprises not to consider AMD, which would in turn cause the uncontestable portion of OEMs' demand to increase.

Step 3 – Determine Whether the Loyalty Rewards Foreclose Rivals from a Significant Share of the Contestable Portion of the Market

Loyalty rewards that entail profit sacrifice by the defendant on the contestable portion of demand can potentially be anticompetitive. However, the effect on competition is unlikely to be significant unless the rewards foreclose rivals from a substantial share of the contestable portion of the market. It is critical to focus only on the contestable share that is foreclosed because this is the share otherwise actually available to the defendant's rivals. Thus, for example, loyalty rewards targeted specifically at customers that are more interested in purchasing from the defendant's rivals have a greater potential for competitive harm than payments to customers that likely would have purchased from the defendant regardless.[46] Additionally, it is necessary to consider the foreclosure effect of all of the defendants' loyalty agreements (and other alleged price and non-price exclusionary actions) in combination; any one such agreement (or other

[46] The latter are more unambiguously intended to incentivize the customer to expand output, which is generally procompetitive.

action) might only foreclose rivals from a small share of the contestable portion of the market, but in combination they might foreclose rivals from the entire contestable portion. In considering the loyalty agreements (and other actions) in combination, what is relevant is foreclosed share, not foreclosed customers. That is, loyalty rewards need not be exclusive, *i.e.*, have a 100% market share threshold, in order to significantly exclude rivals.

When examining the share of the contestable portion of a market foreclosed by the defendant's loyalty rewards, additional weight should be given to the foreclosure of key customers or segments that may influence the purchasing decisions of other customers. For example, we understand that Intel allegedly targeted the major OEMs with its loyalty rewards. Being able to supply these OEMs appears to be critical for achieving success in the microprocessor market. The major OEMs collectively purchase roughly 75% of the x86-based microprocessors.[47] Moreover, this likely understates their importance to microprocessor manufacturers for several reasons.

First, the major OEMs' share of sales to enterprise customers is significantly larger than their overall share. The enterprise segment is important because enterprise customers tend to be less-price sensitive and purchase higher-end PCs and servers powered by higher-end microprocessors. Because Intel and AMD tend to earn higher margins on higher-end microprocessors, the size of the enterprise segment likely understates its importance for achieving profitability.

Second, adoption by major OEMs may offer AMD a certain validation that could potentially translate into a greater acceptance of AMD's products throughout the industry. For example, in April 2000, industry analysts speculated that Gateway's success in selling PCs with AMD's Athlon processor would prompt renewed interest in AMD from Intel-only OEMs such as Dell.[48]

Finally, major OEMs appear to play an important role in determining the technology choices of generic "white box" manufacturers. White-box manufacturers serve the lower end of the PC market but because they generally do not have the buying power to negotiate the same prices as major OEMs, they tend to rely instead on other approaches to obtaining computer parts at a

[47] Gartner Dataquest, Personal Computer Quarterly Statistics United States Database.

[48] Hesseldahl, Arik. "AMD's Q1 Revenues Rise to $1 Billion; Rumors Swirl of Possible Dell Design Win, Samples from Dresden." Electronic News. April 10, 2000. p. 18. <http://www.edn.com/article/CA49208.html>.

discount.[49] For example, when major OEMs over-order a given part, they often resell the part to white-box manufacturers on the grey market. White-box manufacturers also purchase soon-to-be outdated parts offered at discount to make way for newer technologies.

Due to the factors described above, AMD's failure to achieve greater adoption among the major OEMs likely has impeded its success to a degree greater than is captured by those OEMs' collective market share. As a result, to the extent Intel foreclosed AMD from a share of the contestable portion of major OEMs' microprocessor demand, this share should be accorded greater weight when assessing the overall significance of the alleged foreclosure.

Step 4 – Determine Whether Market Foreclosure Resulting From the Loyalty Rewards Significantly Diminishes Rivals' Ability to Compete

For loyalty rewards to harm competition, it is not sufficient merely that they lead to the defendant gaining significant share at the expense of its rivals; they must also significantly diminish the rivals' ability to compete. Essentially, the loyalty payment is an inducement to the customer to purchase more from the defendant. As a result, it can never directly make the customer worse off; if it did, the customer would not agree to the deal (or would choose not to meet the loyalty threshold if the terms were imposed on it), and the inducement would fail. However, the customer may be harmed indirectly if the loss of sales diminishes rivals' ability to compete. For example, in industries in which economies of scale play an important role, lost sales may cause rivals per unit costs to rise, making it harder for the rivals to compete more generally. Alternatively, in technology-based industries, lost sales may result in reduced cash flow available for investment in R&D, leading to inferior product offerings in the future. In the extreme case, lost sales may cause rivals to exit the market altogether.

If meeting the loyalty threshold may contribute to higher prices or reduced product quality in the future, one obvious question is why a sophisticated customer would agree to such a deal. The answer is that if customers do not bear the full impact of the reduced competition resulting from their decision to meet the loyalty threshold, a negative externality exists that a dominant firm may be able to exploit.[50] For example, suppose that if a given customer agrees to allocate all of

[49] Ogg, Erica. "Trouble on Horizon for 'White Box' PC Makers." CNET News. October 30, 2007.

[50] Rasmusen, Eric B. and J. Mark Ramseyer and John S. Wiley, Jr. "Naked Exclusion." The American Economic Review. Vol. 81, No. 5. December 1991. pp. 1137-114 ("Rasmusen et al");

its sales to the dominant firm in order to reach the loyalty threshold, the dominant firm's rivals' earnings will decrease and their ability to invest in product improvements will also diminish, allowing the dominant firm to raise its prices by $10 in the future. The dominant firm will subsequently increase its profits by $10 on every unit it sells, but the customer will only pay higher prices on the share of the dominant firm's supply that it buys. The dominant firm's gain is greater than the customer's loss. As a result, the dominant firm can afford to offer the customer a payment large enough to induce the customer's loyalty without the dominant firm having to give up all of its gains, making the deal profitable for both parties. The dominant firm's other customers, however, may be made unambiguously worse off by the deal.

For example, suppose the dominant firm sells 100 units and the customer buys 10. The dominant firm's profits will increase by $1,000, but it will only need to offer the customer a loyalty payment worth $101 to make it worthwhile for the customer to buy exclusively from the dominant firm.[51] In the meantime, the customer's rivals face a total of $900 in higher prices resulting from the customer's decision. The dominant firm can make similar deals with other customers, each deal leaving the customer slightly better off but making all of its rivals significantly worse off. The net result, however, is that all customers can end up paying higher prices.[52]

The potential for a dominant firm to expand its market power in this fashion is even greater when its customers are not the end users of the product but rather use the product as an input into a good that they compete with each other to supply in a downstream market (*e.g.*, OEMs are not the end consumers of microprocessors; they assemble computers using microprocessors and other inputs and then compete with each other in the sale of those computers). If the dominant firm's customers compete in a downstream market, each customer knows that any future harm to competition in the upstream market will also affect the customer's competitors. As a result, some portion of that effect will be passed on to consumers rather than being entirely borne by the

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Segal, Ilya R. and Michael D. Whinston. "Naked Exclusion: Comment." The American Economic Review. Vol. 90, No. 1. March 2000. pp. 296-309. ("Segal/Whinston")

[51] This assumes, as in the examples above, that the customer does not strictly prefer to meet some of the contestable portion of its demand with the rival firms' products. If it does, the loyalty payment will have to compensate the customer for the higher prices it can expect in the future and for purchasing a less-preferred product. As a result, the dominant firm will have to offer a loyalty payment worth more than $101 in order to induce the customer to meet the loyalty threshold.

[52] *See* Rasmusen et al and Segal/Whinston.

customers. Thus, the customer will not need to be fully compensated for the expected increase in its input prices (or reduction in their quality). The degree of competition in the market in which OEMs compete may, therefore, enhance the effectiveness of the loyalty reward schemes utilized by Intel.

Returning to the above example, suppose again that by meeting the loyalty threshold, the customer enables the dominant firm to diminish its rivals' ability to compete and increase its future prices by $10 to all of its customers. Now, however, suppose that the customers compete in a downstream market and can expect to pass half of the cost increase on to their consumers. In that scenario, the dominant firm would only have to offer the customer a loyalty payment worth $51 to induce it to meet the loyalty threshold, thus rendering such a strategy even more profitable for the dominant firm.

There are several ways in which a reduction in the current demand for AMD's microprocessors could diminish its ability to compete in the future. Arguably, the most significant of these is the potential impact on AMD's ability to invest in R&D. The microprocessor market is, of course, an R&D-intensive industry in which each new generation of microprocessors is significantly faster than the previous one.[53] In order to maintain a sufficient level of R&D spending to compete effectively with Intel, AMD must either have access to substantial cash flow or to external financing. If Intel's alleged loyalty rewards effectively limited AMD's share of the microprocessor market, they would likely hamper AMD's access to both sources of financing. AMD's cash flow would be reduced as a result of lower sales and profits, and its cost of capital would likely increase as well, as outside investors would most likely consider AMD to be a more risky investment and therefore require a higher return.

In practice, AMD's ability to invest in R&D certainly appears limited relative to that of Intel. Whereas Intel has consistently been profitable, AMD has not, providing Intel with a far greater source of internal cash flow. AMD has been forced to rely heavily on other sources of financing to fund its R&D. One consequence has been AMD becoming significantly more leveraged than Intel.[54] AMD's dependence on other sources of funds, coupled with Intel's greater profitability, has rendered AMD unable to invest in R&D at anywhere near the level of Intel. The end result is that AMD has been unable to invest in R&D at anywhere near the level of Intel. In fact, over

[53] "Moore's Law." Intel. <http://www.intel.com/technology/mooreslaw/ >.
[54] Bloomberg Data. 2009.

the past five years, Intel has consistently invested between three to five times as much in R&D as has AMD.[55, 56] Such a discrepancy is likely to make it difficult for AMD to compete effectively in the future, and at the very least affords it a much lower margin for error.

Effectively limiting AMD's share of the microprocessor market is likely to diminish AMD's ability to compete in other ways. The microprocessor industry is characterized by significant economies of scale in production. Because fixed costs, such as fab construction, capital equipment acquisition, and R&D investment, are so high relative to the cost of producing an additional microprocessor, manufacturers strive to maximize production volumes in order to reduce average costs. As a result, anything that limits a manufacturer's sales volume is likely to increase its average costs. An assessment of the impact Intel's alleged loyalty rewards have on AMD should examine AMD's cost structure and determine whether its limited market share relative to Intel causes it to be at a substantial cost disadvantage.

If many of the scale economies in production occur within each plant, it is possible that AMD could achieve sufficient scale without having as many plants as Intel.[57] However, at least some scale economies can be achieved across plants. One example is the return on R&D investment, which benefits production at all plants. Another is learning by doing, which is critical to reducing margin costs in semiconductor manufacturing,[58] and which is likely to be shared, at least to some extent, across plants.

Perpetuation of Uncontestability

Above, we discussed a number of features that may limit the contestable share of OEMs' demand in the microprocessor market. We also showed that a limited contestable share was a

[55] AMD. "Form 10-K: Advanced Micro Devices INC." AMD. February 24, 2009. p. 50.

[56] "2008 Annual Report." Intel. 2008. p. 26.

[57] Although if there are economies of scale in having a larger plant, Intel may still retain an edge over AMD in this dimension.

[58] Macher, Jeffrey and David Mowrey. "'Managing' Learning by Doing: An Empirical Study in Semiconductor Manufacturing." Journal of Product Innovation Management. 2003. Vol. 20. pp. 391-410. An example of learning by doing in microprocessor manufacturing is the improvement over time of wafer yields for a given microprocessor technology, known as. Since the cost of producing a wafer of microprocessors is relatively fixed, higher yields result in lower marginal costs. The speed at which microprocessor manufacturers move down the "yield curve" is generally recognized to be correlated to the volume of production. Hennessy, John and David Goldberg and David A. Patterson. Computer Architecture: A Quantitative Approach. 3rd edition. Morgan Kaufmann Publishers. 2003. pp. 14-16.

condition for foreclosure through loyalty rewards to be effective. However, a limited contestable share may also be a *result* of effective foreclosure. To see why, consider the features of the microprocessor market discussed above that may limit the contestable share of demand. Each of these features likely would be exacerbated if Intel's alleged loyalty rewards effectively limited AMD's share.

For example, if Intel effectively limits AMD's share of the microprocessor market, it may be able to prevent AMD from practically expanding its production capacity. AMD is more likely to obtain financing to expand its capacity if there is a healthy demand for the microprocessors produced using its existing capacity. Consequently, Intel could have a strong incentive to offer very low – even below cost – incremental prices for the contestable portion of customers' demand, so as to ensure that there is not a healthy demand for AMD's existing capacity. Even if Intel's strategy required it to sacrifice profits to entice customers not to purchase from AMD, it might pay off in the future by keeping AMD's capacity low, and hence maintaining the uncontestable share of demand.

As a numerical example, suppose AMD has the available capacity (after meeting its other supply obligations) to supply only 40% of a given OEM's microprocessor demand. Intel might be content simply to charge high prices and supply 60% of the OEM's demand, which AMD by assumption cannot contest, even if that means letting AMD supply the remaining 40%. However, allowing AMD to capture this much of the OEM's demand might provide AMD with the incentive and ability to expand its capacity and compete for a larger share of the OEM's demand in the future. If Intel instead offered the OEM a loyalty payment in exchange for purchasing a certain share of its demand, say 80%, from Intel, it could reduce the demand for AMD's microprocessors, which in turn might prevent AMD from obtaining financing to expand its capacity. Because it might prevent any erosion in the uncontestable share of the market, thereby limiting AMD's ability to compete effectively and protecting Intel's future profits, such a strategy could be profitable for Intel in the long run even if it involved profit sacrifice in the short run.

On the demand side of the market, if Intel is able to limit effectively AMD's share of the microprocessor market, it makes it all the more likely that Intel will continue to retain a branding advantage over AMD. Retaining a dominant share would also allow Intel to retain its status as the "industry standard." Protecting its share of the microprocessor market in one period could

benefit Intel in the future in other ways as well. Economists Janusz Ordover and Greg Shaffer have shown that, in a market with switching costs, loyalty rewards can be used to weaken a rival's ability to compete in the future if the rival is initially financially and capacity constrained[59] – both of which appear to apply to AMD. Similarly, by using loyalty rewards to limit AMD's share in one period, Intel may be able to create or expand an indirect network effects advantage over AMD in future periods, which would act to reduce the contestable portion of the market and limit AMD's ability to compete effectively.

The fact that reduced contestability is both a condition for, and a potential result of, successful foreclosure through loyalty rewards has two implications for the potential impact of Intel's alleged loyalty rewards on competition in the microprocessor market. The first is that successful foreclosure of AMD today could lead to a more limited contestable share tomorrow, which may diminish AMD's ability to compete. Second, it implies that successful foreclosure today is likely to make it easier to foreclose again tomorrow.

Step 5 – Determine Whether the Conduct Allows the Defendant to Maintain or Significantly Increases Its Market Power

The defendant's loyalty rewards must significantly increase the defendant's market power – or allow it to maintain market power that it otherwise would have lost – in order to harm competition. If the defendant's conduct significantly diminishes all established rivals' ability to compete, this requirement amounts to showing that there are entry barriers to the market. If entry barriers are importantly effective, a significant reduction in rivals' ability to compete will result in significantly increased market power for the defendant, which is likely to result in harm to consumers through higher prices, reduced innovation, or both. Absent significant entry barriers, however, the weakened rival(s) may be replaced by new entrants that are able to discipline effectively the defendant's market power. Having said that, many of the same industry features, such as substantial scale economies and sunk costs, that cause lost sales to result in a diminished ability to compete may also create entry barriers. Simply put, if it is important to have substantial sales in order to be able to compete effectively, entry is likely to be difficult.

[59] Ordover, Janusz and Greg Shaffer. "Exclusionary Discounts." CCP Working Paper No. 07-13. 2007. p. 6. Their result holds even if the rival is equally efficient and the customer prefers to purchase from both suppliers rather than just one so that the dominant firm must sacrifice short-run profits to exclude the rival.

In the case of the x86 microprocessor market, Intel and AMD are virtually the only suppliers (with a combined unit share of 99.9% since 2000[60]). As a result, AMD is the only existing competitive restraint on Intel's market position (assuming that there is an antitrust relevant market limited to microprocessors with the x86 architecture). Entry by a significant new microprocessor supplier is unlikely because of the substantial fixed and sunk costs required to develop new microprocessors and build production capacity. Thus, if AMD's ability to compete has been significantly diminished by Intel's alleged conduct, Intel's market power has most likely increased (or been prevented from declining). This increase would most likely translate into higher prices and/or reduced product quality.

Step 6 – Determine Whether Any Expected Anticompetitive Effects Are Outweighed by Any Procompetitive Benefits of the Loyalty Rewards

Even if loyalty rewards result in a significant increase in the dominant firm's market power, it is possible that consumers will not be harmed if the loyalty rewards offer procompetitive benefits that cannot be achieved through less restrictive means. Loyalty rewards can potentially serve a number of procompetitive purposes. For example, loyalty rewards can more closely align the marketing incentives facing downstream firms with those of the discounting manufacturer. Because loyalty rewards enable downstream firms to receive higher profits on marginal sales, they are more likely to provide promotional and point of sale services for the relevant products.[61] Loyalty rewards can also help decrease unit costs by allowing firms to more quickly recover their fixed costs or achieve certain economies of scale.[62]

Additionally, loyalty rewards can be used to eliminate double marginalization, resulting in lower prices and higher output.[63] Double marginalization refers to the situation in which both the buyer and seller have market power in their respective markets, and thus the price of the product

[60] Gartner Dataquest, Personal Computer Quarterly Statistics United States Database.

[61] Spector, David. "Loyalty Rebates and Related Pricing Practices: When Should Competition Authorities Worry?" in Evans and Padilla, Eds, Global Competition Policy – Economic Issues and Impact. LECG. 2004. p. 327; Kobayashi, Bruce H. "The Economics of Loyalty Discounts and Antitrust Law in the United States." Law and Economics Working Paper Series. George Mason University School of Law. 2005. p. 6.

[62] Geradin, Damien. "A Proposed Test for Separating Pro-Competitive Loyalty Rebates from Anti-Competitive Ones." October 2008. p. 33.

[63] Kolay, Sreya and Greg Shaffer and Janusz Ordover. "All-Units Discounts in Retail Contracts." Journal of Economics & Management Strategy. Vol. 13, Issue 3. 2004. pp. 429-459.

is marked up twice, once in the upstream market and once in the downstream market. Relative to the case in which the two firms are vertically integrated, double marginalization results in higher prices and lower output, which harms consumers, and also leads to lower combined profits for the two firms. An upstream firm can eliminate some double marginalization through the use of loyalty rewards because they enable it to earn higher profits on inframarginal sales while effectively charging a lower price at the margin. As a result, the downstream firm faces lower marginal costs, which in turn provides it with an incentive to lower the downstream price. The resulting downstream price approaches that which would be set by a vertically integrated firm, which leads to higher joint profits and lower prices for consumers.

Although the elimination of double marginalization is a potentially important procompetitive benefit that can result from loyalty rewards more generally, it is unlikely that this benefit flows from the loyalty rewards allegedly offered by Intel to OEMs. As noted above, double marginalization occurs when both the buyer and seller have market power in their respective markets. Although Intel has significant market power in the microprocessor market, it is unlikely that OEMs have much market power in the downstream desktop PC, laptop PC, and server markets. The markets for PCs and servers are generally considered to be very competitive and profit margins tend to be low. As a result, there is unlikely to be a second markup to eliminate, with or without loyalty rewards.

It might appear that market-share payments ought to be of greater anticompetitive concern than volume-based schemes because they more explicitly reward exclusivity. However, when demand for a given product is uncertain, percentage-based payments enable downstream customers to qualify for the payment scheme even if they cannot meet a specific quantity threshold for a payment. Because small customers are eligible for the same payments as large customers, market-share payments may generate greater competition in the downstream market.[64]

An economic assessment of loyalty rewards requires a balancing of any potential harm to competition due to the foreclosure of rivals and increased market power with any procompetitive benefits the loyalty rewards may engender. When evaluating potential procompetitive benefits,

[64] Spector, David. "Loyalty Rebates and Related Pricing Services: When Should Competition Authorities Worry?" in Evans and Padilla, Eds, Global Competition Policy – Economic Issues and Impact. LECG. 2004. p. 330.

it is important to consider whether those benefits could have been achieved through less restrictive means.

CONCLUSION

This paper has shown that as a matter of economic theory, it is clear that Intel's alleged conduct *may* have harmed competition and consumers, and therefore should be carefully analyzed on an empirical basis. This paper also provides an economic framework with which to assess the allegations against Intel. But we are not privy to the confidential case materials and therefore are unable to undertake a rigorous empirical application of this framework. The European Commission undertook an extensive empirical investigation prior to its decision this May to fine Intel €1.06 billion (approximately $1.5 billion) and the U.S. Federal Trade Commission is currently undertaking its own. It is through these investigations, as well as the *AMD v. Intel* and class action private litigation matters, that an empirical assessment will be made whether Intel actually harmed competition and consumers. It is our aspiration for this paper that it will help to clarify the elements that an empirical investigation needs to illuminate in order to reach the right conclusions for the public interest.