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Illumina-GRAIL in Retrospect

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Abstract
In 2023, the Antitrust Agencies released updated Merger Guidelines. These Guidelines outline policies and procedures in enforcing § 7 of the Clayton Act as it relates to horizontal, vertical, and complementary mergers. In this paper, we consider the application of these guidelines to a recently challenged vertical merger: the Illumina-GRAIL merger. The FTC found the merger to be anticompetitive; and on appeal, the Fifth Circuit Court of Appeals largely agreed. While we show that the positions taken by the FTC are consistent with the Guidelines, we provide an economic analysis that reveals that these positions and the subsequent judicial decision are inconsistent with economic theory, fail to protect competition, and fail to promote consumer welfare. Consequently, the Merger Guidelines may deter procompetitive mergers and lead the Agencies astray in their enforcement efforts.

Keywords Antitrust · Vertical merger · Guidelines · Federal Trade Commission · Multi-cancer early detection test · Double marginalization

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1 Introduction

The recently released 2023 Merger Guidelines outline the policies and procedures that are employed by the U.S. Department of Justice (DOJ) and the Federal Trade Commission (FTC) in enforcing § 7 of the Clayton Act. These Guidelines apply to all types of mergers: horizontal, vertical, and complementary. Guideline 5 is concerned with vertical mergers and examines the ways in which vertical mergers may be anticompetitive.

In this article, we focus our attention on the Guidelines as they relate to vertical mergers and the Illumina-GRAIL merger specifically. In considering the proposed acquisition of GRAIL by Illumina, Inc., the FTC found the merger to be anticompetitive. On appeal, the Fifth Circuit Court of Appeals largely agreed with the analysis of the competitive significance of the merger.

Here, we show that the decisions by the FTC and the Court of Appeals are consistent with the 2023 Merger Guidelines. We go on to show, however, that these decisions yield economic results that are inconsistent with protecting competition and promoting consumer welfare. The obvious implication of our analysis is that the Guidelines may deter procompetitive vertical mergers to the detriment of consumers and the firms involved.

In Sect. 2, we provide a brief history of Illumina and GRAIL in the biotechnology sector. In Sect. 3, we present the FTC's objection to the merger and the Fifth Circuit's confirmation of the FTC's concerns. In doing so, we also show that these concerns are consistent with the 2023 Merger Guidelines. In Sect. 4, we explain the flaws in the economic analyses of the Illumina-GRAIL merger and the adverse economic consequences of the merger's prohibition. In Sect. 5, we provide some further thoughts on the treatment of vertical mergers under the Merger Guidelines. Finally, we conclude in Sect. 6.

2 Illumina and GRAIL

There are a few types of cancer that can be detected before they become symptomatic – such as breast, cervical, colon, lung, and prostate – for which the U.S. Preventive Services Task Force has screening recommendations. Unfortunately, nearly all other types of cancer – such as bone, liver, pancreatic, and stomach – are not detected until they become symptomatic and are far more difficult to treat once detected.

However, "multi-cancer early detection" (MCED) tests permit the detection of up to 50 different types of cancer with a simple blood test before a patient experiences symptoms. These tests leverage short-read DNA sequencing, which are called "next generation sequencing" (NGS), as distinct from long-read technology, which has lower accuracy and higher cost (FTC, 2021). MCED tests use biomarkers (proteins, DNA, or RNA) that are detectable in a patient's blood sample and indicative of the presence of specific types of cancer. MCED tests have the potential to revolutionize cancer care through early detection, wider treatment options, and improved patient health outcomes including reductions in morbidity and mortality.

Illumina – a biotechnology company that specializes in DNA sequencing technology – developed cutting-edge NGS technology, which is an essential input in performing MCED tests. In 2016, GRAIL was founded by Illumina, as a producer of MCED tests.[1] Subsequently, Illumina divested GRAIL as a separate company, but retained 12% of GRAIL's stock. In September 2020, however, Illumina reversed course and purchased the remainder of GRAIL for $8 billion (FTC, 2023a). Illumina purchased all of the outstanding stock of GRAIL before the FTC and the European Commission cleared the merger.

This acquisition gave rise to FTC concerns about the vertical merger and its competitive consequences. Initially, an administrative law judge (ALJ) at the FTC heard the case and ruled in favor of Illumina; but in 2021, the FTC staff appealed that ruling to the full Commission, which reversed and held that the acquisition violated § 7 of the Clayton Act, given that it may substantially lessen competition among GRAIL and other MCED test developers. Illumina then appealed the FTC's decision to the U.S. Court of Appeals for the Fifth Circuit.

The European Commission (EC) similarly initiated an antitrust investigation. The EC concluded that the merger violated European antitrust law, ordered Illumina to divest GRAIL, and fined Illumina for consummating the merger when the company knew that there were antitrust challenges in the US and the European Union (EU). Since GRAIL's MCED test was not being sold in the EU, Illumina challenged the EC's authority on jurisdictional grounds.

In a press release, Illumina announced that it would divest GRAIL if it lost in the Court of Appeals or on its jurisdictional challenge in the EU. On December 15, 2023, the Court of Appeals largely agreed with the FTC that the acquisition could impair competition in the market for "research, development, and commercialization of MCED tests."

In spite of the fact that there was still hope for Illumina to prevail, it announced on December 17, 2023, that it would divest GRAIL (Illumina, 2023a). Its plan was to divest GRAIL in one of several ways with the aim of maximizing the value of GRAIL to Illumina's stockholders. While the divestiture may not be completely smooth sailing, there will be no "eggs left to unscramble." Following the acquisition, GRAIL was not fully integrated with Illumina. GRAIL was operated as an independent entity to make a possible divestiture as simple as possible.

In its challenge, the FTC alleged that Illumina faces no viable (actual) competitors in the market for NGS platforms. Despite other firms in the NGS technology market, the FTC found no suitable alternatives for Illumina's NGS technology for use in MCED tests. We, therefore, consider Illumina to be a monopolist for NGS products.[2]

There are other companies, however, in the race to develop MCED tests, including Exact/Thrive, Guardant, Singlera, Freenome, Natera, and Helio Health. One potential rival, Exact, is developing a product called CancerSEEK, which requires three tests

[1] As of April 2021, GRAIL began selling an MCED test – "Galleri" – that is not currently FDA-approved nor covered by health insurance (and costs a patient approximately $1,000 out-of-pocket). In November 2023, however, Galleri received limited FDA approval (in the form of an "investigational device exemption") to study the use of the tests in the Medicare population (Young, 2023).

[2] In its Complaint, the FTC indicates ""Illumina is the only NGS platform capable of meeting the technological demands required by MCED test developers."

relative to Galleri's one. Moreover, relative to Galleri, CancerSEEK can identify only 10 potential cancers; it cannot identify the location of the cancer, and it has lower accuracy. Even with all of these product differences – which make it a questionable substitute for Galleri – Exact's CEO reported that a launch timeline of CancerSEEK was unknown and could be 10 or more years, if ever (Illumina, 2023b). All other MCED test developers are potential, not actual, competitors.[3] There is a great deal of uncertainty as to which (if any) companies will develop high-quality, accurate MCED tests and to what extent such hypothetical tests will be interchangeable with GRAIL's Galleri.

GRAIL's stated goals include revolutionizing cancer screening by universally providing MCED tests to patients over the age of 50 at routine screenings (FTC, 2013b). If preventive care moves to a model of testing for 50 cancers at a routine wellness exam, then the Galleri test may well be preferred to any other test that screens for a smaller number of cancers. Accuracy of the tests will also be important, as false positives will generate unnecessary patient concern and health care costs. False negatives will leave cancer undetected until it becomes symptomatic and, therefore, more difficult and expensive to treat.

3 Vertical Mergers Under the Guidelines

A vertical merger involves firms in two markets: the *relevant* market and the *related* market. The *relevant* market is the one in which the acquired firm participates and is defined as the collection of all reasonable substitutes. The *related* market is the one in which the acquiring firm participates. The Guidelines do not require that the related market be precisely defined. Guideline 5 explains the antitrust concerns with vertical mergers.[4] For the most part, the DOJ and the FTC are concerned with the merged firm's ability and incentive to foreclose rivals in the relevant market.[5]

When the merged firm can withhold products or services from competing firms, the merger can substantially lessen competition in several ways. For example, rival firms may be excluded entirely from the relevant market, which would clearly diminish competition. Moreover, the risk of foreclosure may prevent competition from materializing in the first place: the possibility of being foreclosed may cause actual and potential rivals to refrain from investing in the relevant product market.

When the merged firm's rivals in the relevant market are dependent on the merged firm for access to the related product, the rivals' ability to operate in the relevant market can be impaired by the merged firm. The merged firm could simply refuse to supply the related product, which could force their rivals to leave the relevant market. In addition to simply refusing to supply the related product, the merged firm can impair

[3] For thoughts on the 2023 Merger Guidelines, treatment, and potential competition, see Gilbert and Melamed (2024).

[4] For a generally positive view of the 2023 Merger Guidelines' treatment of vertical mergers, see Salop (2024).

[5] The Agencies are also concerned that the merged firm could gain access to competitively sensitive information that it can use to impair competition in the relevant market.

competition in other ways: the merged firm could degrade the quality of the related product that it supplies to its rivals. Alternatively, it could delay supplies or decrease its reliability. The DOJ and the FTC also observed that the merged firm could impair competition by forcing its rivals to collude in the relevant market by threatening to withhold their related product. This, of course, would violate § 1 of the Sherman Act, but it is a logical possibility.

Guideline 5 recognizes that an assortment of actions is available to the merged firm that could impair competition. As a result, the Agencies focus on the overall risk that the merged firm would employ one or more actions that impair competition. The Agencies, therefore, may not specify which action is apt to be employed, but simply identify an assortment of possible antitrust concerns.

3.1 Ability to Foreclose Rivals

According to Guideline 5, the Agencies rely on four factors in assessing the merged firm's ability to foreclose its rivals in the relevant market and whether the vertical merger may violate § 7 of the Clayton Act:

1. The availability of substitutes for the related product. The fewer the number of substitutes for the related product, the greater will be the merged firm's ability to foreclose rivals in the relevant market. There seems to be no doubt that there are no substitutes—reasonable or otherwise—for Illumina's NGS platform that is suitable for MCED tests: Illumina is a monopolist in the related market.
2. The competitive significance of the related product. If the merged firm's related product is critical to the rival firms' ability to compete in the relevant market, foreclosure in the related market can significantly impair competition. Since MCED tests currently rely on the use of Illumina's NGS platforms, access to this related product is essential. Without it, any rival MCED test provider will be unable to compete.
3. Competition in the relevant market. The fewer the number of rivals in the relevant market, the more that any foreclosure will impair competition. At this time, there are no competitors in the relevant market, which is the MCED test market. There are, however, a handful of potential rivals. Even if the market is defined to be "research, development, and commercialization of MCED tests," there are not many firms in the market. Consequently, foreclosing any of them would seem to be competitively significant.
4. Competition between the merged firm and its dependent rivals. The relevant product market is apt to include differentiated products. The more homogenous are the products in the relevant market, the greater will be the merged firm's incentive to foreclose its rivals. GRAIL and its potential rivals intend to offer MCED tests, but the extent of heterogeneity is decidedly unclear. The tests may differ in various ways, including: accuracy; number of blood tests required; number of cancers that can be detected; ability to detect the location of the cancer; and perhaps other things. Since the potential rivals' MCED tests are still in development, we cannot know the extent of the heterogeneity, but it may be substantial.

Based on these four considerations, it is quite clear that Illumina could foreclose GRAIL's rivals from access to its NGS platform. It does not follow, however, that it has the incentive to do so.

3.2 Structure of the Related Market

The Agencies consider the structure of the related market in assessing the merged firm's ability and incentive to foreclose its rivals in the relevant market. The merged firm's foreclosure share is the share of the related market to which the merged firm could foreclose its rivals. If the foreclosure share approaches monopoly proportions and the related product is competitively significant to the merged firm's rivals, these two factors alone are sufficient to infer that the merged firm can foreclose its rivals by withholding access to the related product. When the merged firm's share of the related product equals or exceeds 50%, the Agencies presume that the merged firm has monopoly power in the related market.[6] Since Illumina accounts for 100% of the required NGS platforms, it is, by definition, a monopoly.

3.3 The FTC Decision

Illumina's decision to re-acquire all of GRAIL's stock aroused antitrust concerns in the U.S. and in the E.U. Our focus is on the FTC's objection to the acquisition, but the E.U. raised additional problems for Illumina. As required by § 7 of the Clayton Act, the FTC had to begin by defining a relevant antitrust market. Following that, the FTC argued that Illumina would have the ability and incentive to foreclose GRAIL's rivals from access to Illumina's NGS platform and consumables.

In defining the relevant product market, the FTC relied on several *Brown Shoe* indicia. First, the FTC observed that MCED tests have unique characteristics and uses that distinguish their product from other tests. Specifically, MCED tests can detect cancer at an early stage when it is most treatable by analyzing DNA fragments in the bloodstream. Second, the FTC pointed out that MCED tests will be sold to distinct customers: those patients who are asymptomatic. These patients have not been diagnosed with cancer, but are being tested for the presence of asymptomatic cancer. Third, the FTC found that MCED tests will have distinct prices relative to the prices of other cancer tests. Finally, the FTC pointed to industry recognition that MCED tests would compete with one another. The FTC cited evidence that GRAIL viewed other actual and potential suppliers of MCED tests as their rivals.

Based on the FTC's use of the *Brown Shoe* indicia, the FTC seems to have proved that the relevant market is composed of MCED tests.[7] This is what the FTC may have proved, but it is not what they alleged to be the relevant product market. Instead, the

[6] In Sherman Act Sect. 2 cases, the courts have usually required a market share of 70–75% for monopoly. A share of 50% only establishes a dangerous probability of achieving monopoly in an attempted monopoly case (Areeda & Hovenkamp, 2022).

[7] The FTC lumps together all prospective MCED tests as though they are reasonably substitutable. Given the potentially substantial product differentiation across MCED tests, this seems speculative.

FTC alleged that the relevant market is "research, development, and commercialization of MCED tests." While this certainly sounds like an area of economic activity, it seems strange to call it a "market."[8] This strained construction of a market may be necessary because the FTC has to find a line of commerce for § 7 of the Clayton Act to be relevant, but that does not mean that the FTC's peculiar construction should be permitted by the judiciary.

Nonetheless, in its appellate decision, the 5th Circuit concluded that the FTC's product market definition was correct. The court reviewed the FTC's application of the *Brown Shoe* indicia to the MCED tests and endorsed the FTC's finding that the relevant product market was "research, development, and commercialization of MCED tests." In spite of the fact that the evidence presented supports MCED tests as the relevant product market, the court embraced the idea of a "research and development" market. It is hard to see that this is a "line of commerce."[9]

3.4 Market Foreclosure

In order to establish the probable anticompetitive consequences of the proposed acquisition, the FTC argued that Illumina would have the "ability and incentive to foreclose" GRAIL's actual and potential rivals. Since Illumina is the only supplier of NGS platforms that are adequate for DNA analysis that involve MCED tests, it is by definition a monopolist. Since there is no other source, Illumina obviously had the ability to foreclose GRAIL's rivals. This, however, does not necessarily mean that foreclosure would be profitable.

In principle, there is a burden-shifting rule of reason analysis when the FTC challenges a proposed merger. The FTC must establish a *prima facie* case that the merger will violate § 7 of the Clayton Act. Based on whatever evidence it can muster, the FTC must demonstrate that there is a reasonable probability that the merger will substantially lessen competition in the relevant antitrust market.

Here, the FTC argued that it met this burden by showing that post-merger Illumina would have both the ability and incentive to foreclose its rivals in the research, development, and commercialization of MCED tests. The FTC took the position that this was sufficient to meet its burden. It ignored the fact that the Illumina-GRAIL merger would eliminate double marginalization and thereby result in lower prices and expanded output, which are clearly procompetitive effects.

The FTC also ignored Illumina's "Open Offer," which guaranteed rivals of GRAIL the same access to and prices of its NGS platform and consumables (FTC, 2023a). The FTC took the position that the open access guarantee was only relevant at the

[8] Many definitions of markets exist. According to Britannica, a market is "(1) a means by which the exchange of goods and services takes place as a result of buyers and sellers being in contact with one another, either directly or through mediating agents or institutions" (2) "…geographical area in which sellers compete with each other for customers." (https://www.britannica.com/money/topic/market). According to the Antitrust Division of the U.S. Department of Justice, a relevant market (for the purposes of merger analysis) is "a product of group of products and a geographic area in which it is produced or sold such that a hypothetical profit-maximizing firm likely would impose at least a small but significant and nontransitory increase in price…" (Horizontal Merger Guidelines, 2010).

[9] For a devastating critique of efforts to define product markets, see Kaplow (2024).

remedy stage and, therefore, was not relevant to its *prima facie* case. Since the open access guarantee had already been extended to some potential MCED test rivals, these rivals could not be foreclosed. As a result, the FTC analyzed a possible anti-competitive consequence that no longer existed. Commissioner Christine Wilson disagreed with the FTC majority in her concurring opinion (FTC, 2023).

On appeal, the Court of Appeals agreed that the open access guarantee had to be considered at the outset of the competitive analysis. In its opinion, it remanded the case to the FTC for further consideration in light of Illumina's open access guarantee.[10]

4 Illumina/GRAIL: Economic Reality

The FTC and the Court of Appeals objected to Illumina's reacquisition of GRAIL and expressed concerns that the merged firm had both the ability and incentive to foreclose potential entrants to the MCED test market. But this seems to ignore the economic reality at the time of the suit.

It is undisputed that Illumina is a monopolist in the supply of next-generation DNA sequencing (NGS) platforms that are able to support MCED tests. At present, the only test in the market is GRAIL's Galleri. This, of course, means that at the time of the suit, the market structure was one of successive monopoly. It is well known that a vertical merger between successive monopolists is welfare enhancing (Spengler, 1950; Machlup & Taber, 1960) because double marginalization is eliminated, which leads to a price reduction in the relevant market, an increase in the quantity consumed, and an improvement in both consumer and social welfare.[11] The total profit generated in the market also rises, so the vertically-integrated firm is better off.

In spite of the fact that the elimination of double marginalization (EDM) yields immediate benefits, it has been marginalized in the 2023 Merger Guidelines. The Agencies treat EDM as an efficiency, which tends to undermine its importance since efficiencies can seldom—if ever—save an otherwise objectionable merger. In most situations, efficiencies reduce a firm's costs through technological change and/or the mitigation of transaction costs. But EDM is quite different—the merger changes the market structure from one of successive monopoly to one of a vertically-integrated monopoly.

4.1 Post-Merger Illumina/Grail

Following Illumina's acquisition of GRAIL, the entities were not integrated operationally. If they had been operated as a vertically-integrated supplier of MCED tests, the profit (π) function would have been:

[10] The FTC did not have to do this since Illumina acquiesced to the divestiture order.

[11] Salop (2024) provides some qualifications with regard to the benefits of EDM. None of them seem relevant to the Illumina-GRAIL case. Chen (2001) has shown that a vertical merger that eliminates double marginalization can have anticompetitive effects. This result is due to the presence of unintegrated downstream rivals. In Illumina, however, there are no unintegrated rivals, although there may be some in the future.

$$\pi = P(Q)Q - C(Q)$$

where *P* is the price of an MCED test, *Q* is the quantity, and *C(Q)* is the cost of producing the test. This expression masks the fact that Illumina would be a divisionalized firm: an upstream division that supplies the NGS platform and consumables to the downstream division that uses the platform to produce MCED tests. If Illumina is going to maximize the firm's profit, division managers must receive the proper instruction. If they are both told to maximize profits, Illumina would experience double marginalization within the firm.[12]

A vertically-integrated Illumina can realize all of the economic profit in its NGS division or in its MCED division, but not both. If we assume that it faces no competition upstream for NGS platforms and consumables, Illumina could elect to realize all of the economic profit in the sale of NGS platforms. The NGS division manager will be charged with maximizing profit through the transfer prices to the downstream MCED division. The manager of the MCED division will be charged with maximizing the quantity sold by setting its prices equal to the sum of the transfer prices "paid" to the upstream division plus the marginal cost of producing the tests.

By adopting this strategy, the Illumina/GRAIL market structure is analogous to one of upstream monopoly and downstream competition, which does not involve double marginalization. The combined firm earns a monopoly return on its NGS platforms and related consumables and a competitive return on its MCED tests. Overall, the combined firm's profit will be maximized.

4.2 Market Foreclosure

The antitrust concern of the FTC, which was endorsed by the Court of Appeals, involves foreclosing rivals of GRAIL. But Illumina presumably would pursue such a strategy only if it were profit-maximizing to do so. As we show below, however, this strategy may not actually be profitable.

If a second MCED test supplier were to enter with a reasonably comparable test, the demand for NGS platforms would either increase or stay the same. The entrants could not charge more than the GRAIL MCED test prices. If the hypothetical rival siphoned off some of GRAIL's business, which is earning a competitive return, it would still be compensating Illumina at a monopoly return for the NGS platform. If the entrants were more efficient than GRAIL, the derived demand for Illumina's NGS platform would expand and thereby improve Illumina's monopoly profit. Foreclosing GRAIL's rivals would reduce Illumina's profit. Consequently, foreclosure by Illumina would be economically irrational and, therefore, not probable.

There is an implicit presumption that entry by rivals to GRAIL is beneficial to consumers – but this is not necessarily the case. The Illumina-GRAIL merger would yield immediate benefits to consumers due to EDM. Forbidding the merger leads to unnecessary losses in consumer welfare. If a second MCED test provider entered with a perfect substitute for GRAIL's Galleri, the relevant market structure would be one of duopoly. If the MCED test duopolists collude—either overtly or tacitly—there

[12] This problem was identified and solved by Hirshleifer (1956).

would be no improvement in consumer welfare since the effective market structure would still be one of successive monopoly. If they were to compete in Cournot fashion, consumer welfare would improve relative to successive monopoly, but still be inferior to vertical integration. If the duopolists compete in Bertrand fashion, the results would be the same as those with vertical integration, but the benefit would not materialize until the entrant materialized.[13]

5 Further Thoughts on the Guidelines and *Illumina*

In addition to the preceding issues, there are some troubling problems with the 2023 Merger Guidelines since they represent enforcement policies of the DOJ and the FTC. We examine some of these here and illustrate them with the FTC's enforcement efforts in the Illumina-GRAIL matter.

5.1 Marginalization of EDM

First and foremost, among the problems within the 2023 Merger Guidelines is the marginalization of EDM. In her concurring opinion, Commissioner Wilson recognized that EDM is a prominent rationale for vertical mergers. In the Merger Guidelines, however, EDM is relegated to a footnote:

> A common rebuttal argument is that the merger would lead to vertical integration of complementary products and as a result, "eliminate double marginalization," since in specific circumstances such a merger can confer on the merged firm an incentive to decrease prices to purchasers. The Agencies examine whether elimination of double marginalization satisfies the approach to evaluating procompetitive efficiencies in Sect. 3.3, including examining: (a) whether the merged firm will be more vertically integrated as a result of the merger, for example because it increases the extent to which it uses internal production of an input when producing output for the relevant market; (b) whether contracts short of a merger have eliminated or could eliminate double marginalization such that it would not be merger-specific, and (c) whether the merged firm has the incentive to reduce price in the relevant market given that such a reduction would reduce sales by the merged firm's rivals in the relevant market, which would in turn lead to reduced revenue and margin on sales of the related product to the dependent rivals" (2023 Merger Guidelines, FN. 31).

Illumina's expert pointed to the economic benefits of EDM in the context of the Illumina-GRAIL merger, but could not quantify the benefits to consumers. Consequently, the FTC dismissed this defense. The Court of Appeals supported the FTC's treatment of EDM. Ignoring EDM, however, is a serious error. In the presence of successive monopoly, vertical integration changes the market structure and yields immediate consumer benefits in the form of lower prices and expanded output. It is

[13] For further thoughts on these issues, see Alderman and Blair (2022).

irresponsible to give no weight to these benefits, which clearly improve consumer welfare, to protect potential entry that may never materialize.

5.2 EDM and Merger-Specificity

In some circumstances, EDM is not merger-specific because there are contractual alternatives to a merger that yield the same benefits.[14] To illustrate, suppose MP is a monopolist in the production of X while MD is the only distributor of X. If MP and MD are owned separately, the market structure is one of successive monopoly. If MP acquires MD, double marginalization will be eliminated.

In principle, there are at least two contractual equivalents. First, MP could impose a maximum resale price on MD. MP would choose the resale price that it would have charged had it been vertically integrated. This would limit MD to a competitive return.[15] A second contractual alternative involves sales quotas. MP would require that MD sell a specified quantity. MP would select the quantity that would have maximized MP's profit had it been vertically integrated. Once again, MD would be limited to a competitive return.

The case described above involves fixed proportions and a simple task for MD—turning a wholesale unit of X into a retail unit of X. MP can impose these terms on MD only if MP has alternative distributors. If there are no other distributors, then there is an element of bilateral monopoly,[16] which is an entirely different market structure.

In the Illumina-GRAIL case, things are not so simple. Illumina's next generation DNA sequencing platform and related consumables constitute an essential input in the production of MCED tests. Since Illumina will not be in the MCED test market, it will be difficult to determine the optimal price for an MCED test. Similarly, the optimal quantity would be elusive. Further complicating matters is the fact that MCED tests eventually will be covered by health insurance, which introduces further complications that are related to negotiated reimbursements by insurance companies.

As a result, we have concluded that contractual alternatives to vertical integration are not economically equivalent.[17] Thus, EDM is merger-specific.

5.3 Intertemporal Tradeoffs

The 2023 Merger Guidelines fail to recognize the intertemporal nature of some tradeoffs and the resulting economic consequences. A simple example illustrates the significance of intertemporal considerations. Suppose that benefits of one dollar today are sacrificed in exchange for future benefits. Assume further that the probability of experiencing the future benefits is 0.75 and that the future benefits occur in six

[14] See Angerhofer and Blair (2021) and Alderman and Blair (2023) for a discussion.

[15] Under *Albrecht v. The Harold Company*, 390 U.S. 145 (1968), setting maximum resale prices was unlawful per se. This Supreme Court misadventure was corrected in *State Oil Co v. Khan*, 522 U.S. 3 (1997).

[16] For an examination of bilateral monopoly, see Machlup and Taber (1960).

[17] For a similar conclusion, see Beck and Scott Morton (2011).

years. If the discount rate is 10%, then the expected present value of one dollar to be received in six years is $(0.75)(\$1.00/(1.10)^6)$ or \$0.42. Thus, for every dollar sacrificed today, the expected future benefit must be \$2.36.

Apparently, the FTC is under no obligation to provide an estimate of the future benefits that justify the tradeoff that it has imposed in the U.S. This is particularly troublesome when present benefits are sacrificed for future benefits that may never materialize. In Illumina, for example, the FTC blocked a vertical merger that would have eliminated double marginalization and improved consumer welfare immediately. Its rationale for doing so was the promise of offsetting benefits in the future. These future benefits are not immediate nor certain. It is unknown which if any of GRAIL's hypothetical rivals will bring a test to market, and if so, how substitutable that test would be for GRAIL's Galleri.

For the tradeoff to be economically sound, the present value of the future benefits discounted by the probability of their occurring must exceed the present value of the forgone benefits that are certain. If this is not the case, then the present sacrifice is economically irrational.

5.4 Quantifying Costs and Benefits

There is a decided imbalance in the requirement to quantify costs and benefits. Both the FTC and the Court of Appeals expected Illumina's expert to quantify the benefit to consumers of EDM. In contrast, the FTC faced no similar requirement in its speculation that Illumina might foreclose GRAIL's rivals at some unspecified date in the future. The FTC provides an array of competitive concerns regarding foreclosure, but offers no estimate of the cost to consumers.

5.5 Quantifying EDM

When Illumina's expert economist explained the benefits of EDM, the FTC demanded that those benefits be quantified. The Court of Appeals agreed. This is an unrealistic burden to put on a defendant for several reasons, and as a result, the benefits of EDM were marginalized.

In order to calculate the gains in consumer and social welfare from EDM, one would need an estimate of the demand for MCED tests. Since this is a nascent market, the data that are necessary to estimate the demand do not exist. In addition, one would need estimates of the costs of the NGS platforms and consumables as well as the costs of performing the MCED tests. While the firm may have reasonable cost estimates at small volumes, the costs at much higher volumes may be elusive.

One might reasonably ask why EDM should be given any credence if quantifying the benefits of EDM are so elusive. The answer is straightforward. In the presence of successive monopoly, a vertical merger has all benefits and no losses. There is no tradeoff. The market structure changes to one that generates better outcomes.

5.6 Illumina Pricing Conduct

Before Illumina sold 88% of GRAIL, its transfer prices (or charges) for its NGS platform were noticeably low. After the spinoff, it increased the price. The FTC observed the price changes and inferred that as evidence that Illumina would abuse GRAIL's rivals.

This reaction, however, was a complete misunderstanding of vertical integration in the presence of successive monopoly. Initially, Illumina and GRAIL were vertically integrated, and Illumina earned its profit at the MCED test stage. After GRAIL was spun off, Illumina moved its profit to the NGS platform stage. This is not evidence of anticompetitive conduct by Illumina. Instead, it is precisely what economic theory would predict.

This evidence undermines the FTC's case against the merger.

6 Conclusion

The Illumina-GRAIL merger was challenged by the FTC because of its potential to foreclose entry into the MCED test market. As we have shown, this concern is not only refuted by the facts in the case (rivals were guaranteed access to NGS technology), but also by economic theory, which considers the change in market structure and associated elimination of double marginalization to be procompetitive. The 2023 Merger Guidelines, as they relate to vertical mergers where double marginalization may be eliminated, may prove problematic for the enforcement of § 7 of the Clayton Act. Application of the Guidelines may block or deter vertical mergers that are procompetitive.

Under the 2023 Merger Guidelines, the burden of proof with regard to EDM falls on the defendants. This means that the DOJ and the FTC ignore an extremely significant structural consideration in establishing its *prima facie* case. In Illumina, for example, the FTC ignored the certain and immediate consumer benefits of EDM while pointing to future benefits that are uncertain and of unknown magnitude.[18]

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Author Contributions R.B. and C.D. contributed to all parts.

Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

[18] Salop (2024) does not appear to share this criticism of merger enforcement policy.

References

Alderman, B. L., Roger, D., & Blair (2022). Preserving potential entry is not the Holy Grail in vertical merger enforcement. *Antitrust*, *36*, 42–49.

Alderman, B. L., Roger, D., & Blair (2023). Reflections on Illumina-GRAIL. *Journal of Antitrust Enforcement*, *11*, 536–543.

Angerhofer, T. J., Roger, D., & Blair (2021). Successive monopoly, bilateral Monopoly, and Vertical mergers. *Review of Industrial Organization*, *59*, 343–361.

Areeda, P. E., & Herbert Hovenkamp. (2022). & *Antitrust Law* ¶ 801 (5th ed.).

Beck, & Marissa and Fiona Scott Morton. (2021). Evaluating the evidence on Vertical mergers. *Review of Industrial Organization*, *59*, 273–302.

Chen, Y. (2001). On Vertical mergers and their competitive effects. *The RAND Journal of Economics*, *32*, 667–685.

Federal Trade Commission. (2021). *Complaint (redacted public version)*. In the Matter of Illumina, Inc. and GRAIL, Inc.

Federal Trade Commission. (2023a). *Brief of the Federal Trade Commission* (Vol. 26July). Illumina, Inc. v. FTC.

Federal Trade Commission (2023b). Concurring Opinion of Commissioner Christine Wilson, In the matter of Illumina, Inc. and GRAIL, February 1.

Gilbert, & Richard and Douglas Melamed. (2024). Potential competition and the 2023 Merger guidelines. *Review of Industrial Organization*. This Issue.

Hirshleifer, J. (1956). On the economics of transfer pricing. *Journal of Business*, *29*, 172–184.

Illumina (2023a). Press Release. Illumina announces decision to divest GRAIL. https://investor.illumina.com/news/press-release-details/2023/Illumina-Announces-Decision-to-Divest-GRAIL/default.aspx.

Illumina, I. (2023b). *Petitioner's reply brief, Illumina, Inc. & Grail, Inc. v* (Vol. 16). FTC.

Kaplow, L. (2024). The 2023 Merger guidelines and market definition: Doubling down or folding? *Review of Industrial Organization*, This Issue.

Machlup, & Fritz and Martha Taber. (1960). Bilateral monopoly, successive monopoly, and vertical integration. *Economica*, *27*, 101–119.

Salop, S. (2024). *The 2023 Merger guidelines: A post-chicago and neo-brandeisian integration, review of Industrial Organization*. This Issue.

Spengler, J. J. (1950). Vertical integration and antitrust policy. *Journal of Political Economy*, *58*, 347–352.

US Department of Justice & Federal Trade Commission (2010). Horizontal Merger Guidelines. https://www.justice.gov/atr/public/guidelines/hmg-2010.pdf.

US Department of Justice & Federal Trade Commission (2023). Merger Guidelines. https://www.justice.gov/opa/pr/justice-department-and-federal-trade-commission-release-2023-merger-guidelines.

Young, K. D. (2023). Grail gets FDA OK for study of cancer blood test. *Medscape Available at*https://www.medscape.com/viewarticle/998794?form=fpf.

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