EUROPEAN COMMISSION
DG Competition

Case M.10059 - SK HYNIX / INTEL'S NAND AND SSD BUSINESS

Only the English text is available and authentic.

REGULATION (EC) No 139/2004
MERGER PROCEDURE

Article 6(1)(b) NON-OPPOSITION
Date: 20/05/2021

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EUROPEAN COMMISSION

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PUBLIC VERSION

In the published version of this decision, some information has been omitted pursuant to Article 17(2) of Council Regulation (EC) No 139/2004 concerning non-disclosure of business secrets and other confidential information. The omissions are shown thus […]. Where possible the information omitted has been replaced by ranges of figures or a general description.

SK Hynix Inc.
2091, Gyeongchung-daero, Bubal-eub
Icheon-si, Gyeonggi-do, 17336
Republic of Korea

Subject: **Case M.10059 – SK hynix/Intel's NAND and SSD business**
Commission decision pursuant to Article 6(1)(b) of Council Regulation No 139/2004[1] and Article 57 of the Agreement on the European Economic Area[2]

Dear Sir or Madam,

(1) On 13 April 2021, the European Commission received notification of a proposed concentration (the "Transaction") pursuant to Article 4 of the Merger Regulation by which SK Hynix Inc. ("SK hynix", South Korea) acquires within the meaning of Article 3(1)(b) of the Merger Regulation sole control of the NAND and solid-state drive business of Intel (the "Target Business")[3]. SK hynix is designated hereinafter as the "Notifying Party", SK hynix and the Target Business together as the "Parties".

1 OJ L 24, 29.1.2004, p. 1 (the 'Merger Regulation'). With effect from 1 December 2009, the Treaty on the Functioning of the European Union ('TFEU') has introduced certain changes, such as the replacement of 'Community' by 'Union' and 'common market' by 'internal market'. The terminology of the TFEU will be used throughout this decision.

2 OJ L 1, 3.1.1994, p. 3 (the 'EEA Agreement').

3 Publication in the Official Journal of the European Union No C 139, 20.04.2021, p. 8.

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1. THE PARTIES

(2) SK hynix is active in the manufacturing and marketing of semiconductor products. SK hynix is headquartered in the Republic of Korea and originally founded its semiconductor business in 1983 as Hyundai Electronic Industrial Co., Ltd. Today, SK hynix primarily designs and manufactures memory storage devices such as Dynamic Random Access Memory ("DRAM"), NAND (meaning "not AND") flash memory and NAND-based Solid-State Drives ("SSDs"), as well as system semiconductors such as Complementary Metal-Oxide-Semiconductor ("CMOS") image sensors.

(3) The Target Business is active in developing, designing, manufacturing, assembling, testing, marketing and selling products utilizing the NAND flash memory technology. The Target Business is also active in developing, designing, manufacturing, assembling, testing, marketing and selling SSDs that utilize NAND flash memory technology.

2. THE OPERATION

(4) The notified Transaction concerns the acquisition by SK hynix of the NAND and SSD business of Intel. It will be implemented by means of a Master Purchase Agreement (the "MPA") entered into on 19 October 2020 by the Parties and will be completed in two steps. At the first closing, SK hynix will acquire Intel's NAND Fabrication ("Fab") Assets through a wholly-owned subsidiary to be organized in China ("FabCo") and, through another wholly-owned subsidiary ("SSDCo"), it will acquire Intel's SSD Business Assets. Intel's remaining NAND operations will be transferred to one or more wholly-owned subsidiaries of Intel ("OpCo"). At the second closing, SK hynix will acquire all of Intel's remaining NAND Business Assets by way of an acquisition of the equity interests in OpCo from Intel.

(5) Therefore, the Transaction constitutes a concentration within the meaning of Article 3(1)(b) of the Merger Regulation.

3. UNION DIMENSION

(6) The undertakings concerned have a combined aggregate world-wide turnover of more than EUR 2 500 million (Parties: […])[4]. In each of at least three Member States, the combined aggregate turnover of the Parties is more than EUR 100 million ([…]). The aggregate turnover of each Party is more than EUR 25 million in each of the Czechia ([…]), the Netherlands ([…]) and Poland ([…]). Each of the Parties has a Union-wide turnover in excess of EUR 100 million ([…]), but they do not achieve more than two-thirds of their aggregate Union-wide turnover within one and the same Member State. The notified operation therefore has a Union dimension pursuant to Article 1(3) of the Merger Regulation.

4. RELEVANT MARKETS

4.1. Introduction to flash memory and data storage solutions

(7) The Transaction relates to flash memory and data storage solutions. Data storage solutions allow for the creation, management and preservation of digital content. They are used in a variety of information technology ("IT") devices and applications, such

[4] Turnover calculated in accordance with Article 5 of the Merger Regulation.

as personal computers, servers, and other business storage systems as well as in industrial and consumer electronic applications, such as digital video recorders, gaming devices and automotive applications. Data storage solutions used in these devices and applications include SSDs, Hard Disk Drives ("HDDs"), memory cards, USB flash drives and embedded flash storage.

(8) Data storage solutions require computer memory, *i.e.* components and recording media, to retain digital data. There are two types of computer memory: volatile and non-volatile memory. Volatile memory (such as random access memory, "RAM"), retains the stored information only while powered. By contrast, non-volatile memory can retain information after having been power cycled (*i.e.*, turned on and off). Volatile memory comes in two main types: Static Random Access Memory ("SRAM") and DRAM.

(9) Flash memory is a type of non-volatile storage technology that stores data in transistors and that does not require power to retain data. Flash memory uses two different technologies to map and store data, NAND and NOR. The names refer to the type of logic gate used in each memory cell ("Not AND" and "Not OR"). Contents of NOR memory can be read more rapidly than the contents of NAND, while data can be written to NAND more rapidly than to NOR.

(10) An SSD is a storage solution that uses NAND flash memory to store digital data.[5] The NAND flash memory is a key input for SSDs. The other main components of an SSD are the controller and the interface. The controller is a chip that directs memory reading, writing, and certain other functions (in other words, it manages how and where data is stored on the memory chips within the SSDs). The interface is the connection between the storage unit and the computer or system where it is inserted. It consists of a physical layer, the physical interconnector, and a logical layer, the protocol used to structure the communication.

(11) The notified Transaction concerns the following three types of data storage that are used in the value chain described above:

(a) DRAM: a type of non-volatile memory, that can retain memory after having been power cycled, used in data and graphic processing applications in data centres as well as in a wide array of IT devices for consumer applications – where only SK hynix is active;

(b) NAND: flash memory (a type of non-volatile semiconductor media) used for data storage in consumer devices, enterprise systems, and industrial applications – where both SK hynix and the Target Business are active; and

(c) SSDs: a type of storage solution used in IT devices and applications, which are based on flash memory – where both SK hynix and the Target Business are active.

(12) In addition to the activities set out above, SK hynix also designs “CMOS” image sensors and managed NAND.

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5 Contrary to an SSD that uses NAND flash memory, an HDD is a storage solution that uses one or more rotating metal or glass disks with magnetic surfaces to store and allow access to data. A read/write head on a moving actuator arm accesses the data while the disk is spinning.

(13) CMOS image sensors are non-memory semiconductors that serve the role of digital film in many IT devices. They are found in several types of electronic components, including microprocessors, batteries, and digital camera image sensors, and are mainly used in digital cameras, smartphones and miniature medical imaging systems. The Target Business is not active in this field or in markets that are upstream or downstream of CMOS image sensors.

(14) Managed NAND is a product that combines NAND and a controller, or both a controller and DRAM. Managed NAND is commonly used in mobile phones, and to a lesser extent in tablets and low-grade laptops (the primary form of storage in laptops and PCs is hard drives and SSDs). It is available in different types:

(a) Embedded MultiMedia Card ("eMMC") is a small storage device that incorporates NAND flash memory and a simple storage controller on a single integrated circuit. It is commonly used in portable devices, such as tablets and mobile phones, as a low-cost method of providing primary internal storage. eMMC can also be used in on-board vehicle entertainment and navigation systems. The next generation of eMMC is Universal Flash Storage ("UFS"). It is a high performing integrated circuit with higher memory capacity and optimized performance for multithreaded applications. As a result, it is currently used in high-end smartphones only.

(b) Embedded Multi-Chip Memory ("eMCP") is Multi-Chip-Package comprising eMMC and DRAM. It is typically used in basic smartphones or non-smartphones/utility phones given its lower cost. uMCP is a new solution comprising UFS and DRAM and expects to utilize UFS's fast speed and MCP's advantages in occupying a smaller foothold area in printed circuit boards and in reducing phone makers' effort in system design.

(15) The Target Business is not active in managed NAND. In addition, as explained further in Section 5.5, even though NAND is an input for managed NAND products, the Target Business' NAND cannot be integrated into SK hynix's current managed NAND products.

4.2. Product market definition

4.2.1. DRAM

4.2.1.1. Previous Commission decisions

(16) In past decisions, the Commission examined whether it was necessary to differentiate between the different types of DRAMs. In particular, the Commission considered whether commodity DRAMs, used as components for personal computers, and high-speed DRAMs, used in high-performance servers and workstations, are separate product markets but ultimately left the market definition question open.[6]

(17) In *JV.44 Hitachi/NEC — Dram/JV*, the Commission considered that DRAMs could be differentiated according to the memory size (e.g. the quantity of data that can be stored on the chips), their intended application (FPM-DRAM, EDO-DRAM, SDRAM, or RDRAM) or the type of the final product where they are installed: servers, PCs,

6 Case IV/JV22 *Fujitsu/Siemens*, paragraph 41.

mobiles, games, network devices, PC peripherals, and others. However, it was not necessary to further delineate the relevant product markets in the context of that case.[7]

(18) From the demand-side, the Commission found that the same type of DRAMs is available to customers as DRAMs are commodity products with standardized specifications.[8] From the supply side, the Commission considered that manufacturers are able to switch between different functional types of DRAM due to similar production technologies, but that switching between different generations of DRAM required significant technology investment costs and important production ramp-up time.[9]

4.2.1.2. Notifying Party's view

(19) The Parties agree with the Commission's past practice that DRAMs are commodity products with standardized specifications, and that DRAM manufacturers are able to switch between different functional types of DRAM due to similar production technologies. However, the Parties submit that the precise product market definition can be left open in this case given that the proposed Transaction will not raise competition concerns irrespective of the precise product market definition.[10]

4.2.1.3. The Commission's assessment

(20) The market investigation confirmed that commodity DRAMs, used as components for personal computers, and high-speed DRAMs, used in high-performance servers and workstations, are separate product markets.[11]

(21) As regards further segmentations, the results were not clear for a segmentation according to the memory size as the majority of the respondents did not have sufficient information to assess whether this market segmentation would be possible.[12] In addition, the majority of respondents to the market investigation took the view that DRAM should not be further segmented into distinct product markets on the basis of its intended application into: (i) FPM-DRAM, (ii) EDO-DRAM, (iii) SDRAM, and (iv) RDRAM.[13] On the contrary, the respondents to the market investigation confirmed that the DRAM market should rather be further segmented on the basis of the type of final product where it is installed into (i.e. (i) servers, (ii) PCs, (iii) mobiles, (iv) games, (v) network devices, (vi) PC peripherals, and others).[14]

4.2.1.4. Conclusion on product market definition

(22) For the purpose of this decision and in light of the results of the market investigation, the Commission will assess the overall product market for DRAM as including all possible narrower markets, i.e. the market for commodity DRAMs, and the DRAM markets for (i) servers, (ii) PCs, (iii) mobiles, (iv) games, (v) network devices, (vi) PC

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7 Case JV.44 *Hitachi/NEC — Dram/JV*, paragraphs 15 and 16.
8 Case JV.44 *Hitachi/NEC — Dram/JV*, paragraph 18.
9 Case JV.44 *Hitachi/NEC — Dram/JV*, paragraph 19.
10 Form CO, paras. 6.286 – 6.287.
11 Replies to Questionnaire, question 5.
12 Replies to Questionnaire, question 6.
13 Replies to Questionnaire, question 7.
14 Replies to Questionnaire, question 8.

peripherals, and others. In any event, the market definition can be left open as the above market segmentations do not impact the outcome of the competitive assessment of the Transaction.

4.2.2. NAND flash memory

4.2.2.1. Previous Commission decisions

(23) The Commission previously considered a separate market for NOR and NAND.[15] The Commission found that NOR and NAND should be distinguished due to low supply-side substitutability between the types of flash memory. Many suppliers were not active in the whole flash memory spectrum and would incur significant costs and risks switching from one memory type to another. On the demand-side, the Commission noted the different end-applications of NOR and NAND and the significant switching cost for consumers.[16] In its most recent decision concerning NAND, the Commission took the view that NAND formed a distinct product market, on the basis that NAND and NOR flash memory have different characteristics and are used in different applications.[17]

(24) The Commission has also previously considered whether NAND should be further distinguished by 2D and 3D NAND and ultimately left the product market definition open.[18] The differences between 2D NAND and 3D NAND in terms of technology, price and capacity were not considered sufficient to conclude that they constitute two separate product markets.

4.2.2.2. Notifying Party's view

(25) The Notifying Party considers[19] that 2D NAND is being increasingly displaced by 3D NAND for many applications, due to the constant effort to reduce the size of chips and the need to increase storage capacity. Moreover, today the cost per GB of 2D NAND is several times higher than that of 3D NAND. 2D NAND flash memory today accounts for a very limited portion of NAND flash memory and has virtually been displaced by 3D NAND flash memory. Competition between NAND suppliers is focused on 3D NAND, and 2D NAND production remains only for niche applications to fulfill product warranty requirements. This displacement is illustrated by the evolution of NAND in smartphones. Until 2016, all smartphones used 2D NAND; since 2017, both 2D and 3D NAND devices have been used on smartphones. Today's Samsung Galaxy and Apple's iPhone utilize only 3D NAND. As such, suppliers have already, or are in the process of phasing out 2D NAND.

(26) The Notifying Party submits that the Transaction will not result in any competition concerns, irrespective of whether 2D NAND and 3D NAND are considered part of the same or separate product markets. The Target Business is no longer active in 2D

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15 Case M.4751 – STM/Intel/JV, paragraphs 16 and 20; and Case M.5804 – Samsung Electronics/Samsung Digital Imaging, paragraphs 20-23.

16 Case M.4751 – STM/Intel/JV, paragraphs 13- 15.

17 Case M.7772 – Western Digital/SanDisk, paragraph 64.

18 Case M.7772 – Western Digital/SanDisk, paragraph 66.

19 Form CO, paras 6.58-6.62.

NAND, while the Parties' combined position in 3D NAND is very similar to their combined position in the overall NAND segment.

4.2.2.3. The Commission's assessment

(27) The market investigation confirmed the existence of separate markets for each of NOR and NAND.[20]

(28) As regards the existence of separate markets between 2D and 3D NAND, the market investigation was inconclusive. From a demand-side perspective, the majority of the respondents explained that 2D and 3D NAND are substitutable.[21] However, from a supply-side perspective, the majority of the respondents confirmed that a supplier could not rapidly switch manufacturing and supplying between 2D NAND and 3D NAND without incurring significant investment.[22] The market investigation confirmed that 2D NAND is an older, legacy technology that is being used decreasingly because it has capacity limitations. 3D NAND technology on the other hand allows stacking which increases capacity and reduces cost. Lastly, the market investigation confirmed that there are no other relevant segmentations within the overall NAND market.[23]

4.2.2.4. Conclusion on product market definition

(29) For the purpose of this decision and in light of the results of the market investigation, the Commission will assess the overall product market for NAND as including the possible markets for 2D and 3D NAND. In any event the market segmentation into 2D and 3D NAND does not impact the outcome of the competitive assessment of the Transaction and the market definition can be left open.

4.2.3. Storage – segmentation based on technology (HDDs vs. SSDs)

4.2.3.1. Previous Commission decisions

(30) With regard to storage solutions, in its decisional practice, the Commission has analyzed potential segmentations based on technology (HDDs vs. SSDs), on intended use (enterprise vs. client storage), on interface (SATA, SAS, PCI). Each of these potential segmentations are discussed in detail below.

(31) The Commission has also found in its previous decisions that HDDs and SSDs did not belong to the same relevant product markets, neither for enterprise use nor for client use[24] due to the significant price difference between the two technologies and the limited storage capacity of SSDs relative to HDDs.[25] The Commission, however, noted that SSDs and HDDs could be substitutes for some enterprise applications, for instance in the case of low-performance SSDs which could be substitutable with high-

20 Replies to Questionnaire, question 10.

21 Replies to Questionnaire, questions 10.3 and 10.4.

22 Replies to Questionnaire, questions 10.5 and 10.6.

23 Replies to Questionnaire, question 11.

24 See also Commission decision of 19 October 2011 in Case M.6214 – Seagate Technology/The HDD Business of Samsung Electronics, recitals 256-259; and Commission decision of 23 November 2011 in Case M.6203 – Western Digital Ireland/Viviti Technologies, recitals 362-365.

25 See Case M.7772 – Western Digital/SanDisk, para. 26.

performance HDDs.[26] In its most recent decision on HDDs and SDDs, the Commission noted the long term trend whereby HDDs are being displaced by SSDs and left open the question as to whether HDDs and SSDs belong to the same product market with respect to client applications. It however concluded, albeit for the sole purpose of that decision, that HDDs and SSDs belonged to separate product markets with respect to enterprise applications.[27]

4.2.3.2. Notifying Party's view

(32) The Notifying Party considers that, since the adoption of the most recent Commission decision regarding these product areas (*Western Digital/SanDisk* in 2016), SSDs have rapidly expanded in both client and enterprise applications, at the expense of HDDs. Although HDDs still offer a cost advantage per GB, SSDs benefit from better performance, speed, lower power consumption and increased durability, which ultimately leads to several cases where the total lifetime cost of using an SSD is in fact comparable or lower than that of using an HDD. SSDs have also grown in storage capacity. For example, […].[28]

4.2.3.3. The Commission's assessment

(33) The market investigation confirmed the segmentation by technology into HDD and SSD.[29] In particular, from the demand-side, the majority of market participants takes the view that SSD and HDDs are not substitutable, as HDD customers seek large capacity storage at the lowest per GB price and SSD is used in lower capacity storage with higher performance. According to the results of the market investigation, if substitution occurred between HDDs and SSDs, it would go primarily in the direction of SSDs replacing HDDs.[30]

(34) From the supply-side, it is considered that suppliers cannot switch manufacturing and supplying between HDDs and SSDs rapidly and without incurring significant investment as the production process for HDDs is different from that of SSDs and they cannot be produced on the same production lines.[31]

4.2.3.4. Conclusion on product market definition

(35) For the purpose of this decision and in light of the results of the market investigation, the Commission will assess the product markets for SSDs and HDDs[32] separately. In any event the market the market definition can be left open as the segmentation into SSDs and HDDs does not impact the outcome of the competitive assessment of the Transaction.

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26 See Case M.7772 – Western Digital/SanDisk, para 28.
27 See Case M.7772 – Western Digital/SanDisk, para. 35.
28 Form CO, para. 6.66.
29 Replies to Questionnaire, question 15.
30 Replies to Questionnaire, question 13.
31 Replies to Questionnaire, question 14.
32 Considering that neither party is active in HDDs, this market will not be discussed separately in this decision. See Form CO, para. 6.65, footnote 115.

4.2.4. Storage – segmentation based on intended use (enterprise vs. client storage)

4.2.4.1. Previous Commission decisions

(36) Previously, the Commission found a distinction between enterprise and client storage because enterprise storage generally requires higher performance and superior endurance, compared to client storage.[33] The Commission has however noted that in some cases, client SSDs can be used for enterprise applications that do not require a high workload.[34]

4.2.4.2. Notifying Party's view

(37) The Notifying party takes the view that enterprise SSDs are generally used in high workload environments, such as servers and corporate datacenters, while client SSDs are deployed in consumer devices (including tablets, smartphones) or systems (such as desktop PCs, notebooks, gaming consoles).

(38) The main customers of enterprise SSDs include OEMs (e.g. producers of enterprise computers or storage systems such as Dell and Oracle) and ODMs (original design manufacturers, which produce computer or storage systems on behalf of OEMs and hyperscalers); end user customers that often purchase SSDs directly from manufacturers for use in "hyperscale" distributed computing environments, such as Facebook, Google, Amazon Web Services, Microsoft, Baidu, Alibaba and Tencent, as well as other large end-users; and distributors that serve smaller OEMs.

(39) Client SSD customers include OEMs such as Apple, Sony, Dell, Lenovo, HP and others, which incorporate SSDs into consumer products (PCs, tablets, storage devices); ODMs such as Quanta, Compal, Wistron and others; end consumers, who purchase client SSDs from client SSD suppliers or from standard electronics hardware stores; and distributors.

4.2.4.3. The Commission's assessment

(40) The market investigation confirmed that the market for storage products should be segmented by intended use into: (i) enterprise (eSSDs) and (ii) client (cSSDs).[35]

(41) From the demand-side, client storage and enterprise storage are not substitutable. Client storage products do not typically have the same price point, components, form factor, or performance specification as enterprise products.[36] From the supply-side, the respondents indicated that it would be relatively easy for a supplier to switch manufacturing between client storage and enterprise storage and start supplying eSSDs or cSSDs rapidly and without incurring significant investment.[37]

4.2.4.4. Conclusion on product market definition

(42) For the purpose of this decision and in light of the results of the market investigation, the Commission will assess the product markets for enterprise and client SSDs as separate markets. In any event the market definition can be left open as the

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33 *See* Case M.7772 – *Western Digital/SanDisk*, paragraph 24.

34 *See* Case M.7772 – *Western Digital/SanDisk*, paragraph 24.

35 Replies to Questionnaire, question 18.

36 Replies to Questionnaire, question 16.

37 Replies to Questionnaire, question 17.

segmentation into enterprise and client SSDs does not impact the outcome of the competitive assessment of the Transaction.

4.2.5. Enterprise storage – segmentation based on interface (SATA vs. SAS vs. PCIe)

4.2.5.1. Previous Commission decisions

(43) In its most recent decision regarding SSDs, the Commission found that enterprise SSDs with different interfaces have different endurance, reliability, latency and price, and are used for different end uses and applications. Ultimately, the Commission left open the question of whether enterprise SSDs should be further segmented by interface.[38] In its previous decisions regarding HDDs, the Commission considered the different interfaces of HDDs to be relevant in the definition of the relevant product markets.

4.2.5.2. Notifying Party's view

(44) The Notifying Party submits that in recent years, Peripheral Component Interconnect Express ("PCIe") eSSDs have been increasingly outperforming and replacing Serial Advanced Technology Attachment ("SATA") eSSDs for enterprise applications. This trend is mainly driven by a decrease in price of NAND flash memory, which has resulted in lower prices for better performing PCIe eSSDs, as well as in an increase in the performance of PCIe eSSDs, which are gradually exceeding the maximum throughput of SATA and Serial-Attached SCSI ("SAS") eSSDs (except for newer versions of SAS). Moreover, due to their scalability, PCIe eSSDs can be used for both lower-cost, mainstream performance purposes, as well as for higher-cost, higher-performance purposes. Thus, in recent years, PCIe eSSDs are replacing both SATA and a portion of SAS eSSDs, especially among customers looking to purchase new systems (for whom potential interface incompatibility issues have no real significance).

(45) The Notifying Party submits that there are several competitors in the overall SSD market and not all of them are active in all three categories mentioned above. Indicatively, the biggest players are active in all three, while the Parties are only active in eSSD SATA and eSSD PCIe.

(46) Ultimately the decision to use PCIe eSSDs, SAS eSSDs or SATA eSSDs primarily depends on the performance requirements of the individual customer, and will be attenuated by their degree of price sensitivity, and their willingness to incur the cost of switching. For example, a more cost-sensitive enterprise customer might be willing to sacrifice higher speeds and reliability for a cheaper price and would therefore purchase SATA eSSDs over PCIe eSSDs (the former is cheaper and slower, relative to PCIe eSSDs).

4.2.5.3. The Commission's assessment

(47) The results of the market investigation are not clear as to whether the market for eSSDs should be segmented by interface into (i) SATA, (ii) SAS and (iii) PCIe.[39]

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38 See Case M.7772 – Western Digital/SanDisk, para. 54.

39 Replies to Questionnaire, question 19.

(48) From the demand-side, the different interfaces for eSSDs were in general not considered to be substitutable. Some respondents take the view that customers show strong interface preferences in the eSSDs they buy and systems designed for a specific interface would need to be modified to switch to another interface of eSSDs. Based on this, it can be deemed that there is limited scope for substitution of eSSDs with different interfaces. Nevertheless, other respondents took the view that all eSSDs could be considered interchangeable with respect to the fact that they perform the same general function. However, they recognized that differences in performance based on interface exist (e.g., for example PCIe is faster than SATA). The possibilities for substitution depend on the specific server or storage device that requires eSSDs, as there is a need to have matching interface connectors on the motherboards of such systems in order for them to match with the specification of the eSSD.[40]

4.2.5.4. From the supply-side, the replies of the respondents were mixed as regards the ability of a supplier to switch manufacturing and supplying between the different interfaces for eSSDs rapidly and without incurring significant investment. In particular, the responses to the market investigation indicate that if a supplier has developed eSSDs with different interfaces, switching between manufacturing one interface eSSD and another generally does not require significant effort or expense as different interface SSDs are easy to develop. This is because the components used for eSSDs are common across interfaces. In particular, the NAND flash memory chip component is common and once the supply of NAND is secured, the other components in an eSSD such as controllers and firmware are available from third parties or can be designed and manufactured in-house.[41] Conclusion on product market definition

(49) For the purpose of this decision and in light of the results of the market investigation, the Commission will assess the product markets for PCIe eSSDs, SAS eSSDs or SATA eSSDs as separate markets. In any event, the market definition can be left open as the segmentation into enterprise and client SSDs does not impact the outcome of the competitive assessment of the Transaction.

4.3. Geographic market definition

4.3.1. DRAM

4.3.1.1. Previous Commission decisions

(50) In its previous decisions concerning the markets for DRAMs and flash memories, the Commission took the view that the geographic scope of all possible products markets is worldwide.[42]

4.3.1.2. Notifying Party's view

(51) The Notifying party has not taken a view regarding the geographic scope of the DRAM market.

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40 Replies to Questionnaire, question 19.1.

41 Replies to Questionnaire, question 19.2.

42 See case COMP/JV.44, Hitachi/NEC-DRAM/JV of 3 May 2000 and case COMP/M.4751, STM/Intel/JV of 10 August 2007.

4.3.1.3. The Commission's assessment

(52) The market investigation has confirmed that the market for DRAMs and all its possible segmentations is worldwide.[43]

4.3.1.4. Conclusion on geographic market definition

(53) In light of the results of the market investigation, the Commission will assess the worldwidemarket for DRAM including all its possible narrower markets, i.e. the market for commodity DRAM,.and DRAM on the basis of the type of final product where it is installed into: (i) servers, (ii) PCs, (iii) mobiles, (iv) games, (v) network devices, (vi) PC peripherals and others.

4.3.2. NAND flash memory

4.3.2.1. Previous Commission decisions

(54) The Commission has previously concluded that the geographic market for NAND flash memory is global in scope.[44]

4.3.2.2. Notifying Party's view

(55) The Notifying Party submits that the geographic market for NAND, 2D NAND and 3D NAND is worldwide in scope.[45]

4.3.2.3. The Commission's assessment

(56) The market investigation confirmed that the geographic market for NAND (and also 2D and 3D NAND) is worldwide in scope.[46]

4.3.2.4. Conclusion on geographic market definition

(57) In light of the results of the market investigation, the Commission will assess the overall worldwide market for NAND, including 2D and 3D NAND.

4.3.3. Storage – segmentation based on technology (HDDs vs. SSDs), segmentation based on intended use (enterprise vs. client storage), segmentation based on interface (SATA vs. SAT vs. PCIe)

4.3.3.1. Previous Commission decisions

(58) In the Commission's previous decisions, the geographic market for SSDs (including any putative narrower markets thereunder) was considered to be worldwide in scope, because (i) transport costs do not play a significant role and amount to less than 1% of total product cost; (ii) there are no significant barriers to trade; (iii) prices do not typically differ by region; (iv) products and product features do not differ by region; (v) manufacturers are active on a global basis (thus competitors tend to be the same

43 Replies to Questionnaire, question 9.
44 Case M.7772 – Western Digital/SanDisk, paragraph 72.
45 Form CO, para 6.79.
46 Replies to Questionnaire, question 12.

regardless of the regions taken into consideration); and (vi) the market players decide their strategy on a global level.[47]

4.3.3.2. Notifying Party's view

(59) The Notifying Party agrees with the Commission's previous decisions that the market for SSDs is worldwide.

4.3.3.3. The Commission's assessment

(60) The market investigation confirms that the market for SSDs and all its possible segmentations is worldwide.[48]

4.3.3.4. Conclusion on geographic market definition

(61) In light of the results of the market investigation, the Commission will assess the worldwide market for SSDs and all its possible segmentations.

5. COMPETITIVE ASSESSMENT

5.1. Analytical framework

(62) The Guidelines on the assessment of horizontal mergers ("Horizontal Merger Guidelines")[49] describe two main ways in which horizontal mergers may significantly impede effective competition, in particular by creating or strengthening a dominant position: (i) by eliminating important competitive constraints on one or more firms, which consequently would have increased market power, without resorting to coordinated behaviour (non-coordinated effects); and (ii) by changing the nature of competition in such a way that firms that previously were not coordinating their behaviour, are significantly more likely to coordinate and raise prices or otherwise harm effective competition (coordinated effects[50]) as a result of the proposed concentration.

(63) A merger giving rise to horizontal non-coordinated effects might significantly impede effective competition by creating or strengthening the dominant position of a single firm, one which, typically, would have an appreciably larger market share than the next competitor post-merger. Moreover, also mergers that do not lead to the creation of or the strengthening of a single firm's dominant position may create competition concerns under the substantive test set out in Article 2(2) and Article 2(3) of the Merger Regulation. Regarding mergers in oligopolistic markets, the Merger Regulation clarifies that "*under certain circumstances, concentrations involving the elimination of important competitive constraints that the merging parties exerted upon each other, as well as a reduction of competitive pressure on the remaining competitors, may, even in the absence of a likelihood of coordination between the*

47 Case M.7772 – *Western Digital/SanDisk*, paragraph 69-72.

48 Replies to Questionnaire, question 22.

49 Guidelines on the assessment of horizontal mergers under the Council Regulation on the control of concentrations between undertakings ("Horizontal Merger Guidelines"), OJ C 31, 05.02.2004, paragraph 22.

50 A merger may also make coordination easier, more stable or more effective for firms which were coordinating prior to the merger.

members of the oligopoly, result in a significant impediment to effective competition".[51]

(64) The Horizontal Merger Guidelines list a number of factors which may influence whether or not significant horizontal non-coordinated effects are likely to result from a merger, such as the large market shares of the merging firms, the fact that the merging firms are close competitors, the limited possibilities for customers to switch suppliers, or the fact that the merger would eliminate an important competitive force. Not all those factors need to be present to make significant non-coordinated effects likely and it is not an exhaustive list.[52]

(65) Further, in some markets, a merger may give rise to coordinated effects where the structure is such that firms would consider it possible, economically rational, and hence preferable, to adopt on a sustainable basis a course of action on the market aimed at selling at increased prices.[53] According to the Horizontal Merger Guidelines, coordination is more likely where it is relatively simple to reach a common understanding on the terms of coordination. Moreover, three conditions need to be met for coordination to be sustainable: (i) the coordinating firms must be able to monitor to a sufficient degree whether the terms of the coordination are being adhered to; (ii) there must be some form of credible deterrent mechanism that can be activated if deviation is detected; and (iii) the reactions of outsiders as well as customers should not be able to jeopardise the results expected from the coordination.[54]

(66) Next to horizontal effects, the Guidelines on the assessment of non-horizontal mergers ("Non-Horizontal Merger Guidelines") sets out that there are also two broad types of non-horizontal mergers that can be distinguished: vertical mergers and conglomerate mergers.[55]

(67) Vertical mergers involve companies at different levels of the supply chain. According to the Non-Horizontal Merger Guidelines, non-coordinated effects may significantly impede effective competition as a result of a vertical merger if such merger gives rise to foreclosure. Foreclosure occurs where actual or potential rivals' access to supplies or markets is hampered or eliminated as a result of the merger, thereby reducing these companies' ability and/or incentive to compete.[56] Such foreclosure may discourage entry or expansion of rivals or encourage their exit.[57] There are two forms of foreclosure: input foreclosure occurs where the merger is likely to raise the costs of downstream rivals by restricting their access to an important input, and customer foreclosure occurs where the merger is likely to foreclose upstream rivals by restricting their access to a sufficient customer base.[58] A vertical merger could also lead to other non-coordinated effects, for instance where the merged entity may, by

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51 Merger Regulation, recital 25. Similar wording is also found in paragraph 25 of the Horizontal Merger Guidelines.

52 Horizontal Merger Guidelines, paragraph 26.

53 Horizontal Merger Guidelines, paragraph 39.

54 Horizontal Merger Guidelines, paragraph 41.

55 Guidelines on the assessment of non-horizontal mergers under the Council Regulation on the control of concentrations between undertakings ("Non-Horizontal Merger Guidelines"), OJ C 265, 18.10.2008, paragraph 3.

56 Non-Horizontal Merger Guidelines, paragraph 18.

57 Non-Horizontal Merger Guidelines, paragraph 29.

58 Non-Horizontal Merger Guidelines, paragraph 30.

vertically integrating, gain access to commercially sensitive information regarding the upstream or downstream activities of rivals.[59] Finally, a vertical merger may also give rise to coordinated effects.

(68) Lastly, the Non-Horizontal Merger Guidelines focus, besides vertical mergers, on conglomerate mergers consisting of mergers between companies that are active in closely related markets, for instance suppliers of complementary products or of products which belong to a range of products that are generally purchased by the same set of customers for the same end use.[60]

(69) In the majority of circumstances, conglomerate mergers do not lead to any competition concerns but in certain specific cases there may be harm to competition.[61] The main concern in the context of conglomerate effects is that of foreclosure.[62] Conglomerate mergers may allow the merged entity to combine products in related markets and this may confer on the merged entity the ability and incentive to leverage a strong market position from one market to another by means of tying or bundling, or other exclusionary practices.[63]

(70) In assessing the likelihood of conglomerate effects, the Commission examines, first, whether the merged entity would have the ability to foreclose its rivals, second, whether it would have the economic incentive to do so and, third, whether a foreclosure strategy would have a significant detrimental effect on competition, thus causing harm to consumers. In practice, these factors are often examined together as they are closely intertwined.[64]

5.2. Horizontal non-coordinated effects

(71) The Commission has investigated and assessed whether the Transaction is likely to give rise to a significant impediment to effective competition as a result of non-coordinated effects in the markets for (i) 3D NAND[65] and (ii) SSDs and the possible narrower markets therein

5.2.1. NAND

5.2.1.1. Notifying Party's view

(72) The Notifying Party takes the view that within NAND, the Parties' activities overlap only in 3D NAND.[66] The Parties provided a competitive assessment under all relevant NAND segmentations to show that the proposed Transaction will not raise horizontal concerns under any such segmentations.

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59 Non-Horizontal Merger Guidelines, paragraph 78.
60 Non-Horizontal Merger Guidelines, paragraph 91.
61 Non-Horizontal Merger Guidelines, paragraph 92.
62 Non-Horizontal Merger Guidelines, paragraph 93.
63 Non-Horizontal Merger Guidelines, paragraph 93.
64 Non-Horizontal Merger Guidelines, paragraph 94.
65 For completeness, in this section the Commission assesses the overall market for NAND as well, despite it not being technically affected.
66 Form CO, para. 6.85.

(73) The Parties combined market share in the NAND martet (approximately [20-30]%) would still be smaller than Samsung's market share and it would be very closely followed by the third competitor, Kioxia.

(74) The Notifying Party submits that the Parties are not close competitors. They serve to a great extent different customers/applications in the NAND segment. More specifically, [60-70]% of SK hynix's NAND revenues are derived from NAND flash memory mobile phone applications, an area where the Target Business is not active.[…].[67]

(75) According to the Notifying Party, the Parties face a number of strong, well-resourced competitors and new entries are occurring as indicated above in paragraph (75) above. Chinese competitor YMTC is in the process of implementing significant expansion plans and is expected to account for about [5-10]% of global NAND flash memory output in 2021, and expand further beyond that to become a leading player in NAND.[68]

(76) Moreover, the Notifying Party submits that there is significant and constant innovation in NAND flash memory. In order to remain competitive, NAND flash memory vendors must continue to innovate and scale the number of stacks.[69]

(77) The Notifying Party submits that Parties and their competitors have different costs structures, different technological capabilities in terms of increasing the number of layers and number of bits per cell, different production capacities. . At the same time, each of the Parties' rivals have ample financial resources and R&D capabilities to be able to exert significant competitive pressure on the Parties and will continue to do so post-Transaction.[70]

5.2.1.2. The Commission's assessment

(78) For the purposes of this decision, the Commission will assess the overall market for NAND including the markets for 2D NAND and 3D NAND. The Commission's market investigation results also concern the overall NAND market and the 3D NAND market. The Target Business is no longer active in 2D NAND, while the Parties' combined position in 3D NAND is very similar to their combined position in the overall NAND segment.

(i) Market shares for the global NAND market

(79) The Parties and their main competitors' market shares in the global NAND market for 2019 are as follows:

[67] Form CO, para. 6.93.
[68] Form CO, para. 6.94.
[69] Form CO, para. 6.96.
[70] Form CO, para. 6.97.

Table 1[71]

NAND suppliers	**Share (% Sales by Value)**
SK hynix	[10-20]%
The Target Business	[10-20]%
Parties Combined	**[10-20]%**
Samsung	[30-40]%
Kioxia	[10-20]%
Western Digital	[10-20]%
Micron	[10-20]%
Others	[0-5]%

(80) The Target Business is the sixth player and holds a single digit share ([5-10]%) on the overall NAND market. SK hynix is the fifth player with a share of [10-20]%. Aside from the Parties, there are at least four other NAND suppliers active on a global basis whose NAND sales are larger than those of the Parties, namely Samsung ([30-40]%), Kioxia ([10-20]%), Western Digital ([10-20]%) and Micron ([10-20]%). In addition, there is a number of well-resourced smaller players, as well as a new entry, while competitors are expanding capacity.[72]

(81) Samsung will remain the leader in this market, with a approximate [30-40]% share that is almost double the Parties' combined share. Kioxia (approximately [10-20]%), Western Digital (approximately [10-20]%), Micron (approximately [10-20]%) are also major players fiercely competing in this segment. In all, there will be five suppliers with double-digit shares post-Transaction.[73]

(i) Market shares for the global 3D NAND market

(82) The Parties and their main competitors' market shares in the global 3D NAND market for 2019 are as follows:

[71] Form CO, para 6.86.
[72] Form CO, paras 6.87 – 6.88, and Table 8.
[73] Form CO, para. 6.88.

Table 2[74]

NAND suppliers	**Share (% Sales by Value)**
SK hynix	[10-20]%
The Target Business	[10-20]%
Parties Combined	**[20-30]%**
Samsung	[30-40]%
Kioxia	[10-20]%
Micron	[10-20]%
Western Digital	[10-20]%
YMTC	[0-5]%

(83) Post-merger Samsung will continue to be the undisputed leader with an approximate [30-40]% share, followed by the merged entity (approximately [20-30]%), Kioxia (approximately [10-20]%), Micron (approximately [10-20]%) and Western Digital (approximately [10-20]%), all strong competitors with double-digit shares. YMTC has started making its way in this market with significant technological achievements and capacity expansion plans.

(ii) Supply for NAND

(84) Customers usually have a variety of options when choosing a supplier. The results of the market investigation indicate that suppliers of NAND sell their products through requests for quotations and long-term agreements with their customers.[75] Respondents to the market investigation described purchasing NAND either on the basis of long term agreements or on the basis of individual orders. In the latter case, this is done after collecting quotations from various suppliers .[76] Pricing tends to be reasonably similar between suppliers and independent market consultant reports can be used to evaluate whether pricing is competitive.[77] This means that suppliers need to maintain a competitive portfolio, both in terms of price and quality, to effectively compete in the market.

(85) Post-transaction, there will continue to be several players in the market, maintaining a high level of competition. Consistent with the Parties and their main competitors' market shares, respondents to the market investigation identified Western Digital, Samsung and Kioxia as top NAND suppliers.[78] They also confirm that the level of competition in the market for 3D NAND is high, and the market is intensely competitive. As a result, at least six entities currently develop and manufacture

74 Form CO, para 6.91.
75 Replies to Questionnaire, question 23.
76 Replies to Questionnaire, question 25.
77 Replies to Questionnaire, question 27.
78 Replies to Questionnaire, questions 24 and 26.

NAND, including Samsung, SK hynix, Micron, Intel, Kioxia, Western Digital, and YMTC. These companies invest in R&D and manufacturing process technologies. [79]

(86) Although the Parties are significant 3D NAND players, as they both provide 3D NAND, which (in contrast to 2D NAND) accounts for the majority of NAND product offerings in today's market,[80] they compete closely with Samsung, Kioxia, Western Digital andMicron. This was confirmed by the respondents to the market investigation. The Parties and the aforementioned players are globally competing, covering all major applications for NAND flash memory, such as smartphone/cSSDs/ eSSDs/ others. These players are active in all the markets where the Parties are active. YMTC, for its part, is active primarily in Chinese market at this moment.[81]

(87) From the supply-side, suppliers experience pressure from (potential) new market entrants in the supply of 3D NAND.Moreover, as a result of the existing players and potential new entrants, the supply of 3D NAND is readily available. When the supply of 3D NAND is readily available, there is a constraint imposed on suppliers which results in a reduction in pricing. YMTC, for example, is a new entrant in the supply of 3D NAND, its entry will increase the level of supply in the market and thus lead to a reduction in pricing. Additionally, suppliers also experience pressure from the fact that customers multisource, as indicated below. [82]

(iii) Demand for NAND

(88) From the demand-side, the Transaction is not likely to provide the Parties with exclusive customers. It is common for customers to source from various suppliers which means that switching suppliers would not be difficult. Respondents to the market investigation confirm that it is easy for a customer to switch between suppliers of 3D NAND[83] as customers usually multisource the product from different suppliers and therefore, do not depend on a single supplier.[84] For this reason, they are also able to easily increase or decrease the amount of their purchases from a given supplier.[85]

(89) However, customers would not have the ability to credibly threaten producers of 3D NAND by starting to source their needs for 3D NAND in-house as the capital expenditure required to produce their own NAND is cost-prohibitive for customers. Production requires dedicated manufacturing fabs and decades of knowledge to maintain the pace on lithography transitions.[86]

(iv) Innovation and financial capacity in the NAND market

(90) The ability of a supplier of 3D NAND to innovate also plays a significant role in remaining competitive on the market for 3D NAND. 3D NAND is quantified by the number of layers stacked in a device. As more layers are added, the bit density increases. Generally, suppliers are scaling 3D NAND roughly one technology

79 Replies to Questionnaire, question 28.
80 Replies to Questionnaire, question 29.
81 Replies to Questionnaire, question 30.
82 Replies to Questionnaire, question 36 and 36.1.
83 See replies to question 32.
84 Replies to Questionnaire, question 33.
85 Replies to Questionnaire, question 34.
86 Replies to Questionnaire, question 35.

generation every year. It is crucial for each player to quickly introduce advanced technologies to gain (or retain) competitiveness. [87]

(91) The market investigation results indicate that suppliers or potential suppliers of 3D NAND have a financial strength comparable to that of SK hynix and the Target Business. In particular, respondents to the market investigation take the view that all the competitors are generally of equal size to SK Hynix and the Target Business and make similar CAPEX investment. The exception to this is Samsung, which is larger and its CAPEX greater than that of other competitors.[88] As a result, the Parties do not appear to have a particular advantage in terms of financial capacity.

(92) The Transaction is viewed by the market players as a transaction that will increase the competition in the market.[89] Moreover, market participants take the view that the Transaction will improve competition as well as the quality and the range offering of products.[90] In fact, according to market participants, the transaction will create a "memory house" able to compete with Samsung.

(v) Competition in the NAND market

(93) While the market investigation results point to an increased market share of the merged entity in 3D NAND post-Transaction, and while the Transaction will lead to a reduction in the number of large suppliers of 3D NAND from seven to six, this does not raise competition concerns for the majority of the respondents. The merged entity will continue to face significant competitive constraints from the remaining players, such that the increase in the merged entity's market share will not lead to the acquisition of market power.[91]

Conclusion

(94) In light of the above, and in particular in view of the moderate combined market share of the Parties as well as the important number of competitors of varying size that will remain active post-merger, the Commission considers that the Transaction does not give rise to serious doubts as to its compatibility with the internal market with respect to the possible markets for NAND.

5.2.2. SSD

(95) The Parties are both active in SSDs, including eSSDs and cSSDs. SK hynix has historically focused on cSSDs, whereas the Target Business has focused on eSSDs.

(96) Within enterprise SSDs, the Parties' activities only overlap in SSDs with PCIe and SATA interfaces. Neither party sells SAS SSDs. Intel […] does not itself compete in SAS SSDs.

87 Replies to Questionnaire, question 37 and 37.1.
88 Replies to Questionnaire, question 38 and 38.1.
89 Minutes of a call with a customer of 22.02.2021.
90 Minutes of a call with a customer of 18.02.2021.
91 Replies to Questionnaire, question 39 and 39.1.

5.2.2.1. Notifying Party's view

(97) According to the Notifying Party, the market for SSDs is highly competitive. Samsung is by far the largest player. Western Digital, Kioxia, Micron and Kingston are also major SSD competitors, while YMTC's entry/expansion[92] will introduce another major competitor. Other emerging players include Seagate (a leading HDD manufacturer) and Ramaxel. SK hynix is the sixth biggest player with a market share of approximately [5-10]%, with only one percentage point separating it from the seventh player, Kingston. Post-Transaction, the merged entity would have a market share of approximately [20-30]% ([10-20% according to Forward Insights; [20-30]% according to Omdia).

(98) The Notifying Party submits that the Parties are not close competitors in SSD. The Target Business primarily focuses on enterprise SSD. Enterprise SSD represents approximately […]% of the Target Business' total 2019 SSD revenues. Conversely, SK hynix focuses more on client SSD. Client SSD represents approximately […]% of SK hynix's total 2019 SSD revenues. Within the enterprise segment, the Parties have differentiated offerings, with the Target Business addressing the requirements of both OEMs and cloud customers, while SK hynix is focused predominantly on cloud customers, with most of its revenues coming from a single customer to which it sells a customized offering ([…]).

(99) The Notifying Party notes that the SSD market is highly competitive not only because of the existence of several competitors but also due to its quality as a dynamic market, in which innovation plays an important part.

(100) In light of the above, the Notifying Party takes the view that the proposed Transaction would not give rise to any anti-competitive concerns in the overall market for SSDs. The Notifying Party further submits that the same conclusion would apply to possible segmentations of the SSD market.

(A) Enterprise SSDs

(101) The Notifying Party submits that if the proposed Transaction was assessed under the narrower enterprise SSDs and client SSDs segments, it would likewise not be problematic.

(102) The proposed Transaction will not change the competitive landscape in the enterprise SSD space. SK hynix is only the sixth player in enterprise SSDs, with a market share by revenue of approximately [0-5]%, and approximately […]% of SK hynix's enterprise SSDs sales are derived from […].

(103) Post-transaction, Samsung will remain the leader with a share of approximately [30-40]% followed by the merged entity with a share of approximately [20-30]% (and a share increment of approximately [0-5]%%). The Parties' major competitors in the enterprise SSDs segment include, besides Samsung, Kioxia, Micron, Western Digital and Seagate. Kioxia (approximately [10-20]%), Micron (approximately [5-10]%) and

[92] YMTC has a small market share in the NAND market and is now expanding in the SSD market. YMTC's entry in the NAND segment makes it a credible and timely entrant in the SSD segment. In September 2020, YMTC announced the release of a SATA eSSD in collaboration with H3C Technologies. Also, YMTC recently released the PC005 and SC001 client SSD under the sub-brand ZhiTai, which leverage YMTC's own 3D NAND flash memory technology. Industry analysts suggest that these products appear to have comparable performance to Samsung's client SSDs.

Western Digital (approximately [5-10]%) are approximately three to four times larger than SK hynix, while Seagate (approximately [0-5]%) has a comparable position to SK hynix.

(104) According to the Notifying Party, yperscale customers have developed and produced their own enterprise SSDs for in-house use in their data centers. Huawei, Google and Amazon also manufacture their own enterprise SSDs. Customers that already produce their own enterprise SSDs can threaten to shift more of their enterprise SSD consumption to their own internal production, and customers that do not already produce their own enterprise SSDs can threaten to do so.

Enterprise SSD segmentation by interface

(105) According to the Notifying party, even assuming the enterprise SSD segment were to be further divided by interface, no competition concerns would arise in the resulting subsegments.

(B) SAS Enterprise SSDs

(106) The Notifying Party submits that neither Party sells SAS enterprise SSDs ("SAS eSSDs").

SATA Enterprise SSDs

(107) According to the Notifying Party, as regards SATA enterprise SSDs ("SATA eSSDs"), the merged entity would have a combined market share of approximately [30-40]%. SK hynix has a market share of approximately [0-5]%, thus the proposed Transaction would result in a de minimis market share increment. […].

(108) The Notifying Party submits that the Target Business's market share has lost [10-20] percentage points between 2015 and 2019 (from approximately [40-50]% in 2015 to approximately [30-40]% in 2019) and its sales have also declined significantly in absolute terms from USD […] in 2017 to USD […] in 2019 given its focus on PCIe. In view of the fact that in recent years PCIe SSDs have been increasingly outperforming and replacing SATA SSDs for enterprise applications, […]. Samsung (approximately [30-40]%) would have a comparable position to the merged entity, followed by Micron (approximately [20-30]%). Further, a number of smaller competitors including, Kioxia (approximately [0-5]%), Western Digital (approximately [0-5]%) and others will continue to compete in this market.

(C) PCIe Enterprise SSDs

(109) In the possible market for PCIe enterprise SSDs ("PCIe eSSDs"), the Parties' combined market share is approximately [40-50]% (Target Business approximately [30-40]% and SK hynix approximately [5-10]%). Western Digital (approximately [5-10]%)[93] and Kioxia (approximately [5-10]%) have comparable positions to SK

[93] In August 2020, Western Digital announced that its revenues from sales of enterprise SSDs "more than doubled in revenue" compared to the previous year and in April 2020, Western Digital confirmed that its latest PCIe-based SSDs "have completed more than 20 qualifications with well over 100 qualifications in progress at multiple cloud and OEM customers worldwide". See https://www.westerndigital.com/company/newsroom/press-releases/2020/2020-08-05-western-digital-reports-fourth-quarter-and-fiscal-year-2020-financial-results; see

hynix, while Micron (approximately [0-5]%) is rapidly catching up (between 2017 and 2019 Micron more than doubled its share). The factors discussed above illustrating the highly competitive nature of the overall segment for enterprise SSDs likewise apply in the narrower markets of SATA eSSDs and PCIe eSSDs.

(110) The Notifying Party submits that the proposed Transaction will not result in any competition concerns in the areas of enterprise SSDs. In the overall enterprise SSD market, SK hynix is the sixth player with a revenue share of approximately [0-5]%, and behind Samsung, Kioxia, Micron, Western Digital, as well as the Target Business, and only half a percentage point ahead of Seagate. Cloud customers, in particular, exercise significant negotiating leverage due to the large size of their purchases and demonstrated ability to manufacture their own SSDs.

(111) The Notifying Party submits that this conclusion would be similar on an SSD interface basis. The Parties are not active in SAS, and SK hynix only has a market share of approximately [0-5]% in SATA. In PCIe, […]% of SK hynix's 2019 global PCIe eSSD sales were to […].

(D) Client SSDs

(112) The Notifying Party considers that the segment for client SSDs is highly competitive. Numerous companies compete in the client SSD segment, in which the Parties' combined share is approximately [10-20]%. Samsung will continue to be the leading supplier with a market share of approximately [30-40]%, while Western Digital (approximately [10-20]%), Kioxia (approximately [10-20]%), Kingston (approximately [5-10]%) and Micron (approximately [5-10]%) are all strong and well-established global players, who will exert competitive pressure on the merged entity.

(113) First, a number of emerging and expanding players, including Seagate and Ramaxel, also participate in the segment. Seagate's history as a major hard drive manufacturer gives it an edge as it expands its SSD business, as it has established relationships with OEMs, which are the major purchasers of client SSDs.

(114) Second, YMTC's entry announced in 2020, provides additional evidence of the highly competitive nature of this segment. Industry analysts suggest that YMTC's recently released products appear to have comparable performance to Samsung's client SSDs.

(115) Third, some potential large clients are currently covering their demand for client SSDs in-house. For example, Apple captures approximately [0-5]% of the total demand.

5.2.2.2. The Commission's assessment

(116) The market investigation confirmed the Notifying Party's claims.. Even though the Parties are considered significant market players in the SSD market, the Commission considers that the Transaction is not likely to give rise to anti-competitive effects for the reasons mentioned below.

https://www.westerndigital.com/company/newsroom/press-releases/2020/2020-04-30-western-digital-reports-fiscal-third-quarter-2020-financial-results.

(i) Market shares for the global SSD market

(117) The Parties' and their main competitors' market shares in the global SSD market for 2019 are as follows:

Table 3[94]

SSD suppliers	**Share (% Sales by Value)**
SK hynix	[5-10]%
The Target Business	[10-20]%
Parties Combined	**[10-20]%**
Samsung	[30-40]%
Western Digital	[10-20]%
Kioxia	[10-20]%
Micron	[5-10]%
Kingston	[0-5]%
Apple	[0-5]%
Seagate	[0-5]%
Ramaxel	[0-5]%
Others	[5-10]%

(118) Post-transaction Samsung will remain the leading SSD supplier, with a share of approximately [30-40]%, far exceeding the combined share of the merged entity. Western Digital (approximately [10-20]%), Kioxia (approximately [10-20]%), Micron (approximately [5-10]%) are also suppliers in SSDs with shares above 5%, and a number of smaller competitors such as Kingston ([0-5]%), Seagate ([0-5]%) and Ramaxel ([0-5]%) have also gained share in recent years. Kingston has increased sales significantly in 2019, capturing now approximately [0-5]% of the SSD supply. Seagate is a new entrant in the SSD market but a leading manufacturer of HDD.[95]

[94] Form CO, para 6.104.
[95] Form CO, para. 6.105.

(i) Market shares for the global Enterprise SSD (eSSD) market

(119) The Parties' and their main competitors' market shares in the global eSSD market for 2019 are as follows:

Table 4[96]

eSSD suppliers	**Share (% Sales by Value)**
SK hynix	[0-5]%
The Target Business	[20-30]%
Parties Combined	**[20-30]%**
Samsung	[30-40]%
Kioxia	[10-20]%
Micron	[5-10]%
Western Digital	[5-10]%
Kingston	[0-5]%
Seagate	[0-5]%
Kingston	[0-5]%
Others	[5-10]%

(120) Post-transaction, Samsung will remain the leader with a share of approximately [30-40]% followed by the merged entity with a share of approximately [20-30]% (and a share increment of approximately [0-5]%). The Parties' major competitors in the enterprise SSDs segment include, besides Samsung, Kioxia, Micron, Western Digital, Kingston and Seagate. Kioxia (approximately [10-20]%), Micron (approximately [5-10]%) and Western Digital (approximately [5-10]%) are approximately three to four times larger than SK hynix, while Seagate (approximately [0-5]%) has a comparable position to SK hynix. It is noteworthy that SK hynix relies on […] for most of its sales.[97]

[96] Form CO, para 6.119.
[97] Form CO , para. 6.120.

(i)Market shares for the global SATA eSSD market.

(121) The Parties' and their main competitors' market shares in the global SATA eSSD market for 2019 are as follows:

Table 5[98]

SATA eSSD suppliers	**Share (% Sales by Value)**
SK hynix	[0-5]%
The Target Business	[30-40]%
Parties Combined	**[30-40]%**
Samsung	[30-40]%
Micron	[20-30]%
Kioxia	[0-5]%
Western Digital	[0-5]%
Seagate	[0-5]%
Kingston	[0-5]%
Others	[5-10]%

(122) Samsung (approximately [30-40]%) would have a comparable position to the merged entity, followed by Micron (approximately [20-30]%). Further, a number of smaller competitors including, Kioxia (approximately [0-5]%), Western Digital (approximately [0-5]%) and others will continue to compete in this subsegment.

(123) The Target Business has lost [10-20] percentage points in share between 2015 and 2019 (from approximately [40-50]% in 2015 to approximately [30-40]% in 2019) and its sales have also declined significantly in absolute terms from USD […] in 2017 to USD […] in 2019 given its focus on PCIe (as described below). In view of the fact that in recent years PCIe SSDs have been increasingly outperforming and replacing SATA SSDs for enterprise applications, […].

[98] Form CO, para. 6.134.

(i)Market shares for the global PCIe eSSD market

(124) The Parties' and their main competitors' market shares in the global PCIe eSSD market for 2019 are as follows:

Table 6[99]

PCIe eSSD suppliers	**Share (% Sales by Value)**
SK hynix	[5-10]%
The Target Business	[30-40]%
Parties Combined	**[40-50]%**
Samsung	[30-40]%
Kioxia	[5-10]%
Western Digital	[5-10]%
Micron	[0-5]%
Silicon Motion	[0-5]%
Seagate	[0-5]%
Others	[5-10]%

(125) Samsung will be the largest competitor after the merged entity (approximately [30-40]%). Western Digital (approximately [5-10]%) and Kioxia (approximately [5-10]%) have comparable positions to SK hynix, while Micron (approximately [0-5]%) is rapidly catching up (between 2017 and 2019 Micron more than doubled its share).

(126) Despite the Parties' combined market shares in the PCIe eSSD market, in light of the assessment below and in particular of the indications provided by the results of the market investigation that a sufficient number of alternative suppliers will remain active in PCIe eSSDs, the Commission considers that the Transaction does not give rise to serious doubts as to its compatibility with the internal market with respect to the possible market for PCIe eSSDs.

[99] Form CO, para. 6.137.

(i)Market shares for the global Client SSD (cSSD) market

(127) The Parties' and their main competitors' market shares in the global cSSD market for 2019 are as follows:

Table 7[100]

PCIe eSSD suppliers	**Share (% Sales by Value)**
SK hynix	[5-10]%
The Target Business	[5-10]%
Parties Combined	**[10-20]%**
Samsung	[30-40]%
Western Digital	[10-20]%
Kioxia	[10-20]%
Kingston	[5-10]%
Micron	[5-10]%
Apple	[0-5]%
Ramaxel	[0-5]%
Seagate	[0-5]%
Others	[5-10]%

(128) Post-transaction the merged entity will have a share of approximately [10-20]%, which means that the market for cSSDs is not affected. Samsung will continue to be the leading supplier with an approximately [30-40]% share, while Western Digital (approximately [10-20]%), Kioxia (approximately [10-20]%), Kingston (approximately [5-10]%) and Micron (approximately [5-10]%) are all strong and well-established global players, who will exert competitive pressure on the merged entity.

Assessment on the global market for SSDs

(129) The Commission's assessment applies to the global SSD market as well as all its potential narrower markets.

(130) As regards the global SSD market, according to the Horizontal Merger Guidelines, in a concentration where the market share of the undertakings concerned is low, the concentration is presumed to be compatible with the internal market. An indication to this effect exists, in particular, when the market share of the undertakings does not

[100] Form CO, para. 6.145.

exceed 25 % either in the common market or in a substantial part of it, the concentration.[101] The above apply to the global SSD market, where the combined market share of the undertakings concerned is ([10-20]%). First, the market investigation results show that the overall SSD market is highly competitive. According to the majority of respondents, competition is equally high for the eSSDs market further divided into the SATA eSSDs and PCIe eSSDs markets.[102] The market for cSSDs is not considered to be an affected market since the Parties' combined market share is less than 20%.

(131) The high level of competition is reflected by the existence of other players that compete closely with the Parties in terms of product portfolio similarity, performance, quality and price in the overall market for SSDs and its potential narrower markets (SATA eSSDs, PCIe eSSDs).[103] Samsung will remain the leading SSD supplier, with several other players in the market (i.e. Western Digital, Kioxia, Micron) that are also established suppliers in SSD occupying considerable market shares. The only market in which Samsung will be the second biggest player, is the market for PCIe eSSDs. A number of smaller competitors such as Kingston, Silicon Motion, Seagate and Ramaxel have also gained share in recent years. In addition, YMTC's recent entry provides additional evidence of the existence of significant competitive constraints in the SSD segment.

(ii) Demand for SSDs

(132) Second, from the demand-side, the market investigation participants take the view that it is easy for a customer to switch between suppliers of SSDs, cSSDs and eSSD (including the markets for SATA eSSDs, PCIe eSSDs). Customers typically multi-source and compare the price offered by each supplier.[104] Customers are also able to easily increase or decrease the amount of their purchases for the above products from a given supplier.[105]

(133) In addition to multi-sourcing, vertical integration is not something that can affect demand in the SSD market. In-house sourcing of SSDs is possible for customers as SSDs can be produced even by suppliers that do not make their own NAND, since they can procure NAND separately from existing suppliers on the market.[106] For the eSSD segment in particular, Google, Amazon and Huawei manufacture their own eeSSDs. Microsoft is already developing eeSSDs by procuring NAND and working with ODMs (e.g., Quanta, Wistron), to develop solutions for its own data centres. The ability of customers to successfully produce their own eSSDs gives them leverage in negotiating with eeSSD suppliers. This means that customers may resort in producing their own eSSDs if that proves to be more cost-efficient than procuring it from

[101] See para. 18 of the Horizontal Merger Guidelines, *Concentrations which, by reason of the limited market share of the undertakings concerned, are not liable to impede effective competition may be presumed to be compatible with the common market. Without prejudice to Articles 81 and 82 of the Treaty, an indication to this effect exists, in particular,*

[102] Replies to Questionnaire, questions 46 and 46.1 – 46.4.

[103] Replies to Questionnaire, questions 48 and 49.

[104] Replies to Questionnaire, questions 45 and 57.

[105] Replies to Questionnaire, question 58.

[106] Replies to Questionnaire, question 59.

suppliers. As the vertical integration continues, they are also less likely to depend on suppliers in the future..

(iii) Supply for SSDs

(134) Third, from the supply-side, the market investigation indicated that current suppliers experience pressure from (potential) new market entrants in the markets of SSDs and in the markets of all its possible markets.[107] Suppliers sell in a variety of different ways, including responding to requests for quotations, long-term agreements and sales through distributors and retailers.[108] The ability to innovate plays an important role for the suppliers who want to remain competitive in the market for SSDs, including all its potential segmentations. The respondents to the market investigation confirm that the SSD market is dynamic and characterized by significant leapfrog innovation. Competitors seek to differentiate their offerings through the development and release of new products and technologies in this space. This rapid pace of technological innovation in SSDs is driving significant growth in demand, which incentivizes all competitors to compete aggressively to capture a larger share of the growing market. It is, therefore, important for suppliers to keep up with the most recent changes in interface and performance. Competition in the SSD market is further intensified by the fact that, similarly to NAND, SSD is a rapidly growing market.[109]

(135) Fourth, contracts in the market for SSDs and of all its sub-markets are typically negotiated bilaterally. Suppliers usually provide a production description and sample products to the customer. Following customer product qualification, the supplier and the customer will extensively negotiate the supply agreement. Enterprise SSD customers typically qualify more than one supplier and multi-source not only for security of supply purposes but also to obtain a stronger bargaining leverage.[110]

(iv) Competition in the SSD market

(136) Furthermore, the increased market power of the merged entity is unlikely to lead to competition concerns. First, the Parties will still have to live up to the pace of a very dynamic market. The new requirements, as well as the new entrants that appear in the market, will result in the market maintaining its competitiveness. Second, Samsung will still hold the largest market share and will continue to be the market leader. The transaction will create a strong competitor with a portfolio consisting of different types of memory that will be able to challenge Samsung and thus, increase competition in the market. Samsung is a powerful "memory house" able to supply different types of memory to different customers and the merged entity is expected to be able to do the same post-Transaction.

(137) In sum, the market investigation results confirm that the increase in market share brought about by the Transaction will not lead to competition concerns. The increase of the merged entity's market share will be outweighed by the fact that the SSD market is highly dynamic, with the Parties facing significant competitive constraints from established suppliers. In addition, post-Transaction, the merged entity will remain smaller than Samsung, the market leader. Certain market participants even took the

[107] Replies to Questionnaire, questions 60 and 60.1 – 60.4.
[108] Replies to Questionnaire, question 44 and 44.1.
[109] Replies to Questionnaire, question 61.
[110] Replies to Questionnaire, question 41.

view that the acquisition of Intel's SSD business by SK hynix will enable the merger entity to better compete with Samsung. This is because the Parties will form another supplier with both SSD and DRAM offerings, improving the overall competition in the market. becoming a viable competitor to an otherwise dominant player, Samsung.[111]

Conclusion

(138) In light of the above, and in particular in view of the moderate combined market share of the Parties as well as the important number of competitors of varying size that will remain active post-merger, the Commission considers that the Transaction does not give rise to serious doubts as to its compatibility with the internal market with respect to the possible markets for SSDs and all possible narrower markets.

5.3. Horizontal coordinated effects

(139) The Commission has investigated and assessed whether the Transaction is likely to give rise to a significant impediment to effective competition as a result of coordinated effects in the markets for (i) 3D NAND[112] and (ii) SSDs and the possible narrower markets therein.

5.3.1. The Notifying Party's view

(140) The Notifying Party submits that there is no plausible basis to conclude that the Transaction could lead to a significant impediment of effective competition stemming from coordinated effects.[113]

5.3.1.1. Ability to reach terms of coordination

(A) NAND/3D NAND

(141) First, the Notifying Party explains that the Transaction does not lead to a material increase in concentration as the NAND/3D NAND market is already fragmented, SK hynix and the Target Business are only number 5 and 6 players, and their combined market share is very limited both in NAND and 3D NAND.

(142) Second, NAND/3D NAND is a highly competitive segment under rapid growth where demand and supply conditions cannot be characterized as leading to a stable economic environment. Flash memory storage has become a key component in smartphones and, as a result, NAND/3D NAND demand has grown - and continues to grow - rapidly, driven by the growth in the use of smartphones and of their average capacity. Other consumer products, such as tablets and cameras, along with industrial equipment and sensors, automotive systems and medical devices, also rely upon flash memory. Industry NAND/3D NAND supply has continued to grow alongside this rapidly expanding demand and is projected to continue to do so.

(143) Third, market conditions in NAND/3D NAND are not stable. Capacity and production are expanding rapidly to keep up with increased demand, while cost and prices are

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111 Minutes from a call with a customer, customer of 22.02.2021.

112 For completeness, in this section the Commission assesses the overall market for NAND as well, despite it not being technically affected.

113 The Notifying Party sets out its arguments regarding coordinated effects in paragraphs 6.153 – 6.230 of the Form CO.

falling. The Notifying Party considers that the rapidly increasing demand means that it is unlikely for NAND/3D NAND competitors to reach a common understanding on the terms of a potential coordination.

(144) Fourth, the Notifying Party submits that asymmetric positions and diverging priorities will remain post-transaction. Samsung will remain the largest supplier with a market share (approx. [30-40]% in NAND and [30-40]% in 3D NAND) significantly higher than the remaining players. Kioxia (approximately [10-20]% in both NAND and 3D NAND), Western Digital (approximately [10-20]% in both NAND and 3D NAND) and Micron (approximately [10-20]% in NAND and in [10-20]% 3D NAND) are also major suppliers and their market shares have fluctuated over time, reflecting the fierce competition between all players.

(145) Fifth, the Notifying Party observes that there are recent entry and expansion efforts in NAND/3D NAND, in particular by YMTC, which is being reported to be increasing its capacity.

(146) Sixth, the Notifying Party explains that NAND (and 3D NAND in particular) is a technologically evolving hi-tech component making coordination difficult and thus highly unlikely. NAND differentiation results from continuous R&D, which is tied to capacity, cost, layer count and bit density. These factors affect the 3D NAND performance, durability, reliability and price.

(147) Last, the Notifying Party notes that sales of NAND/3D NAND are lumpy with suppliers typically concluding framework sales contracts with customers. Customers then make purchase undertakings, where volumes and prices are negotiated within such framework sales contracts. Opportunities for NAND/3D NAND suppliers to compete for sales contracts are relatively infrequent, while purchase undertakings are typically large, which makes coordination unlikely.

(B) SSD

(148) First, the Notifying Party considers that, in light of the number of players and the position of SK hynix in SSD[114] and the possible markets thereof, the Transaction does not lead to a material increase in concentration.

(149) Second, the Notifying Party submits that SSD is complex and highly competitive with rapid growth where demand and supply conditions cannot be characterized as stable. Demand for enterprise SSD in recent years has been driven by expansion of data center servers in an increasingly connected cloud environment. New and/or improved enterprise SSD products tend to be released in a cycle of approximately 18 months.

(150) Third, the Notifying Party observes that, post-Transaction there will remain many strong competitors with asymmetric and fluctuating shares, different costs and capacity, and diverging priorities. In addition, smaller but vigorous competitors and dynamic new entrants contribute to share asymmetry.

(151) Fourth, the Notifying Party considers that the asymmetric nature of upstream and downstream vertical integration in the SSD industry results in different production costs and would make a hypothetical coordination even more difficult. SSD suppliers

[114] For the purposes of this section the term SSD will be used to also refer to eSSDs, SATA sSSDs, and PCIe eSSDs.

have adopted different make/buy strategies regarding the key SSD components, i.e, NAND, controllers and firmware, including in-house production, outsourcing, or a combination of the two.

(152) Fifth, the Notifying Party notes that SSDs are a heterogeneous product and differ in terms of characteristics such as performance, endurance and reliability and, to a lesser extent, other features (such as power consumption). SSDs are customized to meet customer specific performance and endurance requirements and undergo customer qualification processes to ensure they meet the specifications of the customer's system or device.

(153) Sixth, the Notifying Party submits that constant innovation in SSD would undermine coordination as competitors constantly attempt to differentiate their offerings through the development and release of new products and technologies in this space.

(154) Last, the Notifying Party observes that sales of SSDs are lumpy with suppliers typically concluding framework sales contracts with customers. Customers then make purchase undertakings, where volumes and prices are negotiated within such framework sales contracts. Opportunities for SSDs suppliers to compete for sales contracts are relatively infrequent, while purchase undertakings are typically large, which makes coordination unlikely.

5.3.1.2. Sustainability of coordination

(A) Ability to monitor deviations

(155) The Notifying Party submits that for both NAND/3D NAND and SSDs the market is not transparent. The supply contracts in NAND and SSD are typically based on non-transparent, confidential bilateral negotiations between customers and suppliers. As a result, NAND and SSD prices and other commercial terms are highly opaque. There is no public price reporting on individual contracts. Market intelligence firms report only on historic aggregated data that they receive by each supplier, and they also have no way of verifying the accuracy of each supplier's transmitted data.

(156) Monitoring (and enforcing) a hypothetical agreement to slow down on NAND and SSD R&D/innovations (e.g., delaying the introduction of 100+ layer NAND) would be equally difficult, as there is no transparency whatsoever regarding R&D activities of competitors, and suppliers can only detect deviations with a delay (i.e., when a "cheating" supplier launches a new product). It would take time for other suppliers to catch up and punish the "cheater", while at the same they would be incurring significant losses from falling behind technologically vis-à-vis the cheater

(B) Ability to establish a credible deterrent mechanism

(157) The Notifying Party submits that the lack of market transparency in NAND and SSD would not allow for a credible deterrent mechanism to be established. In addition to prices being opaque, customers can create strong incentives for aggressive price competition. In order to remain competitive, NAND suppliers must continue to innovate and scale the number of stacks - generally suppliers are scaling 3D NAND roughly by one technology generation every year. In view of the short technological cycle of the NAND and SSD products, the gains from deviation from a hypothetical coordination would be significant due to the expected profits made with next generation products.

(C) Reaction of outsiders

(158) The Notifying Party considers that the presence of a significant number of competitors with asymmetric and fluctuating capacity and market positions makes coordination very difficult. Both markets are also characterized by new entry and expansion, which would destabilize any coordination attempt. Customers can create strong incentives for aggressive price competition while, in particular with regard to eSSDs, hyperscale customers have developed and produced their own enterprise SSDs for in-house use in their data centres, which gives them an important leverage not only in negotiating with enterprise SSD suppliers but also in neutralizing any coordination attempt.

5.3.1.3. SK hynix's shareholding in Kioxia

(159) The Notifying Party submits that SK hynix' existing passive interest in Kioxia has no impact on the risk of potential coordinated effects from the Transaction.

(160) First, the Notifying Party notes that this interest exists pre-merger and the Transaction does not modify the competitive dynamics in the NAND and SSD markets. The Transaction does not lead to any material increase in concentration; it brings together two companies with largely complementary product portfolios, overlapping only in a few markets where they are not close competitors and with moderate combined market shares. There is no indication of past coordination or softened competition in NAND or SSD

(161) Second, to the extent that structural links may increase the risk of coordinated effects, the Notifying Party argues that this is typically the case where they involve or lead to the exchange of confidential or competitively sensitive information. SK hynix' interest in Kioxia […]. Therefore, this link does not in any way increase the level of transparency in the industry. The Transaction does not in any way change this reality.

5.3.2. The Commission's assessment

(162) The Commission considers that the Transaction will not create conditions that will enable or sustain coordination.

5.3.2.1. Ability to reach terms of coordination

(163) The Commission considers that suppliers of NAND and SSD will not be able to reach terms of coordination as a result of the Transaction.

(A) NAND

(164) Overall, the market investigation confirmed that the risk of coordination will remain low post-Transaction.[115] NAND/3D NAND is expected to remain competitive because there will remain six suppliers competing for business. Currently NAND suppliers do not coordinate their behaviour and the continued strength of competition between suppliers post-Transaction means that the Transaction will not in any way impact this lack of coordination.[116]

[115] Replies to Questionnaire Q1, question 73.
[116] Replies to Questionnaire Q1, question 73.1.

(165) The Commission, considers that the Transaction is unlikely to enable suppliers of NAND to reach terms of coordination.

(166) First, the Transaction will not significantly increase concentration on the market as there will remain several NAND/3D NAND suppliers on the market. In NAND, market leader Samsung, Kioxia, Western Digital, and Micron, along with Windbond and Powerchip will remain on the market. Similarly, in 3D NAND Samsung, Kioxia, Micron, Western Digital and YMTC will remain active.

(167) Second, the Parties are players with low market shares, which means that the Transaction will not significantly increase the degree of concentration of the market. In NAND, the Target Business had [5-10]% and SK hynix [10-20]% in 2019. Samsung is the market leader with [30-40]%, followed by Kioxia ([10-20]%) and Western Digital ([10-20]%). Similarly, in 3D NAND, SK hynix and the Target Business are the 5th and 6th players, preceded by Samsung ([30-40]%), Kioxia ([10-20]%), Micron ([10-20]%) and Western Digital ([10-20]%). Therefore, the merged entity's share will remain much lower than the one of the market leader, whereas there will remain a number of other significant players with market shares above 10% (i.e. larger than the increment brought by the Transaction).

(168) Third, the combination of the Parties' activities will not enable coordination on the market as the Parties are not particularly close competitors in NAND, as explained above in Section 5.2. They serve to a great extent different customers/applications. More specifically, […]% of SK hynix's NAND revenues are derived from NAND flash memory mobile phone applications, an area where the Target Business is not active. […].

(169) Fourth, the NAND/3D NAND market is characterised by a customer-led need for significant and constant innovation and there is no evidence showing that this need would be affected by the Transaction. In order to remain competitive, NAND suppliers must continue to innovate and scale the number of stacks. In particular, 3D NAND is quantified by the number of bits per cell and the number of layers stacked in a device. Generally, suppliers are scaling 3D NAND roughly by one technology generation every year. It is crucial for each player to quickly introduce advanced technologies to gain or maintain competitiveness. Technology innovation in NAND drives down the production cost in every generation of products. If a company fails to roll-out a next generation product line with reduced production cost, it would face significant losses that could drive it out of the market.

(170) In the course of the market investigation, customers and competitors thus confirmed that innovation in NAND/3D NAND products is important for suppliers to gain an advantage over their competitors.[117] All competitors compete to develop the next generation of NAND flash memory, and to release competitive new generation products in a timely manner. Given the highly competitive nature of the NAND market, such innovations can make a supplier's products more competitive than products offered by rivals.[118] Innovations are necessary to increase performance and reduce cost as well as to overall increase efficiency of the manufacturing process. Lack

[117] Replies to Questionnaire Q1, question 68.

[118] Replies to Questionnaire Q1, question 68.1.

of innovation will inevitably lead to a competitor lagging behind and therefore losing position in the market.[119]

(171) Fifth, the Transaction will not lead to a change in the way contracts are negotiated between suppliers and customers. Typically, suppliers conclude framework sales contracts and customers then make purchase undertakings, where volumes and prices are negotiated, within such framework sales contracts. As sales are lumpy and infrequent, each sale opportunity would be valuable for each competitor thus minimising the incentive to adhere to a coordinated behaviour.

(172) In the course of the market investigation, both customers and competitors confirmed that NAND/3D NAND, especially those aimed for high-end applications such eSSDs, need to be adapted on the basis of customer requirements or specifications.[120] Respondents also confirmed that supply conditions are overall not stable due to volatile demand and supply.[121] It is noted that NAND demand has been fluctuating but is continuously expanding and is projected to continue to expand in future. All major NAND suppliers have introduced additional production facilities to catch up with this growing market demand and are expected to continuously increase the production capacity to meet future market growth.[122]

(173) Regarding prices, customers explain that NAND/3D NAND prices are not transparent.[123] The same applies for volumes sold.[124] Prices are negotiated bilaterally and competitors do not have the ability to monitor prices.[125] Many NAND suppliers also use significant portions of their NAND internally, further obfuscating price and supply/demand.[126] Suppliers confirmed that they are not in a position to know when competitors plan price increases.[127] Some suppliers explained that they carry out their own price analysis on the basis of customers pushing back when they consider a price is not sufficiently competitive.[128] Market participants further explain that historic prices and volumes are available via industry analytical publications/reports such as TrendForce, Forward Insights and Gartner.[129]

(174) Similarly, suppliers submit that they are not in a position to know how much spare production capacity is held by their competitors or if they plan to expand capacity.[130] General estimates based on publically available information are possible but the level of accuracy is not high.[131]

(175) Sixth, the NAND/3D NAND market is characterised by differentiation in product characteristics. NAND from different suppliers have different attributes depending on the design choices each NAND supplier had made. For example, differences in the

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119 Replies to Questionnaire Q1, question 68.1.
120 Replies to Questionnaire Q1, question 66.
121 Replies to Questionnaire Q1, question 67.
122 Replies to Questionnaire Q1, question 67.1.
123 Replies to Questionnaire Q1, question 69.
124 Replies to Questionnaire Q1, question 71.
125 Replies to Questionnaire Q1, question 69.1.
126 Replies to Questionnaire Q1, question 69.1.
127 Replies to Questionnaire Q1, question 70.
128 Ibid.
129 Replies to Questionnaire Q1, question 71.1.
130 Replies to Questionnaire Q1, question 72.
131 Replies to Questionnaire Q1, question 72.1.

number of layers in a NAND chip lead to performance differences across different NAND products, which makes them suitable for different end uses. Similarly, differences in the number of bits per cell can lead to differences in durability and reliability across different NAND products, which further differentiates the end uses for which they are suitable. The differences in layer count and bit density also lead to material cost differences across different NAND products, which are further exacerbated by the differences in scale among the different suppliers. The Transaction could not result in harmonising suppliers' design and R&D planning, therefore causing NAND to become a more homogeneous product.

(176) Seventh, NAND/3D NAND players have asymmetric positions with fluctuating market shares pre-Transaction. Samsung is the leader with a share that is almost double the Parties' combined share, and more than double the individual shares of the other competitors, resulting in a high level of share asymmetry in NAND/3D NAND. Kioxia, Western Digital and Micron are also important players in this market and their market shares have fluctuated over time. Their capacity expansion plans and participation in the innovation race demonstrate their incentive and efforts to expand sales and increase shares. The recent entry by YMTC, backed up by large capacity investments, will likely lead to an increase of the competitive dynamics in place.

(B) SSD

(177) The Commission considers that the Transaction is unlikely to enable suppliers of SSD to reach terms of coordination

(178) First, the Transaction will only lead to a small increase in concentration in light of SK hynix's low market share in SSDs ([5-10]%), eSSDs ([0-5]%), SATA eSSDs ([0-5]%), and PCIe eSSDs ([5-10]%)[132] and the number of remaining players in each possible market segmentation.

(179) In the overall SSDs market, there will remain at least ten players including Samsung, Kioxia, Intel, Micron, and Western Digital. In eSSDs, there will remain at least six players including Samsung, Micron, Western Digital and Kioxia. In SATA eSSDs, there will remain at least six players including Samsung and Micron. In PCIe eSSDs, there will remain at least seven players including Samsung, Micron, Western Digital and Kioxia.

(180) Second, the supply and demand conditions will not be affected by the Transaction. Similarly to NAND, the SSD market and the possible market segmentations is characterised by rapid growth and increasing demand without stable market conditions. Demand for eSSD in particular in recent years has been driven by expansion of data centre servers in an increasingly connected cloud environment. New and/or improved eSSD products tend to be released in a cycle of approximately 18 months. Industry supply has continued to grow alongside this rapidly expanding market demand.

(181) Third, SSD players have asymmetric positions with fluctuating market shares pre-Transaction. There is no evidence pointing towards a change that the Transaction will bring about that will lead to more symmetry or stable shares.

[132] The Target's respective market shares are: [10-20]% in SSDs, [20-30]% in eSSDs, [30-40]% in SATA SSDs, and [30-40]% in PCIe eSSDs.

(182) In the overall SSDs market, Samsung will remain the leading SSD supplier post-Transaction, with a share of approximately [30-40]%. The Parties have a combined share of approximately [20-30]% (Target Business at approximately [10-20]% and SK hynix at approximately [5-10]%). The shares of other major competitors are less than half of Samsung's share, i.e., Western Digital at approximately [10-20]%, Kioxia at approximately [10-20]%, and Micron at approximately [5-10]%.

(183) The market share asymmetry is also observed in the SSD possible market segmentations:

(a) In eSSD, Samsung will remain the leader with a share of approximately [30-40]% followed by the merged entity with a share of approximately [20-30]% (and a share increment of approximately [0-5]%), Kioxia (approximately [10-20]%), Micron (approximately [5-10]%), Western Digital (approximately [5-10]%) and Seagate (approximately [0-5]%).

(b) In SATA eSSD, the merged entity would have a comparable position to Samsung (approximately [30-40]%), followed by Micron (approximately [20-30]%), while a number of smaller competitors including, Kioxia (approximately [0-5]%), Western Digital (approximately [0-5]%) and others will continue to compete in this possible market.

(c) In PCIe eSSD, Samsung would be the largest competitor after the merged entity (approximately [30-40]%). Western Digital (approximately [5-10]%) and Kioxia (approximately [5-10]%) follow, while Micron (approximately [0-5]%) is rapidly catching up. In August 2020, Western Digital announced that its revenues from sales of enterprise SSDs more than doubled in revenue compared to the previous year, while between 2017 and 2019 Micron more than doubled its share in PCIe eSSD.

(184) Fourth, the Transaction is not likely to affect the vertical integration in the SSD industry, which is asymmetric across the different suppliers, resulting in different production costs. SSD suppliers have adopted different make/buy strategies regarding the key SSD components, i.e, NAND, controllers and firmware, including in-house production, outsourcing, or a combination of the two. In terms of downstream integration, the leading SSD competitor, Samsung, is active in in PCs and servers that incorporate SSDs, while other SSD suppliers are not.

(185) Fifth, SSD and its segmentations are overall not a homogeneous product as they need to be customised on the basis of customer requirements. SSDs differ in terms of characteristics such as performance, endurance and reliability and, to a lesser extent, other features (such as power consumption). SSDs are customized to meet customer specific performance and endurance requirements and undergo customer qualification processes to ensure they meet the specifications of the customer's system or device. The high degree of SSD differentiation results in numerous different SSD types with different characteristics, applications and prices. The Transaction is not likely to alter the way SSDs are produced and therefore is not expected to make coordination overall more likely.

(186) The results of the market investigation thus confirmed that customers often require customized SSDs in order to meet their needs and requirements.[133] SSDs may be

[133] Replies to Questionnaire, questions 78 and 78.1.

designed with different end applications in mind, such as enterprise or consumer applications. For example, they may have different storage capacities or interfaces. Customers switch between solutions to suit their needs.[134] Almost all market respondents confirmed that supply and demand fluctuate, with the market going though oversupply and undersupply cycles which are sometimes driven by changes in demand, but they are also sometimes driven by the investment choices of suppliers.[135]

(187) Sixth, the Transaction will not lead to a change in the way contracts are negotiated between suppliers and customers. Typically, suppliers conclude framework sales contracts and customers then make purchase undertakings, where volumes and prices are negotiated, within such framework sales contracts. As sales are lumpy and infrequent, each sale opportunity would be valuable for each competitor thus minimising the incentive to adhere to a coordinated behaviour.

(188) In the course of the market investigation, competitors and customers explained that prices are not transparent.[136] SSD pricing is competitive and is one of the key parameters on which competition between suppliers takes place. Transparency exist only for historic prices stemming from the fact that retail prices are typically published on the websites of suppliers, distributors and re-sellers of SSDs.[137] Suppliers have no visibility into planned price increases of their competitors as due to the competitive nature of the sector, pricing is entirely driven by supply and demand. As such, variations in prices occur in real time in response to these factors.[138] Therefore, if a supplier were to plan a price increase or decrease, this would not be known to its competitors. Similarly, volumes sold are not transparent either, and industry reports only publish historic figures that the suppliers choose to share.[139] Spare capacity or capacity expansion are generally not publicly available.[140]

5.3.2.2. Sustainability of coordination

(189) The Commission considers that the Transaction will not increase the likelihood of sustainable coordination on the markets and segmentations for NAND/3D NAND and SSDs.

(A) Monitoring deviations

(190) The Commission considers that the Transaction is not likely to create conditions that would allow monitoring of deviations from a potential coordination strategy regarding either NAND or SSD.

(191) In addition to the findings described above in Section 5.3.3.1, the Commission considers that the Transaction is not likely to create such conditions that will allow the monitoring of deviations from a hypothetical coordination strategy. The market investigation confirmed[141] that contract negotiations between suppliers and customers are usually bilateral and remain opaque in all their elements, including price, duration

134 Replies to Questionnaire, question 78.1.
135 Replies to Questionnaire, questions 79 and 79.1.
136 Replies to Questionnaire, questions 81 and 81.1.
137 Replies to Questionnaire, question 81.1.
138 Replies to Questionnaire, question 81.1.
139 Replies to Questionnaire, questions 83 and 83.1.
140 Replies to Questionnaire, question 84.
141 Replies to Questionnaire, questions 70, 71, 72 and 74.

and volumes. Non-disclosure agreements are put in place to ensure that commercial terms remain confidential. Price increases or capacity expansions are not known to competitors.

(192) Market reports do not publish NAND or SSD price or other terms of individual contracts. Market intelligence firms report only on historic aggregated data that they receive by each supplier without being in a position to verify the accuracy of each supplier's transmitted data. Whilst the market reports offer a general understanding of the approximate, competitive pricing level for each component from customers or general industry knowledge, competitors cannot ascertain prices or commercial terms offered by competing suppliers for any given contract. These conditions make monitoring the enforcement of a hypothetical coordination and deviations highly unlikely.

(B) Deterrent mechanism

(193) The Commission considers that the Transaction is not likely to enable the establishment of a credible deterrent mechanism that would discourage competitors from deviating from a hypothetical coordination strategy in NAND or SSD.

(194) On the basis of the findings above in paragraphs (195)-(197) the Transaction would not make the market more transparent as regards prices, volumes, spare capacity and capacity expansion, or other commercial terms, as also confirmed by the market investigation[142]. NAND and SSD customers can create strong incentives for aggressive price competition, while increasing the difficulty for competitors of enforcing a hypothetical deviation deterrence mechanism against deviators.

(195) In addition, the short technological cycle of the NAND and SSD products would not allow for a competitor not adhering to such hypothetical coordination to be detected. Also, the gains from deviation from a hypothetical coordination would be significant due to the expected profits made with next generation products.

(196) Therefore, the establishment of a credible deterrent mechanism would not be enabled by the Transaction as it could not impact the existing market conditions for NAND and SSD.

(C) Reaction of outsiders

(197) The Commission considers that the Transaction is not likely to decrease the ability or the incentive of competitors and customers to disrupt a potential coordination strategy.

(198) As explained above in Section 5.2, the market for NAND and SSD is characterized by the presence of a significant number of competitors with asymmetric and fluctuating capacity and market positions. Both markets are also characterized by new entry and expansion efforts, which would destabilize any coordination attempt.

(199) NAND and SSD customers are sophisticated technology companies, familiar with the cost structure of NAND and SSD suppliers, able to design and negotiate favourable contracting terms that can help deter any coordination attempt. Key Enterprise SSD customers in particular are powerful hyperscale cloud service providers, such as Google, Microsoft, Amazon Web Services, Huawei, Alibaba and Baidu, as well as

142 Replies to Questionnaire, sections E and F.

sizeable, sophisticated OEMs with significant technical understanding and expertise, including Lenovo, Dell, HPE and others.

(D) SK hynix's link to Kioxia

(200) The Commission considers that the Transaction is not likely to create coordination on the NAND or SSD markets as a result of SK hynix's existing link to Kioxia.

(201) SK hynix's interest in Kioxia does not amount to decisive influence. […].

(202) This situation will remain unchanged by the Transaction, which will not alter the nature of SK hynix's interest and lack of control over Kioxia. Consistent with this assessment, respondents to the market investigation[143] did not raise any concerns vis-à-vis the existing interest of SK hynix in Kioxia.

5.3.2.3. Conclusion on coordinated effects

(203) The Commission concludes that in light of the above and in particular the results for the market investigation the Transaction is not likely to (i) enable NAND and SSD suppliers to reach terms of coordination, or (ii) make coordination sustainable in the markets for NAND and SSDs.

5.4. Vertical non-coordinated effects

5.4.1. Legal framework

(204) As mentioned in Section 5.1 above, the Non-horizontal Merger Guidelines recognise that non-horizontal concentrations are generally less likely to significantly impede effective competition than horizontal concentrations.[144] These concentrations may significantly impede competition in two main ways: non-coordinated effects and coordinated effects.[145] This section will assess potential non-coordinated effects, as potential coordinated effects were assessed in section 5.3 above.

(205) Vertical non-coordinated effects may principally arise when non-horizontal concentrations give rise to foreclosure.[146] The Non-Horizontal Merger Guidelines distinguish between two forms of foreclosure. Input foreclosure occurs where the concentration is likely to raise the costs of downstream competitors by restricting their access to an important input. Customer foreclosure occurs where the concentration is likely to foreclose upstream competitors by restricting their access to a sufficient customer base.[147]

(206) As regards ability to foreclose, input foreclosure may lead to competition problems if the upstream input is important for the downstream product and if the vertically integrated merged entity have a significant degree of market power in the upstream market. It is only in those circumstances that the merged entity can be expected to have significant influence on the conditions of competition in the upstream market and

[143] Replies to Questionnaire, question 31 and 40.
[144] Non-Horizontal Merger Guidelines, paragraph 11.
[145] Non-Horizontal Merger Guidelines, paragraph 17.
[146] Non-Horizontal Merger Guidelines, paragraph 18.
[147] Non-Horizontal Merger Guidelines, paragraph 30.

thus, possibly, on prices and supply conditions in the downstream market.[148] Customer foreclosure may be a concern when it involves a company which is an important customer with a significant degree of market power in the downstream market. If, on the contrary, there is a sufficiently large customer base, at present or in the future, that is likely to turn to independent suppliers, the Commission is unlikely to raise competition concerns on that ground.[149]

(207) With respect to incentives to foreclose, the incentive of the merged entity to foreclose depends on the degree to which foreclosure would be profitable. In relation to input foreclosure, the merged entity faces a trade-off between the profit lost in the upstream market due to a reduction of input sales to rivals and the profit gain, in the short or longer term, from expanding sales downstream or, as the case may be, being able to raise prices to consumers.[150] In relation to customer foreclosure, the trade-off is between the possible costs associated with not procuring products from upstream rivals and the possible gains from doing so, for instance, because it allows the merged entity to raise prices in the upstream or downstream markets.[151]

(208) As regards the effects on competition, input foreclosure raises competition concerns when it leads to increased prices on the downstream market.[152] If there remain sufficient credible downstream competitors whose costs are not likely to be raised, competition from those firms may constitute a sufficient constraint on the merged entity and therefore prevent output prices from rising above pre-merger levels.[153] By denying competitive access to a significant customer base for the foreclosed rivals' (upstream) products, the merger may reduce their ability to compete in the foreseeable future. As a result, rivals downstream are likely to be put at a competitive disadvantage (*e.g.*, raised input costs), which may allow the merged entity to profitably raise prices or reduce the overall output on the downstream market.[154] If there remain a number of upstream competitors that are not affected, competition from those firms may be sufficient to prevent prices from rising in the upstream market and, consequently, in the downstream market.[155]

5.4.2. Affected markets

(209) A market is considered to be affected when one or more of the parties to the concentration are engaged in business activities in a relevant market, which is upstream or downstream of a relevant market in which any other party to the concentration is engaged, and any of their individual or combined market shares at either level is 30% or more, regardless of whether there is or is not any existing supplier/customer relationship between the parties to the concentration. The only market where the combined market shares of the Parties exceeds 30% is the market for eSSDs, as well as the possible narrower markets of SATA eSSDs and PCIe eSSDs. The Transaction gives rise to two vertical relationships, as both NAND (including 2D

148 Non-Horizontal Merger Guidelines, paragraphs 34-35.
149 Non-Horizontal Merger Guidelines, paragraph 61.
150 Non-Horizontal Merger Guidelines, paragraph 40.
151 Non-Horizontal Merger Guidelines, paragraph 68.
152 Non-Horizontal Merger Guidelines, paragraphs 47-49.
153 Non-Horizontal Merger Guidelines, paragraph 50.
154 Non-Horizontal Merger Guidelines, paragraph 72.
155 Non-Horizontal Merger Guidelines, paragraph 74.

NAND and 3D NAND) and DRAM can be an input product to eSSDs, including SATA eSSDs and PCIe eSSDs.

(210) Regarding the first vertical relationship, both SK hynix and the Target Business produce NAND flash memory, which is an input for SSDs, in which they are also both active. In the market for NAND and in the narrower market for 2D NAND, the Parties' combined market share remains below 20% (respectively [10-20]% and [10-20]%). In 3D NAND, the Parties have a combined market share in 2019 of [20-30]%.[156] As the Target Business no longer has activities in 2D NAND, the Commission focussed its assessment on the market for NAND and the potential narrower market for 3D NAND. On the downstream market for SSDs, the Parties have a combined 2019 market share in eSSDs of [30-40]%[157], and have combined 2019 market shares in the possible narrower markets of SATA eSSDs and PCIe eSSDs of respectively [30-40]%[158] and [40-50]%[159].

(211) Regarding the second vertical relationship, SK hynix develops and manufactures DRAM. DRAM can be incorporated into eSSDs as cache memory, where they are used for data and graphic applications in data centers or servers. SK hynix has a 2019 market share of [20-30]% in the market for DRAM.[160]

(212) Because the Parties' combined market shares in eSSDs as well as the market segmentations of SATA eSSDs and PCIe SSDs exceed 30%, the two vertical relationships described above are both affected.

(213) In this decision, the Commission assesses whether the Transaction would likely confer on the Parties the ability and incentive to implement an input foreclosure and/or a customer foreclosure strategy with regard to: (i) the Parties' NAND / 3D NAND and eSSD products, including SATA and PCIe eSSDs (section 5.4.3); and (ii) SK hynix' DRAM products, including high-speed DRAMs and DRAMs used in servers, and the Parties' eSSD products, including SATA and PCIe eSSDs (section 5.4.4).

(214) While the Commission's assessment takes into account the market for eSSDs as well as potential narrower markets for SATA and PCIe eSSDs, it should be noted that throughout the market investigation, respondents provided the same information in relation to these three markets and did not indicate that their answers to questions regarding the Parties' vertical relationships for eSSDs, SATA eSSDs or PCIe eSSDs would differ.[161] The market structure for eSSDs, SATA eSSDs and PCIe eSSDs are broadly similar and most market participants are active in all markets. Moreover, the suppliers of eSSDs that responded to the market investigation indicate that it would be relatively easy to switch between SATA and PCIe interfaces with little additional cost and effort.[162]However, given that the Parties combined market share for PCIe eSSDs is significantly higher than in the markets for eSSDS and SATA eSSDS, the Commission assessed in particular whether foreclosure concerns would arise in

156 Form CO, Table 10.
157 Form CO, Table 12.
158 Form CO, Table 14.
159 Form CO, Table 15.
160 Form CO, Table 18.
161 Replies to Questionnaire, questions 90.2, 91.2, 92.2, 93.1, 94.1, 95.2, 101.1, 102.1, 104.1, 105.1, 106.1, 107.1, 108.1, 115.1 and 116.1.
162 Replies to Questionnaire, question 19.2.

relation to the vertical relationship between the Parties' NAND (including 3D NAND) and DRAM products, and the Parties' PCIe eSSDs.

5.4.3. NAND/eSSDs

5.4.3.1. Input foreclosure

(A) Potential concern

(215) The Commission has assessed the ability and incentive of the Parties post-Transaction to foreclose competing suppliers of eSSDs (including SATA and PCIe eSSDs) by:

i. restricting their access to the Parties' NAND / 3D NAND; or

ii. supplying NAND / 3D NAND at worse terms (e.g. by increasing prices).

(B) The Notifying Party's views

(216) The Notifying Party claims that the Parties will lack both the ability and the incentive post-Transaction to foreclose access to the Parties' NAND and 3D NAND by refusing to supply competing suppliers of eSSDs or by supplying NAND or 3D NAND under worse terms.

As regards ability

(217) First, the Notifying Party submits that third party NAND sales of SK hynix amount to approximately […]% of its 2019 NAND revenues. Of these third party sales, only around […]% was destined for SSDs. As to Intel, its third party NAND sales account for approximately […]% of its 2019 NAND revenues and only around […]% for the first half of 2020. Therefore, the Parties would not be able to foreclose access to NAND products.

(218) Second, many of the Parties' major competitors in the downstream SSD markets are vertically integrated companies with in-house NAND production (*i.e.* Samsung, Kioxia, Western Digital and Micron).

(219) Third, the Notifying Party submits that downstream SSD suppliers that are not vertically integrated will continue to have ample alternative sources of NAND supply, including Samsung (with a market share of approximately [30-40]%), Kioxia (approximately [10-20]%), Western Digital (approximately [10-20]%) and Micron (approximately [10-20]%). Moreover, the Notifying Party argues that the expansion of the vertically integrated player YMTC in the NAND flash memory sector is expected to have a material impact on the position of incumbent players.

(220) Finally, the Notifying Party submits that, according to its best estimates, it would require approximately six months for NAND customers to switch to alternative NAND suppliers and this time would even be shorter where the customer has qualified multiple NAND suppliers.

As regards incentives

(221) The Notifying Party submits that the Parties will not have the incentive post-Transaction to foreclose access for competing SSD suppliers to their NAND products, or only to provide these products at worse terms.

(222) According to the Notifying Party, the restriction of access to the Parties' NAND products would mean that the Parties would exit a profitable business without at the same time gaining any competitive advantages in the downstream SSD markets. Most competitors in SSDs are vertically integrated in NAND. Furthermore, non-integrated SSD competitors would have access to a wide array of NAND suppliers to whom they could easily switch.

As regards effects

(223) First, the Notifying Party argues that any potential input foreclosure strategy would have no effects on competition, as both the Parties and most of their competitors are already vertically integrated in NAND and SSDs. The Transaction would therefore have no impact on these competitors.

(224) Second, given the relatively small combined share in 3D NAND of [20-30]%, which includes third-party and captive sales), non-vertically integrated SSD competitors have ample alternative sources of NAND supply.

(C) Commission's assessment

(225) For the reasons set out below, the Commission considers that the Parties will not have the ability or incentive post-Transaction to engage in an input foreclosure strategy. Moreover, any such strategy would likely not have any material effect on competition.

As regards ability

(226) The Commission considers that the Parties will not have the ability to engage in input foreclosure.

(227) According to paragraph 34 of the Non-Horizontal Merger Guidelines, input foreclosure only raises competition concerns if the upstream product is an important input for the product downstream. This is the case, for example, when the input concerned represents a significant cost factor relatively to the price, where the upstream product represents a significant source of product differentiation for the downstream product or where the cost of switching is relatively high.

(228) The Notifying Party itself admits that NAND flash memory is a key input for SSDs. The results of the market investigation indicate that a majority of the respondents consider that it is easy for SSD suppliers to switch between NAND products[163] and that end-customers would not be affected by a switch in NAND.[164] The fact that customers are able to switch producers does not mean however that a product is not an important input. Therefore, Commission considers that NAND represents a key input for SSDs.

(229) The Non-Horizontal Merger Guidelines further state that input foreclosure only is a concern where the vertically integrated firm resulting from the merger has a significant degree of market power in the upstream market.[165]

[163] Replies to Questionnaire, question 91.
[164] Replies to Questionnaire, question 92.
[165] Non-Horizontal Merger Guidelines, paragraph 35.

(230) The Parties' combined market shares in the market for NAND and the potential narrower market for 3D NAND are relatively modest (respectively [10-20]% and [20-30]%). In both markets, several important competitors will remain active following the Transaction and Samsung will remain by far the largest competitor (respectively [30-40]% and [30-40]%). Three other competitors will also remain active, each having market shares between 10 and 20% in both the markets for NAND and 3D NAND. All large market players are vertically integrated and also supply SSDs (including SATA eSSDs and PCIe eSSDs). […].[166][167]

(231) The Commission considers that the above suggests that potential input foreclosure does not raise competition concerns.

(232) Moreover, a majority of the respondents to the market investigation indicate that in their view the Parties will not have the ability to either stop supplying NAND or to do so at worse terms.[168] In particular, respondents observe that "*[t]here will be sufficient suppliers of NAND, making this strategy unprofitable.*"[169] This confirms the Commission's finding regarding the market structure for the market for NAND and the potential narrower market for 3D NAND as set out above.

(233) In light of the above, the Commission concludes that the Parties will not have the ability to foreclose competitors on the market for the supply of eSSDs (and the market segmentations for SATA and PCIe eSSDs) by restricting access to potentially critical inputs.

As regards incentives

(234) The Commission considers that the Parties will lack the incentive to engage in input foreclosure because it would not be profitable to do so.

(235) The Parties would face a trade-off between the potential loss of profit in the upstream market due to a reduction of input sales to downstream competitors and the potential profit gain from expanding sales downstream or raising prices to consumers.[170]

(236) In this regard, the Commission observes first that, as mentioned above, respondents to the market investigation indicate that the SSD market is highly competitive.[171] Most of the competitors that supply eSSDs, as well as SATA and PCIe SSDs, are vertically integrated and would therefore not be impacted by an input foreclosure strategy. Table 1 below illustrates the market shares of the vertically integrated competitors on these markets:

166 Replies to Questionnaire, question 90.
167 Replies to Questionnaire, question 90.1.
168 Replies to Questionnaire, question 93.
169 Replies to Questionnaire, question 93.1.
170 Non-Horizontal Merger Guidelines, paragraph 40.
171 Replies to Questionnaire, question 90.1.

Table 8: market shares of vertically integrated companies supplying eSSDs

	eSSDs (2019)	SATA eSSDs (2019)	PCIe SSDs (2019)
Parties combined	[20-30]%[172]	[30-40]%	[40-50]%
Samsung	[30-40]%	[30-40]%	[30-40]%
Kioxia	[10-20]%	[0-5]%	[5-10]%
Micron	[5-10]%	[20-30]%	[0-5]%
Western Digital	[5-10]%	[0-5]%	[5-10]%
Total	***[80-90]%***	***[90-100]%***	***[80-90]%***

Tables 12, 14 and 15 of the Form CO

(237) The remaining non-vertically integrated competitors can easily switch to other NAND suppliers.[173] All respondents to the market investigation who expressed an opinion consider that sufficient NAND suppliers remain on the market.[174] The Commission considers that, since non-vertically integrated competitors could easily switch to other NAND suppliers, the Parties would likely not be able to obtain a larger market share downstream as a result of a potential input foreclosure strategy. In this regard, it is worth noting that all respondents to the market investigation who expressed an opinion indicate that the Transaction will either have a positive or a neutral effect on the market for NAND and the potential narrower market for 3D NAND.[175] None of the respondents indicated that the Transaction would have a negative impact on their company.[176]

(238) The potential profit gain on the downstream market for eSSDs (or the market segmentations for SATA and PCIe eSSDs) therefore would likely be non-existent or small as compared to the loss of profits on the upstream markets for NAND/3D NAND that would result from an input foreclosure strategy.

(239) Finally, the majority of the respondents to the market investigation indicate that the Parties will not have an incentive to engage in an input foreclosure strategy.[177]

(240) In light of these findings and the outcome of the market investigation, the Commission concludes that the Parties would not have the incentive to engage into input foreclosure.

As regards effects

(241) The Commission considers that a potential input foreclosure strategy would likely have no material effect on competition.

(242) First, as indicated above, only a small number of eSSD suppliers could potentially be foreclosed. This makes it less likely that the Transaction could be expected to result

[172] Market shares according to Forward Insights. The Parties' combined market share for eSSDs according to Omdia is [30-40]%. As Omdia's estimation of the Parties' combined market share in eSSDs gives rise to vertically affected markets, this estimation is used earlier in this decision.

[173] Replies to Questionnaire, question 91.

[174] Replies to Questionnaire, question 95.

[175] Replies to Questionnaire, question 142.

[176] Replies to Questionnaire, question 141.

[177] Replies to Questionnaire, question 94.

in a significant price increase – and therefore to significantly impede competition – in the downstream market.[178]

(243) Second, vertically integrated companies constitute the largest part of the market for eSSDs as well as potential narrower markets for SATA eSSDs and PCIe eSSDs. These companies would be able to maintain a sufficient competitive constraint on the Parties following the Transaction.

(244) Third, the market investigation confirms that sufficient NAND (and 3D NAND) suppliers remain on the market following the Transaction[179] and that non-vertically integrated SSD suppliers may easily switch between NAND suppliers[180].

(245) In light of the above, the Commission considers that a decision post-Transaction to restrict access to the Parties' NAND/3D NAND products would have no material impact on rival eSSD suppliers (including suppliers of SATA and PCIe eSSDs).

Conclusion

(246) The Commission considers that, in view of the considerations above and the results of the market investigation, the Transaction does not raise serious doubts as to its compatibility with the internal market with respect to potential input foreclosure on the upstream markets for NAND/3D NAND and the downstream market for eSSDs as well as the potential narrower markets for SATA or PCIe eSSDs).

5.4.3.2. Customer foreclosure

(A) Potential concern

(247) In theory, the Transaction could give rise to competition concerns on the basis of a potential customer foreclosure strategy whereby the Parties, as eSSD suppliers, would decide to foreclose any rivals on the upstream market for 3D NAND.

(B) The Notifying Party's views

(248) The Notifying Party submits that the Transaction will not lead to any customer foreclosure.

(249) First, the Notifying Party submits that neither SK hynix nor the Target Business currently source any of their NAND requirements from third parties. The Transaction would therefore not affect customer access for upstream NAND suppliers.

(250) Second, the Notifying Party argues that the Parties would not have the ability to foreclose customers due to its combined share in the overall market for SSDs.

(251) Finally, any foreclosed NAND suppliers would also have access to other downstream areas that incorporate NAND, such as embedded flash storage for use in smartphones, tablets, automotive and other applications.

(252) The Notifying Party submits that any incentive to foreclose access to the NAND customer base would be entirely theoretical given that the Parties currently do not

178 Non-Horizontal Merger Guidelines, paragraph 48.
179 Replies to Questionnaire, question 95.
180 Replies to Questionnaire, question 91.

source any of their NAND requirements from third parties. For this reason, the Notifying Party argues that any effect of a customer foreclosure strategy would be hypothetical and implausible.

(C) Commission's assessment

(253) The Commission considers that the Transaction does not give rise to concerns that the Parties may engage in a customer foreclosure strategy post-Transaction.

(254) Neither SK hynix nor the Target Business currently procure any NAND or 3D NAND from third parties. Therefore, the Transaction does not remove any important buyer from the market and it would not give the Parties the ability or the incentive to engage in a customer foreclosure strategy. For this reason, the Transaction will not have an effect on the market for NAND or on the potential market for 3D NAND as a consequence of a potential customer foreclosure strategy.

(255) This assessment is confirmed by the results of the market investigation, with the majority of respondents confirming that the Parties will neither have the ability[181] nor the incentive[182] to engage in a customer foreclosure strategy and that in any event a sufficient number of NAND/3D NAND buyers remains on the market[183] following the Transaction.

Conclusion

(256) The Commission considers that, in view of the considerations above and the results of the market investigation, the Transaction does not raise serious doubts as to its compatibility with the internal market with respect to potential customer foreclosure on the upstream market for NAND or a potential upstream market for 3D NAND and the downstream market for eSSDs or potential narrower markets for SATA or PCIe eSSDs.

5.4.4. DRAM/SSD

5.4.4.1. Input foreclosure

(A) Potential concern

(257) The Commission has assessed the ability and incentive of the Parties to foreclose competing eSSD suppliers by restricting their access to potentially critical inputs, *i.e.*, SK hynix' DRAM. In doing so, the Commission investigated whether the Parties would be able, post-Transaction, to either stop supplying DRAM (more specifically high-speed DRAMs and DRAMs used in servers) to other eSSD suppliers or to do so at worse terms (*e.g.* through higher prices).

(258) The Commission's assessment focussed on high-speed DRAMs and DRAMs used in servers. eSSDs are used for enterprise storage (storage for servers and storage systems in high workload environments, such as corporate data centres). DRAM can be included into eSSDs as cache memory for writing data to the eSSD and to improve

[181] Replies to Questionnaire, question 101.
[182] Replies to Questionnaire, question 102.
[183] Replies to Questionnaire, question 103.

performance. DRAMs used in eSSDs are therefore high-speed DRAMs that are meant to be used for servers.

(B) The Notifying Party's views

(259) The Notifying Party argues that it will not be able to foreclose access to DRAM for downstream SSD competitors.

(260) First, the Notifying Party submits that the merged entity would have a global share of [20-30]% in DRAM. The Parties would therefore lack the market power, post-Transaction, to restrict its downstream competitors in SSDs from accessing DRAM.

(261) Second, there would be ample sources of alternative DRAM suppliers including Samsung (with a market share of approximately [40-50]%), Micron (approximately [20-30]%) as well as smaller competitors such as Nanya (approximately [0-5]%) and Winbond (approximately [0-5]%).

(262) Third, the Notifying Party submits that DRAM is a commoditized product and SSD suppliers would therefore be able to switch to alternative DRAM suppliers relatively quickly without incurring significant cost.

(C) Commission's assessment

(263) For the reasons set out below, the Commission considers that the Parties will not have the ability or incentive post-Transaction to engage in an input foreclosure strategy. Moreover, any such strategy would likely not have any material effect on competition.

As regards ability

(264) The Commission considers that the Parties will likely not have the ability post-Transaction to engage in input foreclosure.

(265) As mentioned above, DRAMs used in eSSDs are high-speed DRAMs that are meant to be used for servers. The Commission considers that high-speed DRAMs, while different from commodity DRAMs, are still commoditized products from a demand-side perspective, as their specifications are standardised by JEDEC (Joint Electron Device Engineering Council).[184]

(266) This is confirmed by the results of the market investigation. Respondents to the market investigation almost unanimously indicated that it is easy or even very easy to switch the supply of DRAM.[185] One respondent states that "*DRAM is not a key component for SSDs; the DRAM is used by a memory controller to manage the NAND. Switching the DRAM would not require a re-design, but would require a requalification.*"[186] Another respondent "*views DRAM as a standardized commodity; it is even more standardized than SSD with less brand loyalty. Therefore, it is easily sourced and multi-sourced from many parties for SSD manufacturing*".[187]

184 See also Case JV.44 *Hitachi/NEC — Dram/JV*, paragraph 18.
185 Replies to Questionnaire, question 105.
186 Replies to Questionnaire, question 105.1.
187 Replies to Questionnaire, question 105.1.

(267) As commoditized products, DRAMs do not appear to be a significant source of product differentiation. One respondent to the market investigation indicates in this regard that "*[t]he origin of the DRAM in an end product is not as relevant to the end-customer because it represents a small percentage of the build material and is a truly integrated component. For example, customers will rarely, if ever enquire as to the origin of the DRAM.*"[188] Overall, all but one respondent to the market investigation who expressed an opinion state that the origin of the DRAM input is not important for the end-customer.[189]

(268) The Non-Horizontal Merger Guidelines further state that input foreclosure only is a concern where the vertically integrated firm resulting from the merger has a significant degree of market power in the upstream market.[190]

(269) SK hynix is already a vertically integrated undertaking that is active both in the supply of DRAM (including high-speed DRAMs used in eSSDs) and in the supply of eSSDs. The Target Business is not active in the supply of DRAM. The Parties will therefore not enhance their market power on any upstream DRAM market as a result of the Transaction. The market investigation results reveal that SK hynix is considered as an important player in DRAM, in particular because SK hynix currently is the second largest DRAM supplier.[191] The Commission considers however that the market share of SK hynix remains below 30% and SK hynix will not increase its market power as a result of the Transaction. SK hynix therefore does not appear to have a significant market power.

(270) Despite the fact that SK hynix is considered to be an important player in DRAM, all respondents to the market investigation who expressed an opinion further state that the Parties will not have the ability to stop supplying DRAM following the Transaction.[192] Respondents consider that sufficient alternative suppliers of DRAM remain on the market (including vertically integrated undertakings that are also active in the supply of eSSDs like Samsung and Micron). One respondent to the market investigation states that it is unlikely that SK hynix will have the ability to enter into an input foreclosure strategy "[…] as DRAM is easily replaceable and a small portion of the inputs/costs of SSD products".[193]

(271) Taking into account that high-speed DRAMs are commoditized products which are not a source of product differentiation, that it is easy or even very easy for consumers to switch between DRAMs, and that DRAMs are a small portion of the inputs/costs of eSSDs, the Commission concludes that DRAMs (including high-speed DRAMs) are not an important input for eSSDs (including SATA and PCIe eSSDs).

(272) The Commission considers that the above suggests that potential input foreclosure does not raise competition concerns.

(273) In light of the above, the Commission concludes that the Parties will not have the ability to foreclose competitors on the market for the supply of eSSDs (and the

188 Replies to Questionnaire, question 106.1.
189 Replies to Questionnaire, question 106.
190 Non-Horizontal Merger Guidelines, paragraph 35.
191 Replies to Questionnaire, question 104.
192 Replies to Questionnaire, question 107.
193 Replies to Questionnaire, question 107.1.

possible markets for SATA and PCIe eSSDs) by restricting access to potentially critical inputs.

As regards incentives

(274) The Commission considers that the Parties will lack the incentive to engage in input foreclosure because it would not be profitable to do so.

(275) The Parties would face a trade-off between the potential loss of profit in the upstream market due to a reduction of input sales to downstream competitors and the potential profit gain from expanding sales downstream or raising prices to consumers.[194]

(276) The potential profit gain from expanding sales of eSSDs (including SATA and PCIe eSSDs) or raising prices to consumers for eSSDs would likely be low, since eSSD suppliers can easily switch to other (high-speed) DRAM suppliers.[195]

(277) Moreover, a respondent to the market investigation indicates that the Parties would not have the incentive to stop supplying DRAM because it is both easily replaceable and represents only a small portion of the input/costs of SSD products.[196] Another respondent submits that SK hynix would not have the incentive to foreclose eSSD suppliers, because it would make them "*less competitive (and could see them pushed out of the market)*".[197] Finally, the majority of the respondents indicate that the Parties would not have the incentive post-Transaction to stop supplying DRAM or to do so at worse terms.[198]

(278) The Commission considers that the above suggests that the Parties would not have an incentive to adopt an input foreclosure strategy as it appears that there are little potential profit gains on the downstream market for eSSDs (or on its market segmentations for SATA and PCIe eSSDs).

As regards effects

(279) Finally, the Commission considers that a potential input foreclosure strategy would likely have no material effect on competition.

(280) The Non-Horizontal Merger Guidelines set out that anticompetitive foreclosure may occur when a vertical merger allows the merging parties to increase the costs of downstream rivals.[199] The Commission considers that this would likely not be the case. The Transaction does not increase the Parties' market power in the upstream market for DRAM or potential narrower markets for high-speed DRAMs or DRAMs used in servers. Therefore, the Parties will not be more likely, as a result of the Transaction, to increase the costs of downstream rivals by refusing to supply DRAM products or to only do so at worse terms.

194 Non-Horizontal Merger Guidelines, paragraph 40.
195 Replies to Questionnaire, question 105.
196 Replies to Questionnaire, question 108.1.
197 Replies to Questionnaire, question 108.1.
198 Replies to Questionnaire, question 108.
199 Non-Horizontal Merger Guidelines, paragraph 48.

(281) Downstream competitors may also constitute a sufficient constraint on the merged entity if there are sufficient competitors remaining whose costs are not likely to be raised, for example because they are capable of switching to adequate alternative inputs.[200] The results of the market investigation above indicate that sufficient credible downstream competitors remain whose costs are not likely raised because they are capable of switching to adequate alternative DRAM products.[201]

(282) In light of the above, the Commission considers that a decision post-Transaction to restrict access to SK hynix' DRAM products would have no material impact on rival eSSD suppliers.

Conclusion

(283) The Commission considers that, in view of the considerations above and the results of the market investigation, the Transaction does not raise serious doubts as to its compatibility with the internal market with respect to potential input foreclosure on the upstream market for DRAM or potential narrower markets for high-speed DRAMs or DRAMs used in servers, and the downstream market for eSSDs (or market segmentations for SATA or PCIe eSSDs).

5.4.4.2. Customer foreclosure

(A) Potential concern

(284) The Commission further assessed the ability and incentive of the merged entity to source internally the entire quantity of DRAM it needs for its eSSDs, thereby foreclosing SK hynix' competitors on the upstream market for DRAMs or potential narrower markets for high-speed DRAMs or DRAMs used in servers.

(B) The Notifying Party's views

(285) The Notifying Party claims that the Parties will lack both the ability and the incentive post-Transaction to foreclose competing DRAM suppliers by internally sourcing the Parties' entire DRAM needs.

As regards ability

(286) First, the Notifying Party submits that the merged entity will not represent an important customer base for DRAM suppliers. […]. The Target Business for its part would only represent a small share of the total DRAM demand as it has a market share for 2019 of approximately [10-20]% on the overall SSD market. Moreover, the Target Business currently sources DRAM from multiple suppliers: […].

(287) Second, the combined market share in 2019 on the overall SSD market is approximately [10-20]%. According to the Notifying Party, there would therefore still be a large customer base left in the SSD market for DRAM supplies if the Parties would hypothetically decide to source all of its DRAM requirements internally.

(288) Third, the Notifying Party argues that the total volume of total DRAM used in SSDs is negligible. According to Omdia, only [0-5]% of DRAM GB shipped in 2019 went

[200] Non-Horizontal Merger Guidelines, paragraph 50.
[201] Replies to Questionnaire, question 109.

into SSDs. DRAM is also incorporated into personal and mobile devices (such as smartphones and wearable devices), consumer electronics and computing systems/equipment (servers, switches etc.). This customer base for DRAM suppliers would in any event not be affected by the Transaction.

As regards incentives

(289) The Notifying Party submits that for the same reasons as above, a future strategy to source all DRAM requirements internally could not plausibly foreclose any DRAM rivals. SK hynix already sources all its DRAM requirements internally, whereas the Target Business would only represent a small share of total DRAM demand. Moreover, SSDs are only one of the application areas where DRAM is used.

As regards effects

(290) Given the above arguments, the Notifying Party maintains that the Transaction cannot give rise to any plausible customer foreclosure concerns.

(C) Commission's assessment

(291) For the reasons set out below, the Commission considers that the Parties will not have the ability or incentive post-Transaction to engage in a customer foreclosure strategy. Moreover, any such strategy would likely not have any material effect on competition.

As regards ability

(292) The Commission considers that the Parties' eSSDs do not represent a significant channel to market for competing DRAM suppliers.

(293) First, for customer foreclosure to be a concern, the Transaction must involve a company that is an important customer with a significant degree of market power in the downstream market.[202] On the downstream market for SSDs, the Parties have a combined 2019 market share in eSSDs of [30-40]%[203], and have combined 2019 market shares in the market segmentations of SATA eSSDs and PCIe eSSDs of respectively [30-40]%[204] and [40-50]%[205]. Despite these market shares, the market investigation indicates that neither SK hynix nor the Target Business are important DRAM buyers.[206] As regards SK hynix, the Commission finds […]. Regarding the importance of the Target Business, one respondent to the market investigation observes that "*Intel's SSD business demand for DRAM is very small as a DRAM customer and likely would not feature as a top 25 customer of any DRAM supplier*".[207] Moreover, the Commission finds that the Target Business procures DRAM from several suppliers (in 2020: […]), which suggests that the Target Business is not an important buyer for a specific DRAM supplier.

202 Non-Horizontal Merger Guidelines, paragraph 61.
203 Form CO, Table 12.
204 Form CO, Table 14.
205 Form CO, Table 15.
206 Replies to Questionnaire, questions 110, 112 and 114.
207 Replies to Questionnaire, question 110.1.

(294) Second, according to paragraph 62 of the Non-Horizontal Merger Guidelines, if there is a sufficiently large customer base, at present or in the future, that is likely to turn to independent suppliers, the Commission is unlikely to raise competition concerns. All respondents to the market investigation who expressed an opinion indicate that sufficient DRAM buyers would remain available post-Transaction.[208] As mentioned above, […]. While the Target Business does procure DRAM from several suppliers, the Commission considers that it cannot be considered as an important buyer. The Target Business has a 2019 market share of [20-30]% in the overall market for SSDs and has higher market shares in the market segmentations for SATA eSSDs ([30-40]%) and PCIe eSSDs ([30-40]%). However, account should also be taken of the existence of different markets corresponding to different uses for the input. The Non-Horizontal Merger Guidelines set out that an upstream supplier may continue to operate efficiently if it finds other uses or secondary markets for its input without incurring significantly higher costs.[209] In the present case, according to Omdia, only [0-5]% of DRAM GB shipped in 2019 went into SSDs, such that alternative end-uses are very significant. The Target Business' share of demand for DRAMs would represent around a quarter to a third of the overall DRAM demand for SSDs, which would amount to only approximately [0-5]% of DRAM GB shipped in 2019. Therefore, the Commission considers that competing DRAM suppliers will remain able to operate effectively following the Transaction.

(295) In light of the above, the Commission concludes that the Parties will likely not have the ability to engage in a customer foreclosure strategy following the Transaction.

As regards incentives

(296) The Commission considers that the merged entity would not have the incentive to engage in customer foreclosure because it would not be profitable to do so.

(297) In fact, the Parties would face a trade-off between the possible costs associated with not procuring products from upstream DRAM suppliers and the possible gains from doing so.[210]

(298) The Commission considered that the possible costs for the Target Business if it decides to only procure DRAM from SK hynix will likely be low. DRAMs (including high-speed DRAMs used in servers) are commoditized products, and rival's DRAM products are therefore not more attractive as a result of product differentiation.

(299) While the possible costs are likely to be low, the Commission further considers that the Target Business will likely not be able to profit from significant gains if it decides to no longer procure DRAM for rival DRAM suppliers. Possible gains could arise if, as a result of the foreclosure strategy, the merged entity could profit from possibly higher price-levels in the upstream market.[211] Above, the Commission considered that the Target Business cannot be considered as an important buyer for DRAM. In particular, the Commission takes into account that, while the Target Business has a 2019 market share of [20-30]% in the overall market for SSDs and has higher market shares in the market segmentations for SATA eSSDs ([30-40]%) and PCIe eSSDs ([30-40]%), only [0-5]% of DRAM GB shipped in 2019 went into SSDs according to

[208] Replies to Questionnaire, question 117.
[209] Non-Horizontal Merger Guidelines, paragraph 66.
[210] Non-Horizontal Merger Guidelines, paragraph 68.
[211] Non-Horizontal Merger Guidelines, paragraph 70.

Omdia. Moreover, the Target Business […]. A foreclosure strategy would therefore only impact a part of it current DRAM demand. A foreclosure strategy whereby the Target Business would only procure DRAM from SK hynix therefore has a minimal impact on overall DRAM sales. A possible foreclosure strategy is therefore not expected to have any impact on price-levels in the upstream market for DRAM or potential narrower markets for high-speed DRAMs or DRAMs used in servers.

(300) Finally, the majority of the respondents to the market investigation indicate that they do not consider that the Parties have an incentive to stop purchasing DRAM.[212]

(301) In light of these considerations, the Commission takes the view that the merged entity will likely not have the incentive to engage in a customer foreclosure strategy following the Transaction.

As regards effects

(302) The Commission considers that a potential customer foreclosure strategy for DRAM would likely have no material effect on competition.

(303) First, the Commission considers that even in the event of a customer foreclosure strategy, only part of the Target Business' current DRAM demand would be foreclosed (as in 2020 the Target Business procured DRAM […]).

(304) Second, rival DRAM suppliers are largely protected from any foreclosure strategy on the market for eSSDs because of the existence of many other markets where DRAM is purchased. According to Omdia, only […]% of DRAM GB shipped in 2019 went into SSDs.

(305) Therefore, a decision post-Transaction whereby the Target Business would only purchase its DRAM needs from SK hynix would have no material impact on rival DRAM suppliers.

Conclusion

(306) In light of the above considerations, the Commission considers that the Transaction does not raise serious doubts as to its compatibility with the internal market with respect to potential customer foreclosure on the upstream market of DRAM or potential narrower markets for high-speed DRAMs or DRAMs used in servers, and the downstream market for eSSDs (or market segmentations for SATA or PCIe eSSDs).

5.5. Conglomerate non-coordinated effects

5.5.1. Legal framework

(307) As mentioned in Section 5.1 above, conglomerate mergers do not lead to any competition problems in most circumstances.[213]

(308) In assessing the likelihood of conglomerate effects, the Commission examines, first, whether the merged entity would have the ability to foreclose its rivals (through tying,

[212] Replies to Questionnaire, question 116.

[213] Non-Horizontal Merger Guidelines, paragraph 92.

bundling or other exclusionary practices), second, whether it would have the economic incentive to do so and, third, whether a foreclosure strategy would have a significant detrimental effect on competition. In practice, these factors are often examined together as they are closely intertwined.[214]

(309) Mixed bundling refers to situations where the products are also available separately, but the sum of the stand-alone prices is higher than the bundled prices.[215] Tying refers to situations where customers that purchase one good (the tying good) are required also to purchase another good from the producer (the tied good). Tying can take place on a technical or contractual basis.[216] Tying and bundling as such are common practices that often have no anticompetitive consequences. Nevertheless, in certain circumstances, these practices may lead to a deduction in the actual or potential ability and incentive of rivals to compete.

(310) In order to be able to foreclose competitors, the merged entity must have a significant degree of market power, which does not necessarily amount to dominance, in one of the markets concerned. The effects of bundling or tying can only be expected to be substantial when at least one of the merging parties' products is viewed by many customers as particularly important and there are few relevant alternatives for that product.[217] Further, for foreclosure to be a potential concern, it must be the case that there is a large common pool of customers, which is more likely to be the case when the products are complementary.[218]

(311) The incentive to foreclose rivals through bundling or tying depends on the degree to which this strategy is profitable.[219] Bundling and tying may entail losses or foregone revenues for the merged entity.[220] It may also increase profits by gaining market power in the tied goods market, protecting market power in the tying good market, or a combination of the two.[221]

(312) It is only when a sufficiently large fraction of market output is affected by foreclosure resulting from the concentration that the concentration may significantly impede effective competition. If there remain effective single-product players in either market, competition is unlikely to deteriorate following a conglomerate concentration.[222] The effect on competition needs to be assessed in light of countervailing factors.[223]

5.5.2. Affected markets

(313) The Target Business is active in the manufacture and supply of both NAND products and SSDs (including market segmentations thereof). SK hynix is active in these markets as well. However, in addition to these, SK hynix also manufactures and sells DRAM, managed NAND and CMOS products.

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214 Non-Horizontal Merger Guidelines, paragraph 94.
215 Non-Horizontal Merger Guidelines, paragraph 96.
216 Non-Horizontal Merger Guidelines, paragraph 97.
217 Non-Horizontal Merger Guidelines, paragraph 99.
218 Non-Horizontal Merger Guidelines, paragraph 100.
219 Non-Horizontal Merger Guidelines, paragraph 105.
220 Non-Horizontal Merger Guidelines, paragraph 106.
221 Non-Horizontal Merger Guidelines, paragraph 108.
222 Non-Horizontal Merger Guidelines, paragraph 113.
223 Non-Horizontal Merger Guidelines, paragraph 114.

(314) In Section 5.4 above, the Commission assessed the vertical relationships between the upstream markets for respectively DRAM and NAND, and the downstream market for eSSDs (including market segmentations for SATA and PCIe eSSDs).

(315) In this Section, the Commission assesses potential foreclosure strategies through the bundling of the products of the Target Business with SK hynix' DRAM, managed NAND and CMOS products. More specifically, the following potential bundles are assessed:

i. the Target Business' NAND with SK hynix' DRAM;

ii. the Target Business' SSDs with SK hynix' managed NAND; and

iii. the Target Business' NAND and SSDs with SK hynix' CMOS image sensors.

(316) As described above, DRAM are chips that are used in data and graphic processing applications in data centres as well as in a wide array of IT devices for consumer applications. The DRAM business accounts for approximately […]% of SK hynix' global revenues. Both DRAM and NAND are SSD components. Table 2 below illustrates the 2019 market shares on a worldwide market for DRAM:

Table 9: 2019 market shares on a worldwide market for DRAM

	Sales value (USD million)	**Market share (% sales by value)**
SK hynix	*[…]*	*[20-30]%*
Samsung	*[…]*	[40-50]%
Micron	*[…]*	[20-30]%
Nanya	*[…]*	[0-5]%
Winbond	*[…]*	[0-5]%
Elite	*[…]*	[0-5]%
ISSI	*[…]*	[0-5]%
Etron	*[…]*	[0-5]%
Others	*[…]*	[0-5]%
Total	**[…]**	**100%**

Table 18 of the Form CO

(317) (Raw) NAND can be combined with a controller, or with both a controller and DRAM, to create "managed NAND" (or embedded flash) products. Managed NAND is used in mobile phones and, to a lesser extent, in tablets and low-grade laptops (laptops and PCs commonly use hard drives and SSDs for storage). Table 3 below illustrates the 2019 market shares on a worldwide market for managed NAND:

Table 10: 2019 market shares on a worldwide market for managed NAND

	Sales volume (in GB)	Market share (%)
SK hynix	[…]	*[10-20]%*
Samsung	[…]	[50-60]%
Micron	[…]	[10-20]%
Kioxia	[…]	[5-10]%
Western Digital	[…]	[5-10]%
Kingston	[…]	[0-5]%
Longsys	[…]	[0-5]%
Others	[…]	[0-5]%
Total	**[…]**	**100%**

Response to Request for Information dated 4 May 2021

(318) According to the Notifying Party, there is no vertical relationship between the Target Business' (raw) NAND and SK hynix's managed NAND. This is because the former cannot currently be integrated into the latter. SK hynix's managed NAND is optimized for SK hynix's NAND, which is more suitable for mobile uses. The NAND that the Target Business produces on the other hand is suitable for SSDs (in programming speed and densities) […]. SK hynix has no plans to develop managed NAND products with the Target Business' NAND. Because of this, the Commission assesses the potential conglomerate effects of potential bundles of the Target Business's SSDs with SK hynix' managed NAND.

(319) Lastly, CMOS image sensors are non-memory semiconductors that function as digital film in many IT devices. They are mainly used in digital cameras, smartphones and miniature medical imaging systems. SK hynix's CMOS image sensors are mainly sold for smartphone applications and are sold to module houses ([…]) – usually designated by smartphone makers – that assemble components for smartphones and then sell to smartphone makers (*e.g.*[…]). Based on revenue, SK hynix's worldwide market share in 2019 (by value) for CMOS image sensors is [0-5]%. Further, Table 4 below illustrates the 2019 market shares on a worldwide market for CMOS image sensors:

Table 11: 2019 market shares on a worldwide market for CMOS image sensors

	Market share based on volume shipment (%)
SK hynix	*[5-10]%*
Sony	[20-30]%
Samsung	[20-30]%
OmniVision	[10-20]%
GalaxyCore	[10-20]%
Others	[10-20]%
Total	**100%**

Table 19 of the Form CO

(320) The respondents to the market investigation did not list any other products than those mentioned above that could potentially be combined in product bundles.

5.5.3. Potential concerns

(321) The Commission assessed potential competition concerns in relation to potential anti-competitive conglomerate strategies for the following combinations of products:

i. the Target Business' NAND with SK hynix' DRAM;

ii. the Target Business' SSDs with SK hynix' managed NAND; and

iii. the Target Business' NAND and SSDs with SK hynix' CMOS image sensors.

(322) In particular, the Commission assessed the ability and the incentive of the merged entity to engage in contractual tying by:

- imposing the purchase of SK hynix' DRAM if the customer wants to purchase the Target Business' NAND or vice versa;
- imposing the purchase of SK hynix' managed NAND if the customer wants to purchase the Target Business' SSDs or vice versa; and/or
- imposing the purchase of SK hynix' CMOS image sensors when the customer wants to purchase the Target Business' NAND or SSDs.

(323) Further, the Commission assessed the ability and the incentive of the merged entity to engage in mixed bundling by incentivising the joint purchase of the merged entity's products by offering higher prices for mix-and-match solutions involving only one of its products as compared to the potential bundles set out above[224].

5.5.4. The Notifying Party's views

(324) The Notifying Party submits that the Transaction will not raise any competition concerns as a result of potential conglomerate effects.

As regards ability

(325) The Notifying Party argues that the Parties will not have the ability to engage in an anti-competitive leveraging strategy for several reasons.

(326) First, SK hynix already has a presence in the markets relevant for the conglomerate effects assessment. The range of products of SK hynix will therefore remain essentially unchanged following the Transaction.

(327) Second, SK hynix would not have market power in any relevant market. In NAND, the Parties' combined market share for 2019 remains below 20% and in 3D NAND is [20-30]%. In SSDs, the Parties' combined market share for 2019 is [10-20]% according to Forward Insight and [20-30]% according to Omdia. In all of these markets (NAND, 3D NAND and SSDs), Samsung remains however by far the largest competitor and several other major players remain. The Parties' combined market share for 2019 is higher in the market for eSSDs ([20-30]% according to Forward Insight and [30-40]% according to Omdia) as well as in the market segmentations for SATA eSSDs ([30-40]%) and PCIe eSSDs ([40-50]%). However, the Transaction

[224] It is noted that there are no interoperability issues with regard to DRAM and DRAM; the market investigation and prenotification calls to market participants do not contradict this assessment.

would not change the competitive landscape, because the share increment for eSSDs, SATA eSSDS and PCIe SSDs of respectively approximately [0-5]%, [0-5]% and [5-10]% is small. SK hynix' market share in a worldwide market for DRAM remains below 30% and also here, Samsung is the largest competitor. Finally, in markets for managed NAND and CMOS image sensors, SK hynix' market share remains below [20-30]%.

(328) The Notifying Party therefore submits that the increased market share for NAND and SSDs would not be indicative of SK hynix' ability to engage in an anti-competitive leveraging strategy.

(329) Third, the Notifying Party explains that customers typically negotiate quantities and prices for products separately, based on the prevailing conditions in the respective product market segmentations.

(330) […], the Notifying Party submits that customers typically negotiate prices, quantities and delivery times separately. As DRAM is a commoditized product, there are no interoperability issues DRAM and NAND. Therefore, customers would be free to mix and match DRAM and NAND from different producers.[…].[225]

(331) As regards a potential bundle comprising of SSDs and managed NAND, the Notifying Party submits that those products have different application areas and typically different customers. These products are therefore typically not bought together and a strategy to bundle SSD and managed NAND would not be meaningful.

(332) For potential bundles comprising of NAND / SSDs and CMOS image sensors, the Notifying Party submits that the same argument applies. These products have different application areas and different customers.

(333) Fourth, the Notifying Party submits that a number of competitors would be able to develop counter strategies, such as to offer competitive alternative bundles comprising of NAND and DRAM, or SSDs and managed NAND.

(334) As regards a potential bundle comprising of NAND and DRAM the Notifying Party observes that Samsung is the biggest competitor in each market and would be easily able to replicate any hypothetical bundling strategy. Micron would be able to do the same since they are also active in both DRAM (approximately [20-30]%) and NAND (approximately [10-20]%).

(335) Multiple competitors would also be able to replicate a potential bundle comprising of SSDs and managed NAND. Samsung is market leader in both managed NAND and SSD, and is active in each market. Micron is also active in both markets and in each market. Finally, Western Digital and Kioxia are also active in all market of SSDs, as well as in most types managed NAND.

(336) Fifth, the Notifying Party considers that customers have sufficient power to defeat any attempt of an anti-competitive leveraging strategy. The Notifying Party submits that customers for each of the products are typically sophisticated buyers with significant technical knowledge and expertise. They tend to multi-source and mix and match when possible. Moreover, the Notifying Party argues that important characteristics for customer choice in all product areas are: (i) the ability to supply the required product

[225] […]

features; (ii) the ability to supply the required quantity; (iii) the ability to respond in case of defective products; and (iv) price competitiveness. Products will need to undergo customer qualification (or enabling) before they are sold. Finally, customers typically keep procurement these products to create the maximum amount of competition and often have multi-vendor policies.

As regards incentives

(337) The Notifying Party argues that the Parties will not have the economic incentive to engage in an anti-competitive leveraging strategy.

(338) According to the Notifying Party, the strategy to tie or bundle the Target Business' NAND with SK hynix' DRAM would in all likelihood reduce profits of the merged entity.

(339) Moreover, the Notifying Party argues that anti-competitive leveraging strategies would only be profitable in the long term if this led to the effective exclusion of competition from the market where the bundled product is sold. On the basis of the market shares on the relevant markets, this development would not be plausible given that robust competitors are active in all product areas that can offer similar bundles both in terms of price and range.

(340) Finally, the Notifying Party argues that customers are sophisticated and powerful enough to favour multi-sourcing as well as mixing and matching over restrictive bundles.

As regards effects

(341) For the reasons set out above, the Notifying Party maintains that any potential anti-competitive leveraging strategy would not have a material effect on competition.

5.5.5. Commission's assessment

(342) For the reasons set out below, the Commission considers that the Parties will not have the ability or incentive post-Transaction to engage in any conglomerate foreclosure strategies. Moreover, any such strategy would likely not have any material effect on competition.

As regards ability

5.5.5.1. Assessment of potential market power

(343) In order to have the ability to foreclose rivals, the merged entity must have a significant degree of market power in at least one of the markets concerned. That is, at least one of the Parties' products must be viewed by many customers as particularly important, for example because of product differentiation, and there must be few relevant alternatives for that product.[226]

[226] Non-Horizontal Merger Guidelines, paragraph 99.

(344) In this respect, the Commission notes first that, in general, the merged entity would not become the largest competitor on any of the markets concerned. Moreover, one or more competitors with larger or similar market shares remain active on each market.

(A) The Target Business' NAND and SK hynix's DRAM.

(345) In the market for NAND flash memory, the Parties' combined market share for 2019 amounted to [10-20]%. In the possible market for 3D NAND, the Parties combined market share is [20-30]% (with the Target Business' 3D NAND products representing [10-20]% of the market). On both these markets, Samsung has a significant higher market share (NAND: [30-40]%; 3D NAND: [30-40]%), there is one other significant competitor with a comparable market position (Kioxia, NAND: [10-20]%; 3D NAND: [10-20]%) and there are several smaller players in the market.

(346) As regards the market for DRAM, SK Hynix holds a worldwide market share, for 2019, of [20-30]%. On this market as well, Samsung is the strongest competitor with a significantly higher market share ([40-50]%). Another competitor, Micron, has a similar market position as SK hynix ([20-30]%) while several smaller market players are also active on the market. Moreover, the Notifying Party submitted, and respondents to the Market Investigation confirm[227], that DRAM is a commoditized product. SK hynix's DRAM can therefore not be viewed as a product that is particularly important for many customers.

(347) As a result, the Commission is of the view that, based on the Parties' market positions in the markets for NAND (as well as 3D NAND) and DRAM, it is unlikely that the Parties will have the ability to leverage their position in either of these markets.

(B) The Target Business' SSDs with SK hynix's managed NAND.

(348) In managed NAND, SK hynix has a market share that remains below 20%. Samsung is by far the biggest competitor with a market share exceeding 50%. Therefore, the Commission considers that SK hynix does not have a significant degree of market power in managed NAND.

(349) On the overall market for SSDs, the combined market share of the Parties in 2019 amounted to [10-20]% according to Forward Insight, and to [20-30]% according to Omdia. The Target Business' market share, according to Forward Insight, amounted to [10-20]%. While many competitors are active in the supply of SSDs, Samsung is the main competitor with a significant stronger market position than the Parties.

(350) In cSSDs, the market share of the Parties is well below 15%. The Parties' combined market share for 2019 is higher in the market for eSSDs however ([20-30]% according to Forward Insight and [30-40]% according to Omdia) and even more so in the possible markets for SATA eSSDs ([30-40]%) and PCIe eSSDs ([40-50]%). The Target Business in particular has a strong market position prior to the Transaction in eSSDs: [20-30]%; SATA eSSDs: [30-40]%; and PCIe eSSDs: [30-40]%). In each of these markets, Samsung is the most important competitor (eSSDs: [30-40]%; SATA eSSDs: [30-40]%; PCIe eSSDs: [30-40]%). However, in PCIe eSSDs the merged entity would become the largest market player.

[227] Replies to Questionnaire, question 105.1.

(351) The results of the market investigation confirm that Samsung is regarded as a very close competitor to the Target Business in the market for eSSDs. Overall, Micron and Kioxia are also considered to be as close competitors.[228] In PCIe eSSDs, only Samsung is regarded as a very close competitor. While not considered as very close competitors, Kioxia and Micron are not generally considered as distant competitors either.[229] In SATA eSSDs, both Samsung and Micron are regarded as very close competitors.[230] Moreover, all respondents to the market investigation who expressed an opinion confirmed that it is easy for customers to switch between SSDs[231], that customers generally multi-source SSDs[232] and that competitors of the Parties have a comparable financial strength[233]. The responses remain the same for eSSDs and possible narrower markets for SATa eSSDs and PCIe eSSDs. Finally, the majority of the respondents indicate that current and potential suppliers of eSSDs are expected to equally profit from market growth.[234] The Commission considers that, for these reasons, the Parties' products cannot be considered as particularly important to customers and that relevant alternatives exist.

(C) The Target Business' NAND and SSDs with SK hynix's CMOS image sensors.

(352) The Commission considered above that the Target Business does likely not have a significant degree of market power in NAND and SSDs. On a market for CMOS image sensors, SK hynix would hold a market share well below 10% while several competitors hold significantly stronger market positions. Therefore, the Commission considers that it is unlikely that the Parties will have the ability to leverage their position in either of these markets.

5.5.5.2. Assessment of the pool of customers for the products concerned

(353) In addition to market power, the Non-Horizontal Guidelines state that for foreclosure to be a potential concern, it must be the case that there is a large common pool of customers. This is more likely to be the case when the products are complementary.[235]

(354) First, as regards the Target Business' NAND and SK hynix's DRAM, the Commission notes that both NAND and DRAM are SSD components. They might therefore both be purchased by SSD manufacturers and NAND and DRAM suppliers therefore share a common pool of customers. However, DRAM is used in many other applications such as personal and mobile devices (*e.g.* smartphones and wearable devices), consumer electronics and computing systems/equipment (servers, switches etc.). SSDs only take up a very small share in DRAM revenues.

(355) Second, the Parties do not share a large common pool of customers as regards the Target Business' SSDs with SK hynix's managed NAND. While SSDs are mainly used in enterprise storage systems (servers), PCs, tablets, gaming consoles etc.,

228 Replies to Questionnaire, question 50.
229 Replies to Questionnaire, question 52.
230 Replies to Questionnaire, question 54.
231 Replies to Questionnaire, question 56.
232 Replies to Questionnaire, question 57.
233 Replies to Questionnaire, question 62.
234 Replies to Questionnaire, question 64.
235 Non-Horizontal Merger Guidelines, paragraph 100.

managed NAND is mainly used in mobile phones. SSD and managed NAND customers do therefore typically not overlap.

(356) Third, as regards the Target Business' NAND and SSDs with SK hynix's CMOS image sensors, the Commission considers that CMOS image sensors are mainly used in different application areas than NAND. CMOS image sensors are mainly sold for smartphone applications. Therefore, there is not a large common pool of customers.

(357) From the above, it follows that as customers do not tend to buy both products, the individual products are likely to be less affected by bundling or tying strategies.

5.5.5.3. Assessment of counter-strategies

(358) In its assessment of the Parties' ability to engage in anti-competitive leveraging strategies, the Commission further considers whether there are effective and timely counter-strategies that rival firms may deploy.[236]

(359) The results of the market investigation confirm that, for each of the potential bundles that are assessed, rival firms would be able to replicate the Parties' bundles. In each instance, all respondents who expressed an opinion believe sufficient competitors would be able to do so.[237]

(360) The Commission further considers whether customers have a strong incentive to buy the range of products concerned from a single source rather than from many suppliers.[238] Where this is the case, customers are more likely to be affected by bundling or tying strategies.

(361) The market investigation confirms, first, that several factors drive consumer choice in the data storage solutions industry to the same extent. Respondents indicate unanimously that these factors include: (i) the ability to supply required product features; (ii) the ability to supply required quantities; (iii) the ability to respond in case of defective products; and (iv) price competitiveness. Moreover, the majority of respondents agree that another important factor is the supplier's ability to supply multiple products.[239]

(362) All respondents who expressed an opinion further confirm that customers prefer to multi-source different products rather than to rely on a single supplier.[240] One respondent states: "*Customers prefer to multi source in order to secure assurance of supply during those times when supply is constrained.*"[241] Furthermore, the majority of respondents also confirm that the bundled sale of NAND and DRAM, SSDs and managed NAND, and NAND/SSDs and CMOS image sensors is uncommon.[242]

(363) In view of the above, the Commission considers that rival firms are able to deploy effective and timely counter-strategies in case of a potential bundling or tying strategy

236 Non-Horizontal Merger Guidelines, paragraph 103.
237 Replies to Questionnaire, questions 127, 133 and 139.
238 Non-Horizontal Merger Guidelines, paragraph 104.
239 Replies to Questionnaire, question 118.
240 Replies to Questionnaire, question 119.
241 Replies to Questionnaire, question 119.1.
242 Replies to Questionnaire, question 121.

from the Parties. Moreover, customers are not likely to be affected by any bundling or tying strategies.

(364) Overall, the results of the market investigation confirm that the majority of the respondents that the Parties do not have the ability to engage in a contractual tying strategy whereby the purchase of a tied good is imposed when a customers to purchase a tied good.[243] Finally, the majority of the respondents consider that the Parties will not have the ability to engage in mixed bundling by incentivising the joint purchase of the merged entity's products by offering higher prices for mix-and-match solutions involving only one of its products as compared to the potential bundles set out above.

(365) For these reasons, the Commission considers that the Parties will not have the ability post-Transaction to engage in any anti-competitive leveraging strategies.

As regards incentives

(366) The Commission has also assessed whether the merged entity will have an incentive to engage in either contractual tying or mixed bundling strategies for the products discussed above, in order to foreclose rivals from effectively competing for customers.

(367) First, as set out above, the merged entity will continue to face several credible competitors, many of which are able to offer the same range of products as the Parties.[244]

(368) Second, as regards potential bundles of the Target Business' SSDs with SK hynix's managed NAND and the Target Business' NAND and SSDs with SK hynix's CMOS image sensors, the Commission considered above that these products are mainly used in different application areas and that customers do not tend to buy both products in these potential bundles. For this same reason, the Commission considers that the Parties will not have an incentive to engage in an anti-competitive leveraging strategy in relation to these products. This is confirmed by the results of the market investigation, where the majority of the respondents indicated in relation to these bundles that the Parties would not have an incentive to engage in either a contractual tying or a mixed bundling strategy.[245]

(369) Third, as regards a potential bundle consisting of the Target Business' NAND and SK hynix's DRAM, the Commission considers that pure bundling and tying may entail losses for the Parties[246] as the market investigation confirmed that a significant number of customers are not interested in buying bundles.[247] Moreover, the Commission considered already above that the Parties lack significant market power and several competitors with considerable market power remain on each market which are able to replicate this bundle[248]. Possible bundled sales by the merged entity would therefore unlikely lead to the marginalisation of competitors. In line with these findings, the majority of the respondents to the market investigation indicate that, in their view, the

243 Replies to Questionnaire, questions 123, 129 and 135.
244 Replies to Questionnaire, questions 127, 133 and 139.
245 Replies to Questionnaire, questions 130, 132, 136 and 138.
246 Non-Horizontal Merger Guidelines, paragraph 106.
247 Replies to Questionnaire, questions 119 and 121.
248 Replies to Questionnaire, question 127.

Parties do not have the incentive to engage in either a contractual tying or a mixed bundling strategy concerning the Target Business' NAND and SK hynix's DRAM.

(370) Based on the above, the Commission considers that the merged entity is unlikely to have the incentive post-Transaction to engage in any anti-competitive leveraging strategies.

As regards effects

(371) Regardless of whether the merged entity has either the ability or the incentive to foreclose rivals on any of the markets that are part of the potential bundles that are assessed, the Commission considers that such strategy would not have an appreciable impact on competition.

(372) It is only when a sufficiently large fraction of market output is affected by foreclosure resulting from the concentration that the concentration may significantly impede effective competition. If there remain effective single-product players in either market, competition is unlikely to deteriorate following a conglomerate concentration.[249] The Non-Horizontal Merger Guidelines set out further that the effect on competition needs to be assessed in light of countervailing factors such as the presence of countervailing buyer power or the likelihood that entry would maintain effective competition in the closely related markets concerned.[250]

(373) As set out above, there are several significant players remaining on each of the markets concerned. Moreover, any potential contractual tying or mixed bundling strategy would be mitigated by the ability of these competitors to react to such strategy by replicating these bundles.[251]

(374) The results of the market investigation confirm the limited effect of the Transaction. All respondents to the market investigation who expressed an opinion indicate that the impact of the Transaction on their company would be either positive or neutral.[252]

(375) As regards potential bundles of the Target Business' SSDs with SK hynix's managed NAND and the Target Business' NAND and SSDs with SK hynix's CMOS image sensors, the Commission considered above that these products are mainly used in different application areas and that customers do not tend to buy both products in these potential bundles. Any potential contractual tying or bundling strategy would therefore not have an appreciable impact on competition.

(376) As regards a potential bundle consisting of the Target Business' NAND and SK hynix's DRAM, the market investigation confirms that the Transaction will not have an appreciable impact on competition. All respondents to the market investigation who expressed an opinion indicate that the impact of the Transaction on a market for DRAM will be neutral.[253] Moreover, all respondents to the market investigation who

[249] Non-Horizontal Merger Guidelines, paragraph 113.
[250] Non-Horizontal Merger Guidelines, paragraph 114.
[251] Replies to Questionnaire, questions 127, 133 and 139.
[252] Replies to Questionnaire, question 141.
[253] Replies to Questionnaire, question 142.

expressed an opinion indicate that the impact of the Transaction will be either positive or neutral on the markets for NAND and 3D NAND.[254]

(377) In light of the above, the Commission considers that any anti-competitive leveraging strategy would not have an appreciable impact on competition.

5.5.5.4. Conclusion

(378) For the reasons set out above, the Commission considers that the Parties will not have the ability or incentive post-Transaction to engage in any conglomerate strategies. Moreover, any such strategy would likely not have any material effect on competition. As a result, the Commission considers that the Transaction will significantly impact effective competition on any market.

6. CONCLUSION

(379) For the above reasons, the European Commission has decided not to oppose the notified operation and to declare it compatible with the internal market and with the EEA Agreement. This decision is adopted in application of Article 6(1)(b) of the Merger Regulation and Article 57 of the EEA Agreement.

For the Commission

(Signed)
Margrethe VESTAGER
Executive Vice-President

[254] Replies to Questionnaire, question 142.