Dynamic Random Access Memory Semiconductors Of One Megabit And Above From Taiwan

Investigation No. 731-TA-811 (Preliminary)

Publication 3149

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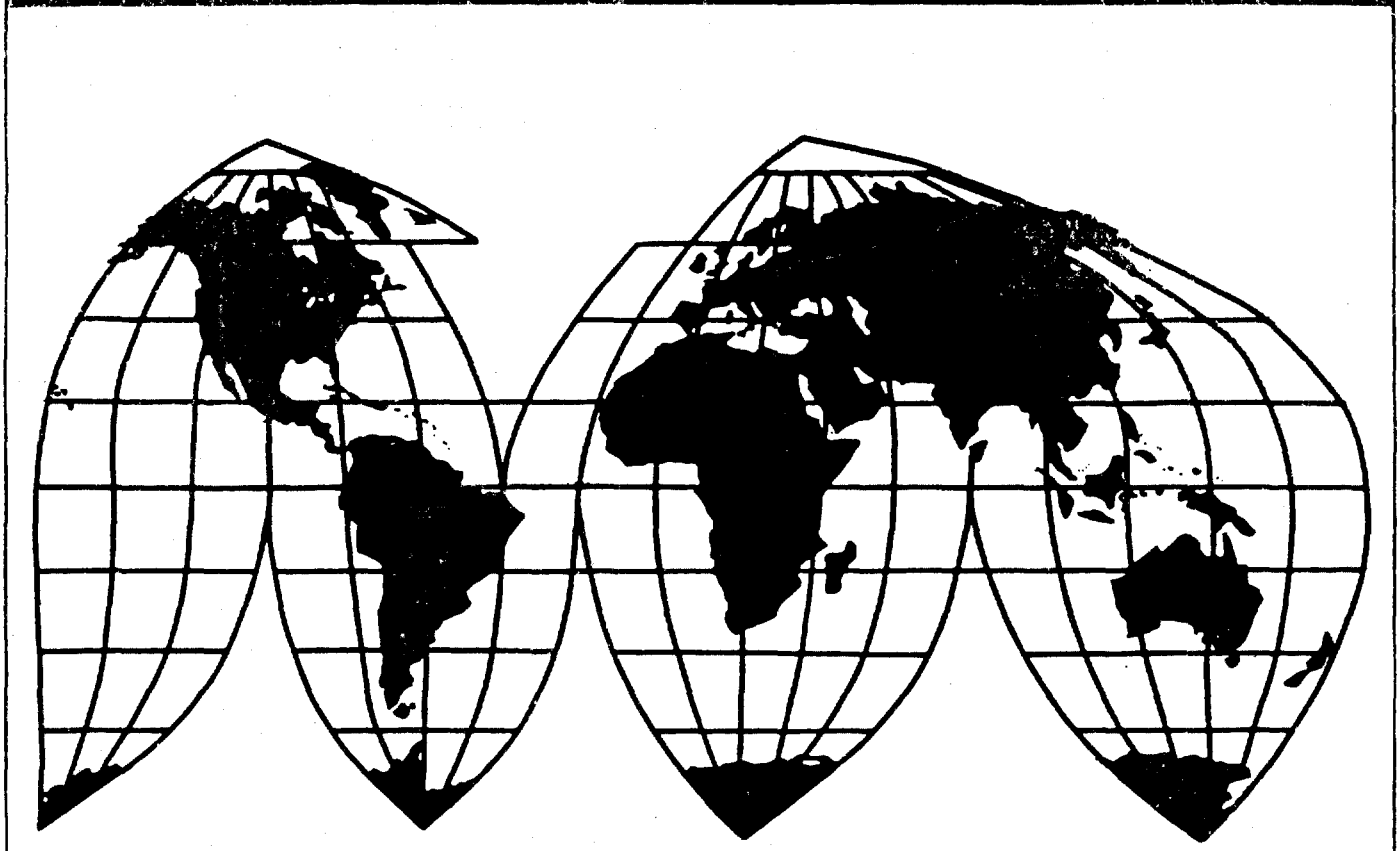
U.S. International Trade Commission



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U.S. International Trade Commission

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UNITED STATES INTERNATIONAL TRADE COMMISSION

Investigation No. 731-TA-811 (Preliminary)

DRAMS OF ONE MEGABIT AND ABOVE FROM TAIWAN

DETERMINATION

On the basis of the record[1] developed in the subject investigation, the United States International Trade Commission determines,[2] pursuant to section 733(a) of the Tariff Act of 1930 (19 U.S.C. § 1673b(a)), that there is a reasonable indication that an industry in the United States is materially injured by reason of imports from Taiwan of dynamic random access memory semiconductors (DRAMs) of one megabit and above, provided for in subheadings 8542.13.80 and 8473.30.10 through 8473.30.90 of the Harmonized Tariff Schedule of the United States, that are alleged to be sold in the United States at less than fair value (LTFV).

COMMENCEMENT OF FINAL PHASE INVESTIGATION

Pursuant to section 207.18 of the Commission's rules, the Commission also gives notice of the commencement of the final phase of its investigation. The Commission will issue a final phase notice of scheduling which will be published in the *Federal Register* as provided in section 207.21 of the Commission's rules upon notice from the Department of Commerce (Commerce) of an affirmative preliminary determination in the investigation under section 733(b) of the Act, or, if the preliminary determination is negative, upon notice of an affirmative final determination in that investigation under section 735(a) of the Act. Parties that filed entries of appearance in the preliminary phase of the investigation need not enter a separate appearance for the final phase of the investigation. Industrial users, and, if the merchandise under investigation is sold at the retail level, representative consumer organizations have the right to appear as parties in Commission antidumping and countervailing duty investigations. The Secretary will prepare a public service list containing the names and addresses of all persons, or their representatives, who are parties to the investigation.

BACKGROUND

On October 22, 1998, a petition was filed with the Commission and the Department of Commerce by Micron Technology, Inc., Boise, ID, alleging that an industry in the United States is materially injured and is threatened with material injury by reason of LTFV imports of DRAMs of one megabit and above from Taiwan. Accordingly, effective October 22, 1998, the Commission instituted antidumping investigation No. 731-TA-811 (Preliminary).

Notice of the institution of the Commission's investigation and of a public conference to be held in connection therewith was given by posting copies of the notice in the Office of the Secretary, U.S.

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[1] The record is defined in sec. 207.2(f) of the Commission's Rules of Practice and Procedure (19 CFR § 207.2(f)).

[2] Commissioner Crawford did not participate in this investigation.

International Trade Commission, Washington, DC, and by publishing the notice in the *Federal Register* of October 29, 1998 (63 FR 58066). The conference was held in Washington, DC, on November 13, 1998, and all persons who requested the opportunity were permitted to appear in person or by counsel.

VIEWS OF THE COMMISSION

Based on the record in this investigation, we find that there is a reasonable indication that an industry in the United States is materially injured by reason of imports of dynamic random access memory semiconductors ("DRAMs") from Taiwan that are allegedly sold in the United States at less than fair value ("LTFV").[1]

I. THE LEGAL STANDARD FOR PRELIMINARY DETERMINATIONS

The legal standard for preliminary antidumping determinations requires the Commission to determine, based upon the information available at the time of the preliminary determinations, whether there is a reasonable indication that a domestic industry is materially injured, or threatened with material injury, by reason of the allegedly LTFV imports.[2] In applying this standard, the Commission weighs the evidence before it and determines whether "(1) the record as a whole contains clear and convincing evidence that there is no material injury or threat of such injury; and (2) no likelihood exists that contrary evidence will arise in a final investigation."[3]

II. DOMESTIC LIKE PRODUCT AND INDUSTRY

A. In General

To determine whether there is a reasonable indication that an industry in the United States is materially injured, or threatened with material injury, by reason of the subject imports, the Commission first defines the "domestic like product" and the "industry."[4] Section 771(4)(A) of the Tariff Act of 1930, as amended ("the Act"), defines the relevant industry as the "producers as a [w]hole of a domestic like product, or those producers whose collective output of a domestic like product constitutes a major proportion of the total domestic production of the product."[5] In turn, the Act defines "domestic like product" as "a product which is like, or in the absence of like, most similar in characteristics and uses with, the article subject to an investigation."[6]

The decision regarding the appropriate domestic like product(s) in an investigation is a factual determination, and the Commission has applied the statutory standard of "like" or "most similar in characteristics and uses" on a case-by-case basis.[7] No single factor is dispositive, and the Commission

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[1] Commissioner Crawford did not participate in this investigation.

[2] 19 U.S.C. § 1673b(a); *see also* American Lamb Co. v. United States, 785 F.2d 994 (Fed. Cir. 1986); Calabrian Corp. v. United States, 794 F. Supp. 377, 381 (Ct. Int'l Trade 1992).

[3] American Lamb, 785 F.2d at 1001; *see also* Texas Crushed Stone Co. v. United States, 35 F.3d 1535, 1543 (Fed. Cir. 1994).

[4] 19 U.S.C. § 1677(4)(A).

[5] *Id.*

[6] 19 U.S.C. § 1677(10).

[7] *See, e.g.,* Nippon Steel Corp. v. United States, 19 CIT 450, 455 (1995). The Commission generally considers a number of factors including: (1) physical characteristics and uses; (2) interchangeability; (3) channels of distribution; (4) customer and producer perceptions of the products; (5) common manufacturing facilities, production processes and production employees; and, where appropriate, (6) price. *See id.* at 455 n.4; Timken Co. v. United States, 913 F. Supp. 580, 584 (Ct. Int'l Trade 1996).

may consider other factors it deems relevant based on the facts of a particular investigation.[8] The Commission looks for clear dividing lines among possible like products, and disregards minor variations.[9] Although the Commission must accept the determination of the Department of Commerce ("Commerce") as to the scope of the imported merchandise allegedly sold at LTFV, the Commission determines what domestic product is like the imported articles Commerce has identified.[10]

B. Product Description

In its notice of initiation, Commerce defined the imported merchandise within the scope of this investigation as:

> DRAMs from Taiwan, whether assembled or unassembled. Assembled DRAMs include all package types. Unassembled DRAMs include processed wafers, uncut die, and cut die. Processed wafers fabricated in Taiwan, but packaged or assembled into finished semiconductors in a third country are included in the scope. Wafers fabricated in a third country and assembled or packaged in Taiwan are not included in the scope.
>
> The scope of this investigation includes memory modules. A memory module is a collection of DRAMs, the sole function of which is memory. Modules include single in-line processing modules ("SIPs"), single in-line memory modules ("SIMMs"), dual in-line memory modules ("DIMMs"), memory cards or other collections of DRAMs whether mounted or unmounted on a circuit board. Modules that contain other parts that are needed to support the function of memory are covered. Only those modules that contain additional items that alter the function of the module to something other than memory, such as video graphics adapter ("VGA") boards and cards, are not included in the scope. Modules containing DRAMs made from wafers fabricated in Taiwan, but either assembled or packaged into finished semiconductors in a third country, are also included in the scope.
>
> The scope includes, but is not limited to, video RAM ("VRAM"), Windows RAM ("WRAM"), synchronous graphics RAM ("SGRAM"), as well as various types of DRAM, including fast page-mode ("FPM"), extended data-out ("EDO"), burst extended data-out ("BEDO"), synchronous dynamic RAM ("SDRAM"), and "Rambus" DRAM ("RDRAM"). The scope of this investigation also includes any future density, packaging or assembling of DRAMs. The scope of this investigation does not include DRAMs or memory modules that are reimported for repair or replacement.[11]

DRAM is a class of volatile semiconductor memory that allows data to be both read from and written to the device's storage locations in a non-linear fashion. DRAMs and DRAM modules (collections

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[8] *See, e.g.*, S. Rep. No. 249, 96th Cong., 1st Sess. 90-91 (1979).

[9] Torrington Co. v. United States, 747 F. Supp. 744, 748-49 (Ct. Int'l Trade 1990), *aff'd*, 938 F.2d 1278 (Fed. Cir. 1991).

[10] Hosiden Corp. v. Advanced Display Manufacturers, 85 F.3d 1561 (Fed. Cir. 1996) (Commission may find a single like product corresponding to several different classes or kinds defined by Commerce); Torrington, 747 F. Supp. at 748-752 (affirming Commission determination of six like products in investigations where Commerce found five classes or kinds).

[11] 63 Fed. Reg. 64040 (Nov. 18, 1998).

of DRAMs mounted on a printed circuit board) are used as the main memory in a variety of electronic products including computers and computer peripherals, telecommunications equipment, networking equipment, and consumer electronics devices. By far, the largest use for DRAMs and DRAM modules is as the main memory in computer equipment.[12]

C. Domestic Like Product Issues in This Investigation

In this preliminary phase of the investigation, we have considered four like product issues: (1) whether cased (*i.e.*, assembled) and uncased (*i.e.*, unassembled) DRAMs are a single like product; (2) whether the like product includes DRAMs assembled into memory modules; (3) whether the like product includes all DRAMs regardless of density (*i.e.*, megabits of memory capacity); and (4) whether specialty DRAMs are part of the same like product as commodity DRAMs.[13] For the reasons discussed below, we find that there is a single domestic like product consisting of all DRAMs, regardless of density, whether cased or uncased, and including DRAMs mounted on memory modules and specialty DRAMs.

1. Whether Cased and Uncased DRAMs are a Single Like Product

A finished or cased DRAM is created by separating a fabricated wafer into individual chips, wire bonding metal lead frames to the chips, solder plating the metal leads, trimming and forming the leads into a desired shape, and encapsulating the chips in either a plastic or ceramic housing.[14] In addressing whether cased and uncased DRAMs constitute a single domestic like product, we have applied a semifinished product analysis.[15] DRAM wafers and dice are dedicated to use in assembled DRAMs and have no independent use. They will ultimately be incorporated into an electronic product in the form of a cased DRAM. Although an uncased DRAM might be sold by a fabricator to an unrelated assembler, there is no

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[12] Confidential Report ("CR") at I-5-I-7, Public Report ("PR") at I-4-I-5.

[13] Petitioner Micron Technology, Inc. ("Micron") argues that the Commission should find a single domestic like product consisting of all DRAMs (including cased and uncased, memory modules and specialty varieties) with a density of one megabit or above, consistent with the scope. Transcript of Commission Staff Conference (Nov. 13, 1998) ("Conf. Tr.") at 41. Respondents agree that there is one domestic like product, but consider that to be the one identified in prior investigations, which includes all DRAMs, regardless of density. *Id.* at 82-83. We must base our domestic like product determination on the record in this investigation and are not bound by prior determinations, even those pertaining to the same imported product. Nippon Steel, 19 CIT at 454-455; Asociacion Colombiana de Exportadores de Flores v. United States, 693 F. Supp. 1165, 1169, n.5 (Ct. Int'l Trade 1988). We note, however, that the Commission has previously found all DRAMS, whether unassembled, assembled, or assembled into modules, and regardless of density, to be a single like product. DRAMs of One Megabit and Above from the Republic of Korea, Inv. No. 731-TA-556 (Preliminary), USITC Pub. 2529 (June 1992), (Final) USITC Pub. 2629 (May 1993), (Remand) USITC Pub. 2997 (Oct. 1996) ("DRAMs from Korea"); Dynamic Random Access Memory Semiconductors of 256 Kilobits and Above from Japan, Inv. No. 731-TA-300 (Preliminary), USITC Pub. 1803 (Jan. 1986); 64K Dynamic Random Access Memory Components from Japan, Inv. No. 731-TA-270 (Preliminary), USITC Pub. 1735 (Aug. 1985), and (Final) USITC Pub. 1862 (June 1986).

[14] CR at I-8-I-9, PR at I-6.

[15] Accordingly, we have considered: (1) whether the upstream article is dedicated to the production of the downstream article, or has independent uses; (2) whether there are perceived to be separate markets for the upstream and downstream articles; (3) differences in the physical characteristics and functions of the upstream and downstream articles; (4) differences in the costs or value of the vertically differentiated articles; and (5) significance and extent of the processes used to transform the upstream into the downstream articles. *See, e.g.*, Fresh Atlantic Salmon from Chile, Inv. No. 731-TA-768 (Final), USITC Pub. 3116 at n.41 (July 1998).

independent commercial market for uncased DRAMs.[16] The design and wafer fabrication stages, which result in the semifinished chip, impart the essential electrical and technical characteristics that will become those of both the uncased DRAM and the cased DRAM.[17] The DRAM assembly process, while not insubstantial, appears to be somewhat less technologically complex and costly than the fabrication process.[18] Accordingly, we find that cased and uncased DRAMs are part of a single domestic like product.

2. Whether the Like Product Includes DRAMs Assembled Into Memory Modules

A DRAM memory module is a packaging arrangement generally consisting of a printed circuit board that contains two or more DRAMs.[19] Applying a semifinished product analysis, we find that the essential physical and functional characteristics of a module are imparted to it by the DRAM chip(s).[20] Although a DRAM can be used either as part of a DRAM memory module or separately, and therefore is not dedicated to use in DRAM modules, the uses of DRAMs and DRAM modules are essentially the same. Both are sold to original equipment manufacturers and distributors and are ultimately used as the main memory in a variety of electronic products, principally including computers.[21] Moreover, the DRAM chips incorporated in a DRAM memory module account for approximately 90-95 percent of the value of the module, reflecting the fact that the module assembly process is neither costly nor technologically complex.[22] Accordingly, we determine that DRAM memory modules are part of the same like product as upstream DRAM products.

3. Whether the Like Product Includes All DRAMs Regardless of Density

The density of a DRAM, measured in "bits," reflects its capacity to hold information. The density of commercially available DRAMs has increased dramatically over the past 20 years, with 4 megabit, 16 megabit, and 64 megabit DRAMs currently accounting for the largest part of the market.[23]

We find that there are no clear dividing lines between currently developed DRAMs of different densities, whether under or over 1 megabit. A DRAM is a die enclosed in a plastic or ceramic housing, with thin metal leads which allow it to be attached to a circuit board, that is designed to store information as electrical charges. DRAMs of varying densities are, to some extent, interchangeable, since memory module purchasers are typically indifferent to the number of individual chips that are used to provide the required memory capacity.[24] DRAMs of different densities also share common distribution channels, being sold to

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[16] Micron Postconference Brief at 5-6.

[17] CR at I-7-I-8, PR at I-5-I-6; Micron Postconference Brief at 5-6, 10.

[18] CR at I-8-I-9, PR at I-6.

[19] CR at I-7, PR at I-5.

[20] CR at I-7-I-8, PR at I-5-I-6; Petition at 6.

[21] CR at II-5, PR at II-3; Micron Postconference Brief at 6. A personal computer, for instance, may be designed so that the function of DRAM memory may be performed either by DRAM chips that are attached directly to the PC motherboard or by a DRAM module attached to the PC motherboard. *Id.*

[22] CR at I-7 n.17, I-9, PR at I-5, I-7; Conf. Tr. at 37, 80.

[23] CR at I-5-I-6, PR at I-4.

[24] CR at I-10-I-11, PR at I-7-I-8; Micron Postconference Brief at 7. As discussed *infra*, while a large number of low density DRAMs could in theory provide the same amount of memory as one high density DRAM, practical interchangeability is probably limited to DRAMs one generation apart in density. CR at I-10 n.30, PR at I-7.

original equipment manufacturers, module assemblers and other resellers.[25] With the exception of different mask sets,[26] DRAMs of different densities are generally manufactured in common facilities and with the same equipment, processes, and production workers.[27] Price differentials among DRAMs of different densities appear to be a function of memory capacity.[28] Based on all these factors, we find that all DRAMs, regardless of density, constitute a single domestic like product.

4. Whether Specialty DRAMs are Part of the Same Like Product as Commodity DRAMs

There are several specialty DRAM products included in the scope of Commerce's investigation: Video RAM (VRAM), Windows RAM (WRAM), and synchronous graphics RAM (SGRAM).[29] Specialty DRAMs have the same basic physical characteristics and uses as commodity DRAMs, but have been configured to provide enhanced performance over commodity DRAMs in specific applications.[30] At least at the computer design stage, commodity and specialty DRAMs are somewhat interchangeable.[31] Commodity and specialty DRAMs share the same channels of distribution and manufacturing process, equipment and employees.[32] While specialty DRAMs tend to command a price premium when first introduced, as those products exit the introductory phase of their product life cycle and an increasing number of suppliers join the market, they are rapidly transformed into commodity goods.[33] For all these reasons, we find that specialty and commodity DRAMs are all included within a single domestic like product.

Based on the foregoing discussion, we find a single domestic like product, consisting of all DRAMs, regardless of density, including cased and uncased DRAMs, DRAMs assembled into memory modules, and specialty DRAMs.

D. Domestic Industry

The domestic industry is defined as "the producers as a [w]hole of a domestic like product."[34] In defining the domestic industry, the Commission's general practice has been to include in the industry all of the domestic production of the like product, whether toll produced, captively consumed, or sold in the domestic merchant market.[35]

There are several issues in this investigation concerning the definition of the domestic industry: (1) whether assembly of uncased DRAMs into cased DRAMs constitutes domestic production; (2) whether assembly of cased DRAMs into DRAM modules constitutes domestic production; and (3) whether the

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[25] CR at I-13, PR at I-9-I-10; Petition at 6.

[26] Mask sets are made of glass and contain the design for each layer of circuitry that will be built up on a silicon wafer in the course of the DRAM fabrication process. CR at I-8, D-4, PR at I-6, D-4.

[27] CR at I-9, PR at I-6.

[28] CR at I-14, PR at I-10.

[29] None of the parties in this preliminary investigation suggests that specialty DRAMs merit treatment as separate domestic like products. Micron Postconference Brief at 6-7; Conf. Tr. 82-83.

[30] CR at I-6, PR at I-4-I-5.

[31] CR at I-11, PR at I-7; Micron Postconference Brief at 9.

[32] CR at I-9, I-13, PR at I-6, I-9.

[33] CR at I-14, PR at I-10.

[34] 19 U.S.C. § 1677(4)(A).

[35] *See* United States Steel Group v. United States, 873 F. Supp. 673, 682-83 (Ct. Int'l Trade 1994), *aff'd*, 96 F.3d 1352 (Fed. Cir. 1996).

domestic industry includes "fabless" design houses.[36] In each instance, the question before us is whether the pertinent companies engage in sufficient production-related activity in the United States to be included in the domestic industry.[37] As explained below, we define the domestic industry to include fabricators and assemblers of DRAMs, but not module assemblers or fabless design houses.[38]

1. Whether Assembly of Uncased DRAMs Into Cased DRAMs Constitutes Domestic Production

The manufacture of DRAMs includes both fabrication and assembly phases. During the period of investigation, 7 of the 12 domestic companies that fabricated uncased DRAMs in the United States also assembled DRAMs in the United States. In addition, two companies without U.S. fabrication facilities assembled DRAMs in the United States.[39]

The assembly stage of DRAM production involves the separation of the wafer into individual chips, wire bonding metal lead frames to the chips, solder plating the metal leads, trimming and forming the leads into a desired shape, encapsulating the chips in plastic or ceramic, and final testing.[40] While somewhat more labor intensive than fabrication, DRAM assembly is nevertheless a highly automated and technologically sophisticated process.[41] The record in this preliminary phase investigation does not contain enough information to allow us to isolate the capital investment or value added associated with DRAM assembly. The record does indicate, however, that during the interim period (January - September of 1998), U.S. DRAM assembly operations employed *** production related workers (PRWs), while domestic fabrication facilities employed 8,549 PRWs.[42] Moreover, the percentage of domestically cased DRAMs incorporating

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[36] Petitioner argues that the domestic industry consists of companies that fabricate DRAMs in the United States, including their assembly operations, as well as other assembly operations using domestically fabricated dice. Micron Postconference Brief at 10-12, 14. Respondents contend that, in addition to fabrication facilities, the industry includes companies that case unassembled DRAMs or assemble cased DRAMs into memory modules in the United States, regardless of the source of the dice used, as well as fabless design houses. Taiwan Semiconductor Industry Association ("TSIA") Postconference Brief at A-1-A-3, A-12-A-13; Alliance Postconference Brief at 2-8.

[37] To assess whether a firm qualifies as a domestic producer, we analyze the nature and extent of a firm's production-related activities in the United States. *See, e.g.*, Certain Stainless Steel Sheet and Strip from France, Germany, Italy, Japan, the Republic of Korea, Mexico, Taiwan, and the United Kingdom, Inv. Nos. 701-TA-380-382 and 731-TA-797-804 (Preliminary), USITC Pub. 3118 at 14 n.88 (Aug. 1998). The Commission generally considers six factors: (1) source and extent of the firm's capital investment; (2) technical expertise involved in U.S. production activities; (3) value added to the product in the United States; (4) employment levels; (5) quantity and type of parts sourced in the United States; and (6) any other costs and activities in the United States directly leading to production of the like product. *Id.*

[38] Although we are not bound by prior determinations, we note that this result is consistent with the Commission's definition of the domestic industry in DRAMs from Korea, USITC Pub. 2629 at 12-16, and in Static Random Access Memory Semiconductors from the Republic of Korea and Taiwan, Inv. Nos. 731-TA-761-762 (Final), USITC Pub. 3098 at 8-10 (Apr. 1998) (SRAMs).

[39] Table III-1, CR at III-3, PR at III-2.

[40] CR at I-8-I-9, PR at I-6.

[41] CR at I-8, PR at I-6; TSIA Postconference Brief at A-2; *** Producer Questionnaire at Question II-12; *** Producer Questionnaire at Question II-13.a.

[42] Table III-7, CR at III-15, PR at III-10.

U.S.-fabricated dice was *** percent in 1995, *** percent in 1996, *** percent in 1997, and *** percent in interim 1998.[43]

Based on the technical sophistication, significant employment, and substantial use of domestic inputs associated with domestic DRAM assembly operations, we find that DRAM assembly facilities should be included in the definition of the domestic industry.[44] [45]

2. Whether Assembly of Cased DRAMs Into Memory Modules Constitutes Domestic Production

The current record contains limited information on capital investment or employment in the domestic assembly of DRAM modules.[46] The parties agreed, however, that the DRAM chips on a module account for 90 to 95 percent of its value, from which it can be inferred that module assembly involves little value added.[47] The percentage of domestically produced modules made with domestically-fabricated dice was *** percent in 1995, *** percent in 1996, *** percent in 1997, and *** percent in interim 1998.[48] Because module assembly appears to add little value to cased DRAMs, and given the relatively unsophisticated nature of the module assembly process and the failure of respondents to offer any factual support for their argument that module assembly constitutes domestic production,[49] we find that module assembly does not constitute domestic production.

3. Whether Fabless Design Houses Are Part of the Domestic Industry Producing DRAMs

"Fabless" design companies focus on the design stage of DRAM production. The design stage involves using skilled technical employees and computer-aided design systems to create the design of the circuit layout for a DRAM, which is then placed on a mask set (by the design house or by a subcontractor).

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[43] Derived from staff worksheet on Cased DRAMs Production.

[44] Petitioner argues that only domestic assembly operations that assemble U.S.-fabricated dice should be considered domestic production. Micron Postconference Brief at 11-12. The Commission has typically decided whether to classify a certain kind of activity as domestic production based on an assessment of all the relevant factors for all companies performing the type of activity in question. Whether domestic companies performing limited domestic production activities (such as finishing operations) use domestic inputs of the relevant semi-finished product is one criterion considered, but is not necessarily determinative. *See, e.g.,* Certain All Terrain Vehicles from Japan, Inv. No. 731-TA-388 (Final), USITC Pub. 2163 at 13-14 (Mar. 1989) (finding that a "modest percentage of domestically sourced parts or raw materials as a percentage of cost does not necessarily mean that a firm is not a domestic producer"). We intend to examine this issue further in any final phase of this investigation.

[45] Commissioner Askey notes that the data upon which the Commission has relied in reaching this preliminary determination categorize as subject imports DRAMs containing dice fabricated in Taiwan, regardless of where assembled, in accordance with Commerce's scope. By contrast, the data on domestic production categorize as domestic both DRAMs containing U.S.-fabricated dice, regardless of where assembled, and DRAMs containing third country (but not Taiwan) dice that are assembled in the United States. In any final phase investigation, Commissioner Askey intends to examine whether the Commission should include in the domestic like product products that are not comparable to those covered by the scope of the investigation. In this regard, she intends to seek relevant information on this issue and requests that the parties address this issue in any final investigation.

[46] *See* Table H-2, CR at H-4, PR at H-3; Table III-7, CR at III-15, PR at III-10; CR at III-2 n.3, PR at III-1.

[47] Conf. Tr. at 37, 79-80. Moreover, the module assembly process is not technologically complex. CR at I-10, PR at I-7.

[48] Derived from staff worksheet on DRAM Modules Production.

[49] TSIA Postconference Brief at A-1.

Unlike integrated DRAM fabricators, which design and then fabricate DRAMs, fabless design houses own no fabrication facilities ("fabs"). Instead, they contract out the production of DRAMs bearing their designs to foundry producers, many of which are located in Taiwan.[50] Design houses also contract out the assembly stage either to the foundry or to another assembler. Each design house then generally markets the finished DRAMs under its own brand name.[51]

The Commission has previously determined that fabless design houses located in the United States are not part of the domestic industry producing static random access memory semiconductors ("SRAMs") because they do not actually engage in production of a domestic like product.[52] The Commission reasoned that SRAM designs, although necessary to SRAM production, were not "like" SRAMs and SRAM modules and therefore were not part of the domestic like product. To the contrary, the Commission found that the designs are incorporated into SRAMs that Commerce had included in the definition of the subject merchandise, despite a request to Commerce by fabless producers that Commerce exclude such SRAMs from the scope.[53]

We find that the Commission's analysis of fabless design houses in the SRAMs investigation is equally applicable to the instant investigation. Commerce has defined the subject merchandise to include unassembled and assembled DRAMs and DRAM modules, but not DRAM designs or mask sets. As in SRAMs, fabless design houses do not actually produce anything in the United States falling within the definition of the corresponding domestic like product. As the Commission noted in SRAMs, the fact that design-type activities have previously been considered a "production-related" activity in applying the six-factor test for domestic production does not mean that a design-only company should be considered a domestic producer. Rather, in all those cases, the company in question actually produced something that fell within the definition of the like product.[54] Accordingly, we find that fabless DRAM design houses are not part of the domestic industry producing DRAMS.[55]

E. Related Parties

We must further determine whether any producer of the domestic like product should be excluded from the domestic industry pursuant to section 771(4)(B) of the Act.[56] That provision of the statute allows the Commission, if appropriate circumstances exist, to exclude from the domestic industry producers that are related to an exporter or importer of subject merchandise, or which are themselves importers. Exclusion of such a producer is within the Commission's discretion based upon the facts presented in each case.[57]

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[50] Foundry producers are companies that have capacity to produce DRAMs and/or other semiconductor products which they use to produce other companies' designs under contract.

[51] CR at I-8 n.22, PR at I-5-I-6 n.22; Alliance Postconference Brief at 2-3.

[52] *See* SRAMs, USITC Pub. 3098 at 9-10.

[53] *Id.*

[54] For example, in Certain Cased Pencils from the PRC and Thailand, Inv. Nos. 731-TA-669-670 (Preliminary), USITC Pub. 2713 (Dec. 1993), a case cited by respondents, Alliance Postconference Brief at 7, the company turned plain pencils into decorated pencils, which fell within the definition of the like product.

[55] In any final phase investigation, Commissioner Hillman invites the parties to submit additional factual information regarding the activities performed by fabless design houses and, in particular, the value added by such activities.

[56] 19 U.S.C. § 1677(4)(B).

[57] *See* Sandvik AB v. United States, 721 F. Supp. 1322, 1331-32 (Ct. Int'l Trade 1989), *aff'd without opinion*, 904 F.2d 46 (Fed. Cir. 1990); Empire Plow Co. v. United States, 675 F. Supp. 1348, 1352 (Ct. Int'l Trade 1987).

(continued...)

In this investigation, Mitsubishi Semiconductor America, Inc. ("Mitsubishi") is a related party by virtue of having imported subject merchandise during the period of investigation. Accordingly, we have considered whether appropriate circumstances exist to exclude it from the domestic industry.

During the period of investigation, Mitsubishi operated a *** in Durham, North Carolina. In addition to ***.[58]

In interim 1998, Mitsubishi accounted for less than *** percent of domestic uncased DRAM production and *** percent of assembly.[59] Mitsubishi's imports of subject merchandise rose from *** in 1995 and 1996 to *** of its domestic production in 1997 and *** of its domestic production in interim 1998.[60] Mitsubishi's financial performance was *** the industry average in all periods except *** the industry average.[61] Mitsubishi *** the petition.[62]

Mitsubishi contends that the closure of its U.S. fab was not caused by competition from subject imports. Rather, it contends that the closure reflected (1) a larger reorganization and consolidation of U.S. assets by its parent company, and (2) the fact that its U.S. fab was producing 4 megabit chips on outdated equipment that could not be upgraded to produce higher-density DRAMs.[63] Mitsubishi also indicates that it imported subject merchandise ***.[64]

In light of Mitsubishi's progression from domestic producer to importer over the period of investigation, the fact that its financial performance *** after it closed its U.S. fab, and its ***, we believe that Mitsubishi's interests lie principally in importing rather than in domestic production.

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[57] (...continued)
The primary factors the Commission has examined in deciding whether appropriate circumstances exist to exclude such parties include: (1) the percentage of domestic production attributable to the importing producer; (2) the reason the U.S. producer has decided to import the product subject to investigation, *i.e.*, whether the firm benefits from the LTFV sales or subsidies or whether the firm must import in order to enable it to continue production and compete in the U.S. market, and (3) the position of the related producer vis-a-vis the rest of the industry, *i.e.*, whether inclusion or exclusion of the related party will skew the data for the rest of the industry. *See, e.g.*, Torrington Co. v. United States, 790 F. Supp. 1161, 1168 (Ct. Int'l Trade 1992), *aff'd without opinion*, 991 F.2d 809 (Fed. Cir. 1993). The Commission has also considered the ratio of import shipments to U.S. production for related producers and whether the primary interest of the related producer lies in domestic production or importation. *See, e.g.*, Sebacic Acid from the People's Republic of China, Inv. No. 731-TA-653 (Final), USITC Pub. 2793, at I-7 - I-8 (July 1994).

[58] Mitsubishi's parent company, Mitsubishi Electric Corp. of Japan, also owns Mitsubishi Electronics America, Inc., another importer of the subject merchandise, and is ***.

[59] Table III-1, CR at III-3, PR at III-2. Even when its fabrication facility was operating, Mitsubishi was never a large domestic producer of uncased DRAMs, accounting for *** percent of domestic production in 1995, *** percent in 1996, and *** percent in 1997. Table III-4, CR at III-12, PR at III-7.

[60] Table III-2, CR at III-9, PR at III-4.

[61] Table VI-2, CR at VI-6, PR at VI-3.

[62] Table III-1, CR at III-3, PR at III-2.

[63] Mitsubishi Postconference Brief at 15-16. Micron contends that Mitsubishi's unwillingness to invest in upgrading its U.S. fab is an indicator of injury to the domestic industry by reason of the subject imports. Conf. Tr. at 99-100.

[64] Table III-2 n.6, CR at III-9, PR at III-4.

Accordingly, we find that appropriate circumstances exist to exclude Mitsubishi from the domestic industry. We note, however, that its exclusion does not change industry-wide financial trends.[65]

In addition, we note that a number of other domestic producers are or may be related parties either by virtue of having imported subject merchandise or through corporate or contractual relationships with Taiwan producers.[66] In any final phase investigation, we will consider whether appropriate circumstances exist to exclude any additional related parties from the domestic industry. In particular, we will seek further information regarding the purposes for which domestic producers purchased subject imports and the nature of the corporate or contractual relationships between domestic and Taiwan producers.

III. REASONABLE INDICATION OF MATERIAL INJURY BY REASON OF SUBJECT IMPORTS

In the preliminary phase of an antidumping duty investigation, the Commission determines whether there is a reasonable indication that an industry in the United States is materially injured by reason of the allegedly dumped imports under investigation.[67] In making this determination, the Commission must consider the volume of the allegedly dumped imports, their effect on prices for the domestic like product, and their impact on domestic producers of the domestic like product, but only in the context of U.S. production operations.[68] The statute defines "material injury" as "harm which is not inconsequential, immaterial, or unimportant."[69] In assessing whether the domestic industry is materially injured by reason of dumped imports, we consider all relevant economic factors that bear on the state of the industry in the United States.[70] No single factor is dispositive and all relevant factors are considered "within the context of the business cycle and conditions of competition that are distinctive to the affected industry."[71]

For the reasons discussed below, we determine that there is a reasonable indication that the domestic DRAM industry is materially injured by reason of allegedly dumped imports from Taiwan.

A. Conditions of Competition

A number of conditions of competition are pertinent to our analysis in this investigation. First, the DRAM market is characterized by rapid technological advancement in terms of density (the amount of memory contained in a chip), die shrinks (the number of chips that can be produced on a wafer of a certain size), and interface speed (the speed with which a DRAM can be accessed by other elements of a computer). Since the Commission's previous investigation in 1993, the industry standard for density has moved from the 4 megabit DRAM to the 16 megabit DRAM and is now changing to the 64 megabit DRAM, with

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[65] Chairman Bragg notes that she would have reached the same determination in this investigation if she had not excluded Mitsubishi from the domestic industry.

[66] *See generally* Table III-2, CR at III-9, PR at III-4; CR at III-5- III-8, PR at III-3-III-4.

[67] 19 U.S.C. § 1673b(a).

[68] 19 U.S.C. § 1677(7)(B)(i). The Commission "may consider such other economic factors as are relevant to the determination," but shall "identify each [such] factor . . . and explain in full its relevance to the determination." 19 U.S.C. § 1677(7)(B).

[69] 19 U.S.C. § 1677(7)(A).

[70] 19 U.S.C. § 1677(7)(C)(iii).

[71] 19 U.S.C. § 1677(7)(C)(iii).

numerous producers worldwide having already made commercial test shipments of 256 megabit DRAMs.[72] DRAM manufacturers are constantly working to reduce die sizes by reducing the dimensions of the individual elements of circuitry on the die, thereby increasing the die yield (the number of usable dice obtained from a single wafer) and reducing production costs. Such die shrinks have taken the industry from 0.30 to 0.35 micron technology in recent years to 0.21 to 0.25 microns today, with 0.18 micron technology planned for the near future at some fabs.[73] With respect to interface technology, the industry has advanced in recent years from fast page mode (FPM) to extended data out (EDO) to synchronous DRAM (SDRAM) technology, and is currently developing even faster interface technologies such as Rambus DRAM.[74] The industry's need to innovate is driven, in part, by continually rising demand for more and faster memory.

To keep developing new technology, DRAM producers must invest constantly in new capital equipment as well as R&D. Historically, that capital equipment has a productive life cycle of about three years.[75] Moreover, the pace of advances in chip density and die shrinks in the DRAM industry may be accelerating.[76]

Collectively, these technological developments are referred to in the industry as a "learning curve" or product life cycle. Each time a producer moves to a new density, die shrink or interface technology, production costs initially rise and yields initially decline. As each product moves through its life cycle, production costs decline and yields rise as experience is gained and production volume increases. Price trends generally correlate with this product life cycle, starting high at the beginning of the product life cycle and then declining rapidly until a product is replaced by the next generation of technology.[77] The period of investigation coincides roughly with the life cycle of the 16 megabit DRAM, with production switching from 4 to 16 megabit DRAMs early in the period, and from 16 to 64 megabit DRAMs at the end of the period.[78]

During the period of investigation, apparent consumption, in terms of bits, increased by 276.2 percent between 1995 and 1997, and by an additional 108.9 percent between interim 1997 and interim 1998.[79] To meet rising demand, both in the United States and worldwide, world capacity to produce DRAMs has increased significantly over the period of investigation.[80] The opening of a new fab or

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[72] CR at I-6, PR at I-4; Conf. Tr. at 15-16; TSIA Postconference Brief at 8, 15, A-9, and Exhibit 1 at 5; Micron Postconference Brief at 8, 33-34, 45, 46, and Exhibit 21; Petition, Exhibit 1 at 10-11, 47.

[73] CR at I-9-I-10, PR at I-6-I-7; Conf. Tr. at 15, 31-32; TSIA Postconference Brief at 3-4, 17, 21, and Exhibit 1 at 5; Micron Postconference Brief at 27, 29, 43, Exhibit 21.

[74] CR at I-6, PR at I-4; Conf. Tr. at 15-16; TSIA Brief, Exhibit 3 at 1-2, Exhibit 13.

[75] Conf. Tr. at 16-17; Petition at 20.

[76] TSIA Postconference Brief at 4.

[77] CR at I-9, I-14, PR at I-6-I-7, I-10; Conf. Tr. at 16-17, 24, 36; Mitsubishi Postconference Brief at 4; Petition, Exhibit 1.

[78] CR at I-6, PR at I-4; Micron Postconference Brief at 33-34, 46; TSIA Postconference Brief, Exhibit 1 at 4. As noted *infra* at 18-19 and n.72, commercial development of the 256 megabit DRAM is already well underway.

[79] Apparent consumption rose from 4,134,916 billion bits in 1995 to 7,567,131 billion bits in 1996 and 15,556,320 billion bits in 1997, and was 22,039,577 billion bits in just the first nine months of 1998. Table IV-4, CR at IV-5, PR at IV-4.

[80] Capacity increases are achieved through die shrinks and yield improvements as well as through construction of new fabs. While Taiwan and some third country producers have achieved capacity increases largely by building new fabs, technology leaders like petitioner have principally achieved significant capacity increases through die shrinks and other process improvements. Conf. Tr. at 38; CR at VII-3, PR at VII-2. In any final

(continued...)

introduction of a new die shrink results in a large immediate increase in production capacity. Because growth in demand for DRAMs has been linear, however, supply and demand in the DRAM market tend to be chronically out of equilibrium.[81] For example, early in the period of investigation worldwide demand for DRAMs exceeded supply, but with subsequent capacity increases during the later part of the period of investigation, growth in world DRAM production capacity has exceeded growth in demand, resulting in significant worldwide price declines.[82]

The DRAM market also is to some extent segregated into two "tiers" of producers and customers. "Tier one" producers are U.S., European, Japanese, Korean and some Taiwan firms, with recognized brand names and leading edge technology, that have been qualified to sell DRAMs to "tier one" OEM (original equipment manufacturer) customers (*e.g.*, major brand name computer manufacturers like IBM, Dell and Hewlett-Packard). Many sales to such customers are on a contract basis. "Tier two" producers are Taiwan producers that produce and sell less well known brand name DRAMs. "Tier two" purchasers include module makers, PC clone makers, and resellers that do not require qualified name-brand DRAMs and generally purchase in the spot market.[83]

In addition, nonsubject imports, principally from Korea and Japan, were present in the U.S. market in significant quantities. During the period of investigation, the U.S. market share held by nonsubject imports in terms of volume ranged from *** percent.[84] A number of Korean and Japanese DRAM producers have production facilities in several countries, including joint ventures or technology partnerships with Taiwan producers.[85] These companies may have the option of sourcing DRAMs for any particular customer or market from manufacturing facilities in several countries.[86]

Finally, we note that the domestic industry captively consumes approximately 10 percent of its production of the domestic like product in the manufacture of downstream products.[87] Accordingly, we have considered whether the captive production provision requires us to focus our analysis primarily on the merchant market when assessing market share and the factors affecting the financial performance of the domestic industry.[88] [89] [90] In the context of the domestic DRAM industry, we find that the statutory

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[80] (...continued)
phase investigation, we will seek further information on the extent to which increases in domestic, Taiwan, and nonsubject production capacity are attributable to each of these phenomena.

[81] Conf. Tr. at 62; TSIA Postconference Brief at 3-4.

[82] Conf. Tr. at 11-13, 64; Micron Postconference Brief at 28-31; TSIA Postconference Brief at 4-6; Mitsubishi Postconference Brief at 4.

[83] Conf. Tr. at 22-23, 54-56; CR at I-11-I-14, II-6, PR at I-8-I-10, II-4. Respondents alleged that DRAMs from tier two Taiwan manufacturers do not compete in the U.S. market with domestically manufactured DRAMs, but instead compete with nonsubject imports from Korea. Conf. Tr. at 72. In any final phase investigation, we intend to look at the degree to which product from Taiwan competes in the U.S. market with domestic product as well as with nonsubject imports.

[84] Table IV-4, CR at IV-5, PR at IV-4.

[85] CR at III-4-III-8, PR at III-2-III-4.

[86] CR at II-4, PR at II-2; Conf. Tr. at 54-59, 73-75, 92, 106; TSIA Postconference Brief at 12-14, 24; Mitsubishi Postconference Brief at 13, 16; Petition at 8, 11; Alliance Postconference Brief at 2-4.

[87] CR at III-16, PR at III-5.

[88] The captive production provision, 19 U.S.C. § 1677(7)(C)(iv), provides:

> (iv) CAPTIVE PRODUCTION -- If domestic producers internally transfer significant production

(continued...)

requirement of significant captive consumption is not satisfied. Accordingly, the captive production provision does not apply in this investigation.[91]

B. Volume of Subject Imports

Section 771(7)(C)(i) of the Act provides that the "Commission shall consider whether the volume of imports of the merchandise, or any increase in that volume, either in absolute terms or relative to production or consumption in the United States, is significant."[92]

As an initial matter, for purposes of this preliminary determination, we have focused on bits for purposes of assessing the volume of imports, because total bits are a uniform measure of the quantity of DRAMs. We recognize, however, that the use of bits as a unit of measurement can present difficulties for our analysis, as total bits are a function of chip density and product mix, both of which have changed over the period of investigation.[93] Accordingly, we do not view the increase in subject imports in the DRAM market measured in terms of bits the same way we might view an increase of such magnitude in the volume of imports of another product. Nevertheless, the increase in the volume of subject imports over the period of investigation was substantial.

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[88] (...continued)

> of the domestic like product for the production of a downstream article and sell significant production of the domestic like product in the merchant market, and the Commission finds that --
>
> > (I) the domestic like product produced that is internally transferred for processing into that downstream article does not enter the merchant market for the domestic like product,
> >
> > (II) the domestic like product is the predominant material input in the production of that downstream article, and
> >
> > (III) the production of the domestic like product sold in the merchant market is not generally used in the production of that downstream article,
>
> then the Commission, in determining market share and the factors affecting financial performance set forth in clause (iii), shall focus primarily on the merchant market for the domestic like product.

[89] The parties all contend that the captive production provision does not apply in this investigation. Micron Postconference Brief at 12-14; TSIA Postconference Brief at A-4-A-6.

[90] Chairman Bragg takes no position on the applicability of the captive production provision in this investigation. She notes that in this investigation she has focused her analysis on conditions in the market as a whole.

[91] In finding that the captive production provision does not apply here, Commissioner Hillman has not reached the question of whether the level of captive production is "significant." Irrespective of the level of captive production, the DRAMs sold in the merchant market are generally used in the production of the same downstream products (*e.g.*, computers and consumer electronics) for which they are internally consumed, and the requirements of 19 U.S.C. § 1677(7)(C)(iv)(3) are therefore not met. *See* CR at I-7 and n.19, II-5, and III-16, PR at I-5, II-3, and III-5.

[92] 19 U.S.C. § 1677(7)(C)(i).

[93] CR at I-6, PR at I-4; Micron Postconference Brief at 33-34, 46; TSIA Postconference Brief, Exhibit 1 at 4.

The quantity of subject imports, measured in bits, increased markedly during the period of investigation, rising from *** billion in 1995 to 431,124 billion in 1996 and 936,708 billion in 1997, an overall increase of nearly *** percent. Subject imports were 1,404,395 billion bits in interim 1998, compared with 582,824 billion bits in interim 1997, a difference of 141 percent.[94] The magnitude of this rise in subject import volume is tempered somewhat, however, by the fact that apparent consumption, in terms of bits, also grew rapidly over the period of investigation, increasing by 276.2 percent between 1995 and 1997, and by over 100 percent between interim 1997 and interim 1998.[95]

In terms of value, subject imports followed a somewhat different trend, rising from $*** in 1995 to $387.1 million in 1996, then declining to $378.7 million in 1997. Subject imports by value were $290.0 million in interim 1998, compared with $240.2 million in interim 1997.[96] Analyzing the volume of the subject imports in value terms is somewhat misleading, however, because of the large price declines that occurred over the period of investigation, which we discuss at length below in the context of price effects.

Subject imports' U.S. market share by quantity also rose over the period, increasing from *** percent in 1995 to *** percent in 1996 and to 5.0 percent in 1997. The market share of subject imports, by quantity, was 5.4 percent in interim 1998, compared with 4.5 percent in interim 1997.[97] In value terms, the market share of subject imports rose from *** percent in 1995 to *** percent in 1996 and 4.5 percent in 1997, and was 6.1 percent in interim 1998, compared with 3.8 percent in interim 1997.[98] During the same period, the domestic industry's market share in terms of bits remained virtually the same, rising slightly from *** percent in 1995 to *** percent in 1996 and *** percent in 1997. The domestic industry's market share was *** percent in interim 1998, compared with *** percent in interim 1997.[99] Thus, while subject imports have gained market share, their gain has been at the expense of nonsubject imports.

Based on the rising volume by quantity of subject imports, for purposes of our preliminary determination we find the increase in the volume of the subject imports in absolute terms to be significant.[100]

C. Price Effects of Subject Imports

Section 771(7)(C)(ii) of the Act provides that, in evaluating the price effects of the subject imports,

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[94] Table IV-2, CR at IV-3, PR at IV-2.
[95] Table IV-4, CR at IV-5, PR at IV-4.
[96] Table IV-2, CR at IV-3, PR at IV-2.
[97] Table IV-4, CR at IV-5, PR at IV-4.
[98] Table IV-4, CR at IV-5, PR at IV-4.
[99] Table IV-4, CR at IV-5, PR at IV-4 (Mitsubishi excluded from domestic market share data).
[100] Commissioner Askey does not join in this conclusion. For purposes of this preliminary phase investigation, she finds that neither the volume nor the increase in volume of the subject imports is significant, whether considered on an absolute or relative basis. In this regard, she notes that, although the volume of the subject imports appears to have increased substantially during the period, the volume increases correspond with substantial increases in apparent consumption. Moreover, the volume increases of the subject imports clearly have come at the expense of nonsubject imports, not the domestic industry, given that the domestic industry's share of the market has remained stable throughout the period. Finally, Commissioner Askey notes that any reliance on the significance of the percentage increase in the volume of the subject imports can be overstated since the volume of the subject imports was minimal at the beginning of the period. Commissioner Askey intends to examine this matter closely in any final phase investigation, however.

the Commission shall consider whether -- (I) there has been significant price underselling by the imported merchandise as compared with the price of domestic like products of the United States, and (II) the effect of imports of such merchandise otherwise depresses prices to a significant degree or prevents price increases, which otherwise would have occurred, to a significant degree.[101]

As discussed above, the market for DRAMs is characterized by a number of conditions of competition that we would expect to contribute to price-based competition and declining prices. Such conditions include world overcapacity for the production of DRAMs, the rough correspondence between the period of investigation and the product life cycle for 16 megabit DRAMs, and the availability of multiple domestic, subject and nonsubject sources of DRAM supply.

Consistent with our understanding of these supply conditions, domestic prices for all three DRAM products for which we obtained usable monthly data [102] fell precipitously over the period of investigation, despite rising demand and shipments. The declining price trend was interrupted only by a small increase in mid-1997 and a slight increase in prices for 16 megabit DRAMs in the last two months of interim 1998.[103] Accordingly, we consider to what extent the subject imports played a significant role in the price declines that have occurred in this market.

Comparisons obtained for the three products for which we obtained usable data, while mixed, show a preponderance of underselling. For product 1, a 16 megabit EDO DRAM, the subject imports undersold the domestic like product in 17 out of 23 possible comparisons, with the margin and frequency of underselling rising in the second half of the period of investigation.[104] For product 2, a 16 megabit SDRAM, the subject imports undersold the domestic like product in only 4 of 14 comparisons and oversold in the other 10 comparisons. Both the margins and frequency of underselling were lower in interim 1998 than in 1997.[105] For product 4, a 4 megabit EDO DRAM, the subject imports undersold the domestic like product in 35 of 42 comparisons by fairly substantial, though variable, margins. All of the instances of overselling were in the first year of the period of investigation.[106] Based on the overall frequency of underselling, as well as the rising frequency and/or margins of underselling in the latter part of the period of investigation for two of the three products examined, we find underselling by the subject imports to be significant for purposes of our preliminary determination.

Our finding with respect to the significance of underselling is based, in part, on our conclusion that the domestic like product and the subject imports are at least moderately substitutable. The record in this preliminary phase investigation indicates that, once qualified by a particular supplier, DRAMs of a particular density and interface technology all compete largely or solely on the basis of price regardless of country of origin.[107]

Nevertheless, there are a number of price-related factors which we will further consider in any final phase of the investigation. First, questions have been raised regarding whether the largest category of

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[101] 19 U.S.C. § 1677(7)(C)(ii).
[102] There were no reported imports of product 3, one variety of 16 megabit DRAM. CR at V-4, PR at V-3.
[103] Tables V-4-V-6, CR at V-9-V-12, PR at V-4-V-5.
[104] Table V-4, CR at V-9, PR at V-4; Figure G-1, CR at G-3, PR at G-3.
[105] Table V-5, CR at V-10, PR at V-4; Figure G-2, CR at G-3, PR at G-3.
[106] Table V-6, CR at V-10-V-11, PR at V-5; Figure G-3, CR at G-4, PR at G-3.
[107] CR at II-5-II-6, PR at II-3-II-4.

DRAM purchasers, OEM computer manufacturers, view so-called "tier two" or "own brand" Taiwan DRAMs as substitutable with "tier one" or recognized name brand DRAMs from the United States or third countries. For purposes of our preliminary determination regarding substitutability, we have relied, in part, on the fact that those producers which respondents categorize as tier one accounted for *** percent of Taiwan DRAM production in 1997 (measured in wafer starts).[108] We will reexamine substitutability among the various products in any final phase of the investigation.[109]

The record is also limited with respect to the degree of competition between DRAMs of different densities and interface technologies. While in theory one could produce a module with a sufficient number of DRAMs of a smaller density to equal the memory capacity of a module made with only a few higher density DRAMs, there are limits to the amount of space that a memory module can take up in a computer or other electronic equipment.[110] Moreover, a DRAM with an older interface technology (such as EDO) will not perform optimally in an application designed for DRAMs with a newer interface technology (such as SDRAM), and a commodity DRAM may not perform optimally in an application designed for a specialty DRAM.[111] Thus, as a practical matter, DRAMs generally appear to be substitutable only from one density generation to the next (*i.e.*, 4 megabit DRAMs can substitute for 16 megabit DRAMs and 16 for 64, but not 4 for 64).[112] The existence and operation of such limits is important, because subject import sales during the period of investigation were somewhat concentrated in lower density products, while the domestic industry's sales were concentrated in higher density products.[113] We have relied, for purposes of our preliminary assessment of substitutability, on the fact that there were sales of subject imports and the domestic like product in every density category during the period of investigation. In any final phase investigation we will attempt to determine whether product differentiation (in terms of density, interface technology, and specialty DRAM products) limits price competition to any significant degree in the domestic DRAM market.[114]

Finally, because of the significant market presence of nonsubject imports, we have considered the limited information available on nonsubject import prices. We note that the record in this preliminary phase of the investigation shows that unit values for subject imports declined more rapidly than those for nonsubject imports over the period of investigation and were lower in most full or partial years examined.[115] We are aware, however, that unit value data may not be the most reliable basis for comparing subject and nonsubject import prices due to differences in product mix. Accordingly, in any final phase investigation, we will seek unit value data segregated by density and type of DRAM.[116]

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[108] CR at II-6, PR at II-4; TSIA Postconference Brief at A-7.

[109] In particular, we will seek information on the amount of time, on average, needed to qualify a new DRAM product with a major OEM computer manufacturer; the extent to which so-called "tier two" Taiwan DRAM manufacturers have attempted to qualify for such sales; and whether such attempts, if any, have been successful. We will also seek information on the extent to which OEM qualification requirements for DRAM manufacturers affect sales to OEMs by independent module assemblers that purchase DRAMs on the spot market and the extent of such sales.

[110] CR at I-11 n.31, PR at I-7.

[111] CR at I-11, PR at I-7-I-8.

[112] CR at I-10 n.30, PR at I-7.

[113] Table II-1, CR at II-2, PR at II-1.

[114] In any final phase investigation, we intend to seek further information on the nature of the DRAM product life cycle, its effect on prices, and the relationship between prices for different generations of DRAMs.

[115] Table IV-2, CR at IV-3, PR at IV-2.

[116] Commissioners Askey and Hillman intend to seek information relating to the impact of nonsubject imports on domestic prices in any final phase of this investigation. This information would include, but not be limited to,

(continued...)

Overall, based on the moderate substitutability of the domestic like product and the subject imports; overlapping product mix of domestic and subject suppliers; evidence of significant underselling by the subject imports; and evidence that subject import prices have fallen lower and more rapidly than either domestic like product prices or nonsubject import prices; we find, for purposes of this preliminary determination, that the subject imports have depressed domestic DRAM prices to a significant degree.[117]

D. Impact of Subject Imports[118] [119]

In examining the impact of the subject imports on the domestic industry, we consider all relevant economic factors that bear on the state of the industry in the United States.[120] These factors include output, sales, inventories, capacity utilization, market share, employment, wages, productivity, profits, cash flow, return on investment, ability to raise capital, and research and development.

In the face of growing demand, a number of indicators of the condition of the domestic industry exhibited rising trends over the period of investigation, including capacity,[121] production,[122] shipments,[123]

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[116] (...continued)
average unit values on a product category basis for nonsubject imports by country, particularly for Japan and Korea.

[117] Commission rules 207.11(b)(2)(v) and (3) require the listing of all lost sales and lost revenue allegations in the petition, or a certification that the facts underlying these loss allegations were not reasonably available to petitioner. As we have previously stated, where a petitioner is a domestic producer of the product at issue, lost sales allegations covering the period up until the filing of the petition must be contained in the petition. Elastic Rubber Tape from India, Inv. Nos. 701-TA-383 and 731-TA-805 (Preliminary), USITC Pub. 3133 at 11-12 n.73 (Oct. 1998). In this investigation, petitioner included neither the information nor the certification required by our rules, and instead submitted all its lost sales and lost revenues allegations for the period prior to the filing of the petition in its producer questionnaire response. Accordingly, for purposes of this preliminary determination, we have not considered the lost sales and lost revenues allegations that were omitted from the petition.

[118] As part of its consideration of the impact of imports, the statute specifies that the Commission is to consider "the magnitude of the margin of dumping." 19 U.S.C. § 1677(7)(C)(iii)(V). The URAA Statement of Administrative Action (SAA) indicates that the amendment "does not alter the requirement in current law that none of the factors which the Commission considers is necessarily dispositive in the Commission's material injury analysis." SAA, H.R. Rep. 316, 103d Cong., 2d Sess., vol. I at 850. Section 771(35)(C) of the Act, 19 U.S.C. § 1677(35)(C), defines the "margin of dumping" to be used by the Commission in a final determination as the last margin or margins published by Commerce prior to the closing of the administrative record in the Commission's investigations. In its notice of initiation, Commerce identified alleged dumping margins ranging from 48 to 69 percent. 63 Fed. Reg. 64040, 64041 (Nov. 18, 1998).

[119] Chairman Bragg notes that she does not ordinarily consider the alleged margin of dumping to be of particular significance in evaluating the effects of subject imports on domestic producers. *See* Separate and Dissenting Views of Commissioner Lynn M. Bragg in Bicycles from China, Inv. No. 731-TA-731 (Final), USITC Pub. 2968 (June 1996).

[120] 19 U.S.C. § 1677(7)(C)(iii).

[121] Domestic capacity to produce uncased DRAMs rose irregularly from *** wafers in 1995 to *** wafers in 1996 and *** wafers in 1997, an increase of *** percent. Uncased DRAM capacity was *** wafers in interim 1998, compared with *** wafers in interim 1997. Capacity to produce cased DRAMs rose from *** units in 1995 to *** units in 1996 and *** units in 1997, an increase of *** percent. Capacity to produce cased DRAMs was *** units in interim 1998 compared with *** units in interim 1997. Table III-3, CR at III-11, PR at III-6 (data for Mitsubishi excluded).

[122] Domestic uncased DRAM production rose from *** wafer starts in 1995 to *** wafer starts in 1996 and *** wafer starts in 1997, an overall increase of *** percent. Wafer starts were *** in interim 1998 compared with *** (continued...)

and employment.[124] The ratio of domestic producers' inventories to total shipments remained small and relatively constant over the period of investigation.[125]

In this context we note that the limited data available suggest that, except during ramp up periods, DRAM producers generally operate at high levels of capacity utilization to meet their fixed costs.[126] Consequently, in periods of falling prices producers appear to face the choice of operating at optimal capacity utilization and selling at whatever price they can get or not producing at all.[127] While some domestic producers may have taken the latter option,[128] most appear to have done the former, selling virtually their entire production at lower prices.

The significant price declines experienced during the period of investigation have had predictably negative effects on the financial condition of the domestic industry. Despite rising shipments, the domestic industry's net sales value and operating income declined continuously over the entire period.[129] As a result, the industry's operating income margin plunged from a robust *** percent in 1995 to *** percent in 1996 and negative *** percent in 1997. The industry's operating income (loss) margin was negative *** percent in interim 1998 compared with negative *** percent in interim 1997.[130]

Given the need for constant innovation and replacement of equipment, the ability to fund capital spending and research and development are important indicators of the condition of the domestic DRAM

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[122] (...continued)
in interim 1997. Production of cased DRAMs rose from *** units in 1995 to *** units in 1996 and *** units in 1997, an increase of *** percent. Production of cased DRAMs was *** units in interim 1998, compared with *** units in interim 1997. Table III-3, CR at III-11, PR at III-6 (data for Mitsubishi excluded).

[123] Shipments of domestic DRAMs rose from *** billion bits in 1995 to *** billion bits in 1996 and *** billion bits in 1997, an increase of *** percent. Shipments of domestic DRAMs were *** billion bits in interim 1998, compared with *** billion bits in interim 1997. Table III-5, CR at III-13, PR at III-8 (data for Mitsubishi excluded).

[124] The average number of production and related workers employed in the production of uncased DRAMs rose from *** in 1995 to *** in 1996 and *** in 1997, and was *** in interim 1998 compared with *** in interim 1997. Table III-7, CR at III-15, PR at III-10 (data for Mitsubishi excluded).

[125] The ratio of inventories to total shipments (on the basis of bits) for uncased DRAMs fluctuated from *** percent in 1995 to *** percent in 1996 and *** percent in 1997, and was *** percent in interim 1998 compared with *** percent in interim 1997. The ratio of inventories to total shipments (on the basis of bits) for cased DRAMs fluctuated from *** percent in 1995 to *** percent in 1996 and *** percent in 1997, and was *** percent in interim 1998 compared with *** percent in interim 1997. Table III-6, CR at III-14, PR at III-9 (data for Mitsubishi excluded).

[126] Reported domestic capacity utilization for uncased DRAMs was *** percent in 1995, *** percent in 1996, and *** percent in 1997. Uncased DRAM capacity utilization was *** percent in interim 1998 compared with *** percent in interim 1997. Cased DRAM capacity utilization ranged from a high of *** percent in 1995 to a low of *** percent in 1997. Table III-3, CR at III-11, PR at III-6 (data for Mitsubishi excluded).

[127] Conf. Tr. at 28.

[128] CR at III-5 (Hitachi), III-6 (Matsushita), III-7 (Toshiba, Oki), III-8 (TwinStar/TI), PR at III-3-III-4.

[129] Net sales declined from $*** in 1995 to $*** in 1996 and $*** in 1997, an overall decline of *** percent. Net sales were $*** in interim 1998, compared with $*** in interim 1997. Operating income declined from $*** in 1995 to $*** in 1996 and to negative $*** in 1997. The industry had an operating loss of $*** in interim 1997 and an operating loss of $*** in interim 1998. Table VI-1, CR at VI-2, PR at VI-2 (data for Mitsubishi excluded), *see* Memorandum INV-V-096 (Dec. 2, 1998).

[130] Table VI-1, CR at VI-2, PR at VI-2 (data for Mitsubishi excluded), *see* Memorandum INV-V-096 (Dec. 2, 1998).

industry. During the period of investigation, the domestic industry's capital expenditures rose from $*** in 1995 to $*** in 1996, then fell to $*** in 1997, for an overall increase of *** percent. Capital expenditures were $*** in interim 1998, compared with $*** in interim 1997.[131] R&D expenses rose from $*** in 1995 to $*** in 1996 and $*** in 1997, and were relatively unchanged between the interim periods, falling slightly from $*** in interim 1997 to $*** in interim 1998.[132] These results suggest that, at least to date, the domestic industry has been able to maintain the needed pace of technological innovation. Because it can take several years to bring a new production facility on line or upgrade the process technology in an existing fab, however, the facilities that began commercial production during the period of investigation were largely planned and funded before the period.[133] Accordingly, in any final phase investigation, we will examine whether the industry's most recent financial losses are hindering its current efforts to upgrade its production facilities or develop the next generation of DRAMs.[134]

Based on our finding that the subject imports have depressed domestic DRAM prices, and because those price declines have contributed to large financial losses for the domestic industry in a growing market, we find, for purposes of this preliminary determination, that the subject imports are having an adverse impact on the domestic industry.

CONCLUSION

For the foregoing reasons, we find a reasonable indication that the domestic industry producing DRAMs is materially injured by reason of the subject imports.

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[131] Table VI-3, CR at VI-7, PR at VI-3 (data for Mitsubishi excluded).

[132] Table VI-3, CR at VI-7, PR at VI-3.

[133] CR at III-4 (Dominion, Fujitsu), III-5 (Hyundai), III-7 (Samsung), and III-8 (White Oak), PR at III-2-III-4.

[134] In any final phase investigation, we will also seek further information regarding the reasons for, and significance of, various entrances and exists from the industry during the period as well as the evident worldwide trend toward consolidation in the DRAM industry.

PART I: INTRODUCTION

BACKGROUND

This investigation results from a petition filed by Micron Technology, Inc. (Micron), Boise, ID, on October 22, 1998, alleging that an industry in the United States is materially injured and threatened with material injury by reason of less-than-fair-value (LTFV) imports of dynamic random access memory semiconductors (DRAMs) of one megabit (Meg) and above from Taiwan. Information relating to the background of the investigation is provided below.[1]

Date	*Action*
Oct. 22, 1998	Petition filed with Commerce and the Commission; institution of Commission investigation (63 FR 58066, Oct. 29, 1998)
Nov. 13, 1998	Commission's conference[2]
Nov. 18, 1998	Commerce's notice of initiation (63 FR 64040, Nov. 18, 1998)
Dec. 7, 1998	Commission's vote
Dec. 7, 1998	Commission determination to Commerce

SUMMARY DATA

A summary of data collected in this investigation is presented in appendix C. Except as noted, U.S. industry data are based on questionnaire responses of 13 firms that accounted for essentially all U.S. production of DRAMs during January-September 1998.[3] U.S. imports are based on responses to Commission questionnaires (see the section on U.S. Tariff Treatment).

PREVIOUS INVESTIGATIONS

Prior to the current investigation, the Commission has conducted a number of investigations concerning DRAMs. These have included both Title VII and unfair trade practices investigations.[4] In addition, in 1998 the Commission conducted investigations concerning a similar product, SRAMs (static random access memory semiconductors).[5]

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[1] *Federal Register* notices cited in the tabulation are presented in app. A. The alleged LTFV margins, as adjusted by Commerce, ranged from 48 to 69 percent.

[2] A list of witnesses appearing at the conference is presented in app. B.

[3] One U.S. producer, ***.

[4] See, U.S. International Trade Commission, *DRAMs of One Megabit and Above From the Republic of Korea (Views on Remand)* (Inv. No. 731-TA-556 (Remand)), USITC Pub. 2997, October 1996; *DRAMs of One Megabit and Above From the Republic of Korea* (Inv. No. 731-TA-556 (Final)), USITC Pub. 2629, May 1993; *Dynamic Random Access Memory Semiconductors of 256 Kilobits and Above From Japan* (Inv. No. 731-TA-300); and *64K Dynamic Random Access Memory Components From Japan* (Inv. No. 731-TA-270 (Final)), USITC Pub. 1862, June 1986. Also, see U.S. International Trade Commission Invs. Nos. 337-TA-414, 337-TA-345, 337-TA-312, and 337-TA-242.

[5] See, U.S. International Trade Commission, *Static Random Access Memory Semiconductors From the Republic of Korea and Taiwan* (Invs. Nos. 731-TA-761-762 (Final)), USITC Pub. 3098, April 1998.

U.S. TARIFF TREATMENT

The U.S. Customs Service ("Customs") has determined that, for tariff and marking purposes, the country of origin of imported DRAMs is the location of assembly rather than the location of wafer fabrication. Mounting (also referred to as packaging) of integrated circuit chips is still considered to be a substantial transformation for both country-of-origin and marking purposes. For the purposes of presentation in this report, questionnaire responses will be used to generate import statistics rather than the official statistics of the U.S. Department of Commerce.

Imports of DRAM wafers and uncut and cut dice are classified in HTS subheading 8542.13.80 (statistical reporting number 8542.13.8005), a classification that includes merchandise other than DRAMs (such as SRAM wafers, dice, and unmounted chips).[6] Imports of assembled or cased DRAMs fall into the same subheading but are reported under statistical categories numbered 8542.13.8021 through 8542.13.8034.[7] Imports of DRAM modules are classified in subheadings 8473.30.10 through 8473.30.90 of the HTS. The normal trade relations (NTR) tariff rate, applicable to imports from Taiwan, for all subheadings identified, is free, as set forth in the general rates of duty column.

THE PRODUCT

In the "Scope of Investigation" section of its notice of initiation, Commerce stated that–

> *The products covered by this investigation are DRAMs from Taiwan, whether assembled or unassembled. Assembled DRAMs include all package types. Unassembled DRAMs include processed wafers, uncut die, and cut die. Processed wafers fabricated in Taiwan, but packaged or assembled into finished semiconductors in a third country are included in the scope. Wafers fabricated in a third country and assembled or packaged in Taiwan are not included in the scope.*
>
> *The scope of this investigation includes memory modules. A memory module is a collection of DRAMs, the sole function of which is memory. Modules include single in-line processing modules ("SIPS"), single in-line memory modules ("SIMMs"), dual in-line memory modules ("DIMMs"), memory cards or other collections of DRAMs whether mounted or unmounted on a circuit board. Modules that contain other parts that are needed to support the function of memory are covered. Only those modules that contain additional items that alter the function of the module to something other than memory, such as video graphics adapter ("VGA") boards and cards, are not included in the scope. Modules containing DRAMs made from wafers fabricated in Taiwan, but either assembled or packaged into finished semiconductors in a third country, are also included in the scope.*
>
> *The scope includes, but is not limited to, video RAM ("VRAM"), Windows RAM ("WRAM"), synchronous graphics RAM ("SGRAM"), as well as various types of DRAM, including fast page mode ("FPM"), extended data-out ("EDO"), burst extended data-out ("BEDO"), synchronous dynamic RAM ("SDRAM"), and "Rambus" DRAM ("RDRAM").*

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[6] Prior to 1996, DRAM wafers and uncut and cut dice were classified in subheading 8542.11.80 (statistical reporting number 8542.11.8001).

[7] Prior to 1996, assembled or cased DRAMs were classified in subheading 8542.11.80 (statistical reporting numbers 8542.11.8021 through 8542.11.8034).

The scope of this investigation also includes any future density, packaging or assembling of DRAMs. The scope of this investigation does not include DRAMs or memory modules that are reimported for repair or replacement.

The DRAMS subject to this investigation are currently classifiable under subheadings 8542.13.80.05, 8542.13.80.24 through 8542.13.80.34 of the Harmonized Tariff Schedule of the United States ("HTSUS"). Also included in the scope are Taiwanese DRAM modules, described above, entered into the United States under subheading and (sic) *8473.30.10.90 of the HTSUS or possibly other HTSUS numbers. Although the HTSUS subheadings are provided for convenience and customs purposes, the written description of the scope of this investigation is dispositive.*

Although the language used by Commerce in the "Scope of Investigation" section of its initiation notice does not use the term "one megabit and above," the notice earlier states that "petitioner alleges that imports of dynamic random access memory semiconductors of one megabit and above ("DRAMs") from Taiwan . . ." Thus, Commerce first uses the acronym "DRAMs" in its initiation notice to refer apparently only to those semiconductors of one megabit and above. Moreover, the HTS provisions cited by Commerce omit statistical reporting numbers 8542.13.8021, 8542.13.8022, and 8542.13.8023, all of which provide for DRAMs of varying densities, but all of which are under one Meg in density. For purposes of presentation in this report, "subject" DRAMs from Taiwan are those of one Meg and above and "nonsubject" DRAMs from Taiwan are those below one Meg.

The following sections present information on both imported and domestically produced DRAMs, as well as information related to the Commission's "domestic like product" determination.[8] A glossary of terms is presented in appendix D.

In the Commission's determination in its most recent DRAM antidumping investigation,[9] the Commission found one like product consisting of "all DRAMs," irrespective of density and whether assembled (cased) or not, and including VRAMs (a specialty type of DRAM, video RAM) and memory modules. Finally, it did not establish an upper limit on the like product based on the existing densities of DRAMs available at that time. In its current petition, Micron's proposed scope language follows the Commission's earlier like-product determination, with the exception that the petitioner is specifically requesting additional specialty DRAMs be included in the like product. Neither the petitioner nor the respondents raised any additional like-product issues.

Physical Characteristics and Uses

DRAM is a class of volatile semiconductor memory that allows data to be both read from and written to the device's storage locations in a non-linear fashion. DRAMs use a memory or storage cell structure based on a transistor and capacitor combination in which digital information is represented by a

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[8] The Commission's decision regarding the appropriate domestic products that are "like" the subject imported products is based on a number of factors, including (1) physical characteristics and uses; (2) common manufacturing facilities and production employees; (3) interchangeability; (4) customer and producer perceptions; (5) channels of distribution; and, where appropriate, (6) price.

[9] U.S. International Trade Commission, *DRAMs of One Megabit and Above From the Republic of Korea* (Inv. No. 731-TA-556 (Final)), USITC Pub. 2629, May 1993, and *DRAMs of One Megabit and Above From the Republic of Korea (Views on Remand)* (Inv. No. 731-TA-556 (Remand)), USITC Pub. 2997, October 1996.

charge stored on each of the capacitors in the memory array. Storage requires two different levels of energy, one to represent the binary digit (bit) "0" and another to represent the binary digit "1". DRAM gets the name "dynamic" from the fact that the capacitors are imperfect and will lose their charge unless the charge is repeatedly replenished (refreshed) on a regular basis (every few milliseconds) by externally supplied signals.

Storage cells in DRAMs are arranged in a matrix of columns and rows allowing each cell to be accessed independently (random access) and in the same amount of time. When a column or row is selected and activated, the cell transistor acts as a solid-state switch that connects the capacitor to the column. The simultaneous selection of a row and column determines the specific cell address. The speed at which the cell can be addressed is called access time and is expressed in nanoseconds (ns), or one-billionths of a second. DRAMs sold in the U.S. market are largely designed with access times ranging from 50ns to over 100ns.[10]

In the early 1970s, DRAM semiconductors (chips) with a density of 1,024 storage cells or bits per chip (1 kilobit or 1K) were introduced. Since then, improvements in semiconductor processing and circuit design have allowed for continued increases in density. The density progression of DRAM chips has typically followed the "rule of four," according to which the cost of development of a new density generation can be justified only by a factor-of-four increase in that density. A 1 Meg DRAM is an integrated circuit (IC) with 1,048,576 bits (1,024 bits squared). It was first offered for sale in limited quantities in 1985 and followed the introductions throughout the 1970s and 1980s of 4K, 16K, 64K, and 256K DRAMs, respectively. In 1989, DRAMs with a density of 4 Megs were introduced, followed by 16 Meg chips in 1991 and 64 Meg chips in 1994. Currently, 4 Meg, 16 Meg, and 64 Meg DRAMs account for the largest part of the market.[11]

Included in the scope of Commerce's investigation are several DRAM types that are offshoots of standard DRAMs but which still use the basic DRAM storage cell structure. First, enhanced addressing modes have been specifically included, such as fast page mode (FPM), extended data out (EDO), burst extended data out (BEDO), synchronous dynamic RAM (SDRAM), and Rambus DRAM (RDRAM). These DRAM products are basically improvements over one another in terms of the speed with which the memory is able to be accessed, thereby affording better communication with ever-advancing microprocessors.[12] In addition, several specialty DRAM products have been specifically included: video RAM (VRAM), Windows RAM (WRAM), and synchronous graphics RAM (SGRAM). VRAM,

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[10] McGraw-Hill Inc., "Semiconductor Memories" and "Computer Memory," *McGraw-Hill Multimedia Encyclopedia of Science and Technology* (U.S.A.: McGraw-Hill, 1996).

[11] Integrated Circuit Engineering (ICE), Howard Dicken, David Hillis, Ravi Krishnan, Sabina Prioletta, and Lita Shon-Roy, editors, *Mid-Term Status 1998* (Scottsdale, AZ: ICE, 1998), pp. 7-43 to 7-51. According to ICE, certain DRAM producers may forego the traditional rule-of-four increase in density for the next product generation. Instead of moving from 64 Meg chips to 256 Meg chips, certain DRAM producers have announced that they may offer 128 Meg chips as a bridge to the 256 Meg generation. Rather than being a true 128 Meg generation, the 128 Meg chips may simply be the joining of two 64 Meg parts on the same die.

[12] FPM is the oldest of these technologies and RDRAM the newest. Generally, each of these products is considered to have been an improvement on its predecessors, and over time the newer technologies replace the older technologies. Currently, SDRAM is the most widely used technology, with EDO being phased out and RDRAM being introduced.

WRAM, and SGRAM are DRAM products that have been optimized for use in specific applications.[13] In general, these products have been configured to provide enhanced performance over regular DRAM in computer video and graphics applications.[14]

Also included in the scope are DRAM memory modules.[15] A DRAM memory module is a packaging arrangement generally consisting of a printed circuit board that contains two or more DRAMs.[16] The most common types of DRAM memory modules are single in-line processing modules (SIPs), single in-line memory modules (SIMMs), dual in-line memory modules (DIMMs), memory cards, and memory boards.[17] Modules provide a packaging arrangement for DRAMs that allows for their attachment and interconnection (in most applications) with a computer's main circuit board.[18]

DRAMs and DRAM modules are used as the main memory in a variety of electronic products, including computers and computer peripherals, telecommunications equipment, networking equipment, and consumer electronics devices. By far, the largest use for DRAMs and DRAM modules is as the main memory in computer equipment.[19]

Manufacturing Facilities and Production Employees

The manufacture of DRAMs is a highly capital-intensive and automated process. Starting with silicon wafers,[20] the DRAM manufacturing process can be divided into three stages: design, fabrication, and assembly and test.[21] The design of the circuit layout for a DRAM often requires highly skilled technical employees, computer hardware, and computer-aided design software.[22] During this process, the

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[13] According to the petitioner, these products account for a relatively small share of the overall DRAM market. Conference transcript, p. 36.

[14] Neil Randall, "A RAM Primer," *PC Magazine*, Oct. 21, 1997, pp. 267-268.

[15] Memory modules are often measured in terms of bytes, rather than bits. There are eight bits in a byte. Therefore, a 32 megabyte DRAM module could potentially be comprised of four 64-Meg DRAMs or sixteen 16-Meg DRAMs.

[16] DRAM memory modules may also contain other parts. If those other parts change the function of the module to something other than memory, such as VGA boards and cards, they are excluded from the scope of Commerce's investigation.

[17] Both the petitioner and respondents estimate that the DRAM chips incorporated in a DRAM memory module account for approximately 90-95 percent of the value of the module. Conference transcript, pp. 37 and 80.

[18] Petitioner's post-conference brief, p. 7.

[19] According to petitioner and respondents, approximately 90 percent of DRAMs are incorporated into computer systems. Conference transcript, pp. 35 and 79. According to ICE, a market research firm, over 75 percent of DRAMs are ultimately incorporated into computer systems.

[20] Wafer preparation entails the chemical transformation of sand (silicon dioxide) into highly pure polysilicon and then into silicon wafers. Most U.S. DRAM fabricators purchase their silicon wafers from third parties and begin the DRAM manufacturing process at the design stage.

[21] This description of DRAM manufacturing draws upon material from Motorola Corp., "The Making of a Semiconductor" (faxed to USITC staff on July 29, 1996); Harris Semiconductor, *How Semiconductors are Made*, found at http://www.semi.harris.com/docs/lexicon/manufacture.html, retrieved Jan. 6, 1997; and Crucial Technology, "Micron Makes Memory. Here's How," found at http://www.crucial.com/library/manufacturing.asp, retrieved Nov. 15, 1998.

[22] "Fabless" DRAM companies concentrate on the design stage. The fabrication stage is contracted out by the fabless company to a "foundry" producer. The foundry producer fabricates the DRAMs, including any prototyping

(continued...)

circuit patterns are transferred to glass photomasks, one for each layer of the DRAM. It is at the design stage that decisions are made relating to the essential characteristics and functions of the DRAMs.

The fabrication process is very automated and extremely capital intensive, with the cost of a new fabrication facility (and equipment) currently estimated at over $1 billion. DRAMs are produced on a single wafer of highly purified silicon, usually 6 to 8 inches in diameter. The process of fabricating DRAMs on the silicon wafer entails the repeated use of photolithographic equipment and photomasks to "expose" numerous layers of circuit patterns onto the surface of the wafer. In addition, chemical impurities (dopants) are introduced to form conducting and non-conducting regions on the wafer by changing the electrical characteristics of certain areas. Metal connections between selected regions of each die are formed and a final protective coating is applied to the wafer. It is in the wafer fabrication stage that the electrical and technical characteristics of the individual DRAMs (dice or chips) are developed. Depending on the diameter of the wafer and the size of the individual die, hundreds of identical DRAMs may be produced simultaneously. At the close of the fabrication stage, a wafer-probe test is performed, electrically testing each die on the wafer and marking defective dice for rejection.

After the fabrication stage, the DRAMs are assembled and further tested. Assembly includes the separation of the wafer into individual chips, wire bonding metal leadframes to the chips, solder plating the metal leads, trimming and forming the leads into a desired shape, and encapsulating the chips in either plastic or ceramic.[23] After assembly, the assembled (or cased) chips are marked for identification purposes and given final tests to ensure quality and reliability. Although test and assembly is quite automated, it is relatively labor intensive compared to fabrication and may be conducted in a lower labor-cost third country.[24]

The manufacturing process for DRAMs of different densities or addressing modes, as well as that for specialty DRAMs (VRAM, SGRAM, and WRAM), is essentially the same. Producing different types of DRAMs requires the use of a different mask set during wafer fabrication, but otherwise the same equipment, processes, and production workers are utilized.[25] While certain manufacturers maintain facilities and production workers dedicated solely to the production of DRAMs, many manufacturers (domestic and in Taiwan) employ their fabrication facilities and personnel in the production of both DRAMs and other semiconductor products such as SRAMs and logic devices.[26]

DRAMs are basically a commodity product. As such, in the DRAM industry great effort is dedicated to maximizing the number of good chips produced per wafer. The higher the number of good DRAMs per wafer, the lower the price that the company can feasibly charge. One way of raising the

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[22] (...continued)
and test run, using the fabless company's design. The assembly stage is also contracted out by the fabless company and can be conducted by the foundry or by a third party. *** telephone interview with USITC staff, Mar. 6, 1998.

[23] E-mail from, *** Jan. 20, 1998.

[24] This delineation of the manufacturing process is referred to as production sharing. For a more detailed explanation of production sharing in semiconductors, see USITC, *Production Sharing: Use of U.S. Components and Materials in Foreign Assembly Operations, 1993-1996* (Inv. No. 332-237), USITC Pub. 3077, December 1997, pp. 3-31 to 3-35.

[25] Conference transcript, pp. 36 and 80. In addition, the DRAM production process is basically identical for both domestic and Taiwan manufacturers. Both industries use silicon wafers as the basic raw material, and both industries utilize similar photolithographic, diffusion, and etching equipment.

[26] Questionnaire responses of ***.

number of good dice per wafer, the wafer yield, is through improvements in processing to reduce the ratio of defective dice. Such improvements usually occur over the production life of a chip design. Wafer yields generally are low at the introduction of a new density generation and improve over its lifetime. Of equal, or perhaps greater, significance is the constant effort by producers to generate "die shrinks." Die shrinks are improved designs that result in smaller chip, or die sizes. By developing smaller dice, producers are able to fabricate more dice on a given wafer. With the relatively constant cost of processing a wafer, regardless of the number of dice, reducing die size allows for reduced per-unit production costs and increased competitiveness.

According to ***,[27] "Module assembly is a straightforward process whereby cased DRAMs are placed onto a small piece of printed circuit board. In the first stage of the module assembly operation, the printed circuit board is put through a screen printer and then a glue machine which places an adhesive on the board. Next an automated pick and place machine selects the appropriate DRAM components, plus associated logic components and capacitors as required, and positions them in the correct positions on the board. In the next stage the modules are placed in a reflow oven, which causes the solder on the leads of the components to adhere to the printed circuit board. In the final stages the modules are put through a wash cycle that removes any excess residue of flux or paste, and then are tested in module test machines. This process is probably the least sophisticated of any of the manufacturing processes."

Interchangeability

DRAMs of similar density, access speed, and variety (regular DRAM, VRAM, SGRAM, etc.) are generally interchangeable regardless of the origin of fabrication.[28] A 64 Meg SDRAM manufactured in Taiwan should be fully interchangeable with a similarly configured domestically produced device, as well as with a nonsubject import.[29] Substitutability also exists between similar DRAMs of different density.[30] For example, in regard to their use in a memory module, four 16 Meg SDRAMs should be interchangeable with one 64 Meg SDRAM.[31] In addition, a certain degree of interchangeability exists among different varieties of DRAMs as well as among those with different addressing modes/access speeds, but may be less common. According to the petitioner, synchronous DRAM can be and is substituted for VRAM in certain graphics applications. However, once an electronic system has been designed to operate with a specific variety of DRAM (regular DRAM, SGRAM, WRAM, or VRAM), substitution of a different DRAM variety may result in a system that is not operating optimally. Similarly, although older addressing-mode

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[27] Questionnaire response of ***.

[28] Questionnaire responses. Responses in a number of questionnaires have identified the necessity of qualifying a DRAM product with original equipment manufacturers (OEMs). The qualification process generally requires the DRAM producer to provide the customer with samples to use as test devices in the customer's equipment. Without qualification, the ability to quickly substitute one producer's DRAM for another producer's would be hampered.

[29] The largest nonsubject sources of DRAM imports to the United States are Korea and Japan.

[30] Practical interchangeability often occurs between DRAMs one density generation removed. For example, 4 Meg chips for 16 Meg chips, or 16 Meg chips for 64 Meg chips.

[31] Conference transcript, p. 24. In certain high density modules (those in excess of 32 megabytes (256 megabits)) 16 Meg DRAMs may no longer be substitutable for 64 Meg DRAMs. Conference transcript, p. 69. For example, a 64 megabyte (512 megabit) module would require thirty-two 16 Meg chips, but only eight 64 Meg chips. At a certain point, memory modules may not have sufficient board space to accommodate additional chips. However, personal computers usually come with a number of memory module slots, and the user may well substitute two 32 megabyte modules containing 16 Meg DRAMs for one 64 megabyte module containing 64 Meg DRAMs.

technology EDO DRAM may function as the main memory in a newer computer system, the system would likely operate more efficiently if it were utilizing newer, faster addressing-mode technology, such as SDRAM.

In general, questionnaire responses indicated that there is no other product that is generally substitutable for DRAMs. Several responses cited certain other semiconductor products that might be substituted for DRAMs. However, these products were identified as being too expensive relative to DRAMs, or they had not achieved sufficient densities or adequate access speeds.[32]

Producer and Customer Perceptions

Taiwan producers have noted several differences in the perception of their DRAM products and those manufactured domestically. Respondents argue that the DRAM industry in Taiwan can be divided into two tiers.[33] The first-tier producers are often contract manufacturers that obtain leading-edge technology and designs from and manufacture on behalf of third parties, usually large Japanese DRAM producers. Reportedly, DRAMs from first-tier producers compete directly with domestically produced DRAMs for sale to tier-one OEM customers, primarily large computer manufacturers.[34] Second-tier producers in Taiwan are those that have developed their own DRAM products without outside assistance, and typically market their products under their own names. Typically, DRAM products from second-tier Taiwan producers lag domestic products in both technology and density.[35] Respondents argue that much of the tier-two production is in 16 Meg EDO DRAMs and does not compete with the bulk of U.S. production, which is in newer 64 Meg SDRAMs. As such, respondents argue that tier-two products from Taiwan are typically perceived as lower end products, lagging in technology and density, lacking in brand name recognition, and unable to qualify for sale to large OEMs.[36]

The majority of U.S. producers generally perceive no difference between similarly configured domestically produced DRAMs and those produced in Taiwan.[37] Petitioner views domestic and Taiwan-produced DRAMs as interchangeable and competitive with one another in the market. Petitioner claims that it sells into both the first- and second-tier markets and in both it faces direct competition from Taiwan producers.[38] However, two domestic producers stated that differences in quality existed, and one U.S. producer noted that domestically produced DRAMs likely used newer technology than their Taiwan-produced counterparts.[39]

On the part of importers, there appears to be little difference in the perception of Taiwan-fabricated DRAMs and similarly configured DRAMs fabricated in the United States. The vast majority of questionnaire responses indicated that there are no perceived differences between the domestic and subject products, and no perceived advantages for either product. Respondents have argued that second-tier

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[32] Questionnaire responses of ***.

[33] Conference transcript, pp. 68-73. See Part VII: Threat Considerations, for a further discussion of Taiwan's tier-one and tier-two producers.

[34] Ibid., p. 68.

[35] Ibid., p. 69, and questionnaire response of ***.

[36] Questionnaire responses of ***.

[37] Questionnaire responses of U.S. producers.

[38] Conference transcript, pp. 94-96.

[39] Questionnaire responses of ***.

Taiwan-produced DRAMs are viewed by customers as incorporating older technology and lower densities than domestically produced DRAMs.[40]

Channels of Distribution

Both U.S.-produced and Taiwan-fabricated DRAMs are sold to a variety of customers, including OEMs, distributors, brokers, and value-added/aftermarket resellers. The petitioner states that all varieties of DRAMs covered by the investigation (WRAM, VRAM, and SGRAM), as well as the various DRAM addressing modes (FPM, EDO, SDRAM, etc.) share the same channels of distribution and are sold primarily to OEMs and distributors.[41] The petitioner further argues that both U.S.-produced DRAMs and the subject imports are sold to a significant degree in all market segments, including the OEM and spot markets, and to all types of customers.[42]

The respondents stress that Taiwan-fabricated DRAMs sold in the United States are divided into two distinct channels of distribution. They state that DRAMs manufactured by tier-one Taiwan producers are sold directly to the advanced OEM market, consisting of major PC producers and related OEM customers that require qualified sources of supply.[43] The respondents assert that while DRAMs manufactured by Taiwan joint ventures and foundries that produce on behalf of third parties are sold in this channel, the United States, Japan, and Korea dominate the tier-one U.S. market.[44] Reportedly, ***[45] of Taiwan DRAMs are fabricated by tier-two producers, who have not qualified to participate in the aforementioned market segment. These DRAMs are shipped to tier-two customers that do not have the advanced technological requirements of the major OEMs.[46] These customers consist of memory board producers, small PC clone producers, and value-added resellers.[47] According to the respondents, U.S. producers do not significantly compete for tier-two customers.[48]

According to questionnaire responses, in 1997, sales of U.S.-produced DRAMs to OEMs accounted for *** percent of the total sales of two U.S. producers. Another U.S. producer sold exclusively to distributors, while two additional companies shipped approximately *** of their U.S.-manufactured product to value-added/aftermarket resellers.[49] Responses from companies that imported DRAMs wholly

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[40] Conference transcript, pp. 65-75.

[41] Petition, p. 6.

[42] Conference transcript, pp. 94-95.

[43] Ibid., pp. 55-56, and post-conference brief of Taiwan Semiconductor Industry Assn., Vanguard International Semiconductor Corp., and Mosel Vitelic Corp. (White & Case post-conference brief), p. 11.

[44] Conference transcript, p. 55, and White & Case post-conference brief, p. 12.

[45] According to the respondents, in 1998, tier-one and tier-two companies in Taiwan accounted for about *** and *** of all wafer starts, respectively. White & Case post-conference brief, p. A-7.

[46] Conference transcript, p. 54. The respondents argue that tier-two Taiwan suppliers only compete in the tier-one market for "legacy" product, which most major global suppliers no longer produce. The petitioner states that Micron has been a significant player in the market for 16 Meg DRAMs, characterized by the respondents as legacy product. Conference transcript, pp. 71 and 95, and petitioner's post-conference brief, p. 33.

[47] Conference transcript, p. 55, and White & Case post-conference brief, p. 11.

[48] White & Case post-conference brief, pp. 1 and 15.

[49] Questionnaire responses of U.S. producers.

or exclusively from Taiwan reveal that the majority of such shipments were also directed to OEMs.[50] Only one importer indicated that 100 percent of the firm's 1997 sales were to module manufacturers.[51]

Price

DRAMS are considered commodity products that compete largely on the basis of price. The DRAM industry is highly cyclical, with short product life cycles. In the short term, prices may differ for technologically advanced or specialty DRAMs,[52] which begin their life cycles as value-added products. However, in the long term, as products exit the introductory phase of their cycle and an increasing number of suppliers join the market, DRAMs are rapidly transformed into commodity goods.

The sharp decline in DRAM prices over the period of investigation is cited by the petitioner as being reflective of the commodity nature of the product.[53] The petitioner stresses that the DRAM industry is extremely price sensitive, with the market showing little discernment towards DRAMs produced by qualified firms or those manufactured by second-tier manufacturers.[54] The respondents question whether data support the assertion that DRAMs have high elasticities of substitution, a characteristic noted by the petitioner as typical of commodity products.[55]

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[50] ***.
[51] Questionnaire response of ***.
[52] Conference transcript, p. 36.
[53] Ibid., p. 24.
[54] Ibid., pp. 20 and 24.
[55] White & Case post-conference brief, p. 11.

PART II: CONDITIONS OF COMPETITION IN THE U.S. MARKET

MARKET SEGMENTS/CHANNELS OF DISTRIBUTION

Domestic fabricators sell DRAMs and modules to both original equipment manufacturers and to distributors, resellers/brokers, and/or memory module manufacturers in what may be described as the aftermarket. "The major PC OEMs only consume about 60 percent of the DRAMs in the market".[1] In 1997, domestic producers generally sold a greater share of production to OEMs than did importers of DRAMs fabricated in Taiwan. For example, Micron reported that *** percent of its sales in 1997 were to OEMs. On average, domestic producers reported that *** percent of sales were to OEMs.

Some importers of DRAMs from Taiwan sell primarily to OEMs while others sell primarily in the aftermarket. Importers of DRAMs from Taiwan with a large share of sales to OEMs include ***, with sales to OEMs in 1997 of *** percent respectively. These firms or their affiliates have production facilities in the United States or elsewhere. Other importers with a large share of sales to OEMs include ***, with sales to OEMs in 1997 of *** percent of total sales, respectively. Other importers of DRAMs from Taiwan responding to Commission questionnaires report a smaller share of sales to OEMs. Importers of DRAMs fabricated in Taiwan reported that *** percent of sales were to OEMs.

Overall, the market penetration of imports of DRAMs from Taiwan in 1997 and interim 1998 was highest in DRAMs of 8 Meg and less. In interim 1998 imports of DRAMs from Taiwan accounted for *** percent of 8 Meg DRAMs fabricated or sold in the United States, and *** percent of 4 Meg DRAMs (table II-1).

Table II-1
DRAMs: Sales, by fabrication of dice and by density, Jan.-Sept., 1998

* * * * * * *

SUPPLY AND DEMAND CONSIDERATIONS

U.S. Supply

Domestic Production

Based on the available information, it appears that domestic producers have the ability to respond to price increases with relatively large changes in the quantity of shipments of DRAMs. The main factor contributing to this responsiveness is the existence of unused capacity including the TwinStar Semiconductor facility formerly owned by Texas Instruments. The facility, now owned by Micron, has been idled since June 1998.

[1] Conference transcript, p. 23.

Industry capacity

Capacity utilization at operating domestic fabrication facilities is high. Capacity utilization by petitioner Micron was *** percent in 1997 and *** percent in interim 1998, in terms of wafer starts. Domestic fabricators *** reported capacity utilization as *** percent in their U.S. fabrication facilities in interim 1998. Fabricators *** reported capacity utilization of *** percent, respectively, in interim 1998. Matsushita, Hitachi, and Mitsubishi all closed their U.S. fabrication facilities in 1998. The TwinStar Semiconductor facility, now owned by Micron, ceased production in June 1998. This facility, if re-opened, would account for *** percent of Micron's total wafer capacity. This facility and the unused capacity of domestic producers *** could be used to increase domestic production of DRAMs.

Production alternatives

*** report that no other products are produced using the same equipment used in the production of DRAMs. *** report that some other products such as SRAMs and logic chips are produced on the same equipment used to produce DRAMs. Presumably these producers could switch some production from these other products to production of DRAMs.

Subject Imports

Based on the available information, it appears that Taiwan producers of DRAMs have the ability to respond to price changes with changes in the quantity of shipments of DRAMs. The majority of fabrication facilities in Taiwan are producing at nearly full capacity. However, most producers have some ability to produce DRAMs on the same equipment used to produce other products.

Industry capacity

The only fabricators in Taiwan with reported wafer starts in interim 1998 that were less than *** percent of reported capacity were ***, with a capacity utilization rate of *** percent, respectively. *** began production in 1997.

Production alternatives

Most Taiwan fabricators of DRAMs reported that they produced some other integrated circuits on the same equipment used to produce DRAMs, or had plans for such production in the future. The exceptions are ***, which reported no production of products other than DRAMs and no plans to begin such production.

Alternative markets

*** of the DRAMs fabricated in Taiwan are produced by firms involved in joint ventures with, or who have technology-transfer agreements with, electronics firms outside Taiwan. Most commonly these are large Japanese DRAM producers. Presumably, Taiwan foundries with such foreign partners could

shift some of their exports to third countries. The foreign partners could then replace these shipments with DRAMs from nonsubject countries.[2]

U.S. Demand

Demand Characteristics

Demand for DRAMs increased significantly throughout the period of investigation, driven by increased sales of personal computers (PCs) and more demanding software. In terms of bits, demand for DRAMs is reported to have increased 60 to 70 percent per year. There have also been changes in the type and density of DRAMs produced and sold since 1995. Production of DRAMs for OEMs has migrated from FPM, to EDO, to SDRAM; and from 4 to 16 and 64 Meg chips.

Substitute Products

While static random access memory semiconductors (SRAMs) are the closest substitute for DRAMs, a number of factors limit the substitutability between the two. An SRAM is also a memory storage device; however, unlike a DRAM, an SRAM does not have to be continually refreshed but maintains stored information as long as power is supplied. Access times for SRAMs are generally much lower than access times for DRAMs. DRAMs are generally not substitutable for SRAMs because DRAMs must be constantly refreshed, and because of slower access times. SRAMs are generally not substitutable for DRAMs because of their higher price. Most producers and importers reported that there were no close substitutes for DRAMs. Responding importers and producers stated that SRAMs are too costly and flash memory is too slow.

Cost Share

The primary use for DRAMs is as memory storage devices in PCs. DRAMs are assembled into modules containing two or more DRAMs. There is normally more than one module in a PC. Most producers and importers reported that DRAMs accounted for approximately 90 percent of the total cost of memory modules. The cost share of DRAMs varies for different types of PCs. Generally DRAMs account for less than 10 percent of the cost of a PC.

SUBSTITUTABILITY ISSUES

Factors Affecting Purchasing Decisions

DRAMs from qualified suppliers are interchangeable, regardless of the country of fabrication. However, half of reporting importers indicated that there are significant differences in product characteristics or sales conditions between domestically produced DRAMs and those produced in Taiwan. Importers of DRAMs produced in Taiwan report a larger share of sales in the aftermarket.

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[2] Conference transcript, pp. 55-56.

DRAMs may be directly attached to a PC motherboard or to a memory module.[3] Modules are used by OEMs and also sold in the aftermarket. DRAMs of the same type and density from different producers or countries are generally interchangeable, although there are some differences in the types and densities of DRAMs produced by producers in different countries.

According to questionnaire responses, OEMs are generally seen as having more stringent qualification programs than aftermarket distributors and brokers. Domestic producers more often reported that their customers had stringent quality control programs. Responding domestic producers sell the majority of their DRAMs to OEMs.

Respondents claim that imports of DRAMs fabricated in Taiwan fall into two categories; those that are the produced in cooperation with a partner and those produced in Taiwan by fabricators using their own designs. Partners "such as Mitsubishi or Fujitsu, Siemans, ... provide the latest proprietary technology in partnership with the Taiwan manufacturing capability and sell the DRAMs to the advanced OEM market."[4] Taiwan fabricators producing from their own designs include ***. These firms account for approximately *** percent of production in Taiwan.[5]

Comparisons of Domestic Products and Subject Imports

Producers and importers were in general agreement that DRAMs of the same type and density are interchangeable, regardless of country of origin. However, nearly half of responding importers reported significant differences in product characteristics or sales conditions between the domestic products and imports from Taiwan (table II-2). *** reported that "U.S. produced DRAMs are typically newer technology, and higher density, with established brand recognition. Taiwan producers offer primarily lower density devices, and older technology which engages them with a separate tier of customers."[6] Another difference between the domestic product and imports from Taiwan was reported by ***, which stated "Taiwan DRAM[s] generally have not been fully qualified by U.S. OEMs unlike domestic DRAM producers."[7] Although there is considerable overlap, domestic producers and those in Taiwan focus on different segments of the market. The market penetration for imports from Taiwan was greatest in 4 and 8 Meg DRAMs. Domestic producers concentrated more on 16 and 64 Meg DRAMs.

Comparisons of Domestic Products and Nonsubject Imports

DRAMs fabricated in nonsubject countries were generally reported as being interchangeable with those fabricated domestically. Product characteristics and sales conditions were generally reported to be similar. Also, the limited information reported in Commission questionnaires indicated that producers of DRAMs in nonsubject countries and domestic producers largely focus on the same market segments. The import penetration of nonsubject imports in 64 Meg and 16 Meg DRAMs, the densities with the largest domestic production, was *** percent, respectively.

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[3] Petitioner's post-conference brief, p. 6.
[4] Conference transcript, p. 54.
[5] White & Case post-conference brief, p. A-7.
[6] *** response to importer's questionnaire, pp. 20 and 21.
[7] *** response to importer's questionnaire.

Comparisons of Subject Imports and Nonsubject Imports

Imports from Taiwan and from nonsubject countries were reported as being interchangeable by both domestic producers and importers. However, 8 of 30 responding importers reported significant differences in product characteristics or sales conditions between imports from Taiwan and nonsubject imports. Market penetration by DRAMs fabricated in Taiwan was highest for 4 Meg and 8 Meg DRAMs (*** percent, respectively), while market penetration by nonsubject imports was highest for 16 Meg and 64 Meg DRAMs (*** percent, respectively.)

Table II-2
DRAMs: Substitutability

Item	Firms reporting "yes"		Firms reporting "no"	
	U.S. producers	U.S. importers	U.S. producers	U.S. importers
Are DRAMs generally used interchangeably?				
U.S. vs Taiwan	6	20	0	1
U.S. vs nonsubject countries	6	21	0	1
Taiwan vs nonsubject countries	6	21	0	1
Significant differences in product characteristics or sales conditions				
U.S. vs Taiwan	1	9	4	9
U.S. vs nonsubject countries	1	6	5	15
Taiwan vs nonsubject countries	1	8	4	12

Note: Responses are from importers of DRAMs from Taiwan and nonsubject countries.

Source: Compiled from data submitted in response to Commission questionnaires.

PART III: CONDITION OF THE U.S. INDUSTRY

The Commission analyzes a number of factors in making injury determinations (see 19 U.S.C. §§ 1677(7)(B) and 1677(7)(C)). Information on the alleged margins of dumping was presented earlier in this report (see page I-1) and information on the volume and pricing of imports of the subject merchandise is presented in parts IV and V. Information on the other factors specified is presented in this section and/or part VI and (except as noted) is based on the questionnaire responses of 13 firms that accounted for essentially all known U.S. fabrication of uncased DRAMs and assembly of cased DRAMs from January 1995 through September 1998.

For the purposes of presentation in this report, unless otherwise noted, "domestic" DRAMs include all uncased and cased DRAMs, as well as DRAM modules, that contain U.S.-fabricated dice, regardless of the location of final assembly or casing. In addition, DRAMs assembled or cased in the United States from third-country-sourced dice (i.e., dice not fabricated in the United States or Taiwan) are also included as "domestic" product.[1]

Data in this section are presented for uncased DRAMs, cased DRAMs, and DRAM modules. Additional data on U.S. production and shipments of DRAMs, by source of dice and location of assembly, are presented in appendix E.

U.S. PRODUCERS

Overview of the Industry

The Commission sent producers' questionnaires to all firms identified as producers in the petition, as well as to several other firms believed to have produced or have been capable of producing DRAMs in the United States during any part of the period January 1995-September 1998. According to questionnaire responses, during at least part of this period 12 firms performed wafer fabrication in the United States, 10 performed DRAM assembly, and 6 also assembled DRAM modules.[2] Responding producers are believed to account for virtually all U.S. DRAM wafer fabrication and most U.S. DRAM assembly, but only a portion of DRAM module assembly.[3]

Table III-1 presents a list of U.S. producers, with each company's position on the petition, U.S. production activities, production locations, and the share of reported January-September 1998 production of uncased and cased DRAMs.

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[1] In its most recent investigation concerning DRAMs, *DRAMs of One Megabit and Above From the Republic of Korea (Views on Remand)*, the Commission adopted its original finding from Inv. No. 731-TA-556 (Final), stating (at p. 3) that "there is one domestic industry producing the like product, consisting of all companies that perform some aspect of DRAM production in the United States, but do not include companies that 'only assemble memory modules from purchased DRAMs, whether domestic or foreign, and do not themselves manufacture DRAMs.' "

[2] The Commission had difficulty in collecting accurate data in this investigation because of the complexity of the production process and because most U.S. producers send some portion of their U.S.-fabricated dice to third countries for assembly.

[3] In addition to those companies that perform fabrication or assembly, the Commission also sent producers' questionnaires to nine companies identified by industry directories as independent DRAM module assemblers.

Table III-1
DRAMs: U.S. producers, positions on the petition, shares of Jan.-Sept. 1998 production (in bits) of uncased and cased DRAMs, U.S. production activities, and U.S. production locations

* * * * * * *

Overview of Companies[4]

Micron Technology

Micron Technology, Inc., Boise, ID, the petitioner, *** at its headquarters in Boise, ID. Micron has ***.[5] In addition to DRAMs, Micron also manufactures other semiconductor products ***, including SRAMs and flash memory. In 1995 Micron broke ground on a new fab in Lehi, UT. However, in February 1996, Micron announced that it was postponing indefinitely the completion of this facility. Micron has also reportedly postponed planned expansions at its Boise site. In October 1998, Micron acquired the worldwide DRAM production business of Texas Instruments (TI). This purchase included the TwinStar wafer fab in Richardson, TX. In addition, Micron took possession of TI's fab in Avezzano, Italy; TI's assembly plant in Singapore; and TI's 25-percent stakes in two DRAM fab joint ventures--KTI Semiconductor in Japan (owned by Kobe Steel and TI) and Tech Semiconductor in Singapore (owned by Hewlett-Packard, Cannon, the Singapore Economic Development Board, and TI).

Dominion Semiconductor

Dominion Semiconductor, LLC (Dominion), Manassas, VA, is a joint venture between International Business Machines (IBM) and Toshiba America Electronic Components (Toshiba). Dominion ***.

Fujitsu Microelectronics, Inc.

Fujitsu Microelectronics, Inc. (Fujitsu), San Jose, CA, is a subsidiary of Fujitsu Ltd. of Japan. Fujitsu ***. Fujitsu's parent company, Fujitsu Ltd., is a global producer of DRAMs and DRAM modules. As part of its global operations, Fujitsu Ltd. ***.

Hitachi Semiconductor of America

Hitachi Semiconductor of America (Hitachi), Irving, TX, is a wholly owned subsidiary of Hitachi Ltd. of Japan. Hitachi operated *** in Irving, TX. In September 1998, Hitachi announced the closing of the Irving facilities. ***. Hitachi Ltd. of Japan is a global producer of DRAMs and various other

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[4] According to the petition, 12 firms perform DRAM fabrication in the United States, and only these 12 firms should be considered as the U.S. industry. Contrary to the Commission's determination in *DRAMs of One Megabit and Above from The Republic of Korea*, petitioner argues that companies only performing DRAM assembly in the United States should not be included in the domestic industry. See petitioner's post-conference brief, pp. 11-12.

[5] ***.

semiconductor products. From 1996 to January 1998, Hitachi was a partner in the TwinStar joint venture (see TwinStar).

Hyundai Electronics America

Hyundai Semiconductor America, Inc. (Hyundai), Eugene, OR, is a subsidiary of Hyundai Electronics Industries Co., Ltd. (HEI) of Korea. Hyundai's U.S. production operations consist of ***. HEI maintains DRAM manufacturing facilities in Korea and China as well as the United States.

International Business Machines

International Business Machines Corp. (IBM), Armonk, NY, has a wholly owned wafer fab in Essex Junction, VT, and half ownership in a joint-venture fab with Toshiba in Manassas, VA (see Dominion Semiconductor).[6] In addition, IBM has fabs and/or assembly facilities in Japan, Germany, France, Italy, and Canada. ***.[7]

Matsushita Semiconductor Corp. of America

Matsushita Semiconductor Corp. of America (Matsushita), Puyallup, WA, is the U.S. subsidiary of Matsushita Electric Corp. of Japan. Matsushita ***.[8] Matsushita's parent company also maintains DRAM production facilities in Japan. As part of its global DRAM operations, Matsushita ***.

Mitsubishi Electronics America

Mitsubishi Semiconductor America Inc. (Misubishi), Durham, NC, is the subsidiary of Mitsubishi Electric of Japan. At its Durham facility, Mitsubishi performed ***. Mitsubishi's parent company also operates wholly-owned DRAM production facilities in Japan and Germany. In addition, ***.

NEC Electronics

NEC Electronics (NEC), Santa Clara, CA, is a subsidiary of NEC Corp. of Japan. NEC ***. NEC's parent company also maintains DRAM production facilities in Japan, China, Singapore, the United Kingdom, and Ireland.

Oki Semiconductor Manufacturing

Oki Semiconductor Manufacturing (Oki), Tualatin, OR, is a subsidiary of Oki America, which in turn is a subsidiary of Oki Electric Industry Co. of Japan. Oki's U.S. operations consisted of a ***. Oki's parent company also manufactures DRAMs in Japan.

Samsung Austin Semiconductor, LLC

Samsung Austin Semiconductor, LLC (Samsung), Austin, TX, is *** percent owned by U.S. subsidiaries of Samsung Electronics Co. Ltd. (SEC), of Korea, and *** percent owned by Intel Corp. of

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[6] IBM also has a joint-venture fab with Cirrus Logic in Fishkill, NY. According to IBM, ***.

[7] ***.

[8] ***.

Santa Clara, CA. Samsung operates ***. SEC also has several wafer fabs producing DRAMs, as well as other semiconductor products, in Korea.

Toshiba America Electronic Components, Inc.

Toshiba America Electronic Components, Inc. (Toshiba), Irvine, CA, is a subsidiary of Toshiba America Inc., which in turn is a subsidiary of Toshiba Corp. of Japan. Toshiba ***. Toshiba is also a joint-venture partner in the Dominion wafer fab (see Dominion). In addition, Toshiba of Japan maintains DRAM production facilities in Japan and collaborates in production with ***.

TwinStar Semiconductor, Inc.

TwinStar Semiconductor, Inc. (TwinStar), Richardson, TX, was a joint venture between TI and Hitachi Ltd., that began operations in 1996. In January 1998, TI purchased Hitachi's stake in TwinStar. In June 1998, as part of its buyout of TI's global DRAM business, Micron took possession of the TwinStar facility (see Micron). While under the ownership of TI and Hitachi, and later TI, the TwinStar facility consisted of a DRAM wafer fab. ***. In August 1998, Micron announced that it would convert the TwinStar facility from a wafer fab into a research and development location.

White Oak Semiconductor

White Oak Semiconductor (White Oak), Sandston, VA, is a joint venture between Siemens AG (Siemens) of Germany and Motorola Corp. (Motorola) of Schaumburg, IL. White Oak concluded construction of its production facility in late 1997, and began shipping DRAMs in August 1998. White Oak is scheduled to produce both DRAMs, of which Siemens will take possession, and SRAMs, of which Motorola will take possession. Currently, White Oak is in the process of ramping up production and is only fabricating DRAMs. In addition to a wafer fab, the White Oak facility also includes a wafer assembly plant. Though at one time a U.S. DRAM producer, Motorola has since exited the DRAM business (circa 1991) and did not produce DRAMs in the United States during the period of investigation. Siemens is a global DRAM producer with facilities in Europe and Asia. As part of its global operations, Siemens is a partner in a joint-venture wafer fab, ProMOS, in Taiwan with Mosel Vitelic.

IMPORTS RELATIVE TO PRODUCTION

Data relating to subject imports relative to production of U.S. producers are presented in table III-2.

Table III-2
DRAMs and DRAM modules: Certain U.S. "domestic production," certain subject "imports" by U.S. producers, and ratio of "imports" to "domestic production," by firms, 1995-97, Jan..-Sept. 1997, and Jan-Sept. 1998.

* * * * * * *

U.S. PRODUCTION, CAPACITY, AND CAPACITY UTILIZATION

U.S. producers' capacity, production, and capacity utilization data for DRAMs and DRAM modules are presented in table III-3. U.S. production data, by firms, of DRAMs and DRAM modules are presented in table III-4 and appendix E.

U.S. PRODUCERS' DOMESTIC SHIPMENTS

Data on U.S. producers' shipments of DRAMs and DRAM modules are presented in table III-5.

U.S. PRODUCERS' INVENTORIES

Data on U.S. producers' inventories of DRAMs and DRAM modules are presented in table III-6.

U.S. EMPLOYMENT, WAGES, AND PRODUCTIVITY

U.S. producers' employment data for DRAMs and DRAM modules are presented in table III-7.

CAPTIVE CONSUMPTION BY U.S. PRODUCERS

Based on questionnaire responses, captive consumption of DRAMs by U.S. producers is estimated to account for approximately 10 percent of domestic production by volume. *** reported a captive consumption rate of *** percent, by far the highest among U.S. producers. *** reported a captive consumption rate of *** percent, and *** reported *** percent. All other U.S. producers that responded reported captive consumption rates of *** percent or less. Items cited as downstream products for captive DRAM consumption include ***.

Table III-3
DRAMs and DRAM modules: U.S. average-of-period capacity, production,[1] and capacity utilization, by products, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
Uncased DRAMs:					
Capacity[2] (*1,000 wafers*)	1,696	1,628	1,875	1,404	1,494
Wafer starts (*1,000 wafers*)[3]	1,591	1,650	1,906	1,389	1,393
Capacity utilization (*percent*)	90.8	97.9	98.0	99.0	93.2
Cased DRAMs:					
Capacity[4] (*1,000 units*)	***	***	***	***	***
Assembly (*1,000 units*)[5]	308,317	380,737	406,491	306,504	***
Capacity utilization (*percent*)	92.8	89.3	90.6	90.8	89.4
DRAM modules:					
Capacity (*billion bits*)	***	***	***	***	***
Production[6] (*billion bits*)	***	***	***	***	***
Capacity utilization (*percent*)	98.8	97.3	97.0	96.7	96.9

[1] The "production" presented for uncased DRAMs is wafer starts and that shown for cased DRAMs is assembly. Although cased production data (which was collected by individual densities along with inventory and shipments data and then compiled to get a total for all cased DRAMs) should equal assembly data (which was not collected on a density basis), there may be discrepancies.

[2] *** did not report capacity data. U.S. producers reported wafer capacity data on the basis of 158- to 168-hour work weeks, operating 50 to 52 weeks per year; no basis was provided for the capacity data reported by ***.

[3] Wafer starts represent the number of raw silicon wafers introduced into the DRAM wafer fabrication process and do not account for yield loss. Wafer yield reported by U.S. producers of uncased DRAMs ranged from 39 to 96.6 percent during the period for which data were requested; no wafer yield was supplied by ***.

[4] *** did not report capacity data. U.S. producers reported capacity data on the basis of 144- to 168-hour work weeks, operating 50 to 52 weeks per year.

[5] *** did not report assembly data. Cased DRAM assembly represents the successful assembly of DRAMs.

[6] DRAM module assembly represents the successful assembly of DRAM modules.

Note.--Capacity utilization is calculated from unrounded figures, using data of firms providing both capacity and production information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table III-4
DRAMs and DRAM modules: U.S. production, by products and by firms,[1] 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Production (*billion bits*)				
Uncased DRAMs	1,482,033	3,231,479	6,723,030	4,912,809	9,992,778
Cased DRAMs	1,281,374	2,564,909	***	***	***
DRAM modules	***	***	***	***	***

[1] Data of individual firms are not publishable, and have been removed.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table III-5
DRAMs and DRAM modules: Shipments of "domestic" product[1] by U.S. producers and importers, by types, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
			Quantity (*billion bits*)		
U.S. company transfers[2]	189,735	367,483	***	***	896,652
Domestic shipments[3]	953,198	1,744,883	***	***	5,489,286
U.S. shipments	1,142,933	2,112,366	4,365,518	3,010,040	6,385,939
"Drop shipments"[4]	***	***	***	***	***
Other exports[5]	***	***	***	***	***
All exports	664,314	1,151,694	2,887,294	1,980,596	4,375,107
All shipments	1,807,247	3,264,060	7,252,812	4,990,636	10,761,045
			Value (*1,000 dollars*)		
U.S. company transfers[2]	532,182	410,116	388,781	306,099	143,832
Domestic shipments[3]	3,153,331	1,786,280	1,560,846	1,270,840	1,073,794
U.S. shipments	3,685,513	2,196,396	1,949,627	1,576,939	1,217,626
"Drop shipments"[4]	***	***	***	***	***
Other exports[5]	***	***	***	***	***
All exports	1,910,044	1,081,555	1,072,182	832,308	755,978
All shipments	5,595,557	3,277,951	3,021,809	2,409,247	1,973,604
			Unit value (*per million bits*)		
U.S. company transfers[2]	$2.80	$1.12	$***	$***	$0.16
Domestic shipments[3]	3.31	1.02	***	***	.20
U.S. shipments	3.22	1.04	.45	.52	.19
"Drop shipments"[4]	***	***	***	***	***
Other exports[5]	***	***	***	***	***
All exports	2.88	.94	.37	.42	.17
All shipments	3.10	1.00	.42	.48	.18

[1] Includes all DRAMs and DRAM modules made from U.S.-fabricated dice, regardless of where assembled, plus dice fabricated in 3rd sources but assembled in the United States.

[2] To avoid double counting, data exclude internal transfers of DRAM products to cased DRAMs and DRAM modules.

[3] To avoid double counting, data exclude non-import purchases of DRAM products to be used in the production of cased DRAMs and DRAM modules

[4] "Drop shipments" reported by producers are shipments to other-than-U.S. markets of product containing U.S. dice that have been assembled by the producers' foreign affiliates/subcontractors.

[5] "Other exports" include all reported exports of cased DRAMs and DRAM modules as well as uncased DRAMs exported to non-affiliates.

Note.--Because of rounding, figures may not add to the totals shown. Unit values are calculated from the unrounded figures, using data of firms supplying both quantity and value information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table III-6
DRAMs and DRAM modules: End-of-period inventories of "domestic" product,[1] by origin of dice, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Quantity (*billion bits*)				
Uncased DRAMs	***	***	***	***	***
Cased DRAMs made from--					
U.S. dice (regardless of where assembled)	***	***	***	***	***
3rd-source dice assembled in the United States	***	***	***	***	***
Total	85,729	232,507	453,603	620,472	484,891
DRAM modules made from--					
U.S. dice (regardless of where assembled)	***	***	***	***	***
3rd-source dice assembled in the United States	***	***	***	***	***
Total	***	***	***	***	***
DRAMs and DRAM modules made from--					
U.S. dice (regardless of where assembled)[2]	***	332,273	580,293	***	800,642
3rd-source dice assembled in the United States	***	32,123	54,742	***	85,997
Total	124,168	364,396	635,034	774,267	886,639
	Ratio to total shipments, on the basis of bits (*percent*)				
Uncased DRAMs	1.1	2.1	0.9	0.9	1.4
Cased DRAMs, average	6.0	8.1	7.0	8.2	3.2
DRAM modules, average	4.5	6.6	4.8	2.5	2.9

[1] "Domestic" product includes U.S.-fabricated uncased DRAMs, cased DRAMs and DRAM modules made from U.S.-fabricated dice (regardless of assembly location), and U.S.-assembled cased DRAMs and DRAM modules made from 3rd-source-fabricated dice.
[2] Includes uncased DRAMs.

Note.--Because of rounding, figures may not add to the totals shown. Ratios are calculated from the unrounded figures, using data of firms supplying both numerator and denominator information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table III-7
Average number of U.S. production and related workers producing DRAMs and DRAM modules, hours worked[1] by, and wages paid to such employees, and hourly wages, productivity, and unit production costs,[2] by products, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Number of production and related workers (PRWs)				
Uncased DRAMs	7,243	8,140	8,812	7,821	8,549
Cased DRAMs	4,028	3,906	***	***	***
DRAM modules	152	140	***	***	***
Total	11,423	12,186	14,234	12,906	13,983
	Hours worked by PRWs (*1,000 hours*)				
Uncased DRAMs	18,273	18,143	17,048	12,924	13,561
Cased DRAMs	***	***	***	***	***
DRAM modules	***	***	***	***	***
Total	29,090	27,726	28,800	21,515	22,740
	Wages paid to PRWs (*1,000 dollars*)				
Uncased DRAMs	365,210	357,327	327,977	246,437	269,886
Cased DRAMs	***	***	***	***	***
DRAM modules	***	***	***	***	***
Total	568,322	525,620	538,764	396,455	427,119
	Hourly wages paid to PRWs				
Uncased DRAMs	$19.99	$19.69	$19.24	$19.07	$19.90
Cased DRAMs	19.07	17.90	17.96	17.50	17.28
DRAM modules	10.08	9.24	17.76	17.21	16.18
Average	19.54	18.96	18.71	18.43	18.78
	Productivity (*million bits per hour*)				
Uncased DRAMs	82.4	181.6	421.2	397.0	709.1
Cased DRAMs	121.3	277.7	581.0	580.2	972.5
DRAM modules	985.8	2,008.5	1,445.1	1,321.9	2,517.8
	Unit production costs (*per million bits*)				
Uncased DRAMs	$0.24	$0.11	$0.05	$0.05	$0.03
Cased DRAMs	.16	.06	.03	.03	.02
DRAM modules	.01	3/	.01	.01	.01

[1] Includes hours worked plus hours of paid leave time.
[2] On the basis of wages paid.
[3] Less than 0.5 cent.

Note.--Because of rounding, figures may not add to the totals shown. Ratios are calculated using data of firms supplying both numerator and denominator information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

PART IV: U.S. IMPORTS, APPARENT CONSUMPTION, AND MARKET SHARES

U.S. IMPORTERS

The Commission sent importer questionnaires to over 100 U.S. companies that were believed to fabricate, assemble, import, or distribute DRAMs or DRAM modules. Twenty-five companies provided the Commission with data on U.S. imports for the period January 1995-September 1998. Table IV-1 presents a list of major U.S. importers.

U.S. IMPORTS, CONSUMPTION, AND MARKET SHARES

For purposes of presentation in this report, imports of products containing U.S.-fabricated dice, regardless of the source of assembly or export, are considered "domestic" product and not imports. A number of U.S. fabricators ship uncased U.S.-fabricated dice overseas for assembly, with much of the assembled product being shipped back to the United States. For the purposes of this report, these shipments are not classified as "imports."

U.S. import data presented in the body of the report are based on data compiled from questionnaires of the Commission, unless otherwise noted. Official statistics are not being used in the body of the report because the U.S. Customs Service has determined that the country of origin of imported DRAMs is the location of assembly rather than the location of wafer fabrication. This differs from Commerce's scope language, which states that the origin of imports from Taiwan should be determined by the source of dice fabrication regardless of where final assembly takes place.

Table IV-2 presents U.S. imports of DRAMS and DRAM modules as reported by respondents to the Commission's questionnaires. Table IV-3 presents shipments of "domestic" and "imported" product, and table IV-4 presents apparent U.S. consumption and market shares of DRAMs and DRAM modules. Additional questionnaire data on U.S. imports, by sources and by origin of dice, are shown in table E-4 in appendix E. Official U.S. import statistics are presented in appendix F.

Table IV-1
DRAMs and DRAM modules: U.S. imports, by firms, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

* * * * * * *

Table IV-2
DRAMs and DRAM modules: U.S. "imports,"[1] by origin of dice, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Quantity (*billion bits*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	***	431,124	936,708	582,824	1,404,395
Nonsubject Taiwan dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Total, all "imports"	3,568,899	7,173,966	14,258,714	9,740,686	19,367,959
	Value (*1,000 dollars*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	***	387,105	378,667	240,200	290,004
Nonsubject Taiwan dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Total, all "imports"	10,471,363	7,747,490	5,869,883	4,403,156	3,042,152
	Unit value (*per million bits*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	$3.51	$0.90	$0.40	$0.41	$0.21
Nonsubject Taiwan dice	***	68.09	14.08	14.08	8.94
3rd-source dice	2.92	1.09	.41	.45	.15
Average, all "imports"	2.93	1.08	.41	.45	.16
	Share of total quantity (*percent*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	***	6.0	6.6	6.0	7.3
Nonsubject Taiwan dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Total, all "imports"	100.0	100.0	100.0	100.0	100.0
	Share of total value (*percent*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	***	5.0	6.5	5.5	9.5
Nonsubject Taiwan dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Total, all "imports"	100.0	100.0	100.0	100.0	100.0

[1] "Imports" include all uncased and cased DRAMs, and DRAM modules, but do not include imports of such products containing U.S.-fabricated dice.

Note.–"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd-source" refers to countries other than the United States and Taiwan. Because of rounding, figures may not add to the totals shown. Unit values and shares are calculated from the unrounded figures; unit values are calculated, using data of firms supplying both quantity and value information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table IV-3
DRAMs and DRAM modules: U.S. shipments of "domestic"[1] product, U.S. shipments of "imported"[2] product, and apparent U.S. consumption, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Quantity (*billion bits*)				
U.S. shipments of "domestic" DRAM products made from:					
U.S. dice	968,049	1,830,133	***	***	5,436,146
3rd-source dice assembled in the United States	174,884	282,233	***	***	949,792
Total	1,142,933	2,112,366	4,365,518	3,010,040	6,385,939
U.S. shipments of "imported" DRAM products:					
Subject Taiwan product	***	***	774,211	475,470	1,194,485
Nonsubject Taiwan product	***	***	***	***	***
3rd-source product	***	***	***	***	***
Total, all imports	2,991,984	5,454,765	11,190,801	7,542,754	15,653,638
Apparent consumption	4,134,916	7,567,131	15,556,320	10,552,794	22,039,577
	Value (*1,000 dollars*)				
U.S. shipments of "domestic" DRAM products made from:					
U.S. dice	3,170,215	1,906,428	1,665,958	1,339,611	1,101,734
3rd-source dice assembled in the United States	515,298	289,968	283,669	237,328	115,892
Total	3,685,513	2,196,396	1,949,627	1,576,939	1,217,626
U.S. shipments of "imported" DRAM products:					
Subject Taiwan product	***	***	310,664	197,243	237,023
Nonsubject Taiwan product	***	***	***	***	***
3rd-source product	***	***	***	***	***
Total, all imports	9,475,522	5,729,192	4,883,026	3,618,336	2,699,864
Apparent consumption	13,161,036	7,925,588	6,832,653	5,195,275	3,917,490

[1] "Domestic" product includes DRAMs and DRAM modules made from U.S.-fabricated dice, regardless of assembly location, and U.S.-assembled cased DRAMs and DRAM modules made from DRAMs that were fabricated in countries other than the United States and Taiwan. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

[2] "Imported" product includes DRAMs and DRAM modules made from Taiwan-fabricated dice (regardless of assembly location) and 3rd-source-fabricated dice assembled outside the United States. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

Note.–"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd source" refers to countries other than Taiwan and the United States. Because of rounding, figures may not add to the totals shown.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table IV-4
DRAMs and DRAM modules: Apparent U.S. consumption and market shares, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Apparent consumption				
Quantity (*billion bits*)	4,134,916	7,567,131	15,556,320	10,552,794	22,039,577
Value (*1,000 dollars*)	13,161,036	7,925,588	6,832,653	5,195,275	3,917,490
	Share of the quantity of U.S. consumption (*percent*)				
U.S. shipments of "domestic"[1] DRAM products made from:					
U.S. dice	23.4	24.2	***	***	24.7
3rd-source dice assembled in the United States	4.2	3.7	***	***	4.3
Total	27.6	27.9	28.1	28.5	29.0
U.S. shipments of "imported"[2] DRAM products:					
Subject Taiwan product	***	***	5.0	4.5	5.4
Nonsubject Taiwan product	***	***	***	***	***
3rd-source product	***	***	***	***	***
Total, all imports	72.4	72.1	71.9	71.5	71.0
	Share of the value of U.S. consumption (*percent*)				
U.S. shipments of "domestic"[1] DRAM products made from:					
U.S. dice	24.1	24.1	24.4	25.8	28.1
3rd-source dice assembled in the United States	3.9	3.7	4.2	4.6	3.0
Total	28.0	27.7	28.5	30.4	31.1
U.S. shipments of "imported"[2] DRAM products:					
Subject Taiwan product	***	***	4.5	3.8	6.1
Nonsubject Taiwan product	***	***	***	***	***
3rd-source product	***	***	***	***	***
Total, all imports	72.0	72.3	71.5	69.6	68.9

[1] "Domestic" product includes DRAMs and DRAM modules made from U.S.-fabricated dice, regardless of assembly location, and U.S.-assembled cased DRAMs and DRAM modules made from DRAMs that were fabricated in countries other than the United States and Taiwan. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

[2] "Imported" product includes DRAMs and DRAM modules made from Taiwan-fabricated dice (regardless of assembly location) and 3rd-source-fabricated dice assembled outside the United States. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

Note.–"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd source" refers to countries other than Taiwan and the United States. Because of rounding, figures may not add to the totals shown; shares are computed from the unrounded figures.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

PART V: PRICING AND RELATED INFORMATION

FACTORS AFFECTING PRICES

Raw Material Costs

The primary raw materials in the production of DRAM semiconductors are silicon wafers, sawn from a single cylindrical crystal. These wafers range in size from 5 to 8 inches in diameter. Important determinants of raw material costs include the size of the dice and the yield, or proportion of starts that reach the final test stage prior to assembly. Raw materials cost is a very small share of total cost. However, the number of saleable DRAMs per wafer is an important determinant of average cost.

Yield, or the percentage of good dice, is generally expected to average approximately 90 percent after ramping-up periods.[1] The average reported yield for domestic producers was *** percent. The only reporting U.S. producers with yield less than 80 percent in interim 1998 were ***. ***. Fabricators in Taiwan with reported yield less than 80 percent were ***. ***.

Transportation Costs to the U.S. Market

Subject DRAMs are classified under subheading 8542.13.80 of the HTS. Also included in this investigation are memory modules containing DRAMs of 1 Meg density or greater which may be classified under subheadings 8473.30.10 through 8473.30.90. These are categories which include a wide variety of parts and accessories for automatic data processing machines.

Transportation costs, for both domestic inland freight and overseas shipments, are a very small share of the overall cost of DRAMs. Average freight and insurance costs for DRAMs of 1 Meg or more from Taiwan in 1997 (not including memory modules) were 0.29 percent of the customs value. Freight and insurance costs were calculated as the difference between the c.i.f. value and the customs value, expressed as a percentage of the customs value.

U.S. Inland Transportation Costs

Most producers and importers reported that U.S. inland transportation costs were 1 percent or less of the total delivered cost of DRAMs. Most domestic producers and importers ship f.o.b. warehouse, with the purchaser paying freight. Because transportation costs are a small share of total costs, geographic location did not seem to be important for most producers and importers. Most reported selling in the entire domestic market with no geographic limitations.

Exchange Rates

Over the period of investigation the value of the Taiwan NT dollar has fallen with respect to the U.S. dollar (figure V-1). The value of the Taiwan NT dollar fell gradually from a high in the second quarter of 1995 to a low in the third quarter of 1997. In the 9 months between the third quarter of 1997

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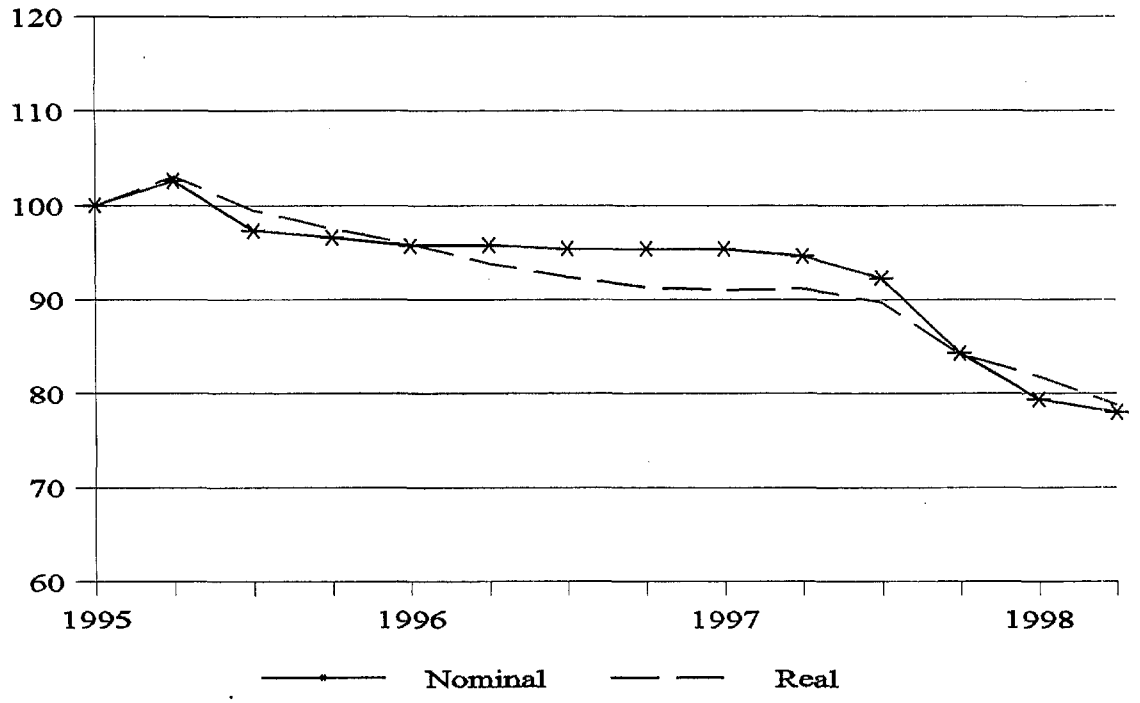
[1] Conference transcript, p. 16.

and the second quarter of 1998, the value of the Taiwan NT dollar fell 15.5 percent in nominal terms, and 12.2 percent in real terms in comparison to the U.S. dollar (Jan. 1995=100).

Figure V-1
Exchange rates: Indices of the nominal and real exchange rates of the Taiwan NT dollar relative to the U.S. dollar, by quarters, Jan. 1995-June 1998



Source: International Monetary Fund, *International Financial Statistics*, Oct. 1998. And The Central Bank of China, *Financial Statistics: Taiwan District, the Republic of China*, July 1998.

PRICING PRACTICES

Pricing Methods

Domestic producers sold a greater share of DRAMs on contract than did importers of DRAMs from Taiwan. Sales under contract for domestic producers *** were reported to be *** percent of each firm's total sales, respectively. Sales prices were reported to be negotiated frequently. Domestic producer Dominion produces DRAMs ***. Importers of DRAMs from Taiwan generally reported a small share of sales under contract. The exceptions were ***, each with roughly half of their sales under contract, and ***, with almost all sales under contract. Five of 11 importers of DRAMs from Taiwan reported no sales under contract, and a sixth (***) reported only *** percent of sales under contract. Sales were generally quoted f.o.b. warehouse, with freight paid by the purchaser.

Sales Terms and Discounts

Sales terms were generally reported to be net 30 days, but some importers reported that some sales on the spot market were paid in advance of shipment. Both domestic producers and importers reported that prices were generally negotiated on a transaction-by-transaction basis rather than having fixed discounts.

PRICE DATA

Domestic producers and importers were asked to provide monthly price and quantity data on all sales in the U.S. market of four products, from January 1995 through September 1998. Products chosen included three 16 Meg DRAMs and one 4 Meg DRAM. A 64 Meg DRAM was not included because sales over the period of investigation were limited. Quantities were reported in units, and sales volumes in dollars. The products chosen were:

Product 1:	**16 Megabit DRAM, 4 x 4, EDO**
Product 2:	**16 Megabit SDRAM, 2 x 8, Synchronous**
Product 3:	**16 Megabit SDRAM, 1 x 16, Synchronous**
Product 4:	**4 Megabit DRAM, 256K x 16, EDO**

Five U.S. producers and 11 importers provided useable data on at least one product.[2] There were no reported imports of product 3, and therefore price trends and comparisons are not discussed for this product. There were some limited imports of product 1 beginning in 1996, but the majority of sales took place in 1997 and 1998. Sales of imported product 2 from Taiwan began in late 1997. The three products for which price comparisons were possible accounted for 49.4 percent of total U.S. DRAM shipments by reporting producers on a bit basis in interim 1998. Sales of these three products by reporting importers accounted for 33.5 percent of total U.S. DRAM shipments by reporting importers in interim 1998.

Price Trends

The prices of all products trended sharply down over the period of investigation, consistent with the DRAM life cycle noted in previous investigations.[3] Production costs and selling prices fall for each new generation of DRAM as producers move along the learning curve, increasing production and yield. Prices increased in mid-1997, then fell rapidly through mid-1998. In the last 2 months for which data were collected, prices for 16 Meg DRAMs (products 1 and 2) increased slightly.

Price Comparisons

Prices for product 1 first declined, then increased slightly in early 1997, and have dropped sharply since mid-1977, for both domestic products and those fabricated in Taiwan. Product 1 fabricated in Taiwan has generally been priced lower than product 1 fabricated domestically since mid-1997, except for November 1997 (tables V-1 and V-4). There were fewer sales of product 2, both produced domestically

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[2] Reported sales of all four products in interim 1998 were 414.9 million units.

[3] *DRAMs of One Megabit and Above From the Republic of Korea*, Inv. No. 731-TA-556 (Final), p. 17, and *DRAMs of One Megabit and Above From the Republic of Korea (Views on Remand)*, Inv. No. 731-TA-556 (Remand), pp. 6-7.

and imported from Taiwan. Since mid-1997, in the months for which sales were reported, product 2 fabricated in Taiwan has generally sold for higher prices than the domestically produced product (tables V-2 and V-5).

Product 4, a 4 Meg DRAM, was the only product for which sales of the domestic product and DRAMs produced in Taiwan could be compared for the entire period of investigation. During the first 3 months of 1995 there were no sales of product 4 produced in Taiwan. For each of the next 7 months DRAMs from Taiwan sold at a higher price than those produced domestically. The margins of overselling ranged from *** percent. In each of the following months, product 4 fabricated in Taiwan sold for a lower price than that fabricated by domestic producers (tables V-3 and V-6).

Annual reported U.S. sales, along with instances and margins of over- or underselling of products 1, 2, and 4 are reported in tables V-1 through V-3. Monthly U.S. sales and average unit value of products 1, 2 and 4 fabricated in the United States and in Taiwan, and margins of underselling are reported in tables V-1 through V-3. Appendix G contains graphs of price trends and margins.

Table V-1
DRAMs: Volume of U.S. sales of product 1 fabricated in the United States and in Taiwan, and instances and range of margins of under- and overselling, 1995-97 and Jan.-Sept. 1998

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Table V-2
DRAMs: Volume of U.S. sales of product 2 fabricated in the United States and in Taiwan, and instances and range of margins of under- and overselling, 1995-97 and Jan.-Sept. 1998

* * * * * * *

Table V-3
DRAMs: Volume of U.S. sales of product 4 fabricated in the United States and in Taiwan, and instances and range of margins of under- and overselling, 1995-97 and Jan.-Sept. 1998

* * * * * * *

Table V-4
DRAMs: Quantity and average selling price of product 1 fabricated in the United States and in Taiwan and margin of underselling, by months, Jan. 1997-Sept. 1998

* * * * * * *

Table V-5
DRAMs: Quantity and average selling price of product 2 fabricated in the United States and in Taiwan and margin of underselling, by months, Jan. 1997-Sept. 1998

* * * * * * *

Table V-6
DRAMs: Quantity and average selling price of product 4 fabricated in the United States and in Taiwan and margin of underselling, by months, Jan. 1995-Sept. 1998

* * * * * * *

LOST SALES AND LOST REVENUES

In the petition, Micron did not provide information regarding specific instances of lost sales or revenue, but stated that, "Petitioner and other U.S. producers have lost significant volumes of sales due to low-priced imports of DRAMs from Taiwan, as can be seen by the declining revenues of U.S. producers and increasing market share of subject imports. Anecdotal information of individual lost sales is rarely available to petitioner, because petitioner is rarely informed of the source from which competing DRAMs were purchased, or, indeed, that competing DRAMs were purchased at all. The U.S. producers only see the end results."[4]

Nevertheless, in its response to the producer's questionnaire in this investigation, Micron submitted a list of 21 sales (involving 16 customers) allegedly lost to DRAMs imported from Taiwan. The alleged lost sales totaled ***. Micron also submitted a list of 61 lost revenue allegations involving 9 firms (51 of these allegations concerned sales to ***). The lost revenue allegations totaled approximately ***. All of these lost sales and lost revenue allegations occurred prior to the filing of Micron's petition on October 22, 1998.[5] Commission staff has not contacted any of the purchasers involved in these lost sales/lost revenues allegations by the petitioner. In the Commission's recent investigations concerning *Elastic Rubber Tape From India*, it stated that:[6]

> "For purposes of these preliminary determinations, we have not considered the lost sale and lost revenue allegations that were omitted from the petition. Commission rules 207.11(b)(2)(v) and (3) require the listing of all lost sales and lost revenue allegations in the petition, or a certification that the facts underlying these lost allegations were not reasonably available to petitioners. As we have previously stated, where a petitioner is a domestic producer of the product at issue, lost sales allegations covering the period up until the filing of the petition must be contained in the petition. Certain Carbon Steel Wire Rod from Canada, Germany, Trinidad & Tobago, and Venezuela, Invs. Nos. 731-TA-763-766 (Preliminary), USITC Pub. 3037 (April 1997) at 26, n. 152. Petitioners included neither the information nor the certification required by our rules, and we instead obtained these additional allegations in the domestic producer questionnaire responses. As a consequence, the Commission was unable to contact a number of the purchasers named in the allegations contained only in the questionnaire responses."

One other domestic producer, ***, stated that it had lost sales and revenue due to lower priced DRAMs fabricated in Taiwan, but was unable to provide information on specific instances. *** indicated

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[4] Petition, p. 25.

[5] Of the 21 lost sales allegations, 14 occurred in 1996, 2 in 1997, and 5 in January-March 1998. Of the 61 lost revenue allegations, 4 occurred in 1996, 7 in 1997, and 50 from Jan. 1 to Oct. 14, 1998.

[6] *Elastic Rubber Tape From India*, Invs. Nos. 701-TA-383 and 731-TA-805 (Preliminary), USITC Pub. 3133, October 1998, pp. 11-12.

that they had reduced prices in order to avoid losing sales to competitors selling DRAMs from Taiwan, but also were unable to provide information on specific instances.

PART VI: FINANCIAL CONDITION OF THE U.S. INDUSTRY

BACKGROUND

Ten producers[1] provided financial data on their DRAM operations.[2] One fabless[3] producer provided capital expenditures and R&D expenses. One assembler of modules provided its results of operations (appendix H).[4]

Financial data include cased and uncased DRAMs, modules containing DRAMs, and various densities of DRAMs. Because of the mix of products, quantities sold have little correlation with financial performance on a per-unit basis and thus were not requested in the financial section of the questionnaire.

OPERATIONS ON DRAMS

The results of the U.S. producers' DRAM operations are presented in table VI-1. The combined companies' net sales value decreased in each comparative period. The combined companies realized decreasing operating income in 1996 compared to 1995 and increasing operating losses from 1997 to interim 1998, resulting in an operating income margin of 50.8 percent in 1995 but an operating loss margin of (77.5) percent in interim 1998.

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[1] The producers with fiscal yearends other than Dec. 31 are ***.

[2] The companies were requested to report domestic and export sales and transfers of DRAMs and DRAM modules produced from wafers and dice fabricated in the United States, regardless of assembly location, plus foreign dice assembled in the United States. ***.

[3] Fabless producers are defined as U.S. firms that do not engage in actual wafer fabrication, but rather design the wafer and purchase the fabricated wafer product of DRAM foundries. ***.

[4] ***.

Table VI-1
Results of U.S. producers on their DRAM operations, fiscal years 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	Fiscal year			Jan.-Sept.	
	1995	1996	1997	1997	1998
	Value (*$1,000*)				
Net sales:					
Trade sales	3,841,269	2,670,035	2,118,882	1,772,710	1,207,440
Company transfers	1,216,278	771,074	582,905	471,626	345,395
Total sales	5,057,547	3,441,109	2,701,787	2,244,336	1,552,835
Cost of goods sold	2,122,703	2,551,589	2,794,075	2,055,241	2,369,672
Gross profit	2,934,844	889,520	(92,288)	189,095	(816,837)
Operating expenses	363,560	396,917	410,303	320,687	386,815
Operating income or (loss)	2,571,284	492,603	(502,591)	(131,592)	(1,203,652)
Interest expense (1)	13,677	19,345	66,792	30,218	97,011
Other expense (1)(2)	133,035	96,739	***	***	42,529
Other income items (1)(3)	69,425	113,008	***	***	41,462
Net income or (loss)	2,493,997	489,527	(638,441)	30,914	(1,301,730)
Depreciation/amortization	444,547	678,939	833,869	584,117	755,037
Cash flow	2,938,544	1,168,466	195,428	615,031	(546,693)
	Ratio to net sales (*percent*)				
Cost of goods sold	42.0	74.2	103.4	91.6	152.6
Gross profit	58.0	25.9	(3.4)	8.4	(52.6)
Operating expenses	7.2	11.5	15.2	14.3	24.9
Operating income or (loss)	50.8	14.3	(18.6)	(5.9)	(77.5)
Net income or (loss)	49.3	14.2	(23.6)	1.4	(83.8)
	Number of firms reporting				
Operating losses (4)	0	5	7	7	9
Data (4)	7	8	8	8	10

(1) Interest expense, other expense, and other income items are not comparable from period to period because ***.
(2) The large other expense in 1997 is due primarily to a ***.
(3) The large other income in 1997 and interim 1997 "relates primarily to the ***."
(4) The number of firms reporting is based on net sales. ***.

Source: Compiled from data submitted in response to Commission questionnaires.

Table VI-2 presents selected financial data by firm, and illustrates some of the similarities and differences among the producers. ***.[5] ***.

Table VI-2
Selected financial data of U.S. producers on their DRAM operations, by firm, fiscal years 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

* * * * * * *

CAPITAL EXPENDITURES, RESEARCH AND DEVELOPMENT EXPENSES, AND INVESTMENT IN PRODUCTIVE FACILITIES

The U.S. producers' capital expenditures, research and development expenditures, and the value of their fixed assets are presented in table VI-3.[6]

Table VI-3
Capital expenditures, research and development expenditures, and assets utilized by U.S. DRAM producers, fiscal years 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	Fiscal year			Jan.-Sept.	
	1995	1996	1997	1997	1998
	Value (*$1,000*)				
Capital expenditures (1)(2)	1,437,569	2,934,846	1,696,373	1,830,029	1,052,646
R&D expenses (3)	***	***	***	***	***
Fixed assets: (2)(4)					
Original cost	3,180,826	5,597,753	6,675,464	6,314,521	7,209,651
Book value	1,973,650	4,017,553	4,687,622	4,338,622	4,657,412

(1) The producers are ***.
(2) Capital expenditures and the original cost and book value may not be comparable because of the ***.
(3) The producers are ***.
(4) The producers are ***.

Source: Compiled from data submitted in response to Commission questionnaires.

[5] ***.
[6] ***.

The producers were requested to identify the source(s) of funds for their capital expenditures, the extent to which reported R&D expenditures are dependent on parent company approval, and the share of R&D that is undertaken by their parent company. *** did not respond; the responses of the other companies *** are as follows:

***.[7] ***.[8]

CAPITAL AND INVESTMENT

The producers' comments regarding any actual or potential negative effects of imports of DRAMs from Taiwan on their firms' growth, investment, ability to raise capital, and/or development and production efforts (including efforts to develop a derivative or more advanced version of the product) are presented in appendix I.

[7] ***.

[8] ***.

PART VII: THREAT CONSIDERATIONS

The Commission analyzes a number of factors in making threat determinations (see 19 U.S.C. § 1677(7)(F)(i)). Information on the volume and pricing of imports of the subject merchandise is presented in parts IV and V; and information on the effects of imports of the subject merchandise on U.S. producers' existing development and production efforts is presented in part VI. The available information on inventories of the subject merchandise; foreign producers' operations, including the potential for "product-shifting;" any other threat indicators, if applicable; and any dumping in third-country markets, follows.

The Commission sent foreign producer's questionnaires, either directly or through counsel, to all Taiwan DRAM producers cited in the petition. Responses were received from nine producers in Taiwan and four firms identified as design houses. Information on DRAM operations in Taiwan was also received from the American Institute in Taiwan (AIT).

THE INDUSTRY IN TAIWAN

According to the petitioner, 11 firms fabricate DRAMs in Taiwan: Acer Semiconductor Manufacturing, Inc. (Acer); Macronix International Co., Ltd. (Macronix); Mosel-Vitelic, Inc.; Nan Ya Technology Corp. (Nan Ya); Powerchip Semiconductor Corp. (Powerchip); ProMOS Technologies (ProMOS); Taiwan Semiconductor Manufacturing Corp. (TSMC); United Microelectronics Corp. (UMC); United Semiconductor Corp. (USC); Vanguard International Semiconductor Corp. (Vanguard); and Winbond Electronics Corp. (Winbond).[1] The petitioner also identified the following four "fabless" design houses believed to be engaged in DRAM production through subcontract work placed in fabrication foundries[2] in Taiwan: Alliance Semiconductor Corp. (Alliance), Etron Technology, Inc. (Etron), G-Link Technology Corp. (G-Link), and Taiwan Memory Technology. In a post-conference brief submitted by the respondents, Mosel-Vitelic, Nan Ya, and Vanguard were further distinguished as tier-two companies producing DRAMs based on indigenous designs and technology. ***[3] were identified as tier-one manufacturers that fabricate dice on behalf of third parties based on the outside companies' designs and technology. *** were noted by the respondents as engaged in tier-one production; however, the respondents noted that these companies may also be considered tier-two suppliers, as a portion of their production of DRAMs is reportedly based on Taiwan-developed designs.

According to information obtained from the AIT, Taiwan's integrated circuit (IC) industry developed in the early 1980s. The industry gained early technological and personnel support from Taiwan-based research organizations and later expanded upon a foundation of related industries in Taiwan, including

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[1] In its post-conference brief, the petitioner further distinguished the following firms as "DRAM-dedicated facilities:" Acer, Macronix, Mosel-Vitelic, Nan Ya, Powerchip, ProMOS, Vanguard, and Winbond. The petitioner identified TSMC, UMC, and USC (a joint venture between UMC, Alliance, and S3, Inc.) as foundry producers of DRAMs.

[2] A foundry is a company whose primary business is to act as a contract producer by processing wafers on behalf of third parties, rather than offering their own products. As explained at the conference, Taiwan foundries process DRAMs with technology and designs supplied and owned by their foundry partners.

[3] ProMOS, a joint-venture operation owned by Mosel Vitelic and Siemens AG, manufactures DRAMs but does not export to the United States. U.S. Department of State telegram 4811 from the American Institute in Taiwan, Nov. 17, 1998.

personal computer manufacturers and other information technology producers. Initially focused on consumer electronics, Taiwan's IC industry now primarily produces application-specific ICs and memory products such as DRAMs and SRAMs. In 1997, DRAM production reportedly rose by 44 percent and accounted for over one-half of the value of Taiwan's total IC production.[4]

During 1989-97, the number of IC manufacturers in Taiwan grew from 6 to 20. Today, these 20 manufacturers, in addition to 3 mask-making firms, 23 assembly firms, and 16 firms involved in testing, make up Taiwan's total IC industry. The total value of production of Taiwan's 20 IC manufacturers reached $5.3 billion in 1997, up nearly 16 percent from 1996. Data pertaining to exports of DRAMs from Taiwan designated Japan, the United States, and Hong Kong as Taiwan's primary export markets in 1997. According to sources in Taiwan, exports of DRAMs are not limited by tariff barriers or other restraint agreements. Taiwan's exports of DRAMs by quantity, value, and country of destination for the period January 1995-August 1998 are presented in table VII-1.[5]

Taiwan's IC producers maintain wafer fabrication facilities that process wafers ranging from 5-inches to 8-inches, and most firms have the capacity to manufacture DRAMs using 0.25-0.35μ (micron) process technology.[6] Estimates by Taiwan's Electronics Research and Service Organization (ERSO) indicate that the production capacity of Taiwan's IC industry grew by 31 percent in 1997 and will increase by another 32 percent in 1998.[7] ERSO reports, however, that Taiwan's IC industry has slowed plans for further expansion in the DRAM sector because of intense global competition in the DRAM market, and that Taiwan's IC industry investment dropped by 40 percent from approximately $5.1 billion in 1997 to $3 billion in 1998. At the same time, according to the Taiwan Semiconductor Industry Association, Taiwan's IC industry plans to invest $53 billion over the next decade to construct 29 8-inch and 12-inch wafer fabrication plants to produce IC products. A report published in September 1998 by Taiwan's Ministry of Economic Affairs states that it is likely that until 2000 the average growth rate in the semiconductor industry will remain at the 15-20 percent level.

The following information, taken from testimony and submissions by both the petitioner and respondents, outlines Taiwan producers' future capacity for the production of DRAMs, the potential for product shifting, and the availability of export markets other than the United States for Taiwan-fabricated memory products.

According to the petitioner, during 1998-99 Taiwan's DRAM producers will add capacity of 85,000 wafers per month with the opening of new facilities built by Acer, ProMOS, Winbond, and Nan Ya.[8] Citing published sources, the petitioner notes that in 1999, Vanguard plans to add process technology that will

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[4] The telegram from the AIT cited the ratio of the value of DRAMs to the value of total IC production in 1997 as 48 percent, but the data included in the telegram indicate a ratio of 52 percent.

[5] As indicated in table VII-1, ERSO's data for the value of Taiwan's exports of DRAMS in 1995-97, both total and those to the United States, differ markedly from the data shown in the body of the table.

[6] The numerical rating of the process technology refers to the feature or device size that can be attained during fabrication. The smaller (or finer) the feature size, the smaller the size of the entire DRAM. Therefore, smaller feature sizes result in more DRAMs per wafer. Also, smaller feature sizes often result in faster DRAMs.

[7] Although the telegram from the AIT listed 1988 as the year in which Taiwan's IC industry would realize an estimated 32 percent growth in capacity, it is assumed to be a typographical error given the stated increase from the previous year, 1997.

[8] Petition, p. 27.

Table VII-1
DRAMs: Taiwan's exports, by country of destination, 1995-97, Jan.-Aug. 1997, and Jan.-Aug. 1998[1]

Destination	1995	1996	1997	Jan.-Aug. 1997	Jan.-Aug. 1998
	Quantity *(1,000 units)*				
United States	46,019	57,838	39,396	15,225	69,339
Hong Kong	19,068	59,458	33,240	10,031	40,957
Japan	10,279	12,943	42,405	11,017	48,011
Malaysia	2,249	4,166	2,829	899	4,588
Singapore	24,332	25,408	21,589	11,122	12,077
All other	5,672	11,736	7,641	2,109	15,137
Total	107,619	171,549	147,100	50,403	190,109
	Value *($1,000 U.S.)*				
United States	398,352	236,306	129,378	48,979	160,488
Hong Kong	114,721	180,588	124,841	45,951	89,255
Japan	13,686	25,309	199,914	67,648	133,024
Malaysia	16,516	17,505	4,940	1,658	6,478
Singapore	179,100	73,593	47,145	21,282	27,110
All other	37,223	66,402	31,754	6,781	40,173
Total	759,598	599,703	537,972	192,299	456,528

[1] Data include exports of "dynamic random access memory integrated circuits (DRAMs)," classified under subheadings 8542.80.90.10.1 (1995) and 8542.19.90.20 (1996-98) of Taiwan's tariff schedule. Data for products classified under subheadings 8542.13.80 and 8473.30.10 through 8473.30.90 are not included, as these categories contain information technology products other than DRAMs.

Note: ERSO's data for the value of Taiwan's exports of DRAMs in 1995-97, both total and those to the United States, differ markedly from the data shown above. ERSO reported the following exports (in $1,000 U.S.):

	1995	1996	1997
To the United States----	364,300	310,300	362,100
Total----------	944,956	927,425	1,319,219

Source: Directorate General of Customs of Taiwan, as reproduced in U.S. Department of State telegram 4811 from the American Institute in Taiwan, Nov. 17, 1998.

allow the company to increase by up to 50 percent the number of dice produced per wafer.[9] The petitioner further states that Powerchip will increase the number of wafers it processes per month by 10,000 during 1999-2000, and TSMC will add a new wafer fabrication plant in 1999 capable of processing 60,000 wafers per month.[10] The petitioner further argues that Taiwan's foundry producers, designed to produce a range of memory products, are flexible enough to shift production from other semiconductors to DRAMs and represent an additional potential source of added DRAM capacity.[11] Citing the current economic troubles of many Asian nations, the petitioner estimates that a portion of Taiwan's alleged capacity growth in DRAM fabrication will be directed at the U.S. market.[12]

The respondents argue that the petitioner, in citing the added capacity of Taiwan's IC manufacturers as a potential threat to the U.S. DRAM industry, has not taken into account the type of products that will be manufactured by Taiwan companies.[13] Referencing questionnaire responses submitted by Taiwan's DRAM producers, the respondents noted that many firms plan to reduce production of DRAMs and utilize current and future production resources for the fabrication of memory products other than DRAMs:

> Specifically, *** has indicated that it will ***. *** has ***. *** plans to ***. Macronix' foundry, which started operations in ***. *** has stated that its ***. *** projects a DRAM capacity *** in 1999; it plans to ***. *** capacity allocated to DRAMs from *** percent in 1997 to *** percent in 1998; and plans to *** the capacity allocated to DRAMs to *** percent in 1999.[14]

The respondents further note that the opening of 12-inch wafer fabrication facilities, which potentially will produce roughly twice the number of dice as plants using 8-inch wafers, is likely to be delayed until 2001.[15]

Questionnaire responses provided by *** specify additional planned reductions in DRAM production and investment. ***.[16] *** intends to ***. Separate plans to ***.[17] Concerning the questionnaire responses of all Taiwan producers, in addition to capital, capacity, and technological constraints, firms listed the lack of design, assembly, and test capabilities as factors limiting their production capabilities. Several firms indicated that they have no plans to increase investments to overcome such limitations.[18]

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[9] The petitioner refers to exhibit 20 of its post-conference brief, "Vanguard to Skip Into 0.19-micron Manufacturing Technology for 64M," *China Economic News Service*, Nov. 10, 1998, which states "Based on 0.25-micron technology currently used by local manufacturers . . . an 8-inch wafer can generate 400-500 64 M DRAM. However, the 0.19-micron manufacturing process can turn out more than 600 DRAM."

[10] See petitioner's post-conference brief, exhibit 20, "Powerchip Semiconductor," ING Barings' Co. Report, Oct. 7, 1998; and "New Factory of Taiwan Chip Maker to Start Production Next Year," *Agence France Presse*, June 24, 1998.

[11] Petition, p. 27, and conference transcript, p. 31.

[12] Petitioner's post-conference brief, p. 44.

[13] White & Case post-conference brief, p. 22.

[14] Ibid., pp. 23-24. The respondents also state that Powerchip plans to shift a large portion of its production from DRAMs to other products. Conference transcript, p. 75.

[15] Conference transcript, p. 89, and White & Case post-conference brief, p. A-10.

[16] Questionnaire responses of ***.

[17] Questionnaire responses of ***.

[18] Questionnaire responses of foreign producers.

Table VII-2 presents Taiwan's inventories and shipments during January 1995-September 1998, as reported by respondents to the Commission's questionnaires. Additional questionnaire data are included in appendix J on Taiwan's production, capacity, and capacity utilization.

Table VII-2
DRAMs≥1 Meg and DRAM modules:[1] Taiwan's inventories and shipments, 1995-97, Jan.-Sept. 1997, Jan.-Sept. 1998, and projected 1998-99

Item	1995	1996	1997	Jan.-Sept.-- 1997	Jan.-Sept.-- 1998	Projected-- 1998	Projected-- 1999
	Quantity (*billion bits*)						
End-of-period inventories	27,583	92,966	442,970	252,258	503,396	381,523	413,958
Shipments:							
Home market:							
Company transfers	***	***	***	***	***	***	***
Other shipments	***	***	***	***	***	***	***
Total home market	***	457,571	1,866,867	1,274,028	2,612,075	4,457,368	7,193,693
Exports to--							
The United States	***	128,745	419,348	268,651	1,131,066	1,832,519	2,559,994
All other markets	***	1,340,209	3,258,567	1,930,434	2,446,453	3,370,339	7,565,786
Total exports	***	1,468,954	3,677,916	2,199,086	3,577,519	5,202,858	10,125,781
Total shipments	495,640	1,926,526	5,544,783	3,473,114	6,189,595	9,660,226	17,319,474
	Ratios and shares (*percent*)						
Inventories to all shipments	5.3	3.9	7.9	5.4	5.9	3.8	2.4
Share of total quantity of shipments:							
Home market:							
Company transfers	***	***	***	***	***	***	***
Other shipments	***	***	***	***	***	***	***
Total home market	***	23.8	33.7	36.7	42.2	46.1	41.5
Exports to--							
The United States	***	6.7	7.6	7.7	18.3	19.0	14.8
All other markets	***	69.6	58.8	55.6	39.5	34.9	43.7

[1] Data are for uncased DRAMs≥1Meg, cased DRAMs≥1Meg made from Taiwan-fabricated dice, and DRAM modules made from Taiwan-fabricated dice.

Note.--Inventory ratios are calculated using data where both comparable numerator and denominator information were supplied.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

U.S. IMPORTERS' INVENTORIES

End-of-period inventories held by U.S. importers of uncased DRAMs, cased DRAMS, and DRAM memory modules are shown in table VII-3.

Table VII-3
DRAMs and DRAM modules: End-of-period inventories of U.S. "imports,"[1] by origin of dice, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Quantity (*billion bits*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	***	24,826	129,746	121,732	270,010
Nonsubject Taiwan dice	***	2/	2/	2/	2/
3rd-source dice	***	780,862	1,494,814	1,306,030	2,466,375
Total, all "imports"	275,649	805,688	1,624,560	1,427,763	2,736,385
	Ratio to total shipments of imports, on the basis of bits (*percent*)				
DRAM products (regardless of where assembled) containing--					
Subject Taiwan dice	19.2	17.4	30.3	38.2	23.7
Nonsubject Taiwan dice	-	2/	2/	2/	2/
3rd-source dice	8.6	14.8	13.8	12.6	12.0
Average, all "imports"	8.8	14.8	14.4	13.3	12.6

[1] "Imports" include all uncased and cased DRAMs, and DRAM modules, but do not include imports of such products containing U.S.-fabricated dice.
[2] Not available.

Note.–"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd-source" refers to countries other than the United States and Taiwan. Because of rounding, figures may not add to the totals shown. Ratios are calculated using unrounded data of firms supplying both quantity and value information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

APPENDIX A

FEDERAL REGISTER NOTICES

If a protest against this survey, as shown on this plat, in two sheets, is received prior to the date of the official filing, the filing will be stayed pending consideration of the protest. This particular plat will not be officially filed until the day after all protests have been accepted or dismissed and become final or appeals from the dismissal affirmed.

FOR FURTHER INFORMATION CONTACT: Bureau of Land Management, 222 North 32nd Street, P.O. Box 36800, Billings, Montana 59107–6800.

Dated: October 23, 1998.

Steven G. Schey,

Acting Chief Cadastral Surveyor, Division of Resources.

[FR Doc. 98–29033 Filed 10–28–98; 8:45 am]

BILLING CODE 4310–DN–P

INTERNATIONAL TRADE COMMISSION

[Investigation No. 731–TA–811 (Preliminary)]

Drams of One Megabit and Above From Taiwan

AGENCY: United States International Trade Commission.

ACTION: Institution of antidumping investigation and scheduling of a preliminary phase investigation.

SUMMARY: The Commission hereby gives notice of the institution of an investigation and commencement of preliminary phase antidumping investigation No. 731–TA–811 (Preliminary) under section 733(a) of the Tariff Act of 1930 (19 U.S.C. 1673b(a)) (the Act) to determine whether there is a reasonable indication that an industry in the United States is materially injured or threatened with material injury, or the establishment of an industry in the United States is materially retarded, by reason of imports from Taiwan of dynamic random access memory semiconductors (DRAMs) of one megabit and above, provided for in subheadings 8542.13.80 and 8473.30.10 through 8473.30.90 of the Harmonized Tariff Schedule of the United States, that are alleged to be sold in the United States at less than fair value. Unless the Department of Commerce extends the time for initiation pursuant to section 732(c)(1)(B) of the Act (19 U.S.C. 1673a(c)(1)(B)), the Commission must reach a preliminary determination in antidumping investigations in 45 days, or in this case by December 7, 1998. The Commission's views are due at the Department of Commerce within five business days thereafter, or by December 14, 1998.

For further information concerning the conduct of this investigation and rules of general application, consult the Commission's rules of practice and procedure, part 201, subparts A through E (19 CFR part 201), and part 207, subparts A and B (19 CFR part 207).

EFFECTIVE DATE: October 22, 1998.

FOR FURTHER INFORMATION CONTACT: Robert Carr (202–205–3402), Office of Investigations, U.S. International Trade Commission, 500 E Street SW., Washington, DC 20436. Hearing-impaired persons can obtain information on this matter by contacting the Commission's TDD terminal on 202–205–1810. Persons with mobility impairments who will need special assistance in gaining access to the Commission should contact the Office of the Secretary at 202–205–2000. General information concerning the Commission may also be obtained by accessing its internet server (http://www.usitc.gov).

SUPPLEMENTARY INFORMATION:

Background.—This investigation is being instituted in response to a petition filed on October 22, 1998, by Micron Technology, Inc., Boise, Idaho.

Participation in the investigation and public service list.—Persons (other than petitioners) wishing to participate in the investigation as parties must file an entry of appearance with the Secretary to the Commission, as provided in §§ 201.11 and 207.10 of the Commission's rules, not later than seven days after publication of this notice in the **Federal Register**. Industrial users and (if the merchandise under investigation is sold at the retail level) representative consumer organizations have the right to appear as parties in Commission antidumping investigations. The Secretary will prepare a public service list containing the names and addresses of all persons, or their representatives, who are parties to this investigation upon the expiration of the period for filing entries of appearance.

Limited disclosure of business proprietary information (BPI) under an administrative protective order (APO) and BPI service list.—Pursuant to § 207.7(a) of the Commission's rules, the Secretary will make BPI gathered in this investigation available to authorized applicants representing interested parties (as defined in 19 U.S.C. 1677(9)) who are parties to the investigation under the APO issued in the investigation, provided that the application is made not later than seven days after the publication of this notice in the **Federal Register**. A separate service list will be maintained by the Secretary for those parties authorized to receive BPI under the APO.

Conference.—The Commission's Director of Operations has scheduled a conference in connection with this investigation for 9:30 a.m. on November 13, 1998, at the U.S. International Trade Commission Building, 500 E Street SW., Washington, DC. Parties wishing to participate in the conference should contact Robert Carr (202–205–3402) not later than November 10, 1998, to arrange for their appearance. Parties in support of the imposition of antidumping duties in this investigation and parties in opposition to the imposition of such duties will each be collectively allocated one hour within which to make an oral presentation at the conference. A nonparty who has testimony that may aid the Commission's deliberations may request permission to present a short statement at the conference.

Written submissions.—As provided in §§ 201.8 and 207.15 of the Commission's rules, any person may submit to the Commission on or before November 18, 1998, a written brief containing information and arguments pertinent to the subject matter of the investigation. Parties may file written testimony in connection with their presentation at the conference no later than three days before the conference. If briefs or written testimony contain BPI, they must conform with the requirements of §§ 201.6, 207.3, and 207.7 of the Commission's rules. The Commission's rules do not authorize filing of submissions with the Secretary by facsimile or electronic means.

In accordance with §§ 201.16(c) and 207.3 of the rules, each document filed by a party to the investigation must be served on all other parties to the investigation (as identified by either the public or BPI service list), and a certificate of service must be timely filed. The Secretary will not accept a document for filing without a certificate of service.

Authority: This investigation is being conducted under authority of title VII of the Tariff Act of 1930; this notice is published pursuant to § 207.12 of the Commission's rules.

Issued: October 23, 1998.

By order of the Commission.

Donna R. Koehnke,

Secretary.

[FR Doc. 98–28998 Filed 10–28–98; 8:45 am]

BILLING CODE 7020–02–P

Dated: November 10, 1998.

Linda Engelmeier,

Departmental Forms Clearance Officer, Office of the Chief Information Officer.

[FR Doc. 98-30805 Filed 11-17-98; 8:45 am]

BILLING CODE 3510-60-P

DEPARTMENT OF COMMERCE

International Trade Administration

[A-583-832]

Initiation of Antidumping Duty Investigation: Dynamic Random Access Memory Semiconductors From Taiwan

AGENCY: Import Administration, International Trade Administration, Department of Commerce.

ACTION: Initiation of antidumping investigation.

EFFECTIVE DATE: November 18, 1998.

FOR FURTHER INFORMATION CONTACT: Alexander Amdur at (202) 482-5346, John Conniff at (202) 482-1009 or Ron Trentham at (202) 482-6320, Import Administration—Room B099, International Trade Administration, U.S. Department of Commerce, 14th Street and Constitution Avenue, NW, Washington, DC 20230.

Initiation of Investigation

The Applicable Statute and Regulations

Unless otherwise indicated, all citations to the statute are references to the provisions effective January 1, 1995, the effective date of the amendments made to the Tariff Act of 1930 ("the Act") by the Uruguay Round Agreements Act ("URAA"). In addition, unless otherwise indicated, all citations to the Department's regulations are references to the provisions codified at 19 CFR Part 351 (1998).

The Petition

On October 22, 1998, the Department of Commerce ("the Department") received a petition filed in proper form by Micron Technology, Inc. ("petitioner"). The Department received supplemental information to the petition on November 5, 1998. In accordance with section 732(b) of the Act, petitioner alleges that imports of dynamic random access memory semiconductors of one megabit and above ("DRAMs") from Taiwan are being, or are likely to be, sold in the United States at less than fair value within the meaning of section 731 of the Act, and that such imports are materially injuring, or threatening material injury to, an industry in the United States. The Department finds that petitioner filed the petition on behalf of the domestic industry because it is an interested party as defined in section 771(9)(C) of the Act, and has demonstrated sufficient industry support with respect to the antidumping investigation it is requesting the Department to initiate. *See* Determination of Industry Support for the Petition below.

Scope of Investigation

The products covered by this investigation are DRAMs from Taiwan, whether assembled or unassembled. Assembled DRAMs include all package types. Unassembled DRAMs include processed wafers, uncut die, and cut die. Processed wafers fabricated in Taiwan, but packaged or assembled into finished semiconductors in a third country are included in the scope. Wafers fabricated in a third country and assembled or packaged in Taiwan are not included in the scope.

The scope of this investigation includes memory modules. A memory module is a collection of DRAMs, the sole function of which is memory. Modules include single in-line processing modules ("SIPS"), single in-line memory modules ("SIMMs"), dual in-line memory modules ("DIMMs"), memory cards or other collections of DRAMs whether mounted or unmounted on a circuit board. Modules that contain other parts that are needed to support the function of memory are covered. Only those modules that contain additional items that alter the function of the module to something other than memory, such as video graphics adapter ("VGA") boards and cards, are not included in the scope. Modules containing DRAMs made from wafers fabricated in Taiwan, but either assembled or packaged into finished semiconductors in a third country, are also included in the scope.

The scope includes, but is not limited to, video RAM ("VRAM"), Windows RAM ("WRAM"), synchronous graphics RAM ("SGRAM"), as well as various types of DRAM, including fast page-mode ("FPM"), extended data-out ("EDO"), burst extended data-out ("BEDO"), synchronous dynamic RAM ("SDRAM"), and "Rambus" DRAM ("RDRAM"). The scope of this investigation also includes any future density, packaging or assembling of DRAMs. The scope of this investigation does not include DRAMs or memory modules that are reimported for repair or replacement.

The DRAMS subject to this investigation are currently classifiable under subheadings 8542.13.80.05, 8542.13.80.24 through 8542.13.80.34 of the Harmonized Tariff Schedule of the United States ("HTSUS"). Also included in the scope are Taiwanese DRAM modules, described above, entered into the United States under subheading and 8473.30.10.90 of the HTSUS or possibly other HTSUS numbers. Although the HTSUS subheadings are provided for convenience and customs purposes, the written description of the scope of this investigation is dispositive.

As we discussed in the preamble to the Department's regulations (62 FR 27323), we are setting aside a period for parties to raise issues regarding product coverage. The Department encourages all parties to submit such comments by December 2, 1998. Comments should be addressed to Import Administration's Central Records Unit at Room 1874, U.S. Department of Commerce, Pennsylvania Avenue and 14th Street, NW, Washington, DC, 20230. This period of scope consultation is intended to provide the Department with ample opportunity to consider all comments and to consult with parties prior to the issuance of the preliminary determination.

Determination of Industry Support for the Petition

Section 732(b)(1) of the Act requires that petitions be filed on behalf of a domestic industry. Section 732(c)(4)(A) of the Act provides that a petition meets this requirement if the domestic producers or workers who support the petition account for: (i) at least 25 percent of the total production of the domestic like product; and (ii) more than 50 percent of the production of the domestic like product produced by that portion of the industry expressing support for, or opposition to, the petition.

Section 771(4)(A) of the Act defines the "industry" as the producers of a domestic like product. Thus, to determine whether the petition has the requisite industry support, the Act directs the Department to look to producers and workers who account for production of the domestic like product. The International Trade Commission ("ITC"), which is responsible for determining whether "the domestic industry" has been injured, must also determine what constitutes a domestic like product to define the industry. However, while both the Department and the ITC must apply the same statutory definition of domestic like product, they do so for different purposes and pursuant to separate and distinct authority. In addition, the Department's determination is subject to limitations of time and information.

Although this may result in different definitions of the domestic like product, such differences do not render the decision of either agency contrary to the law.[1]

Section 771(10) of the Act defines the domestic like product as "a product which is like, or in the absence of like, most similar in characteristics and uses with, the article subject to an investigation under this title." Thus, the reference point from which the domestic like product analysis begins is "the article subject to an investigation," *i.e.*, the class or kind of merchandise to be investigated, which normally will be the scope as defined in the petition. As noted earlier, the scope of the petition is limited to DRAMs of one megabit and above. This is petitioner's sole proposed domestic like product. The Department has no basis on the record to find this domestic like product definition clearly inadequate. The Department has, therefore, adopted the domestic like product definition set forth in the petition.

In this case, the Department determined that the petition and supplemental information contained adequate evidence of sufficient industry support; therefore, polling was not necessary. *See* Initiation Checklist, dated November 12, 1998, (public document on file in the Central Records Unit of the Department of Commerce, Room B-099). Additionally, no person who would qualify as an interested party pursuant to section 771(9)(A),(C), or (D) of the Act has expressed opposition to this petition. Accordingly, the Department determines that this petition is filed on behalf of the domestic industry within the meaning of section 732(b)(1) of the Act.

Less Than Fair Value Allegation

Petitioner identified the following Taiwanese producers/exporters in the petition: Mosel-Vitelic, Inc., Winbond Electronics, Acer Semiconductor Manufacturing Inc., Powerchip Semiconductor Corp., United Microelectronics Corporation, Taiwan Semiconductor Manufacturing Corporation, Macronix International Co., Ltd., Alliance Semiconductor Corporation, Etron Technology, Inc., Taiwan Memory Technology, Inc. and G-Link Technology Corp. Petitioner further identified Vanguard International Semiconductor Corporation ("Vanguard") and Nan Ya Technology Corporation ("Nan Ya") as two major producers/exporters of DRAMs from Taiwan. Petitioner based export price ("EP") on price quotes obtained by petitioner's sales personnel in the ordinary course of business. These price quotes were for delivery of 4x4 16 Megabit EDO DRAMs. Petitioner explained that it is Micron's practice to receive verbal quotes without written documentation and supplied an affidavit signed by a Micron sales representative attesting to the validity of the price quotes. All U.S. market price quotes were denominated in dollars and petitioner made no adjustments to these price quotes.

With respect to normal value ("NV") petitioner used prices, based on written price quotes for 4x4 16 megabit EDO DRAMs produced by Vanguard and Nan Ya. The price quotes were obtained by a private market research firm. Petitioner made no adjustment to these home market price quotes.

Petitioner alleged that sales of the foreign like product were made at prices below the cost of production within the meaning of section 773(b) of the Act and requested the Department to initiate a country-wide sales below cost investigation. To support this claim, petitioner compared the home market prices to each company's cost of production ("COP"). Petitioner calculated the COP for Vanguard and Nan Ya based on Micron's actual production experience with adjustments for known differences in costs incurred in Taiwan and the United States.

Petitioner determined the die sizes, mask levels, metal levels, and process technologies from examination of actual DRAM die from Vanguard and Nan Ya. For the purposes of the petition, the processing yields were assumed to be the same as those experienced by Micron. Petitioner derived labor rates from the Bureau of Labor Statistics. Because the most recent data available for Taiwan was from 1996, petitioner adjusted the labor rates for the 1997 inflation rate.

Petitioner adjusted utility expenses using the ratio of U.S. energy costs to Taiwanese energy costs, based on OECD energy price data. For Vanguard, petitioner derived general and administrative ("G&A") expenses, interest expenses, and research and development ("R&D") expenses from the company's financial statements for the six months ending June 30, 1998. *See* Exhibit 6 of the petition. Financial statements for the 1997 fiscal year were not available so these represent the most recent publicly available financial statements for Vanguard.

Petitioner was unable to obtain financial statements for Nan Ya and therefore based its G&A expenses and R&D expenses on Vanguard's financial statements. Interest expenses were calculated using the 1997 consolidated financial statements of Nan Ya's parent company, Nan Ya Plastics. *See* Exhibit 5 of the supplement to the petition.

Petitioner utilized Micron's intellectual property expenses, which reflect royalties paid to other companies for use of their technology in DRAM production. Again, petitioner believes that this estimate is conservative since Micron maintains a larger patent portfolio than either Vanguard or Nan Ya. By having a smaller patent portfolio, Vanguard and Nan Ya need more licensing agreements for DRAMs production.

Petitioner conservatively estimated a profit rate of zero for constructed value. Because the home market prices of Vanguard and Nan Ya were lower than the COP, normal value was based on CV for comparison to the U.S. prices. Petitioner used exchange rates as published by the Federal Reserve Bank of New York for currency conversions.

Based on comparisons of EP to NV, the petitioner estimated dumping margins from 48 to 69 percent.

Initiation of Cost Investigations

Pursuant to section 773(b) of the Act, petitioners provided information demonstrating reasonable grounds to believe or suspect that sales in the home market of Taiwan were made at prices below the COP and, accordingly, requested the Department to conduct a country-wide sales-below-COP investigation in connection with the requested antidumping investigation in Taiwan. The Statement of Administrative Action ("SAA"), accompanying the URAA, H.R. Doc. No. 103-316, vol. 1 at 833 (1994), states that an allegation of sales below COP need not be specific to individual exporters or producers. The SAA also states that "Commerce will consider allegations of below-cost sales in the aggregate for a foreign country, just as Commerce currently considers allegations of sales at less than fair value on a country-wide basis for purposes of initiating an antidumping investigation." *Id.*

Further, the SAA provides that "new section 773(b)(2)(A) retains the current requirement that Commerce have 'reasonable grounds to believe or suspect' that below-cost sales have occurred before initiating such an investigation." Reasonable grounds will "exist when an interested party provides specific factual information on costs and prices, observed or

[1] *See Algoma Steel Corp., Ltd.* v. *United States*, 688 F. Supp. 639, 642-44 (CIT 1988); *High Information Content Flat Panel Displays and Display Glass Therefor from Japan: Final Determination; Rescission of Investigation and Partial Dismissal of Petition*, 56 FR 32376, 32380-81 (July 16, 1991).

constructed, indicating that sales in the foreign market in question are at below-cost prices." *Id.* Based upon the comparison of the prices from the petition for the representative foreign like products to its adjusted costs of production, in accordance with section 773(b)(2)(A)(i) of the Act, we find the existence of "reasonable grounds to believe or suspect" that sales of these foreign like products in Taiwan were made below their respective COP's. Accordingly, the Department is initiating the requested country-wide cost investigation.

Initiation of Antidumping Investigation

We have examined the petition on DRAMs from Taiwan and have found that it meets the requirements of section 732 of the Act, including the requirements concerning allegations of the material injury or threat of material injury to the domestic producers of a domestic like product by reason of the complained-of imports, allegedly sold at less than fair value. Therefore, we are initiating an antidumping duty investigation to determine whether imports of DRAMs from Taiwan are being, or are likely to be, sold in the United States at less than fair value. Unless extended, we will make our preliminary determination by April 1, 1999.

Distribution of Copies of the Petition

In accordance with section 732(b)(3)(A) of the Act, a copy of the public version of the petition has been provided to the representatives of the authorities of Taiwan. We will attempt to provide a copy of the public version of the petition to each exporter named in the petition (as appropriate).

ITC Notification

We have notified the ITC of our initiation, as required by section 732(d) of the Act.

Preliminary Determination by the ITC

The ITC will determine by December 7, 1998, whether there is a reasonable indication that imports of DRAMs from Taiwan are causing material injury, or threatening to cause material injury, to a U.S. industry. A negative ITC determination in the investigation will result in this investigation being terminated; otherwise, the investigation will proceed according to statutory and regulatory time limits.

This notice is published pursuant to section 771 (i) of the Act.

Dated: November 12, 1998.

Robert S. LaRussa,

Assistant Secretary for Import Administration.

[FR Doc. 98-30855 Filed 11-17-98; 8:45 am]

BILLING CODE 3510-DS-P

DEPARTMENT OF COMMERCE

International Trade Administration

[A-122-814]

Pure Magnesium From Canada; Notice of Extension of Time Limit for Administrative Review

AGENCY: Import Administration, International Trade Administration, Department of Commerce.

ACTION: Notice of extension of time limit.

SUMMARY: The Department of Commerce is extending the time limit for the final results of the fifth review of the antidumping duty order on pure magnesium from Canada. The period of review is August 1, 1996 through July 31, 1997. This extension is made pursuant to section 751(a)(3)(A) of the Tariff Act of 1930, as amended by the Uruguay Round Agreements Act.

EFFECTIVE DATE: November 18, 1998.

FOR FURTHER INFORMATION CONTACT: Zak Smith, Office 1, Import Administration, International Trade Administration, U.S. Department of Commerce, 14th Street and Constitution Avenue, NW, Washington DC 20230; telephone (202) 482-0189.

SUPPLEMENTARY INFORMATION: Because it is not practicable to complete this review within the time limit mandated by section 751(a)(3)(A) of the Tariff Act of 1930, as amended (*i.e.*, November 9, 1998), the Department of Commerce ("the Department") is extending the time limit for completion of the final results to not later than March 8, 1999. *See* November 2, 1998 Memorandum from Deputy Assistant Secretary for AD/CVD Enforcement Richard W. Moreland to Assistant Secretary for Import Administration Robert LaRussa on file in the public file of the Central Records Unit, B-099 of the Department.

This administrative review and notice are in accordance with section 751(a)(1) of the Act (19 U.S.C. 1675 (a)(1)) and 19 CFR 351.213(h)(2).

Dated: November 4, 1998.

Susan Kuhbach,

Acting Deputy Assistant Secretary for AD/CVD Enforcement.

[FR Doc. 98-30854 Filed 11-17-98; 8:45 am]

BILLING CODE 3510-DS-P

DEPARTMENT OF COMMERCE

International Trade Administration

[A-122-829, A-533-814, A-588-844, A-580-830, A-469-808, A-583-829]

Notice of Preliminary Determinations of Sales at Less Than Fair Value and Postponement of Final Determinations—Stainless Steel Round Wire From Canada, India, Japan, Spain, and Taiwan; Preliminary Determination of Sales at Not Less Than Fair Value and Postponement of Final Determination—Stainless Steel Round Wire From Korea

AGENCY: Import Administration, International Trade Administration, Department of Commerce.

EFFECTIVE DATE: November 18, 1998.

FOR FURTHER INFORMATION CONTACT: Thomas Schauer (Canada, Spain) at (202) 482-4852; Diane Krawczun (India) at (202) 482-0198; Jarrod Goldfeder (Japan), at (202) 482-1784; or Gabriel Adler (the Republic of Korea, Taiwan) at (202) 482-1442, Import Administration, Room 1870, International Trade Administration, U.S. Department of Commerce, 14th Street and Constitution Avenue, N.W., Washington, DC 20230.

The Applicable Statute and Regulations

Unless otherwise indicated, all citations to the statute are references to the provisions effective January 1, 1995, the effective date of the amendments made to the Tariff Act of 1930 (the Act) by the Uruguay Round Agreements Act (URAA). In addition, unless otherwise indicated, all citations to Department of Commerce (Department) regulations refer to the regulations codified at 19 CFR part 351 (April 1998).

Preliminary Determinations

We preliminarily determine that stainless steel round wire from Canada, India, Japan, Spain, and Taiwan is being sold, or is likely to be sold, in the United States at less than fair value (LTFV), as provided in section 733 of the Act. We also preliminarily determine that stainless steel round wire from the Republic of Korea (Korea) is not being sold, or is not likely to be sold, in the United States at less than fair value. The estimated margins are shown in the *Suspension of Liquidation* section of this notice.

Case History

These investigations were initiated on May 6, 1998. *See Initiation of Antidumping Duty Investigations: Stainless Steel Round Wire from Canada, India, Japan, the Republic of Korea, Spain, and Taiwan*, 63 FR 26150

APPENDIX B

LIST OF WITNESSES APPEARING AT THE CONFERENCE

UNITED STATES INTERNATIONAL TRADE COMMISSION

CALENDAR OF PUBLIC CONFERENCE

Those listed below appeared as witnesses at the United States International Trade Commission's conference:

Subject: **Dynamic Random Access Memory Semiconductors from Taiwan**

Investigation No. **731-TA-811 (Preliminary)**

Date and Time: November 13, 1998, 9:30 a.m.

Location: U.S. International Trade Commission
Main Hearing Room
Room 101
500 E Street, SW
Washington, DC 20436

In Support of the Imposition of Antidumping Duties

Hale and Dorr/Washington, DC/
on behalf of

Micron Technology, Inc.

Gary Kotterman, Corporate Marketing Manager
Micron Technolgy
Michael Sadler, Vice President, Sales
Micron Technology
Mark Love, Economic Consultant
Economic Consulting Services, Inc.
Bonnie Byers, Trade Economist
Hale and Dorr

Gilbert B. Kaplan)
Paul W. Jameson)--OF COUNSEL
Michael D. Esch)

In Opposition to the Imposition of Antidumping Duties

White & Case/Washington, DC
on behalf of

Taiwan Semiconductor Industry Association and its Member Companies

John G. Reilly
Nathan Associates
Genda J. Hu, President
Taiwan Semiconductor Industry Association
Ken Hurley, Vice President, General Manager
Nan Ya Technology Corporation USA

David P. Houlihan--OF COUNSEL

Baker & McKenzie/Washington, DC
on behalf of

Powerchip Semiconductor Corporation
Mitsubishi Electric Corporation
Mitsubishi Electronics America, Inc.
Mitsubishi Semiconductor America, Inc.

Kevin M. O'Brien--OF COUNSEL

APPENDIX C

SUMMARY TABLE

Table C-1
DRAMs and DRAM modules: Summary data concerning the U.S. market, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

(Quantity=*billion bits, except where noted*; value=*1,000 dollars*; unit values and unit production costs are per *million bits*; period changes=*percent, except where noted*)

Item	Reported data			Jan.-Sept.--		Period changes			
	1995	1996	1997	1997	1998	1995-97	1995-96	1996-97	Jan.-Sept. 1997-98
U.S. consumption quantity:									
Amount	4,134,916	7,567,131	15,556,320	10,552,794	22,039,577	+276.2	+83.0	+105.6	+108.9
"Domestic" product share[1]	27.6	27.9	28.1	28.5	29.0	+0.4	+0.3	+0.1	+0.5
"Imported" product share:[1]									
Subject Taiwan dice	***	***	5.0	4.5	5.4	***	***	***	+0.9
Nonsubject Taiwan dice	***	***	***	***	***	2/	2/	3/	2/
3rd-source dice	***	***	***	***	***	-3.5	-3.3	-0.2	-1.4
Total	72.4	72.1	71.9	71.5	71.0	-0.4	-0.3	-0.1	-0.5
U.S. consumption value:									
Amount	13,161,036	7,925,588	6,832,653	5,195,275	3,917,490	-48.1	-39.8	-13.8	-24.6
"Domestic" product share[1]	28.0	27.7	28.5	30.4	31.1	+0.5	-0.3	+0.8	+0.7
"Imported" product share:[1]									
Subject Taiwan dice	***	***	4.5	3.8	6.1	***	***	***	+2.3
Nonsubject Taiwan dice	***	***	***	***	***	2/	2/	3/	2/
3rd-source dice	***	***	***	***	***	-3.0	-1.3	-1.6	-3.0
Total	72.0	72.3	71.5	69.6	68.9	-0.5	+0.3	-0.8	-0.7
"Imported" product made from--									
Subject Taiwan dice:									
U.S. shipments quantity	***	***	774,211	475,470	1,194,485	***	***	***	+151.2
U.S. shipments value	***	***	310,664	197,243	237,023	***	***	***	+20.2
Unit value	$3.48	$0.79	$0.40	$0.41	$0.20	-88.5	-77.3	-49.4	-52.2
Ending inventory quantity	***	24,826	129,746	121,732	270,010	***	***	+422.6	+121.8
Nonsubject Taiwan dice:									
U.S. shipments quantity	***	***	***	***	***	4/	4/	+91.7	+718.7
U.S. shipments value	***	***	***	***	***	4/	4/	-60.4	+419.7
Unit value	4/	$68.09	$14.08	$14.08	$8.94	4/	4/	-79.3	-36.5
Ending inventory quantity	-	5/	5/	5/	5/	5/	5/	5/	5/
3rd source dice:									
U.S. shipments quantity	***	***	***	***	***	+257.5	+74.5	+104.8	+104.6
U.S. shipments value	***	***	***	***	***	-50.3	-40.9	-15.9	-28.0
Unit value	$3.15	$1.11	$0.44	$0.49	$0.18	-86.0	-64.9	-60.1	-62.7
Ending inventory quantity	***	780,862	1,494,814	1,306,030	2,466,375	***	***	+91.4	+88.8
All "foreign" dice:									
U.S. shipments quantity	2,991,984	5,454,765	11,190,801	7,542,754	15,653,638	+274.0	+82.3	+105.2	+107.5
U.S. shipments value	9,475,522	5,729,192	4,883,026	3,618,336	2,699,864	-48.5	-39.5	-14.8	-25.4
Unit value	$3.16	$1.09	$0.44	$0.48	$0.18	-86.1	-65.6	-59.6	-62.1
Ending inventory quantity	275,649	805,688	1,624,560	1,427,763	2,736,385	+489.4	+192.3	+101.6	+91.7
"Domestic" product made from U.S. dice or from 3rd-source dice assembled in the United States:									
U.S. shipments:									
Quantity	1,142,933	2,112,366	4,365,518	3,010,040	6,385,939	+282.0	+84.8	+106.7	+112.2
Value	3,685,513	2,196,396	1,949,627	1,576,939	1,217,626	-47.1	-40.4	-11.2	-22.8
Unit value	$3.22	$1.04	$0.45	$0.52	$0.19	-86.2	-67.8	-57.0	-63.6
Export shipments:									
Quantity	664,314	1,151,694	2,887,294	1,980,596	4,375,107	+334.6	+73.4	+150.7	+120.9
Exports/shipments[1]	36.8	35.3	39.8	39.7	40.7	+3.1	-1.5	+4.5	+1.0
Value	1,910,044	1,081,555	1,072,182	832,308	755,978	-43.9	-43.4	-0.9	-9.2
Unit value	$2.88	$0.94	$0.37	$0.42	$0.17	-87.1	-67.3	-60.5	-58.9
Ending inventory quantity	124,168	364,396	635,034	774,267	886,639	+411.4	+193.5	+74.3	+14.5

See footnotes at end of table.

Table C-1--Continued
DRAMs and DRAM modules: Summary data concerning the U.S. market, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

(Quantity=*billion bits, except where noted*; value=*1,000 dollars*; unit values and unit production costs are per *million bits*; period changes=*percent, except where noted*)

Item	Reported data			Jan.-Sept.--		Period changes			Jan.-Sept.
	1995	1996	1997	1997	1998	1995-97	1995-96	1996-97	1997-98
U.S. producers'--									
Average capacity (*1,000 wafers*)	1,696	1,628	1,875	1,404	1,494	+10.5	-4.0	+15.2	+6.4
Wafer starts (*1,000 wafers*)	1,591	1,650	1,906	1,389	1,393	+19.8	+3.7	+15.5	+0.3
Capacity utilization[1]	90.8	97.9	98.0	99.0	93.2	+7.1	+7.0	+0.1	-5.7
Production quantity of uncased DRAMs	1,482,033	3,231,479	6,723,030	4,912,809	9,992,778	+353.6	+118.0	+108.0	+103.4
Production workers	11,423	12,186	14,234	12,906	13,983	+24.6	+6.7	+16.8	+8.3
Hours worked (*1,000 hours*)	29,090	27,726	28,800	21,515	22,740	-1.0	-4.7	+3.9	+5.7
Wages paid (*$1,000*)	568,322	525,620	538,764	396,455	427,119	-5.2	-7.5	+2.5	+7.7
Hourly wages	$19.54	$18.96	$18.71	$18.43	$18.78	-4.2	-3.0	-1.3	+1.9
Financial data:									
Net sales	5,057,547	3,441,109	2,701,787	2,244,336	1,552,835	-46.6	-32.0	-21.5	-30.8
Cost of goods sold	2,122,703	2,551,589	2,794,075	2,055,241	2,369,672	+31.6	+20.2	+9.5	+15.3
Gross profit or (loss)	2,934,844	889,520	(92,288)	189,095	(816,837)	-103.1	-69.7	-110.4	-532.0
Operating expenses	363,560	396,917	410,303	320,687	386,815	+12.9	+9.2	+3.4	+20.6
Operating income or (loss)	2,571,284	492,603	(502,591)	(131,592)	(1,203,652)	-119.5	-80.8	-202.0	-814.7
Capital expenditures	1,437,569	2,934,846	1,696,373	1,830,029	1,052,646	+18.0	+104.2	-42.2	-42.5
COGS/sales[1]	42.0	74.2	103.4	91.6	152.6	+61.4	+32.2	+29.3	+61.0
Operating results/sales[1]	50.8	14.3	(18.6)	(5.9)	(77.5)	-69.4	-36.5	-32.9	-71.6

[1] 'Reported data' are in percent and 'period changes' are in percentage-point.
[2] An increase of less than 0.05 percentage points.
[3] A decrease of less than 0.05 percentage points.
[4] Not applicable.
[5] Not available.

Note.--"Nonsubject" Taiwan products are uncased and cased DRAMs<1Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." Period changes are derived from the unrounded data. Because of rounding, figures may not add to the totals shown. Unit values and other ratios are calculated from the unrounded figures, using data of firms supplying both numerator and denominator information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

APPENDIX D

GLOSSARY OF TERMS

GLOSSARY OF TERMS[1]

Access time.--Time interval between the instant that a piece of information is sent and the instant it returns.

Assembly.--The series of operations after fabrication in which the wafer is separated into individual chips and mounted and connected to a package.

Bit.--Short for "Binary Digit." The smallest piece of data (a "1" or "0") that a computer recognizes. Combinations of 1s and 0s are used to represent characters and numbers.

Byte.--A number of bits, usually eight, that represent one numeric or alphabetic character.

Cased DRAM.--DRAMs that have undergone both the fabrication and assembly/test stages. At this point, the individual DRAMs have been separated from the wafer, electrically tested, and encapsulated into a package. The package is usually of molded plastic and includes a lead frame and metal leads which will allow the DRAM to be physically attached to a printed circuit board with other components to form a finished product.

Chip.--A single piece of semiconductor material onto which specific electrical circuits have been fabricated; refers to a semiconductor that has not yet been packaged. Also called "die."

CMOS (complementary metal oxide semiconductor).--Negative and positive channel MOS transistors on the same chip.

CPU (central processing unit) or microprocessor.--The computer module in charge of retrieving, decoding, and executing instructions.

CVD (chemical vapor deposition).--A method for depositing some of the layers which function as dielectrics, conductors, or semiconductors. A chemical containing atoms of the material to be deposited reacts with another chemical, liberating the desired material, which deposits on the wafer while by-products of the reaction are removed from the reaction chamber.

Deposition.--Process in which layers are formed as the result of a chemical reaction in which the desired layer material is formed and coats the wafer surface.

Die.--A single piece of semiconductor material onto which specific electrical circuits have been fabricated; refers to a semiconductor that has not yet been packaged. Also called a "chip."

Diffusion.--A process used in semiconductor production which introduces minute amounts of impurities (dopants) into a substrate material such as silicon or germanium and permits the impurity to spread into the substrate. The process is very dependent on temperature and time.

Dopant.--An element that alters the conductivity of a semiconductor by contributing either a hole or electron to the conduction process.

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[1]Sourced principally from Peter Van Zant, *Microchip Fabrication: A Practical Guide to Semiconductor Processing* (New York, NY: McGraw-Hill, 1997), pp. 587-605; Commission publications; and Neil Randal, "A RAM Primer," *PC Magazine*, Oct. 21, 1997, pp. 267-268.

DRAM (dynamic random access memory).--Memory device for the storage of digital information. DRAMs store information in a volatile state and require constant electrical refreshing or the information will be lost.

DRAM addressing mode.--The technology used by a specific DRAM device to access its storage cells. Examples are fast page mode (FPM), extended data out (EDO), burst extended data out (BEDO), synchronous (SDRAM), and Rambus (RDRAM). In succession, each of these products has been an improvement over its predecessors in reducing access time and improving communication with the microprocessor.

Etch.--A process for removing material in a specific area through a wet or dry chemical reaction or by physical removal, such as by sputter etch.

"Fabless" firms.--"Fabless" companies concentrate on the semiconductor design stage. The fabrication stage is contracted out by the fabless company to a "foundry" producer. The foundry producer fabricates the DRAM, including any prototyping and test run, using the fabless companies' design. The assembly stage is also contracted out by the fabless company and can be conducted by the foundry or by a third party.

Fabrication.--Integrated circuit manufacturing processes.

Ion implantation.--Introduction of selected impurities (dopants) by means of high-voltage ion bombardment to achieve desired electronic properties in defined areas.

Kilobit.--One thousand (actually 1,024) bits of information.

Lithography.--Process of pattern transfer: when light is utilized, it is termed photolithography; and when patterns are small enough to be measured in microns, it is referred to as microlithography.

Logic.--The circuits used to control operation of integrated circuit devices.

Mask.--A glass plate covered with an array of patterns used in the photomasking process. Each pattern consists of opaque and clear areas that respectively prevent or allow light through. Masks are aligned with existing patterns on silicon wafers and used to expose photoresist. Mask patterns may be formed in emulsion, chrome, iron oxide, silicon, or a number of other opaque materials.

Megabit.--One million (actually 1,048,576) bits of information.

Memory module.--A packaging arrangement consisting of chips mounted on a printed circuit board. Modules are less susceptible to damage during installation than individual chips and require less board space. DRAM modules can easily be "plugged" into and removed from sockets in electronic applications such as desktop computers. In contrast, individual cased DRAMs need to be soldered to a main circuit board in applications and then cannot be easily removed or replaced. Various types of modules include single in-line packages (SIPs), single in-line memory modules (SIMMs), and dual in-line memory modules (DIMMs).

Overall yield.--The percentage of functioning packaged chips from a wafer related to the number of dice mapped onto the wafer. Overall yield is the product of fabrication yield, sort yield, and assembly yields.

Package.--Protective container for a semiconductor chip (generally plastic or ceramic) having electrical leads for external connections.

Photoresist.--The light-sensitive film spun onto wafers and exposed using high-intensity light through a mask. The exposed (or unexposed, depending on its polarity) photoresist is dissolved with developers, leaving a pattern of photoresist which allows etching to take place in some areas while preventing it in others.

RAM (random access memory).--A type of circuitry used in memory integrated circuits. Compared with other types of memory circuitry, RAM provides the fastest capabilities for storing and retrieving digital information. However, RAM circuits are not suited to certain applications because, unlike circuits based on read only memory (ROM) circuitry, they need to be connected to a source of electrical power to retain stored information. They are thus characterized as "volatile" memory circuits. RAM devices temporarily store information.

Reticle.--An exposure mask with only a portion of a complete die pattern.

ROM (read only memory).--A type of circuitry used in memory integrated circuits. ROM circuits are designed only to give back prestored information. This information is specifically designed into the chip memory array during fabrication. Unlike random access memory (RAM) circuitry, ROM circuits store information permanently and do not need to be recharged. They are thus characterized as "nonvolatile" memory circuits. However, they provide slower capabilities for storing and retrieving information than RAM circuits.

Semiconductor.--An electronic device whose main functioning part is made from a material (usually silicon, the "semiconductor") whose conductivity ranges between that of a conductor and that of an insulator. Semiconductor devices achieve amplification and rapid on-off switching by moving electronic charges along controlled paths inside a solid block of semiconductor material (hence the name "solid state").

Silicon.--A nonmetallic element used in the semiconductor industry as a substrate for multiple layers of material, built to form electrical circuits. Silicon is grown from a crystal to form a cylinder-shaped "log." Slicing the logs into sections about 1/40 of an inch thick creates bare wafers.

SGRAM (sychronous graphics RAM).--A specialty variety of DRAM. SGRAM is DRAM optimized for use in graphics applications. It is constructed with a "dual bank" feature which allows it to access two memory pages simultaneously, thereby speeding performance.

SRAM (static random access memory).--Fast read-write memory cell based on transistors that is volatile in nature but does not require constant electrical refreshing.

Substrate.--The underlying material upon which a device, circuit, or epitaxial layer is fabricated.

Transistor.--A semiconductor device that uses a stream of charge carriers to produce active electronic effects. The name was coined from the electrical characteristic of "transfer resistance."

Uncased DRAM.--DRAMs that have completed the fabrication stage but have not yet undergone assembly and final testing. Uncased DRAMs may still be incorporated on a wafer or may have been separated into individual chips. Many companies that perform fabrication, which is extremely capital intensive, contract out the more labor intensive assembly and test stages to locations in Southeast Asia.

Video graphics adapter (VGA).--A board or card that plugs into a computer which allows the computer's software to communicate display information to the monitor. Typical video adapters include VGA, super VGA, and Hercules.

Volatile memory circuit.--A memory circuit that loses its data when power to the chip is lost.

VRAM (video RAM).--VRAM is a specialty variety of DRAM. VRAM is optimized for use in video applications. VRAM is constructed with two access ports (regular DRAM has only one), which allows for faster memory performance.

Wafer.--A thin, usually round slice of a semiconductor material, from which chips are made.

Wafer fabrication.--The series of manufacturing operations in which the circuit or device is put in and on the wafer.

WRAM (Windows RAM).--WRAM is a specialty variety of DRAM. WRAM is optimized in graphics applications. WRAM is constructed with a second access port (regular DRAM has only one) and a double-buffering data system, which allows for faster performance.

APPENDIX E

ADDITIONAL QUESTIONNAIRE DATA ON U.S. PRODUCTION, SHIPMENTS, IMPORTS, AND CONSUMPTION OF DRAMS AND DRAM MODULES BY SOURCE OF DICE AND LOCATION OF ASSEMBLY

Table E-1
Uncased DRAMs: U.S. capacity, wafer starts, production,[1] and capacity utilization, by firms,[2] 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
Average-of-period capacity (*1,000 wafers*)	1,696	1,628	1,875	1,404	1,494
Wafer starts (*1,000 wafers*)	1,591	1,650	1,906	1,389	1,393
Production (*billion bits*)	1,482,033	3,231,479	6,723,030	4,912,809	9,992,778
Production (*1,000 units*)	303,389	439,585	490,910	368,751	420,884
Capacity utilization (*percent*)	90.8	97.9	98.0	99.0	93.2

[1] *** do not fabricate uncased DRAMs in the United States; *** was unable to provide data on uncased DRAMs for this investigation. Production data presented for uncased DRAMs are intended to represent the successful fabrication of uncased DRAM dice. Production data may not reconcile with shipment and inventory data. Firms cited "yield loss, scrap, samples, returns, and theft" as reasons for the discrepancies.

[2] Data of individual firms are not publishable, and have been removed.

Note.--Ratios are calculated from the unrounded figures; averages are computed using data of firms supplying both numerator and denominator information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table E-2
Cased DRAMs: U.S. capacity, assembly, production,[1] and capacity utilization, by firms,[2] 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
Average-of-period capacity (*1,000 units*)	***	***	***	***	***
Assembly (*1,000 units*)	308,317	380,737	406,491	306,504	***
Production (*billion bits*)	1,281,374	2,564,909	***	***	***
Production (*1,000 units*)	288,832	393,817	425,886	321,017	360,480
Capacity utilization, based on production (*percent*)	83.3	89.2	92.0	92.2	91.7
Capacity utilization, based on assembly (*percent*)	92.8	89.3	90.6	90.8	89.4

[1] Cased DRAM assembly represents the successful assembly of DRAMs. Assembly data, however, may be slightly overstated by the amount of unadjusted yield loss and may not reconcile with shipment and inventory data. Data presented for production were provided on an individual density basis and were compiled for this table. *** reported that they do not assemble DRAMs in the United States.
[2] Data of individual firms are not publishable, and have been removed.

Note.--Because of rounding, figures may not add to the totals shown. Ratios are calculated from the unrounded figures; averages are computed using data of firms supplying both numerator and denominator information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table E-3
DRAM modules: U.S. capacity, production, and capacity utilization, by firms, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

* * * * * * *

Table E-4
DRAMs and DRAM modules: U.S. imports, by sources and by origin of dice, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Quantity (*billion bits*)				
Taiwan:					
Subject Taiwan dice	***	141,198	318,620	192,511	720,236
Nonsubject Taiwan dice	***	***	***	***	***
U.S. dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Subtotal	***	166,717	393,776	230,735	876,429
3rd sources:					
Subject Taiwan dice	***	***	618,088	390,313	684,158
Nonsubject Taiwan dice	***	***	***	***	***
U.S. dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Subtotal	***	7,680,100	14,767,633	10,027,978	19,743,598
Total, all imports	3,932,443	7,846,817	15,161,408	10,258,713	20,620,027
	Value (*1,000 dollars*)				
Taiwan:					
Subject Taiwan dice	***	***	153,742	95,177	178,410
Nonsubject Taiwan dice	***	***	***	***	***
U.S. dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Subtotal	***	***	184,543	114,263	209,056
3rd sources:					
Subject Taiwan dice	***	***	224,925	145,022	111,594
Nonsubject Taiwan dice	***	***	***	***	***
U.S. dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Subtotal	***	***	6,057,893	4,517,336	3,083,065
Total, all imports	10,856,097	8,134,024	6,242,436	4,631,599	3,292,121

See footnotes at end of table.

Table E-4--Continued
DRAMs and DRAM modules: U.S. imports, by sources and by origin of dice, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Unit value (*per million bits*)				
Taiwan:					
Subject Taiwan dice	$***	$***	$0.48	$0.49	$0.25
Nonsubject Taiwan dice	***	***	***	***	***
U.S. dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Average	***	***	.47	.50	.24
3rd sources:					
Subject Taiwan dice	***	***	.36	.37	.16
Nonsubject Taiwan dice	***	***	***	***	***
U.S. dice	***	***	***	***	***
3rd-source dice	***	***	***	***	***
Average	***	***	.41	.45	.16
Average, all imports	2.76	1.04	.41	.45	.16

Note.--"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd-source" refers to countries other than Taiwan and the United States. Because of rounding, figures may not add to the totals shown. Unit values are calculated using unrounded data of firms supplying both quantity and value information.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table E-5
DRAMs and DRAM modules: U.S. shipments of "domestic"[1] product, U.S. shipments of "imported"[2] product, and apparent U.S. consumption, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Quantity (*billion bits*)				
U.S. shipments of "domestic" DRAM products made from:					
U.S. dice assembled in--					
Taiwan	***	***	***	***	***
United States	***	***	***	***	***
3rd-source countries	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	968,049	1,830,133	***	***	5,436,146
3rd-source dice assembled in the United States	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Total	1,142,933	2,112,366	4,365,518	3,010,040	6,385,939
U.S. shipments of "imported" DRAM products:					
Subject DRAMs and DRAM modules made from--					
Taiwan dice assembled in--					
Taiwan	***	***	***	***	490,149
United States	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	774,211	475,470	1,194,485
Nonsubject DRAMs and DRAM modules made from Taiwan dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	***	***	***
DRAMs and DRAM modules made from 3rd-source dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	5,067,817	10,358,530	7,033,495	14,356,512
Subtotal	***	***	***	***	***
Total, all imports	2,991,984	5,454,765	11,190,801	7,542,754	15,653,638
Apparent consumption	4,134,916	7,567,131	15,556,320	10,552,794	22,039,577
	Value (*1,000 dollars*)				
U.S. shipments of "domestic" DRAM products made from:					
U.S. dice assembled in--					
Taiwan	***	***	***	***	742
United States	***	***	***	***	***
3rd-source countries	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	3,170,215	1,906,428	1,665,958	1,339,611	1,101,734
3rd-source dice assembled in the United States	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Total	3,685,513	2,196,396	1,949,627	1,576,939	1,217,626

See footnotes at end of table.

Table E5--Continued
DRAMs and DRAM modules: U.S. shipments of "domestic"[1] product, U.S. shipments of "imported"[2] product, and apparent U.S. consumption, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Value (*1,000 dollars*)				
U.S. shipments of "imported" DRAM products:					
Subject DRAMs and DRAM modules made from--					
Taiwan dice assembled in--					
Taiwan	***	***	101,970	76,201	122,347
United States	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	310,664	197,243	237,023
Nonsubject DRAMs and DRAM modules made from Taiwan dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	***	***	***
DRAMs and DRAM modules made from 3rd-source dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	***	4,547,661	3,403,809	2,434,633
Subtotal	***	***	***	***	***
Total, all imports	9,475,522	5,729,192	4,883,026	3,618,336	2,699,864
Apparent consumption	13,161,036	7,925,588	6,832,653	5,195,275	3,917,490

[1] "Domestic" product includes DRAMs and DRAM modules made from U.S.-fabricated dice, regardless of assembly location, and U.S.-assembled cased DRAMs and DRAM modules made from DRAMs that were fabricated in countries other than the United States and Taiwan. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

[2] "Imported" product includes DRAMs and DRAM modules made from Taiwan-fabricated dice (regardless of assembly location) and 3rd-source-fabricated dice assembled outside the United States. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

Note.–"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd source" refers to countries other than Taiwan and the United States. Because of rounding, figures may not add to the totals shown.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table E-6
DRAMs and DRAM modules: Apparent U.S. consumption and market shares, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Apparent consumption				
Quantity (*billion bits*)	4,134,916	7,567,131	15,556,320	10,552,794	22,039,577
Value (*1,000 dollars*)	13,161,036	7,925,588	6,832,653	5,195,275	3,917,490
	Share of the quantity of U.S. consumption (*percent*)				
U.S. shipments of "domestic"[1] DRAM products made from:					
U.S. dice assembled in--					
Taiwan	***	***	***	***	***
United States	***	***	***	***	***
3rd-source countries	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	23.4	24.2	***	***	24.7
3rd-source dice assembled in the United States	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Total	27.6	27.9	28.1	28.5	29.0
U.S. shipments of "imported"[4] DRAM products:					
Subject DRAMs and DRAM modules made from--					
Taiwan dice assembled in--					
Taiwan	***	***	***	***	2.2
United States	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	5.0	4.5	5.4
Nonsubject DRAMs and DRAM modules made from Taiwan dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	***	***	***
DRAMs and DRAM modules made from 3rd-source dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	67.0	66.6	66.7	65.1
Subtotal	***	***	***	***	***
Total, all imports	72.4	72.1	71.9	71.5	71.0
	Share of the value of U.S. consumption (*percent*)				
U.S. shipments of "domestic"[1] DRAM products made from:					
U.S. dice assembled in--					
Taiwan	***	***	***	***	2/
United States	***	***	***	***	***
3rd-source countries	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	24.1	24.1	24.4	25.8	28.1
3rd-source dice assembled in the United States	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Total	28.0	27.7	28.5	30.4	31.1

See footnotes at end of table.

Table E-6--Continued
DRAMs and DRAM modules: Apparent U.S. consumption and market shares, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Item	1995	1996	1997	Jan.-Sept.-- 1997	1998
	Share of the value of U.S. consumption (*percent*)				
U.S. shipments of "imported"[3] DRAM products:					
Subject DRAMs and DRAM modules made from--					
Taiwan dice assembled in--					
Taiwan	***	***	1.5	1.5	3.1
United States	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	4.5	3.8	6.1
Nonsubject DRAMs and DRAM modules made from Taiwan dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	***	***	***	***
Purchase adjustment	***	***	***	***	***
Subtotal	***	***	***	***	***
DRAMs and DRAM modules made from 3rd-source dice assembled in--					
Taiwan	***	***	***	***	***
3rd sources	***	***	66.6	65.5	62.1
Subtotal	***	***	***	***	***
Total, all imports	72.0	72.3	71.5	69.6	68.9

[1] "Domestic" product includes DRAMs and DRAM modules made from U.S.-fabricated dice, regardless of assembly location, and U.S.-assembled cased DRAMs and DRAM modules made from DRAMs that were fabricated in countries other than the United States and Taiwan. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

[2] Less than 0.05 percent.

[3] "Imported" product includes DRAMs and DRAM modules made from Taiwan-fabricated dice (regardless of assembly location) and 3rd-source-fabricated dice assembled outside the United States. Data presented are net of company transfers of uncased and cased DRAMs that were used to make the upstream subject DRAM products. Adjustments for producer purchases of the downstream product destined for upstream production have been made to avoid double counting.

Note.–"Nonsubject" Taiwan products are uncased and cased DRAMs<1 Meg; all other DRAMs and all DRAM modules containing Taiwan dice are "subject." The term "3rd source" refers to countries other than Taiwan and the United States. Because of rounding, figures may not add to the totals shown; shares are computed from the unrounded figures.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

APPENDIX F

IMPORT DATA COMPILED FROM OFFICIAL STATISTICS OF THE U.S. DEPARTMENT OF COMMERCE

Table F-1
All subject cased DRAMS:[1] U.S. imports for consumption, by principal sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**53,921**	**76,494**	**117,624**	**83,760**	**116,574**
Korea	173,493	251,377	284,510	197,816	247,957
Japan	237,419	232,017	264,963	205,903	153,016
Singapore	94,102	106,563	156,652	100,678	135,530
Canada	78,828	73,696	63,315	45,531	39,049
Malaysia	38,778	56,910	43,175	35,036	18,487
Germany	17,586	24,610	49,664	32,746	42,399
France	1,809	4,321	17,435	9,690	30,944
Italy	6,004	11,608	20,875	13,567	10,658
United Kingdom	24,344	19,997	12,133	8,896	8,428
All others	13,438	17,740	14,016	8,991	14,382
Total	739,722	875,333	1,044,362	742,614	817,424
	Value (1,000 dollars)				
Taiwan	**$455,263**	**$349,519**	**$427,018**	**$304,274**	**$320,666**
Korea	4,099,519	2,736,208	2,085,077	1,554,984	1,019,375
Japan	3,857,349	2,306,984	1,701,873	1,381,485	726,347
Singapore	1,253,507	1,094,419	814,441	550,221	400,753
Canada	701,197	850,738	611,335	435,828	579,447
Malaysia	543,857	518,510	202,912	175,238	51,262
Germany	279,458	169,348	203,845	146,104	100,330
France	48,498	68,841	101,018	65,902	81,673
Italy	125,533	107,278	86,280	66,381	35,369
United Kingdom	195,128	88,830	37,378	27,108	19,512
All others	154,797	119,235	56,760	42,647	33,048
Total	11,714,106	8,409,910	6,327,937	4,750,172	3,367,782
	Share of total on the basis of value (percent)				
Taiwan	**3.9**	**4.2**	**6.7**	**6.4**	**9.5**
Korea	35.0	32.5	33.0	32.7	30.3
Japan	32.9	27.4	26.9	29.1	21.6
Singapore	10.7	13.0	12.9	11.6	11.9
Canada	6.0	10.1	9.7	9.2	17.2
Malaysia	4.6	6.2	3.2	3.7	1.5
Germany	2.4	2.0	3.2	3.1	3.0
France	0.4	0.8	1.6	1.4	2.4
Italy	1.1	1.3	1.4	1.4	1.0
United Kingdom	1.7	1.1	0.6	0.6	0.6
All others	1.3	1.4	0.9	0.9	1.0
Total	100.0	100.0	100.0	100.0	100.0

[1] HTS items 8542.13.8024 through 8542.13.8034.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-2
Cased DRAMS not over 40,000 bits (HTS item 8542.13.8021):[1] U.S. imports for consumption, by specified sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**244**	**1,254**	**4,405**	**1,344**	**1,528**
Korea	310	2,256	1,486	919	1,764
Japan	4,932	1,938	1,107	1,017	373
Singapore	188	1,026	154	112	102
Canada	143	63	91	35	0
Malaysia	200	5,884	16,482	13,435	1,540
Germany	1,304	349	1,222	1,106	306
France	71	17	13	12	29
Italy	15	95	250	200	94
United Kingdom	793	59	52	40	63
All others	220	8,305	9,946	6,156	2,707
Total	8,420	21,246	35,208	24,376	8,506
	Value (1,000 dollars)				
Taiwan	**1,918**	**3,439**	**12,007**	**2,642**	**5,333**
Korea	5,094	10,581	7,221	5,270	4,898
Japan	43,293	14,077	2,926	2,616	828
Singapore	4,632	7,355	733	513	193
Canada	2,423	604	214	144	0
Malaysia	2,070	8,400	24,373	19,775	2,310
Germany	9,024	1,317	1,589	1,109	905
France	3,731	265	98	91	206
Italy	217	294	753	727	49
United Kingdom	2,182	491	212	183	196
All others	2,637	12,837	9,971	6,121	2,791
Total	77,221	59,660	60,097	39,191	17,709
	Average unit value				
Taiwan	**$7.87**	**$2.74**	**$2.73**	**$1.97**	**$3.49**
Korea	16.44	4.69	4.86	5.73	2.78
Japan	8.78	7.26	2.64	2.57	2.22
Singapore	24.64	7.17	4.76	4.58	1.88
Canada	16.96	9.63	2.35	4.17	-
Malaysia	10.34	1.43	1.48	1.47	1.50
Germany	6.92	3.77	1.30	1.00	2.96
France	52.62	15.22	7.81	7.37	7.16
Italy	14.41	3.08	3.02	3.63	0.52
United Kingdom	2.75	8.31	4.04	4.60	3.14
All others	12.02	1.55	1.00	0.99	1.03
Average	9.17	2.81	1.71	1.61	2.08

[1] HTS item 8542.11.8021 in 1995.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-3
Cased DRAMS over 40,000 bits but not over 80,000 bits (HTS item 8542.13.8022):[1] U.S. imports for consumption, by specified sources, 1995-97, Jan.-Sept. 1997 and Jan.-Sept.1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**130**	**244**	**938**	**396**	**179**
Korea	66	296	587	347	248
Japan	2,553	4,989	2,339	2,042	1,843
Singapore	242	736	1,092	520	104
Canada	6	10	0	0	(2)
Malaysia	2,162	90	135	133	319
Germany	9	146	59	56	213
France	65	401	1	1	7
Italy	108	35	271	(2)	2
United Kingdom	209	104	106	106	135
All others	815	432	102	92	350
Total	6,365	7,483	5,630	3,693	3,400
	Value (1,000 dollars)				
Taiwan	**628**	**1,075**	**2,284**	**1,211**	**469**
Korea	479	2,110	4,593	2,894	1,736
Japan	20,186	24,074	6,780	6,052	3,577
Singapore	871	1,837	3,206	1,112	226
Canada	51	1,963	0	0	4
Malaysia	2,207	370	463	447	268
Germany	69	3,206	417	406	452
France	87	1,415	180	142	588
Italy	948	301	1,229	2	48
United Kingdom	2,432	1,354	180	169	260
All others	620	1,524	684	564	386
Total	28,578	39,229	20,016	12,999	8,014
	Average unit value				
Taiwan	**$4.83**	**$4.42**	**$2.43**	**$3.06**	**$2.62**
Korea	7.26	7.14	7.82	8.33	6.99
Japan	7.91	4.83	2.90	2.96	1.94
Singapore	3.60	2.49	2.94	2.14	2.18
Canada	8.69	194.15	-	-	42.93
Malaysia	1.02	4.13	3.44	3.37	0.84
Germany	7.72	21.96	7.10	7.22	2.13
France	1.33	3.53	309.55	280.00	81.90
Italy	8.76	8.53	4.54	6.74	22.44
United Kingdom	11.64	12.97	1.70	1.60	1.92
All others	0.76	3.52	6.59	6.11	1.11
Average	4.49	5.24	3.56	3.52	2.36

[1] HTS item 8542.11.8022 in 1995.
[2] Less than 500 units.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-4
Cased DRAMS over 80,000 bits but not over 300,000 bits (HTS item 8542.13.8023):[1] U.S. imports for consumption, by specified sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**1,051**	**884**	**858**	**557**	**2,994**
Korea	903	1,116	579	417	697
Japan	4,795	1,483	865	642	1,819
Singapore	4,168	205	518	134	2,534
Canada	169	110	4	4	4
Malaysia	542	149	217	217	77
Germany	305	69	43	33	136
France	20	12	0	0	61
Italy	10	0	176	176	32
United Kingdom	463	26	67	60	42
All others	11,114	2,692	244	173	229
Total	23,540	6,746	3,571	2,413	8,625
	Value (1,000 dollars)				
Taiwan	**3,024**	**2,588**	**2,406**	**1,646**	**3,932**
Korea	5,987	6,782	2,538	1,813	3,472
Japan	20,691	7,103	6,604	3,549	3,084
Singapore	8,045	1,131	1,690	829	4,861
Canada	2,116	951	33	32	54
Malaysia	2,779	786	677	677	200
Germany	1,754	131	254	240	510
France	137	288	0	0	187
Italy	137	0	1,271	1,271	19
United Kingdom	1,249	141	404	387	141
All others	14,854	7,511	1,336	829	1,253
Total	60,773	27,412	17,213	11,273	17,713
	Average unit value				
Taiwan	**$2.88**	**$2.93**	**$2.80**	**$2.95**	**$1.31**
Korea	6.63	6.08	4.38	4.35	4.98
Japan	4.32	4.79	7.63	5.52	1.70
Singapore	1.93	5.52	3.26	6.17	1.92
Canada	12.50	8.61	7.72	7.43	15.08
Malaysia	5.13	5.26	3.11	3.11	2.59
Germany	5.74	1.89	5.89	7.26	3.76
France	6.69	24.40	-	-	3.08
Italy	13.28	-	7.22	7.22	0.59
United Kingdom	2.70	5.43	6.07	6.50	3.38
All others	1.34	2.79	5.48	4.83	5.46
Average	2.58	4.06	4.82	4.67	2.05

[1] HTS item 8542.11.8023 in 1995.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-5
Cased DRAMS over 300,000 bits but not over 3,000,000 bits (HTS item 8542.13.8024):[1] U.S. imports for consumption, by specified sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**43,178**	**23,639**	**8,379**	**5,413**	**1,578**
Korea	29,644	19,908	17,513	11,408	7,012
Japan	68,351	45,938	22,956	18,906	9,760
Singapore	30,136	29,854	13,686	10,068	7,609
Canada	8,825	260	73	16	3
Malaysia	4,504	2,667	1,067	912	922
Germany	3,711	3,696	3,264	2,802	1,139
France	389	281	4	3	45
Italy	753	1,437	4,581	2,272	137
United Kingdom	6,354	755	290	167	18
All others	4,270	4,091	885	640	492
Total	200,115	132,526	72,698	52,607	28,715
	Value (1,000 dollars)				
Taiwan	**297,493**	**118,702**	**37,604**	**25,888**	**5,192**
Korea	329,758	198,006	196,613	137,017	24,266
Japan	513,353	234,744	76,385	61,979	23,723
Singapore	350,773	371,928	40,605	31,426	8,947
Canada	68,355	2,538	948	326	56
Malaysia	31,483	22,986	4,930	4,540	1,329
Germany	19,802	9,801	5,759	4,709	1,848
France	5,990	7,769	25	23	320
Italy	11,492	2,138	5,543	1,939	125
United Kingdom	10,576	3,325	1,371	1,249	140
All others	28,015	29,450	5,134	3,531	2,339
Total	1,667,090	1,001,387	374,917	272,627	68,285
	Average unit value				
Taiwan	**$6.89**	**$5.02**	**$4.49**	**$4.78**	**$3.29**
Korea	11.12	9.95	11.23	12.01	3.46
Japan	7.51	5.11	3.33	3.28	2.43
Singapore	11.64	12.46	2.97	3.12	1.18
Canada	7.75	9.75	13.05	19.86	20.53
Malaysia	6.99	8.62	4.62	4.98	1.44
Germany	5.34	2.65	1.76	1.68	1.62
France	15.41	27.64	6.58	6.73	7.13
Italy	15.26	1.49	1.21	0.85	0.91
United Kingdom	1.66	4.40	4.72	7.50	7.58
All others	6.56	7.20	5.80	5.52	4.75
Average	8.33	7.56	5.16	5.18	2.38

[1] HTS item 8542.11.8024 in 1995.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-6
Cased DRAMS over 3,000,000 bits but not over 15,000,000 bits (HTS item 8542.13.8026):[1] U.S. imports for consumption, by specified sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**10,289**	**51,091**	**88,956**	**66,897**	**58,342**
Korea	89,724	110,970	94,773	70,064	53,653
Japan	134,993	106,206	78,771	62,602	30,832
Singapore	56,664	33,968	20,294	16,491	6,847
Canada	65,537	52,055	22,221	17,731	7,872
Malaysia	29,337	41,363	23,266	19,583	7,876
Germany	11,386	14,438	19,217	13,076	9,085
France	867	711	770	267	1,743
Italy	3,617	5,508	3,746	2,481	988
United Kingdom	17,865	18,522	8,561	6,705	2,976
All others	8,733	11,469	7,681	4,672	7,184
Total	429,012	446,301	368,256	280,569	187,398
	Value (1,000 dollars)				
Taiwan	**135,024**	**207,402**	**266,231**	**195,199**	**151,016**
Korea	1,247,167	707,291	382,993	285,108	148,581
Japan	1,820,505	778,184	303,949	246,367	87,333
Singapore	600,607	172,453	62,333	53,387	15,477
Canada	515,561	386,811	152,716	126,110	46,101
Malaysia	307,109	204,013	59,264	49,781	17,767
Germany	159,060	66,110	36,784	27,632	12,818
France	14,032	5,705	3,931	1,340	3,946
Italy	39,466	26,076	10,579	7,418	1,032
United Kingdom	179,795	79,965	16,732	12,988	4,754
All others	113,009	60,220	15,969	11,599	11,672
Total	5,131,335	2,694,230	1,311,481	1,016,929	500,497
	Average unit value				
Taiwan	**$13.12**	**$4.06**	**$2.99**	**$2.92**	**$2.59**
Korea	13.90	6.37	4.04	4.07	2.77
Japan	13.49	7.33	3.86	3.94	2.83
Singapore	10.60	5.08	3.07	3.24	2.26
Canada	7.87	7.43	6.87	7.11	5.86
Malaysia	10.47	4.93	2.55	2.54	2.26
Germany	13.97	4.58	1.91	2.11	1.41
France	16.18	8.03	5.10	5.02	2.26
Italy	10.91	4.73	2.82	2.99	1.04
United Kingdom	10.06	4.32	1.95	1.94	1.60
All others	12.94	5.25	2.08	2.48	1.62
Average	11.96	6.04	3.56	3.62	2.67

[1] HTS item 8542.11.8026 in 1995.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-7
Cased DRAMS over 15,000,000 bits (HTS item 8542.13.8034):[1] U.S. imports for consumption, by specified sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**454**	**1,764**	**20,288**	**11,451**	**56,654**
Korea	54,126	120,499	172,224	116,344	187,292
Japan	34,075	79,873	163,236	124,396	112,424
Singapore	7,302	42,741	122,672	74,119	121,074
Canada	4,466	21,380	41,021	27,784	31,174
Malaysia	4,937	12,881	18,843	14,541	9,689
Germany	2,489	6,476	27,182	16,867	32,174
France	553	3,329	16,661	9,420	29,155
Italy	1,634	4,662	12,548	8,814	9,533
United Kingdom	125	720	3,282	2,024	5,433
All others	434	2,181	5,451	3,678	6,710
Total	110,595	296,506	603,408	409,438	601,312
	Value (1,000 dollars)				
Taiwan	**22,746**	**23,415**	**123,183**	**83,187**	**164,458**
Korea	2,522,593	1,830,911	1,505,472	1,132,859	846,529
Japan	1,523,491	1,294,056	1,321,538	1,073,139	615,292
Singapore	302,127	550,038	711,504	465,408	376,329
Canada	117,281	461,389	457,671	309,391	533,290
Malaysia	205,264	291,511	138,717	120,917	32,166
Germany	100,597	93,437	161,302	113,763	85,664
France	28,476	55,367	97,063	64,538	77,406
Italy	74,574	79,064	70,158	57,024	34,212
United Kingdom	4,757	5,539	19,275	12,872	14,617
All others	13,774	29,565	35,657	27,516	19,037
Total	4,915,680	4,714,292	4,641,540	3,460,616	2,799,000
	Average unit value				
Taiwan	**$50.08**	**$13.28**	**$6.07**	**$7.26**	**$2.90**
Korea	46.61	15.19	8.74	9.74	4.52
Japan	44.71	16.20	8.10	8.63	5.47
Singapore	41.38	12.87	5.80	6.28	3.11
Canada	26.26	21.58	11.16	11.14	17.11
Malaysia	41.58	22.63	7.36	8.32	3.32
Germany	40.41	14.43	5.93	6.74	2.66
France	51.48	16.63	5.83	6.85	2.66
Italy	45.65	16.96	5.59	6.47	3.59
United Kingdom	38.01	7.69	5.87	6.36	2.69
All others	31.70	13.56	6.54	7.48	2.84
Average	44.45	15.90	7.69	8.45	4.65

[1] HTS item 8542.11.8034 in 1995.

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-8
Cased DRAMS: U.S. imports for consumption, by densities, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Density	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Less than 40K	8,420	21,246	35,208	24,376	8,506
Over 40K to 80K	6,365	7,483	5,630	3,693	3,400
Over 80K to 300K	23,540	6,746	3,571	2,413	8,625
Over 300K to 3 Meg	200,115	132,526	72,698	52,607	28,715
Over 3 Meg to 15 Meg	429,012	446,301	368,256	280,569	187,398
Over 15 Meg	110,595	296,506	603,408	409,438	601,312
Total	778,046	910,809	1,088,771	773,096	837,956
	Value (1,000 dollars)				
Less than 40K	77,221	59,660	60,097	39,191	17,709
Over 40K to 80K	28,578	39,229	20,016	12,999	8,014
Over 80K to 300K	60,773	27,412	17,213	11,273	17,713
Over 300K to 3 Meg	1,667,090	1,001,387	374,917	272,627	68,285
Over 3 Meg to 15 Meg	5,131,335	2,694,230	1,311,481	1,016,929	500,497
Over 15 Meg	4,915,680	4,714,292	4,641,540	3,460,616	2,799,000
Total	11,880,678	8,536,211	6,425,263	4,813,634	3,411,218
	Average unit value				
Less than 40K	$9.17	$2.81	$1.71	$1.61	$2.08
Over 40K to 80K	4.49	5.24	3.56	3.52	2.36
Over 80K to 300K	2.58	4.06	4.82	4.67	2.05
Over 300K to 3 Meg	8.33	7.56	5.16	5.18	2.38
Over 3 Meg to 15 Meg	11.96	6.04	3.56	3.62	2.67
Over 15 Meg	44.45	15.90	7.69	8.45	4.65
Average	15.27	9.37	5.90	6.23	4.07

Source: Compiled from official statistics of the U.S. Department of Commerce.

Table F-9
Unmounted chips, dice, and wafers:[1] U.S. imports for consumption, by principal sources, 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

Country	1995	1996	1997	January-September--	
				1997	1998
	Quantity (1,000 units)				
Taiwan	**64,620**	**108,885**	**83,617**	**57,760**	**66,345**
Japan	291,907	344,787	476,166	337,264	373,579
France	12,979	19,493	33,928	26,104	42,622
Singapore	22,327	43,381	36,615	31,440	36,498
Malaysia	44,513	59,894	70,236	44,887	13,692
Canada	502	352	247	205	119
Germany	42,331	14,203	5,643	4,082	3,637
Korea	5,806	15,518	17,052	10,911	16,065
United Kingdom	12,155	120,658	1,519	1,323	562
Italy	641	1,495	2,903	1,756	2,999
All others	132,846	47,435	31,862	27,493	53,030
Total	630,627	776,101	759,788	543,225	609,148
	Value (1,000 dollars)				
Taiwan	**234,611**	**460,122**	**248,797**	**158,755**	**182,027**
Japan	922,575	662,885	455,144	344,702	282,149
France	508,848	478,740	275,133	200,226	358,631
Singapore	88,367	213,533	94,366	62,915	49,491
Malaysia	45,975	71,388	50,069	40,706	20,316
Canada	8,660	54,852	41,116	34,696	26,420
Germany	103,512	82,502	40,660	34,467	36,541
Korea	42,112	56,662	37,318	24,053	27,884
United Kingdom	75,996	13,181	7,815	4,779	4,676
Italy	13,605	24,465	7,058	5,312	12,738
All others	671,327	194,384	59,829	46,079	47,206
Total	2,715,588	2,312,714	1,317,305	956,690	1,048,079
	Average unit value				
Taiwan	**$3.63**	**$4.23**	**$2.98**	**$2.75**	**$2.74**
Japan	3.16	1.92	0.96	1.02	0.76
France	39.21	24.56	8.11	7.67	8.41
Singapore	3.96	4.92	2.58	2.00	1.36
Malaysia	1.03	1.19	0.71	0.91	1.48
Canada	17.25	155.64	166.48	169.43	222.28
Germany	2.44	5.81	7.20	8.44	10.05
Korea	7.25	3.65	2.19	2.20	1.74
United Kingdom	6.25	0.11	5.14	3.61	8.33
Italy	21.23	16.36	2.43	3.02	4.25
All others	5.05	4.10	1.88	1.68	0.89
Average	4.31	2.98	1.73	1.76	1.72

[1] HTS item 8542.13.8005 (8542.11.8001 in 1995). These items include merchandise other than DRAMs.

Source: Compiled from official statistics of the U.S. Department of Commerce.

APPENDIX G

PRICE GRAPHS

Figure G-1
DRAMs: Price trends of U.S. producers and importers of product 1 fabricated in Taiwan, and margins of over- or underselling, by months, Jan. 1997-Sept. 1998

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Figure G-2
DRAMs: Price trends of U.S. producers and importers of product 2 fabricated in Taiwan, and margins of over- or underselling, by months, Jan. 1997-Sept. 1998

* * * * * * *

Figure G-3
DRAMs: Price trends of U.S. producers and importers of product 4 fabricated in Taiwan, and margins of over- or underselling, by months, Jan. 1995-Sept. 1998

* * * * * * *

APPENDIX H

RESULTS OF OPERATIONS, CAPITAL EXPENDITURES, RESEARCH AND DEVELOPMENT EXPENSES, AND INVESTMENT IN PRODUCTIVE FACILITIES OF MODULE ASSEMBLER

DRAM MODULE ASSEMBLER OPERATIONS

The DRAM module assembly operations of *** are presented in table H-1.[1]

Table H-1
Results of DRAM module assembly operations of ***, calendar years 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

* * * * * * *

CAPITAL EXPENDITURES, RESEARCH AND DEVELOPMENT EXPENSES, AND INVESTMENT IN PRODUCTIVE FACILITIES

The U.S. module assembler's capital expenditures, research and development expenditures, and the value of its fixed assets are presented in table H-2.

Table H-2
Capital expenditures, research and development expenditures, and assets utilized by the U.S. DRAM module assembler, calendar years 1995-97, Jan.-Sept. 1997, and Jan.-Sept. 1998

* * * * * * *

[1] The fiscal yearend of ***.

APPENDIX I

EFFECTS OF IMPORTS ON PRODUCERS' EXISTING DEVELOPMENT AND PRODUCTION EFFORTS, GROWTH, INVESTMENT, AND ABILITY TO RAISE CAPITAL

APPENDIX I

EFFECTS OF IMPORTS ON PRODUCERS' EXISTING DEVELOPMENT AND PRODUCTION EFFORTS, GROWTH, INVESTMENT, AND ABILITY TO RAISE CAPITAL

RESPONSES OF U.S. PRODUCERS TO THE FOLLOWING QUESTIONS:

1. Since January 1, 1995, has your firm experienced any actual negative effects on its return on investment or its growth, investment, ability to raise capital, existing development and production efforts (including efforts to develop a derivative or more advanced version of the product), or the scale of investments as a result of imports of DRAMs of 1 Meg or above or any DRAM modules from Taiwan?

*** did not respond. The responses of the other producers *** are:

***.[1] ***.[2] ***.[3]

2. Does your firm anticipate any negative impact of imports of DRAMs of 1 Meg or above or any DRAM modules from Taiwan?

*** did not respond. The responses of the other producers are:

* * * * * * *

[1] ***.

[2] ***.

[3] ***.

APPENDIX J

ADDITIONAL DATA ON FOREIGN PRODUCERS' CAPACITY, PRODUCTION, INVENTORIES, CAPACITY UTILIZATION, AND SHIPMENTS

Table J-1
Uncased DRAMs≥1 Meg: Taiwans capacity, wafer starts, production, inventories, capacity utilization, and shipments, 1995-97, Jan.-Sept. 1997, Jan.-Sept. 1998, and projected 1998-99

Item	1995	1996	1997	Jan.-Sept.-- 1997	Jan.-Sept.-- 1998	Projected-- 1998	Projected-- 1999
	Quantity (*billion bits, except where specified*)						
Capacity[1] (*1,000 wafers*)	517	1,194	1,835	1,317	1,312	1,906	1,613
Wafer starts[1] (*1,000 wafers*)	578	1,195	1,791	1,313	1,142	1,573	1,340
Production	523,579	1,993,154	5,860,454	3,623,960	6,312,730	9,798,830	17,624,524
End-of-period inventories	***	***	45,472	***	53,810	38,318	***
Shipments:							
Home market:							
Transfers to produce cased DRAMs	326,479	1,095,036	4,089,208	2,745,275	4,726,950	7,220,674	13,774,554
Other company transfers	***	***	***	***	***	***	***
Other shipments	***	***	***	***	***	***	***
Total home market	***	***	***	***	***	***	***
Exports to--							
The United States	***	***	***	***	***	***	***
All other markets	***	***	***	***	***	***	***
Total exports	***	***	***	***	***	***	***
Total shipments	521,828	1,970,454	5,835,803	3,603,282	6,309,895	9,811,488	17,645,556
	Ratios and shares (*percent*)						
Capacity utilization[1]	111.8	100.1	97.6	99.7	87.1	82.5	83.1
Inventories to production	.7	1.4	1.0	1.2	.9	.6	.1
Inventories to all shipments	.7	1.4	1.0	.6	.9	.6	.1
Share of total quantity of shipments:							
Home market:							
Transfers to produce cased DRAMs	62.6	55.6	70.1	76.2	74.9	73.6	78.1
Other company transfers	***	***	***	***	***	***	***
Other shipments	***	***	***	***	***	***	***
Total home market	***	***	***	***	***	***	***
Exports to--							
The United States	***	***	***	***	***	***	***
All other markets	***	***	***	***	***	***	***

[1] Includes data for DRAMs<1 Meg, ***.

Note.–Inventory ratios are calculated using data where both comparable numerator and denominator information were supplied.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table J-2
Cased DRAMs≥1 Meg:[1] Taiwans capacity, production, inventories, capacity utilization, and shipments, 1995-97, Jan.-Sept. 1997, Jan.-Sept. 1998, and projected 1998-99

Item	1995	1996	1997	Jan.-Sept.-- 1997	Jan.-Sept.-- 1998	Projected-- 1998	Projected-- 1999
	Quantity (*billion bits, except where specified*)						
Capacity[2] (*1,000 units*)	***	***	***	***	***	***	***
Assembly[2] (*1,000 units*)	***	***	***	***	***	***	***
Production	324,140	1,106,832	4,147,204	2,779,635	4,768,900	7,413,527	13,830,116
End-of-period inventories	25,549	68,467	380,996	205,015	440,674	341,350	382,555
Shipments:							
Home market:							
Transfers to produce DRAM modules	***	***	***	***	***	***	***
Other company transfers	***	***	***	***	***	***	***
Other shipments	***	***	***	***	***	***	***
Total home market	***	466,903	1,816,170	1,246,180	2,185,743	3,292,187	6,769,206
Exports to--							
The United States	***	***	***	***	***	***	***
All other markets	***	***	***	***	***	***	***
Total exports	***	588,579	2,003,297	1,374,676	2,414,148	3,744,938	6,606,449
Total shipments	300,348	1,055,482	3,819,468	2,620,856	4,599,892	7,037,126	13,375,655
	Ratios and shares (*percent*)						
Capacity utilization[2]	***	***	***	***	***	***	***
Inventories to production	7.9	6.2	9.2	5.5	6.9	4.6	2.8
Inventories to all shipments	8.4	6.5	10.0	5.9	7.2	4.9	2.9
Share of total quantity of shipments:							
Home market:							
Transfers to produce DRAM modules	***	***	***	***	***	***	***
Other company transfers	***	***	***	***	***	***	***
Other shipments	***	***	***	***	***	***	***
Total home market	***	44.2	47.6	47.5	47.5	46.8	50.6
Exports to--							
The United States	***	***	***	***	***	***	***
All other markets	***	***	***	***	***	***	***

[1] Unless otherwise specified, data are for cased DRAMs≥1 Meg made from Taiwan-fabricated dice.
[2] Includes data for cased DRAMs<1 Meg made from Taiwan-fabricated dice and cased DRAMs made from non-Taiwan dice, ***. Firms having assembly done for them under subcontract were unable to provide capacity data; the only capacity and assembly data presented are for firms that did their own assembly.

Note.--Inventory ratios are calculated using data where both comparable numerator and denominator information were supplied.

Source: Compiled from data submitted in response to questionnaires of the U.S. International Trade Commission.

Table J-3
DRAM modules:[1] Taiwans production, inventories, and shipments, 1995-97, Jan.-Sept. 1997, Jan.-Sept. 1998, and projected 1998-99

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