PWB OUTLOOK

WALT CUSTER
CUSTER CONSULTING GROUP
www.custerconsulting.com
June 2000

Continuous Improvement

Upgrades from 12/99 Presentation

Entire color presentation in PDF format posted on:
Custer Consulting Group website
http://www.custerconsulting.com **(look under Downloads)**
Also: CircuiTree " Market Outlook" articles, business indicators & more

Handouts
- Chart colors adjusted so all information also shows on B&W handout
- Larger charts

Future Change ???
Blue -> White background

TOPICS

GLOBAL ECONOMY

ELECTRONIC EQUIPMENT

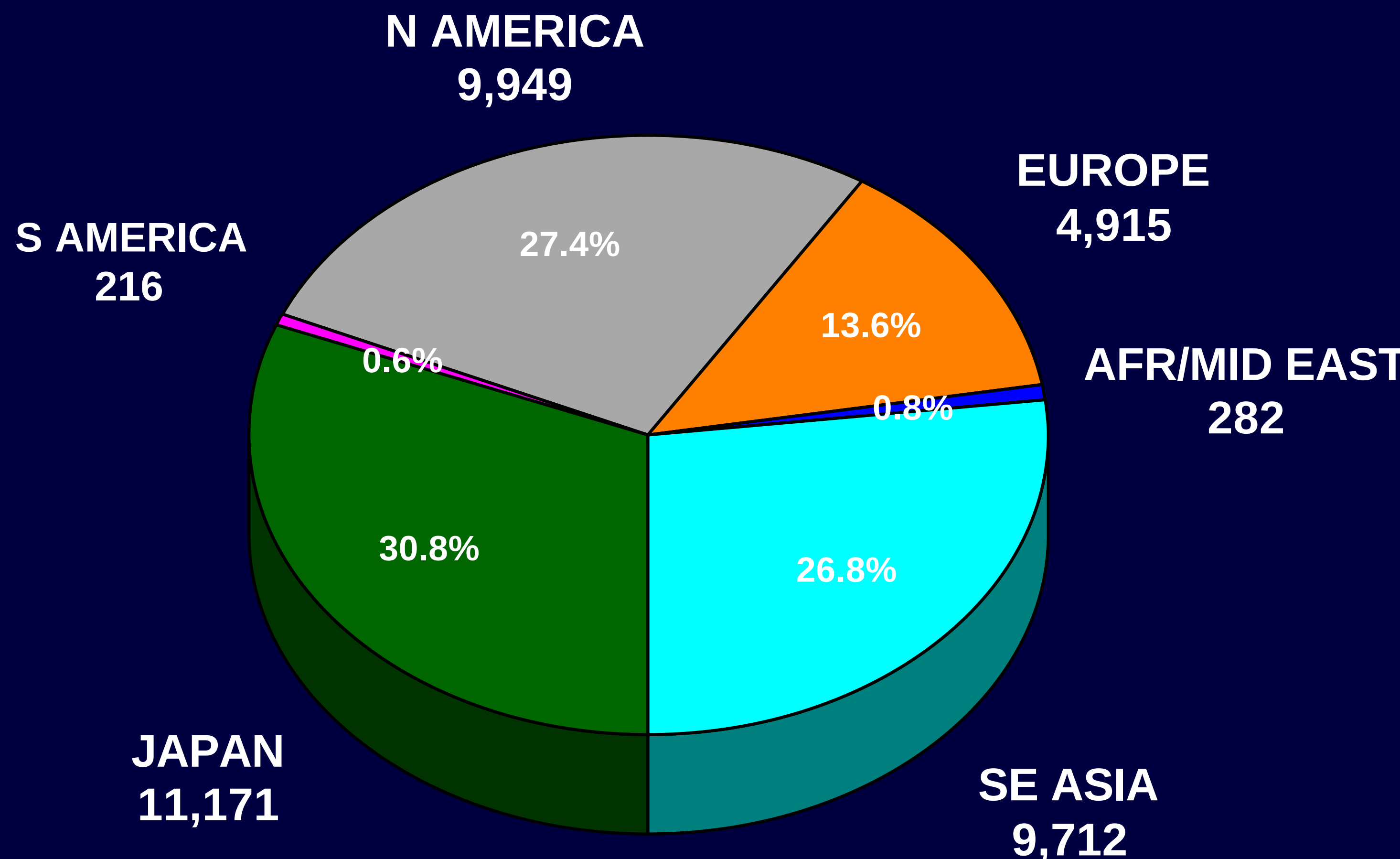
SEMICONDUCTORS

PRINTED CIRCUIT BOARDS

FUTURE OUTLOOK

1999 WORLD RIGID & FLEX PCB PRODUCTION

BY GEOGRAPHICAL AREA ($M)

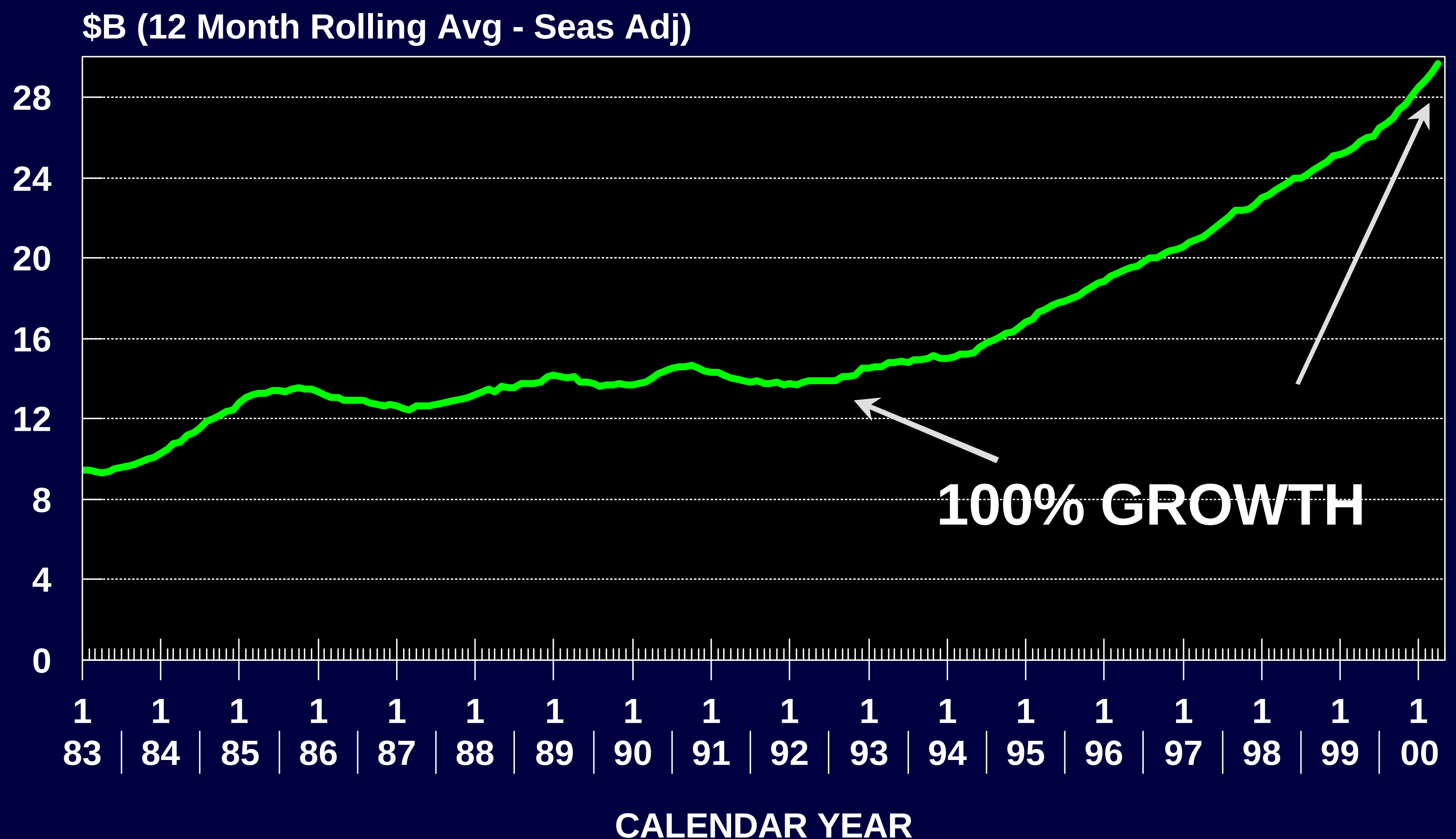


Total: $36.2 Billion

IPC T/MRC 6/2000 (includes Buildup PCBs)

US ELECTRONIC EQUIPMENT ORDERS

COMMUNICATION, COMPUTER & OFFICE, MILITARY, INSTRUMENTS



US DEPT OF COMMERCE 6/2000

INDUSTRIAL PRODUCTION - WORLD

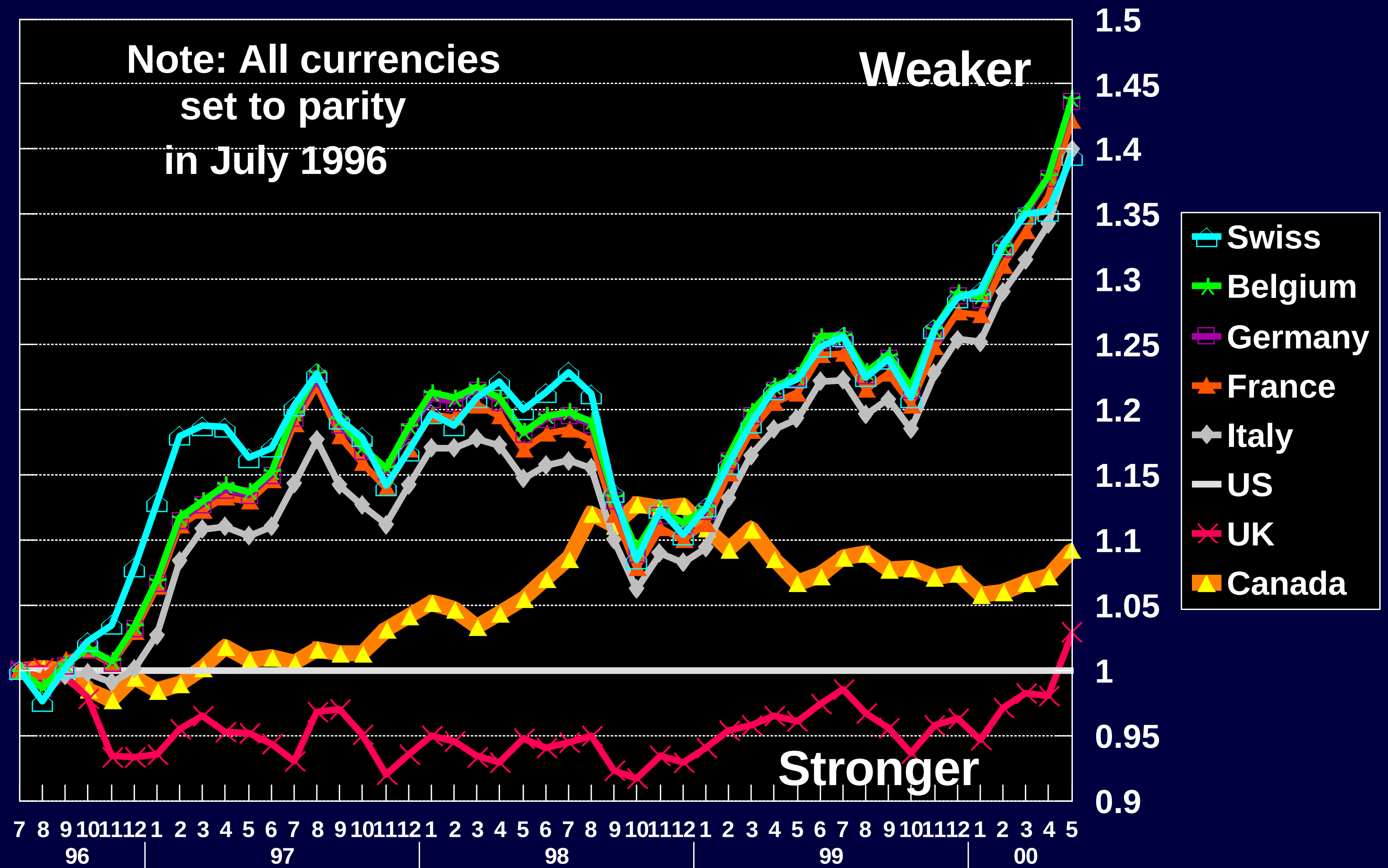
% CHANGE vs ONE YEAR EARLIER

BRITAIN	+2.2 Apr
FRANCE	+4.4 Mar
GERMANY	+6.1 Apr
ITALY	- 4.2 Apr
NETHERLANDS	+5.1 Apr
SPAIN	+9.9 Mar
EURO-11	+5.0 Mar
RUSSIA	+10.6 May
CANADA	+6.2 Mar
USA	+5.9 May
CHINA	+11.4 Apr
MALAYSIA	+18.6 Apr
SINGAPORE	+9.5 Apr
S KOREA	+16.9 Apr
TAIWAN	+6.0 Apr
THAILAND	+4.2 Apr
JAPAN	+6.3 Apr

Economist 6/2000 http://www.economist.com

EUROPEAN EXCHANGE RATES vs US $

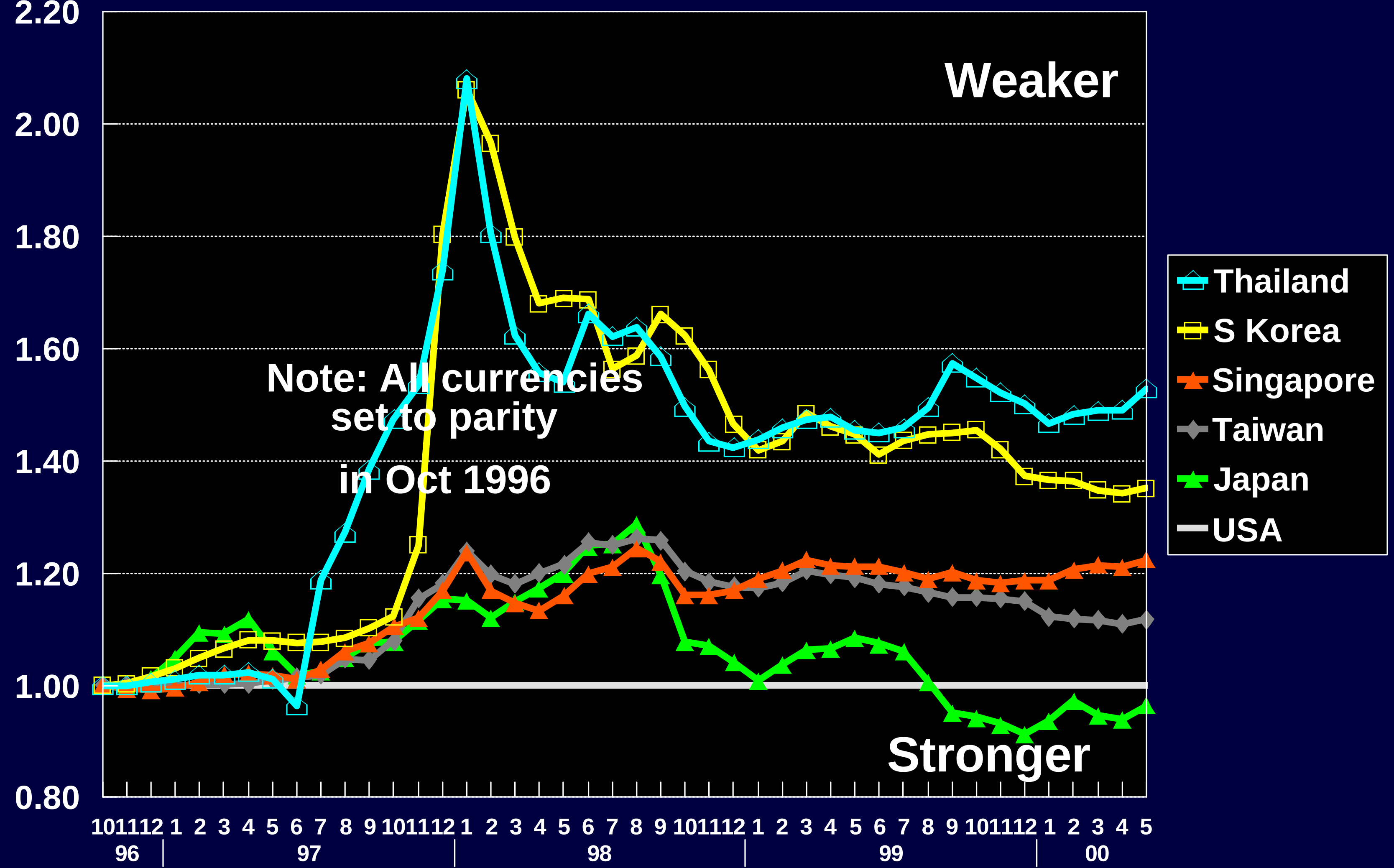
7/96 = 1.00



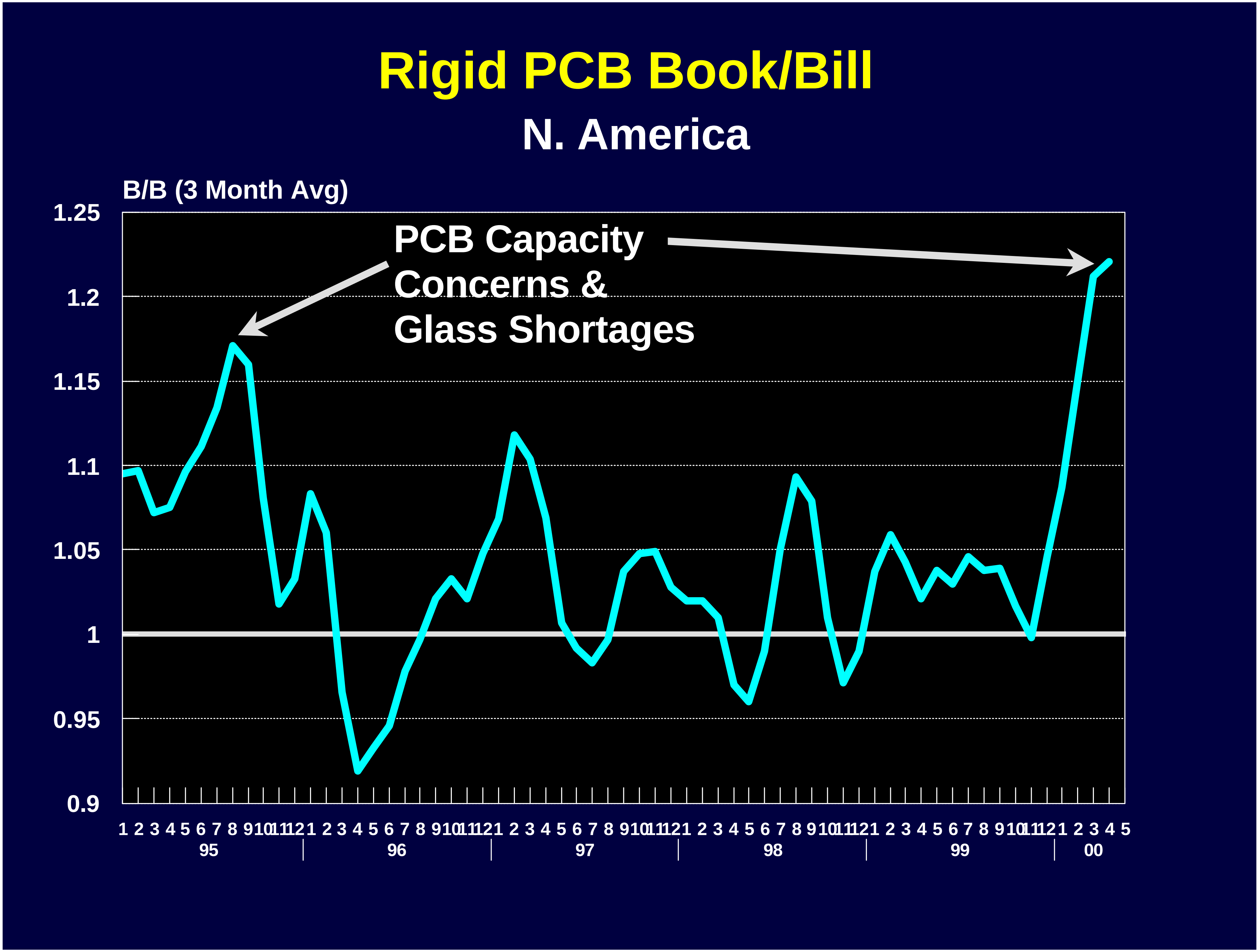
http://www.stls.frb.org/fred/data/exchange.html

SE ASIA EXCHANGE RATE vs US $

10/96 = 1.00

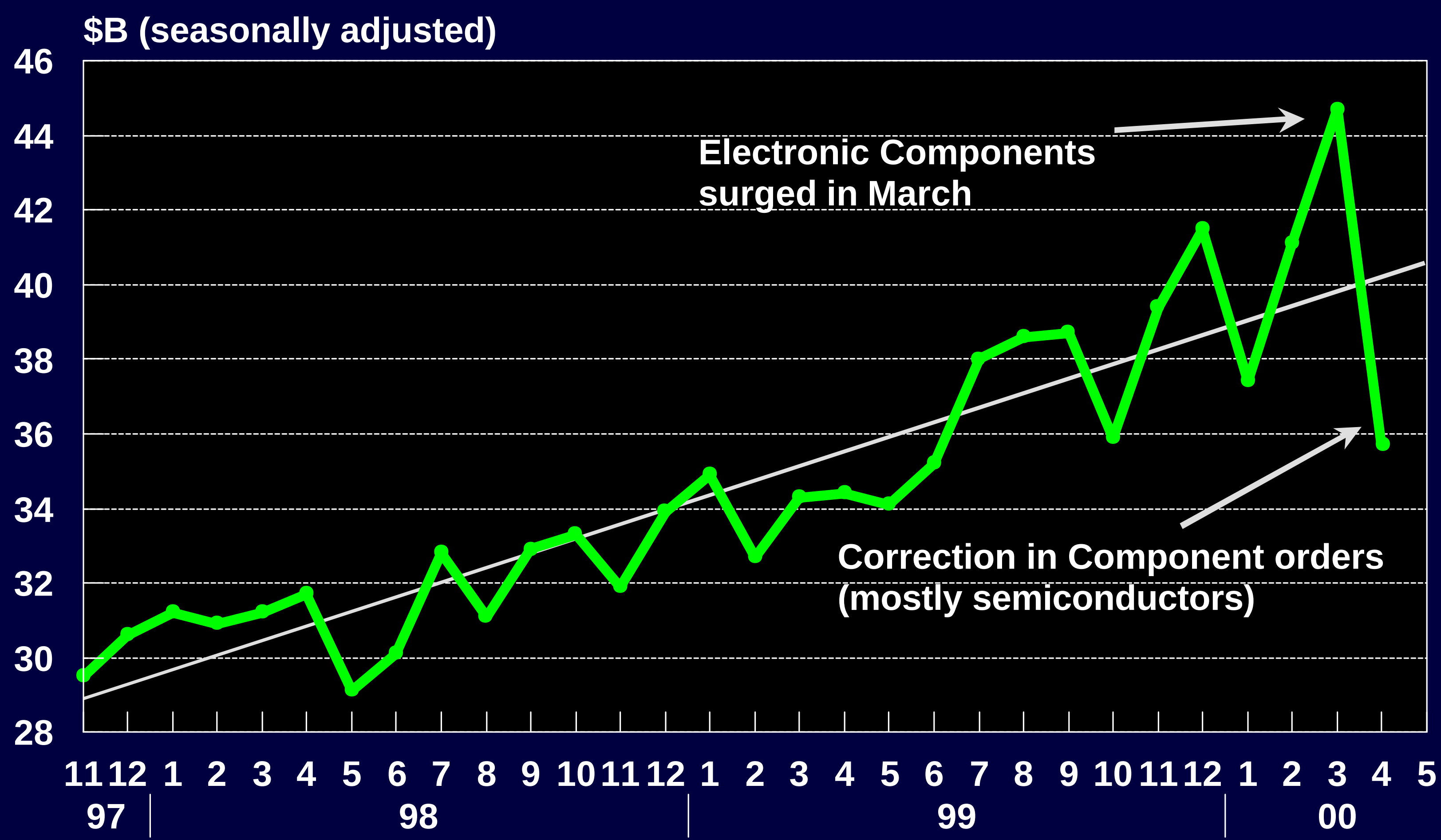


http://www.stls.frb.org/fred/data/exchange.html



Rigid PCB Book/Bill
N. America
B/B (3 Month Avg)
1.25
1.2
1.15
1.1
1.05
1
0.95
0.9
PCB Capacity
Concerns &
Glass Shortages
1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5
95
96
97
98
99
00

U.S. DURABLE GOODS ORDERS
ELECTRONIC & OTHER ELECTRICAL EQUIPMENT



U.S Dept of Commerce 5/2000

LONG TERM GROWTH DRIVERS

INCREASING ELECTRONIC CONTENT OF CAPITAL GOODS

PRODUCTS THAT DID NOT EXIST A DECADE AGO

EMERGING GLOBAL MARKETS

GLOBAL PERSONAL COMPUTER CATCH-UP TO USA LEVELS

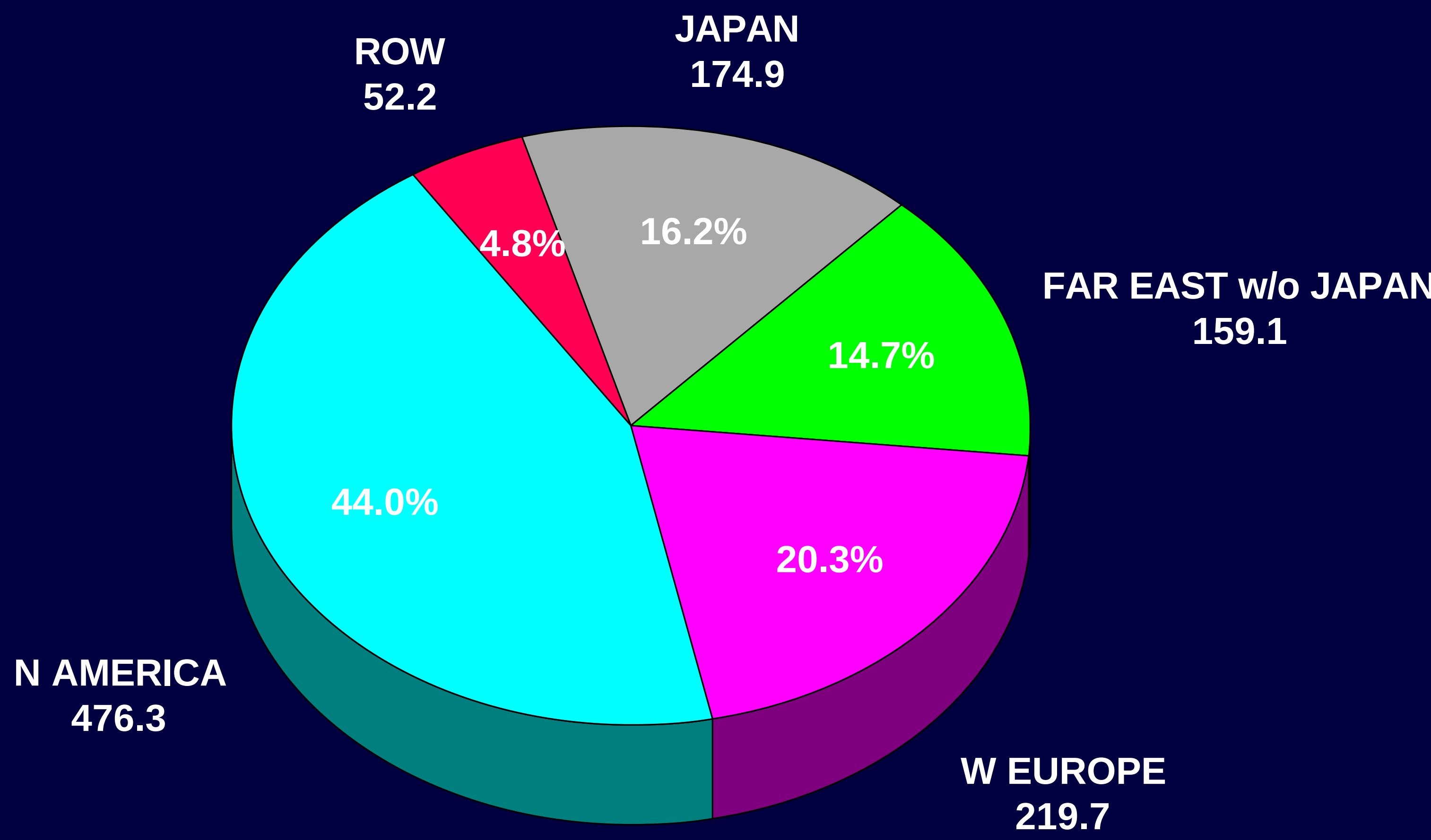
CELLULAR PHONES - DEVELOPING NATIONS

INTERNET EXPLOSION

E-BUSINESS HARDWARE

WORLD ELECTRONIC EQUIPMENT PRODUCTION

1999

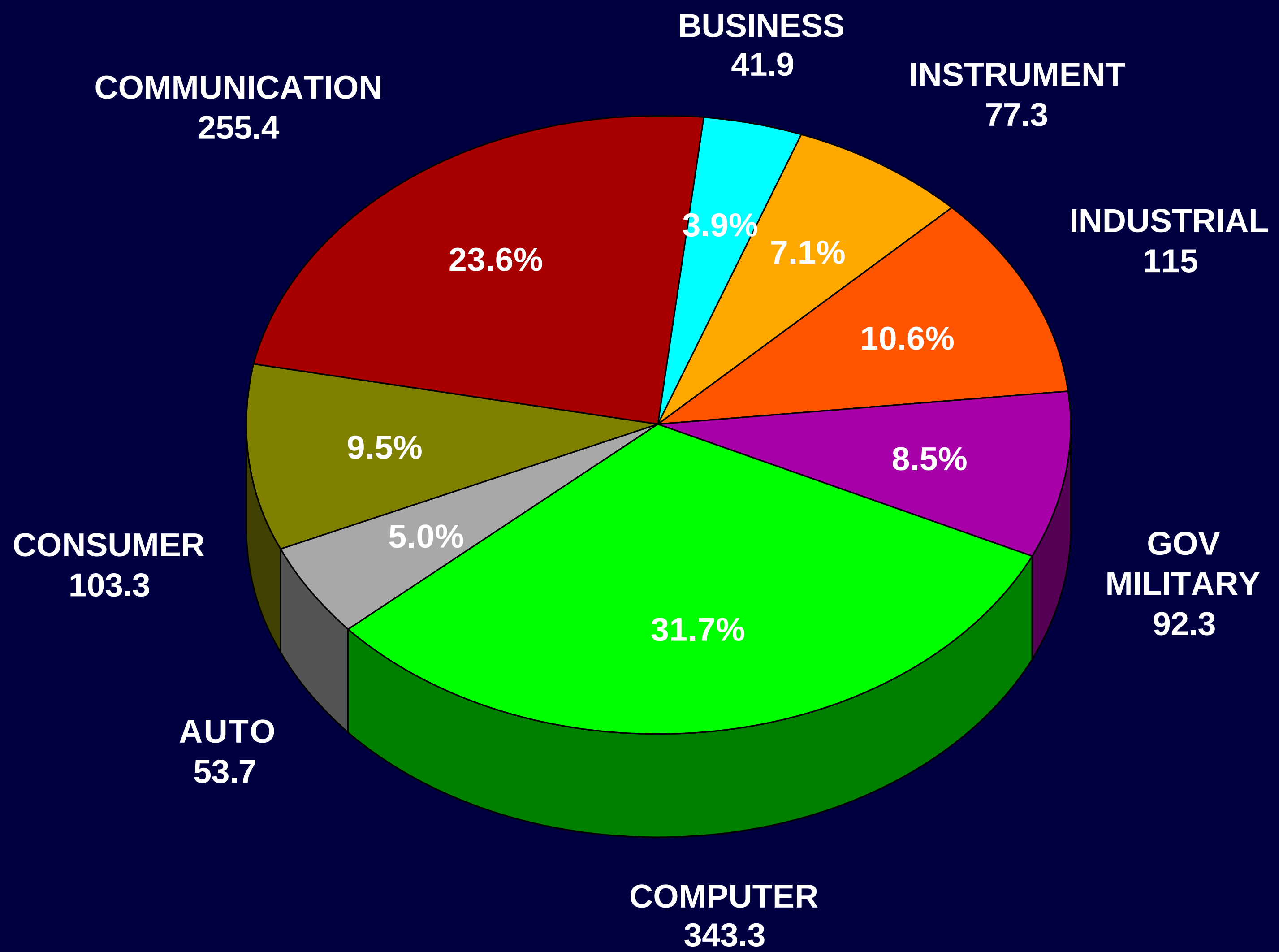


TOTAL $1,082 Billion

ELECTRONIC OUTLOOK CORP: R ANAVY 4/2000

ELECTRONIC EQUIPMENT PRODUCTION

WORLD - 1999 ESTIMATE ($B)

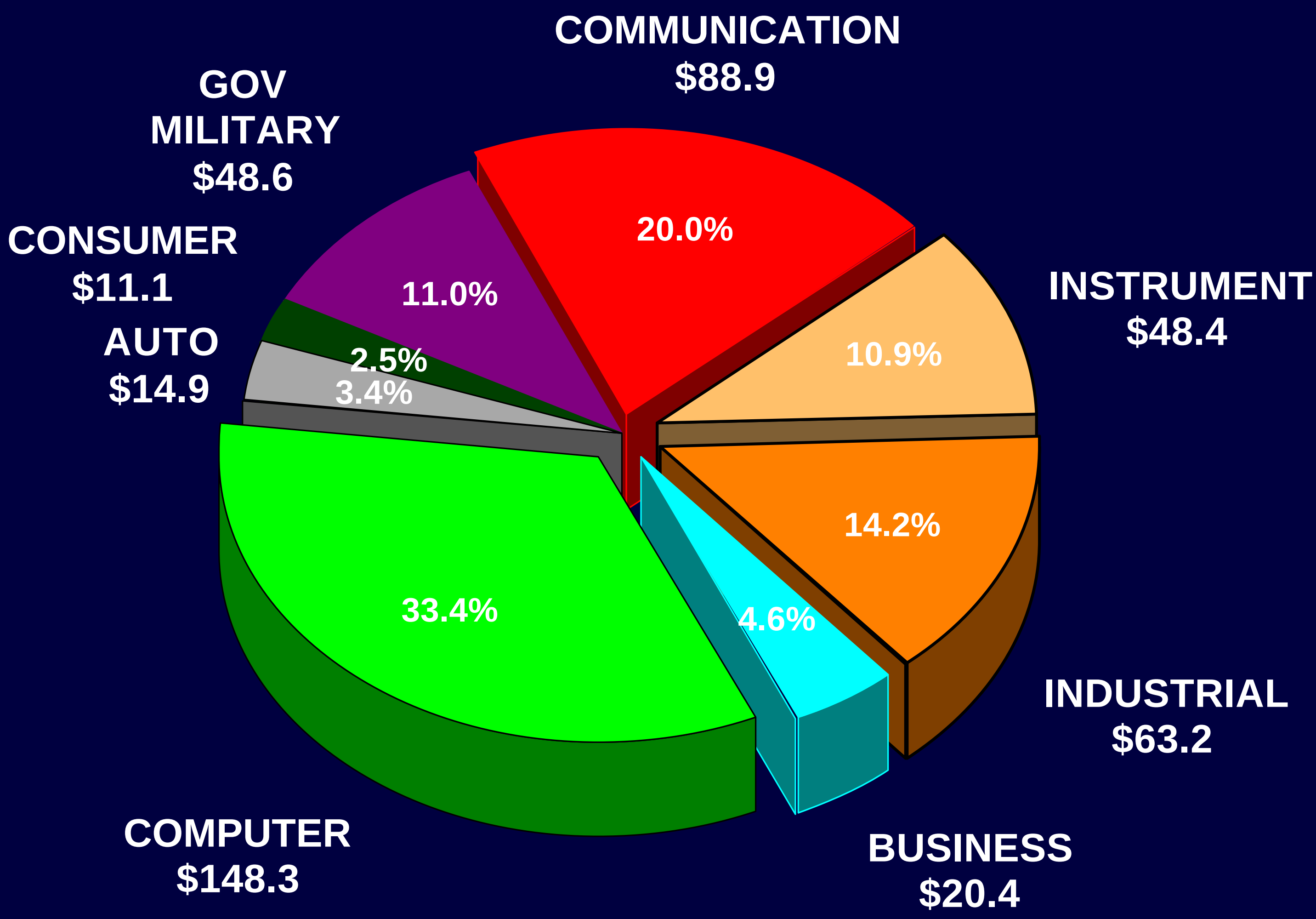


ELECTRONIC OUTLOOK 4/2000

TOTAL $1,082 B

US PRODUCTION OF ELECTRONIC EQUIPMENT

1999 ESTIMATE ($B)

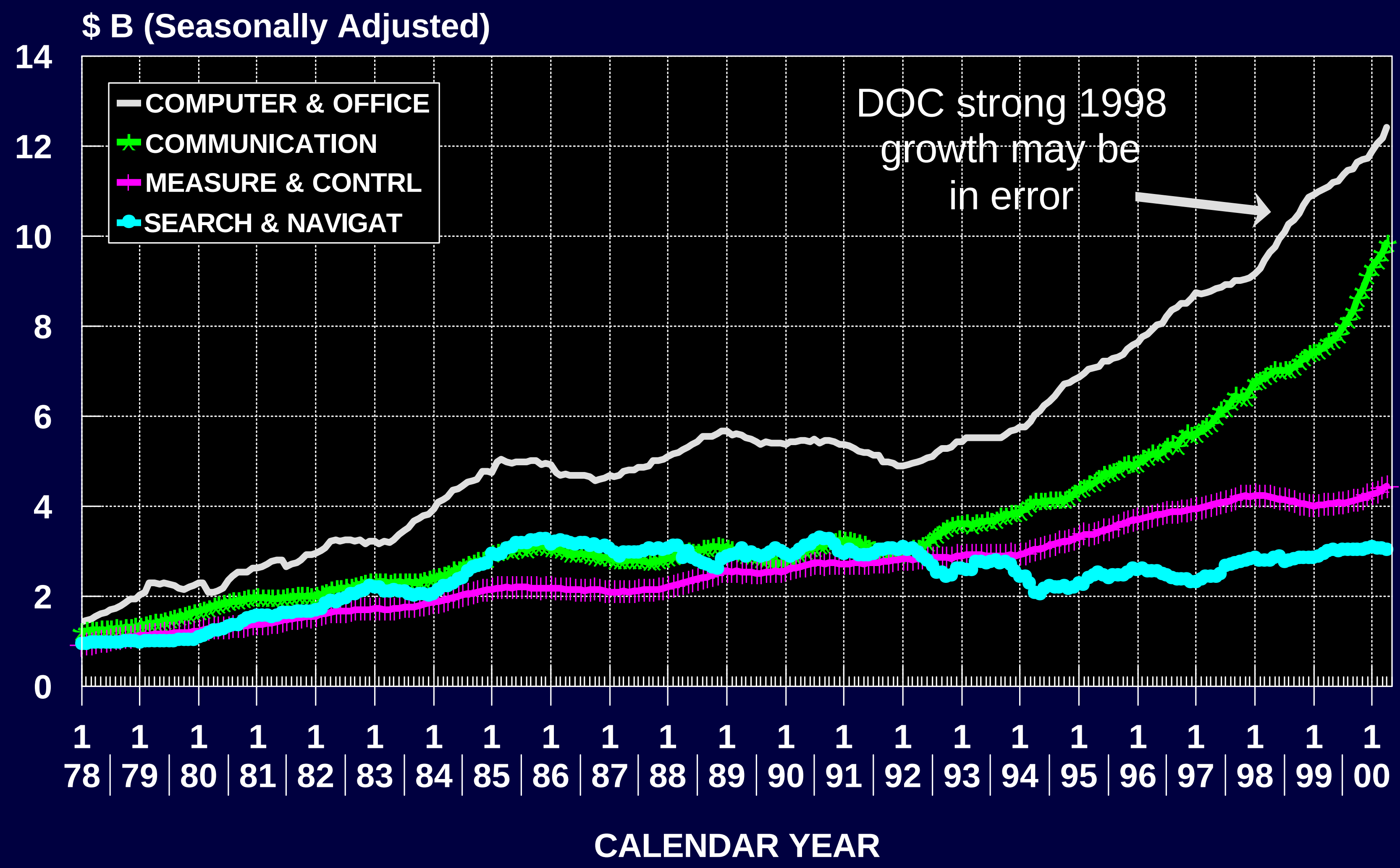


TOTAL = $444 Billion

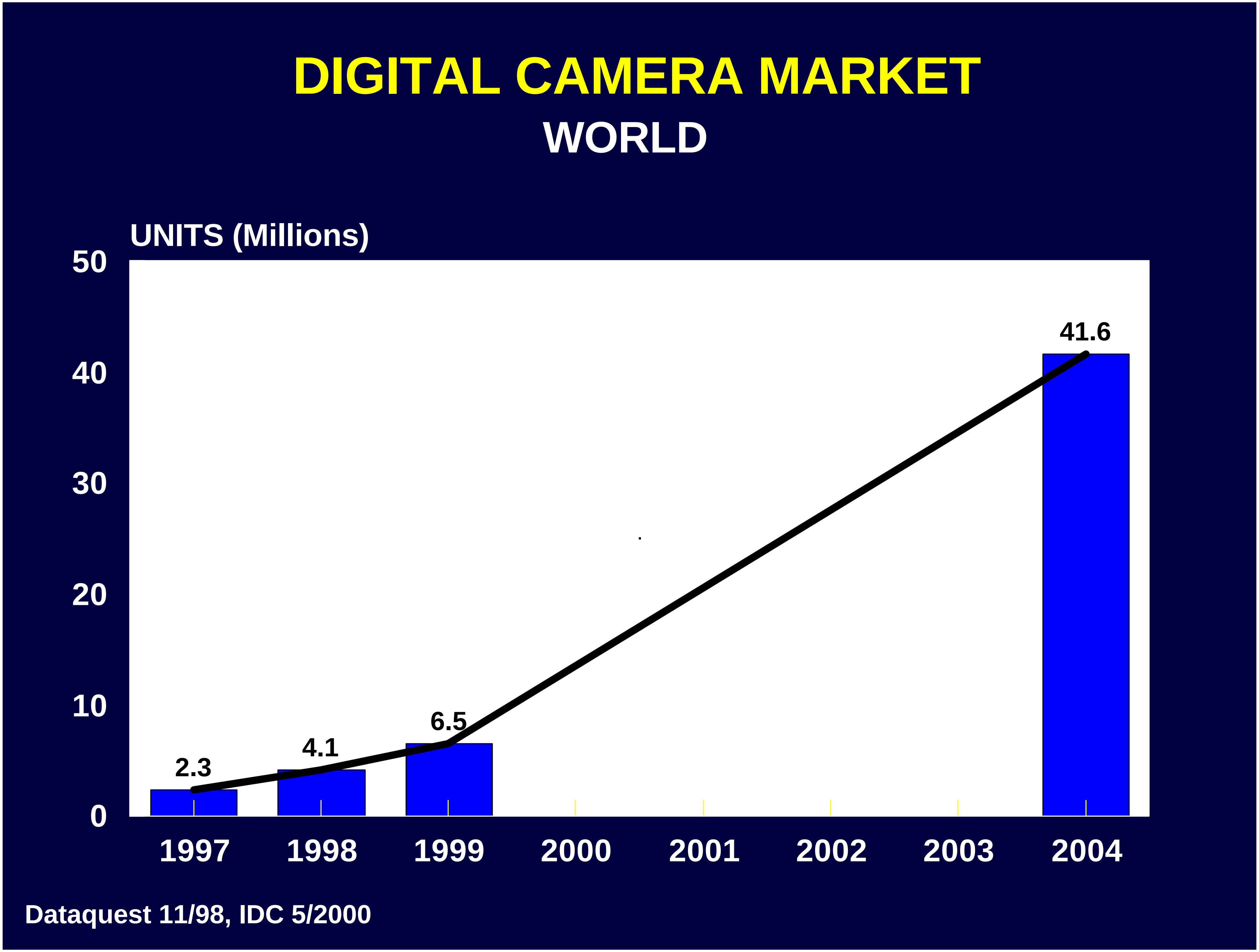
Electronic Outlook Corp 4/2000

US ELECTRONIC EQUIPMENT BOOKINGS

12 MONTH ROLLING AVERAGE



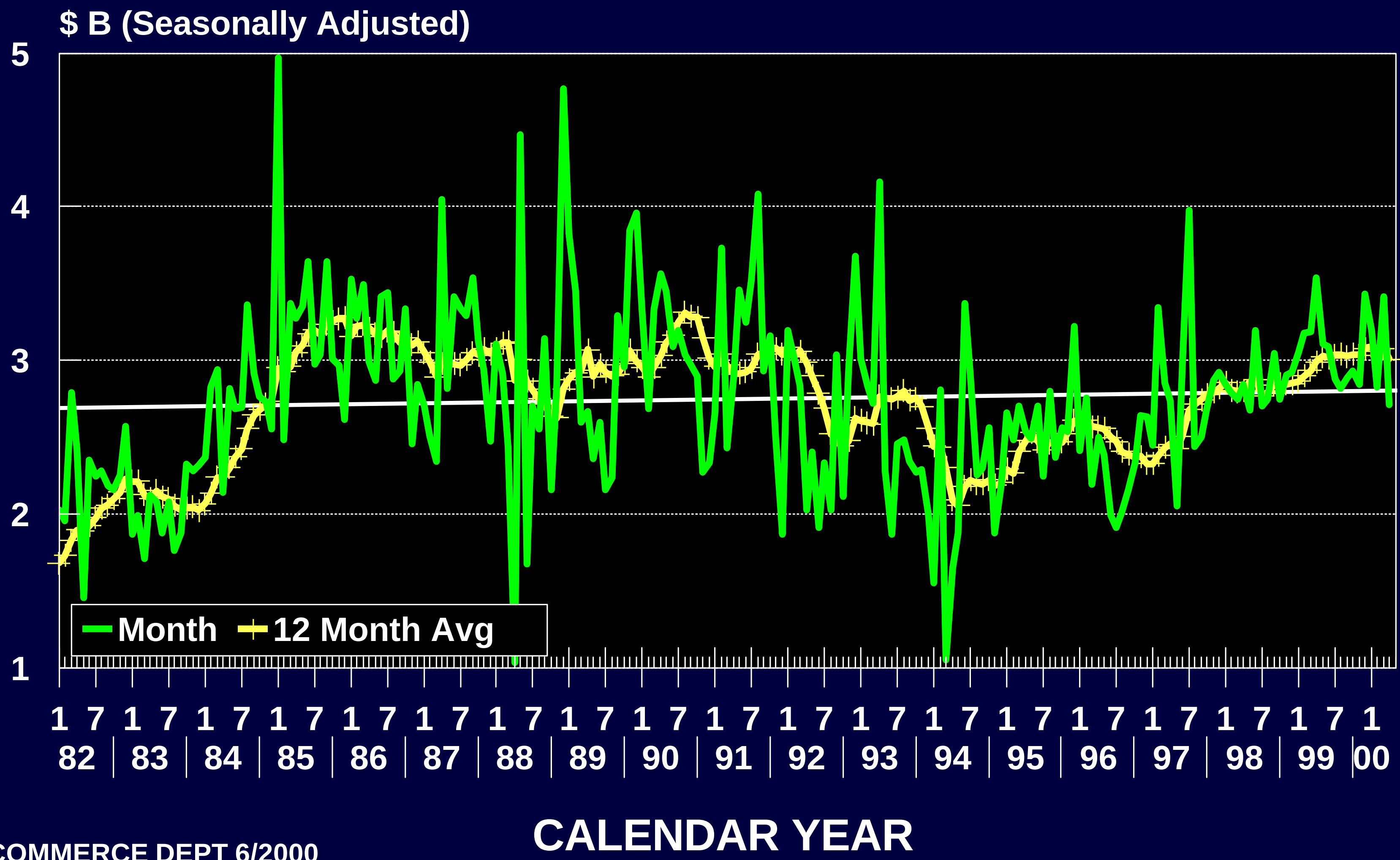
US DEPT OF COMMERCE 6/2000


DIGITAL CAMERA MARKET
WORLD
UNITS (Millions)
50
40
30
20
10
0
2.3
4.1
6.5
41.6
1997
1998
1999
2000
2001
2002
2003
2004
Dataquest 11/98, IDC 5/2000

SEARCH & NAVIGATION EQUIPMENT

BOOKINGS

PRIMARILY MILITARY ELECTRONICS



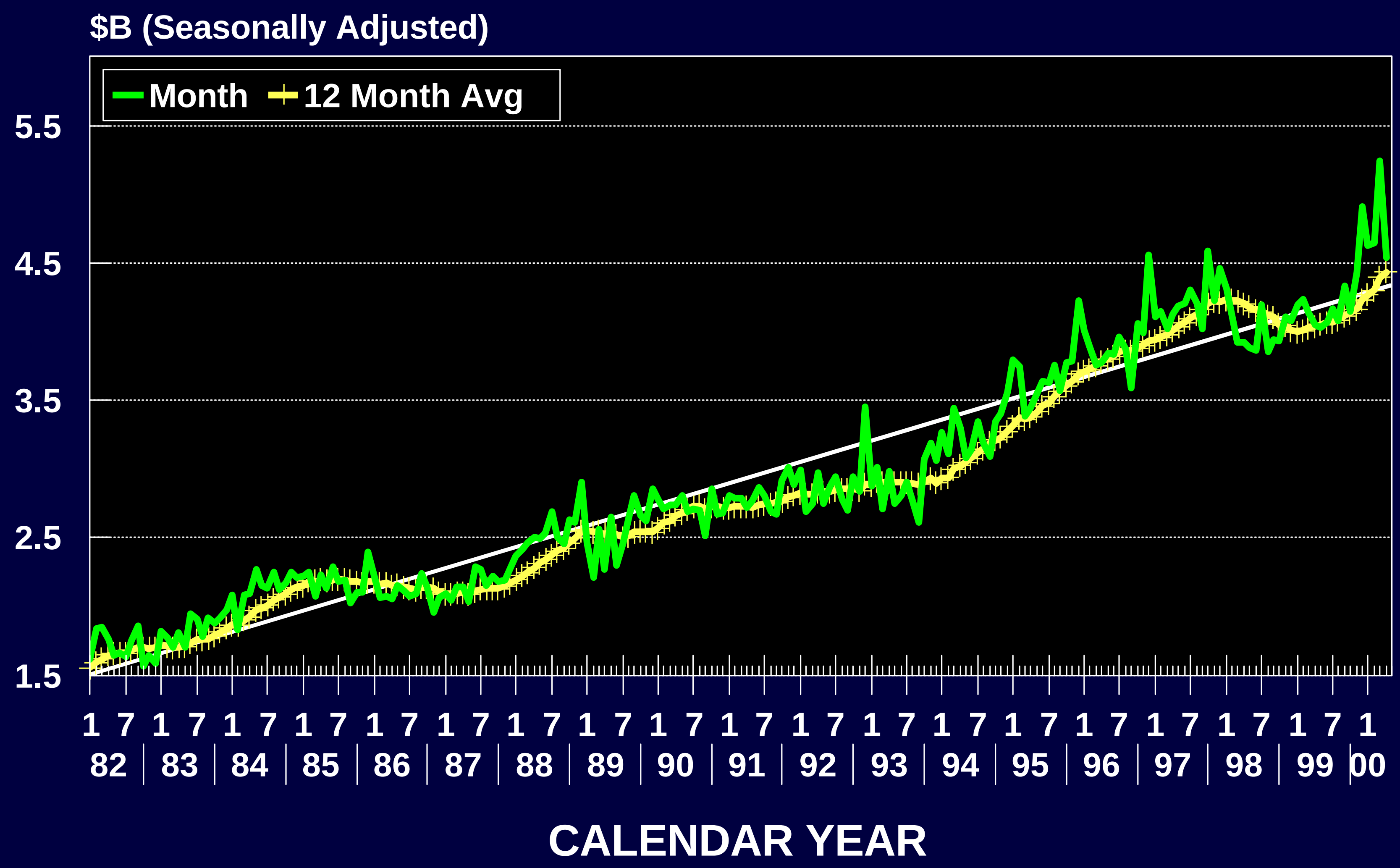
COMMERCE DEPT 6/2000

Government, Military & Aerospace

Rank		1998 Global Segment Revenue ($M)
1	Raytheon	$14,822
2	Lockheed Martin	$7,342
3	General Electric Co. (GEC)	$6,116
4	General Motors	$5,968
5	TRW	$4,900
6	Northrop Grumman	$4,006
7	Litton Industries	$2,841
8	Honeywell	$2,528
9	Boeing Company, The	$2,527
10	Rockwell International	$2,318
11	Allied Signal	$2,154
12	ITT Industries	$1,220
13	Harris	$937
14	Motorola	$882
15	Sagem	$739

Electronic Business: www.eb-mag.com/registrd/issues/9907/0799top3.htm

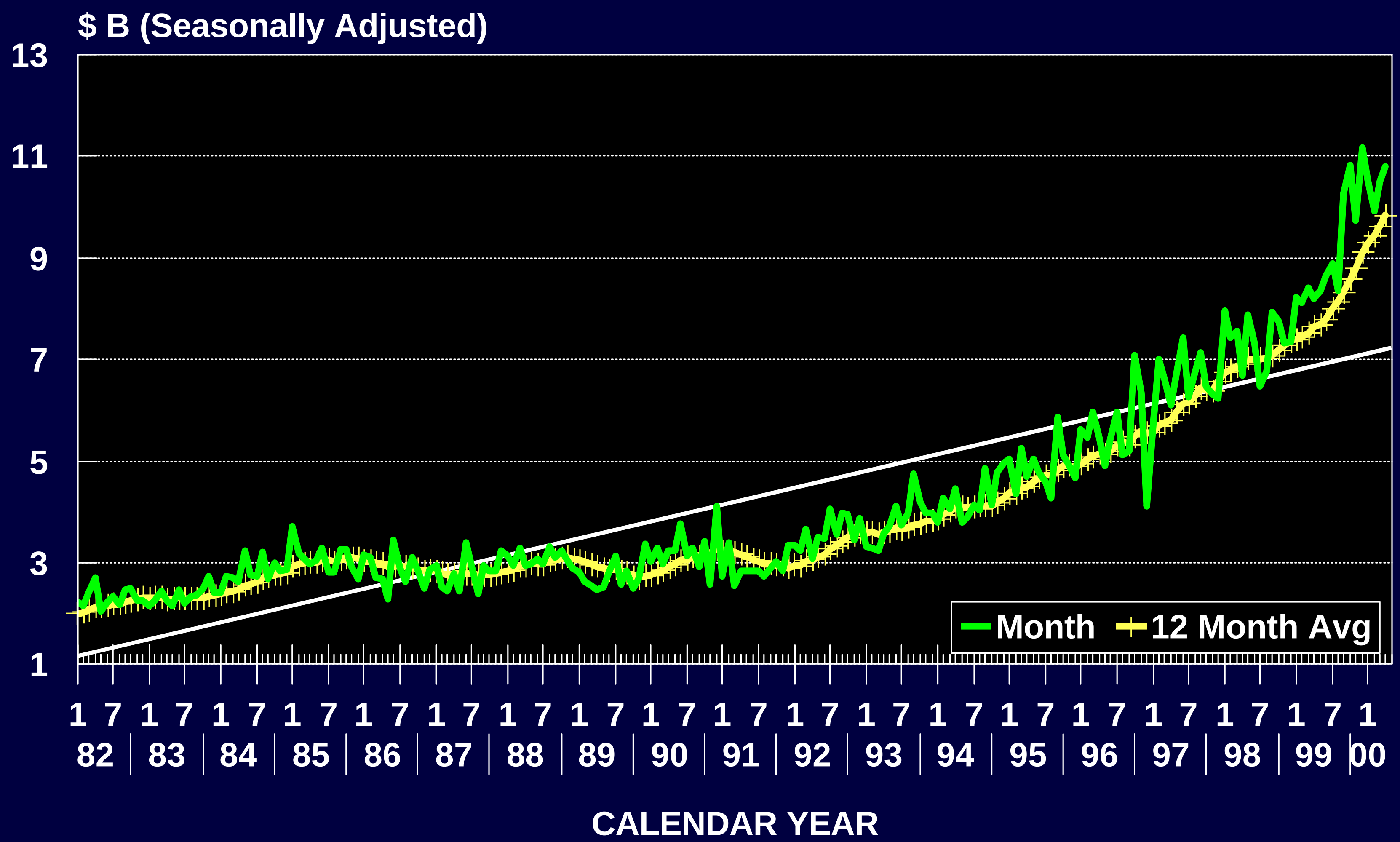
MEASUREMENT & CONTROL EQUIPMENT
BOOKINGS



COMMERCE DEPT 6/2000

COMMUNICATIONS EQUIPMENT

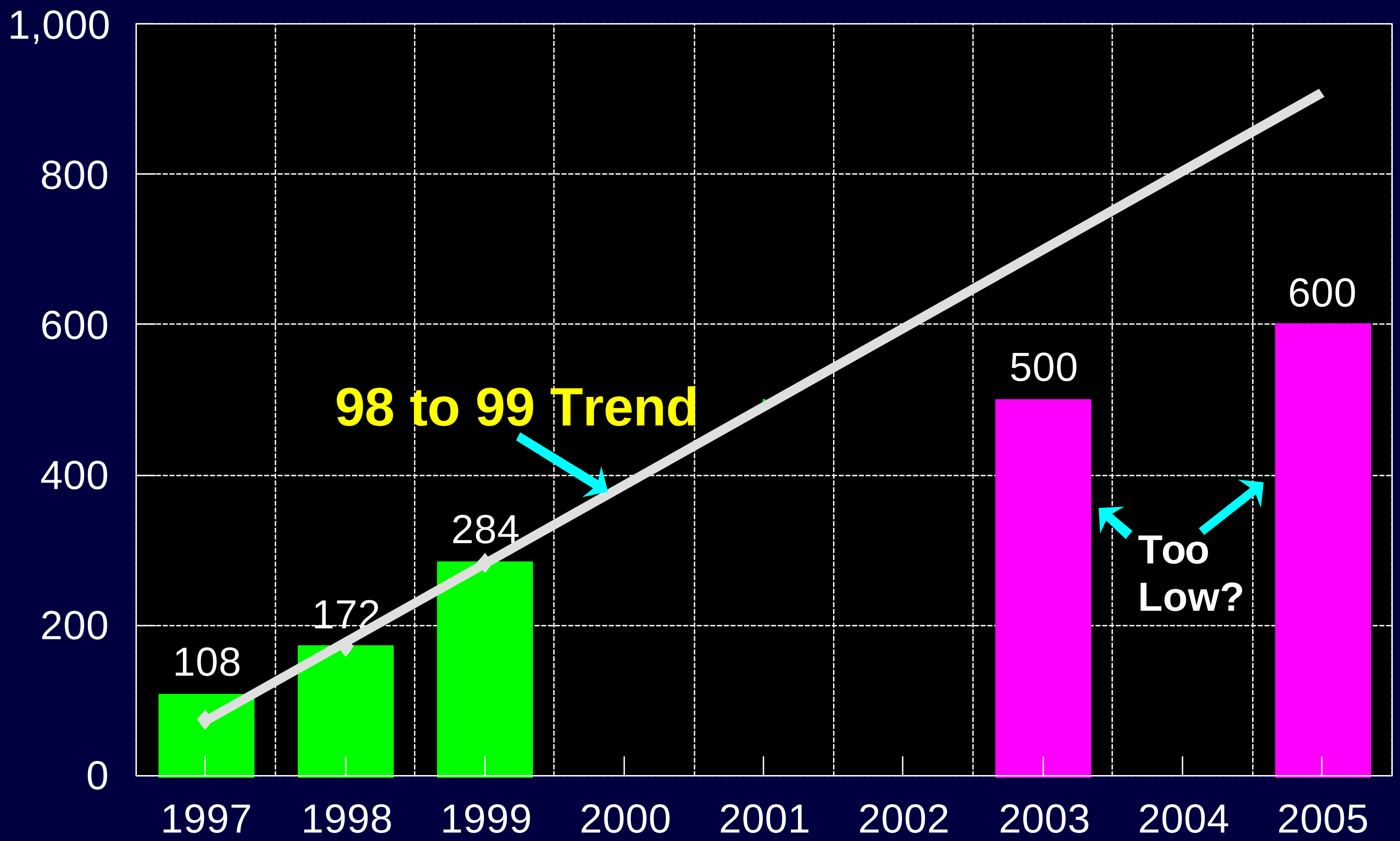
BOOKINGS



COMMERCE DEPT 6/2000

WORLD CELLULAR PHONE GROWTH

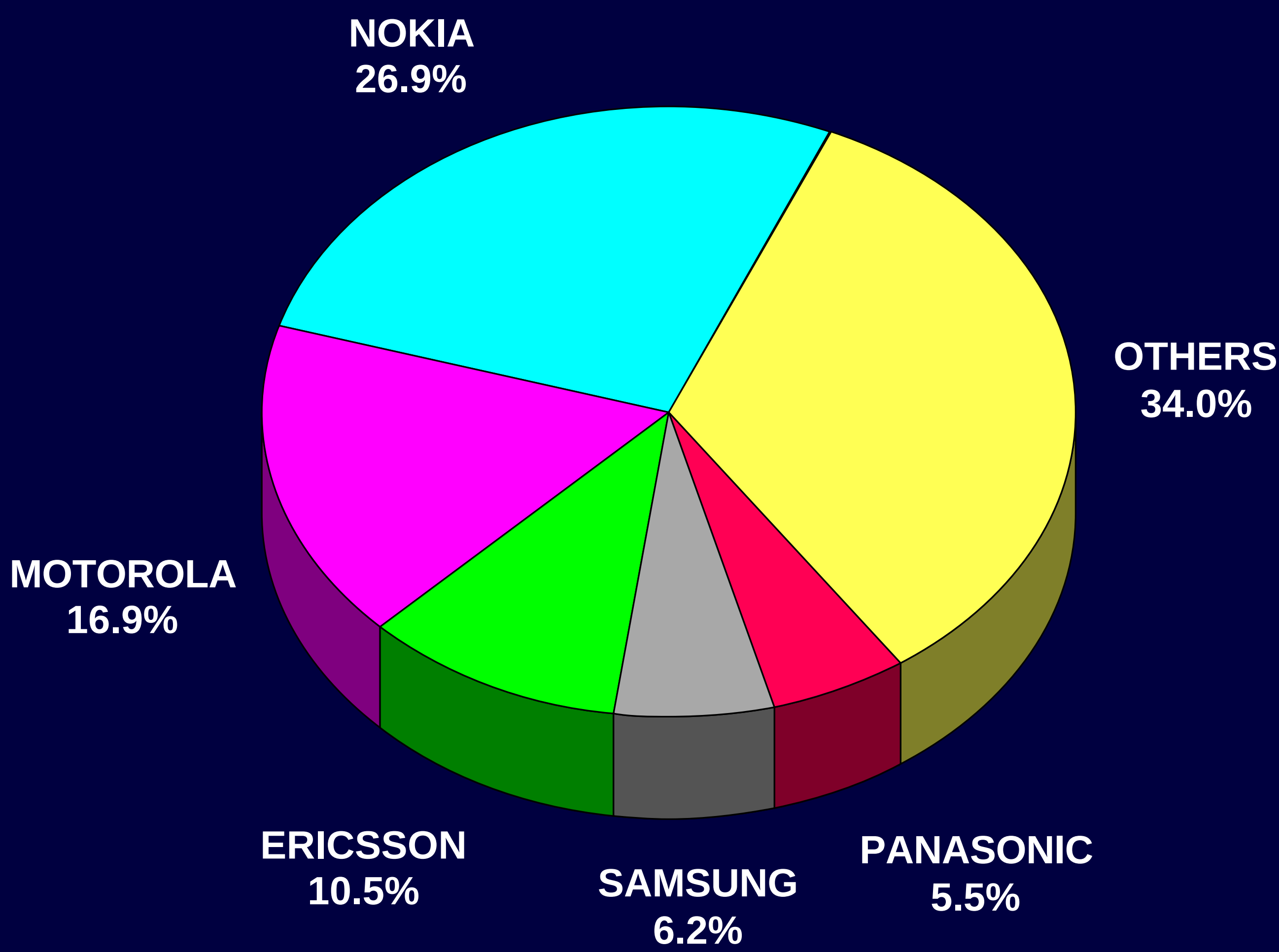
TOTAL SALES - ANALOG & DIGITAL



Ericsson 5/99 Forecast, Dataquest 2/2000

WORLD CELLULAR PHONE SALES

1999



DATAQUEST 2/2000

TOTAL: 283 MILLION UNITS

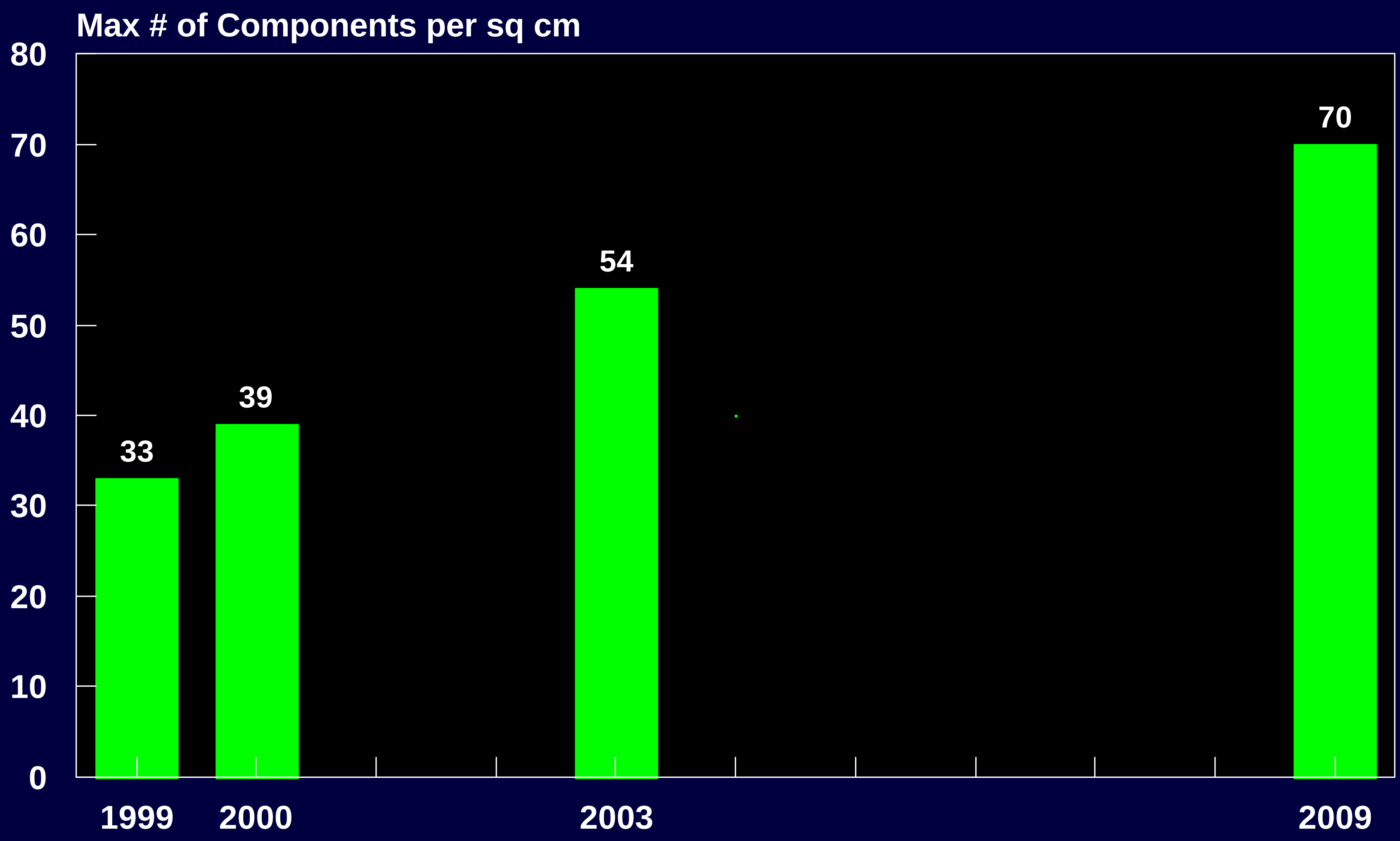
Worldwide Mobile Phone Sales

Units (000)

	1998		1999		99/98
	Units	% Share	Units	% Share	Growth %
Nokia	38,622	22.5	76,335	26.9	97.6
Motorola	33,379	19.5	47,818	16.9	43.3
Ericsson	25,906	15.1	29,785	10.5	14.8
Samsung	4,687	2.7	17,687	6.2	277.4
Panasonic	14,463	8.4	15,581	5.5	7.7
Others	54,538	31.8	96,376	34.0	76.7
Total	171,594	100.0	283,581	100.0	65.5

Dataquest 2/2000 Estimates

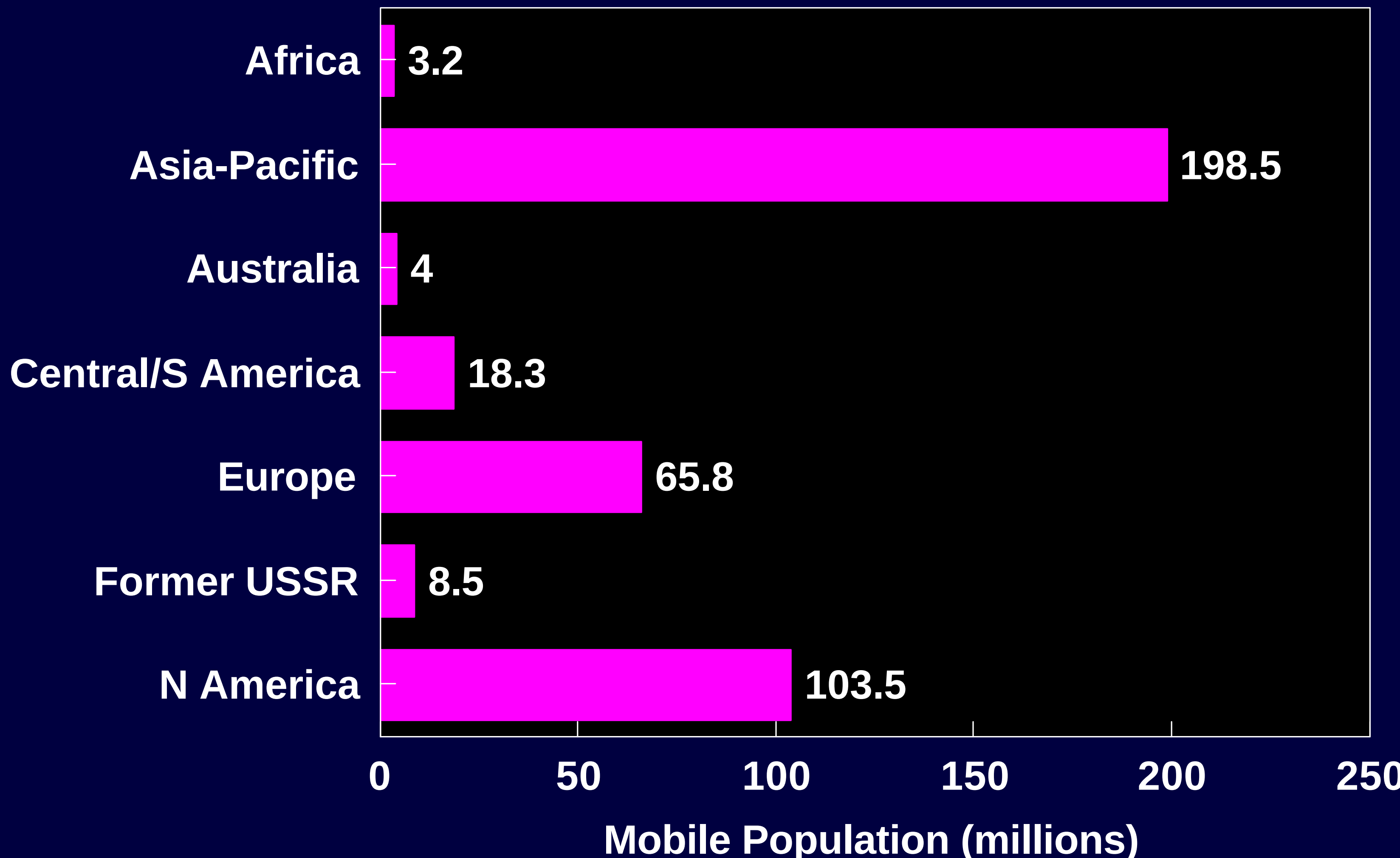
Passive Component Densities in Cellular Headsets



Materials Research Lab, Penn State University 4/2000

Mobile Technology Users - 2000

Handheld PCs, Cel Phones, Pagers & Smart Phones

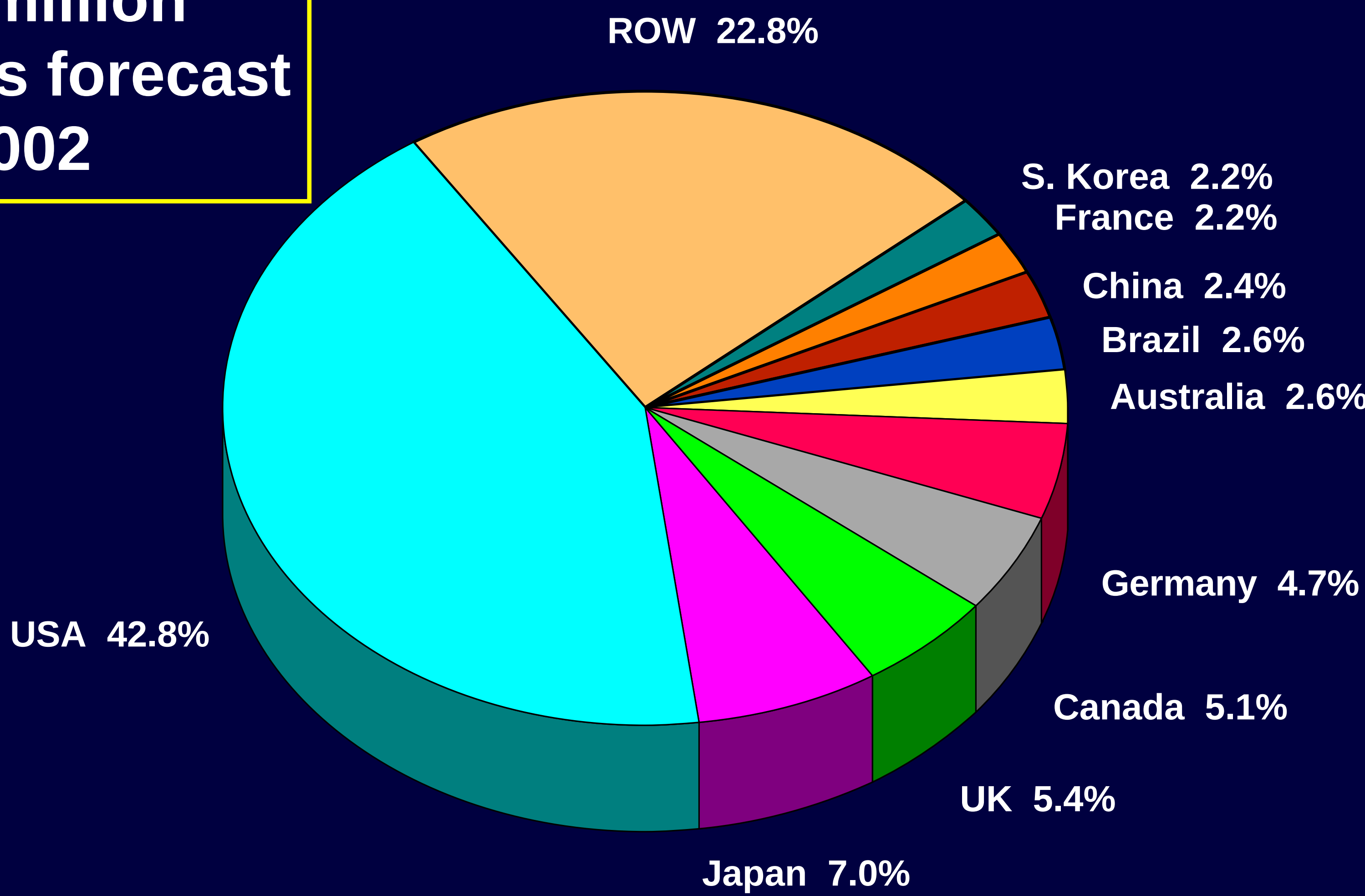


Researchportal.com 4/2000

WORLD INTERNET USERS

1999

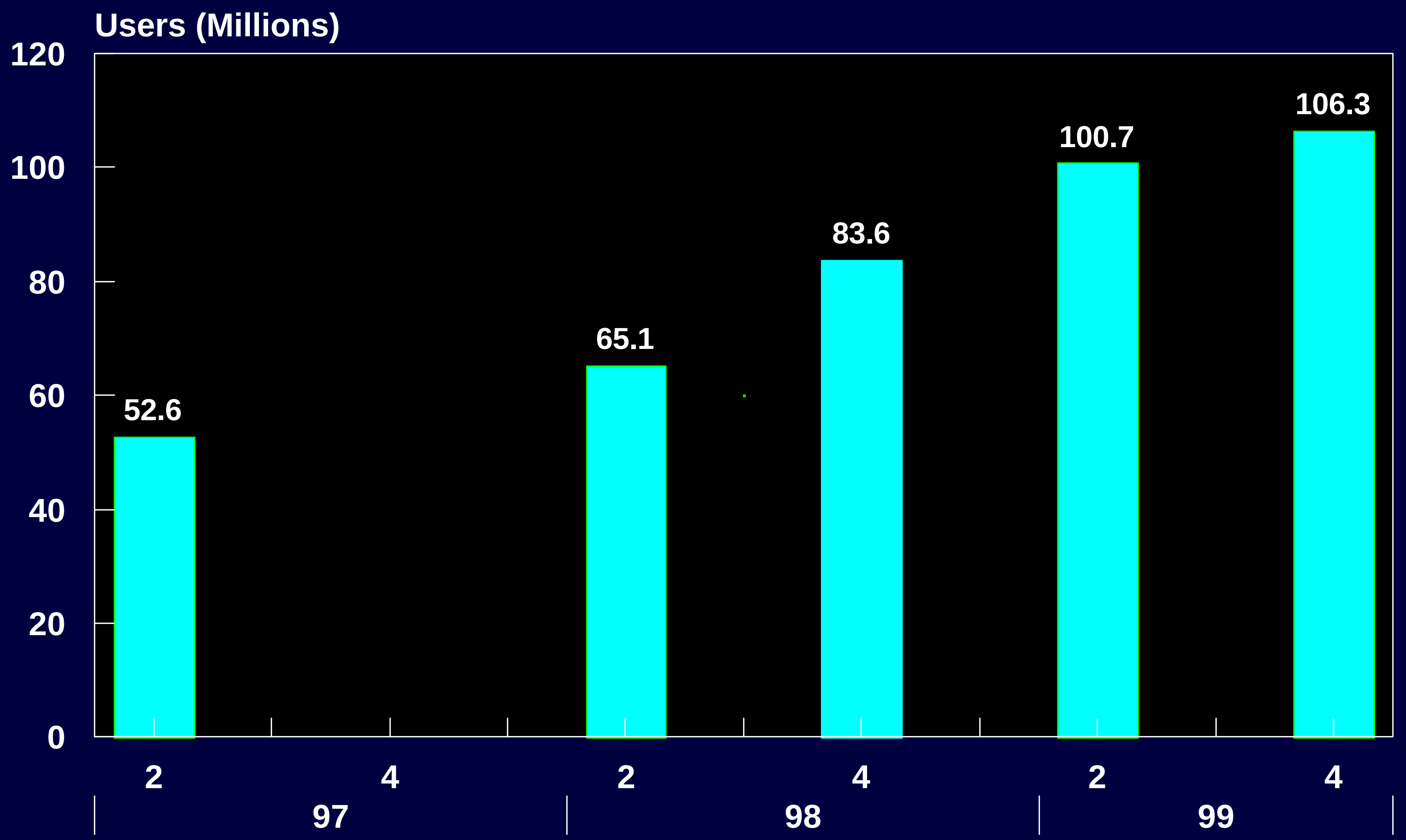
490 million users forecast by 2002



TOTAL: 259 MILLION USERS

Computer Industry Almanac 5/2000

US Adult Internet Users



Infoworld: The Strategis Group 4/2000

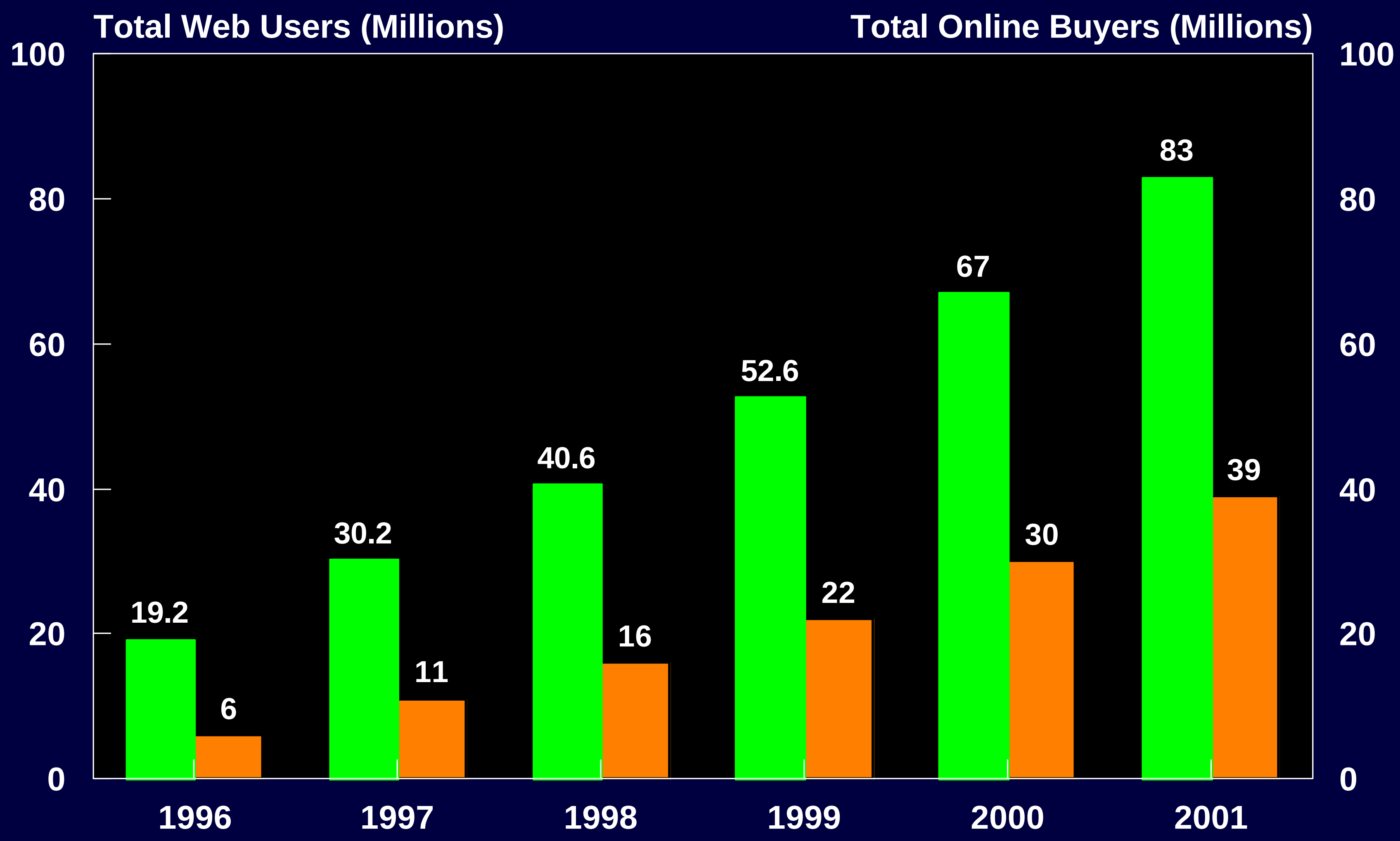
Internet Driven Changes

- Post office -> E-Mail
- Libraries & magazines -> On-line information
- Retail stores -> E-Commerce
- Financial services -> Internet based
- and many more

Drivers

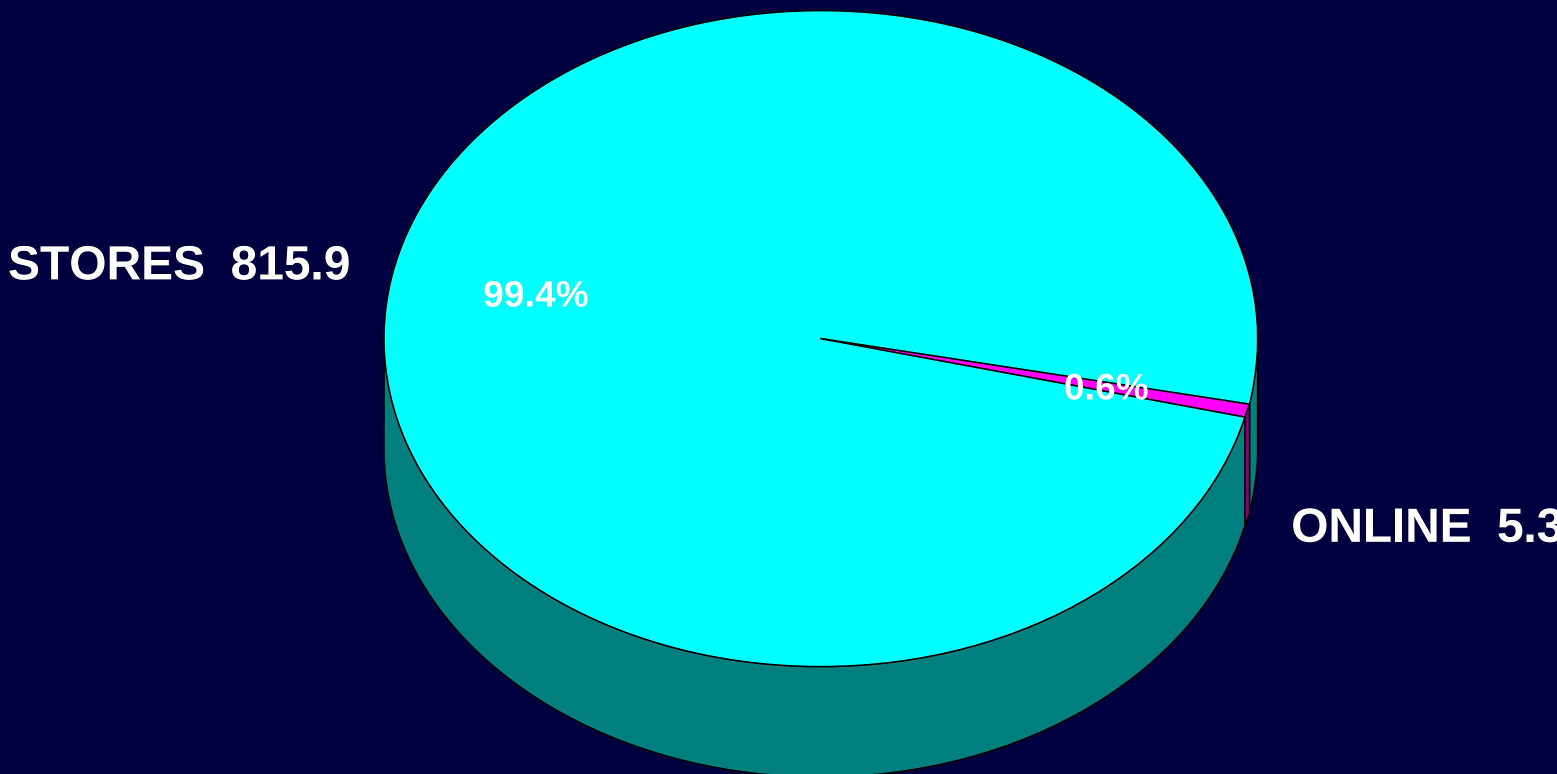
- Speed
- Cost
- Ease of use
- Availability

Growing Market - US Online Consumers



Infoworld: IDC 1/99

RETAIL SALES - STORES vs ONLINE
U.S. - 4Q '99

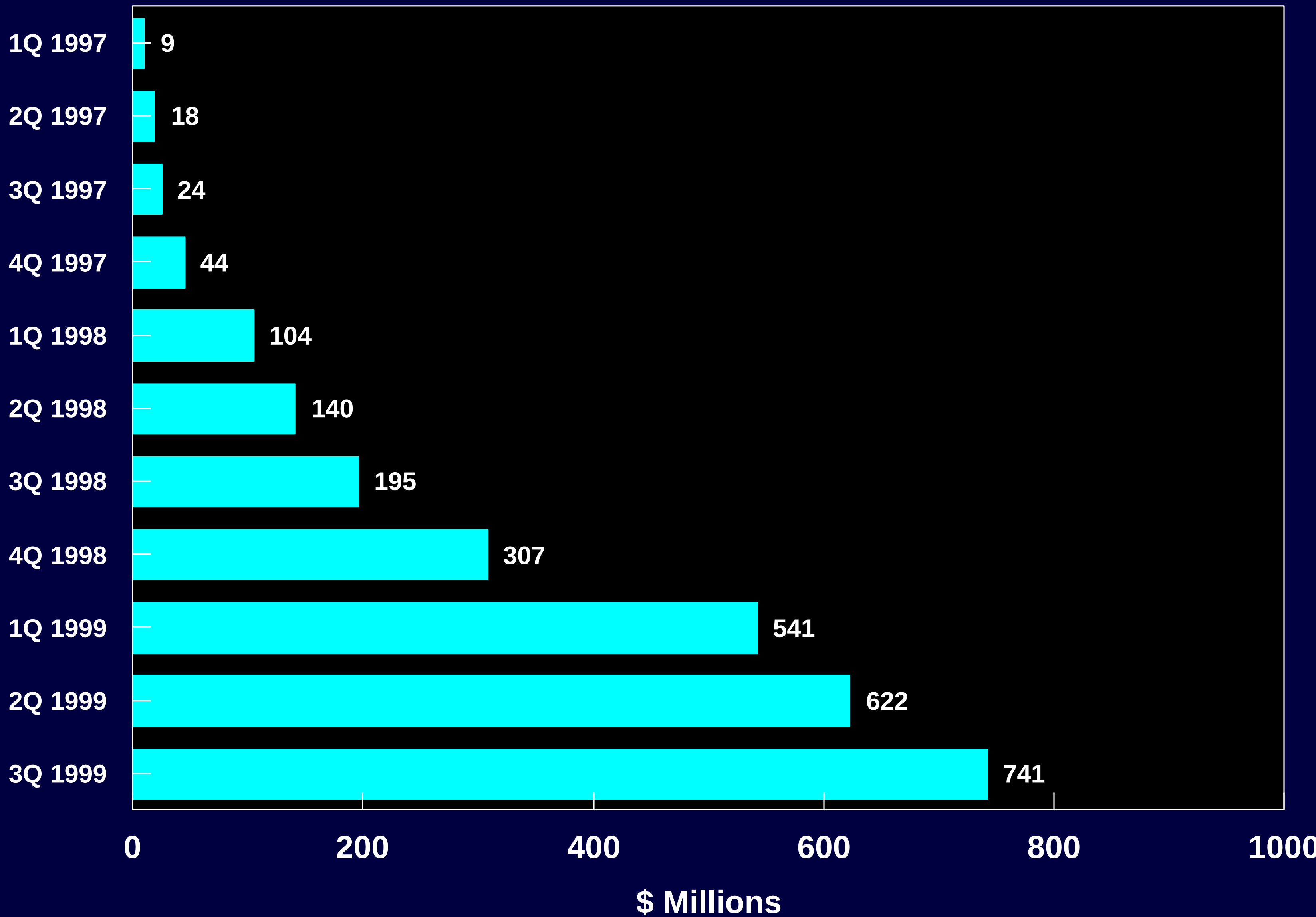


TOTAL: $821.2 Billion

U.S. Dept of Commerce 3/2000

The Rise of eBay

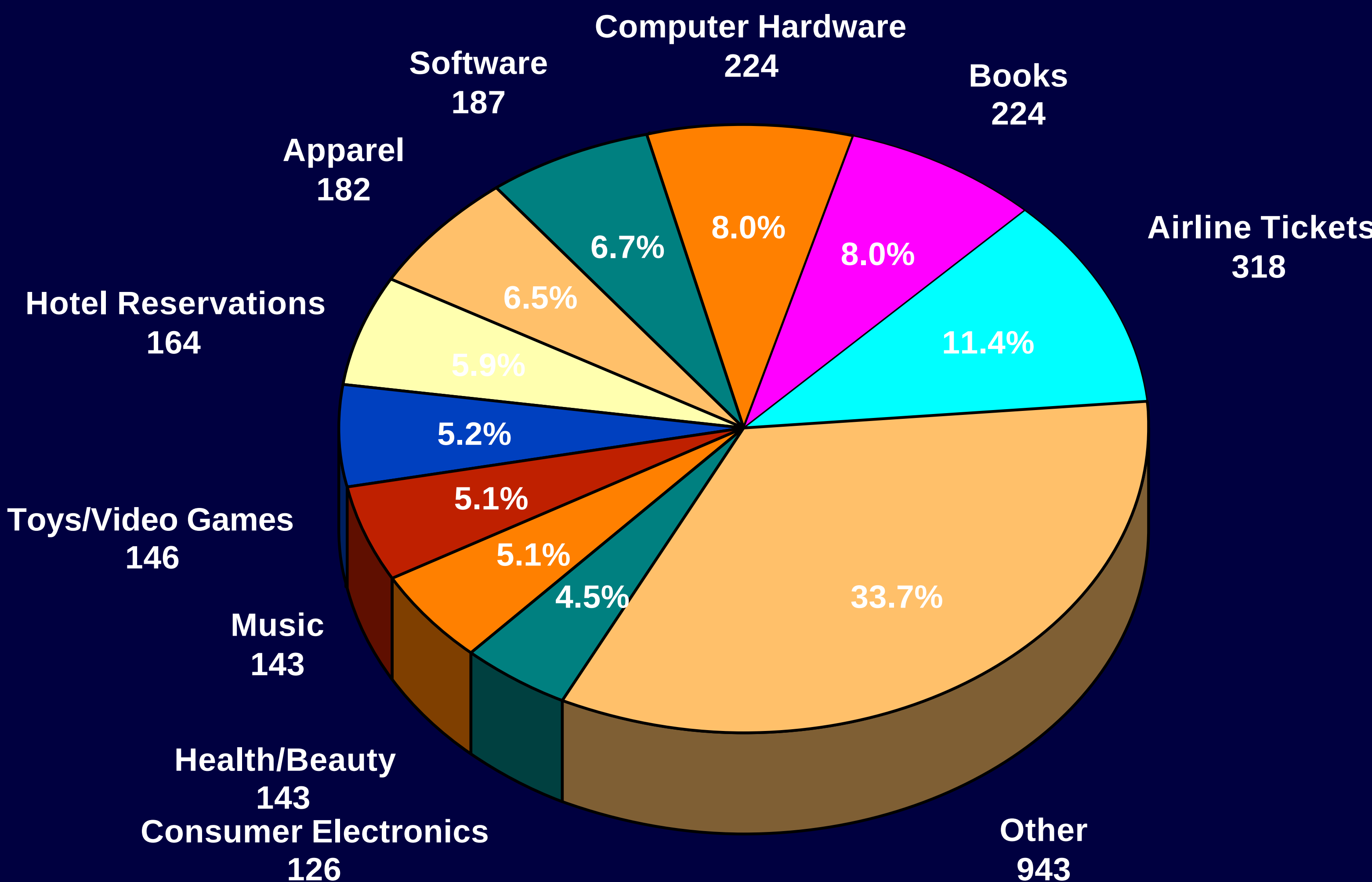
Gross Merchandise Sales in $ Millions



Computerworld 1/2000

Total Online Retail Spending

U.S. - January 2000



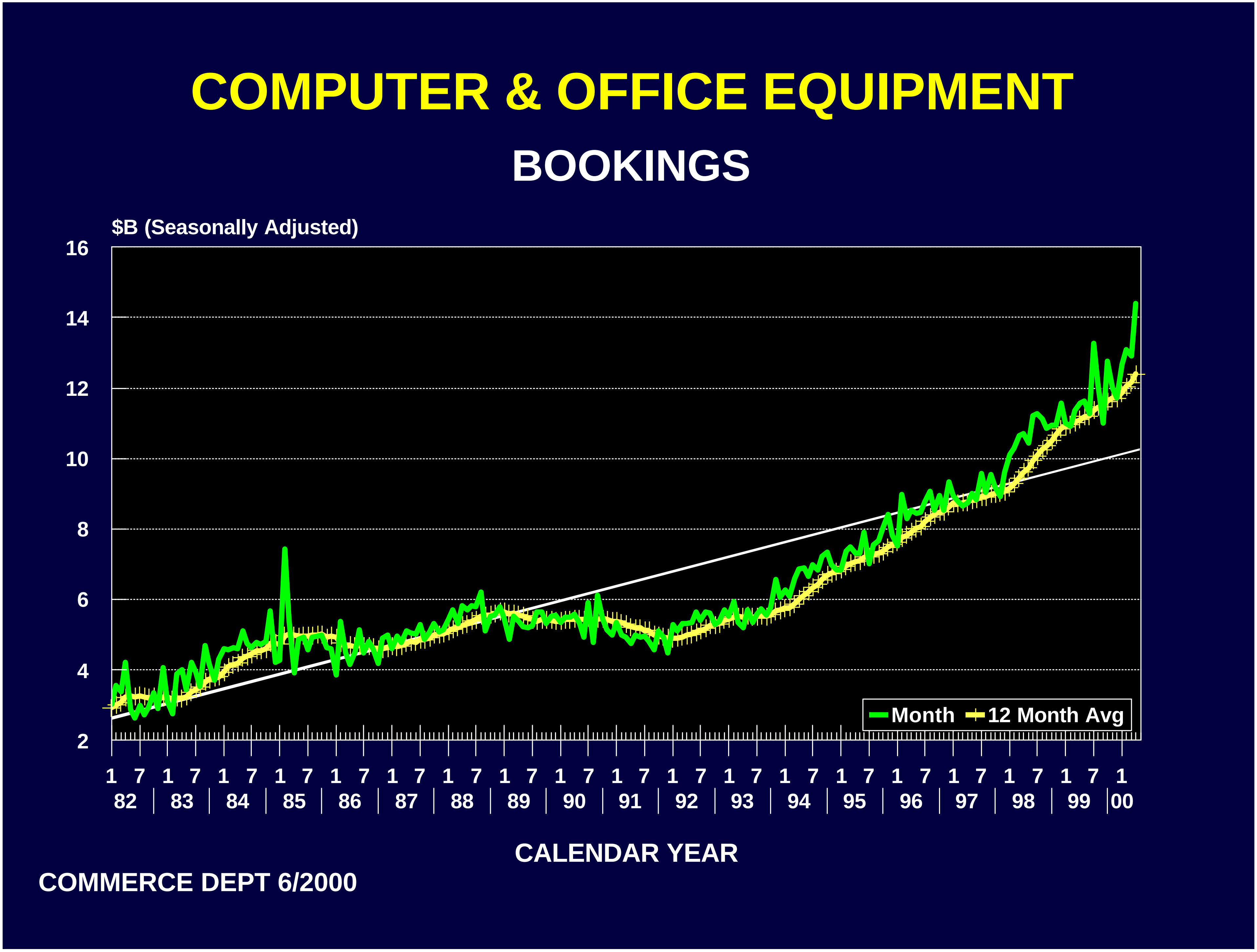
TOTAL: $2,800 Billion

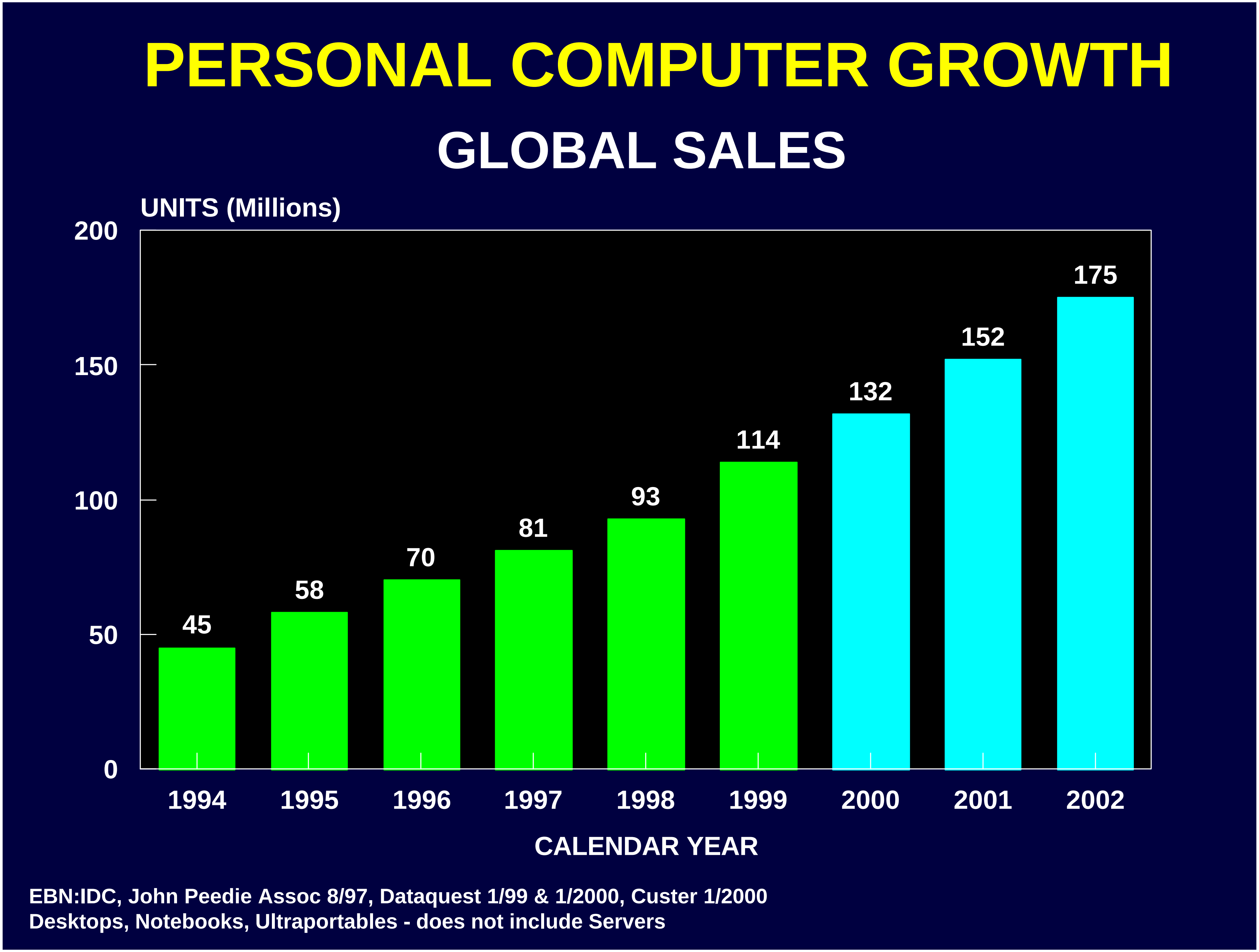
National Retail Federation & Forrester Research 3/2000

Business-to-Business e-Commerce to Skyrocket

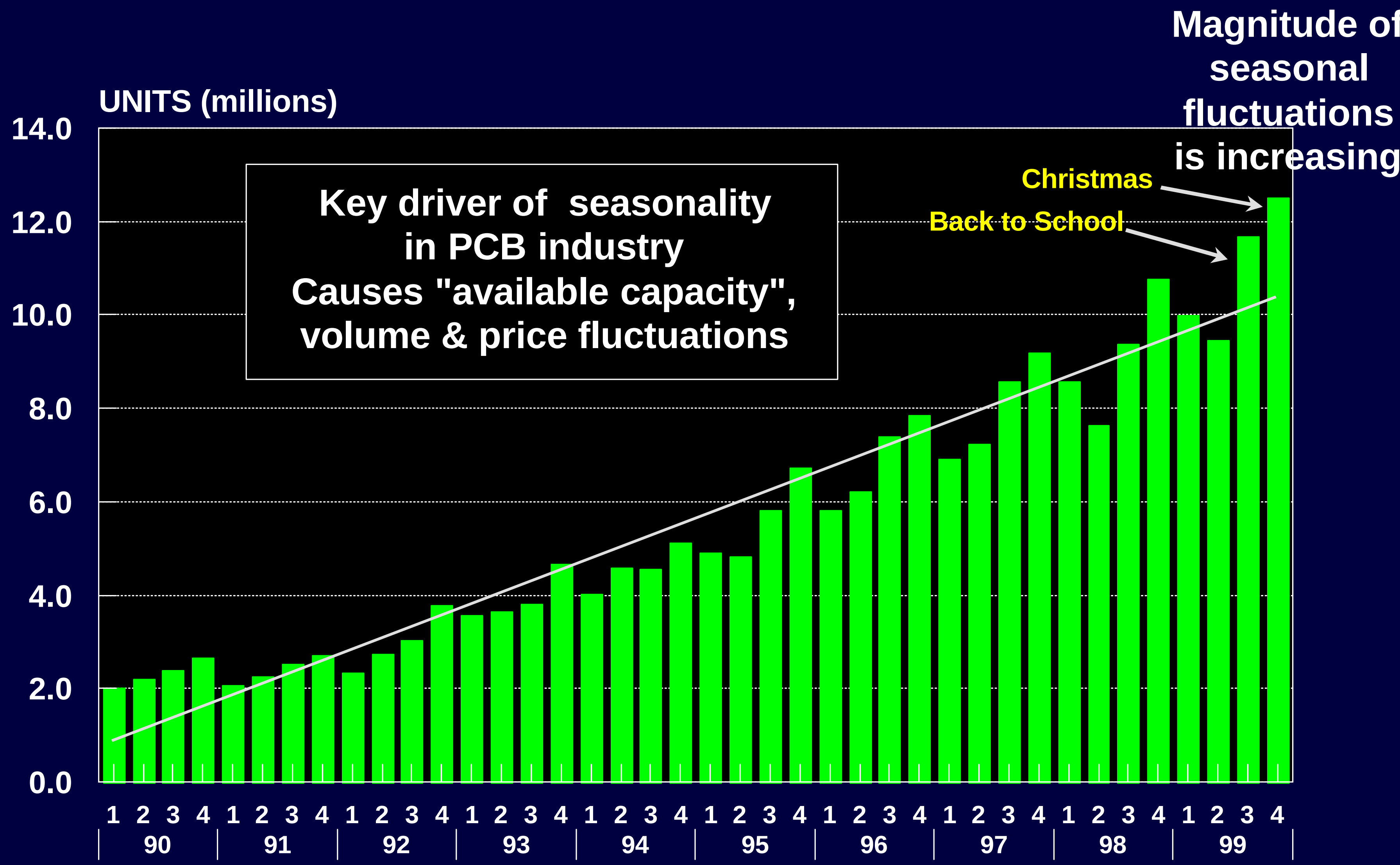
U.S. 1998-2003

Infoworld:Boston Consulting Group 1/2000


COMPUTER & OFFICE EQUIPMENT
BOOKINGS
$B (Seasonally Adjusted)
16
14
12
10
8
6
4
2
Month
12 Month Avg
1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1 7 1
82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 00
CALENDAR YEAR
COMMERCE DEPT 6/2000


PERSONAL COMPUTER GROWTH
GLOBAL SALES
UNITS (Millions)
200
150
100
50
0
45
58
70
81
93
114
132
152
175
1994
1995
1996
1997
1998
1999
2000
2001
2002
CALENDAR YEAR
EBN:IDC, John Peedie Assoc 8/97, Dataquest 1/99 & 1/2000, Custer 1/2000
Desktops, Notebooks, Ultraportables - does not include Servers

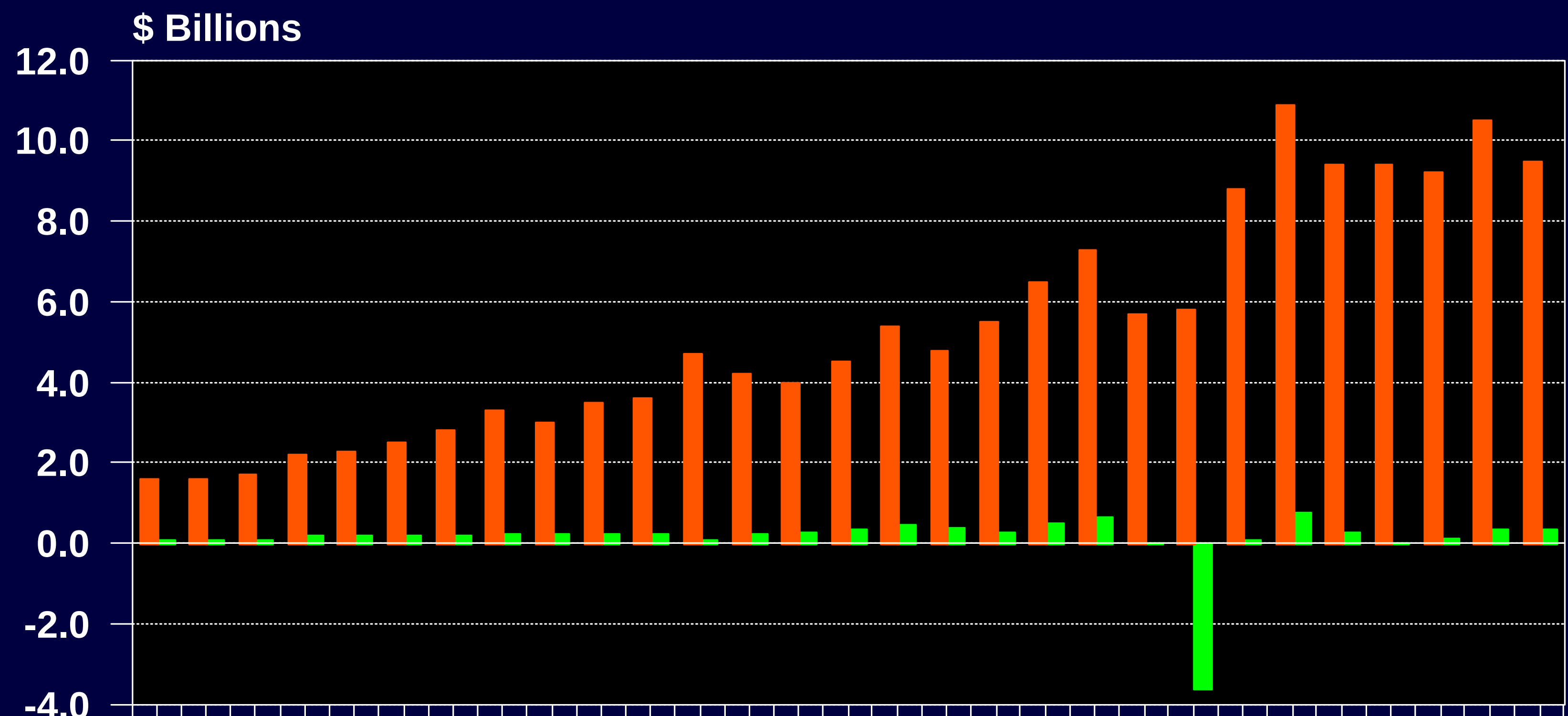
MICROCOMPUTER SHIPMENTS TO THE U.S.



Electronic Outlook: US Microcomputer Statistics Committee

Compaq Computer

Revenue & Net Income



	93				94				95				96				97				98				99				00
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
Revenue	1.6	1.6	1.7	2.2	2.3	2.5	2.8	3.3	3.0	3.5	3.6	4.7	4.2	4.0	4.5	5.4	4.8	5.5	6.5	7.3	5.7	5.8	8.8	10.9	9.4	9.4	9.2	10.5	9.5
Income	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.2	0.3	0.4	0.5	0.4	0.3	0.5	0.7	0.0	-3.6	0.1	0.8	0.3	0.0	0.1	0.3	0.3

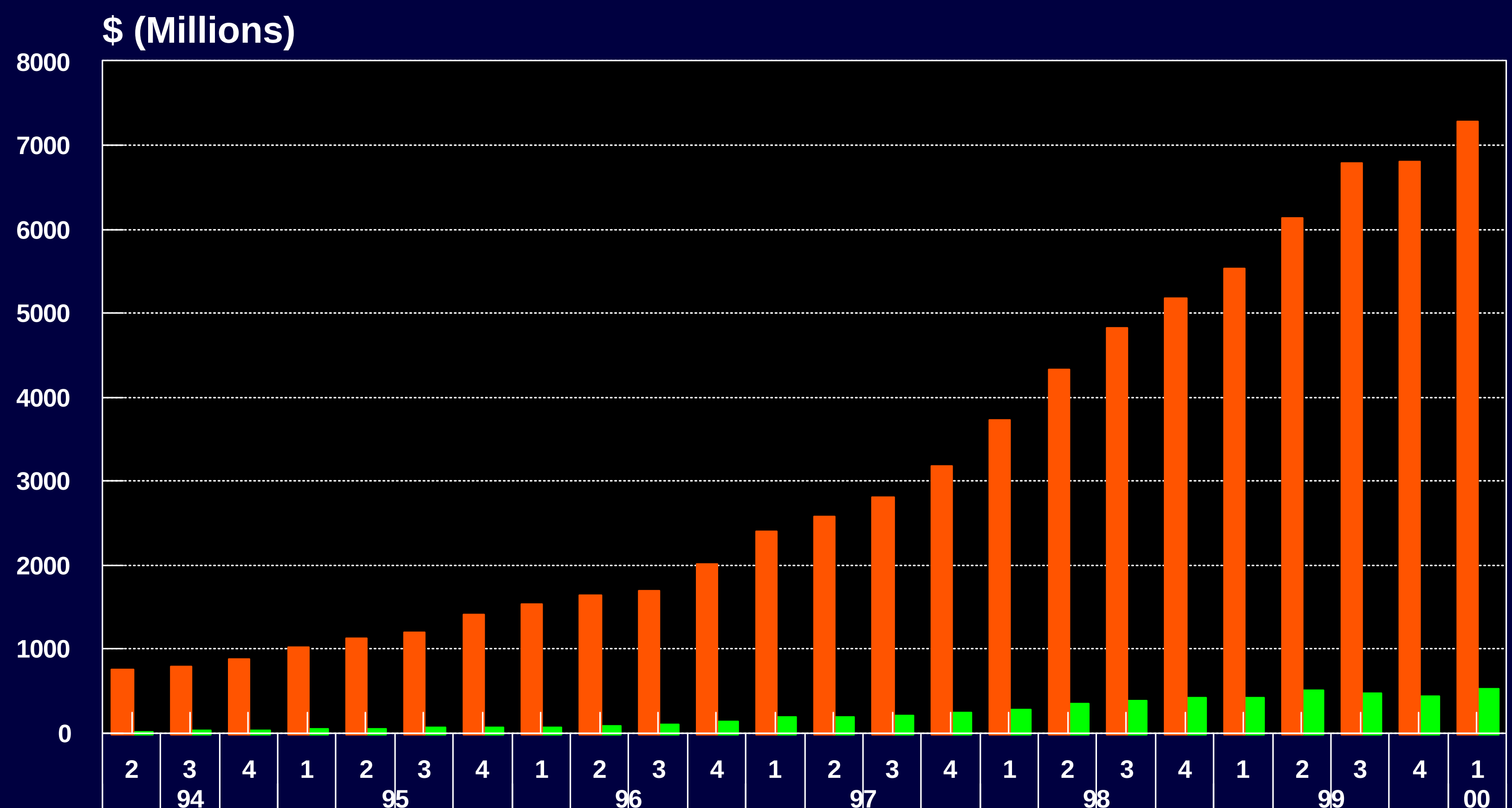
CY

FY=CY

CPQ

DELL COMPUTER

Revenue & Net Income



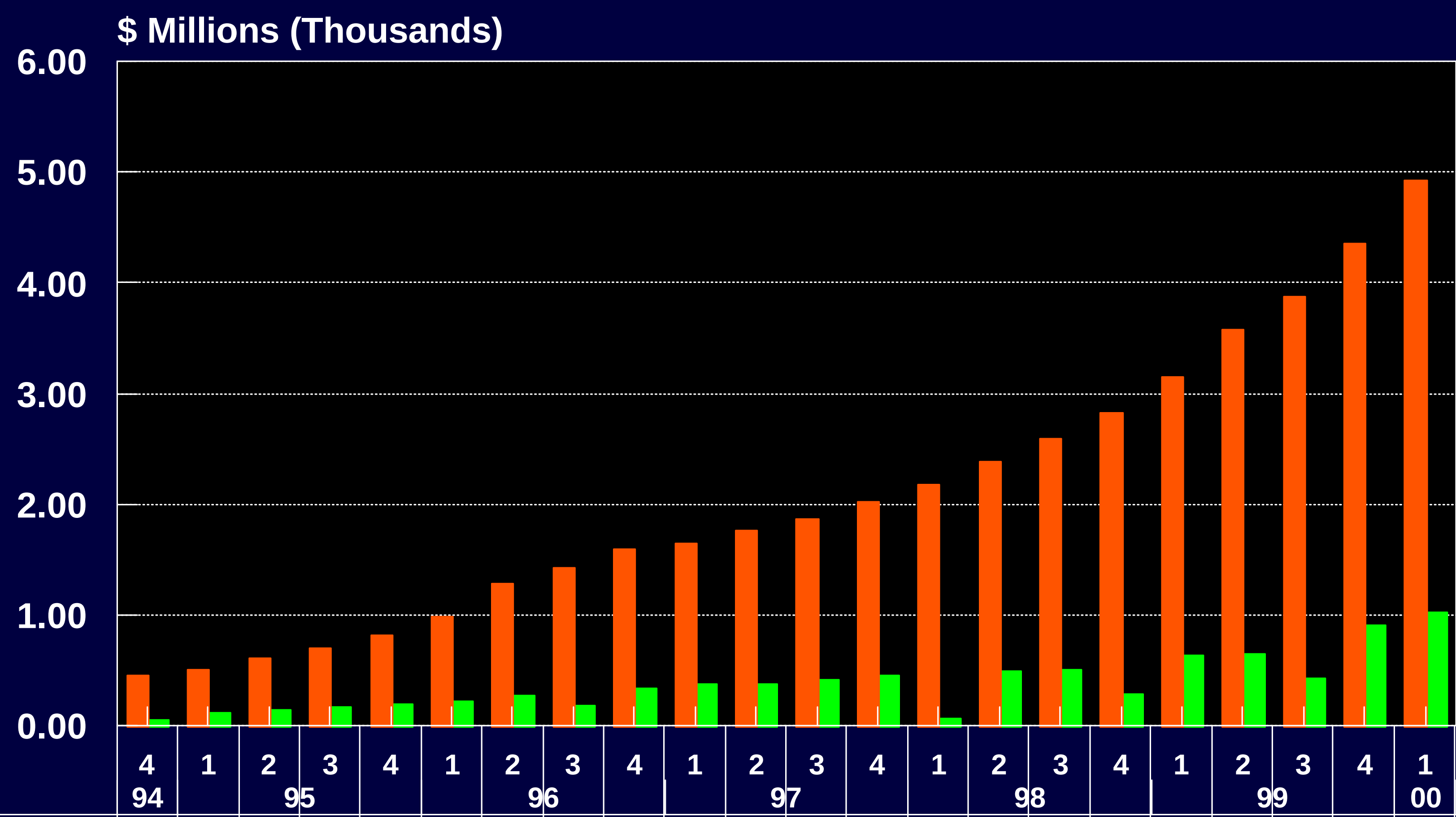
	2 (94)	3 (94)	4 (94)	1 (95)	2 (95)	3 (95)	4 (95)	1 (96)	2 (96)	3 (96)	4 (96)	1 (97)	2 (97)	3 (97)	4 (97)	1 (98)	2 (98)	3 (98)	4 (98)	1 (99)	2 (99)	3 (99)	4 (99)	1 (00)
SALES	767	792	885	1033	1136	1206	1416	1539	1638	1690	2019	2412	2588	2814	3188	3737	4331	4818	5173	5537	6142	6784	6801	7280
PROFITS	19	29	41	58	62	65	75	70	82	112	149	188	198	214	248	285	346	384	425	434	507	483	436	525

CY

FY ends October

CISCO SYSTEMS

Revenue & Net Income



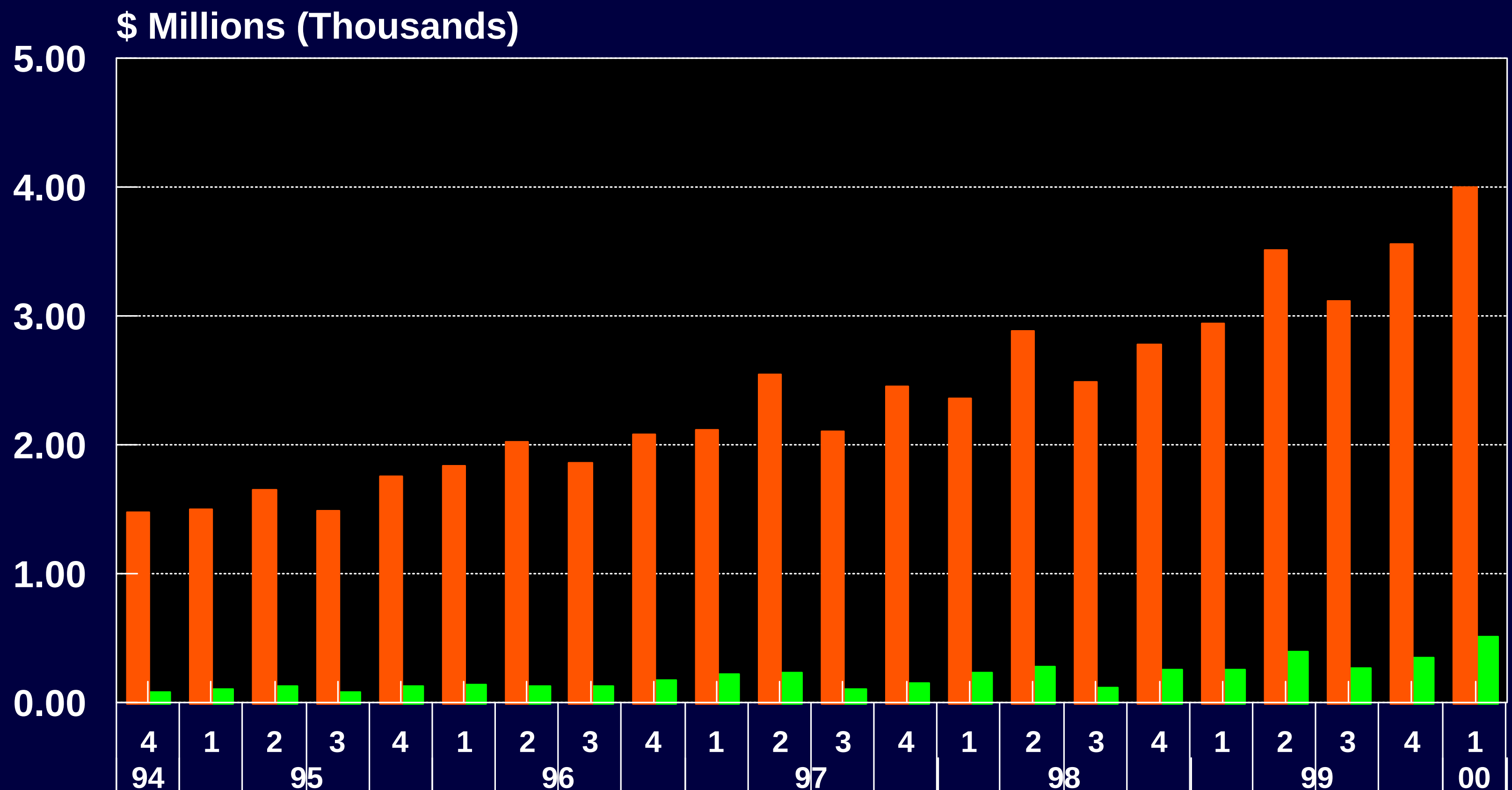
	4 94	1 95	2 95	3 95	4 95	1 96	2 96	3 96	4 96	1 97	2 97	3 97	4 97	1 98	2 98	3 98	4 98	1 99	2 99	3 99	4 99	1 00
Revenue	0.46	0.51	0.62	0.71	0.83	0.99	1.29	1.43	1.59	1.65	1.77	1.87	2.02	2.18	2.39	2.60	2.83	3.15	3.58	3.88	4.35	4.92
Income	0.05	0.13	0.14	0.17	0.20	0.23	0.28	0.18	0.34	0.38	0.38	0.42	0.46	0.07	0.49	0.51	0.29	0.65	0.65	0.44	0.91	1.03

CY

CSCO

Sun Microsystems

Revenue & Net Income



	4 94	1 95	2 95	3 95	4 95	1 96	2 96	3 96	4 96	1 97	2 97	3 97	4 97	1 98	2 98	3 98	4 98	1 99	2 99	3 99	4 99	1 00
Revenue	1.48	1.51	1.65	1.49	1.75	1.84	2.02	1.86	2.08	2.12	2.54	2.10	2.45	2.36	2.88	2.49	2.78	2.94	3.52	3.12	3.55	4.01
Income	0.08	0.11	0.13	0.09	0.13	0.14	0.12	0.12	0.18	0.22	0.24	0.11	0.15	0.23	0.27	0.11	0.26	0.26	0.40	0.27	0.35	0.51

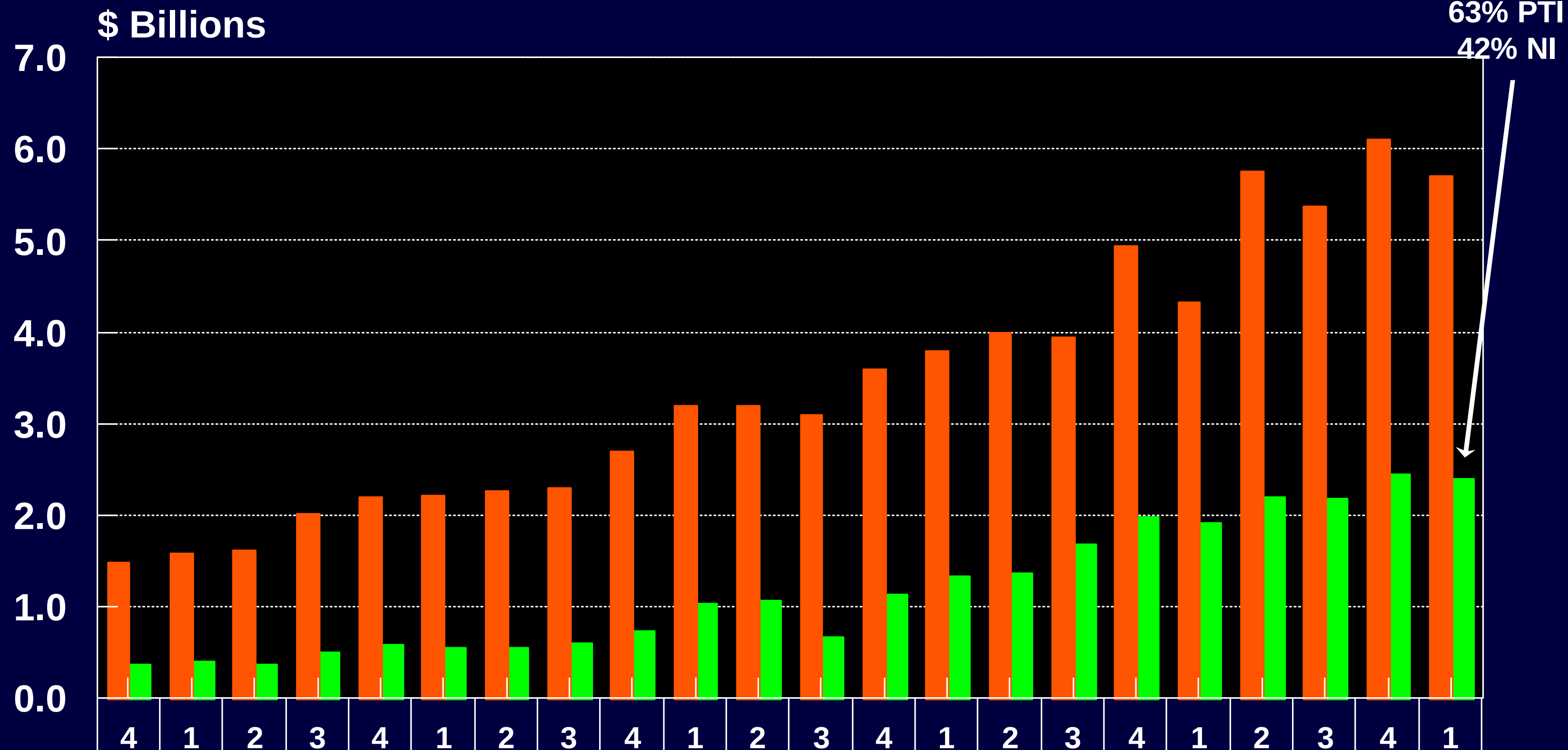
CY

SUNW

FY ENDS 6/30

Microsoft

Revenue & Net Income



	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
	94	95				96				97				98				99				00
Revenue	1.5	1.6	1.6	2.0	2.2	2.2	2.3	2.3	2.7	3.2	3.2	3.1	3.6	3.8	4.0	4.0	4.9	4.3	5.8	5.4	6.1	5.7
Income	0.4	0.4	0.4	0.5	0.6	0.6	0.6	0.6	0.7	1.0	1.1	0.7	1.1	1.3	1.4	1.7	2.0	1.9	2.2	2.2	2.4	2.4

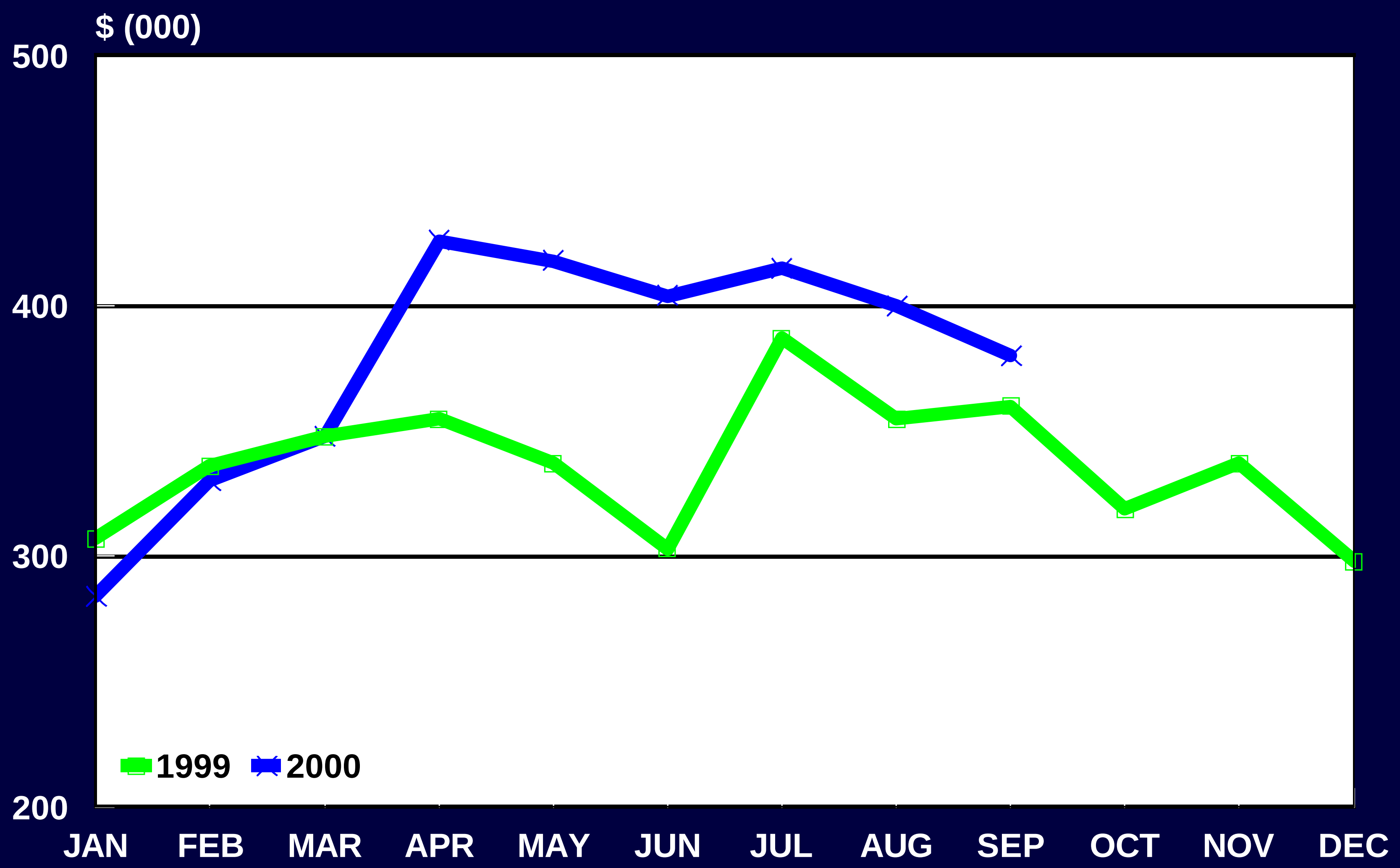
CY

MSFT

FY ends June

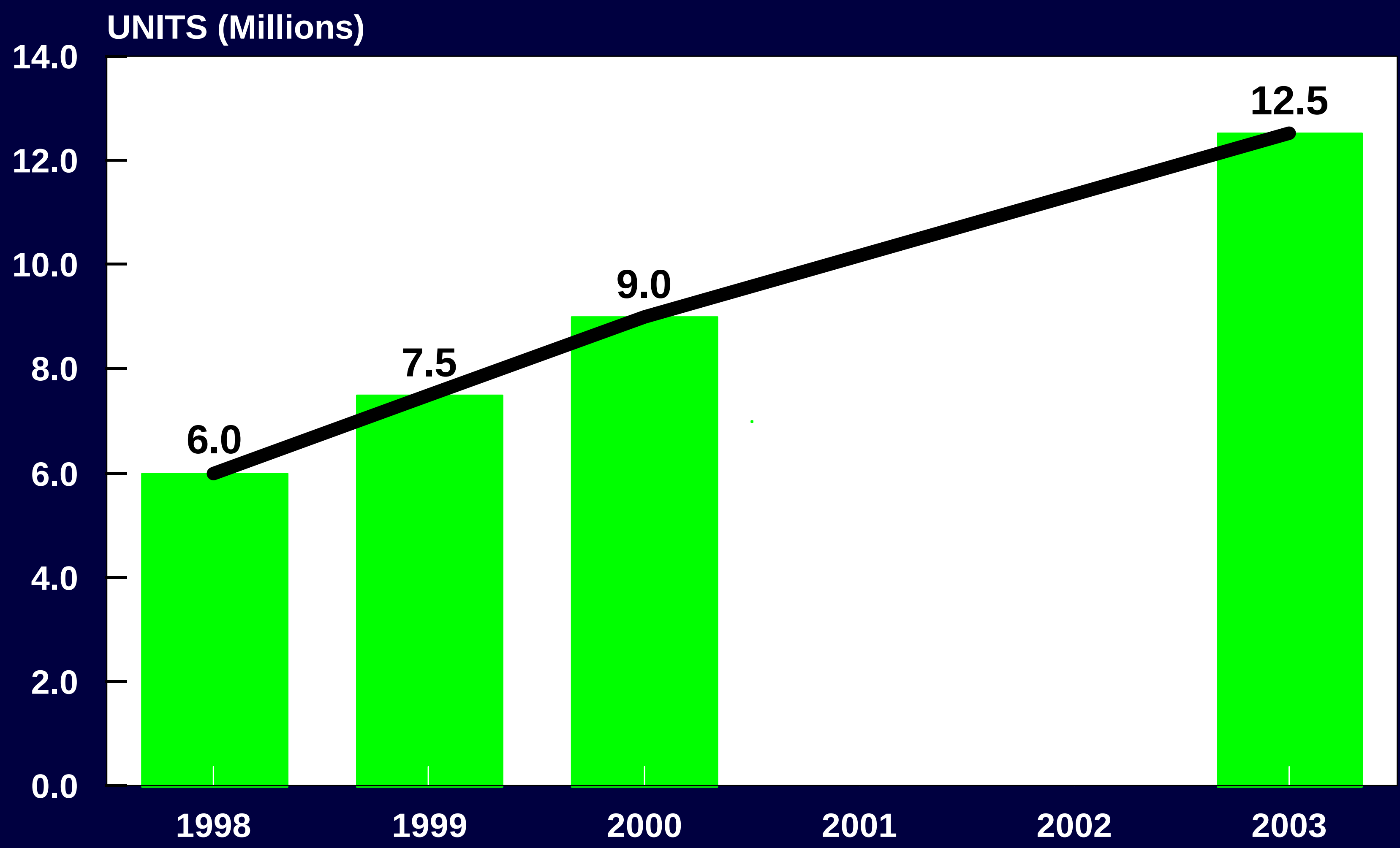
PC PRODUCT SPENDING BY LARGE US FIRMS

1999 to 2000 - ACTUAL & PROJECTIONS

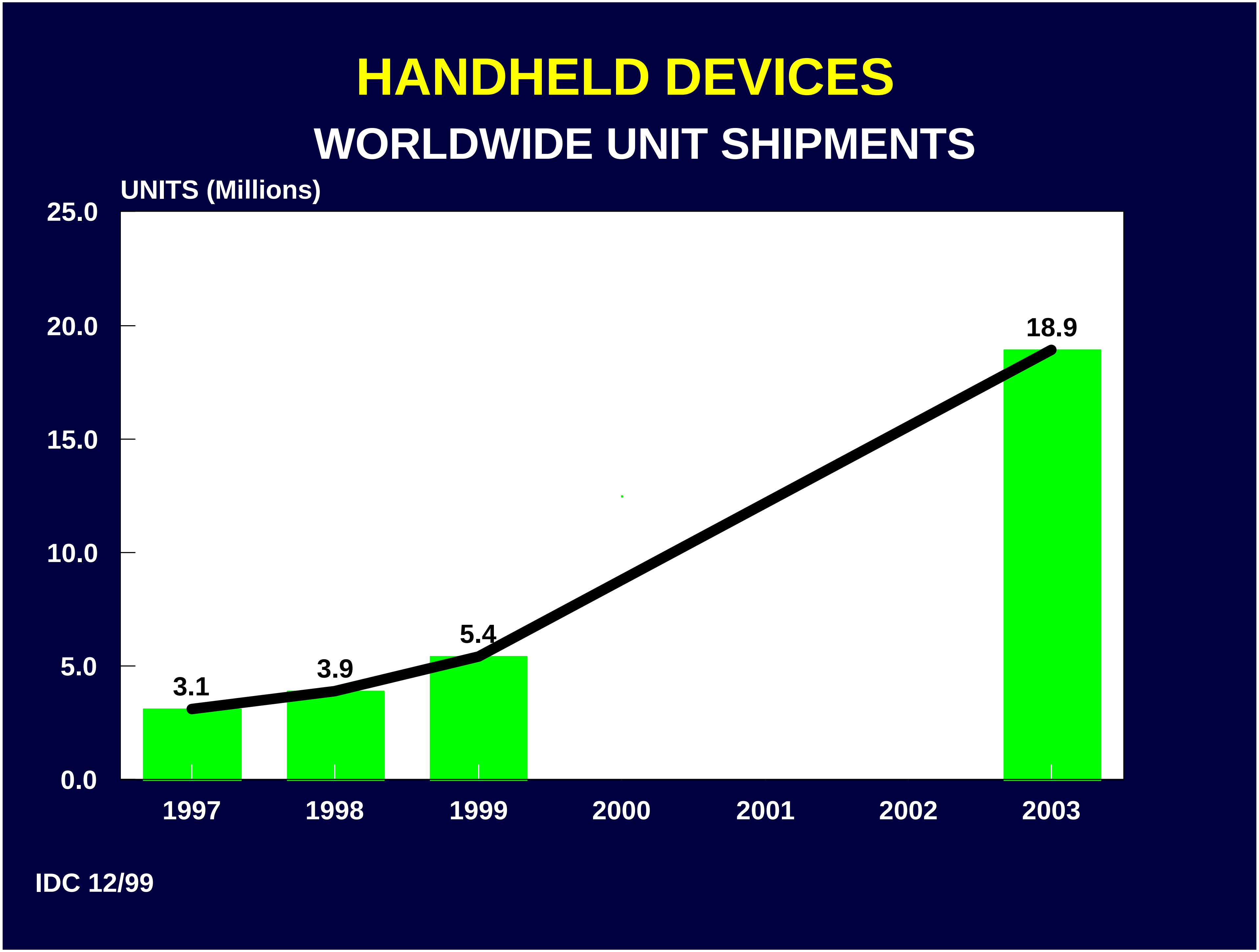


CRN 5/29/2000

U.S. Notebook Sales

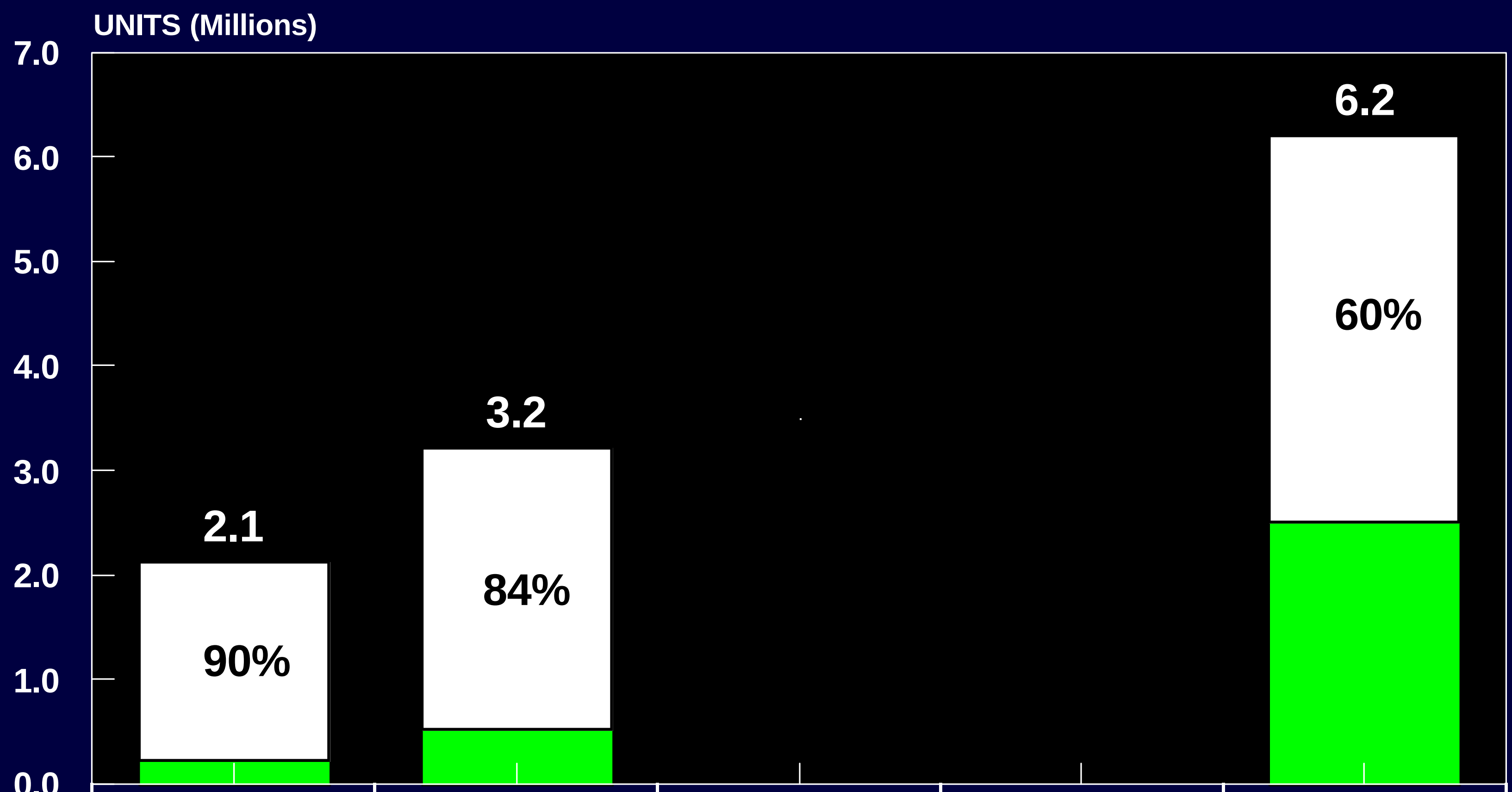


Mobile Computing & Communications: IDC 5/2000


HANDHELD DEVICES
WORLDWIDE UNIT SHIPMENTS
UNITS (Millions)
25.0
20.0
15.0
10.0
5.0
0.0
3.1
3.9
5.4
18.9
1997
1998
1999
2000
2001
2002
2003
IDC 12/99

HANDHELD DEVICES

U.S. MARKET SHARE

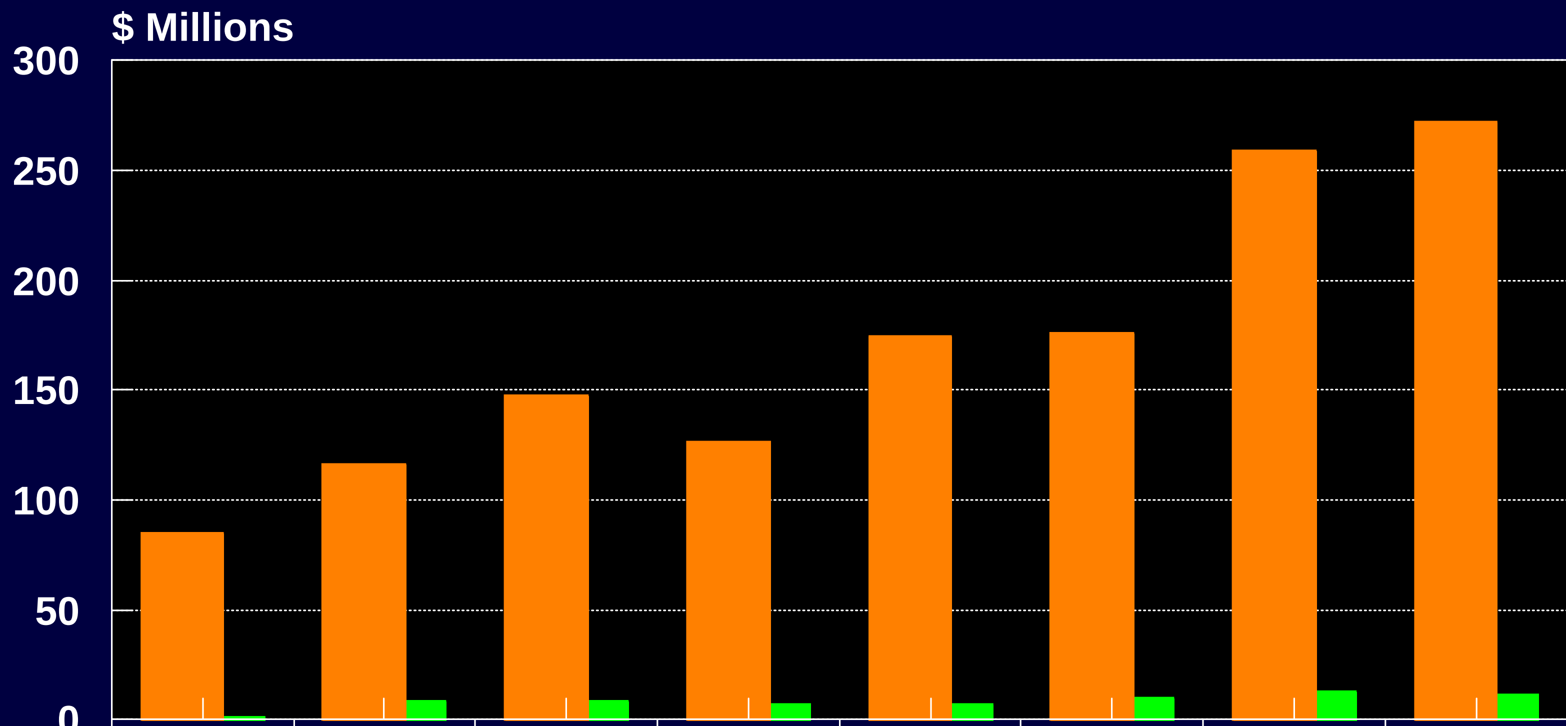


	1999	2000	2001	2002	2003
Palm OS	1.9	2.7			3.7
Windows CE	0.2	0.5			2.5

Computerworld 2/2000

Palm Inc

Revenue & Net Income



	2	3 98	4	1	2 99	3	4	1 00
Revenue	85	116	147	126	174	176	259	272
Income	1	8	8	7	7	10	13	11

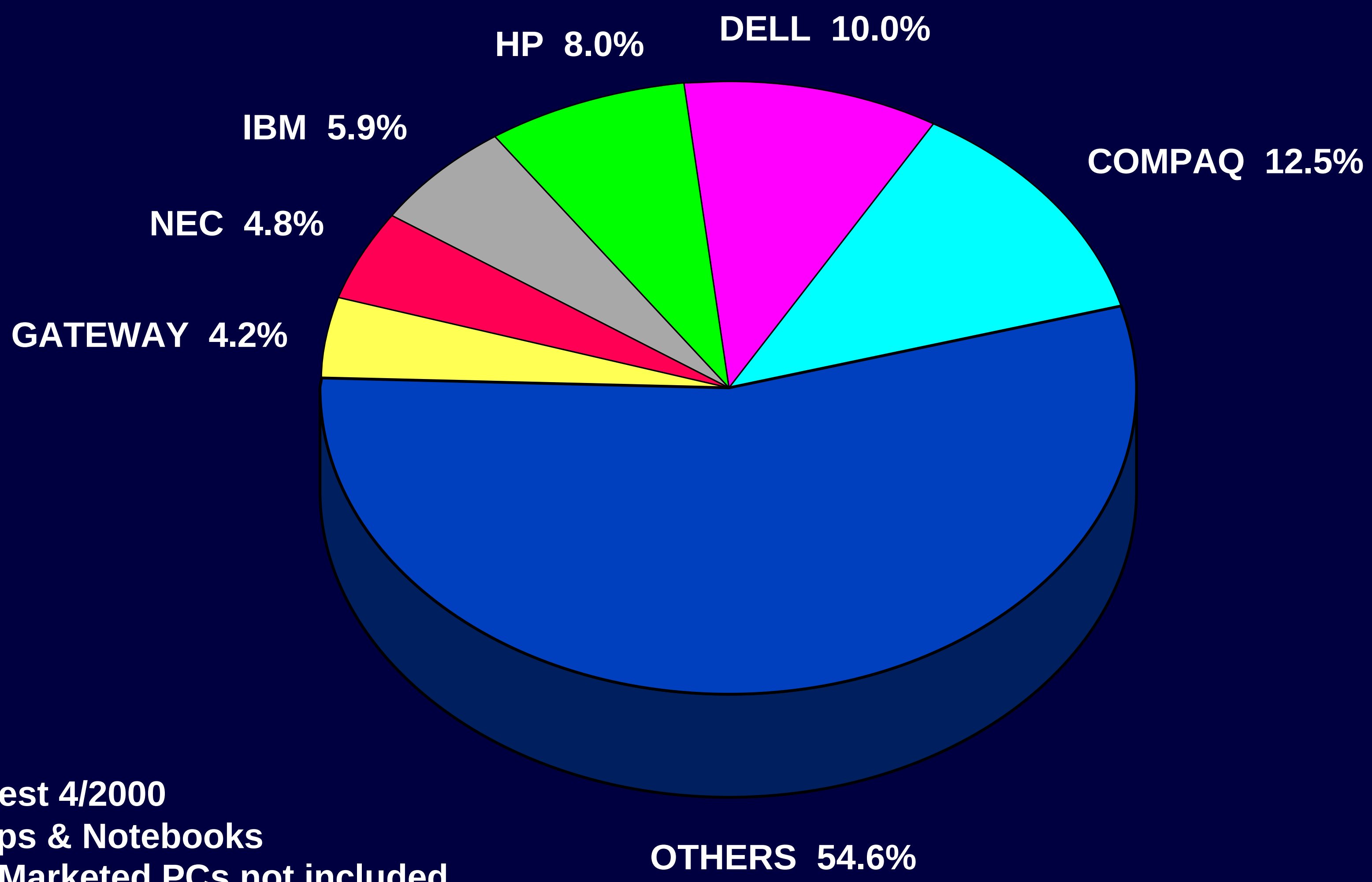
CY

FY ends May

PALM

WORLD PERSONAL COMPUTER MARKET

First Quarter 2000

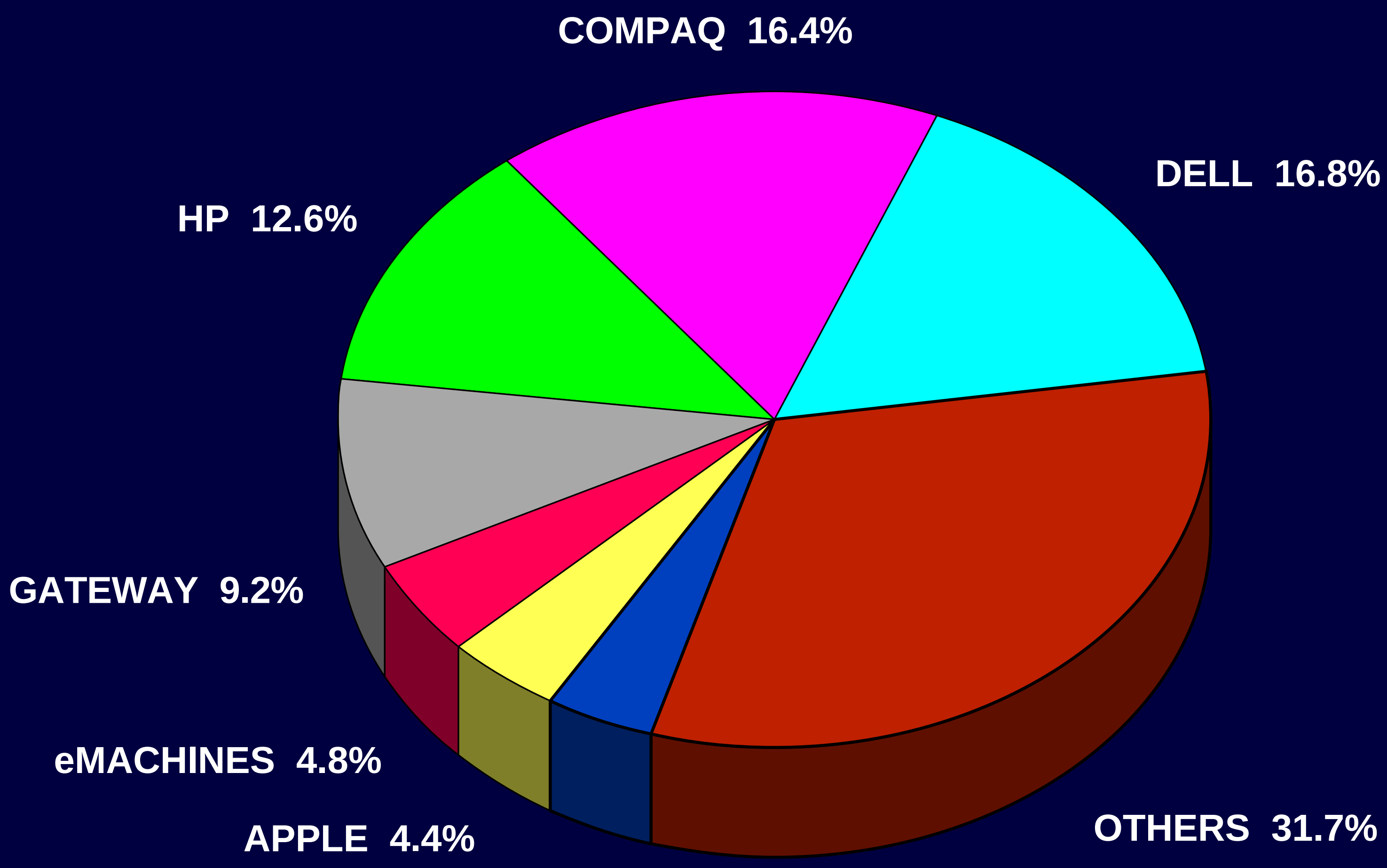


Dataquest 4/2000
Desktops & Notebooks
Server Marketed PCs not included

TOTAL: 30.0 Million Units

U.S. PERSONAL COMPUTER MARKET

First Quarter 2000

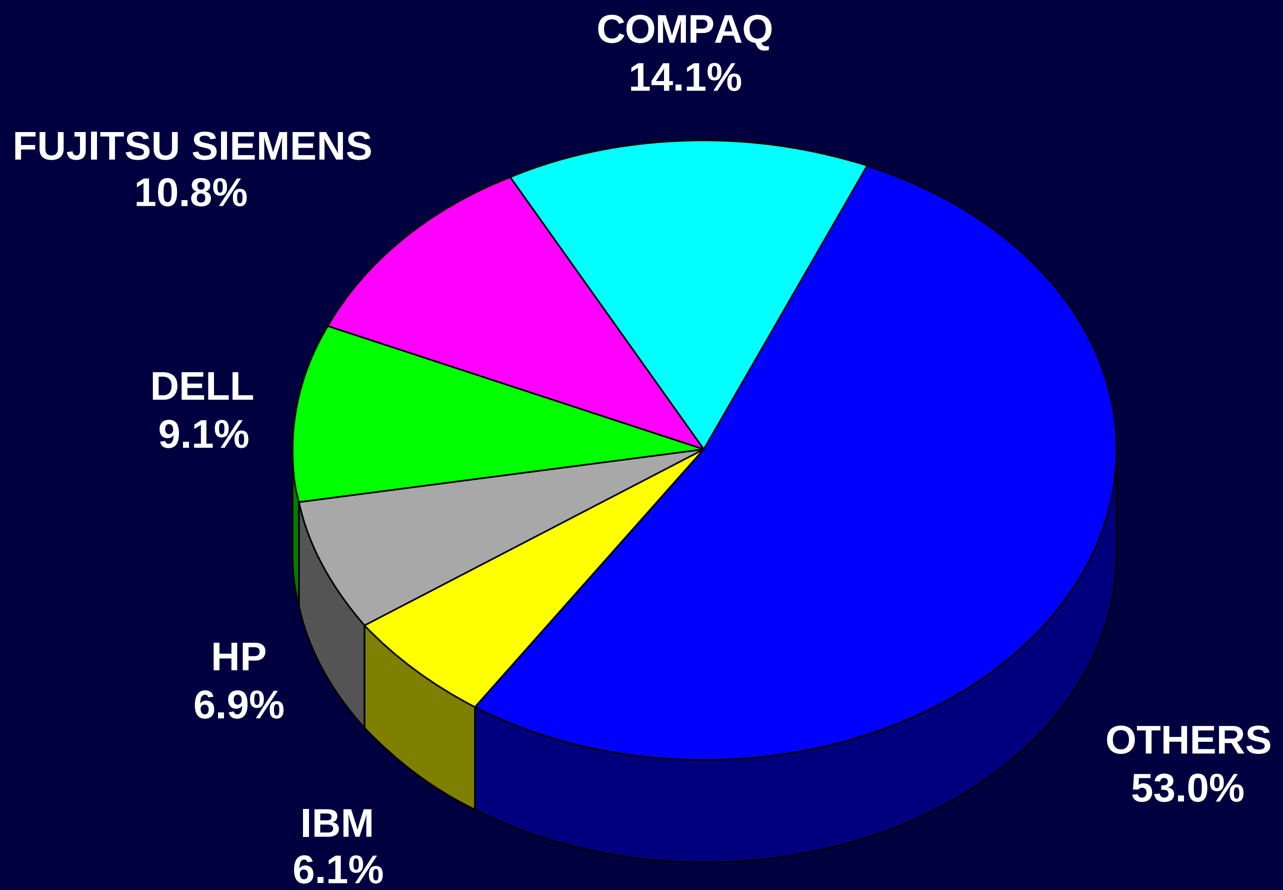


Dataquest 4/2000
Desktops & Notebooks
Server Marketed PCs not included

TOTAL: 11.1 Million Units

EUROPEAN PERSONAL COMPUTER MARKET

First Quarter 2000

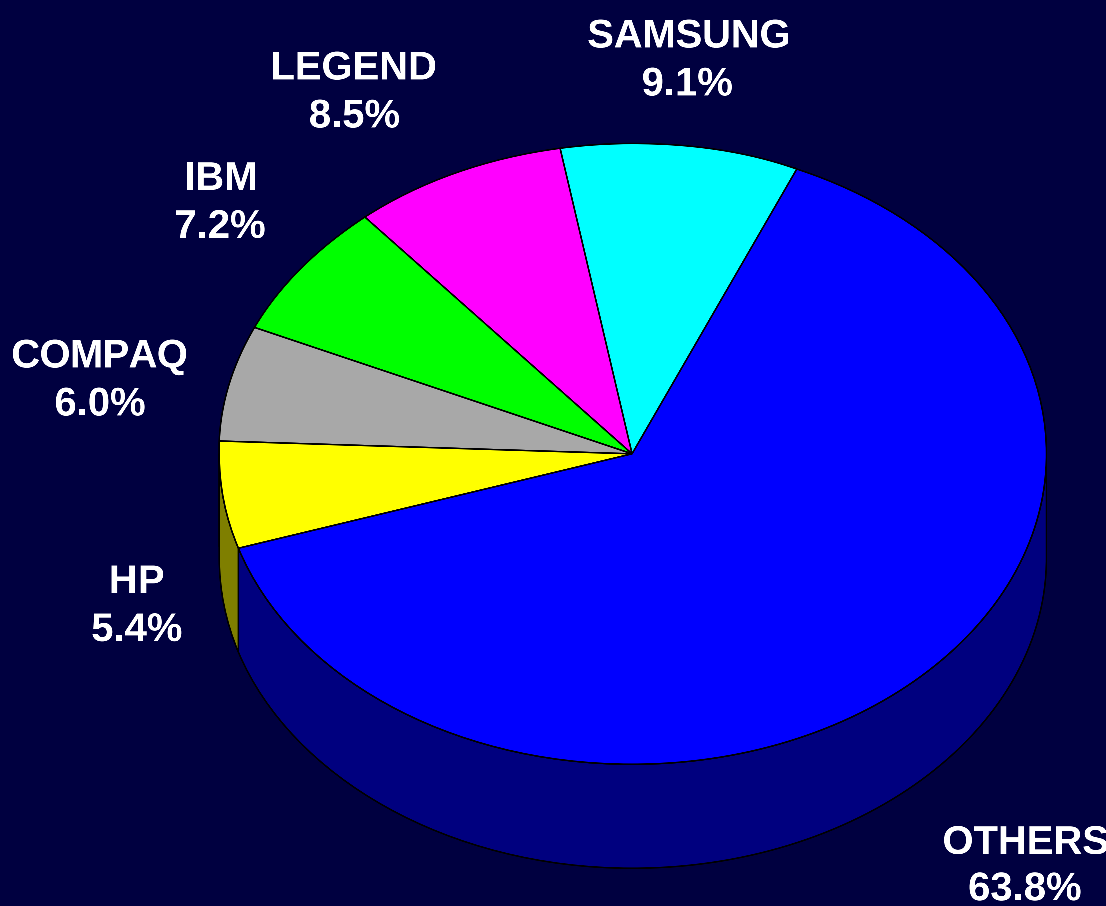


DATAQUEST 5/2000
Desktops & Notebooks
Server Marketed PCs not included

TOTAL: 7.5 M UNITS

SE ASIA PERSONAL COMPUTER MARKET

First Quarter 2000



IDC 5/2000
Excludes Japan

TOTAL: 4.2 M UNITS

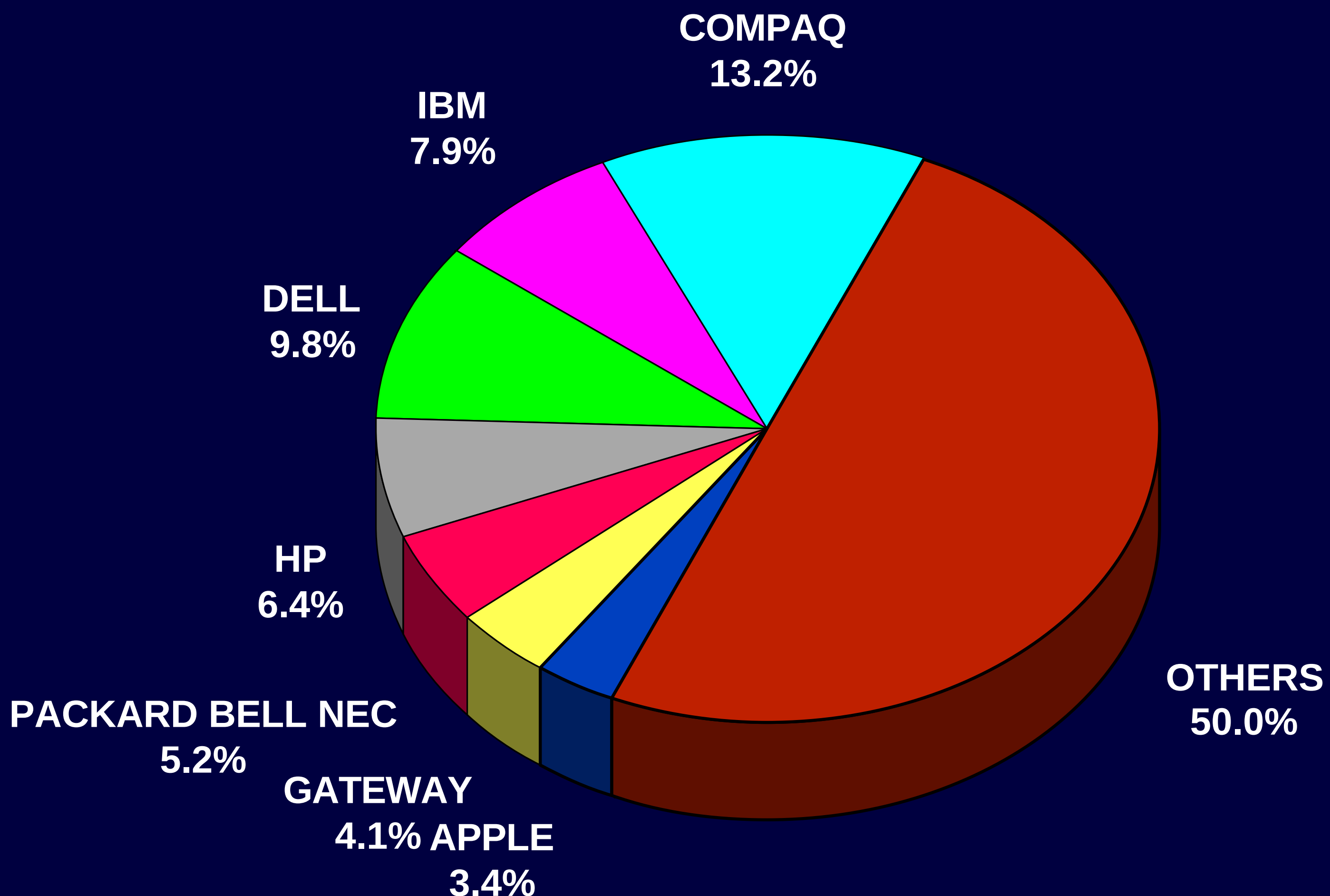
SE Asia PC Shipments (000) 1Q '2000

	Units Q1 00	Share	Q1 00/Q1 99 % Change
PRC	1,374	32.4	34.6
Korea	1,043	24.6	146.0
Australia	442	10.4	-8.4
India	342	8.1	27.4
Taiwan	269	6.3	37.8
Hong Kong	148	3.5	38.9
Malaysia	141	3.3	52.5
Singapore	120	2.8	13.4
Thailand	103	2.4	39.7
Indonesia	94	2.2	111.2
New Zealand	76	1.8	.9
Philippines	64	1.5	48.9
Vietnam	27	.6	2.4
Total	4,243	100.0%	43.4%

IDC 5/2000

WORLD PERSONAL COMPUTER MARKET

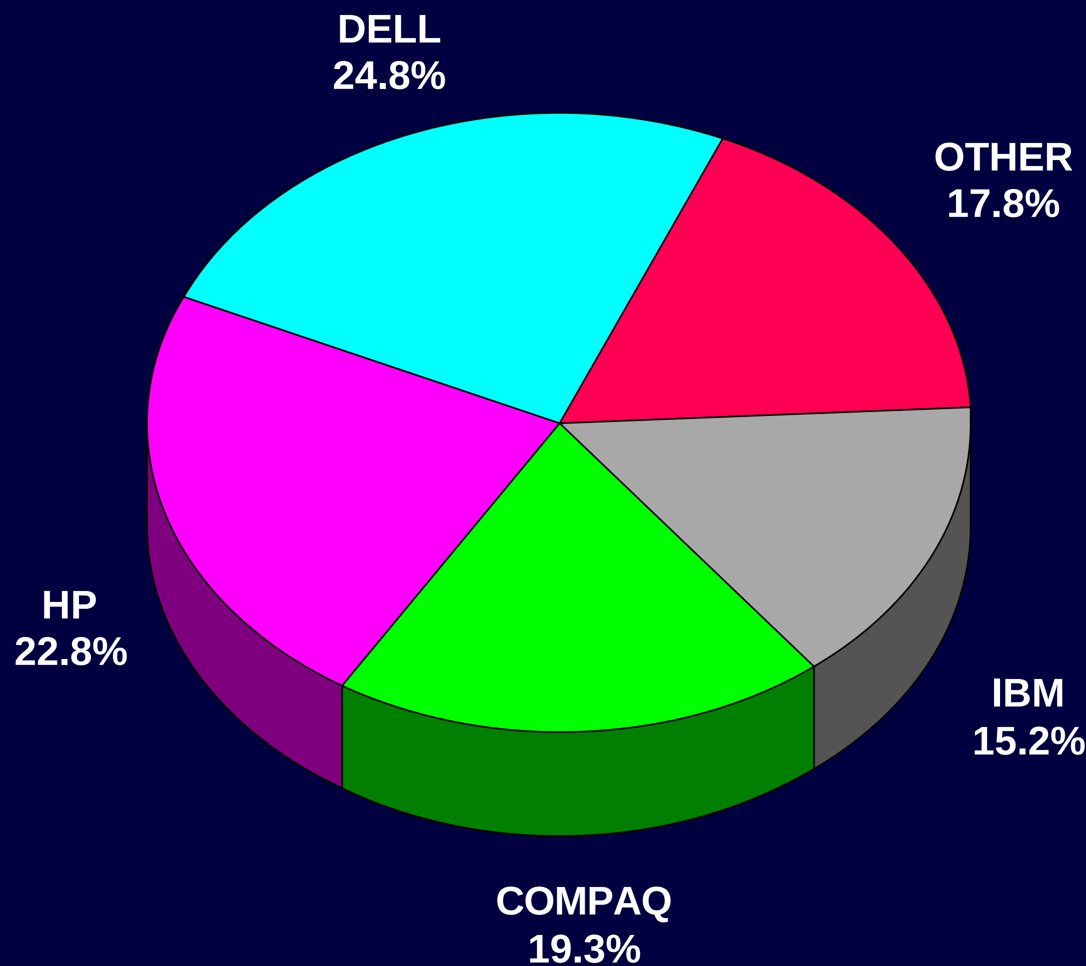
1999



DATAQUEST 1/2000
Preliminary, Servers not included

TOTAL: 113.5 M UNITS

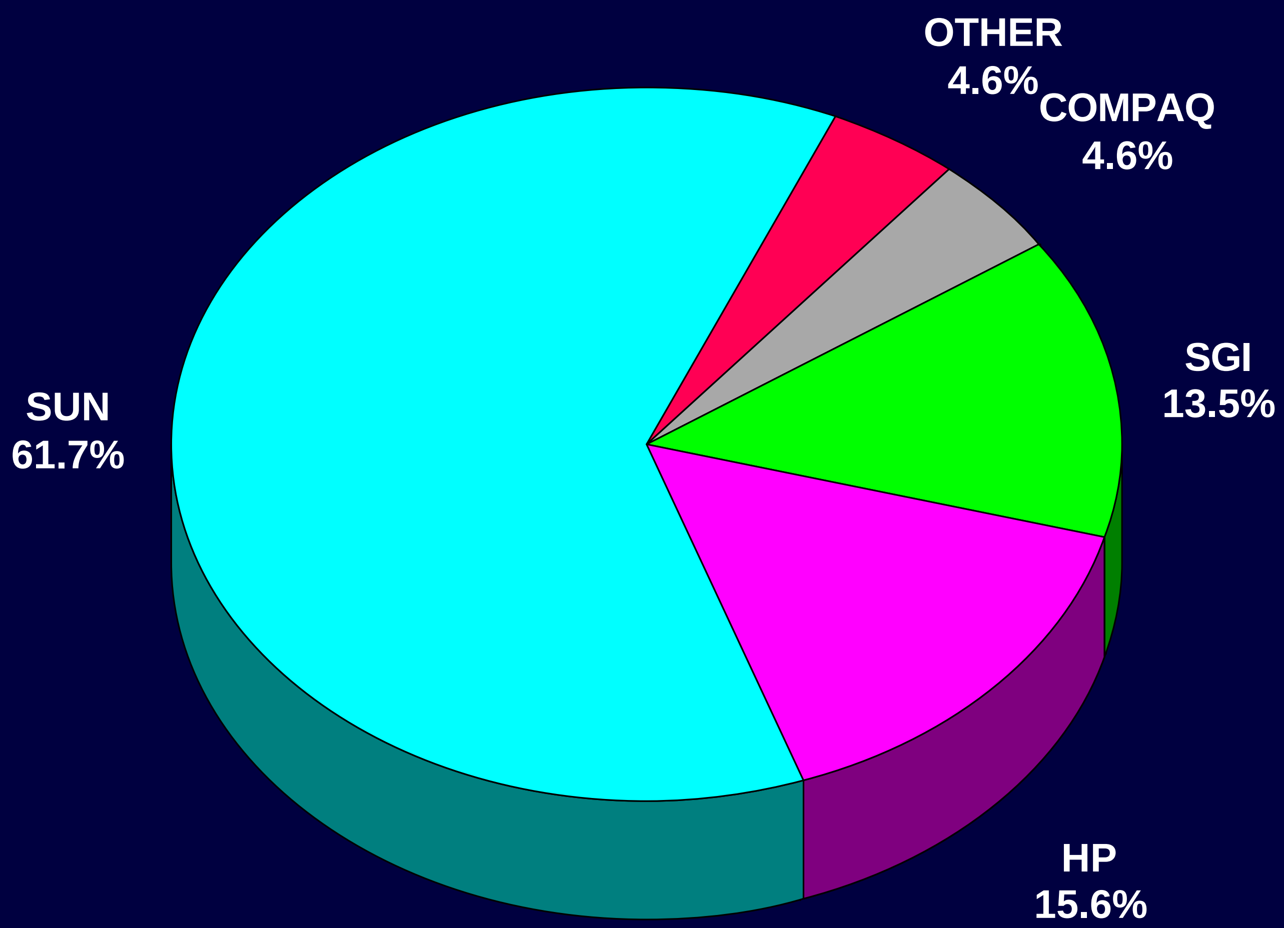
WINDOWS NT WORKSTATION WORLD MARKET 1999



TOTAL: 1,007,000 Units

IDC 2/2000

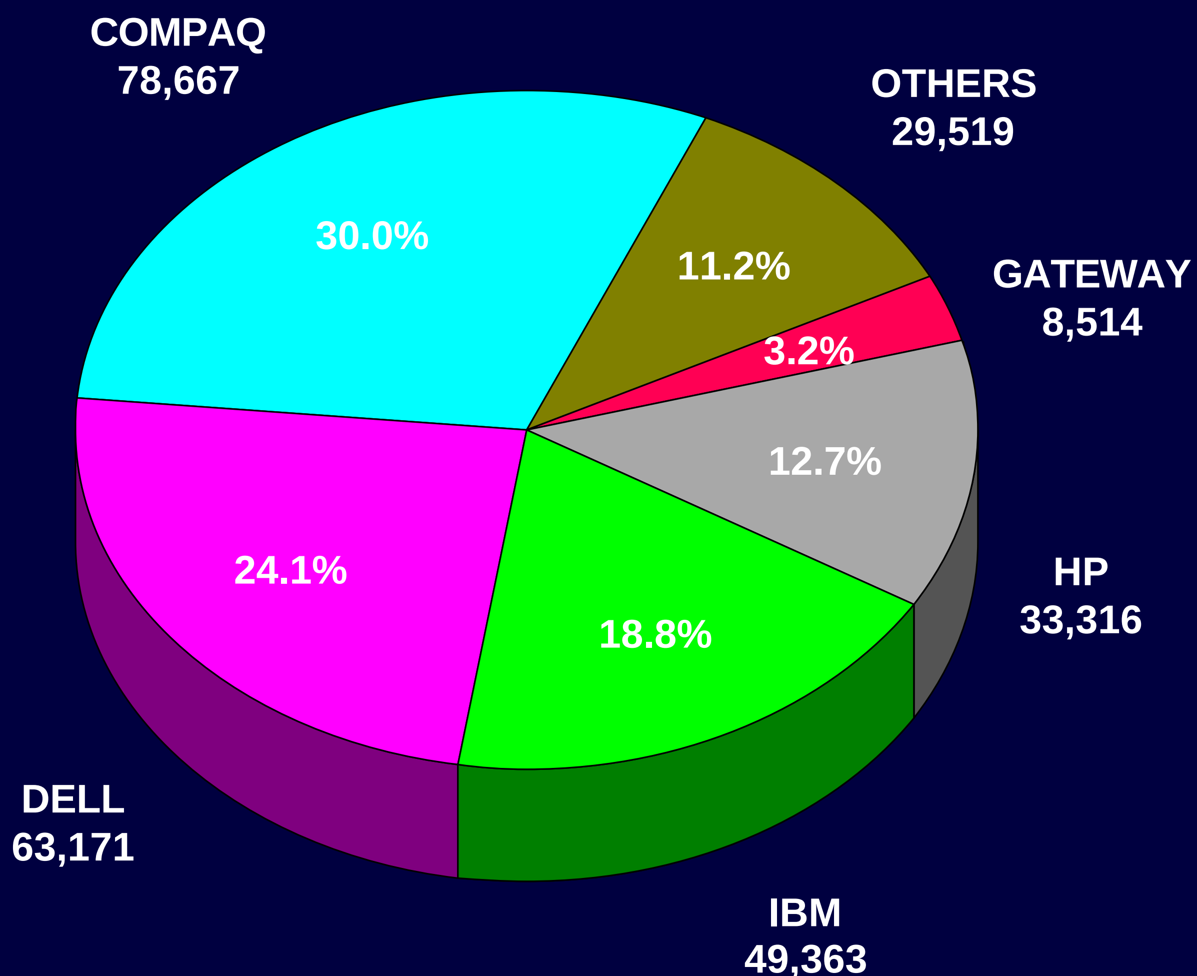
UNIX WORKSTATION WORLD MARKET 1999



TOTAL: 609,000 Units

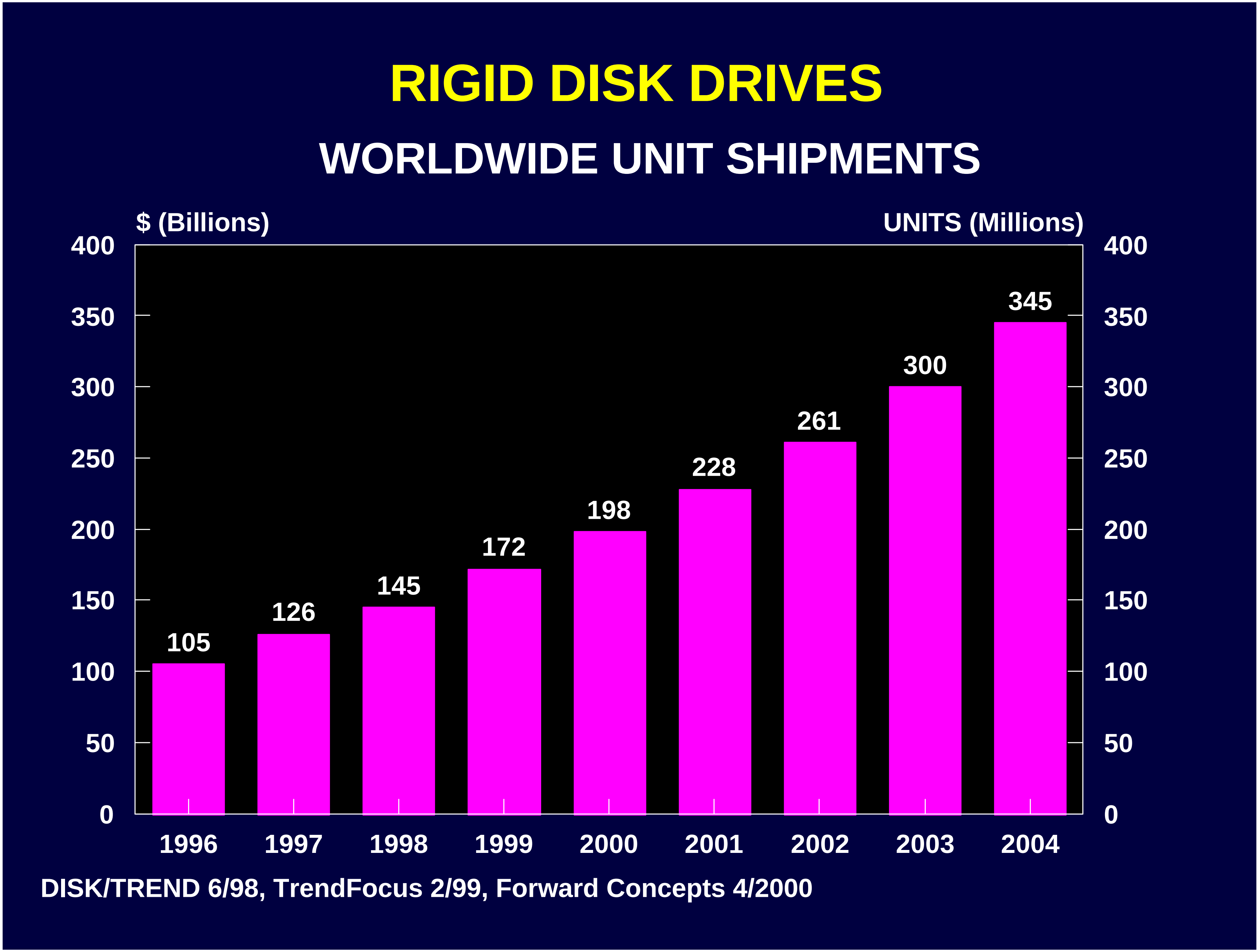
IDC 2/2000

US PC SERVER VENDORS
1999

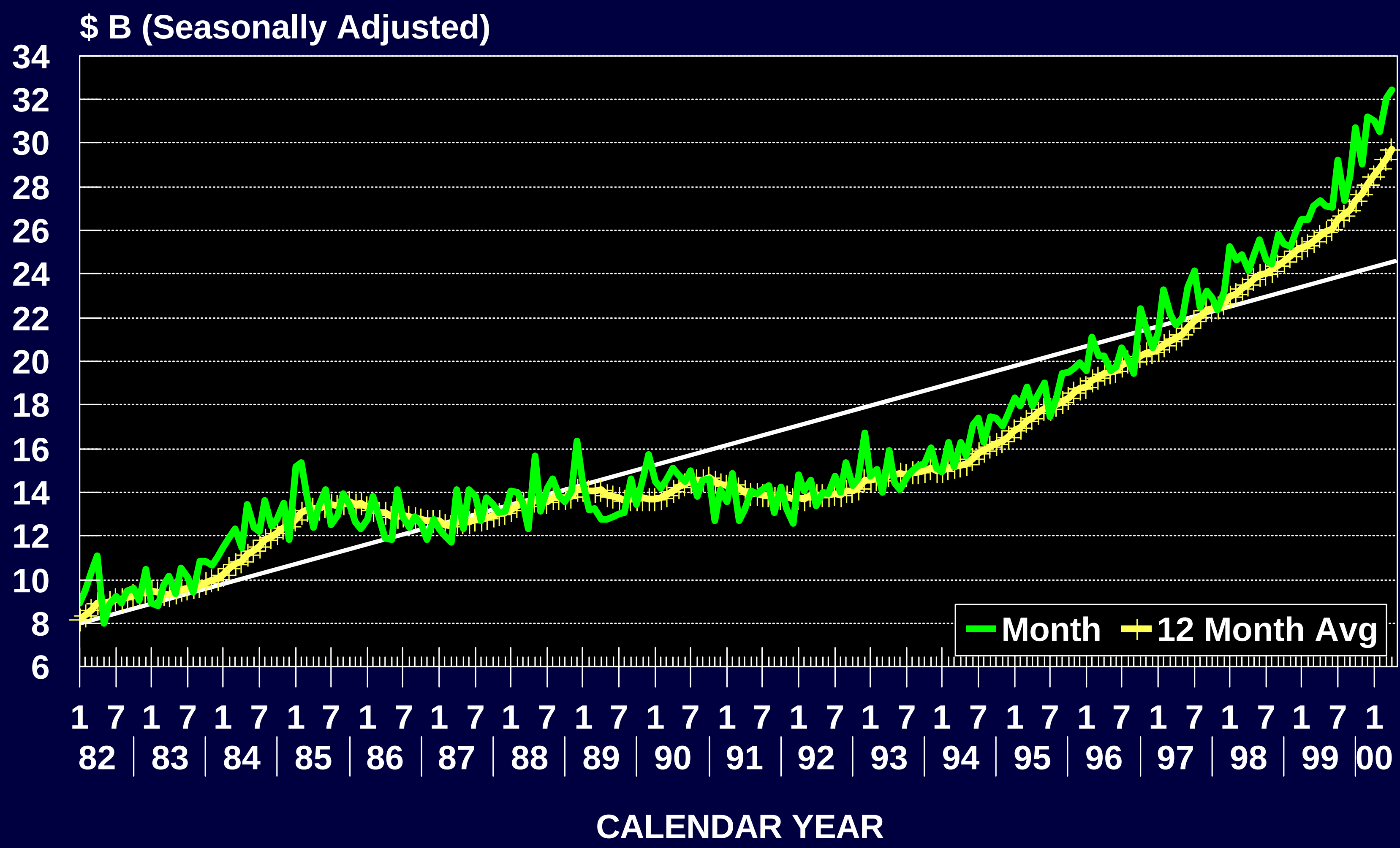


TOTAL: 262,560 Units

Computerworld 1/2000

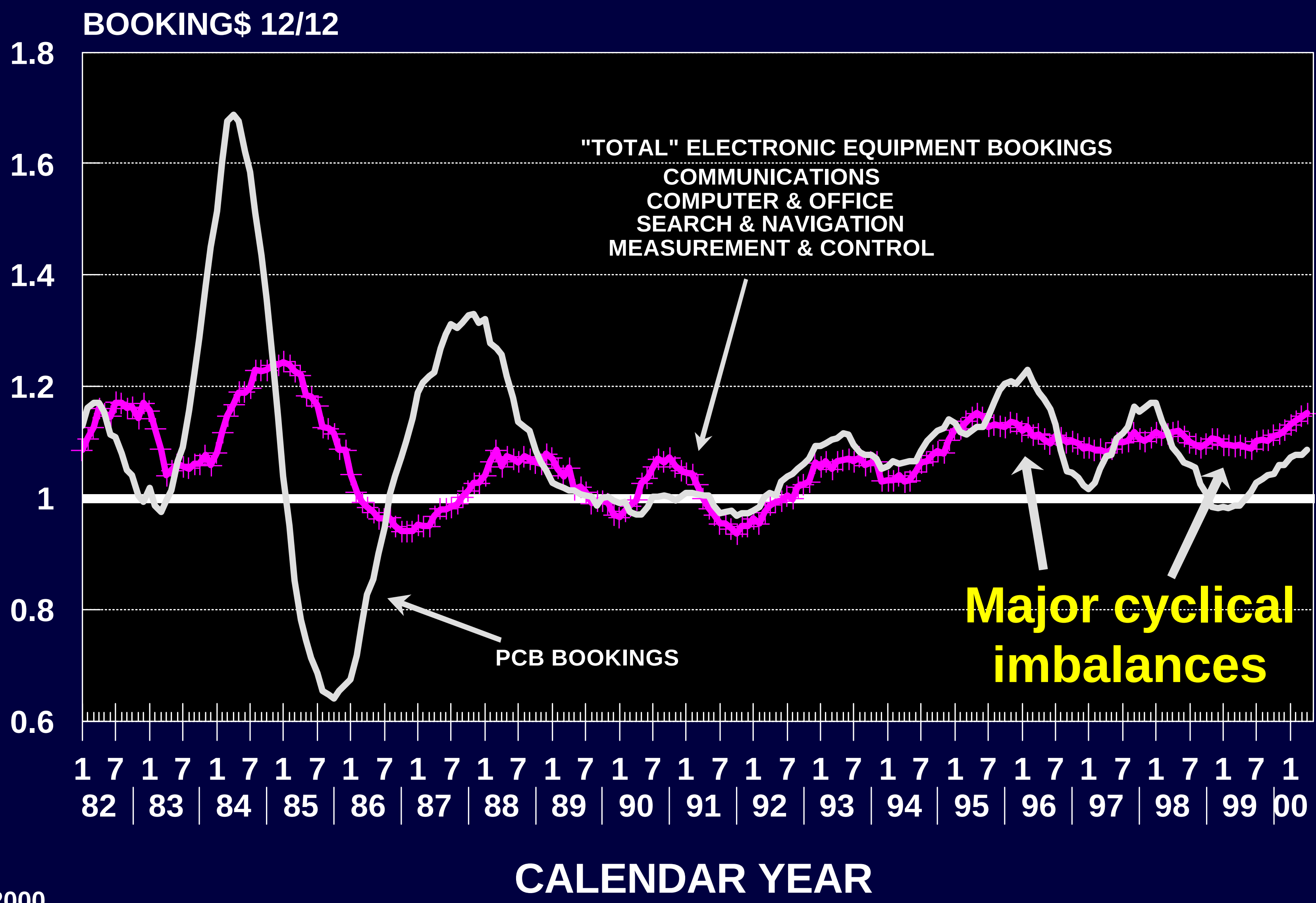

RIGID DISK DRIVES
WORLDWIDE UNIT SHIPMENTS
$ (Billions)
UNITS (Millions)
400
350
300
250
200
150
100
50
0
105
126
145
172
198
228
261
300
345
1996
1997
1998
1999
2000
2001
2002
2003
2004
DISK/TREND 6/98, TrendFocus 2/99, Forward Concepts 4/2000

TOTAL ELECTRONIC EQUIPMENT
BOOKINGS



COMMERCE DEPT 6/2000

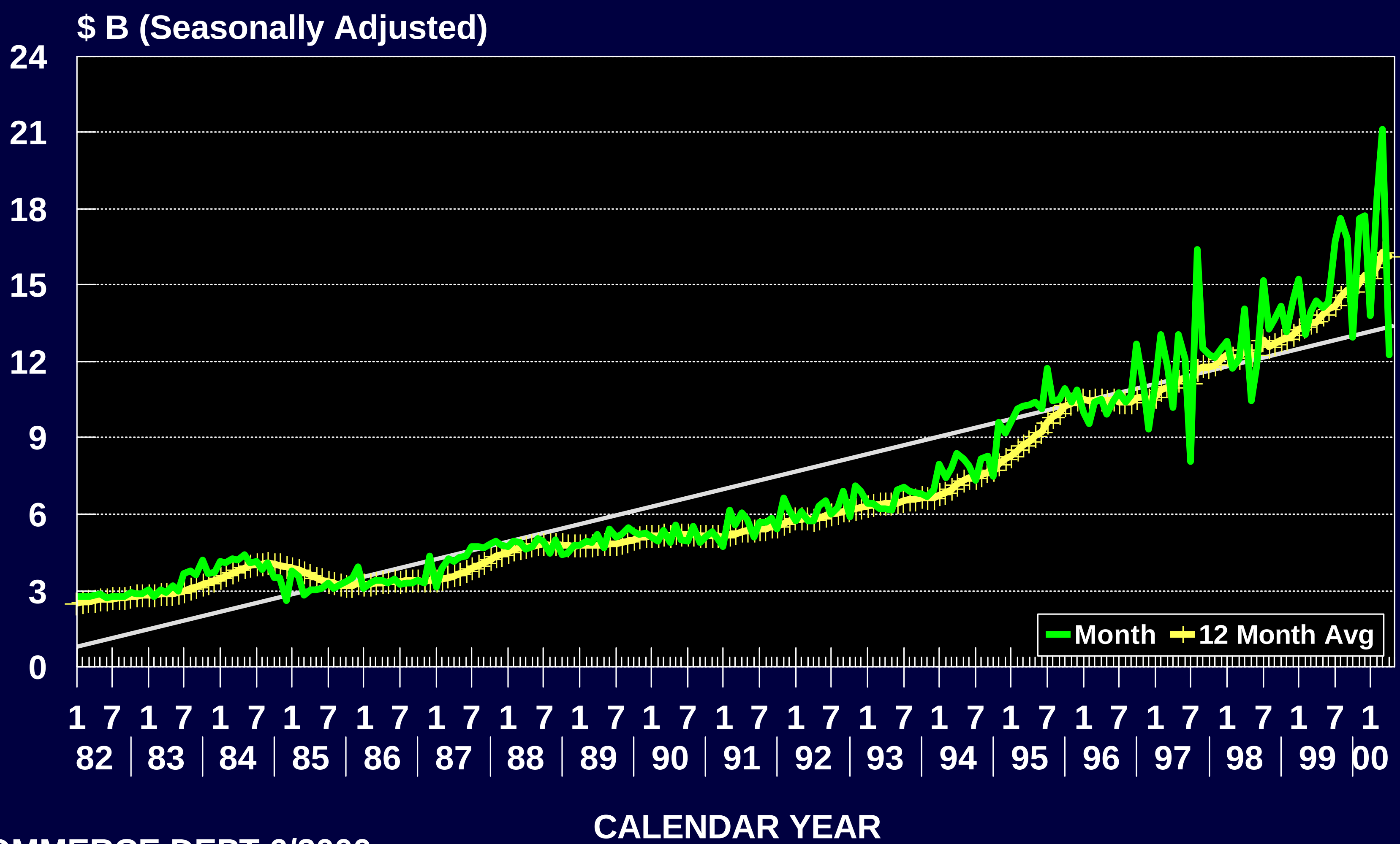
U.S. PCBs vs Total Electronic Equipment



6/2000

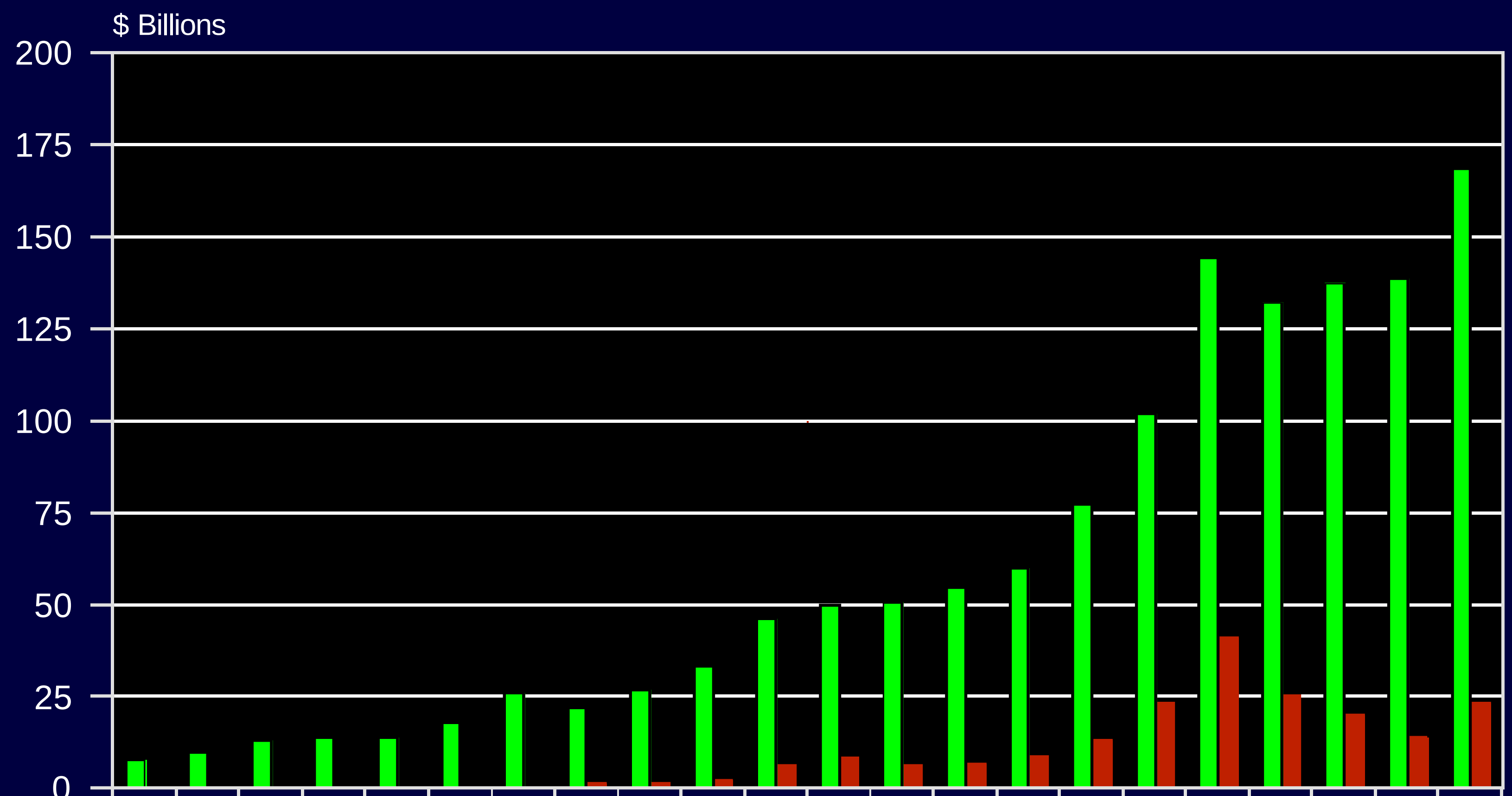
ELECTRONIC COMPONENTS

BOOKINGS



COMMERCE DEPT 6/2000

World Semiconductor Sales
Total & Memory

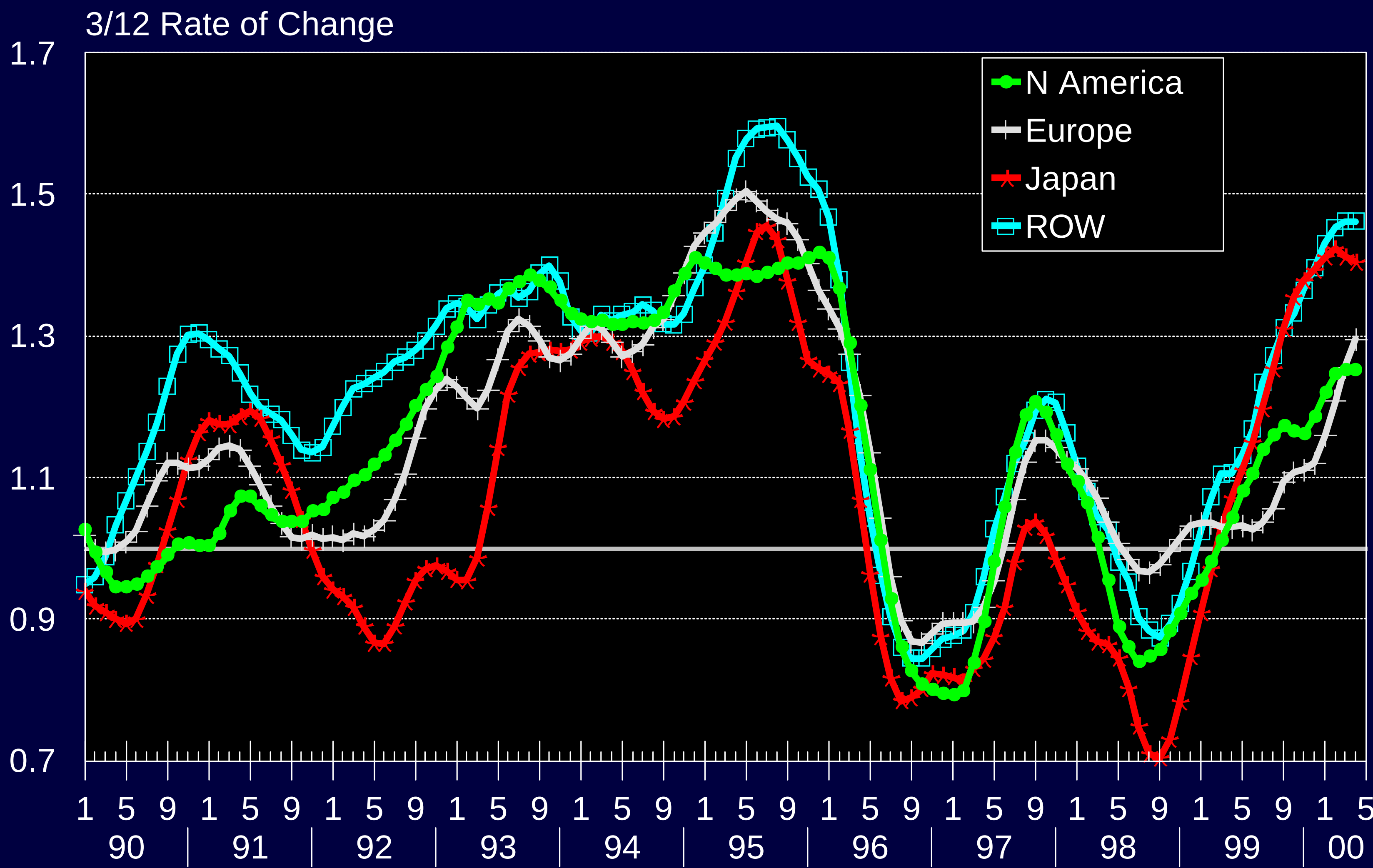


	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Total	8	10	13	14	14	18	26	22	27	33	46	50	51	55	60	77	102	144	132	137	139	169
DRAMs								1	2	2	6	8	6	7	9	13	23	41	25	20	14	23

Electronic Business: Dataquest 3/2000

SEMICONDUCTOR GROWTH RATES

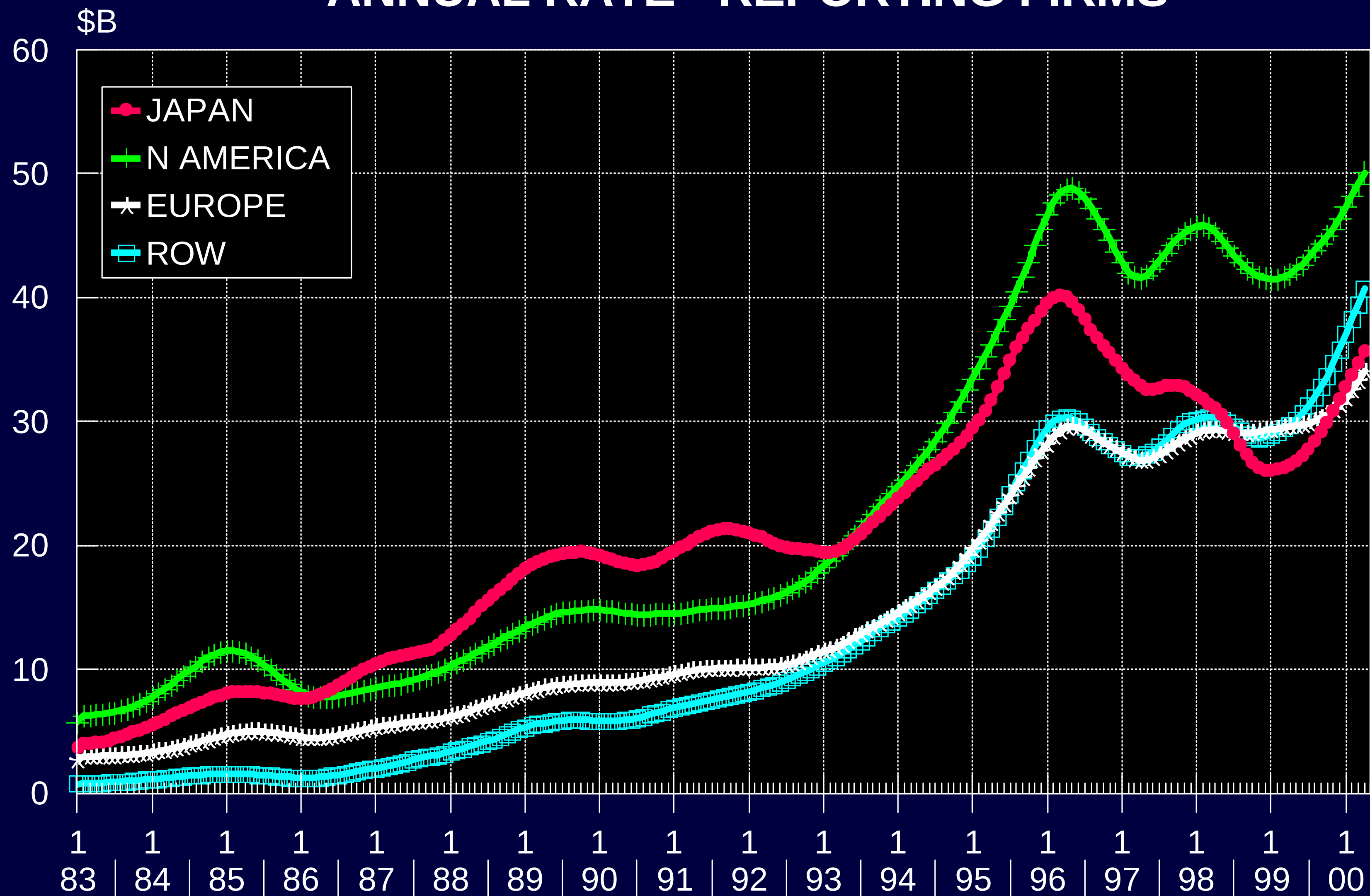
TOTAL $ SHIPMENTS TO AN AREA



Total $ Shipments From All Countries To An Area
SIA website: www.semichips.org/

TOTAL SEMICONDUCTOR $ SHIPMENTS TO AREA

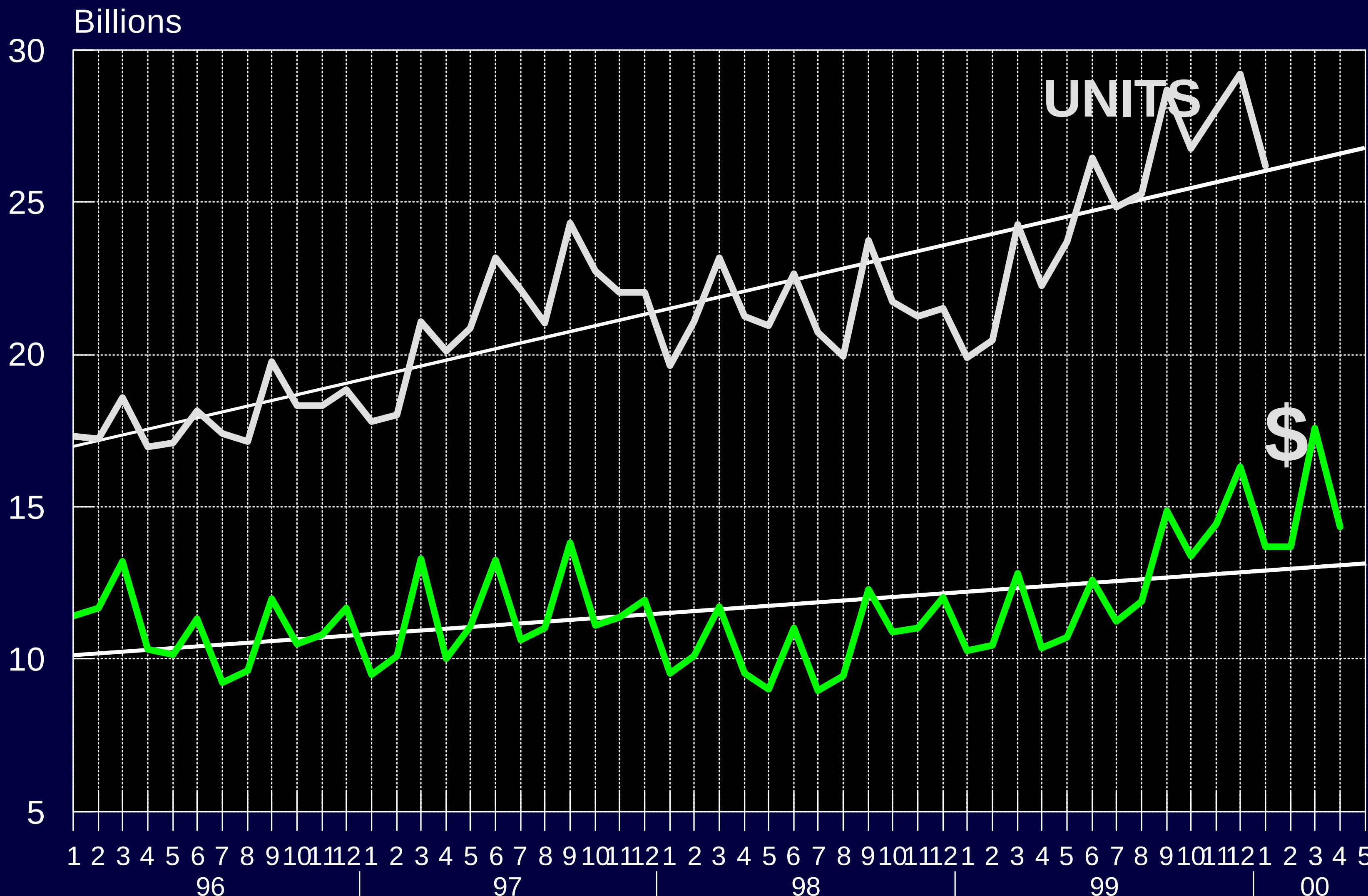
ANNUAL RATE - REPORTING FIRMS



SIA website: www.semichips.org/

WORLD SEMICONDUCTOR SHIPMENTS

MONTHLY $ and UNITS



SIA via E Henderson (Not Seasonally Adjusted)

MONTHLY SEMICONDUCTOR SHIPMENTS
$ Billions

	4/99	4/00	% CH
Americas	3.64	4.57	25.7%
Europe	2.48	3.32	33.6%
Japan	2.43	3.43	41.1%
Asia Pacific	2.66	3.89	46.0%
Total	11.21	15.20	35.6%

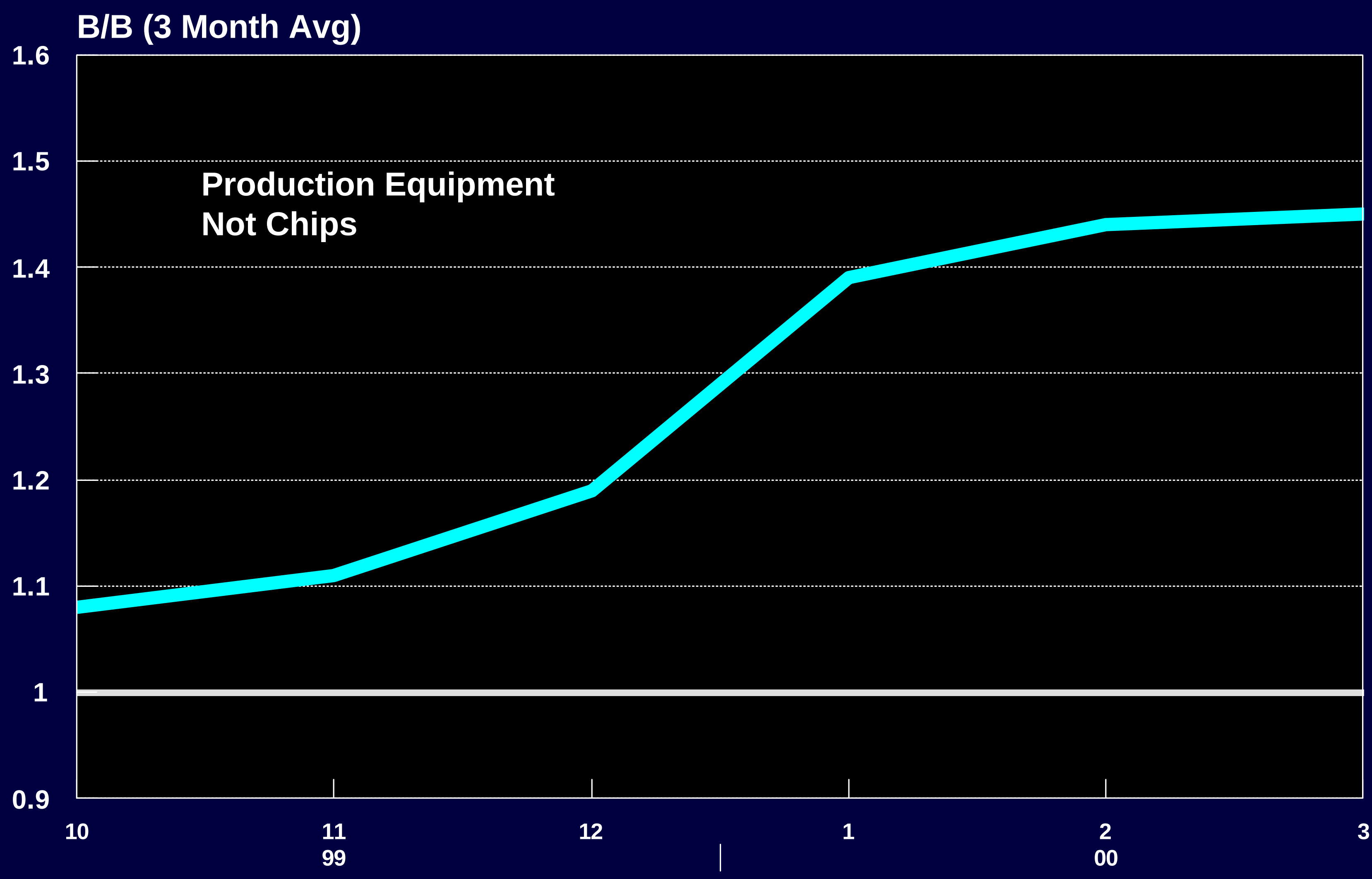
SIA 6/2000 - Monthly data

Top 10 Worldwide Semiconductor Vendors ($M)

	1998	1999	99/98 %
Intel	22,784	26,806	17.7
NEC	7,947	9,210	15.9
Toshiba	5,913	7,618	28.8
Samsung	4,743	7,125	50.2
Texas Instruments	5,820	7,120	22.3
Motorola	7,088	6,394	-9.8
Hitachi	4,668	5,554	19.0
Infineon	3,909	5,223	33.6
STMicroelectronicsN.V.	4,199	5,077	20.9
Philips	4,448	5,074	14.1
Others	67,167	83,378	24.1
Total Market	138,686	168,579	21.6

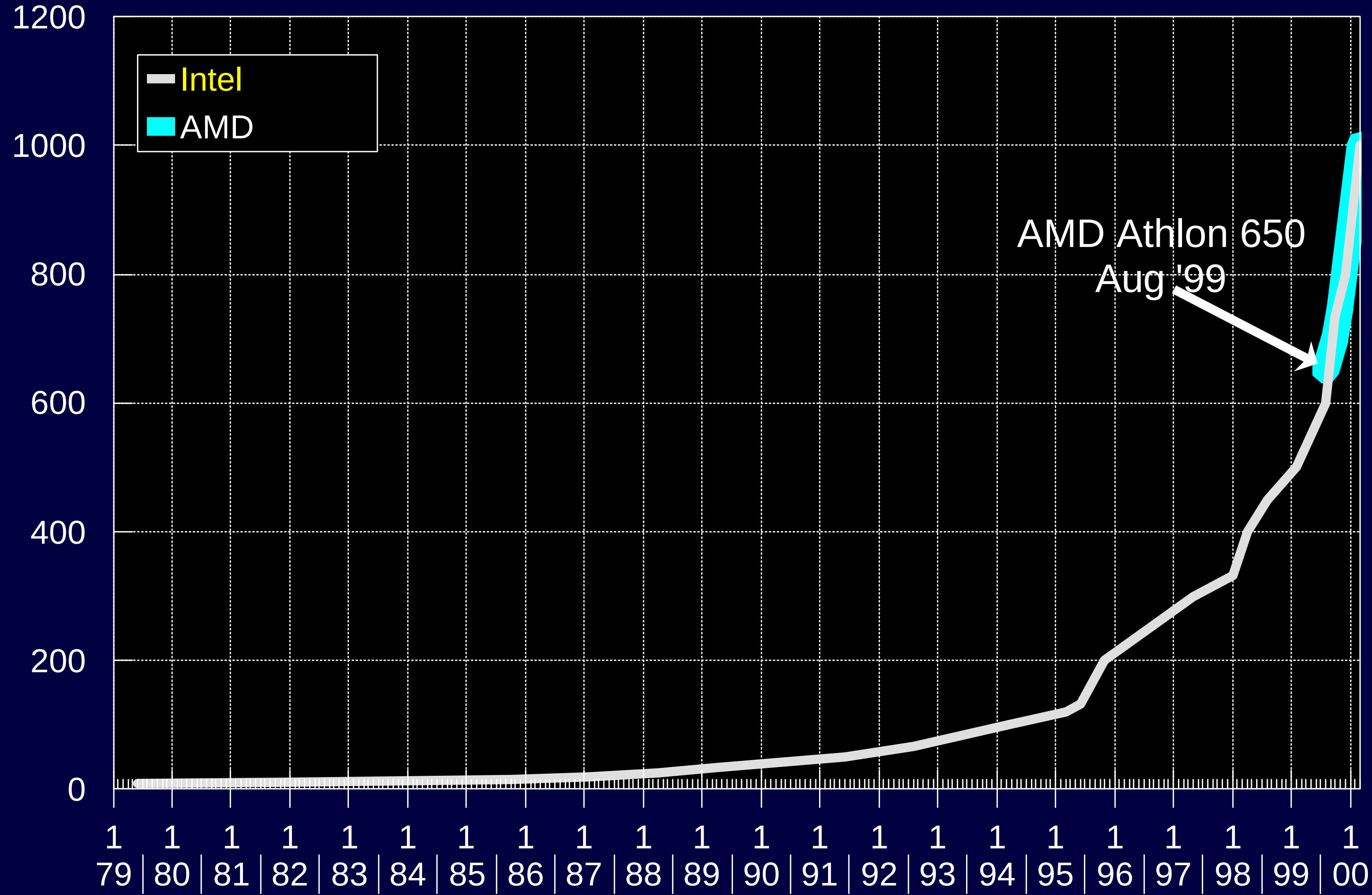
Source: Dataquest 1/2000

N American Semiconductor Equipment Industry
Book/Bill Ratio



Microprocessor Speeds

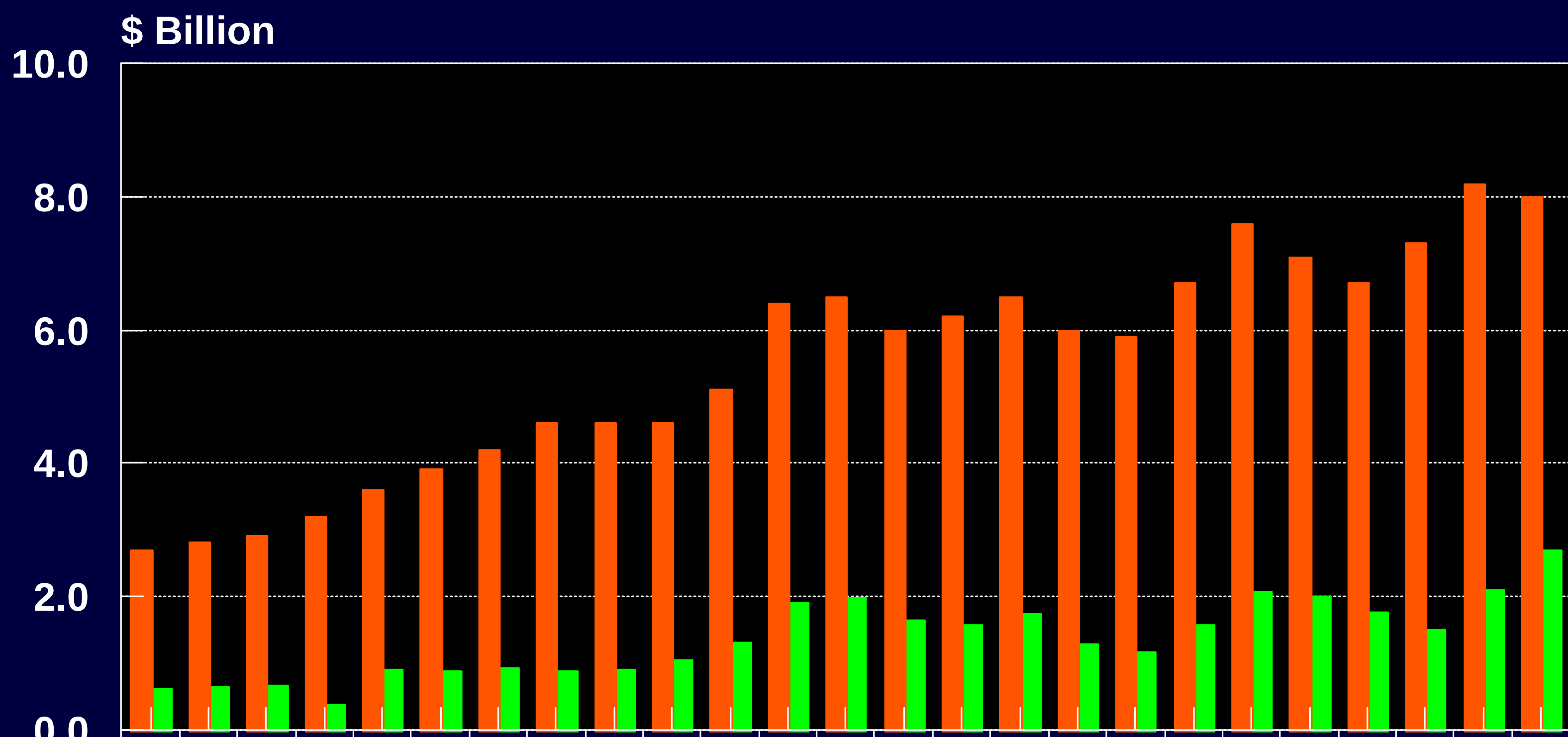
Intel & AMD



Maximum PC, May 2000

Intel

Revenue & Net Income



	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
		94				95				96				97				98				99			00
Revenue	2.7	2.8	2.9	3.2	3.6	3.9	4.2	4.6	4.6	4.6	5.1	6.4	6.5	6.0	6.2	6.5	6.0	5.9	6.7	7.6	7.1	6.7	7.3	8.2	8.0
Income	0.6	0.6	0.7	0.4	0.9	0.9	0.9	0.9	0.9	1.0	1.3	1.9	2.0	1.7	1.6	1.7	1.3	1.2	1.6	2.1	2.0	1.8	1.5	2.1	2.7

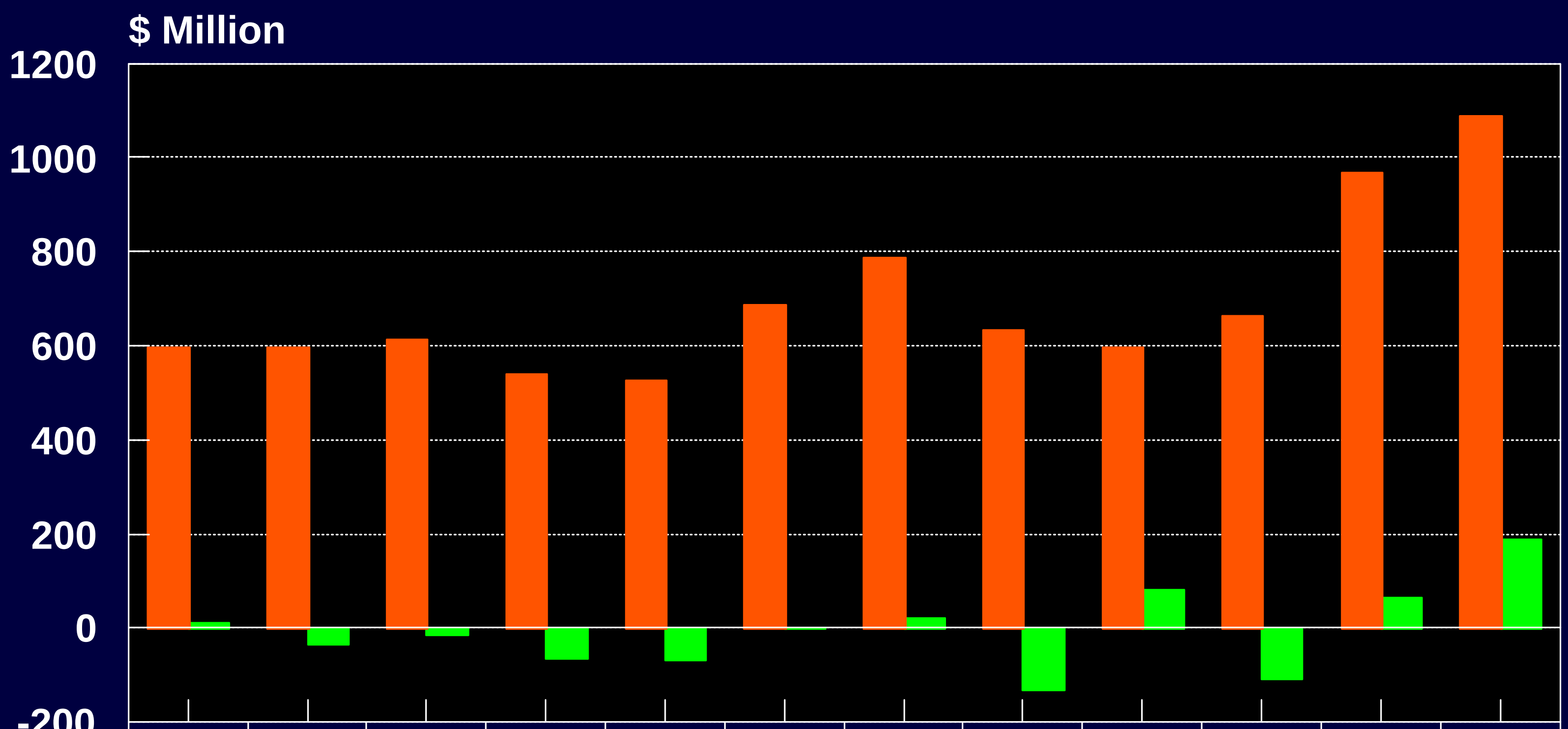
CY

INTC

FY=CY

Advanced Micro Devices

Revenue & Net Income



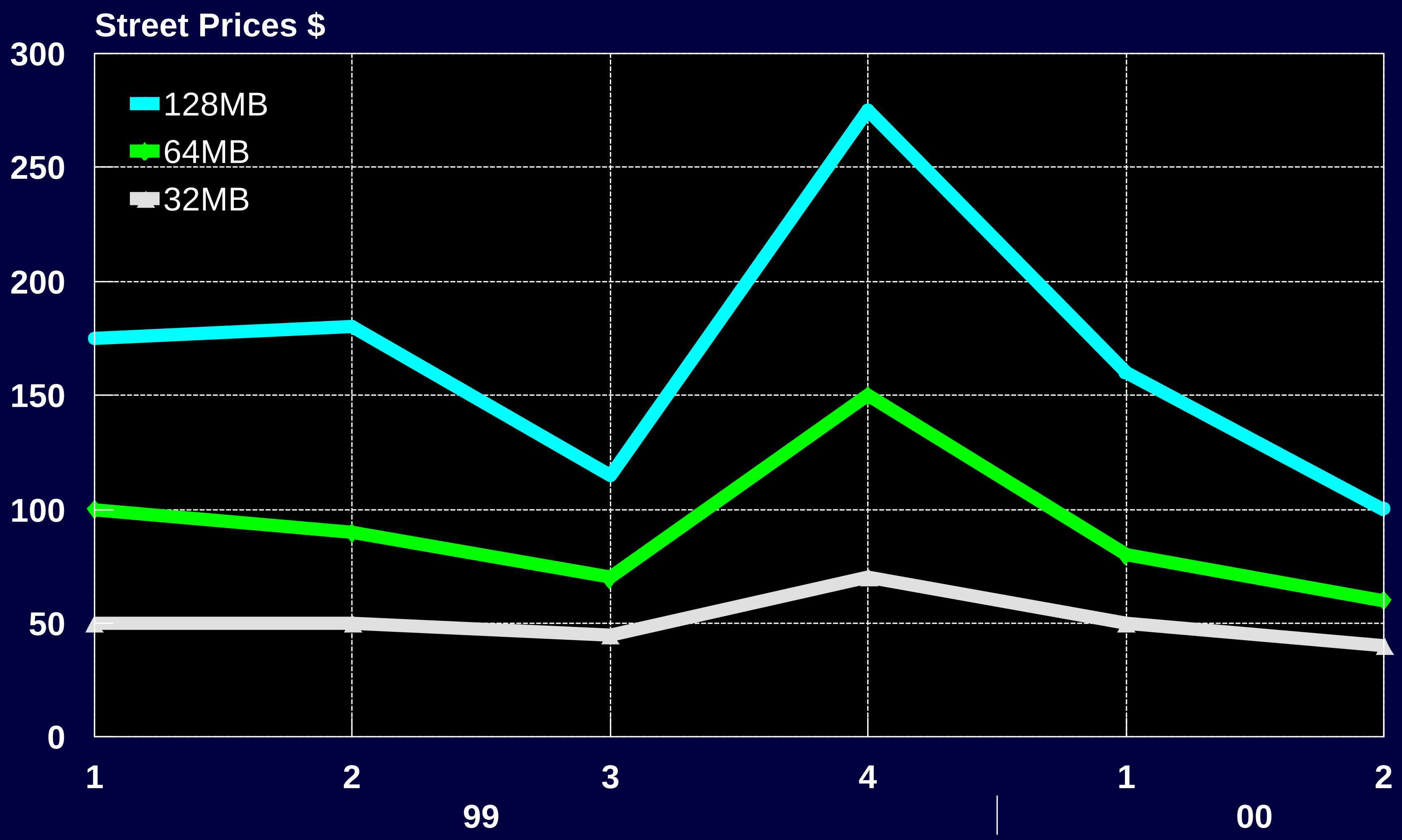
	3	4	4	1	2	3	4	1	2	3	4	1
	96		97		98				99			00
Revenue	595	597	613	541	527	686	789	632	595	662	969	1090
Income	10	-31.7	-12.3	-62.7	-64.6	1	22.3	-128	80	-105	65	189

CY

AMD

FY=CY

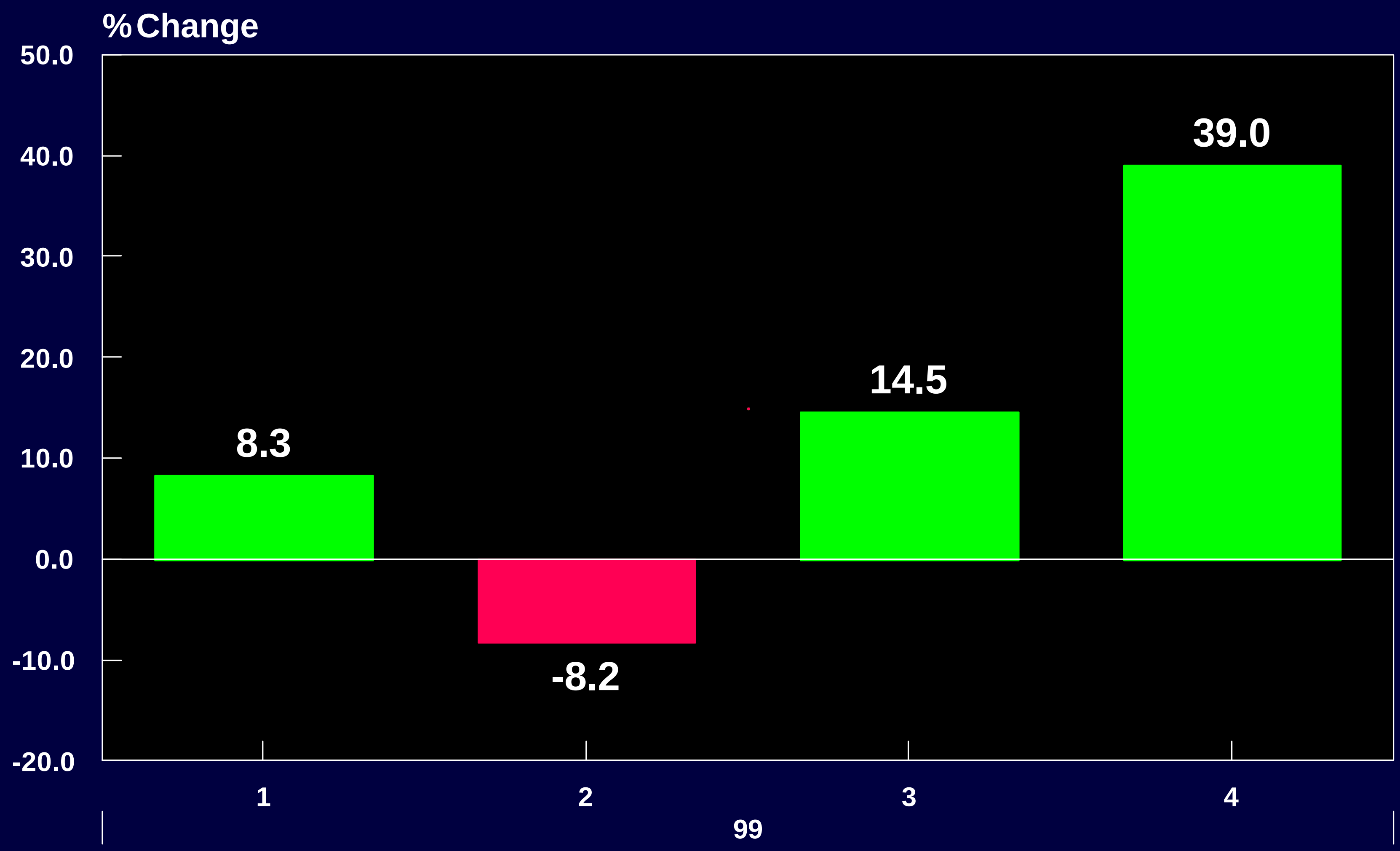
DRAM Prices



InfoWorld 4/2000

Global DRAM $ SHIPMENTS

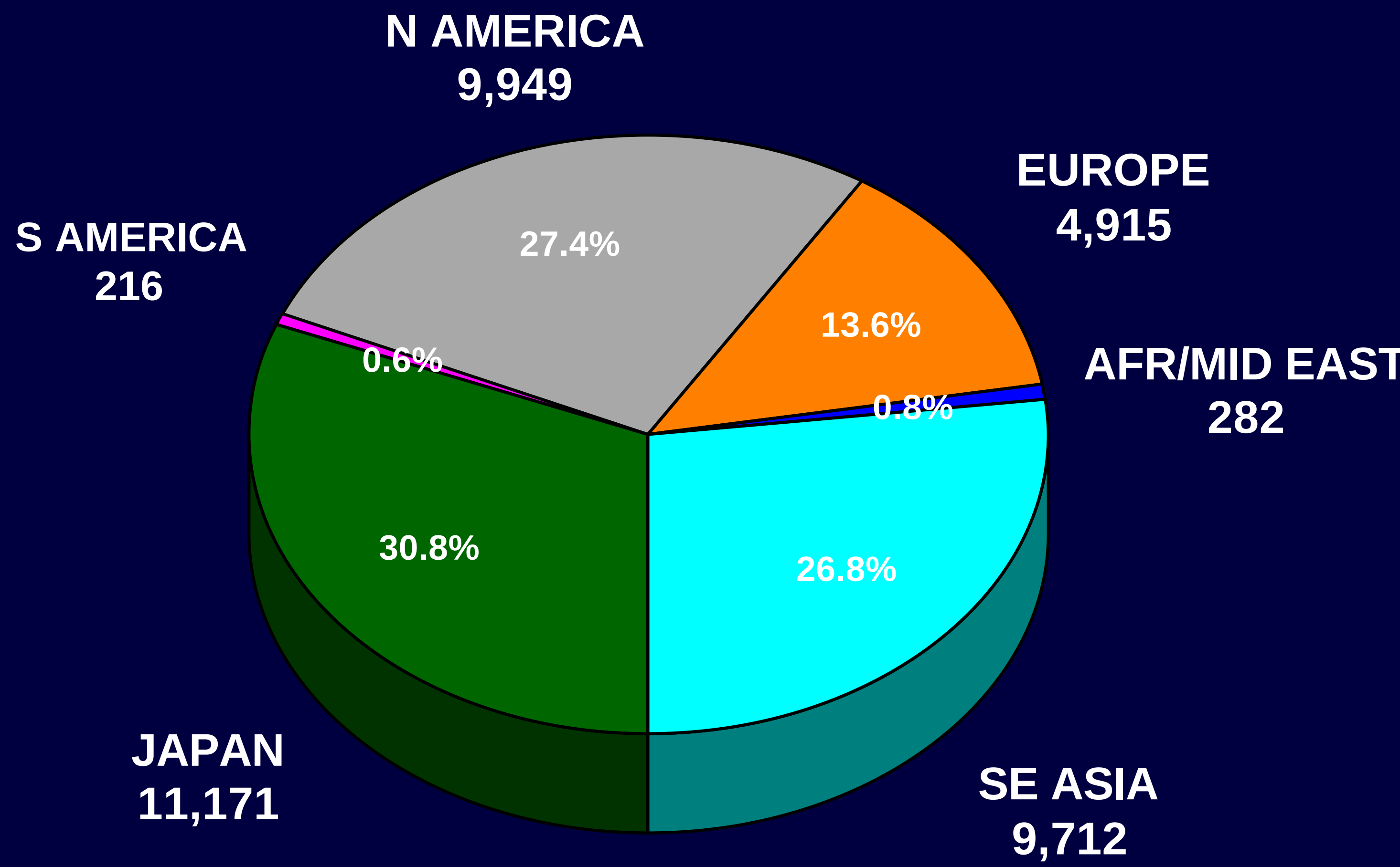
Quarter-to-Quarter % Change



Semico Research 5/2000

1999 WORLD RIGID & FLEX PCB PRODUCTION

BY GEOGRAPHICAL AREA ($M)

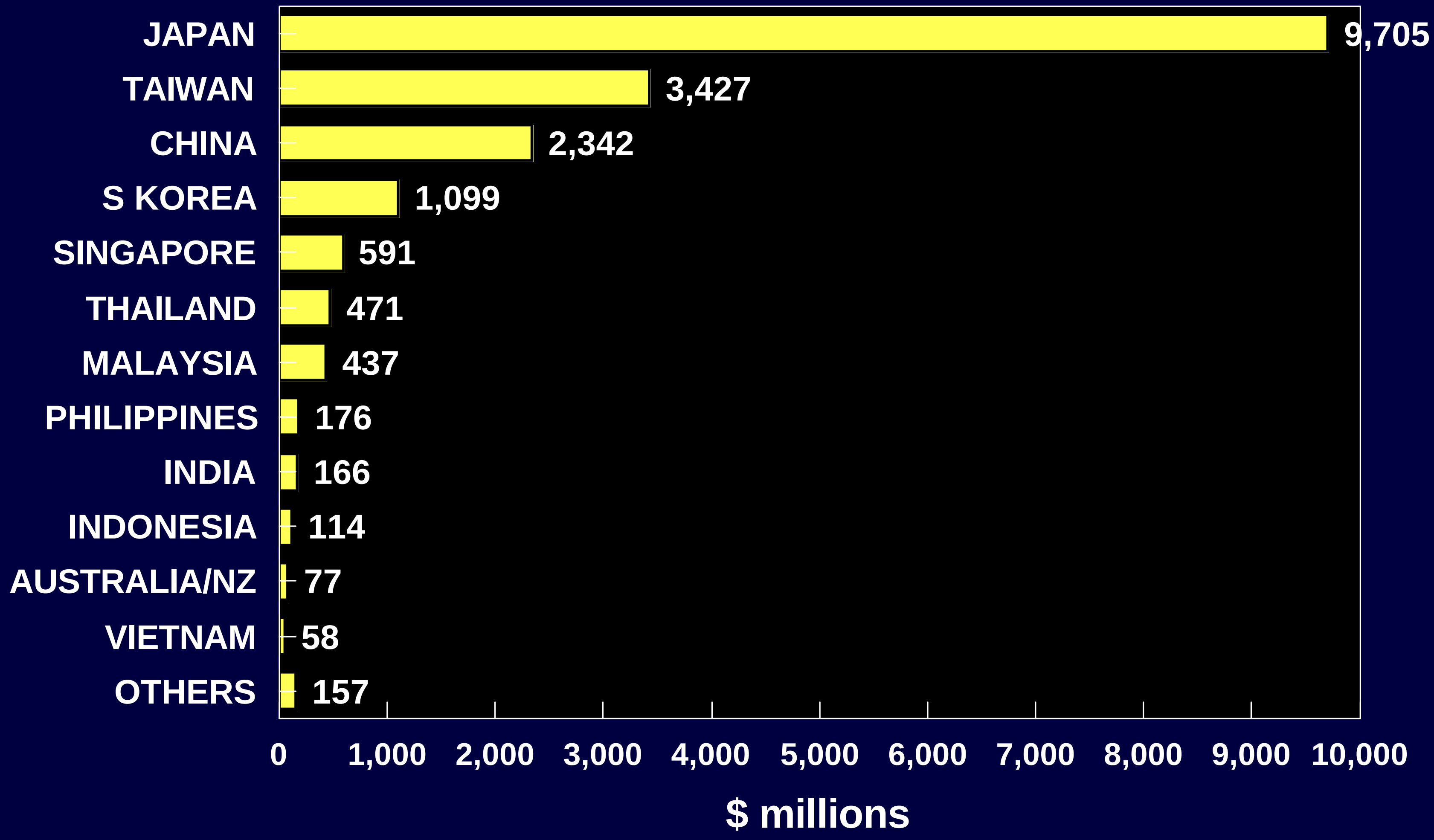


Total: $36.2 Billion

IPC T/MRC 6/2000 (includes Buildup PCBs)

ASIA/PACIFIC RIGID PWB PRODUCTION

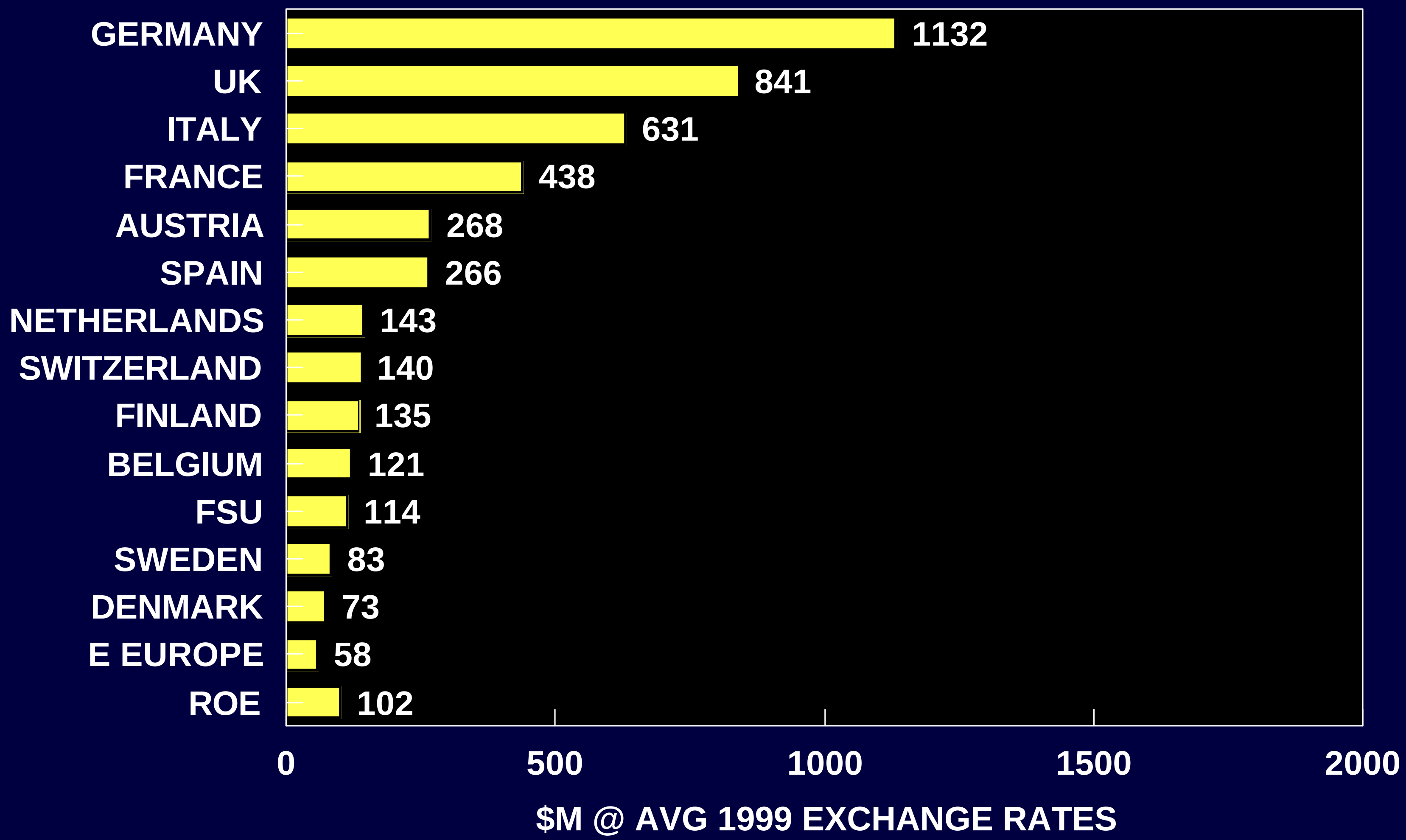
1999 TOTAL = $18.8 Billion



IPC TMRC 6/2000 (includes 1,942 million Microvia)

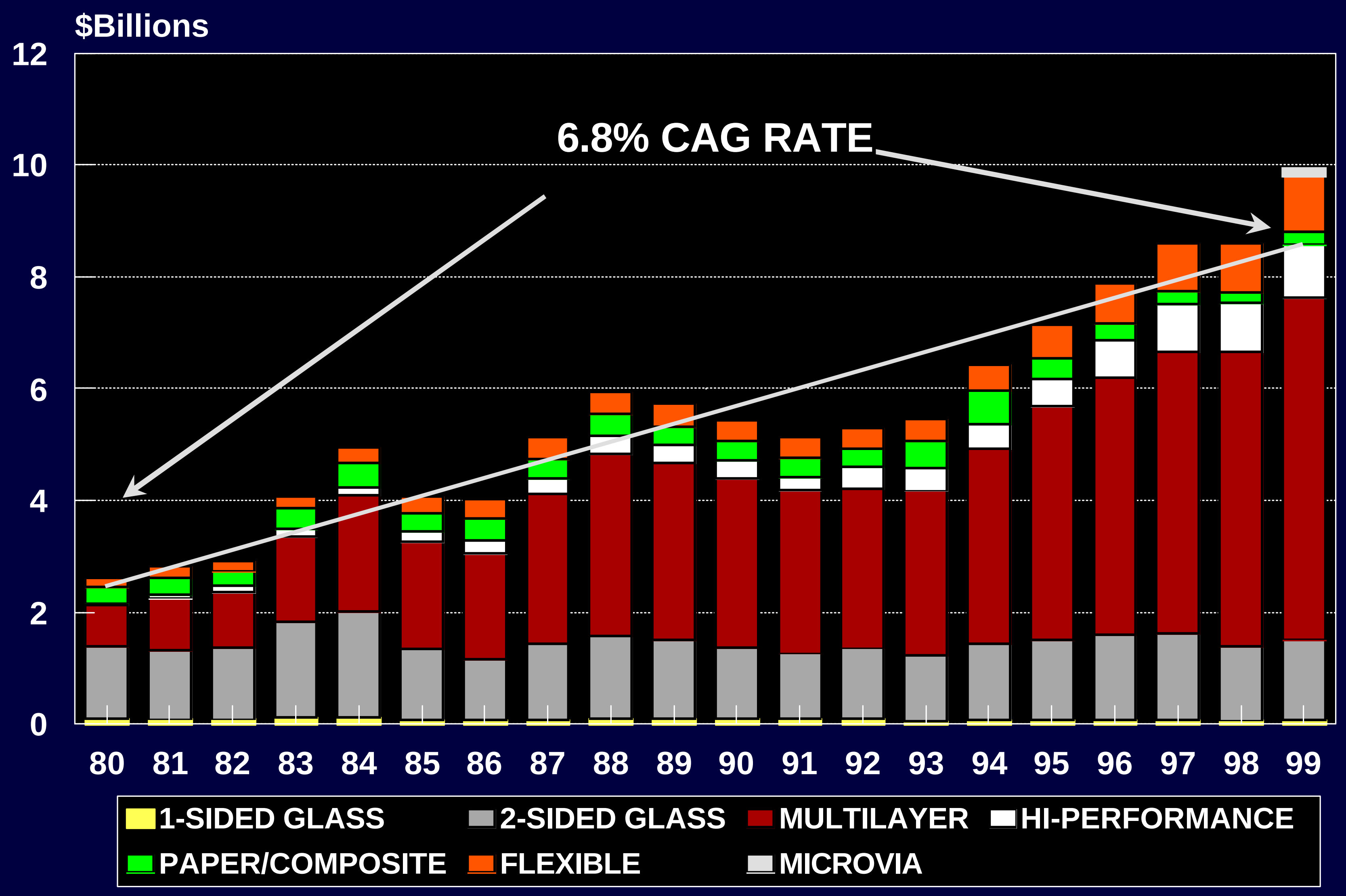
EUROPE RIGID PWB PRODUCTION

1999 Total = $4.5 Billion



IPC 6/2000 (includes $200 million Microvia)

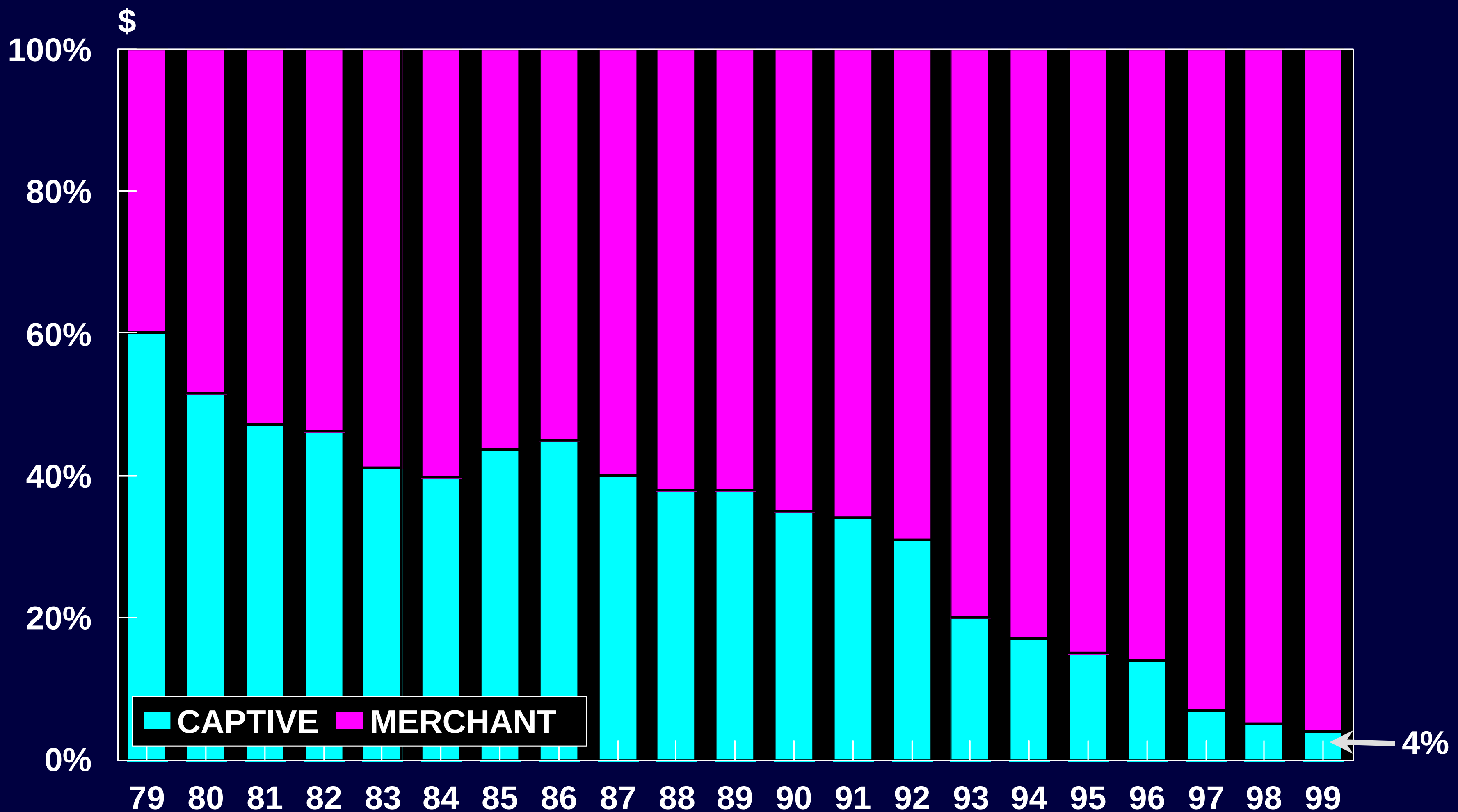
N. AMERICAN PCB SHIPMENTS



IPC T/MRC 6/2000

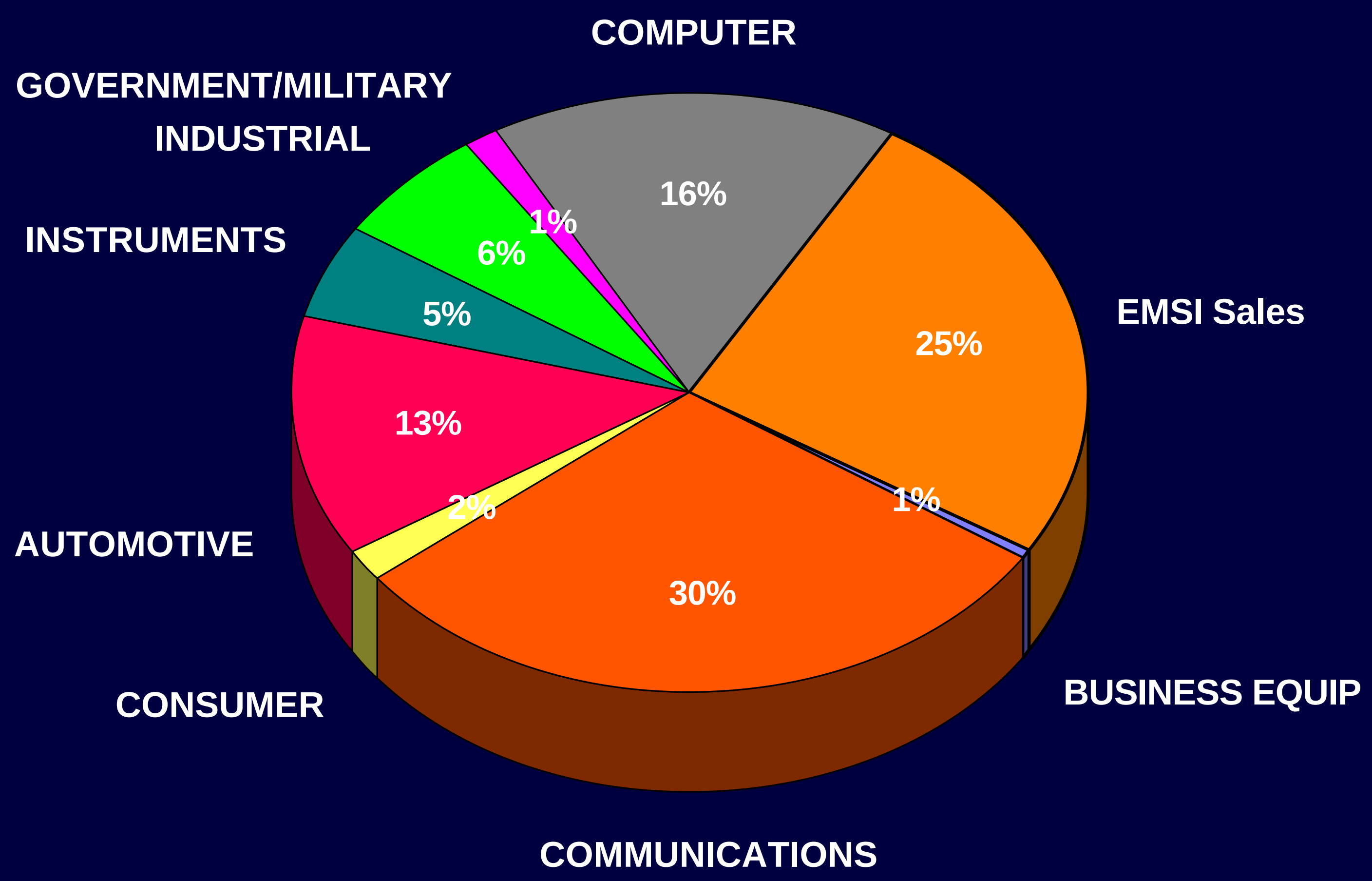
RIGID PCBs - MAKE OR BUY

U.S. CAPTIVE vs MERCHANT PRODUCTION



IPC TMRC 6/2000

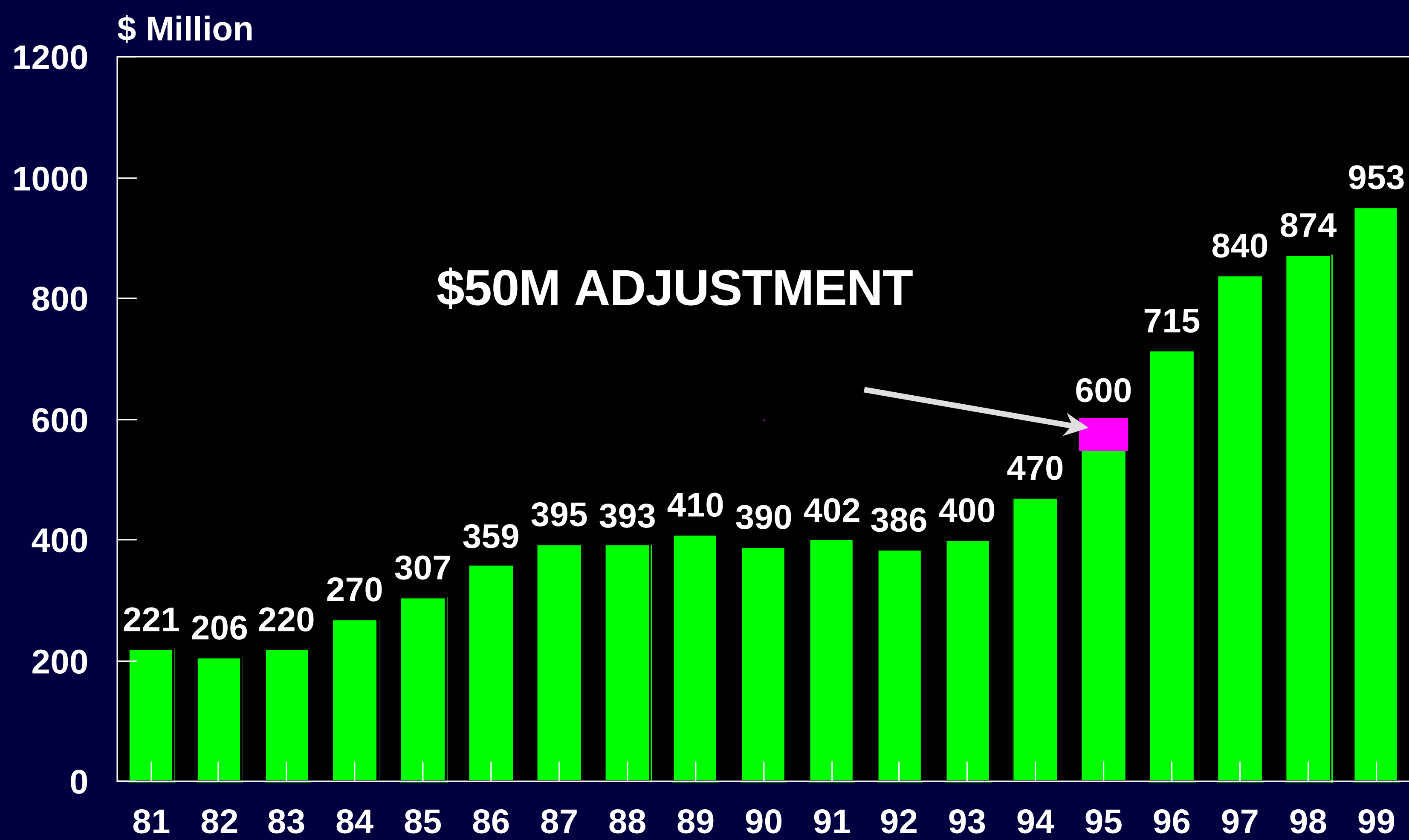
1999 U.S. RIGID CIRCUITS
PRODUCTION by END MARKET



TOTAL: $7.9 Billion
Independent Manufacturers

IPC TMRC 6/2000

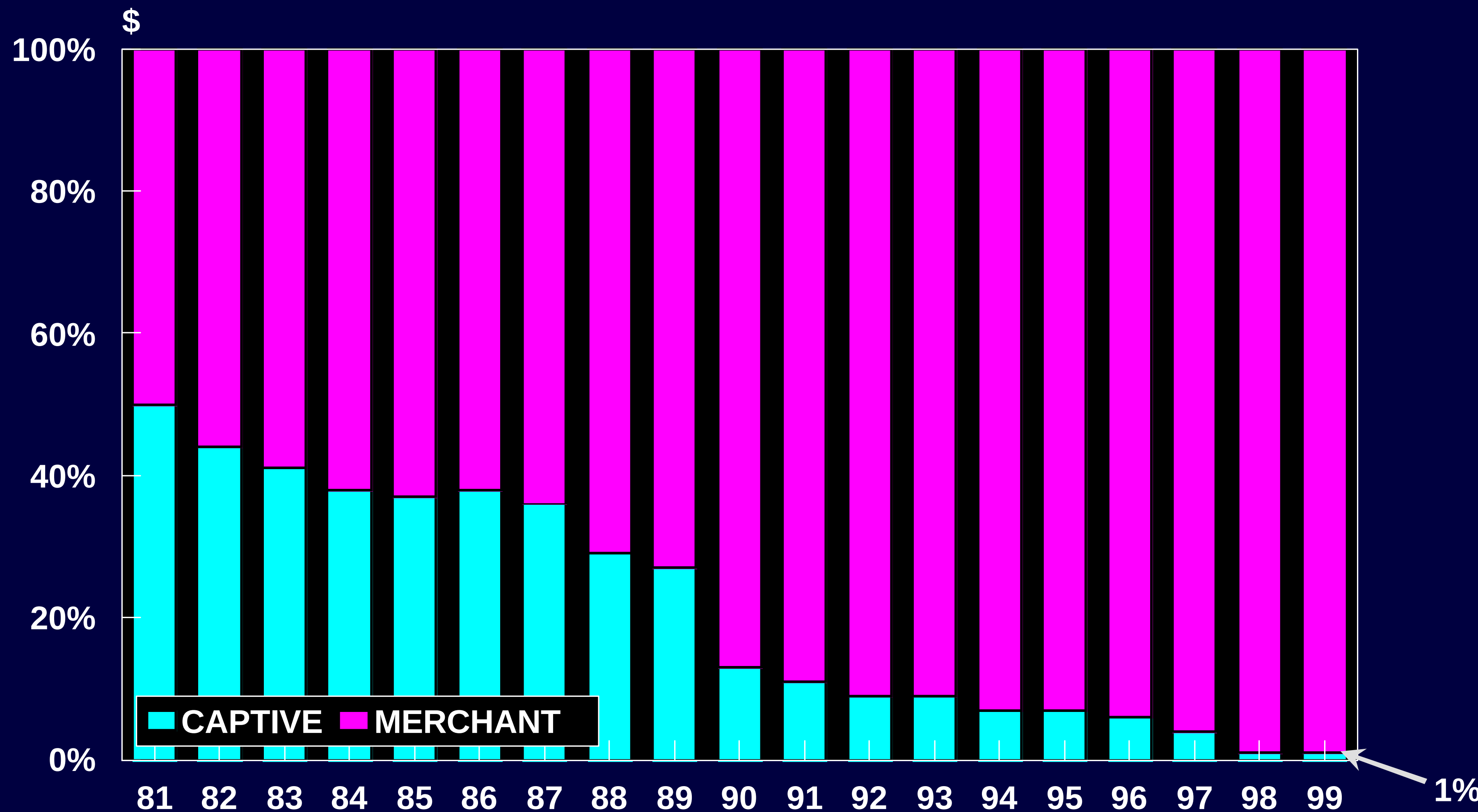
U.S. MARKET FOR FLEXIBLE CIRCUITS



IPC TMRC 6/2000

FLEXIBLE PCBs - MAKE OR BUY

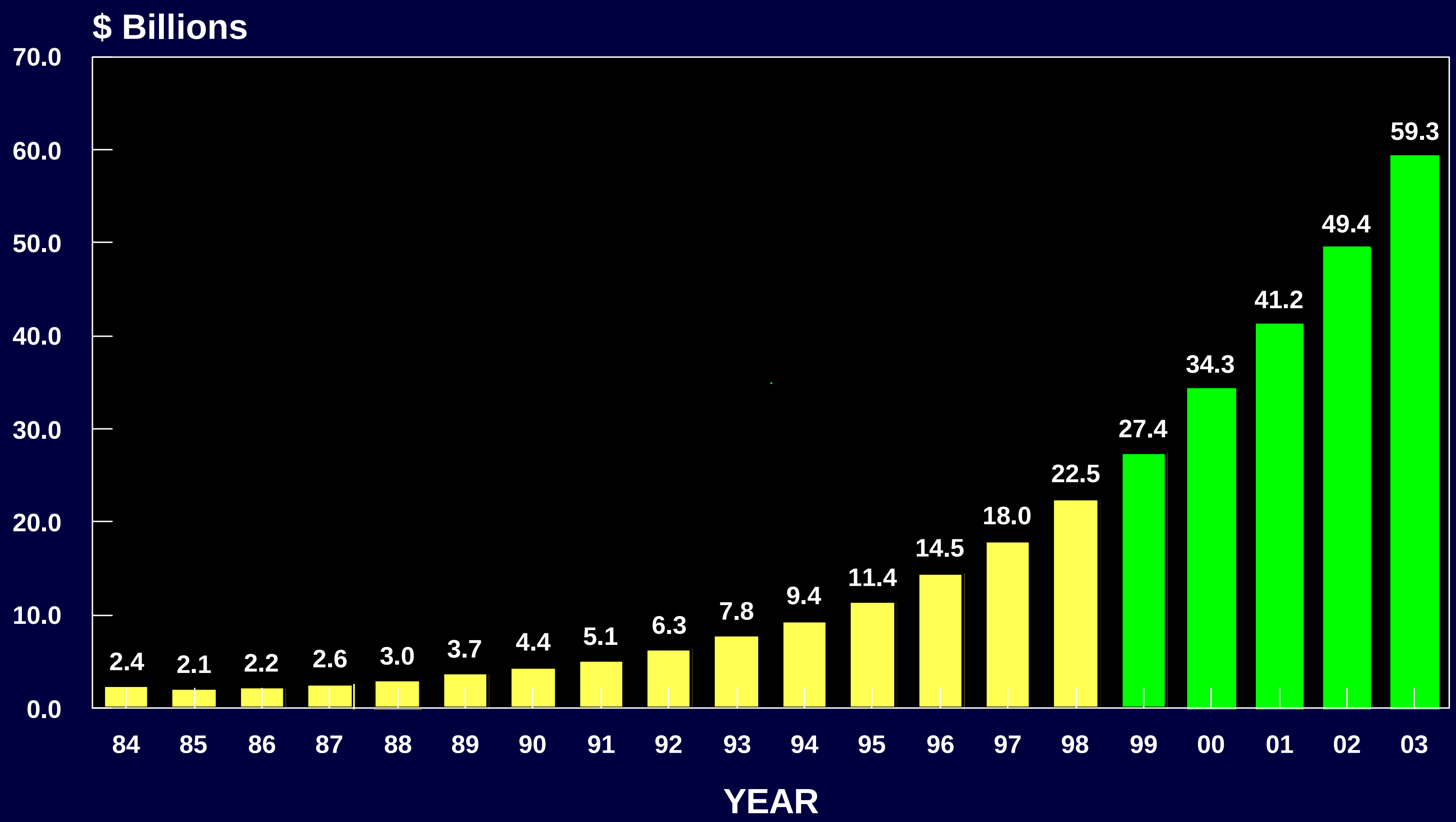
U.S. CAPTIVE vs MERCHANT PRODUCTION



IPC TMRC 6/2000

MARKET FOR

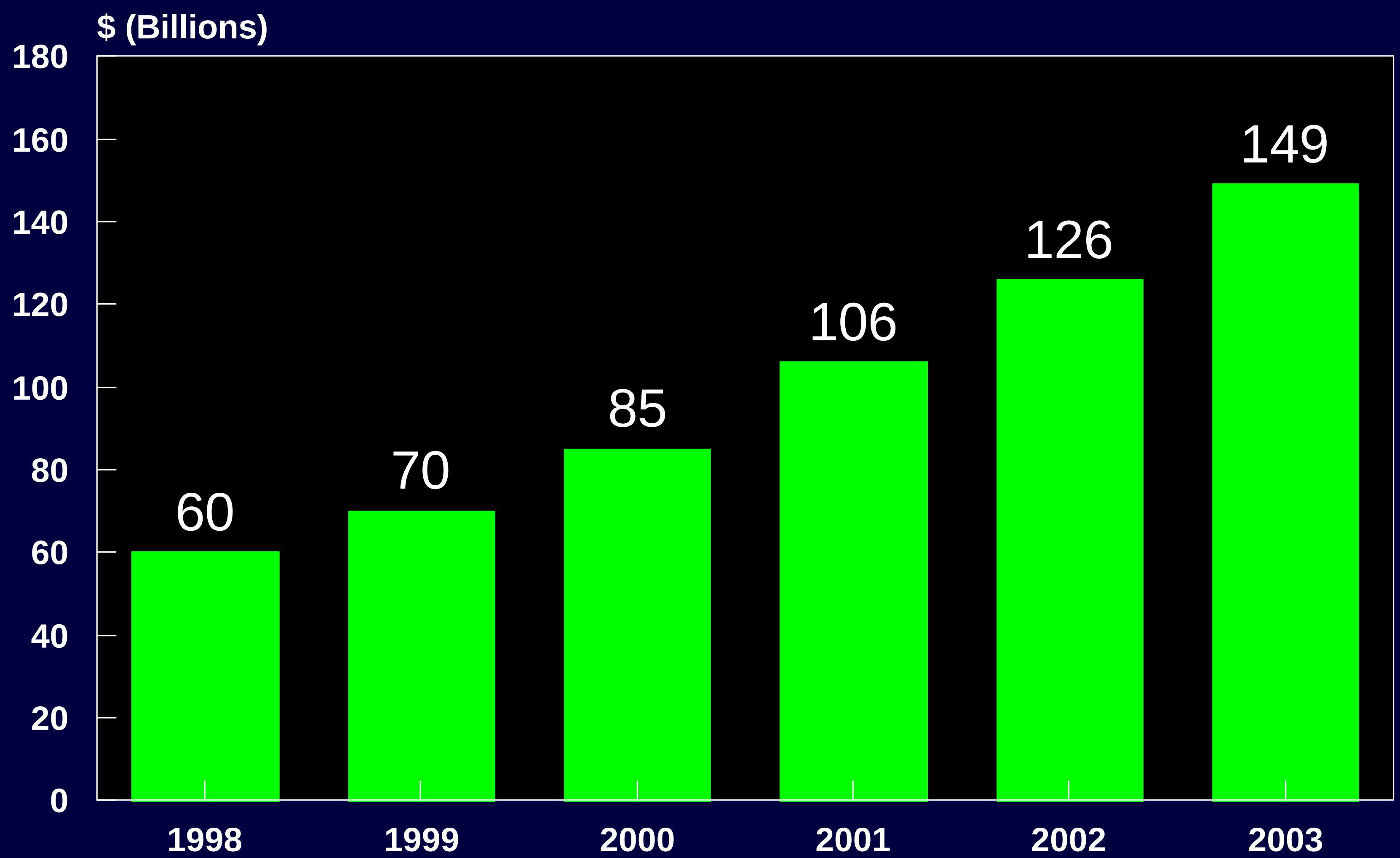
ELECTRONIC MANUFACTURING SERVICES
(U.S. CONTRACT ASSEMBLY)



IPC 6/2000

CONTRACT ELECTRONIC MANUFACTURERS

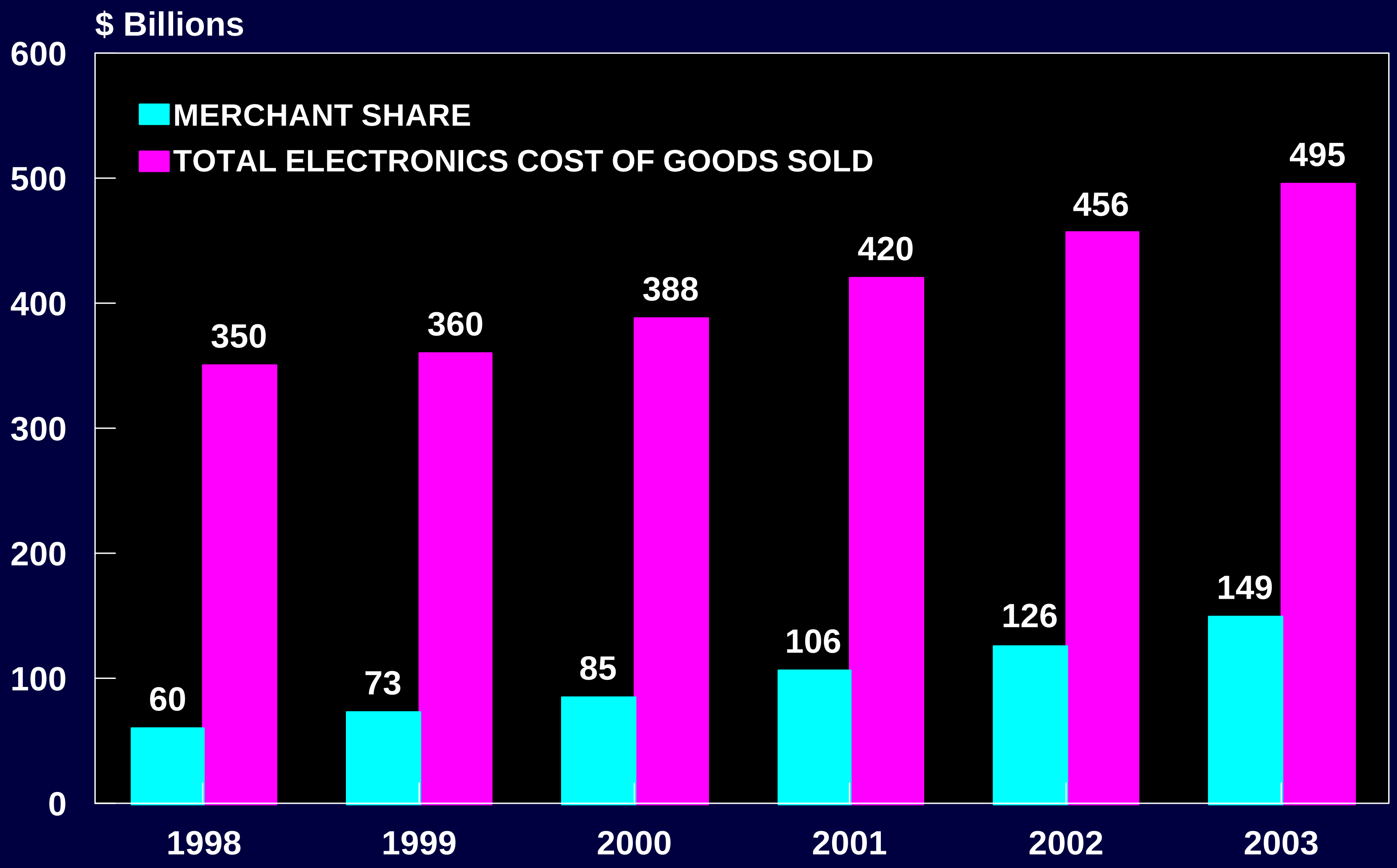
WORLD SALES



EBN : Technology Forecasters 5/00

CONTRACT ELECTRONIC MANUFACTURERS PICKING UP A LARGER SHARE

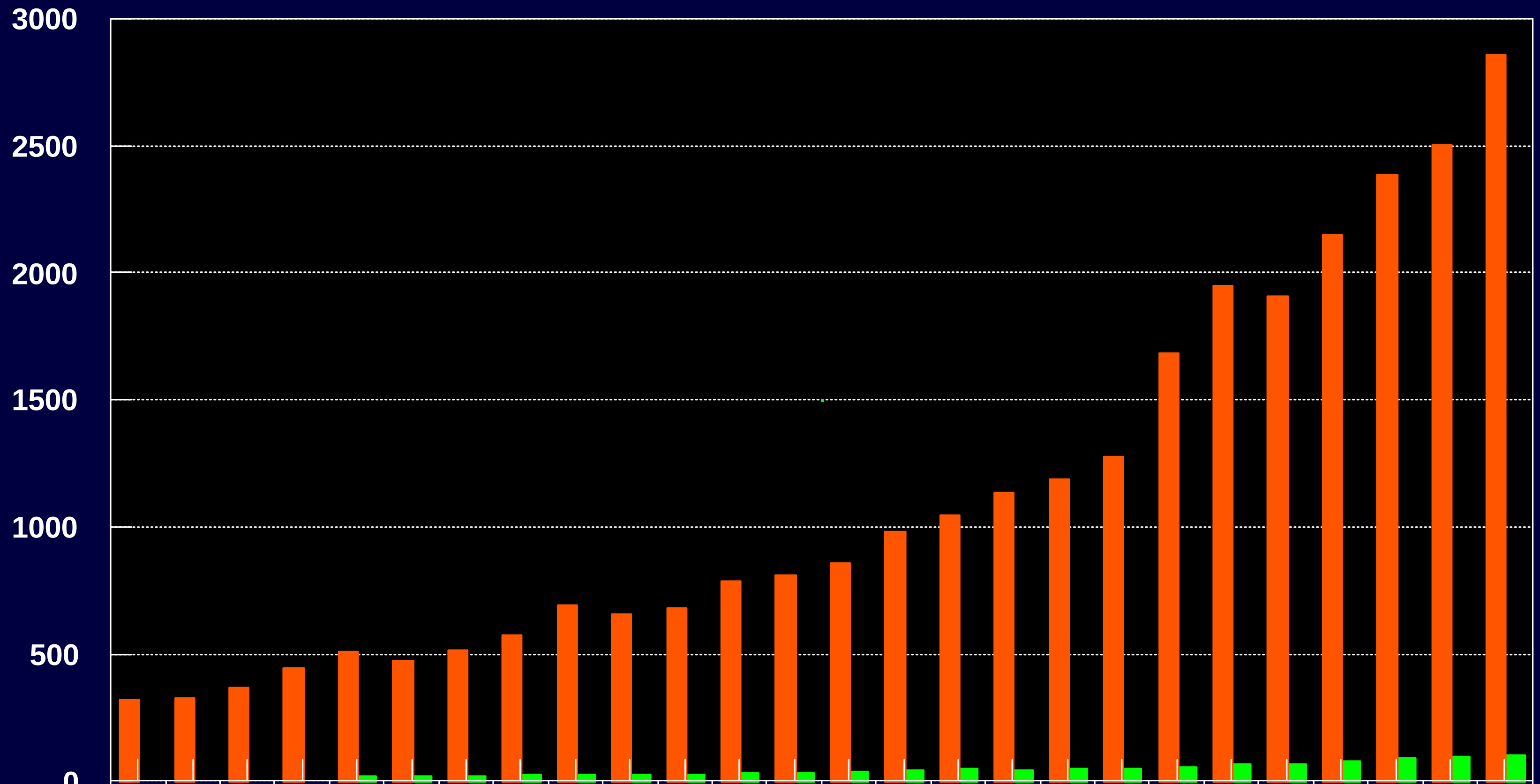
MERCHANT MARKET SHARE OF WORLD ELECTRONICS MARKET



EBN: Technology Forecasters 5/00, Custer estimates

SOLECTRON

Revenue & Net Income



	4	1	2	3	4	1	2	3	4	1	2	3	4
	93	94				95				96			
Revenue	322	327	365	443	507	471	517	571	691	657	681	789	808
Income					18	18	20	23	27	28	28	32	32

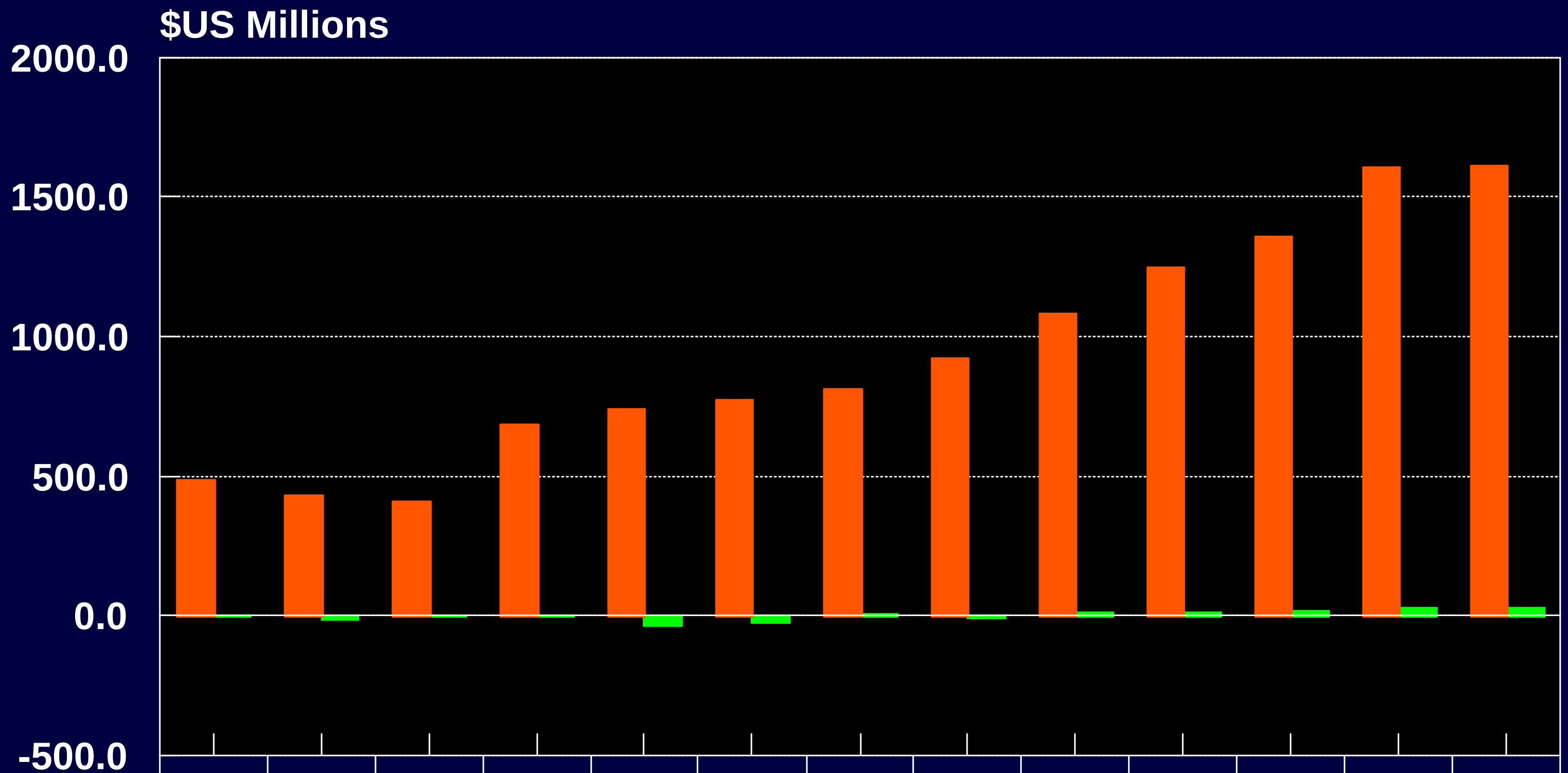
	1	2	3	4	1	2	3	4	1	2	3	4	1
	97				98				99				00
Revenue	859	983	1045	1137	1187	1278	1686	1946	1908	2152	2386	2502	2860
Income	38	42	48	45	49	49	56	64	66	76	89	98	100

FY ends in August

SLR

Celestica

Revenue & Net Income



	1	2	3	4	1	2	3	4	1	2	3	4	1
		97				98				99			00
Revenue	484.0	431.0	409.0	683.0	739.0	774.0	812.0	925.0	1082.0	1250.0	1357.0	1609.0	1612.0
Income	-0.1	-9.8	1.4	2.0	-31.8	-19.2	6.3	-3.8	9.5	13.3	19.5	26.2	26.1

CY

FY=CY

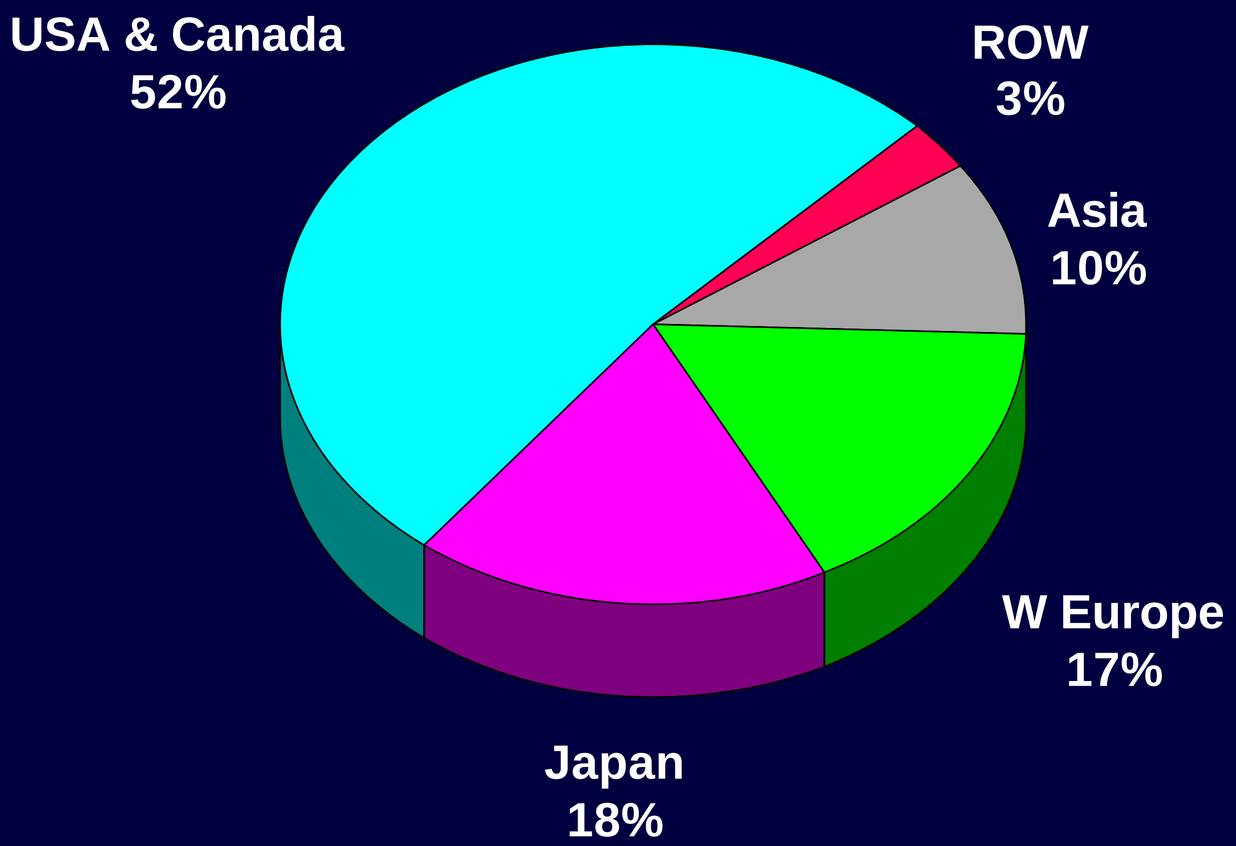
CLS

TOP CONTRACT MANUFACTURERS - 1999

	$ Sales	99/98 Growth %
Solectron	8,948	47
SCI Systems	7,225	10
Celestica	5,297	63
Flextronics Intl	3,219	79
Jabil Circuit	2,433	53
NatSteel Electronics	1,824	29
SYNNEX Information Tech	1,482	65
Sanmina	1,217	34
Universal Scientific	932	55
Dovatron Intl	923	57
Manufacturers' Services	921	10
Benchmark Electronics	878	67
C-MAC Industries	791	133
Elcoteq Network	752	91
ACT Manufacturing	696	18
Venture Manufacturing	576	32
JIT Holdings	529	55
Plexus	492	5

CEM DEMAND BY REGION

1998



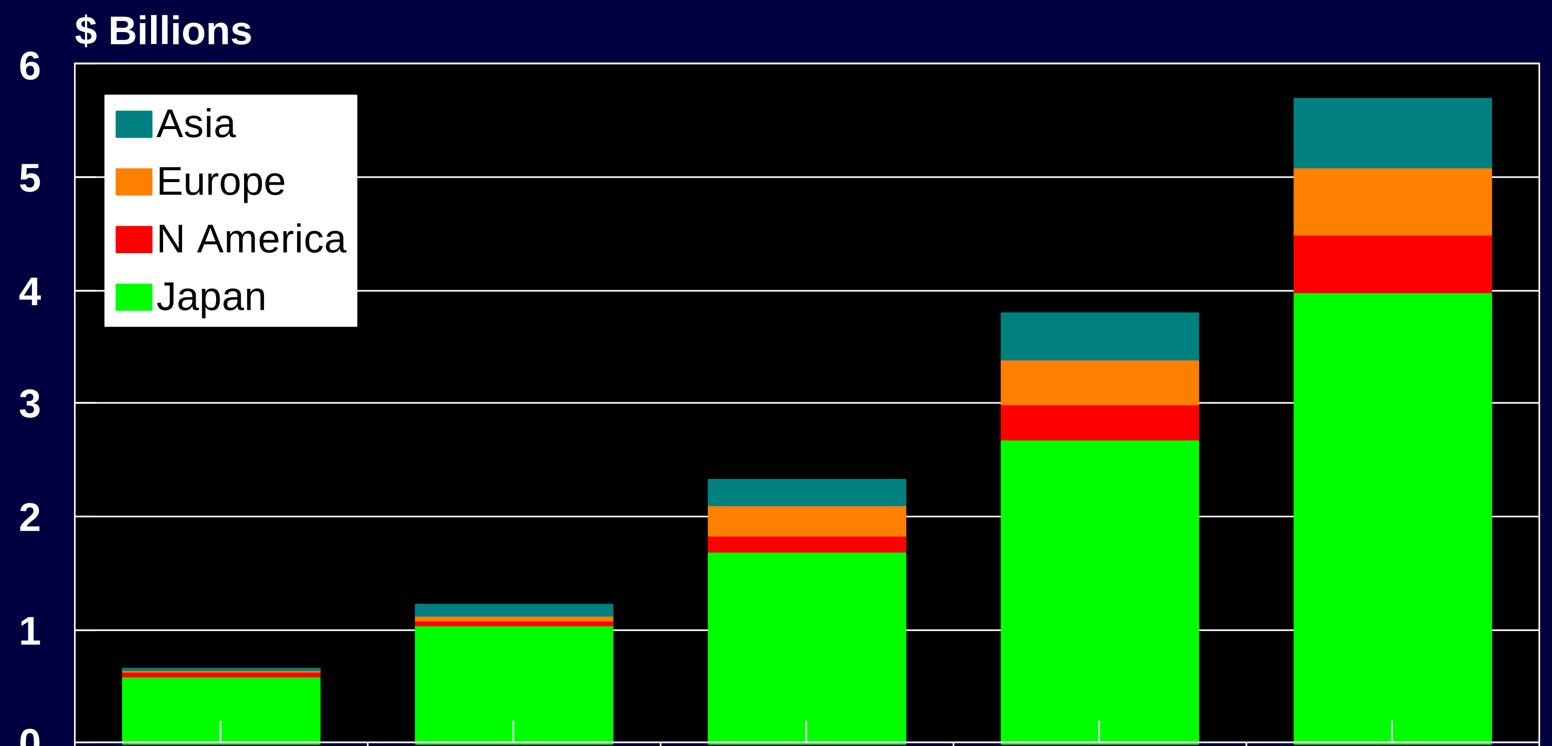
US Bancorp Piper Jaffray Equity Research 9/99

TOP N AMERICAN PCB MANUFACTURERS

PCB FAB & TOTAL - 1999 ESTIMATE ($M)

	PCB	TOTAL
VIASYSTEMS	1,130	1,230
HADCO	885	1,015
TYCO	515	590
HONEYWELL	405	Large
PHOTOCIRCUITS	385	385
SANMINA	330	1,375
DII GROUP (Flextronics)	315	1,100
DYNAMIC/DETAILS	280	280
IBM	220	430
3M	150	Large
MERIX	138	138
TTM TECHNOLOGIES	125	125
SHELDAHL	105	127
VIKTRON	93	133
CIRCUIT SYSTEMS	89	89
TOPPAN WEST	80	80
CIRCUIT-WISE	75	75
AUTOMATA ITERNATIONAL	75	75
BUREAU ELECTRONICS	74	74

WORLD MICROVIA BOARD PRODUCTION



	1997	1998	1999	2000	2001
Asia	0.01	0.085	0.21	0.4	0.6
Europe	0.015	0.04	0.26	0.4	0.6
N America	0.035	0.04	0.15	0.3	0.5
Japan	0.6	1.055	1.7	2.7	4

H Nakahara 1/2000

INDUSTRY CONSOLIDATIONS

VIASYSTEMS GROUP (HICKS, MUSE, TATE & FURST)

LUCENT TECHNOLOGIES (ex AT&T, RICHMOND)
CIRCO CRAFT
FORWARD GROUP
ISL
ERICCSON
MOMMERS PRINT SERVICE
ZINCOCELERE
PAGG CORP
TERMBRAY
MARCONI COMMUNICATIONS' NETWORK COMPONENTS & SERVICES
INTERNATIONAL WIRE's WIRE HARNESS UNIT
TOP LINE ELECTRONICS

HADCO (agreement to be bought by Sanmina 4/2000)

ZYCON
- **ACT**

CONTINENTAL
- **DYNAFLEX**
- **RADIAN**
- **PCA DESIGN**

INDUSTRY CONSOLIDATIONS

<u>**SANMINA**</u>

COMPTRONIX
ASSEMBLY SOLUTIONS
GOLDEN EAGLE SYSTEMS
LUCENT CUSTOM MANUFACTURING
ELEXSYS
PRAGMATEC
ALTRON
HADCO
ESSEX AB

<u>**PRAEGITZER - sold to TYCO 10/99**</u>

TREND CIRCUITS
3 DESIGN FACILITIES - sold 1/2000
INTERGRAPH PCB FACILITY - closed 7/99
LIKOM PCB, MALAYSIA (51%) - for sale
INTRACOM DESIGN, EDINBURGH, SCOTLAND

<u>**JOHNSON MATTHEY - sold to AlliedSignal 7/99 (now Honeywell)**</u>

ACI
CRAY
UNIVERSAL CIRCUITS, BUFFALO, MN

INDUSTRY CONSOLIDATIONS

DII GROUP (sold to Flextronics 11/99)
MULTEK
UNISYS, ROSEVILLE
IBM, AUSTIN
HP, BOEBLINGEN
GREATSINO ELECTRONIC TECHNOLOGY, CHINA
ERICCSON ASSEMBLY, KINDBERG, AUSTRIA
MICRO ELECTRONICA, BRAZIL
CUMEX, GUADALAJARA, MEXICO

CORNERSTONE CAPITAL
AUTOMATA - sale in process
KODE (KAM CIRCUITS) - receivership 2/99
PAM CIRCUITS - closed
MICRON TECHNOLOGY ASSEMBLY FACILITIES

TYCO
ELECTROSTAR
SIGMA CIRCUITS
AMP (QLP) - SOLD TO NELCO
SOLADYNE (from MERIX)
ADVANCED QUICK CIRCUITS
PRAEGITZER

INDUSTRY CONSOLIDATIONS

MERIX
HEWLETT-PACKARD, LOVELAND - closed
SOLADYNE/ROGERS - sold to TYCO 2/99
AMKOR CHIP CARRIER FACILITY

PENTEX-SCHWEITZER
DEGUSSA ELECTRONICS

BAIN CAPITAL
DYNAMIC CIRCUITS
DETAILS INC
CUPLEX
NTI - shut down 1Q'2000

C-MAC INDUSTRIES
CAROLINA CIRCUITS (former DEC)

ADFLEX - sold to INNOVEX 8/99
XYRATEX FLEX OPERATIONS
THAILAND JV

INDUSTRY CONSOLIDATIONS

CIRCUIT SYSTEMS
PHILIPS (ex MAGNAVOX)
SILICON VALLEY PRINTED CIRCUITS

WU's
MOTOROLA, SINGAPORE (2)

THAYER
COSMOTRONICS
PACIFIC CIRCUITS
POWER CIRCUITS TTM Technologies

M&I CAPITAL
ELECTROTEQ

EL MAN
ERICSSON, ITALY PCB FACILITY

INDUSTRY CONSOLIDATIONS

PARLEX
DYNAFLEX (from HADCO)
POLY-FLEX (from COOKSON)

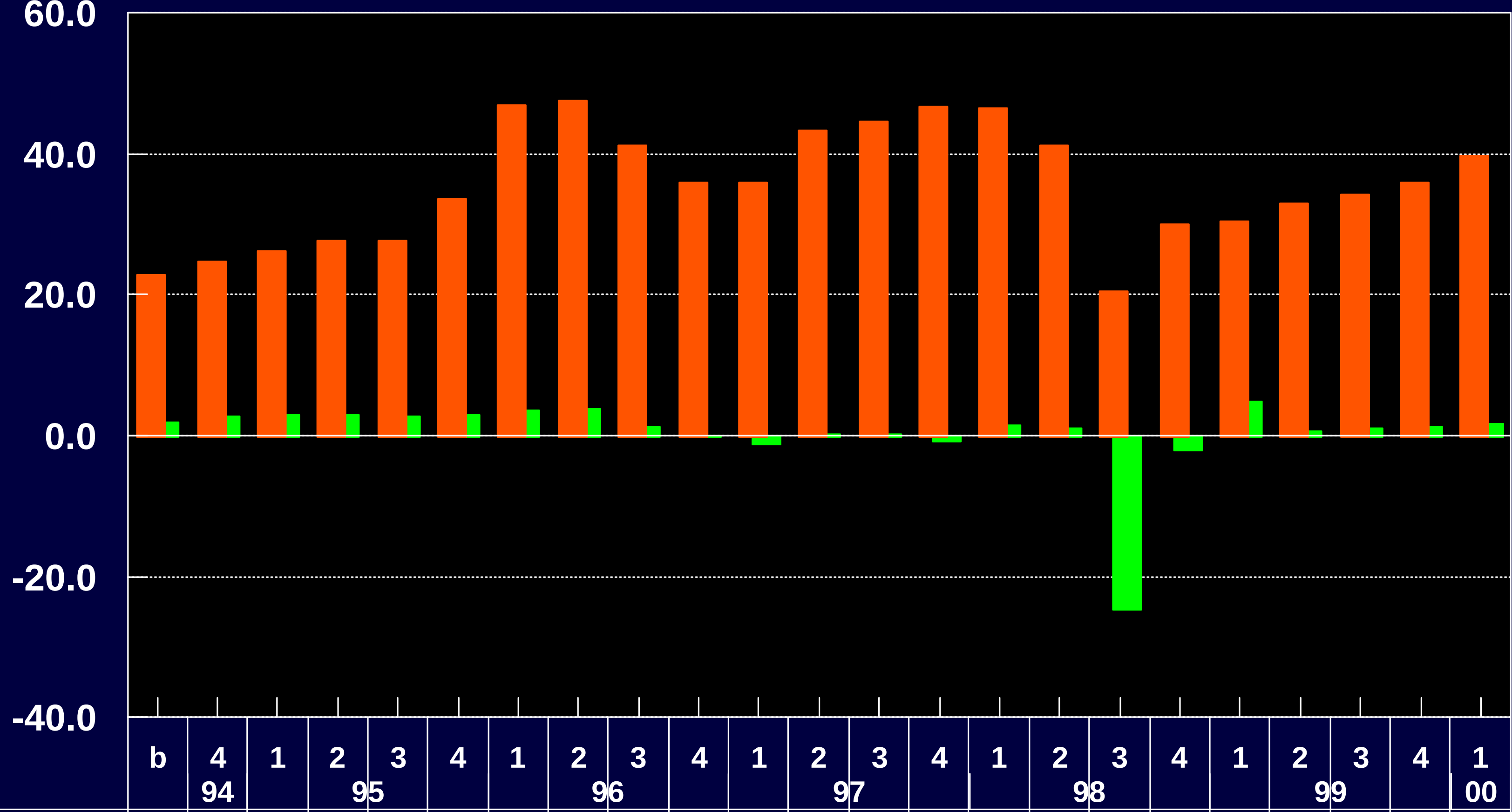
PROTOTRON CIRCUITS
SOUTHWEST CIRCUITS

ALLIEDSIGNAL (now HONEYWELL)
LITRONICS CHIP CARRIER FACILITY
JOHNSON MATTHEY ELECTRONICS

GUL TECHNOLOGIES, SINGAPORE
ACCUDYNE
ELLIOT TECHNOLOGIES

MERIX

Revenue & Net Income

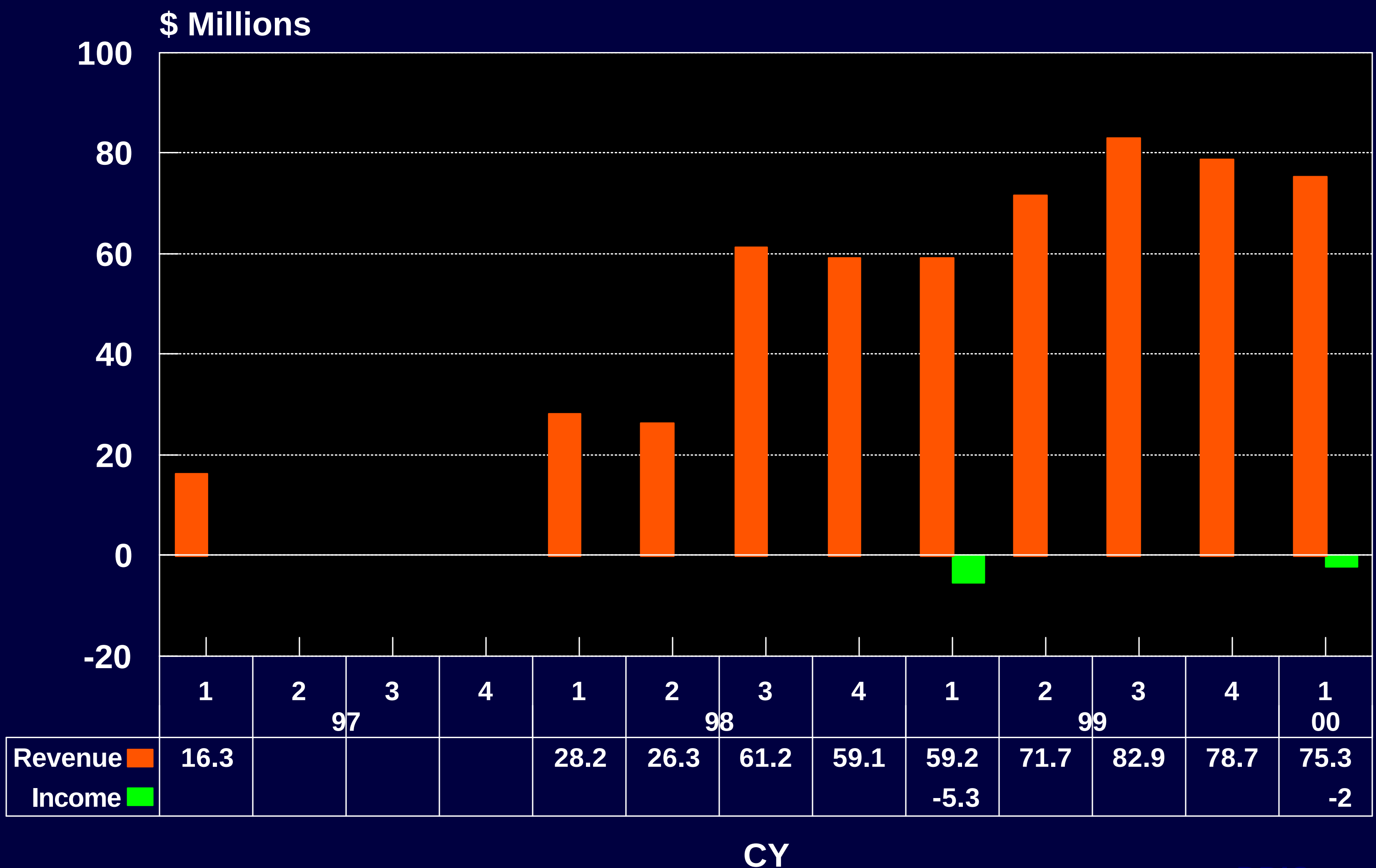


	b	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
		94	95				96				97				98				99				00
Revenue	22.7	24.8	26.2	27.7	27.7	33.6	46.9	47.5	41.1	35.8	35.9	43.3	44.6	46.6	46.4	41.1	20.5	30.0	30.5	32.9	34.1	35.9	39.7
Income	2.0	2.7	3.0	3.0	2.7	2.9	3.5	3.7	1.3	-0.1	-1.1	0.3	0.3	-0.6	1.5	1.0	-24.4	-1.9	4.9	0.7	1.0	1.2	1.7

FY ends May

DYNAMIC DETAILS, INC

Revenue & Net Income

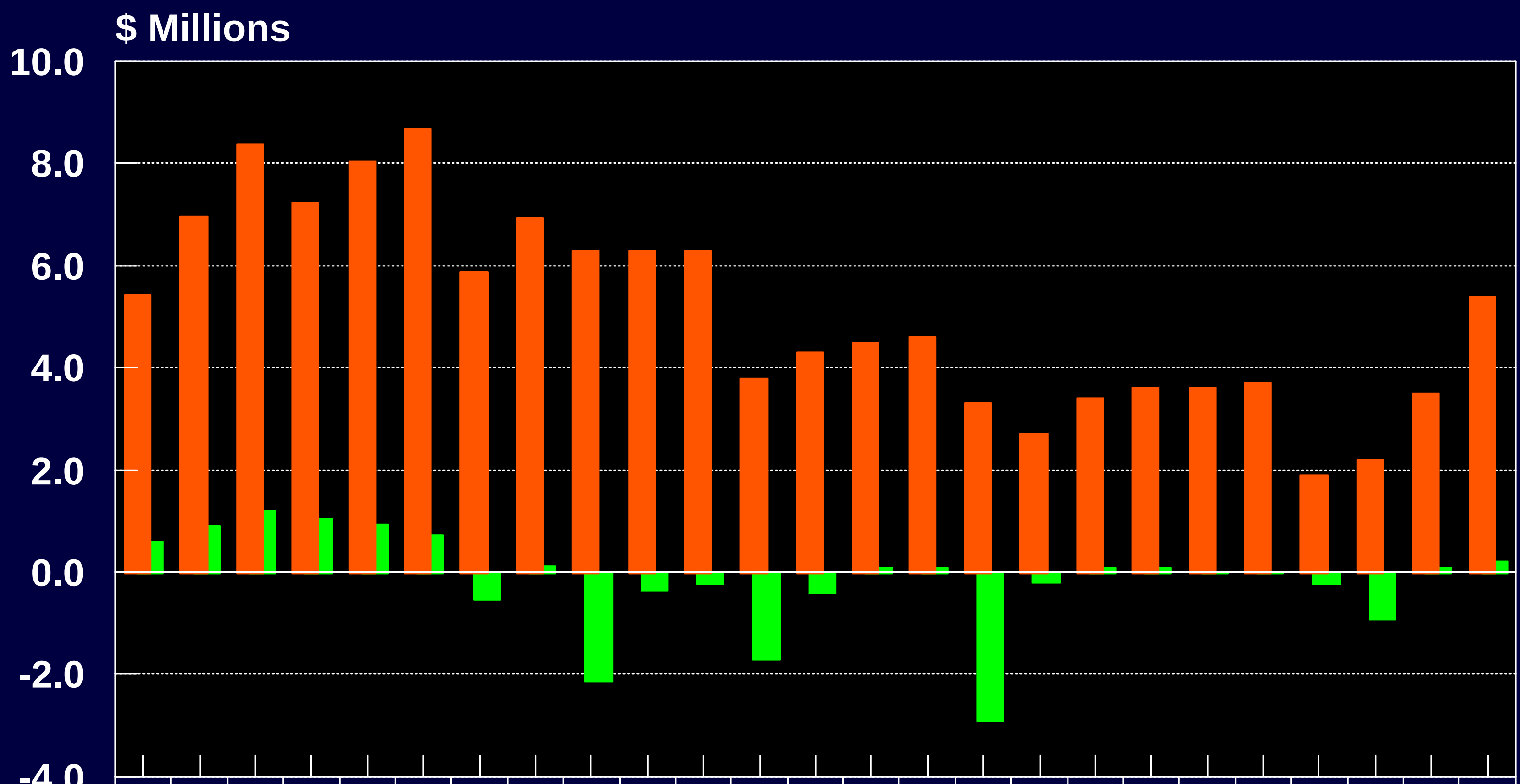


FY=CY

DDIC

M-WAV

Revenue & Net Income

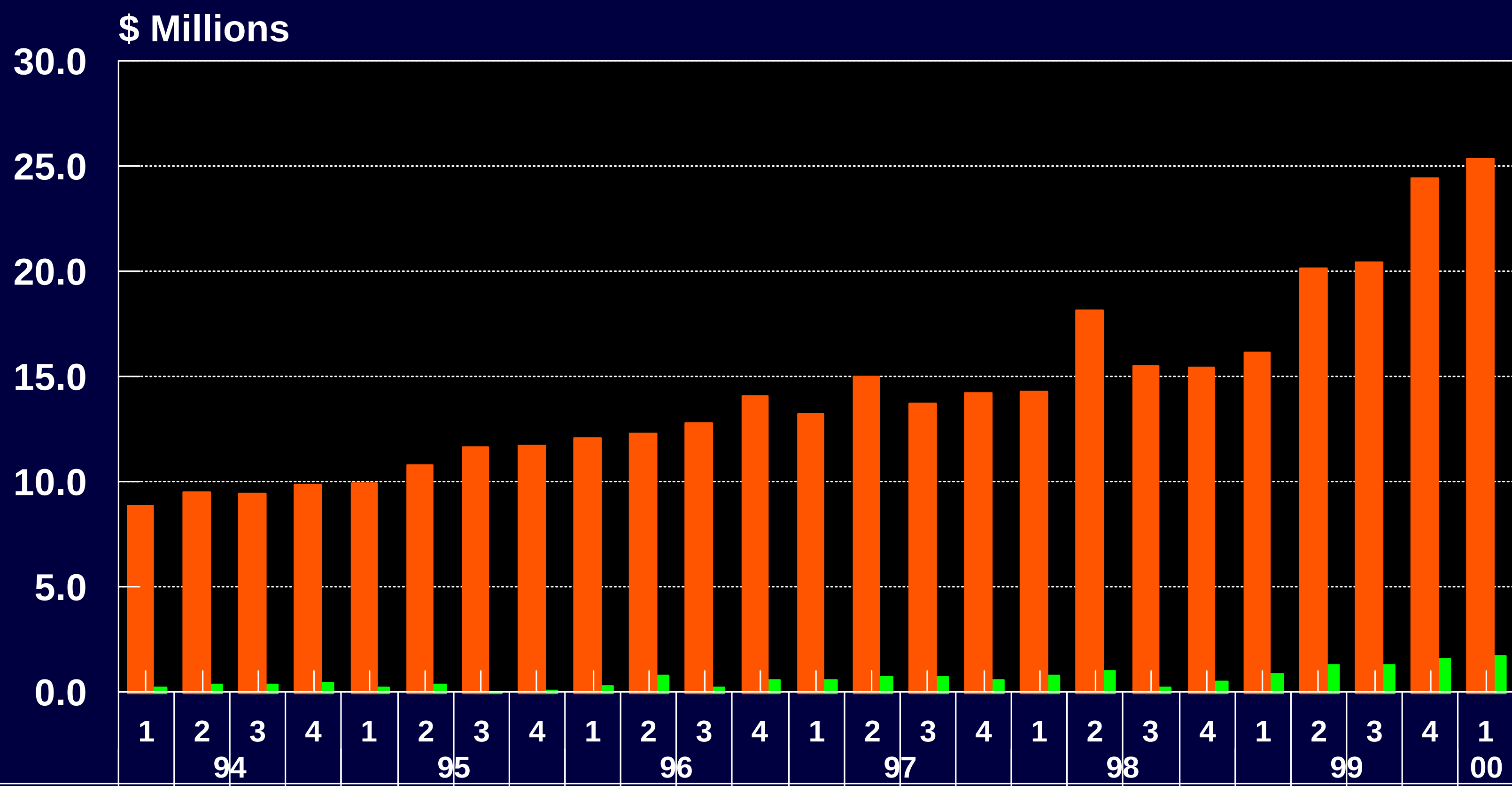


	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
		94				95				96				97				98				99			00
Revenue	5.4	7.0	8.4	7.2	8.0	8.7	5.9	6.9	6.3	6.3	6.3	3.8	4.3	4.5	4.6	3.3	2.7	3.4	3.6	3.6	3.7	1.9	2.2	3.5	5.4
Income	0.6	0.9	1.2	1.1	0.9	0.7	-0.5	0.1	-2.1	-0.3	-0.2	-1.7	-0.4	0.1	0.1	-2.9	-0.2	0.1	0.1	0.0	0.0	-0.2	-0.9	0.1	0.2

FY = CY

PARLEX

Revenue & Net Income



	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
	94				95				96				97				98				99				00
Revenue	8.9	9.5	9.4	9.9	9.9	10.8	11.6	11.7	12.1	12.3	12.8	14.1	13.2	15.0	13.7	14.2	14.3	18.1	15.5	15.4	16.1	20.1	20.4	24.4	25.3
Income	0.2	0.3	0.4	0.5	0.2	0.4	0.0	0.1	0.3	0.8	0.2	0.6	0.6	0.7	0.7	0.6	0.8	1.0	0.2	0.5	0.9	1.3	1.3	1.6	1.7

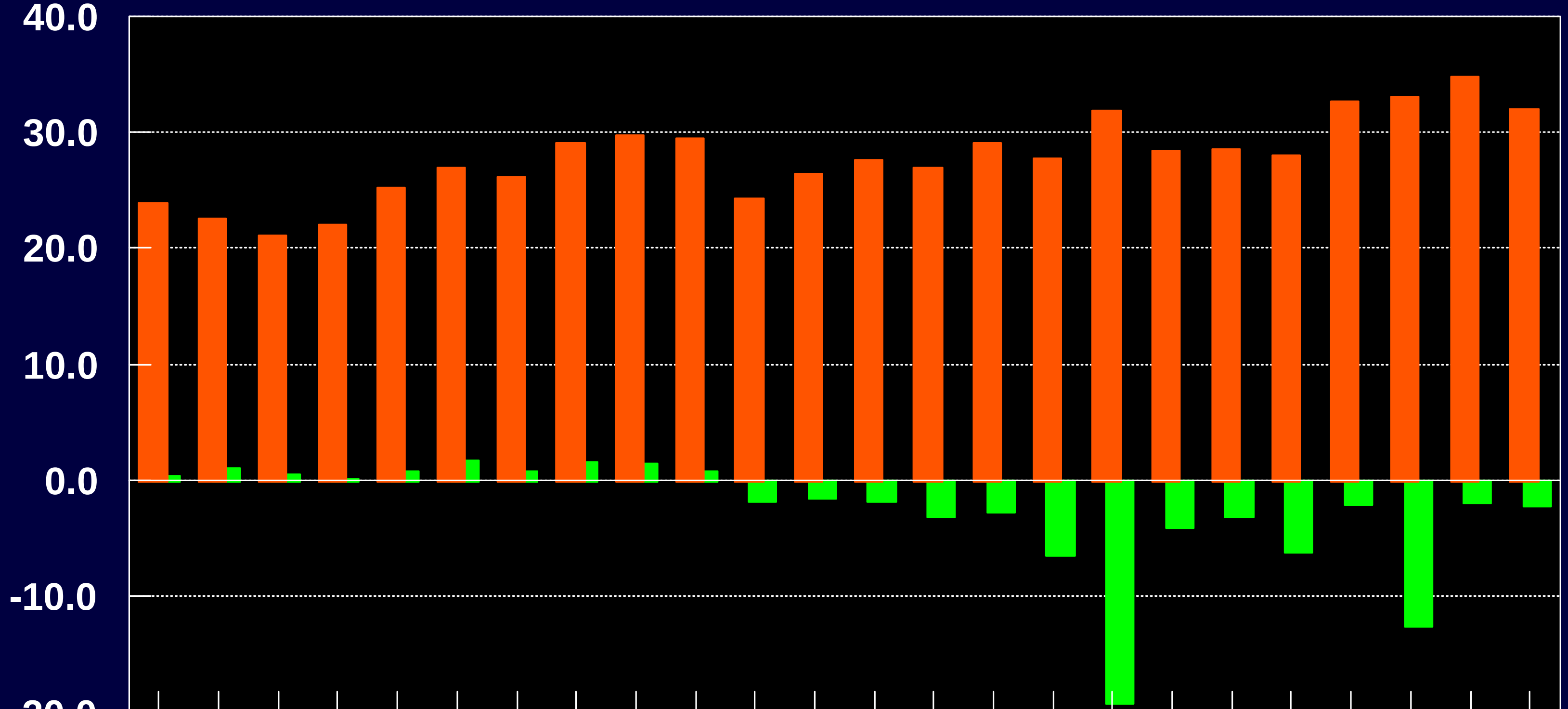
CY

FY ends June 30

PRLX

SHELDAHL

Revenue & Net Income

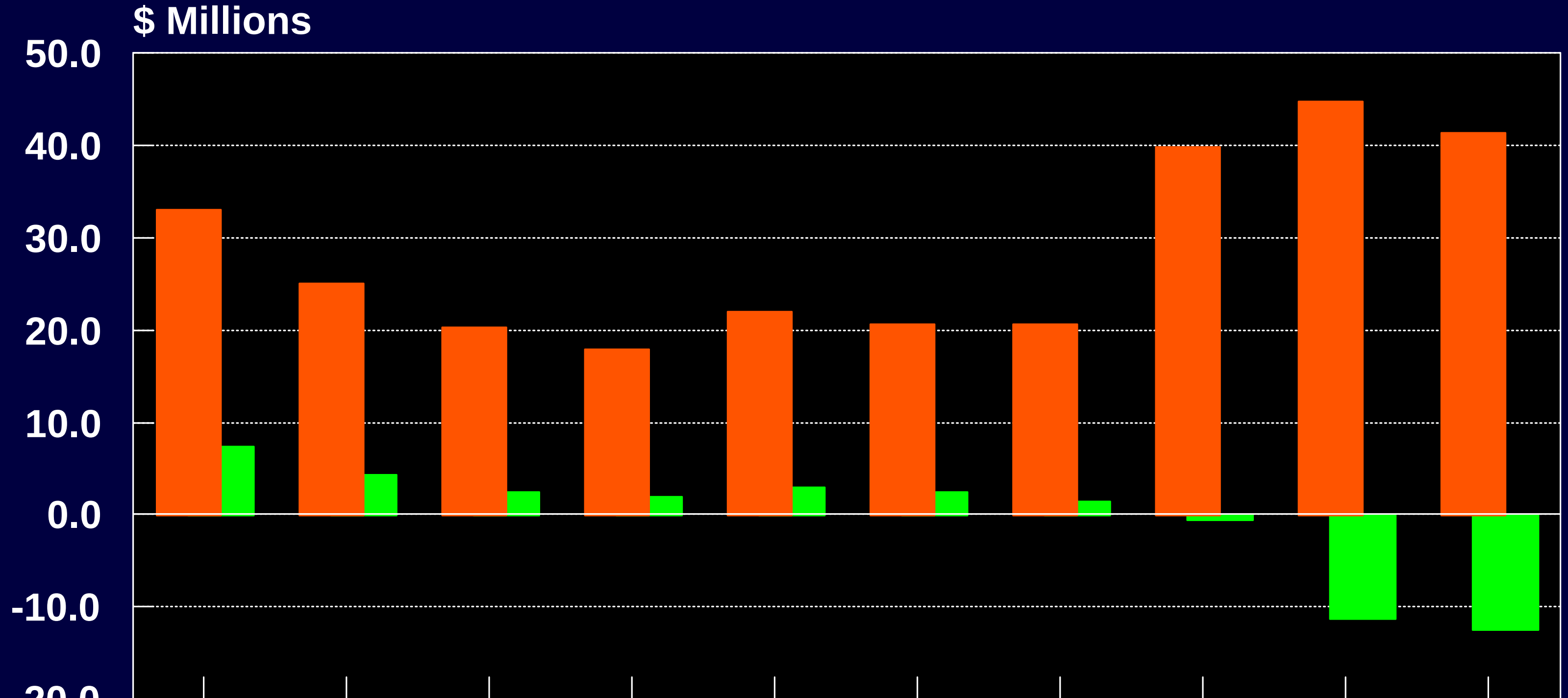


	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
	94				95				96				97				98				99			
Revenue	23.9	22.5	21.1	22.0	25.2	27.0	26.1	29.0	29.7	29.4	24.3	26.4	27.6	27.0	29.0	27.8	31.9	28.4	28.5	28.0	32.6	33.0	34.8	32.0
Income	0.4	1.0	0.5	0.1	0.8	1.7	0.9	1.6	1.5	0.8	-1.7	-1.5	-1.7	-3.0	-2.7	-6.4	-19.1	-4.0	-3.0	-6.1	-2.0	-12.5	-1.9	-2.1

CY

INNOVEX

Revenue & Net Income



	4	1	2	3	4	1	2	3	4	1
	97		98				99			00
Revenue	33.0	25.1	20.3	17.9	22.0	20.7	20.6	39.8	44.7	41.4
Income	7.3	4.3	2.4	2.0	3.0	2.5	1.5	-0.5	-11.2	-12.3

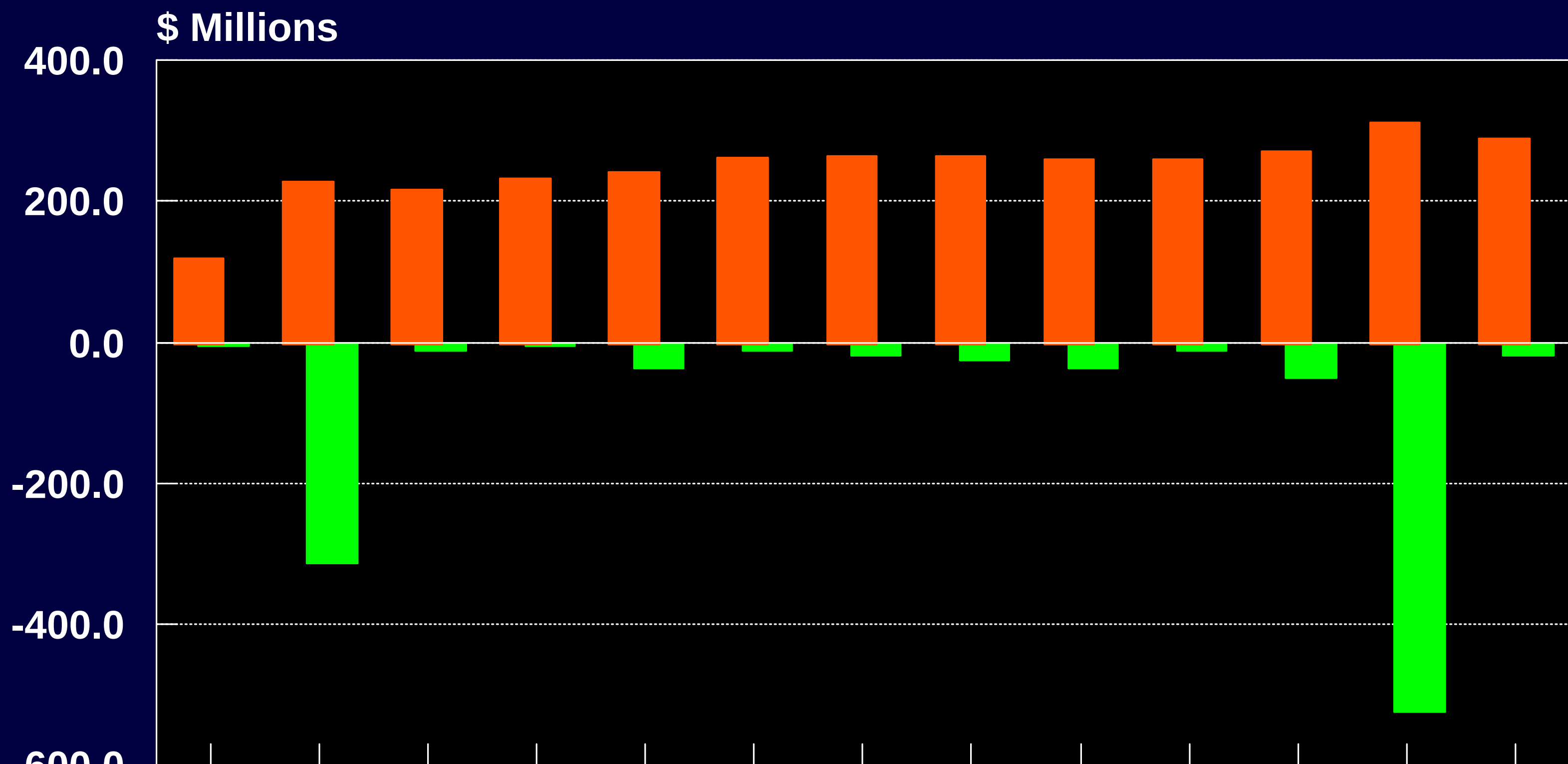
CY

FY ends September

INVX

VIASYSTEMS

Revenue & Income



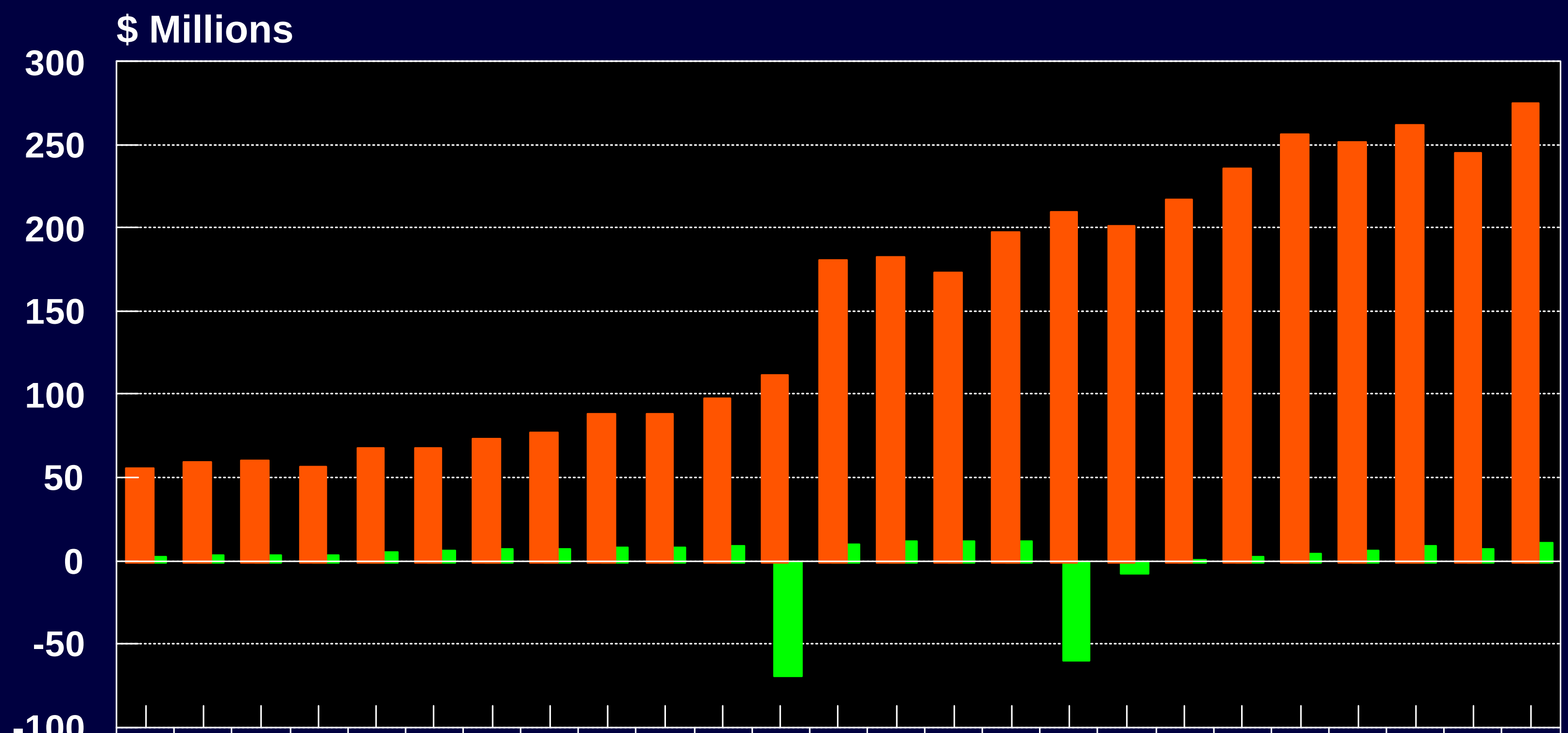
	1	2	3	4	1	2	3	4	1	2	3	4	1
		97				98				99			00
Revenue	119.9	226.8	216.8	232.0	242.4	261.9	263.0	265.0	260.0	260.0	270.0	312.0	289.0
Net Income	-2.3	-311.9	-9.4	-3.9	-35.6	-9.3	-15.7	-24.1	-34.2	-10.9	-48.2	-523.0	-16.3

CY

Sources: 10Q & 10K reports and company press releases

HADCO

Revenue & Net Income



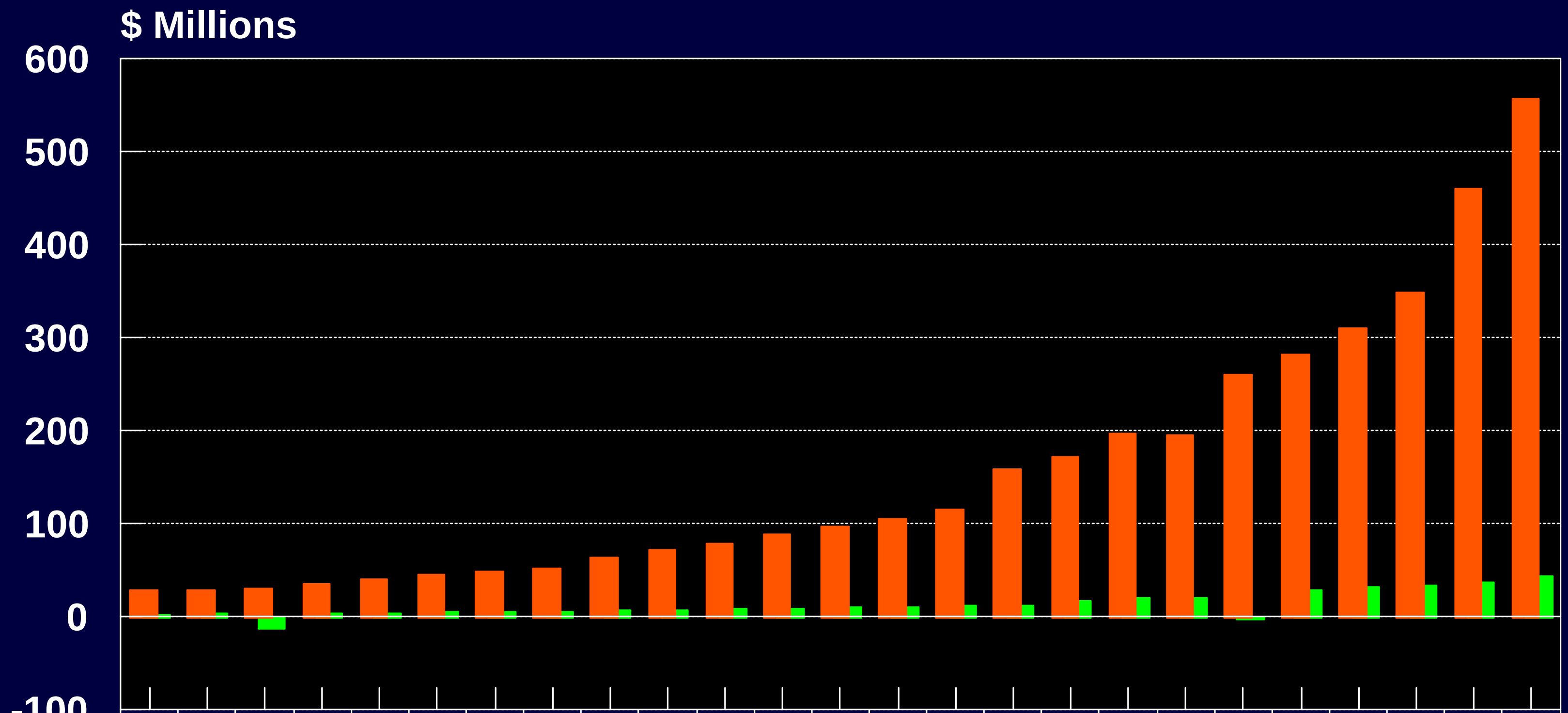
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
	94				95				96				97				98				99				00
Revenue	56	59	60	57	68	68	73	77	88	88	98	112	181	183	173	198	210	201	217	236	256	252	262	245	275
Income	2	3	4	3	5	6	7	7	8	8	9	-69	10	11	11	12	-60	-7	0	2	5	7	9	7	11

CY

FY ends October 31

SANMINA

Revenue & Net Income



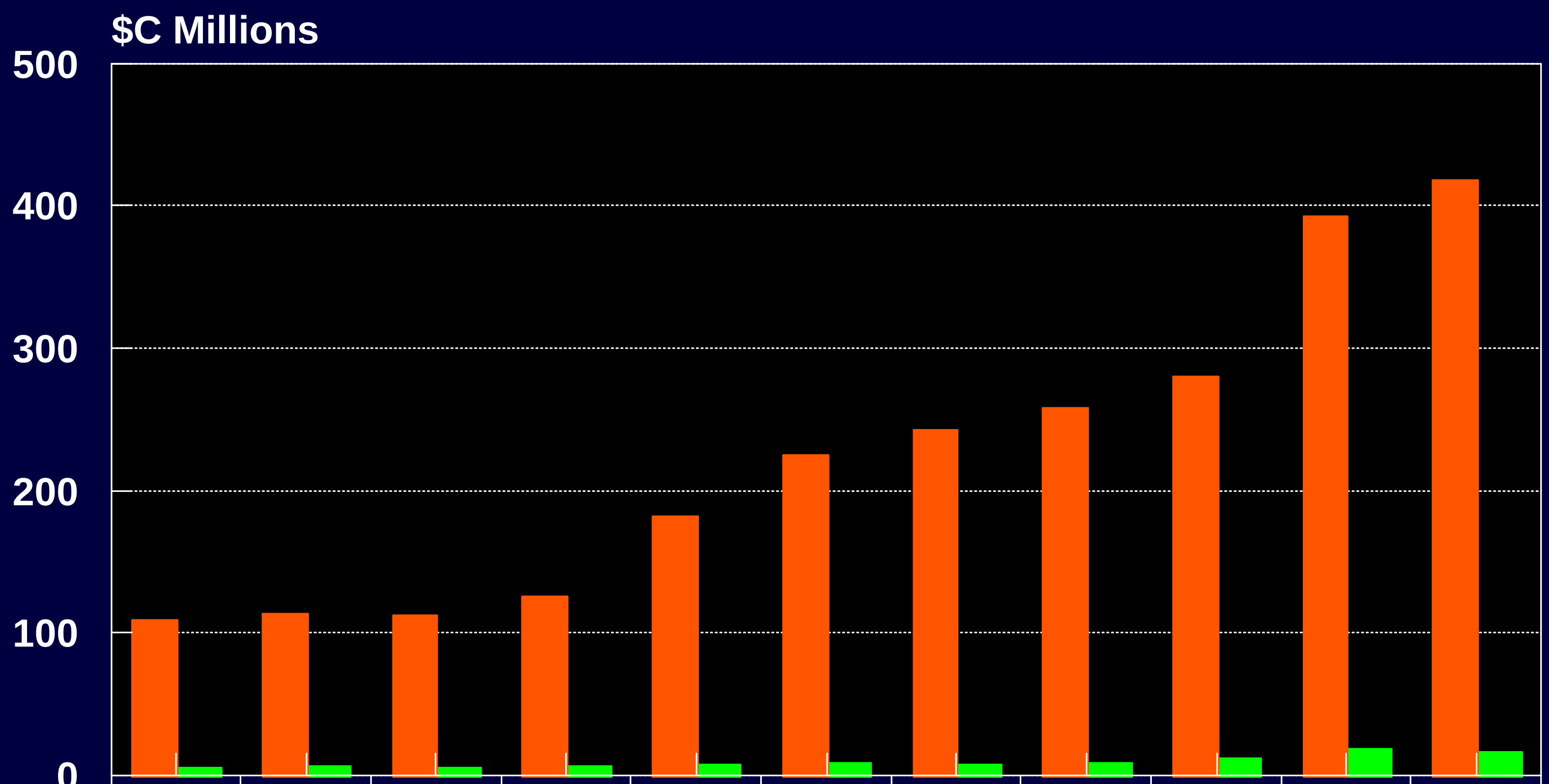
	94				95				96				97				98				99				00
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
Revenue	28	29	30	35	39	45	49	52	63	71	79	89	97	105	114	159	172	197	194	260	281	310	349	460	555
Income	3	3	-11	3	4	5	5	6	7	8	8	9	10	11	11	13	17	19	19	-1	29	31	34	36	44

CY

FY ends September 30

C-MAC INDUSTRIES

Revenue & Net Income



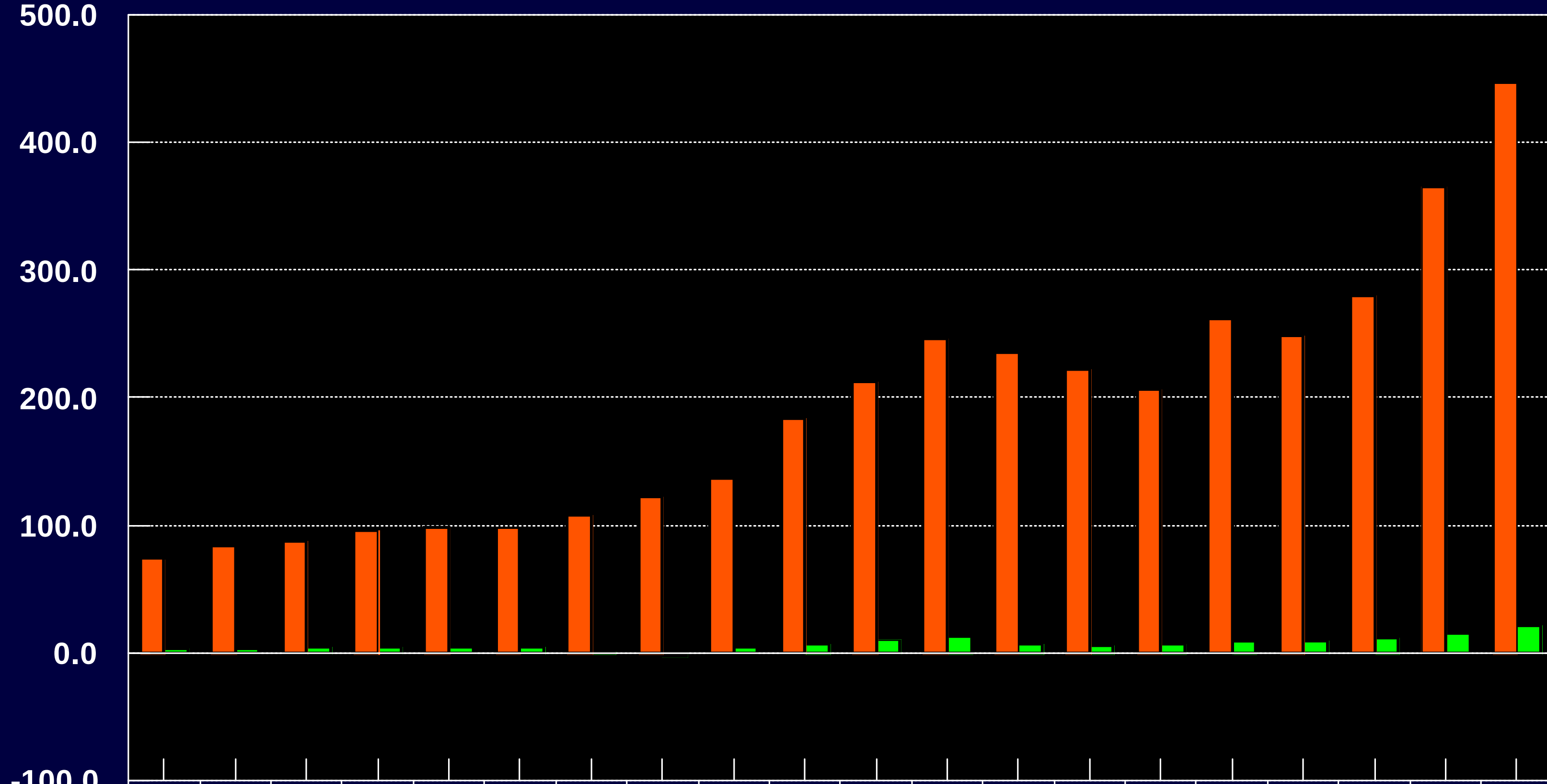
	3	4	1	2	3	4	1	2	3	4	1
	97		98				99				00
Revenue	109	113	112	126	182	225	243	258	280	393	418
Income	5.5	6.4	4.7	5.9	6.9	8	6.9	8.9	11.6	18	16.7

CY

FY=CY

DII Group (DOVatron)

Revenue & Net Income

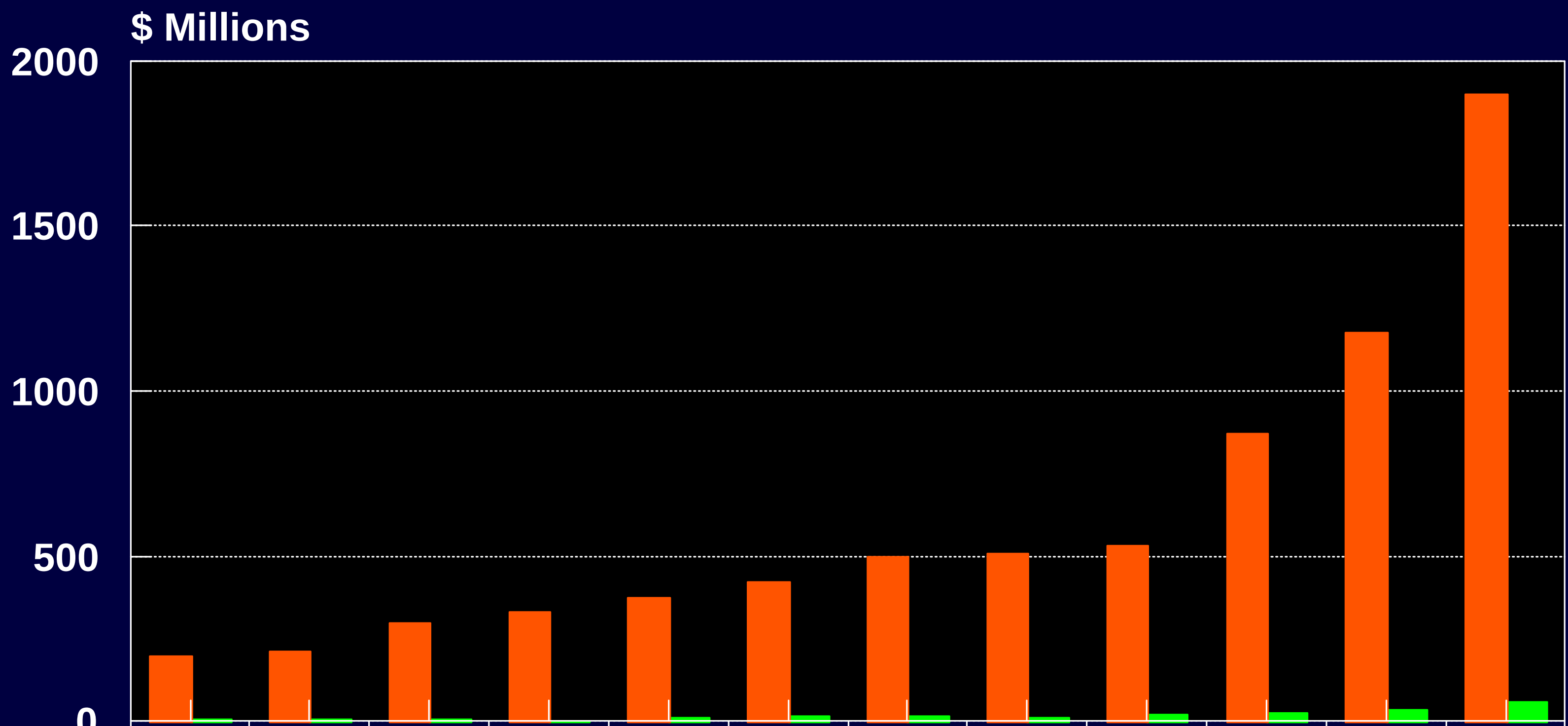


	95				96				97				98				99			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Revenue	73.7	83.4	87.3	96.0	98.5	97.8	108.2	122.7	137.1	184.1	213.0	245.6	235.0	222.0	206.0	262.0	248.0	280.0	365.0	447.0
Income	3.4	3.9	4.5	4.6	4.5	5.0	1.5	-3.1	5.1	7.5	10.0	12.7	6.8	6.1	6.5	8.8	8.9	12.3	15.0	20.9

DIIG: FY=CY

Flextronics

Revenue & Net Income



	2	3	4	1	2	3	4	1	2	3	4	1
		97				98				99		00
Revenue	197	210	295	331	376	423	500	509	530	871	1179	1897
Income	5.3	6.5	5.9	0.8	11.7	12.9	15.5	11.5	17.6	23	34.3	57.3

FY ends 3/31

CY

FLEX

N. AMERICAN PCB MANUFACTURERS - PUBLIC DATA
QUARTERLY SALES & NET INCOME ($M)

		LAST YEAR SALES	LAST YEAR INC	THIS YEAR SALES	THIS YEAR INC	QUARTER ENDING
CIRCUIT SYS	CSYI	20.7	-0.3	23.0	-1.1	1/00
CIRCUIT WORLD	TSE:CWW	4.2	0.2	4.7	0.3	3/00
DYNAMIC/DETAILS	DDIC	59.2	-5.3	75.3	-2.0	3/00
HADCO	HDCO	255.6	4.6	275.4	10.6	4/00
INNOVEX	INVX	20.7	5.5	41.4	-12.3	3/00
MERIX	MERX	30.5	4.9	39.7	1.7	2/00
M-WAV	MWAV	3.7	0.0	5.4	0.2	3/00
PARLEX	PRLX	16.1	0.9	25.3	1.7	3/00
SHELDAHL	SHEL	28.0	-6.1	32.0	-2.1	2/00
VIASYSTEMS	VG	211.0	-4.7	289.0	-16.3	3/00
TOTAL		649.7	-0.3	811.2	-19.3	
INCOME %			-0.0%		-2.4%	

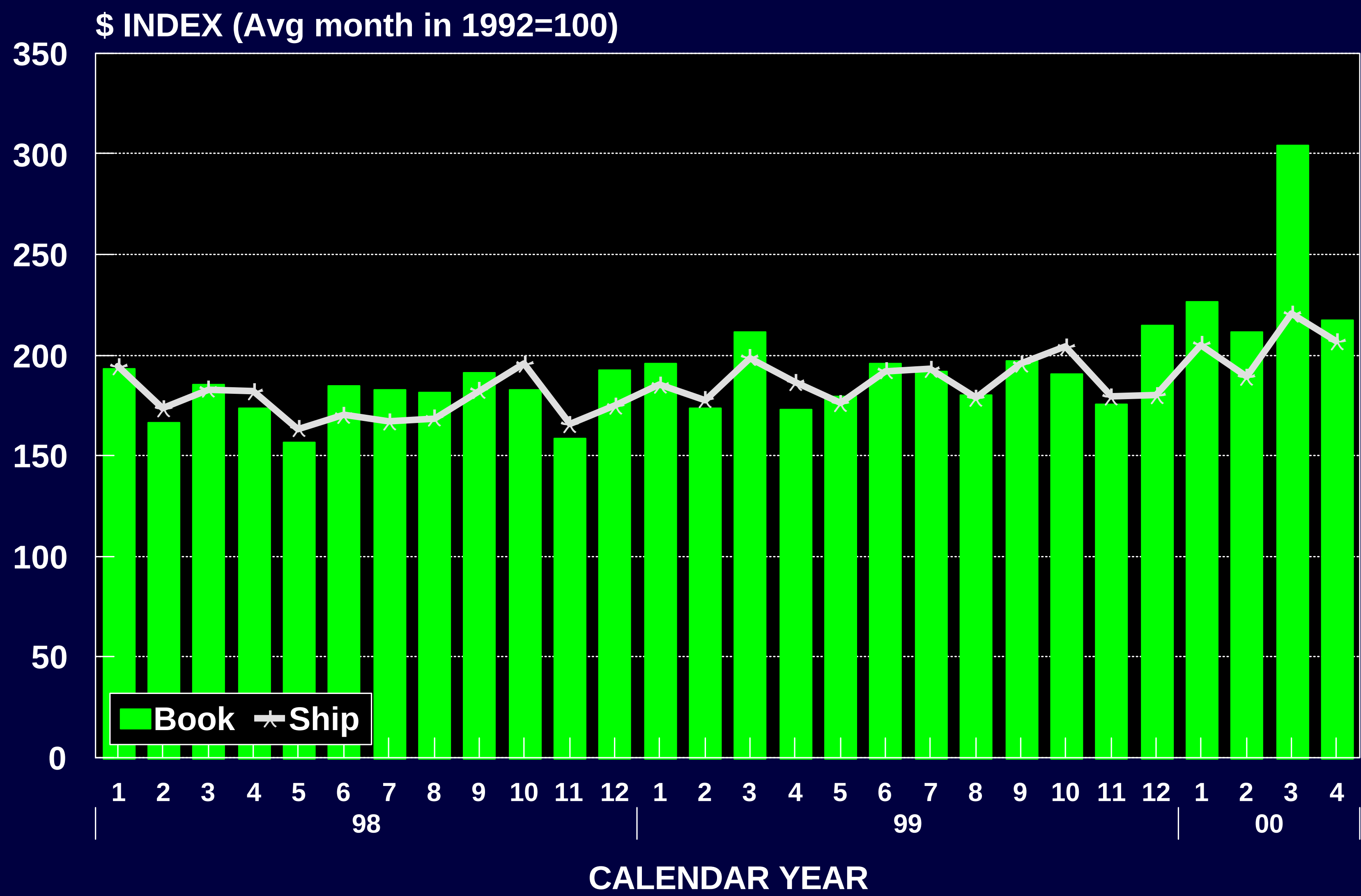
Includes foreign sales

N. AMERICAN CEMs WITH PCB FABS - PUBLIC DATA
QUARTERLY SALES & NET INCOME ($M)

		LAST YEAR SALES	LAST YEAR INC	THIS YEAR SALES	THIS YEAR INC	QUARTER ENDING
C-MAC	TSE:CMS	166.4	4.7	286.3	11.4	3/00
FLEXTRONICS	FLEX	942.0	18.6	1897.0	57.3	3/00
SANMINA	SANM	281.0	28.8	555.0	43.9	3/00
TOTAL		1389.4	52.1	2738.3	112.6	
INCOME %			3.8%		4.1%	

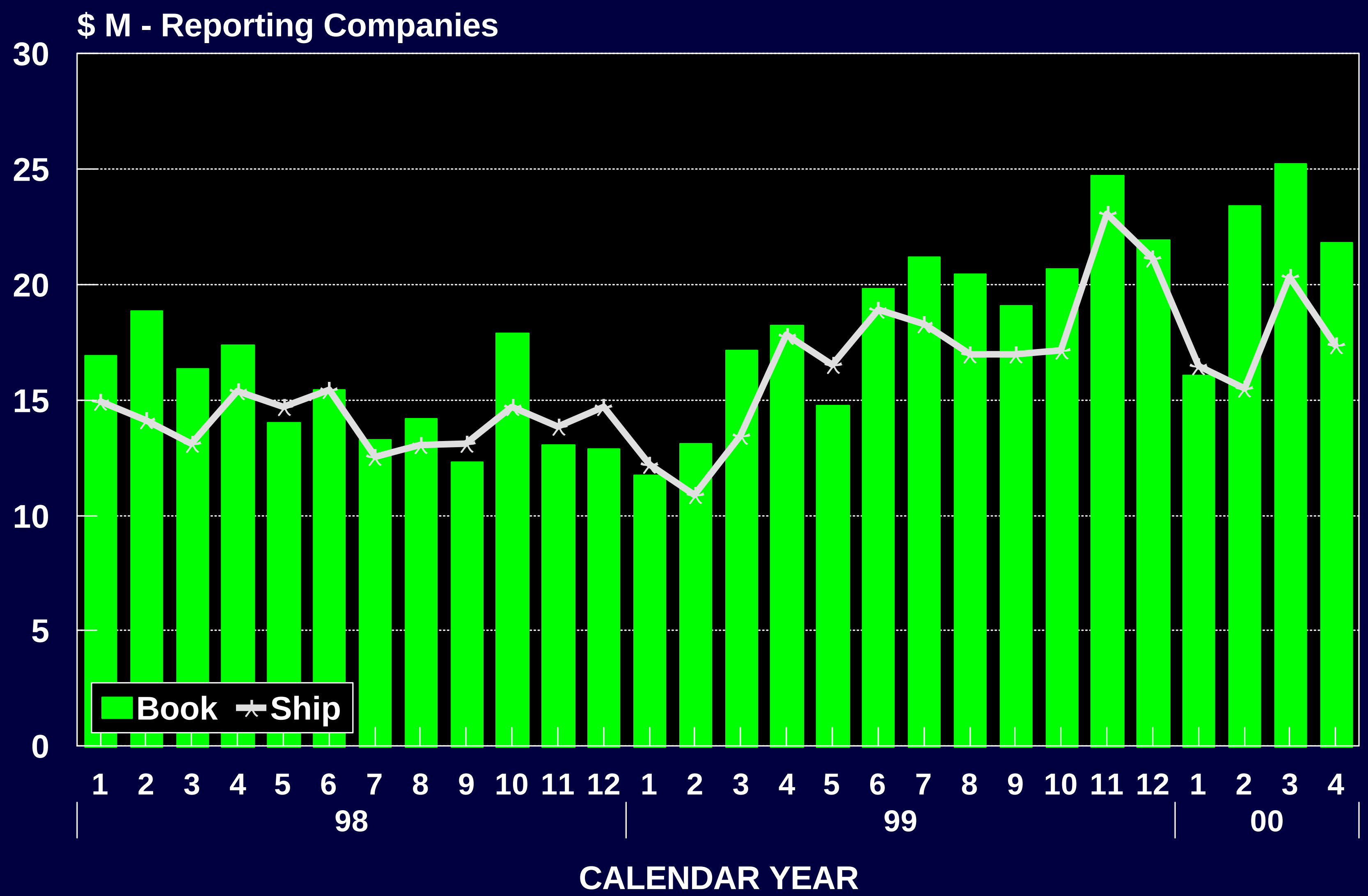
Includes foreign sales

U.S. RIGID PCB BOOKINGS & SHIPMENTS



IPC T/MRC 5/2000

U.S. FLEX CIRCUITS BOOKINGS & SHIPMENTS



IPC T/MRC 5/2000

APRIL U.S. PCB GROWTH INDICATORS

% GROWTH - April 2000 vs April 1999

RIGID PCB $ SHIPMENTS
- UP 11.0%

RIGID PCB $ BOOKINGS
- UP 25.7%

RIGID PCB BOOK/BILL RATIO

3-MONTH AVG	1.22
1-MONTH	1.13

LAMINATE+PREPREG SQ FT SHIPMENTS
- UP 5.6%

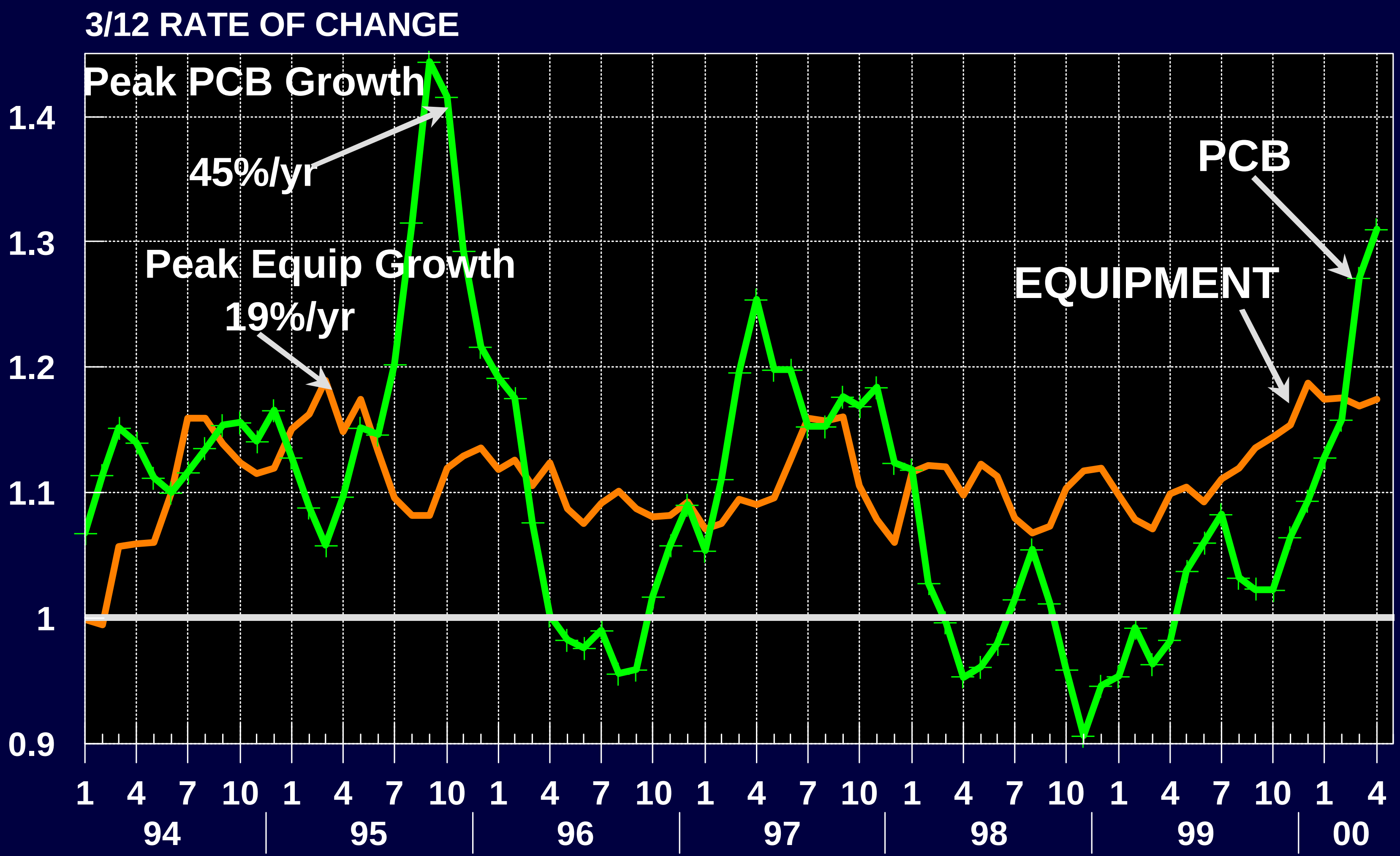
LAMINATE+PREPREG SQ FT BOOKINGS
- UP 27.0%

FLEX CIRCUIT $ SHIPMENTS
- UP 31.7%

FLEX CIRCUIT $ BOOKINGS
- UP 71.5%

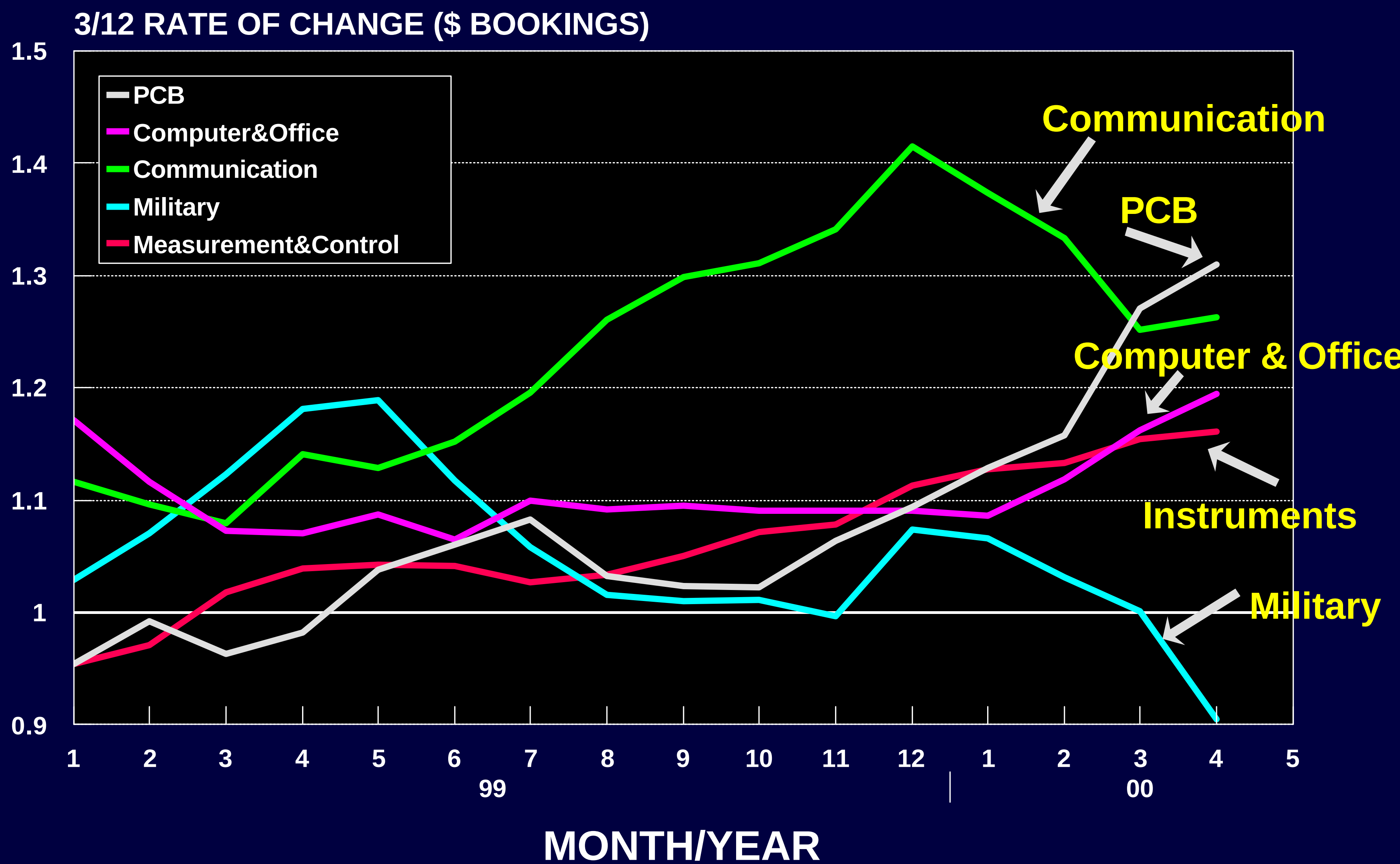
U.S. ELECTRONIC EQUIPMENT vs PCBs

$ BOOKINGS GROWTH



6/2000

US RIGID PCB vs ELECTRONIC EQUIPMENT BOOKINGS



US COMMERCE DEPT & IPC T/MRC 6/2000

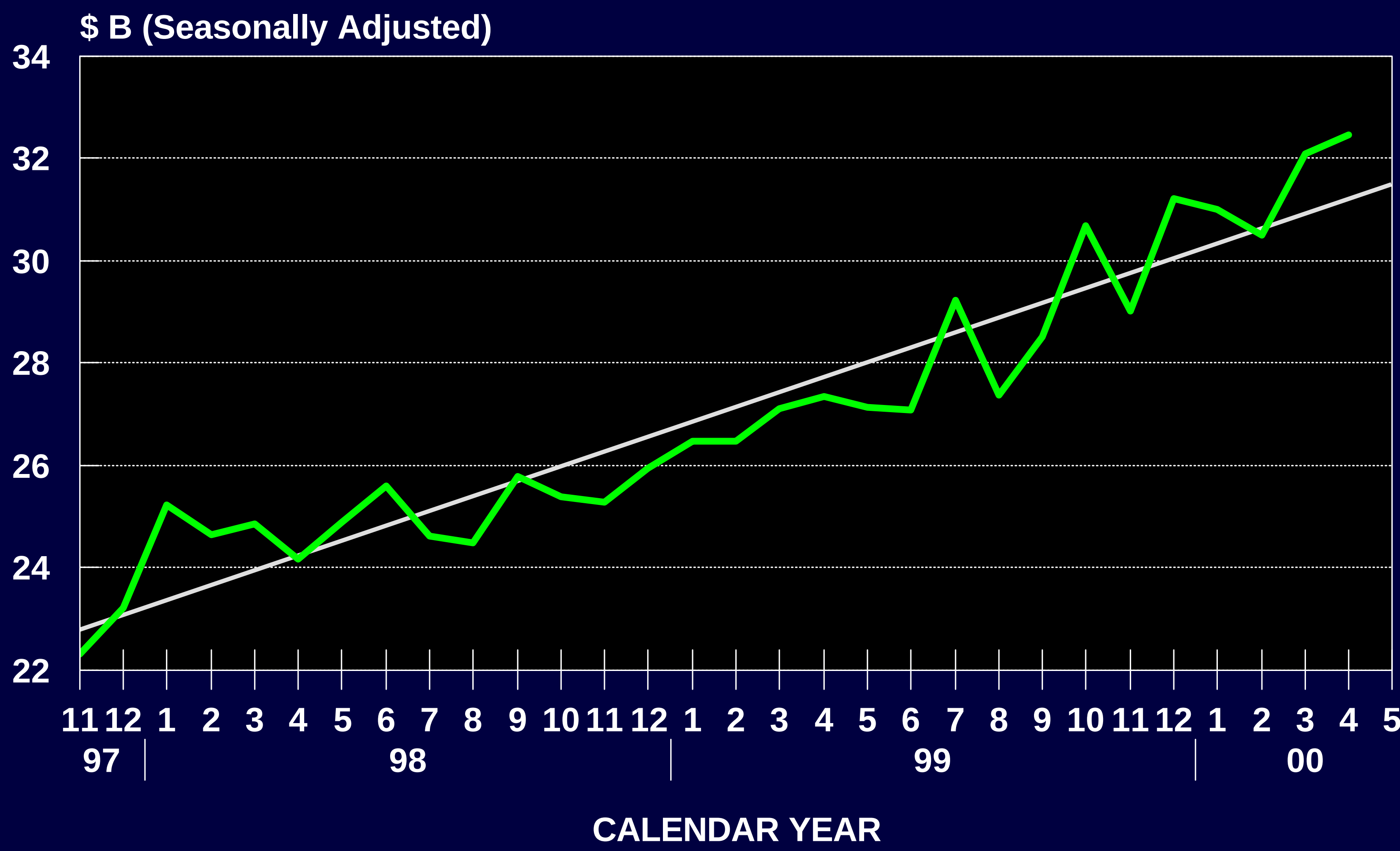
PRESENT GROWTH RATES (%)

U.S. ECONOMY & ELECTRONICS INDUSTRY

	LATEST MONTH	ANNUAL GROWTH RATE	3-MONTH GROWTH RATE
RIGID PCB BOOKING $	4/00	113.4	131.0
RIGID PCB SHIPMENT $	4/00	108.7	109.5
LAMINATE+PREPREG SHIPMENTS SF	4/00	112.0	107.8
ELECTRONIC COMPONENTS BOOK $	4/00	118.9	125.2
ELECTRONIC EQUIPMENT BOOKINGS $			
COMPUTER & OFFICE	4/00	111.7	119.4
COMMUNICATIONS	4/00	128.6	126.3
MEASURE/CONTROL INSTRUMENTS	4/00	109.8	116.1
MILITARY (SEARCH & NAVIG)	4/00	100.7	90.5
TOTAL ELECTRONIC EQUIPMENT	4/00	115.2	117.4
INDUSTRIAL PRODUCTION	4/00	104.4	105.5

NOTE: 3 month growth rates compare most recent
3 months to same 3 months one year earlier

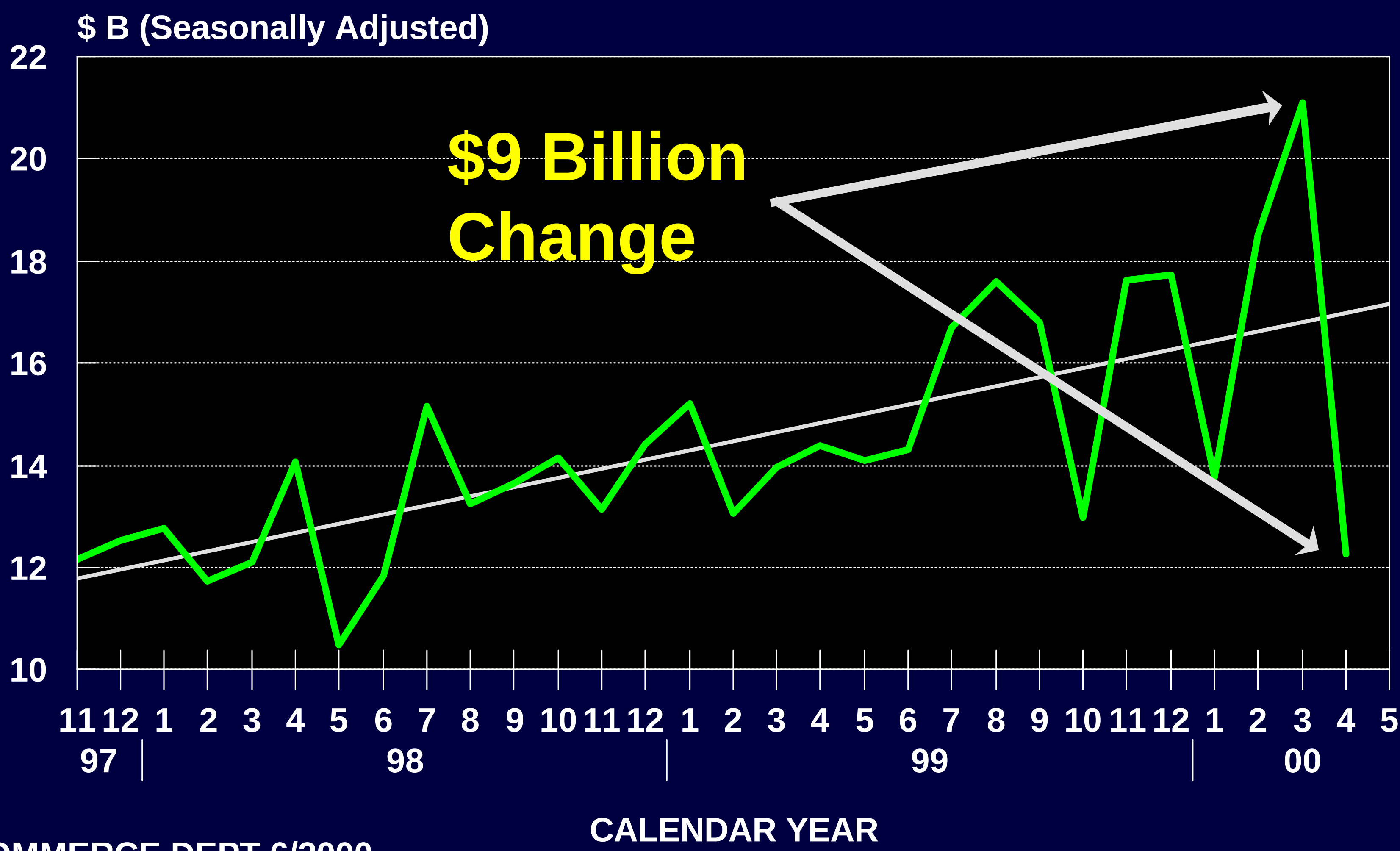
TOTAL ELECTRONIC EQUIPMENT
BOOKINGS



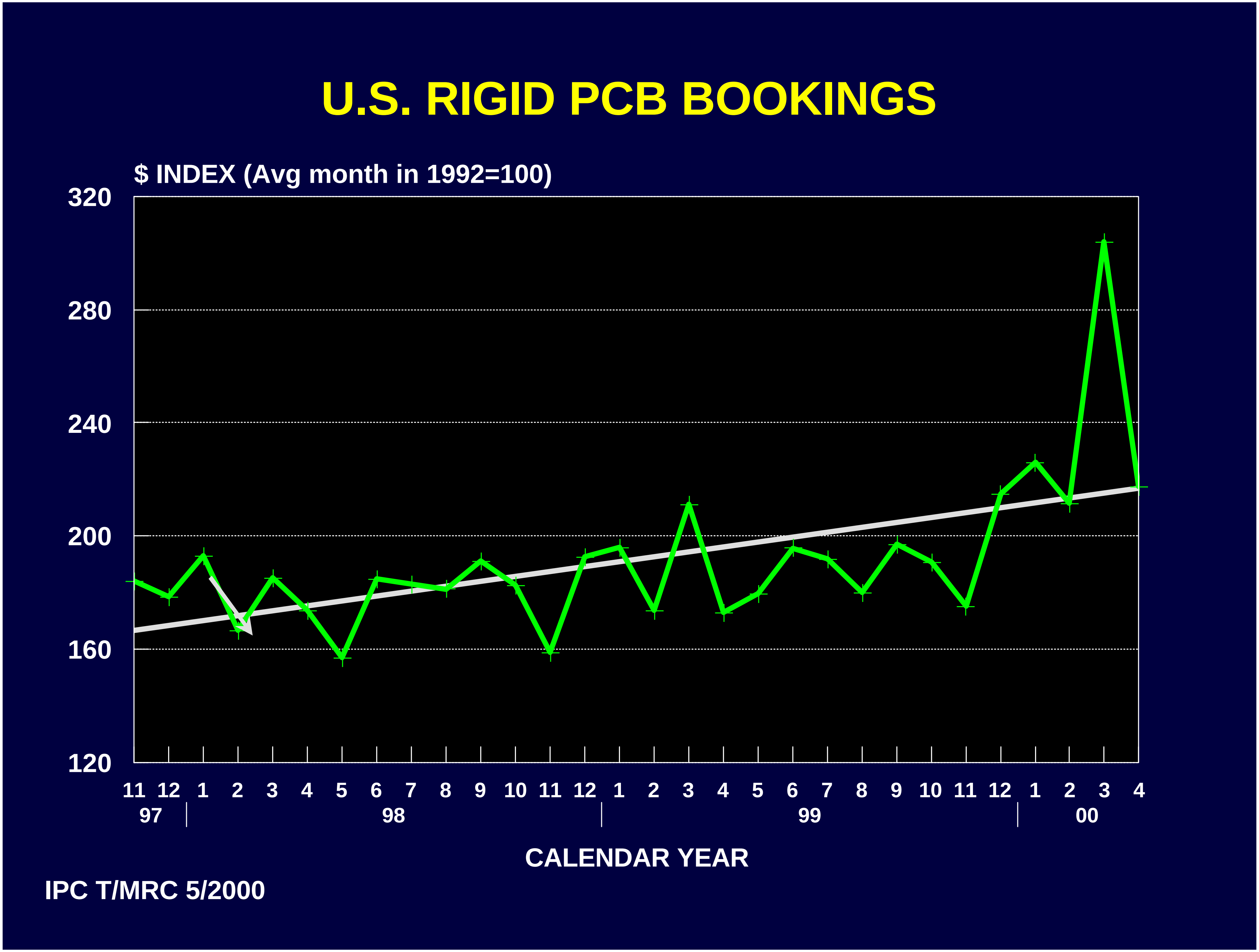
COMMERCE DEPT 6/2000

U.S. ELECTRONIC COMPONENTS

BOOKINGS



COMMERCE DEPT 6/2000


U.S. RIGID PCB BOOKINGS
$ INDEX (Avg month in 1992=100)
320
280
240
200
160
120
11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4
97
98
99
00
CALENDAR YEAR
IPC T/MRC 5/2000

Summary

- N. American PCB, semiconductor & electronic equipment orders are all currently strong. Lead times have extended. Overbooking is a concern.
- All key industrial countries' economies are growing. Interest rates are being raised to limit future inflation.
- Passive component shortages are serious problem. Massive cel phone growth has impacted global component availability. Microprocessors & flash memory are tight and glass cloth & laminate supply are issues.
- Personal computer induced seasonality continues.
- End Markets are healthy. Huge new markets are emerging.
- 8-12% domestic PCB growth is likely for 2000. Longer term, sporadic "double digit" cyclical peaks in PCB demand will continue.