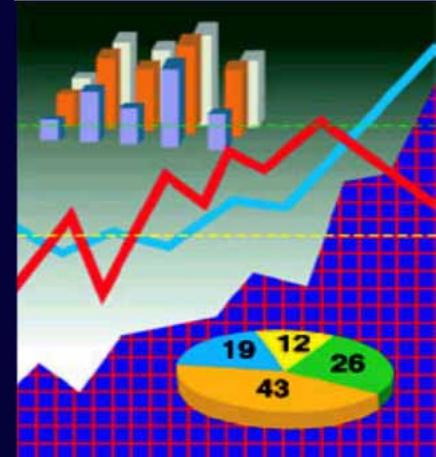


20160619

# Business Outlook Global Electronics Industry (with emphasis on Europe)



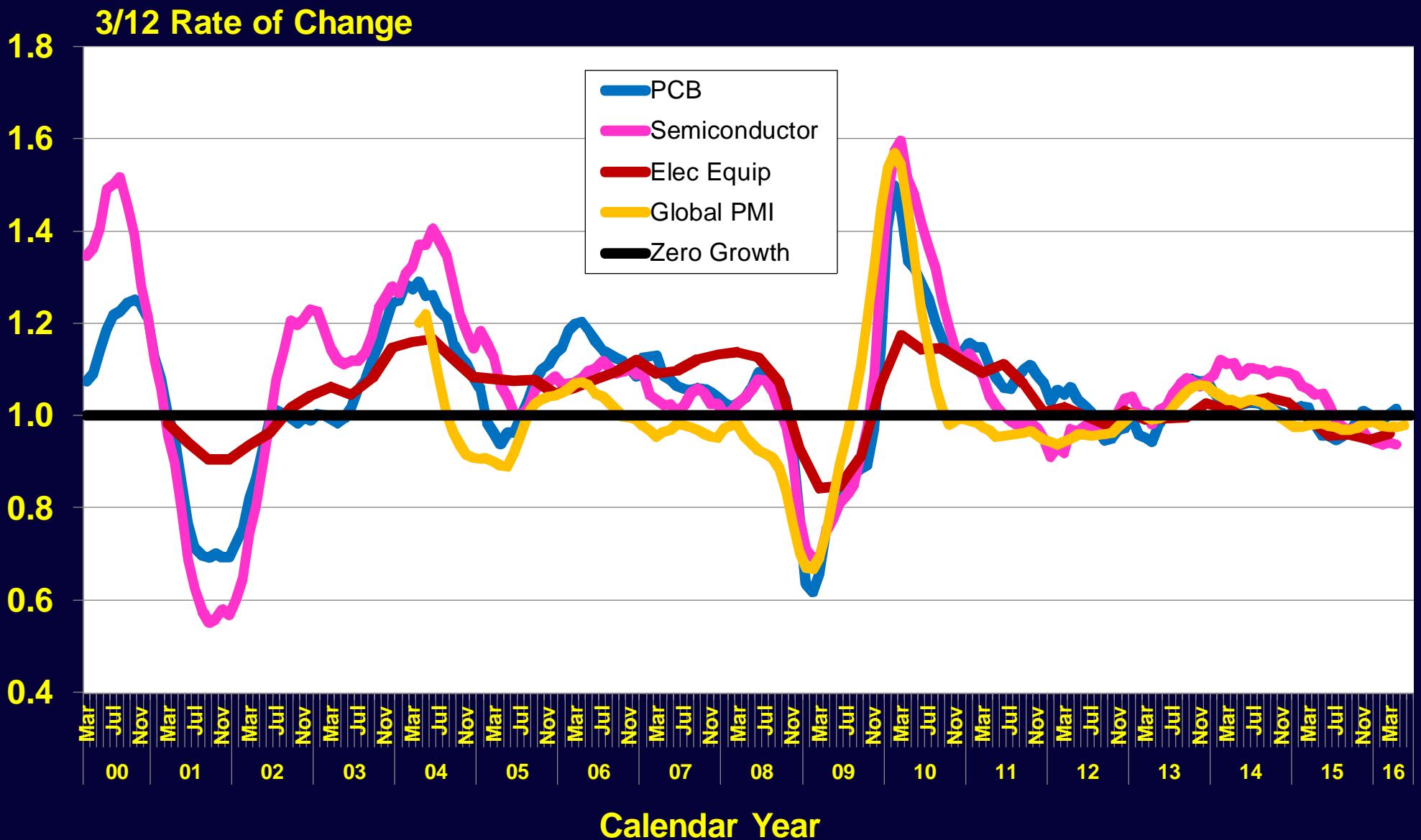
Custer Consulting Group  
[www.custerconsulting.com](http://www.custerconsulting.com)  
June 2016

# Setting Expectations

# World & European Electronic Supply Chain Growth

# Global PMI, Electronic Equipment, PCB & Semiconductor Shipments

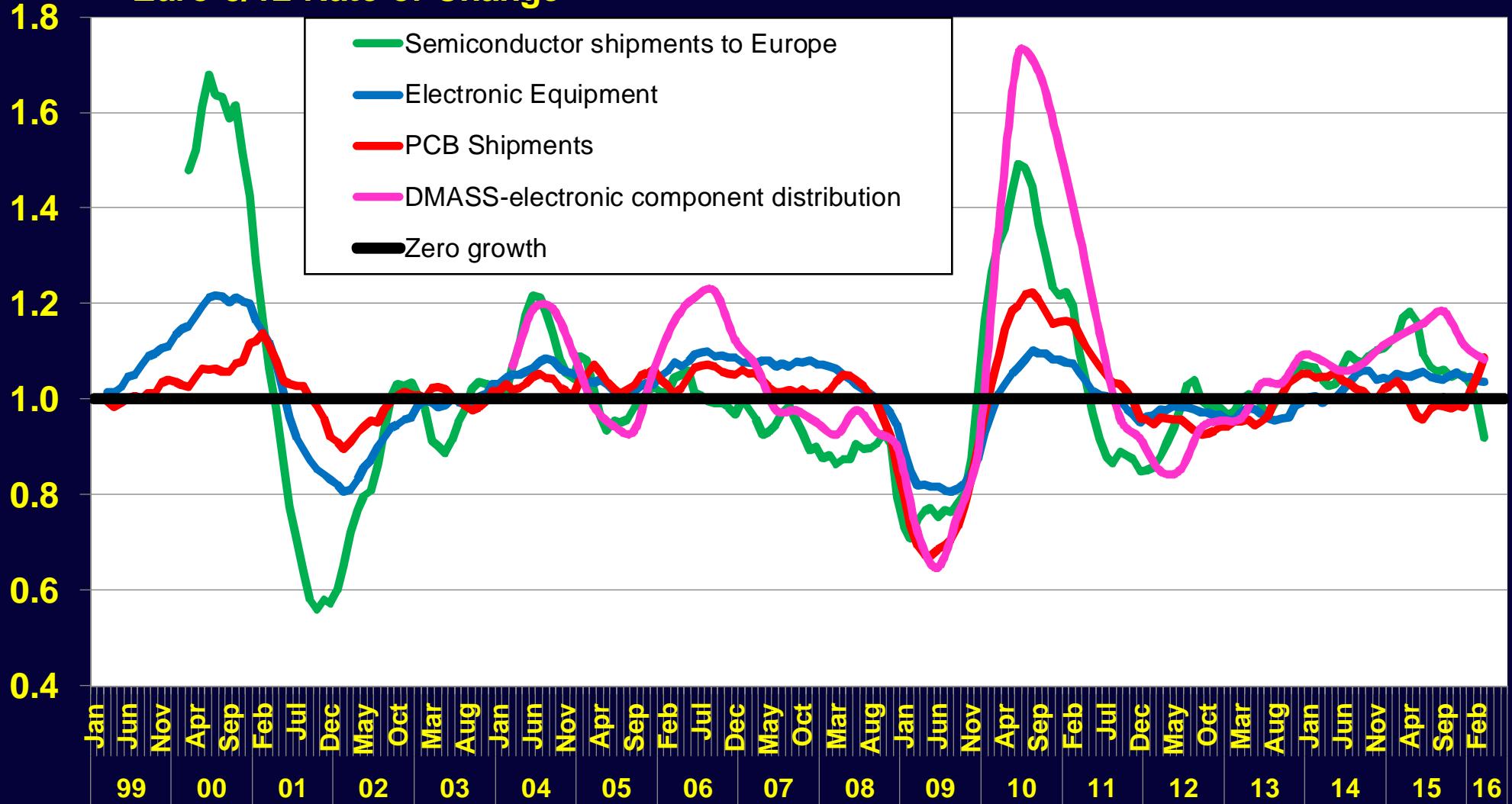
20160608



# European Electronic Equipment, Semiconductors to Europe, DMAS Semiconductor Distribution, PCB Production

20160607

## Euro 3/12 Rate of Change



Total \$ Semiconductor Shipments from All Countries to Europe [www.sia-online.org/](http://www.sia-online.org/),  
Eurostat class C26 & SEMI, CCG Extrapolation of SEMI growth

# 2016 Challenges

Global Electronic Equipment volume markets excluding automotive are stagnant; emerging markets are not yet large

China in turmoil, Japan contracting, USA slowing but Europe is still expanding

Global unrest and terrorist threats are major issues; enhanced border security impedes commerce

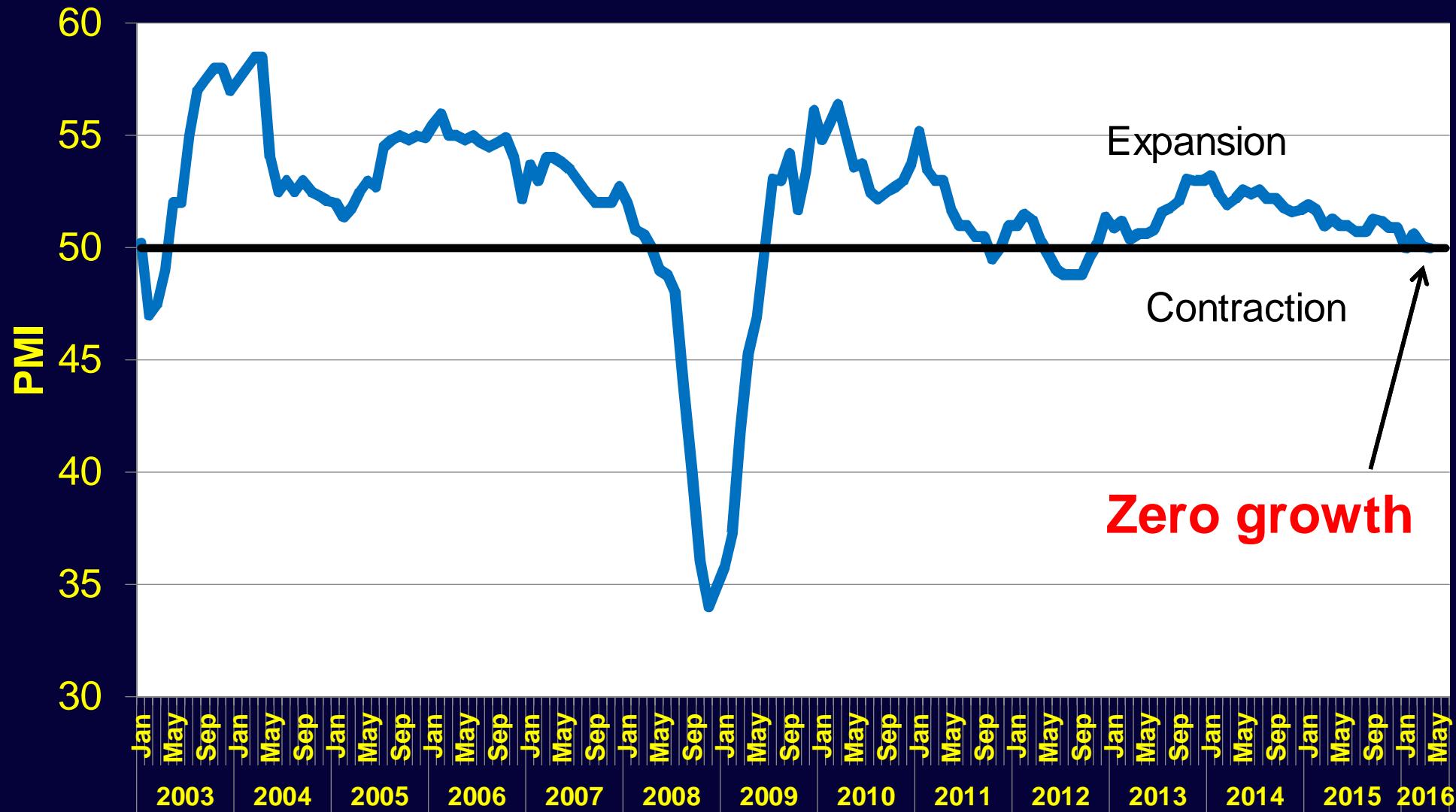
Immigrant migration is disruptive

Political uncertainty is widespread, Brexit looms

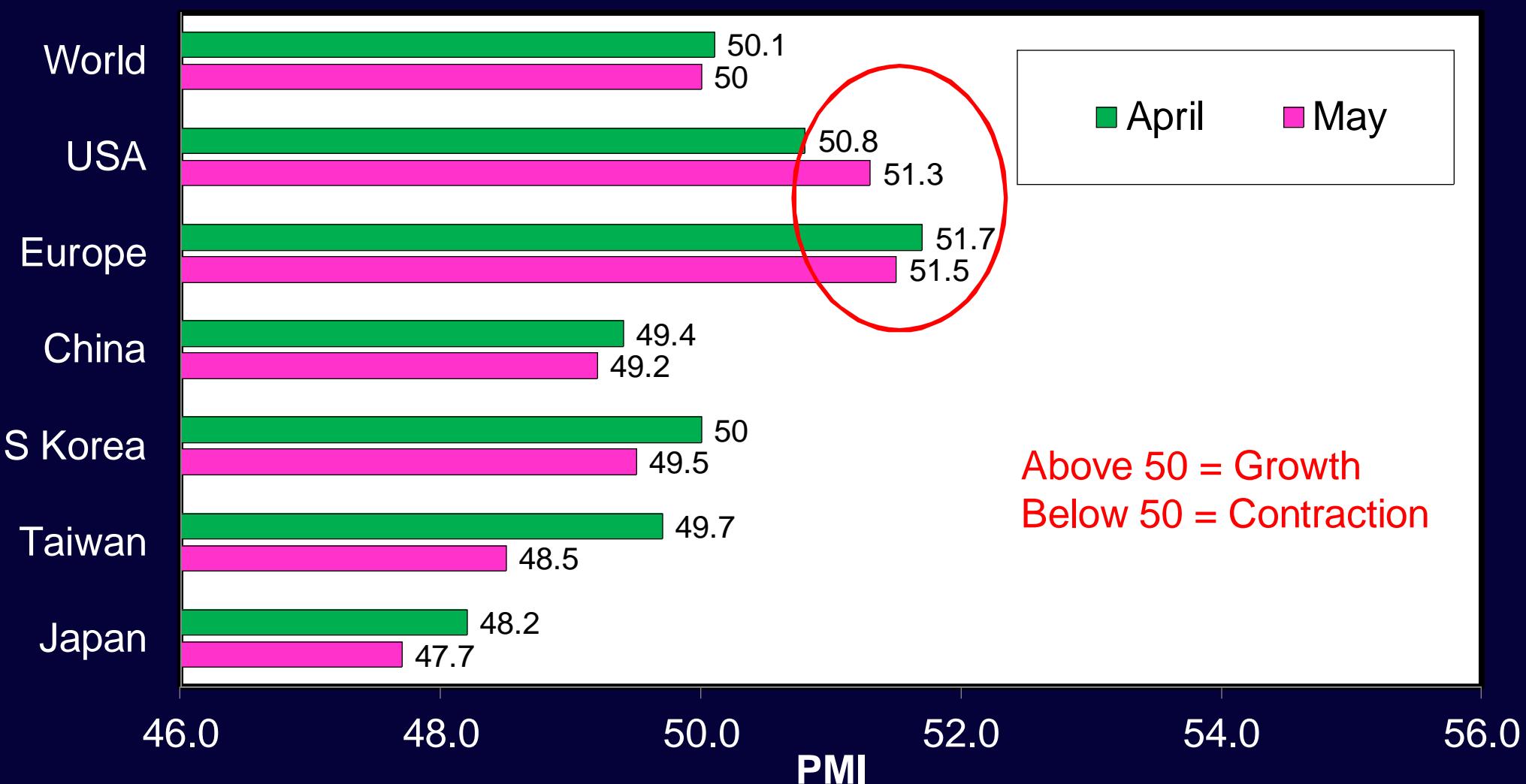
# Business Conditions

# Global "Purchasing Managers" Index

Diffusion Index, >50 = Growth



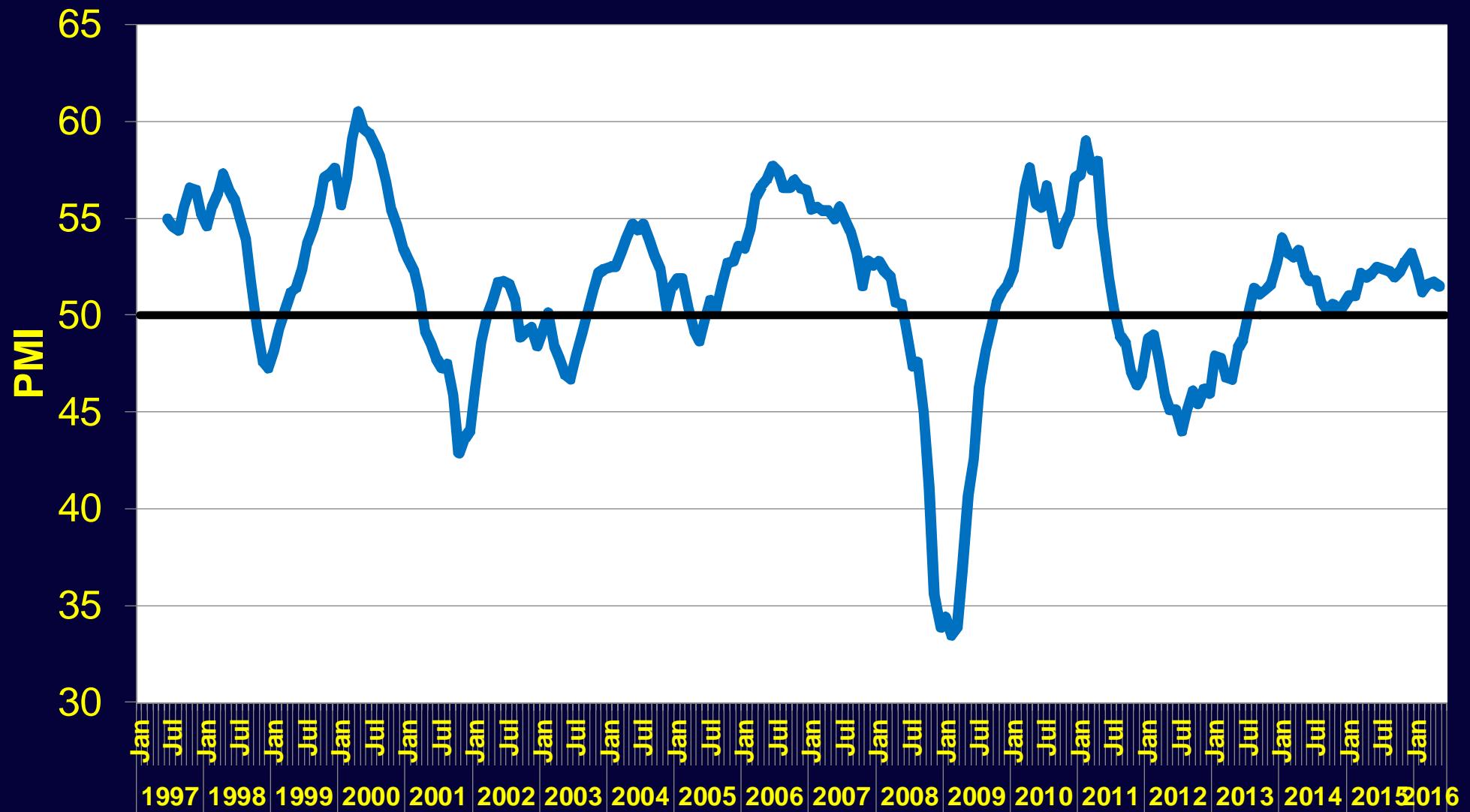
# Purchasing Managers' Indices May vs. April 2016



20160601

# Eurozone "Purchasing Managers" Index

## Diffusion Index, >50 = Growth



# European Purchasing Managers' Indices

## May vs. April 2016

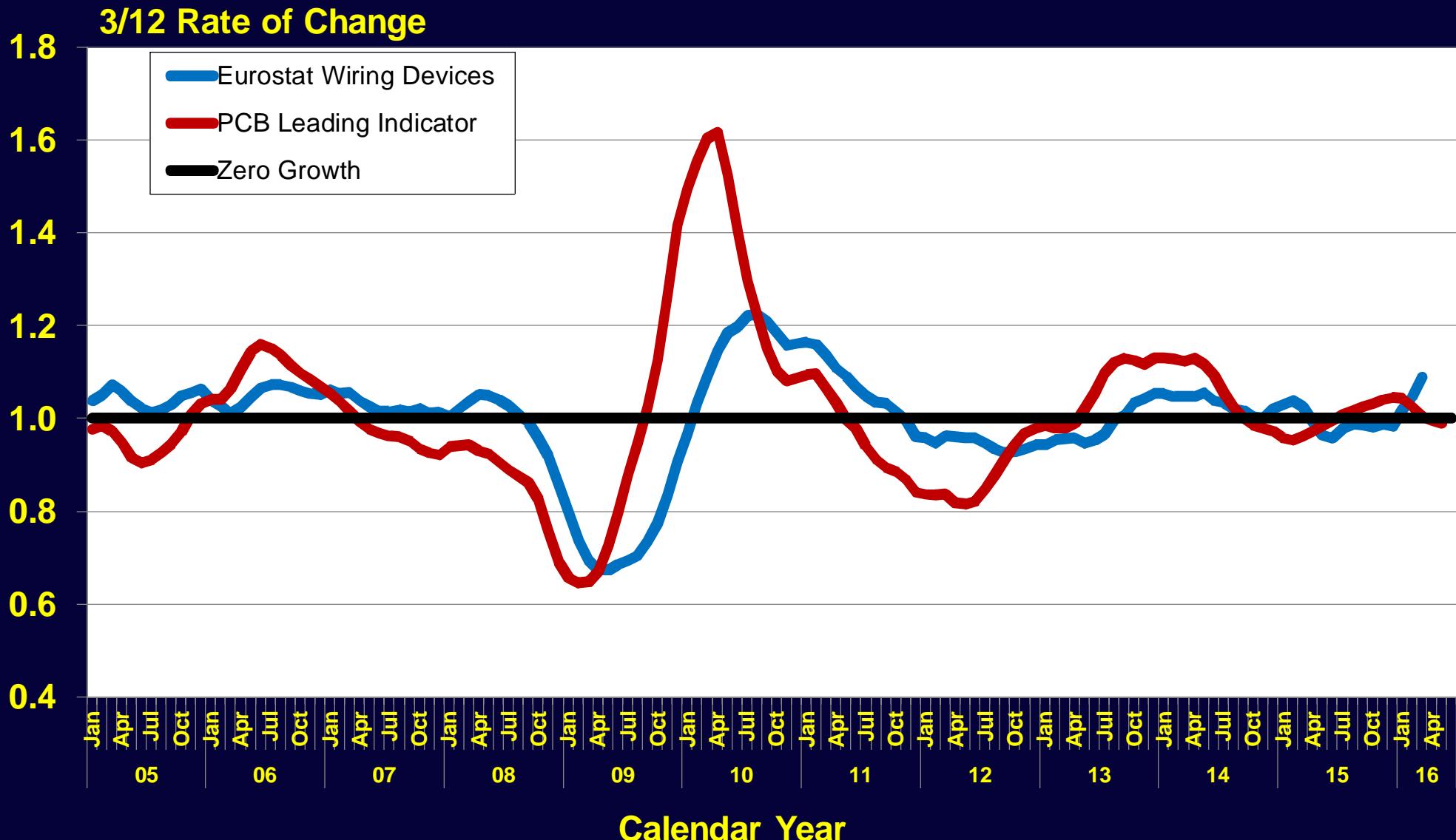
20160601



**PMIs  
are a 2 to 6 month  
leading indicator  
of  
electronics  
growth**

20160605

# Europe PMI Leading Indicator vs. Europe Wiring Devices

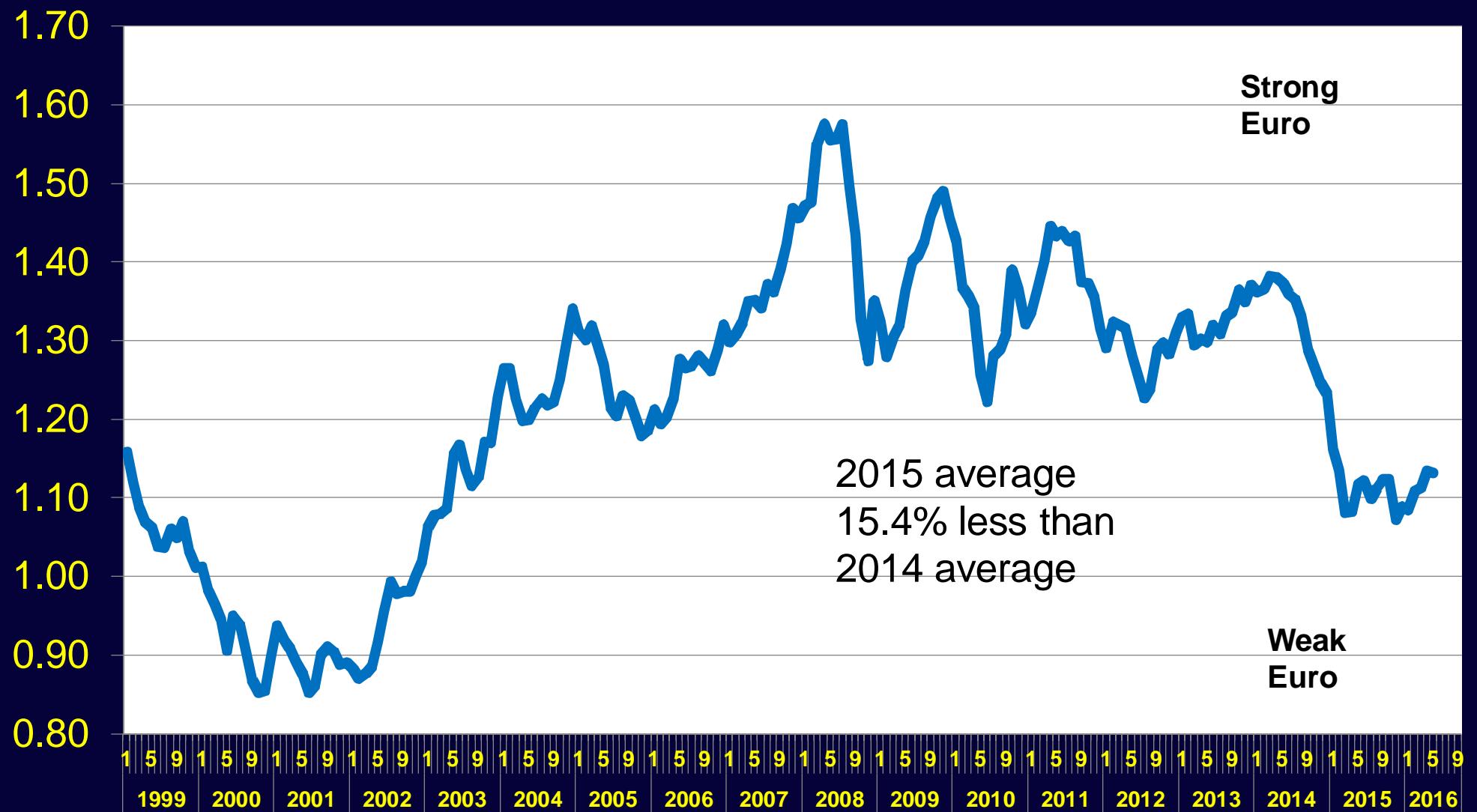


Source: Custer Consulting Group

# Exchange Rate Impact

# Euro vs. U.S. Dollar

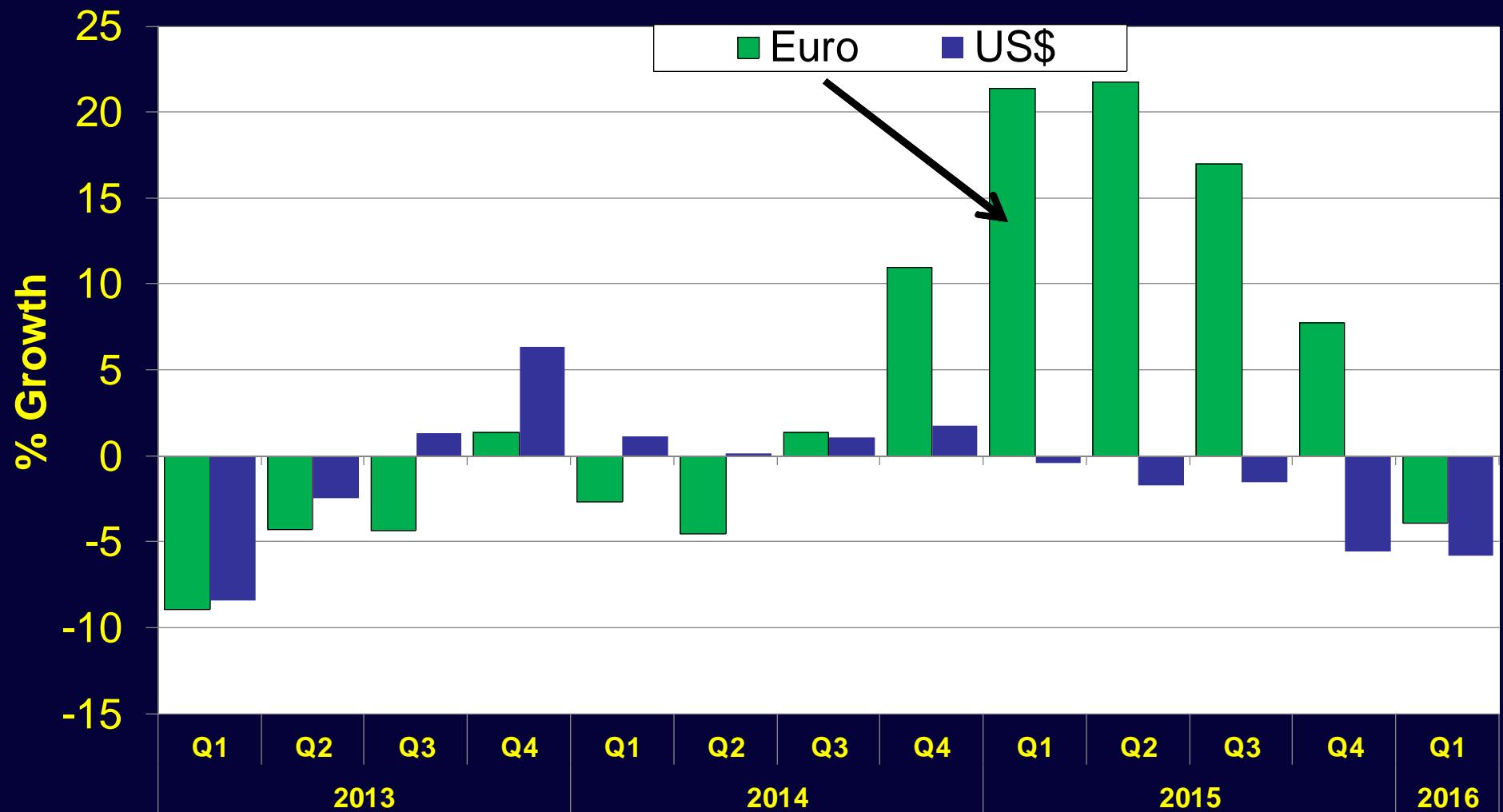
## US\$/Euro



**Growth rates  
distorted  
by  
Exchange Rates**

# World Electronic Equipment Sales

## US\$ vs. Euro Denominated Quarterly Growth



Global model based on regional shipment indices

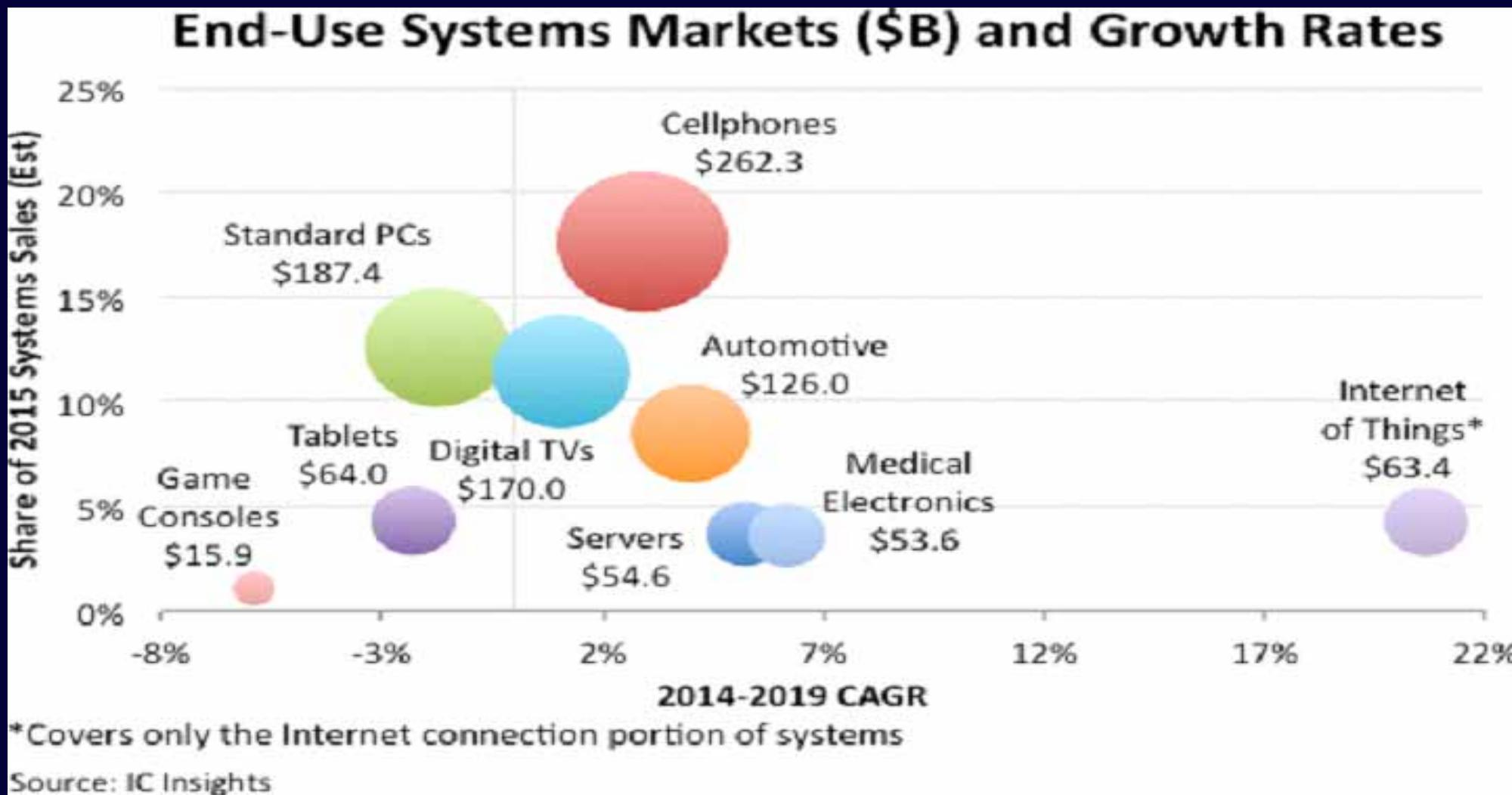
# **Electronic Equipment**

## **World**

20151212

# End-Use Markets Size (\$B) & Growth Rates

20150308



# **Methods to Measure Electronic Industry Growth**

**Sector composites based upon financial reports of similar companies**

- Typically quarterly, semianually or monthly

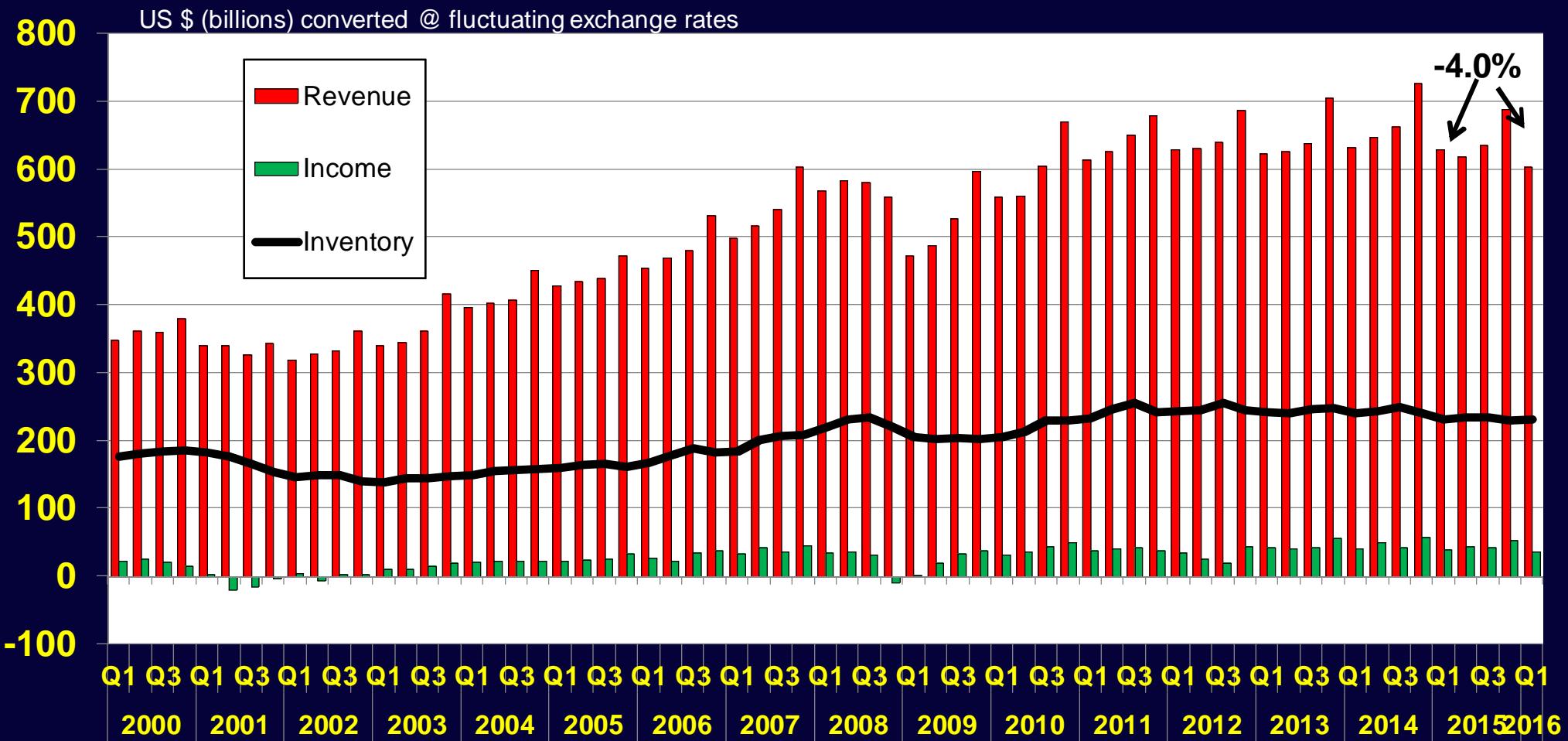
**Government and trade organization statistics**

- Typically monthly

- **TIMELY DATA REPORTED ON A CONSISTENT BASIS IS KEY**

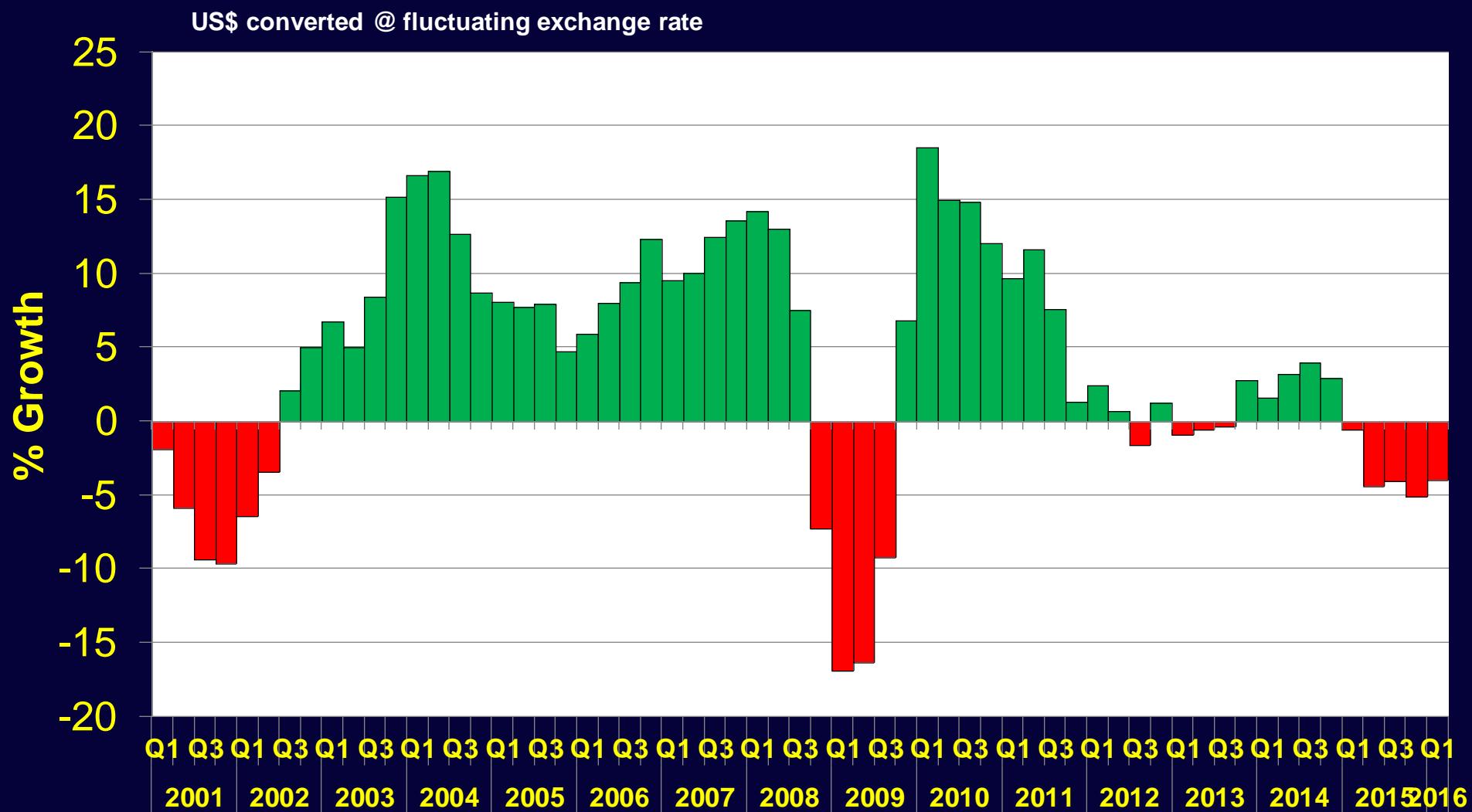
# Electronic Equipment Suppliers Composite of 213 Public Companies

## Revenue, Net Income & Inventory



Computer 13, Internet 13, Storage 17, Communication 30, SEMI 40, Medical 21, Instruments 16, Military 21, Business & Office 6, Consumer 21, Automotive 15

# Electronic Equipment Suppliers Composite of 213 Public Companies Quarterly Revenue Growth



# Regional Data

U.S.

Europe

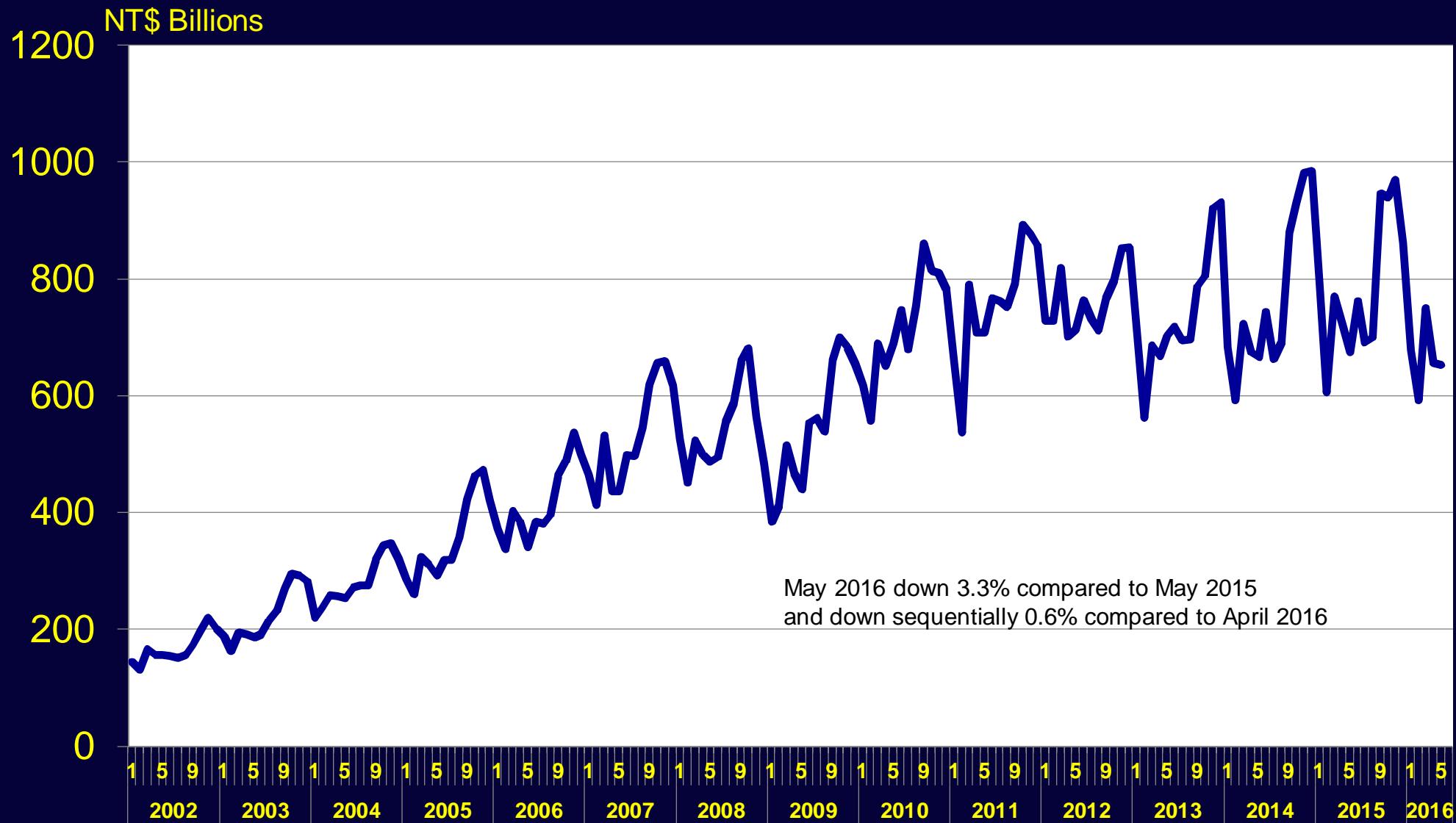
Japan

China/Taiwan

S Korea

# Taiwan/China Electronic Equipment Producers Composite of 101 Manufacturers Consolidated Revenue

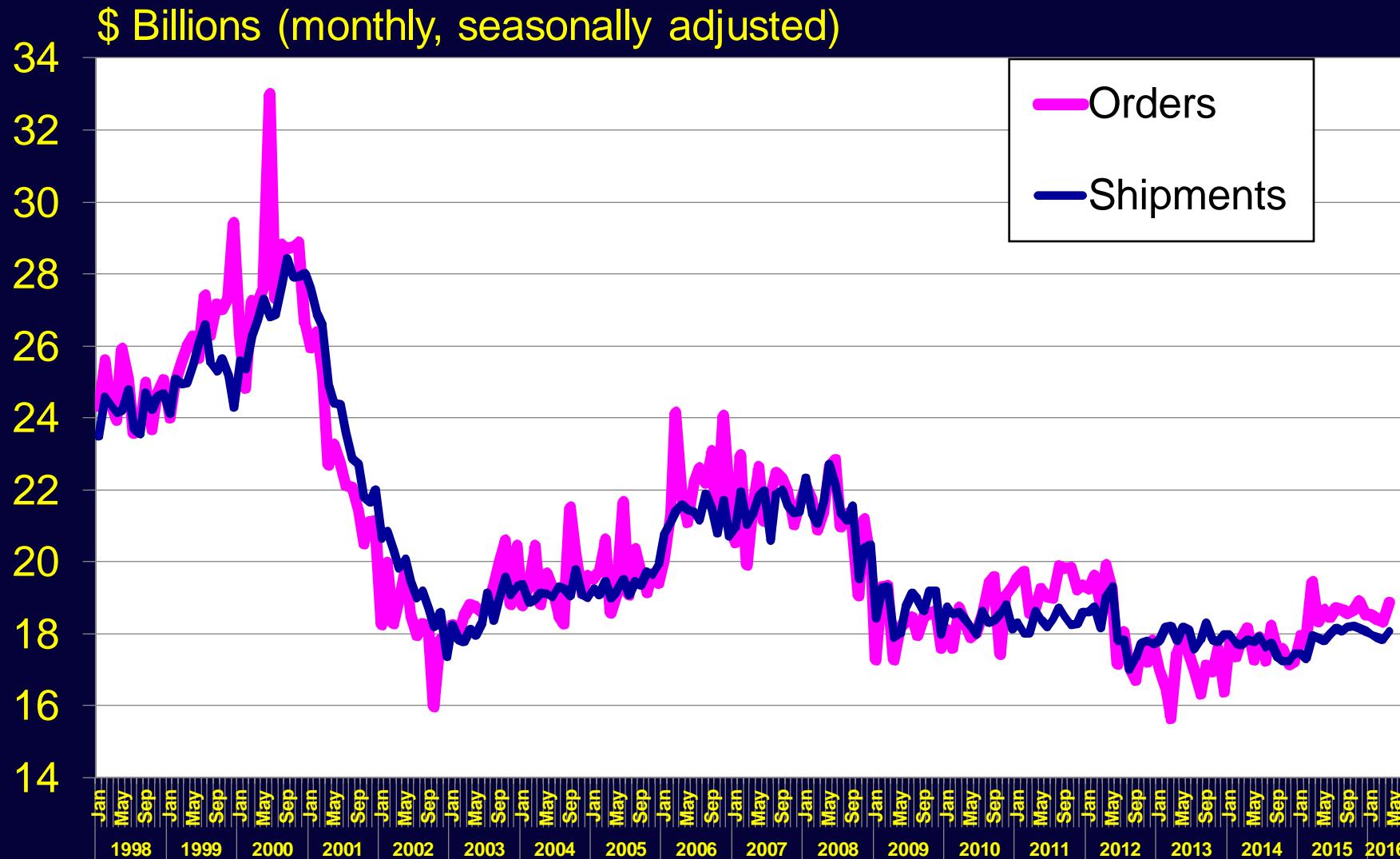
20160613



Taiwan listed companies, often with significant manufacturing in China

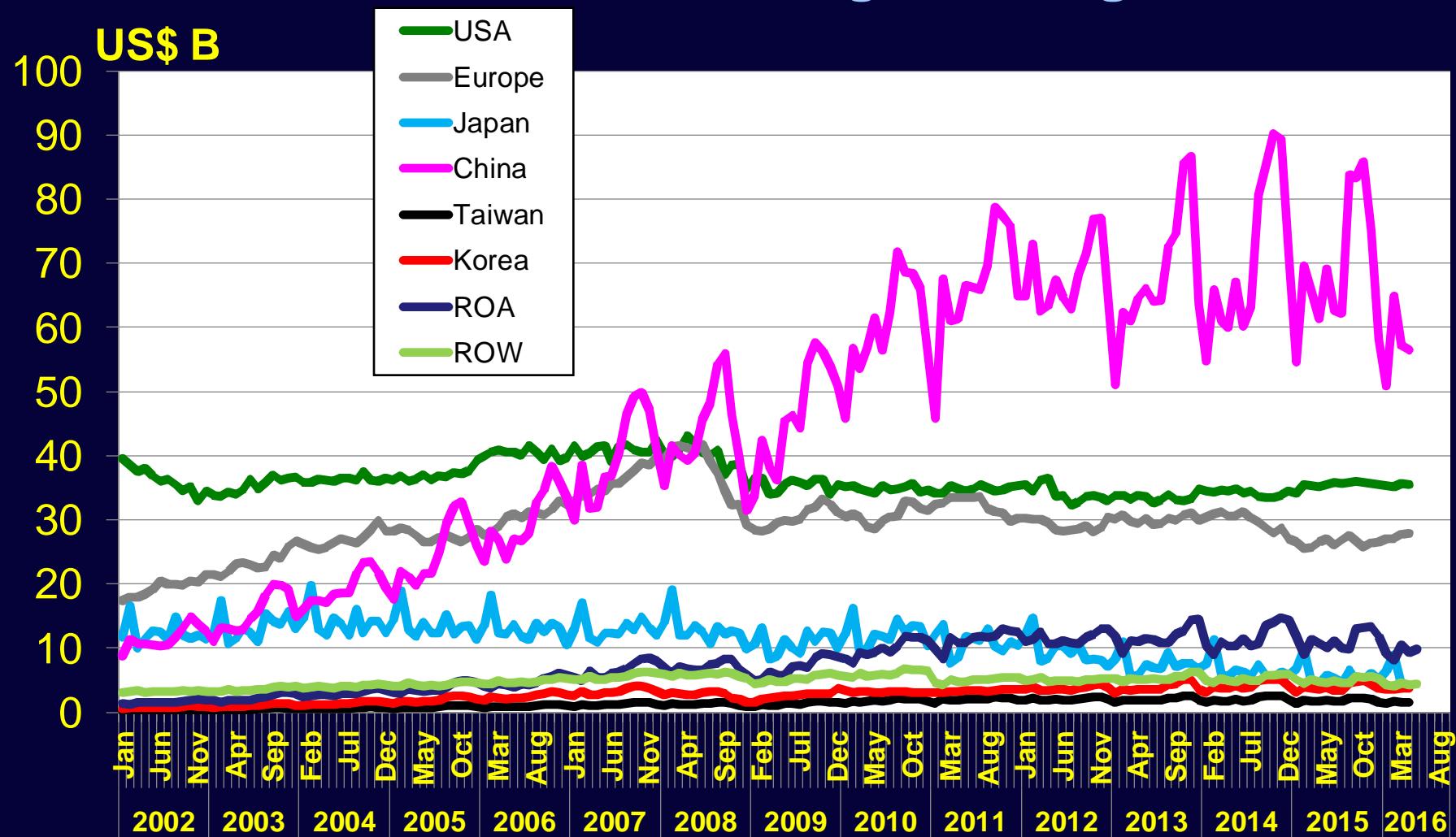
# U.S. Electronic Equipment Orders & Shipments

## Computer, Communications, Measurement & Control and Military



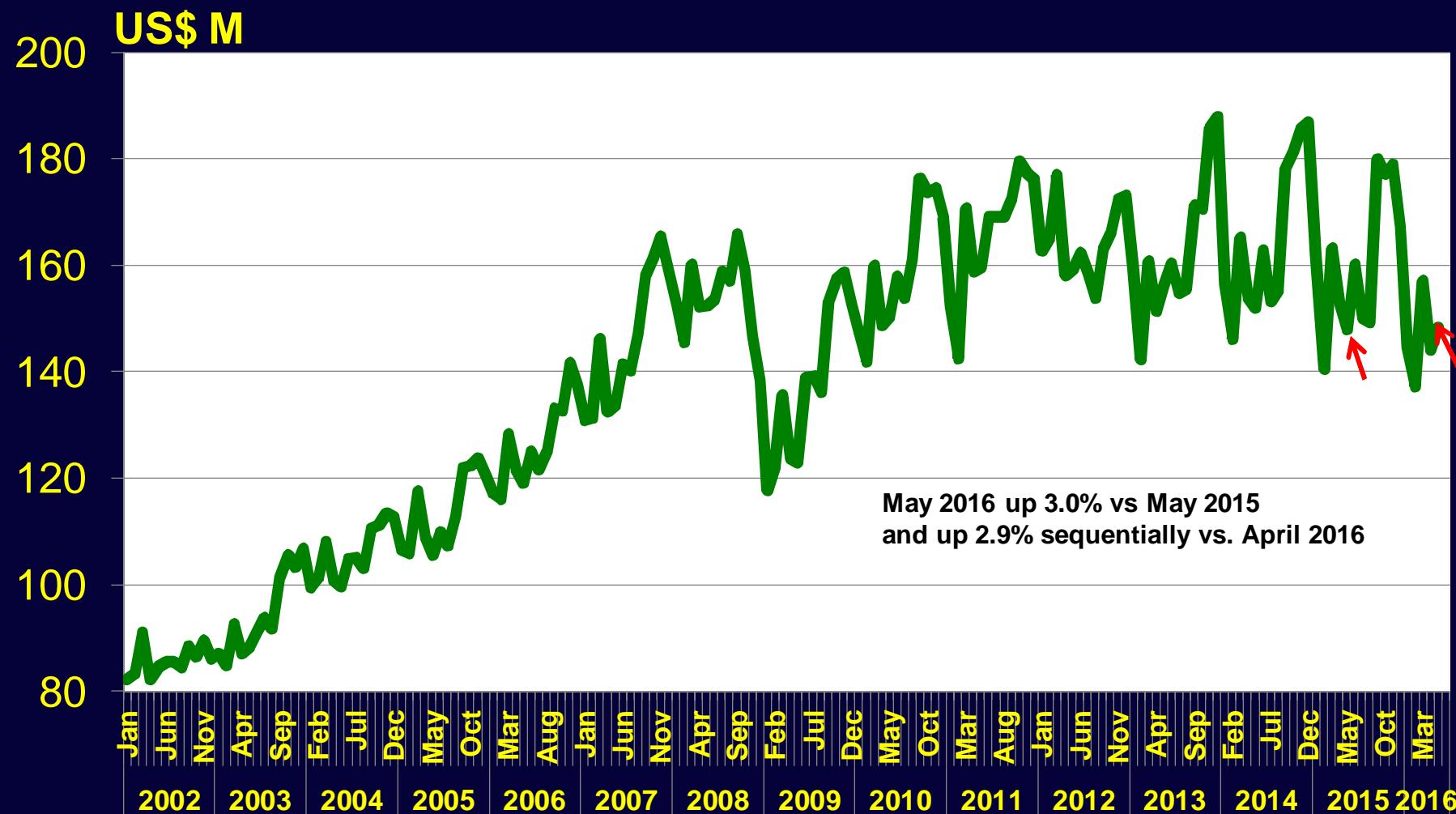
# World Electronic Equipment Monthly Shipments

Converted @ Fluctuating Exchange Rates



# World Electronic Equipment Monthly Shipments

Converted @ Fluctuating Exchange Rates

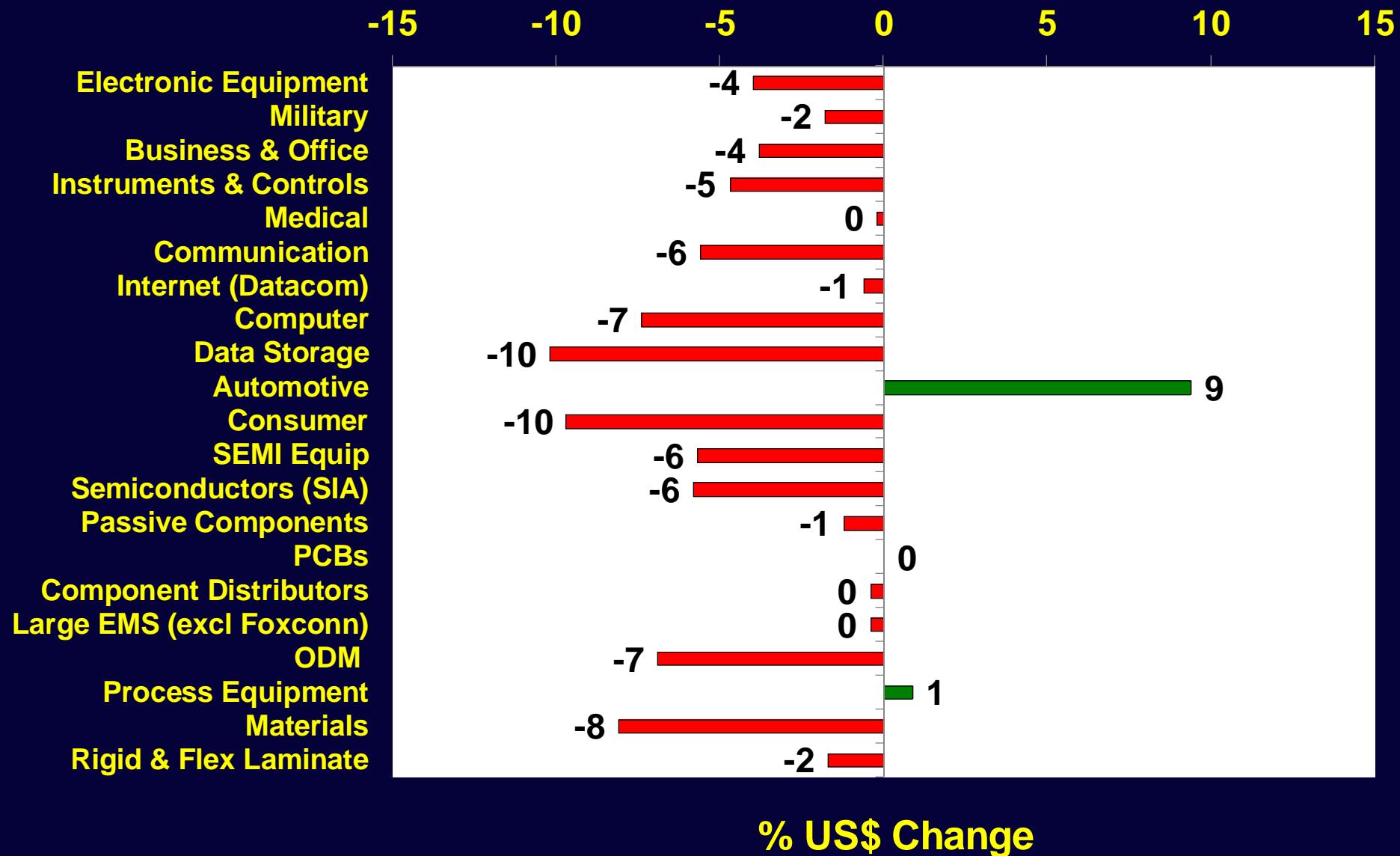


# **Electronic Equipment Growth**

**Europe &  
World**

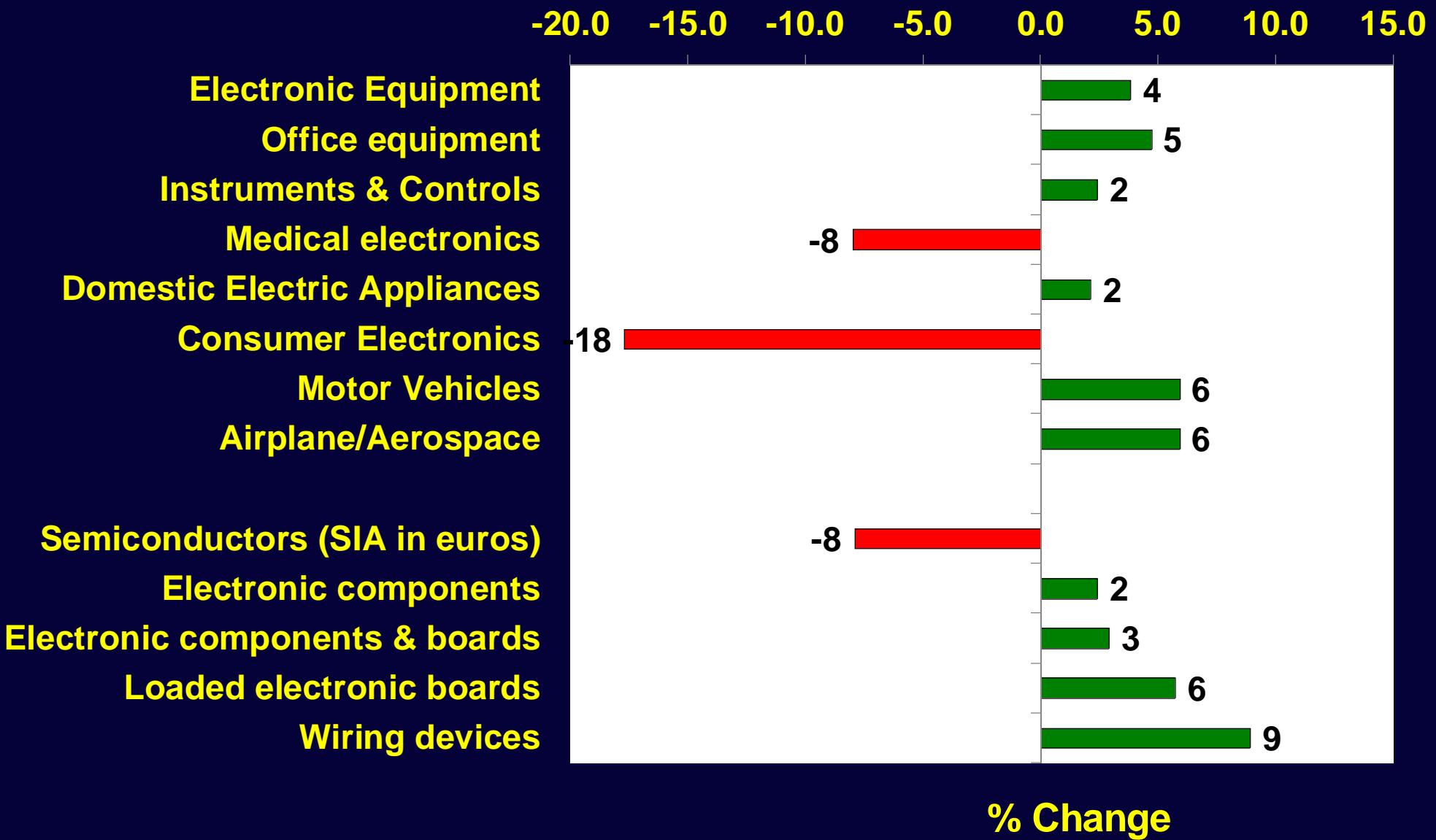
# Global Electronic Supply Chain Growth 1Q'16 vs. 1Q'15

20160526



US\$ equivalent at fluctuating exchange; based upon industry composites including acquisitions

# European Electronic Supply Chain Growth 1Q'16 vs 1Q'15



Euro denominated growth rates; Eurostat, SIA & Custer Consulting Group

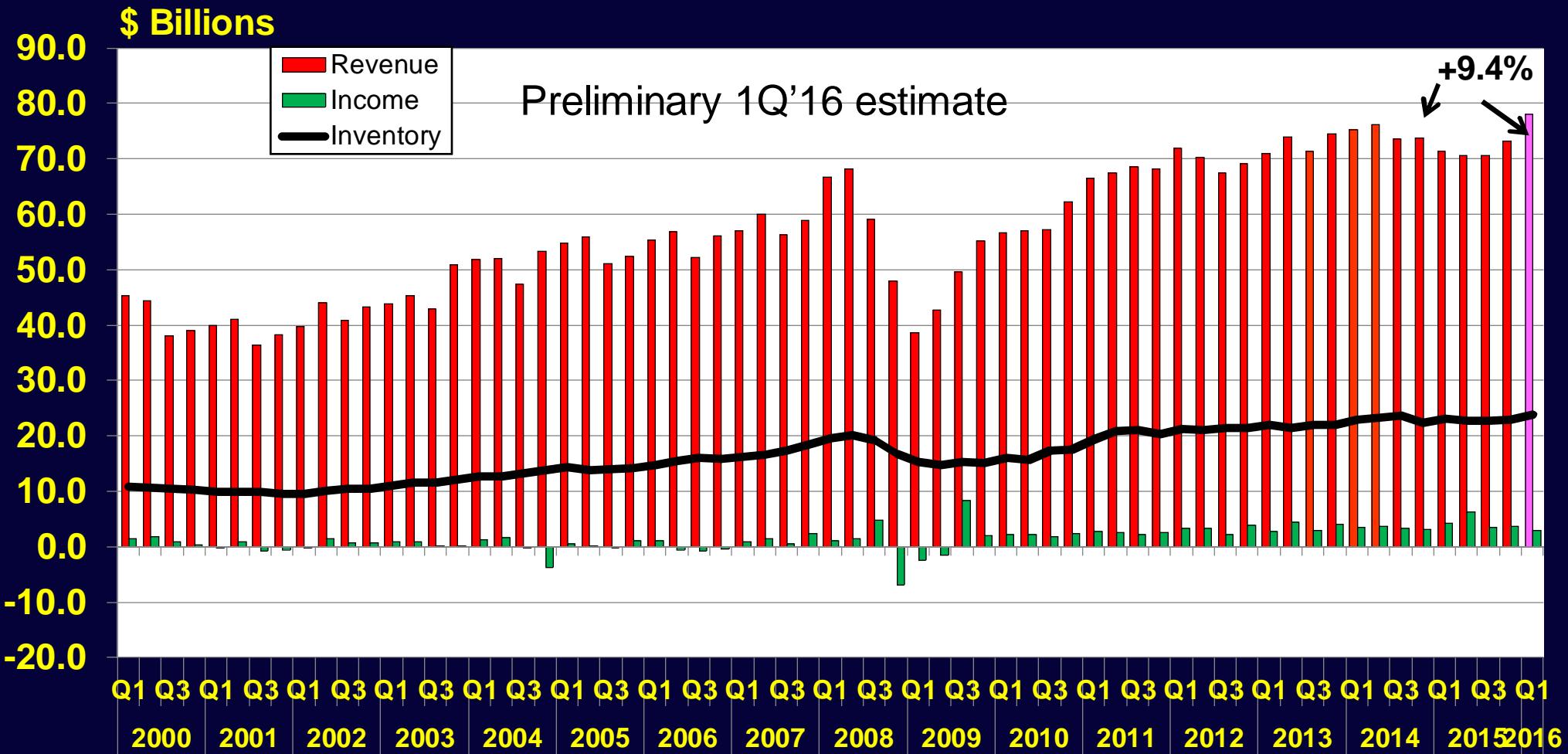
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# European Computer, Electronic & Optical Products Production



20160516

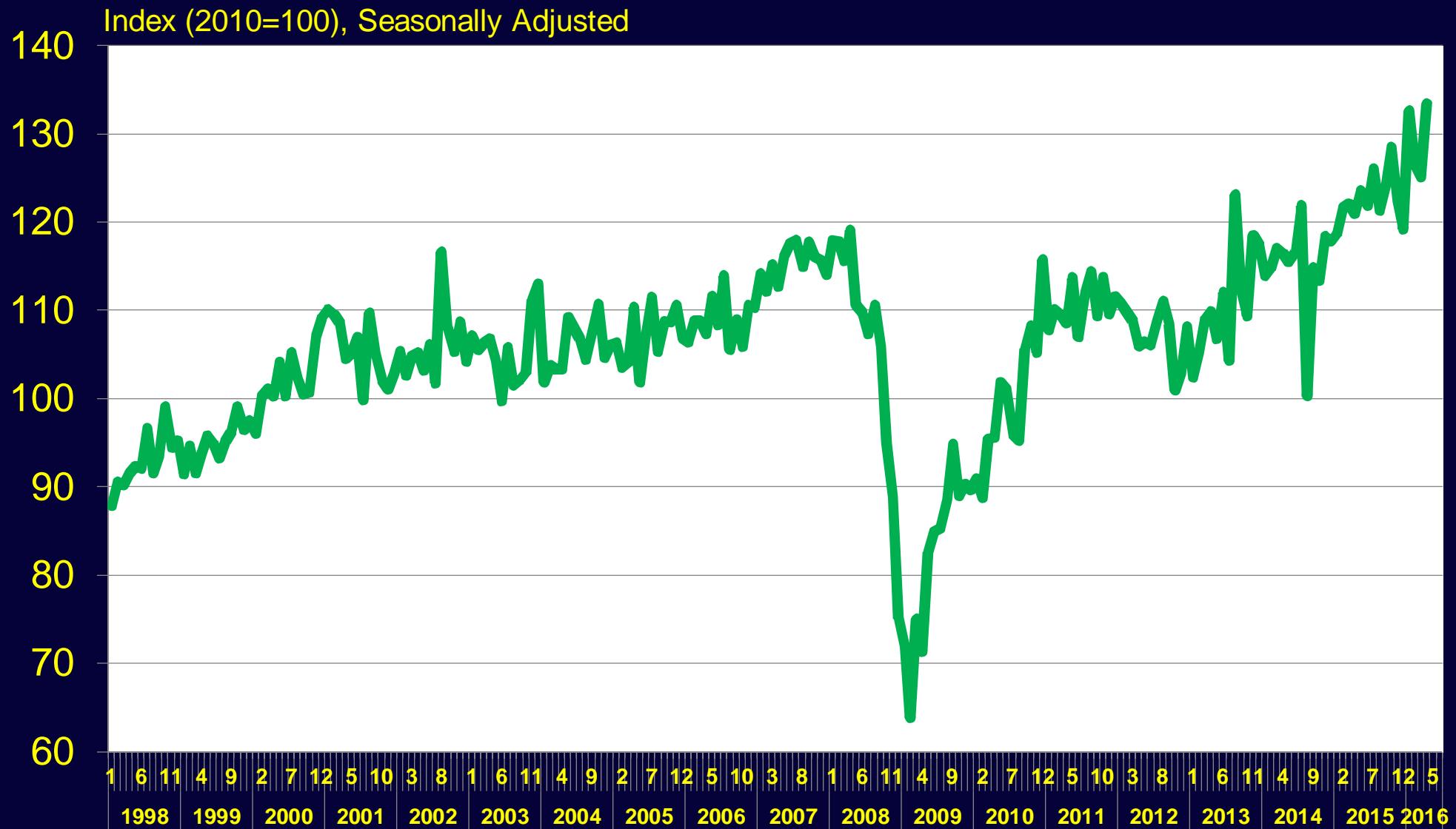
# Automotive Equipment Suppliers Composite of 15 Public Companies Revenue, Net Income & Inventory



Autoliv, Borg Warner, Continental AG, Delphi, Denso, Federal Mogul, Gentex, Hella, Johnson Controls, Lear, Magna, TRW Automotive, Valeo, Visteon, ZF Friedrichshafen

20160613

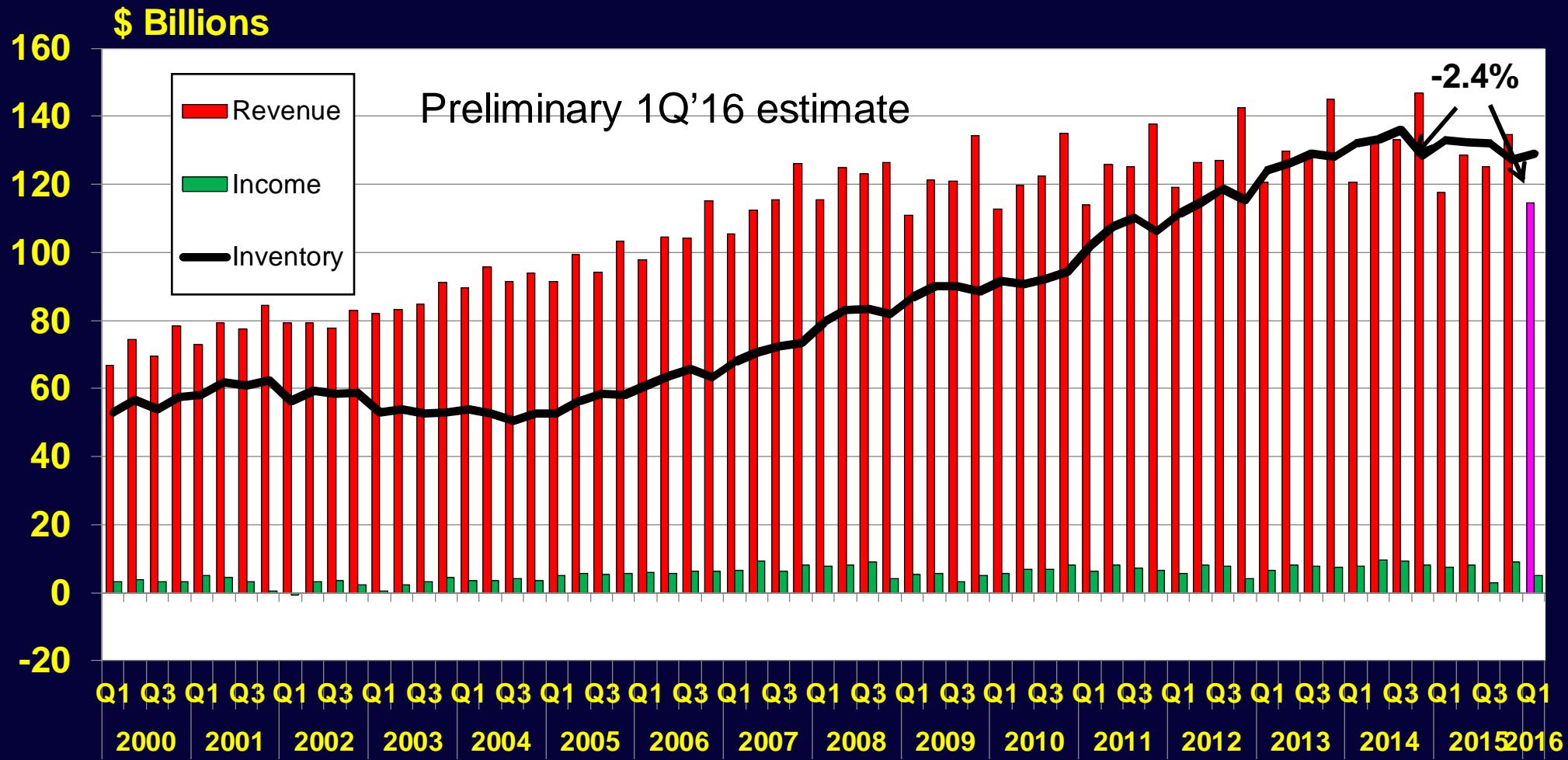
# European Motor Vehicle Production



Eurostat, C291 category, EU 27 countries

# Military & Aerospace Composite of 22 Public Companies

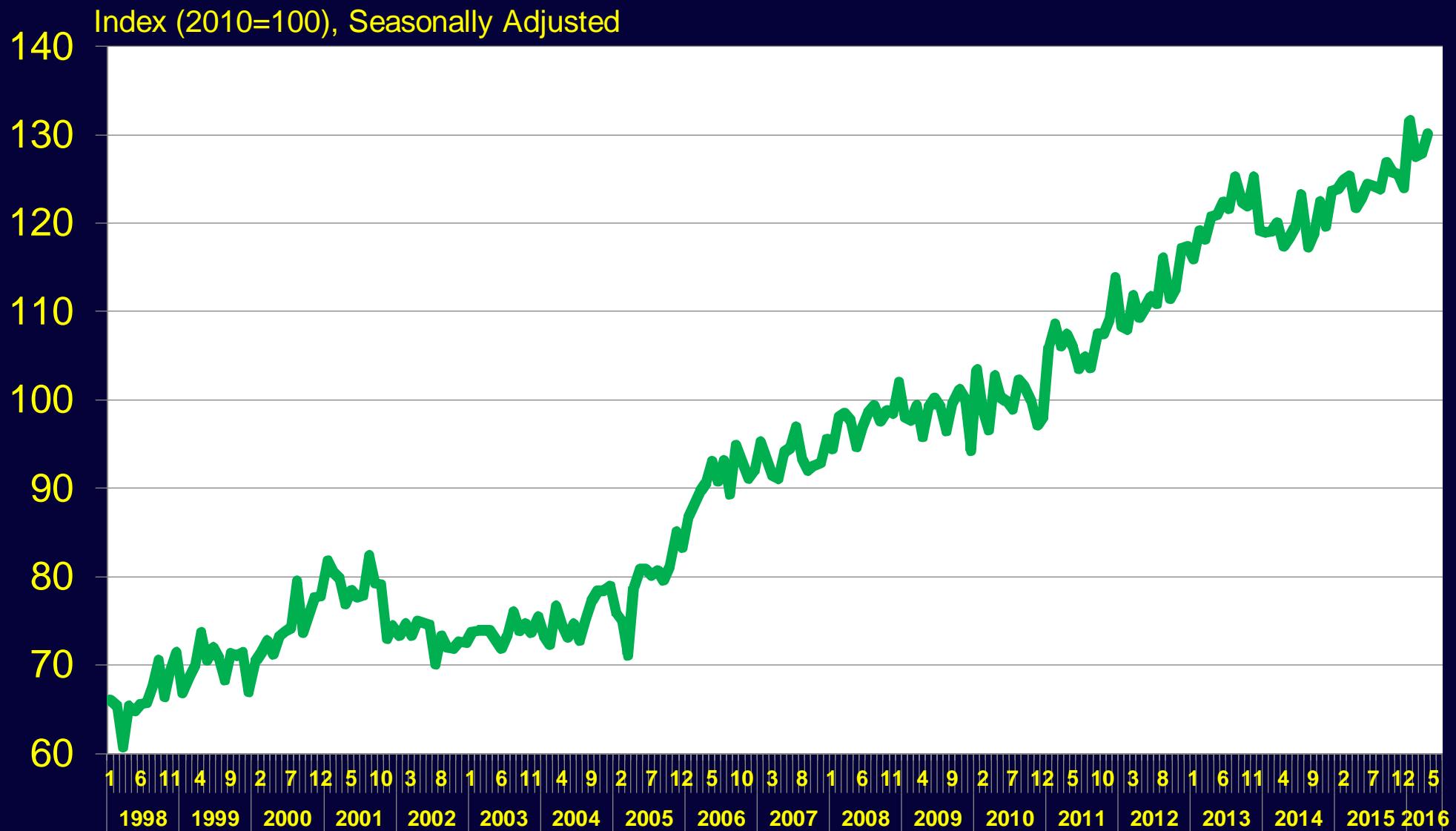
## Revenue, Net Income & Inventory



Boeing, Bombardier, EADS (Airbus), Finmeccanica, General Dynamics, Halliburton, Harris, Honeywell (military portion), L-3 Communications, Lockheed, Moog, Northrop Grumman, Raytheon, Rockwell Collins, Textron, Thales, United Technology

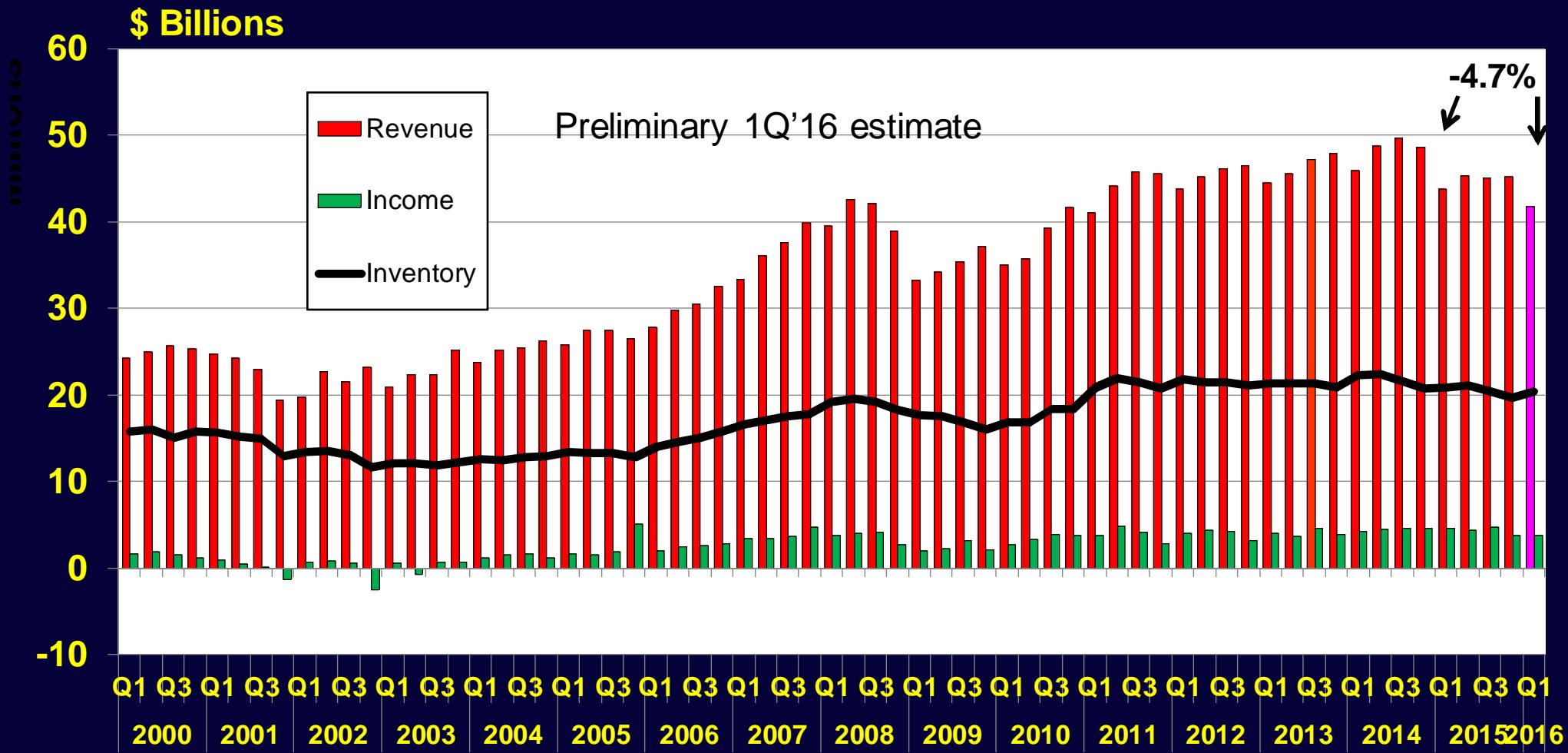
20160613

# European Production - Aircraft, Spacecraft & Related Equipment



# Instruments & Control Equipment Composite of 16 Public Companies

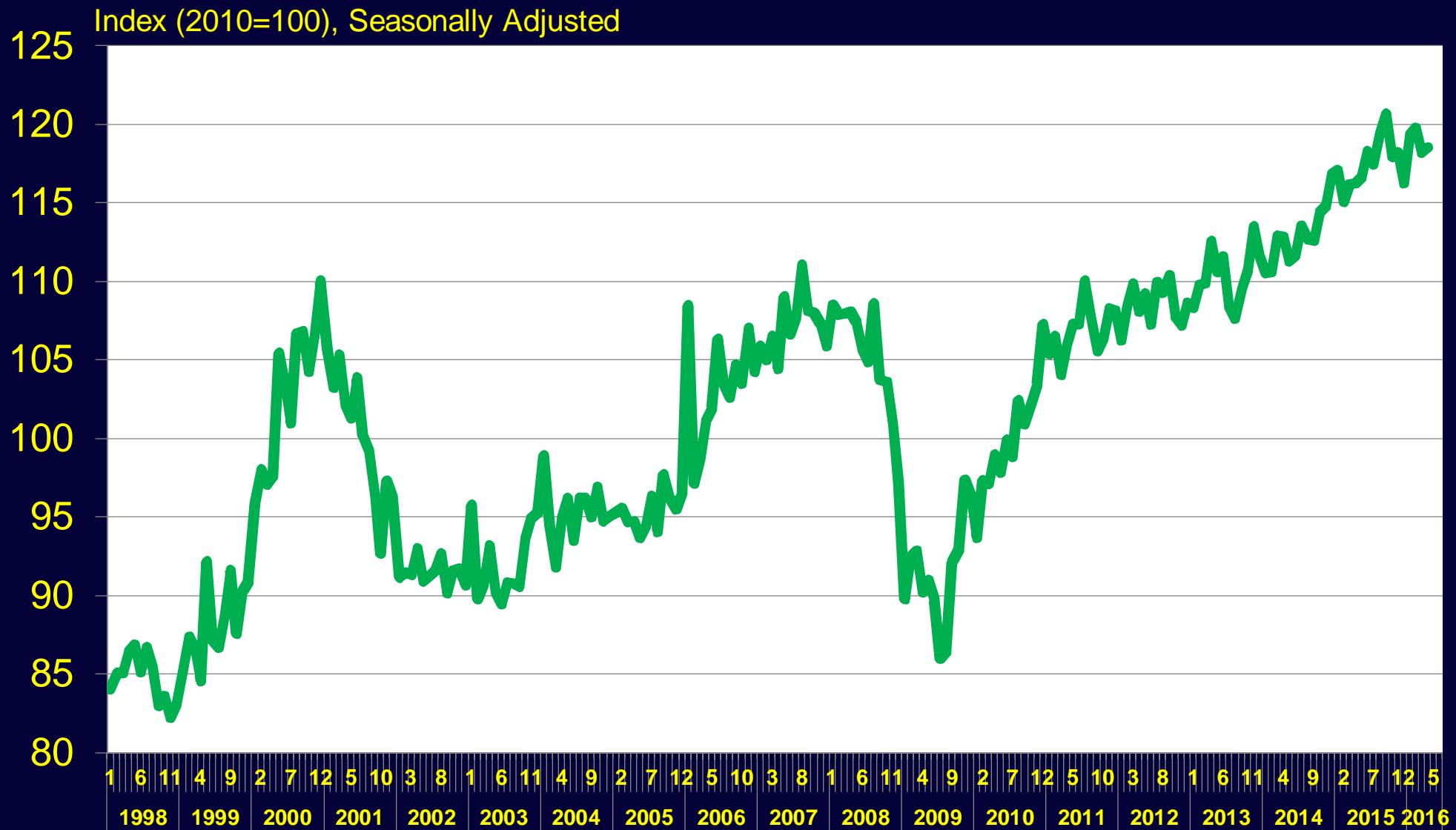
## Revenue, Net Income & Inventory



ABB, Agilent, Ametek, Emerson, Itron, Keysight, National Instruments, PerkinElmer, Rockwell Automation, Rotork, Teledyne, ThermoFisher, Woodward Govenor

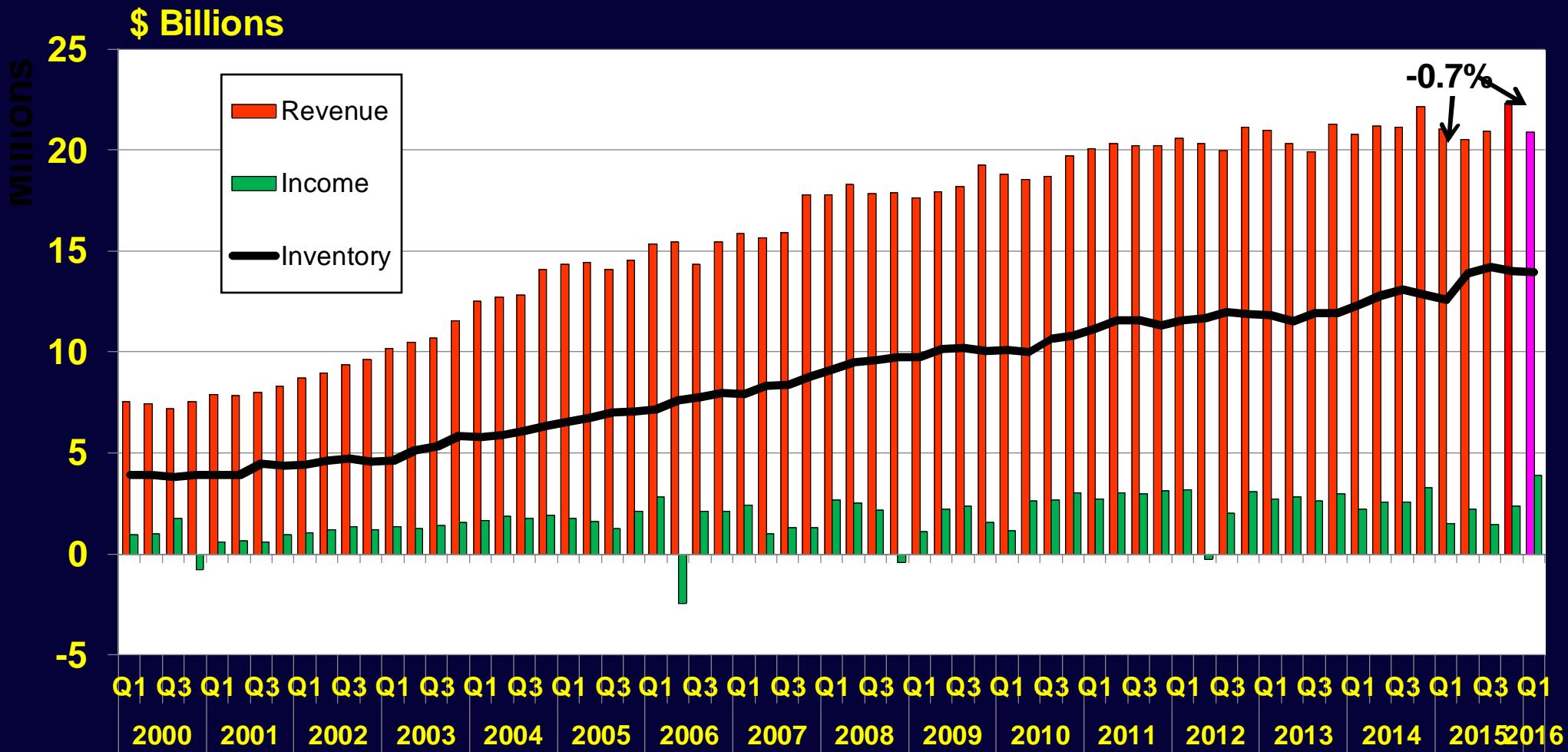
20160613

# European Production - Instruments & Appliances for Measuring, Testing & Navigation



# Medical Equipment Composite of 21 Public Companies

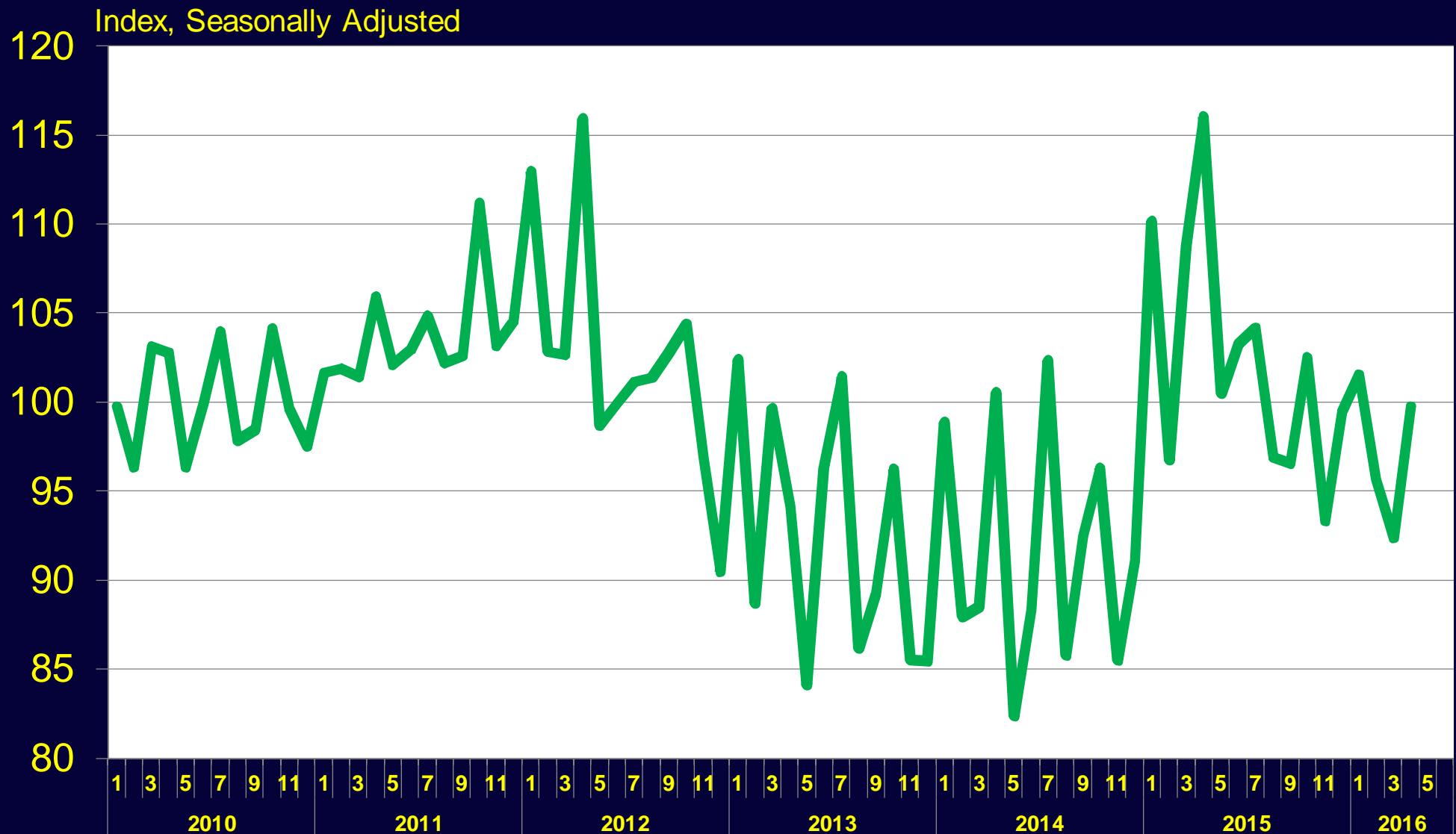
## Revenue, Net Income & Inventory



Analogic, Bio-Rad Laboratories, Boston Scientific, Bruker, CareFusion, Covidien, Draeger, Guidant, Hill-Rom, Intuitive Surgical, Invacare, Medtronic, ResMed, St Jude Medical, Smith & Nephew, STERIS, Stryker, Varian Medical, Waters, Zimmer

20160613

# European Production - Irradiation, Electromedical & Electrotherapeutic Equipment

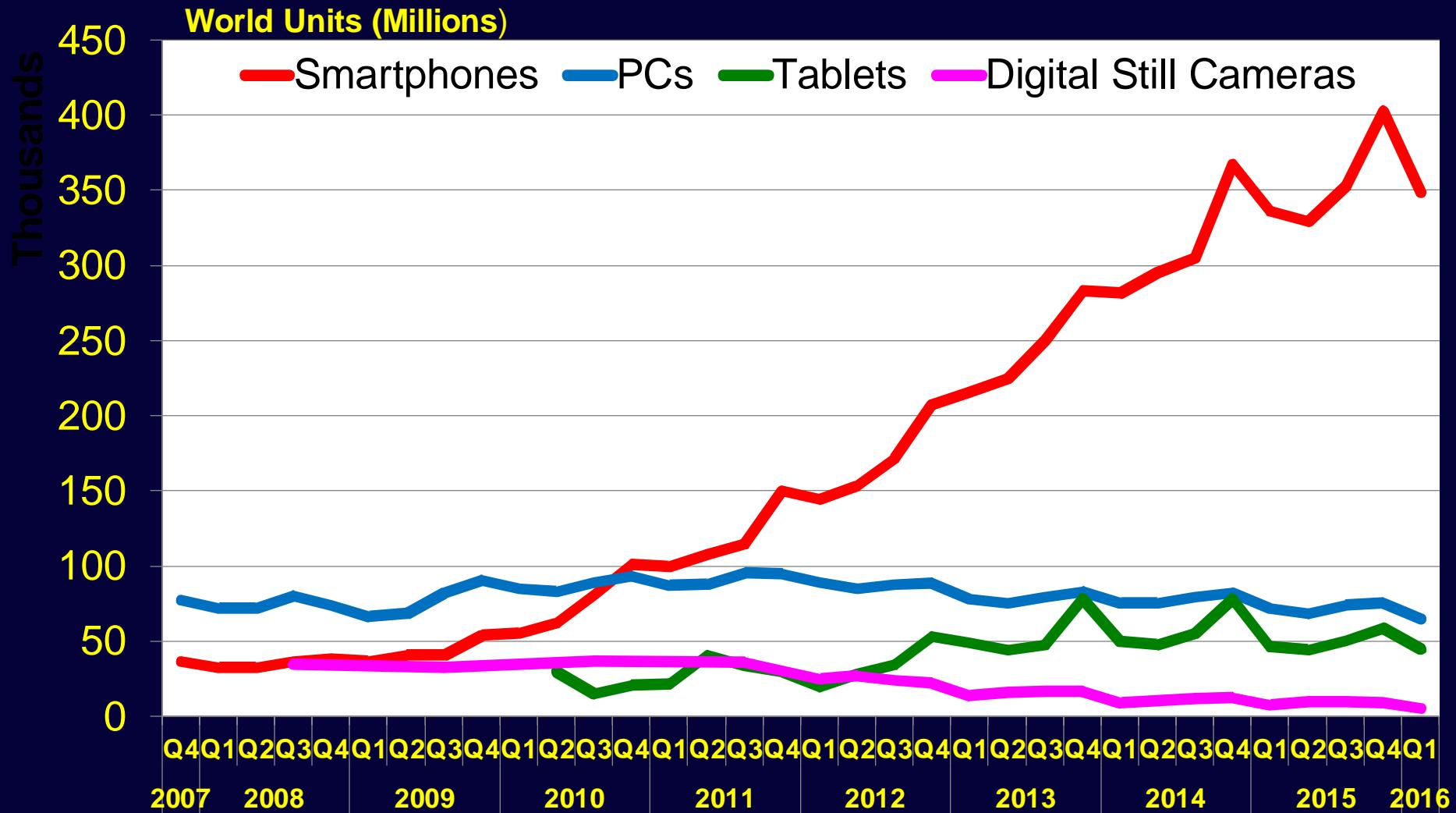


Eurostat, C266 category, EU 27 countries

# High Volume Consumer Driven Markets

20160521

# Smartphones Cannibalize PCs, Tablets & Digital Cameras

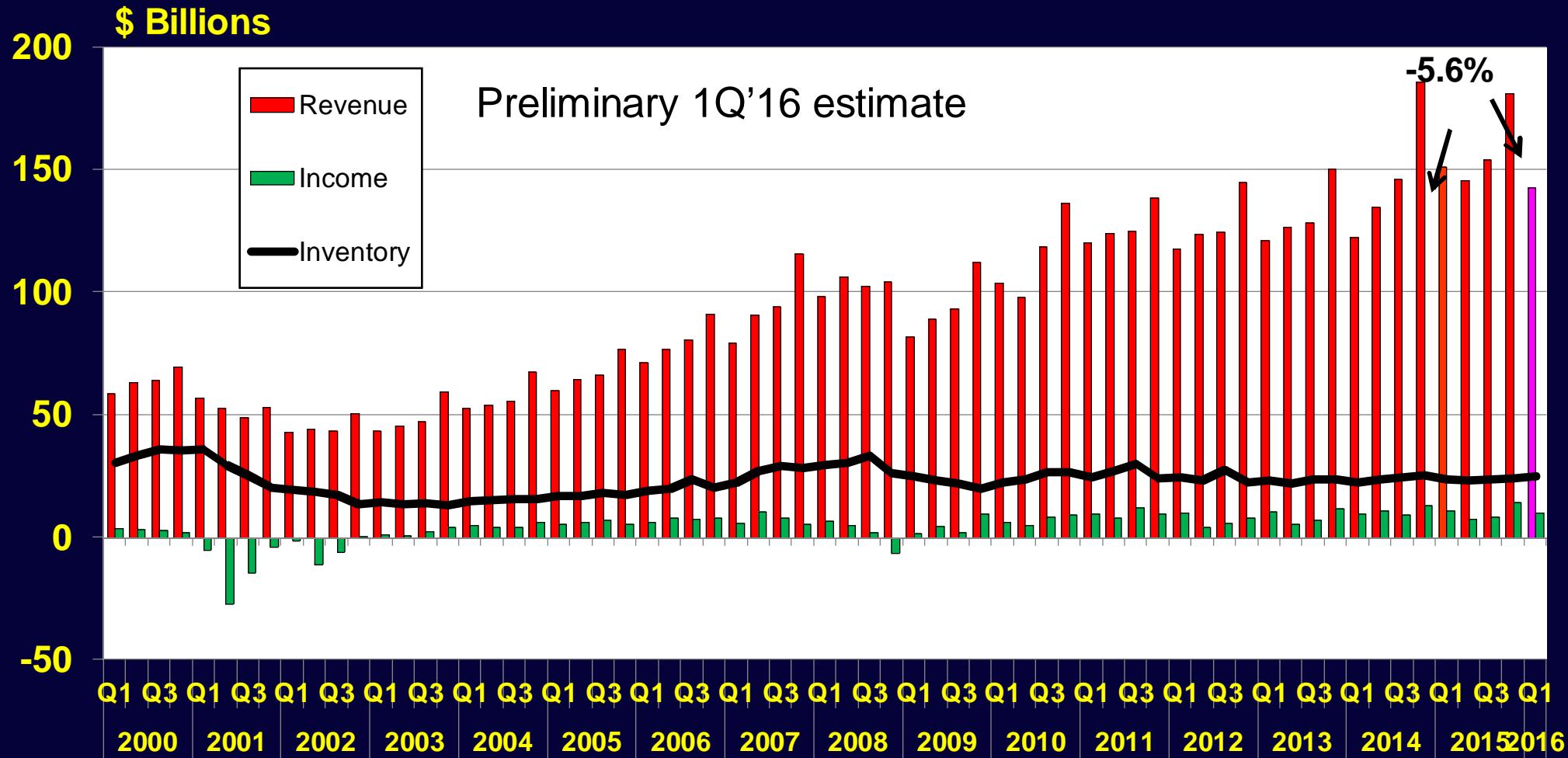


# Communication Equipment Suppliers Composite of 30 Companies

20160514

10 mobile phone makers, 20 other telecom equipment makers plus estimate of other mobile makers

## Revenue, Net Income & Inventory

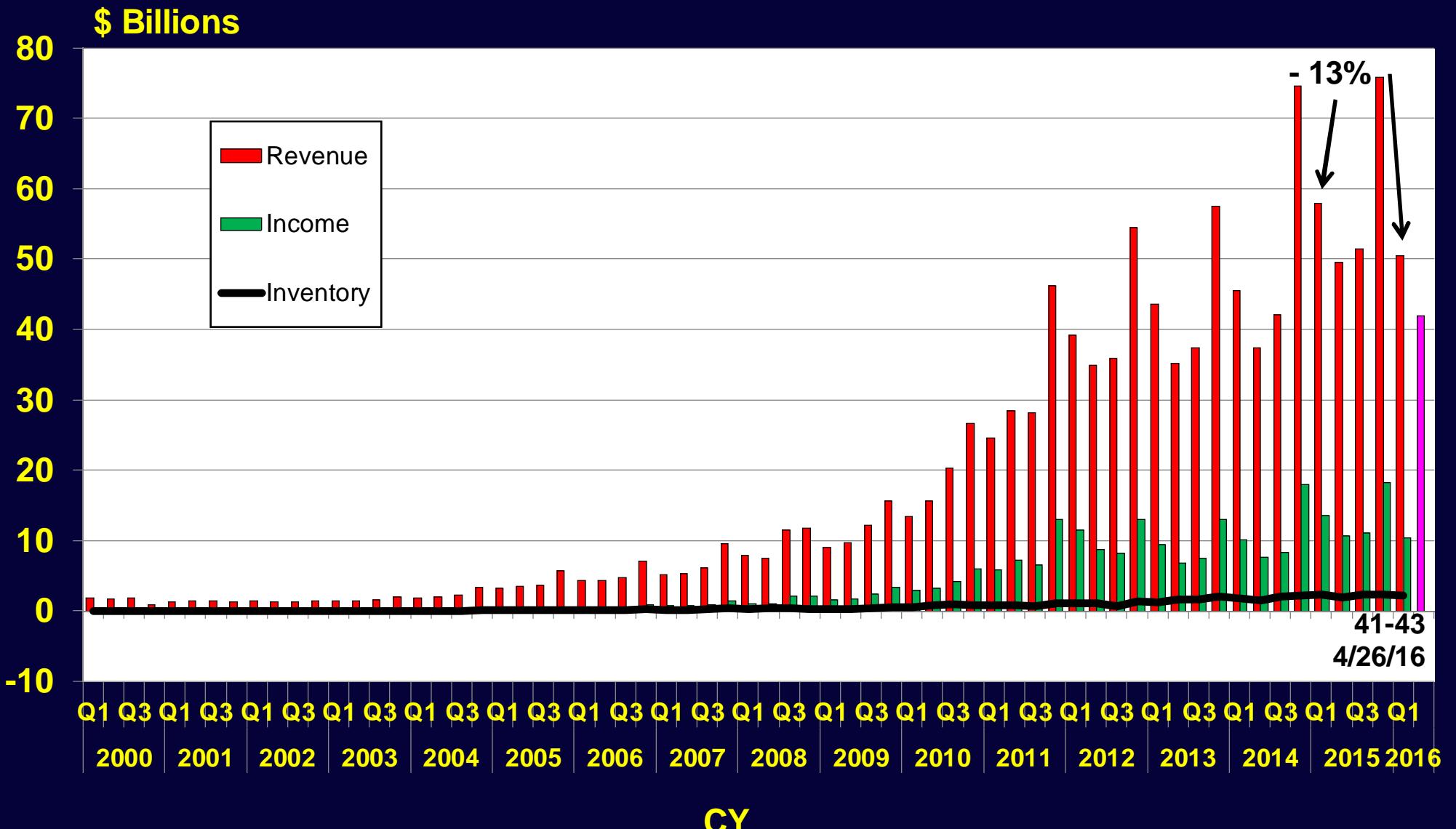


3COM, ADC Telecom, Alcatel+Lucent, Ciena, Ericsson, Motorola Solutions, Nokia, Polycom, TellLabs, Palm, Adva Optical Networking, Arris Group, AudioCodes, Broadsoft, Fabrinet, Gigamon, Infinera, Ixia, Neophotonics, Radware ; Apple iPhone, HTC, Huawei Device, LG, Motorola Mobility, Nokia, RIM, Samsung, Sony Mobility, ZTE; Euros & Krona converted at fluctuating exchange; mobile phone volumes from company reports & Gartner Dataquest quarterly unit shipment estimates; historical data included for acquired companies

20160428

# Apple Inc.

## Revenue, Net Income & Inventory



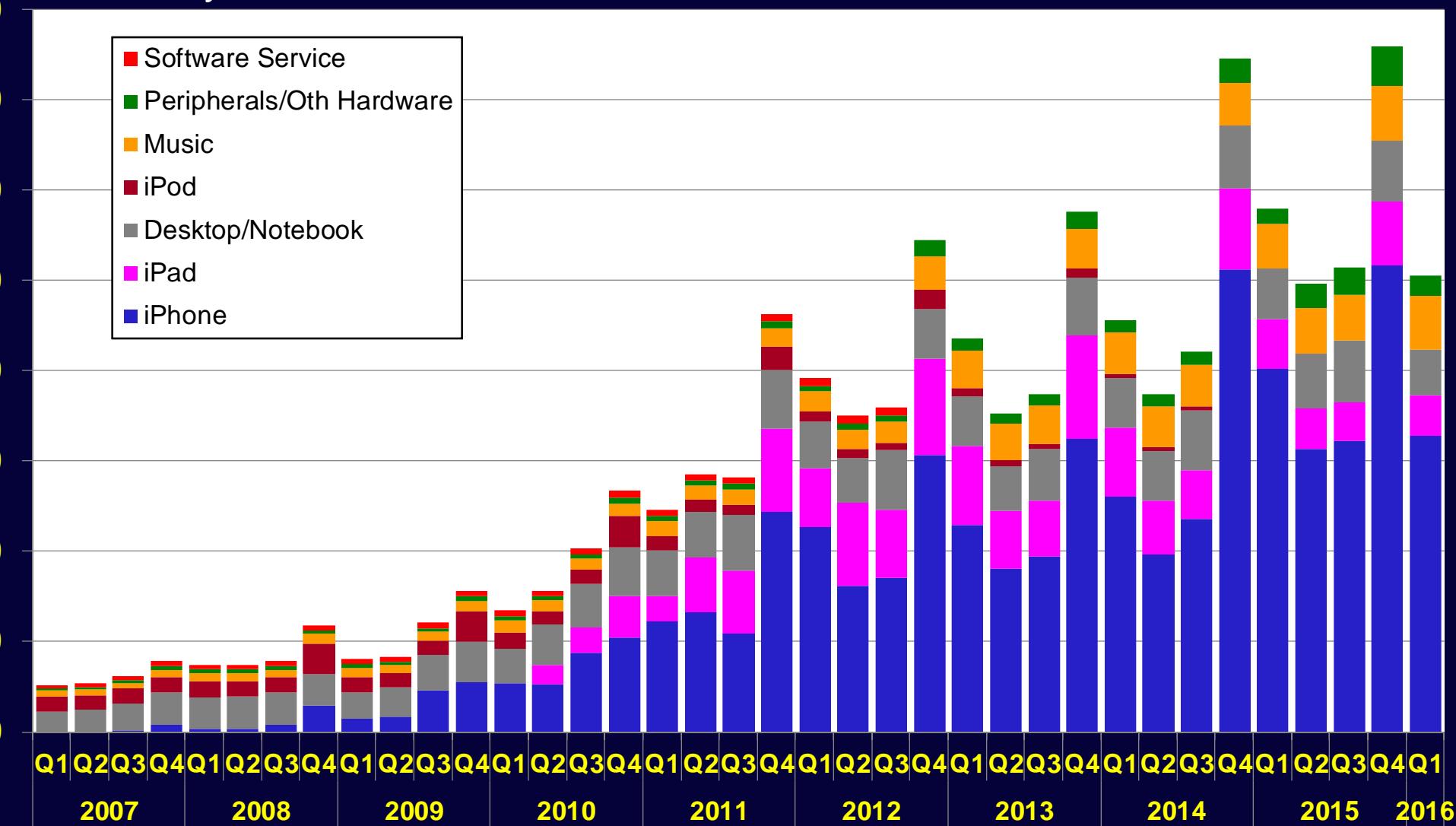
FY ends September

AAPL

# Apple Product Mix

20160503

Quarterly Revenues \$B



# Future High Volume Markets

**Autonomous cars**

**Internet of Things**

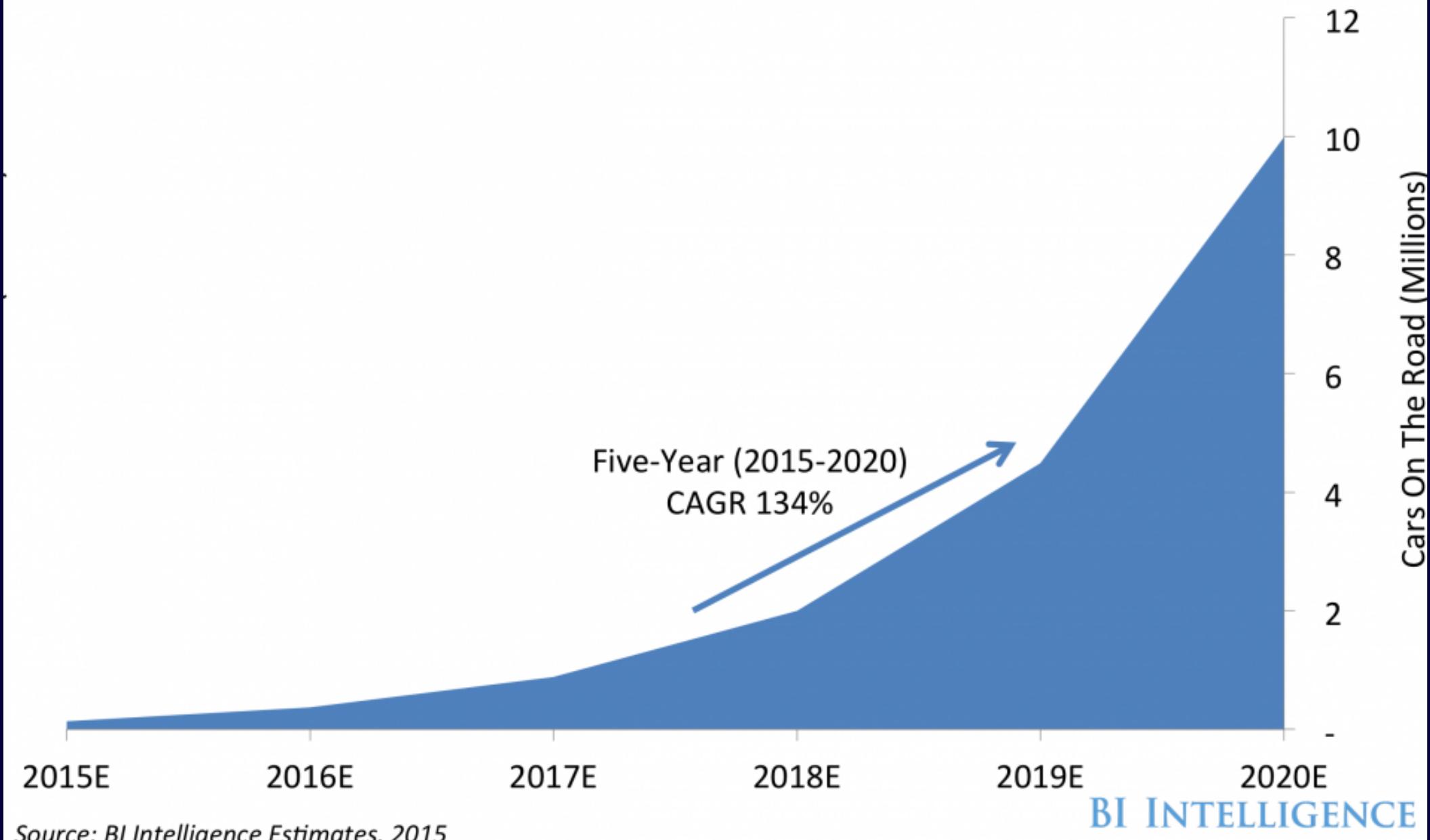
**Drones**

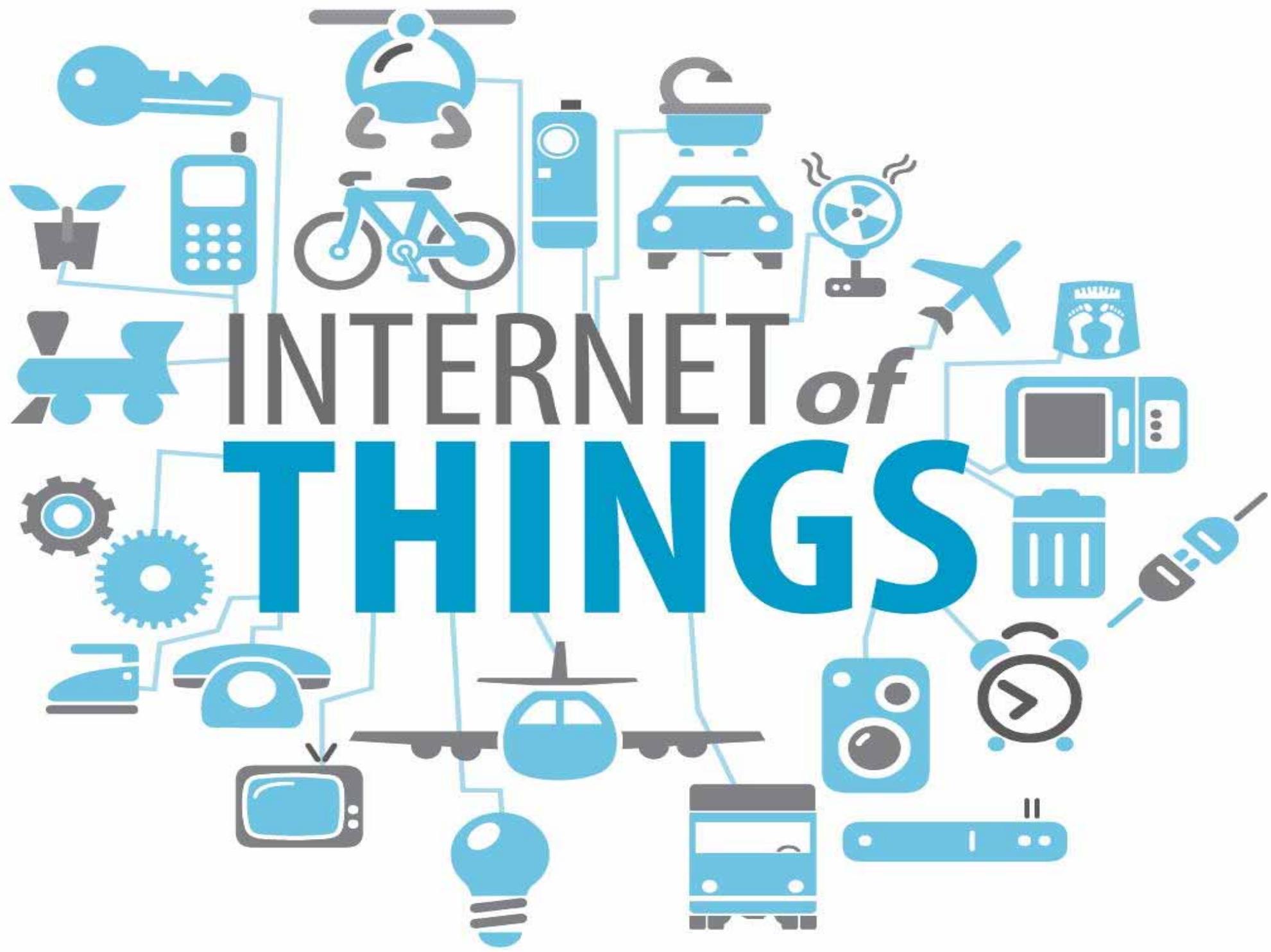
**Robots**

**Wearables**

# Estimated Global Installed Base Of Cars With Self-Driving Features

*All Levels*





# Wearable Devices 2015-2017

## Millions of Devices

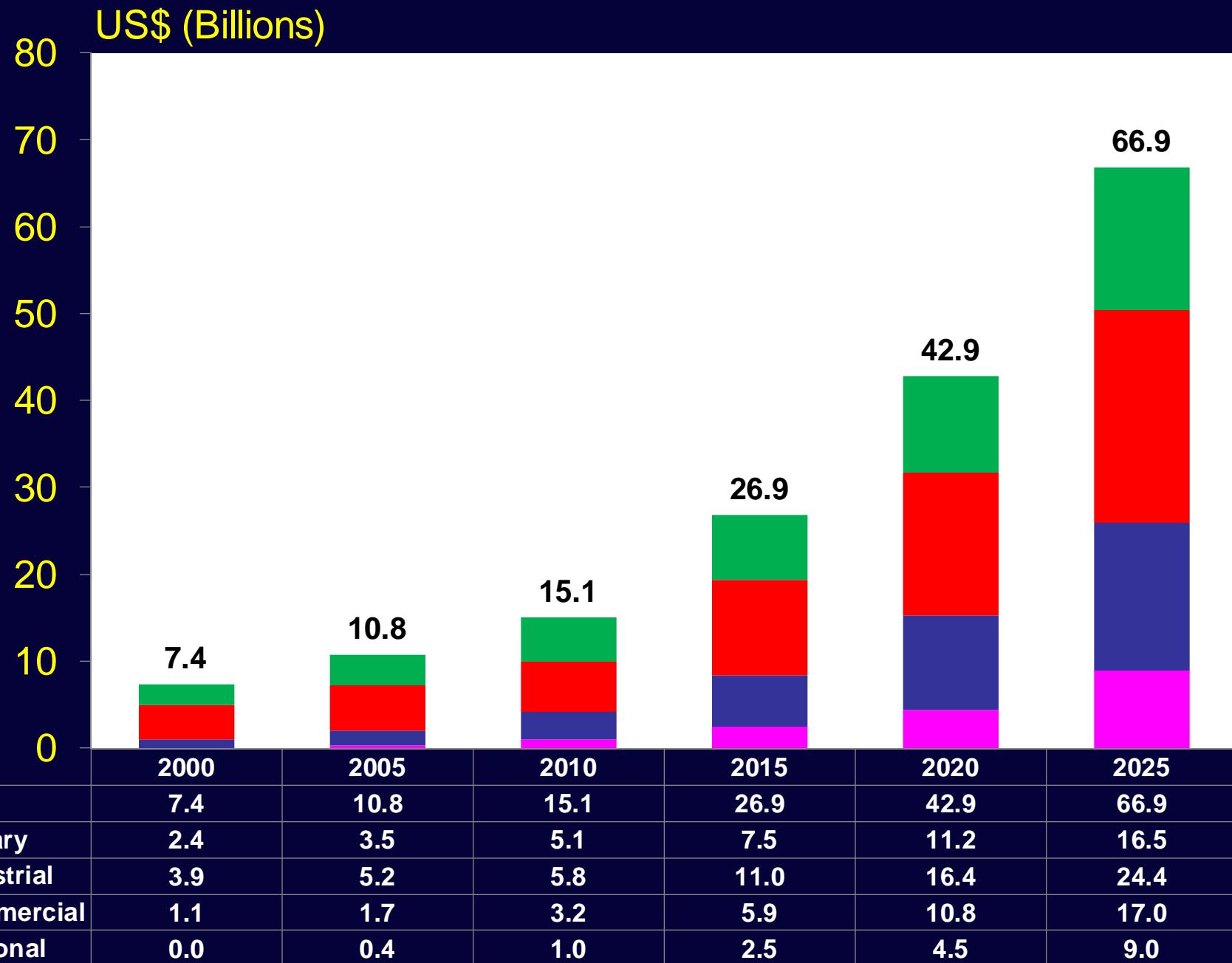
<u>Device</u>	<u>2015</u>	<u>2016</u>	<u>2017</u>
Smartwatch	30.3	50.4	66.7
Head-mounted Display	0.1	1.4	6.3
Body-worn Camera	0.1	0.2	1.1
Bluetooth Headset	116.3	128.5	139.2
Wristband	30.2	35.0	44.1
Smart Garment	0.1	1.0	5.3
Chest Strap	12.9	13.0	8.0
Sports Watch	21.0	24.0	26.9
Other Fitness Monitor	21.1	21.1	25.1
Total	232.0	274.6	322.7

**Most will take a few  
years  
to develop**

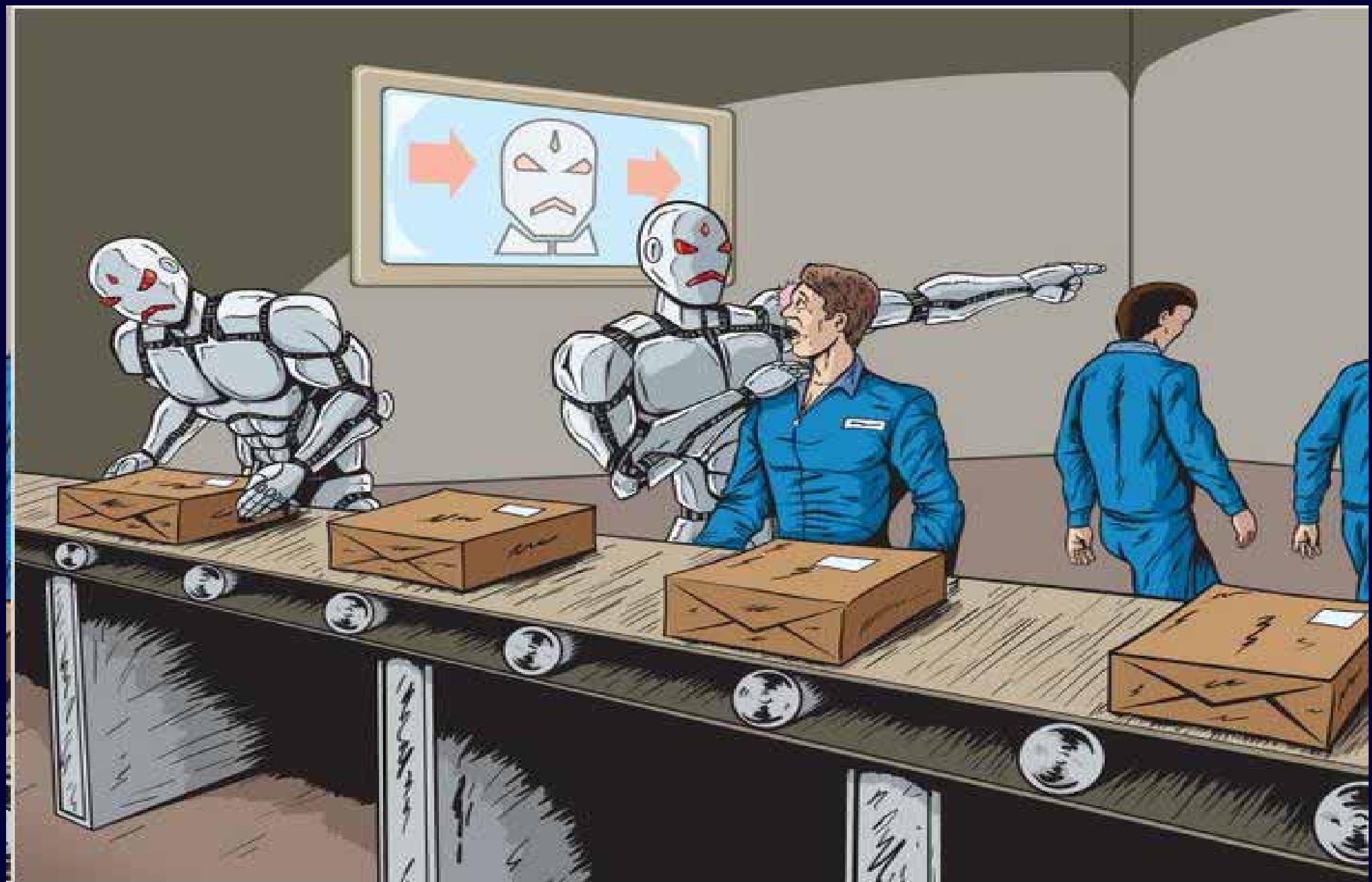
# A Key Exception



# World Spending on Robots



# Automation has its concerns



# Semiconductors

# 1Q'16 Semiconductor Sales Leaders (US\$ millions, including Foundries)

<u>Rank</u>	<u>Maker</u>	<u>1Q'16</u>	<u>1Q'16/1Q'15</u>
1	Intel	13,115	9%
2	Samsung Electronics	9,340	0%
3	TSMC (1)	6,122	-12%
4	Broadcom Ltd (2)	3,550	-4%
5	Qualcomm (2)	3,337	-25%
6	SK Hynix	3,063	-30%
7	Micron	2,930	-28%
8	TI	2,804	-5%
9	Toshiba	2,446	-7%
10	NXP	2,224	-16%
11	Infineon	1,776	7%
12	MediaTek (2)	1,691	12%
13	ST	1,601	-6%
14	Renesas	1,415	-4%
15	Apple (2)	1,390	10%
16	GlobalFoundries (1)	1,360	-5%
17	Nvidia (2)	1,285	15%
18	Sony	1,125	-12%
19	UMC (1)	1,034	-9%
20	AMD (2)	832	-19%
	<b>Total Top 20</b>	<b>62,440</b>	<b>-6%</b>

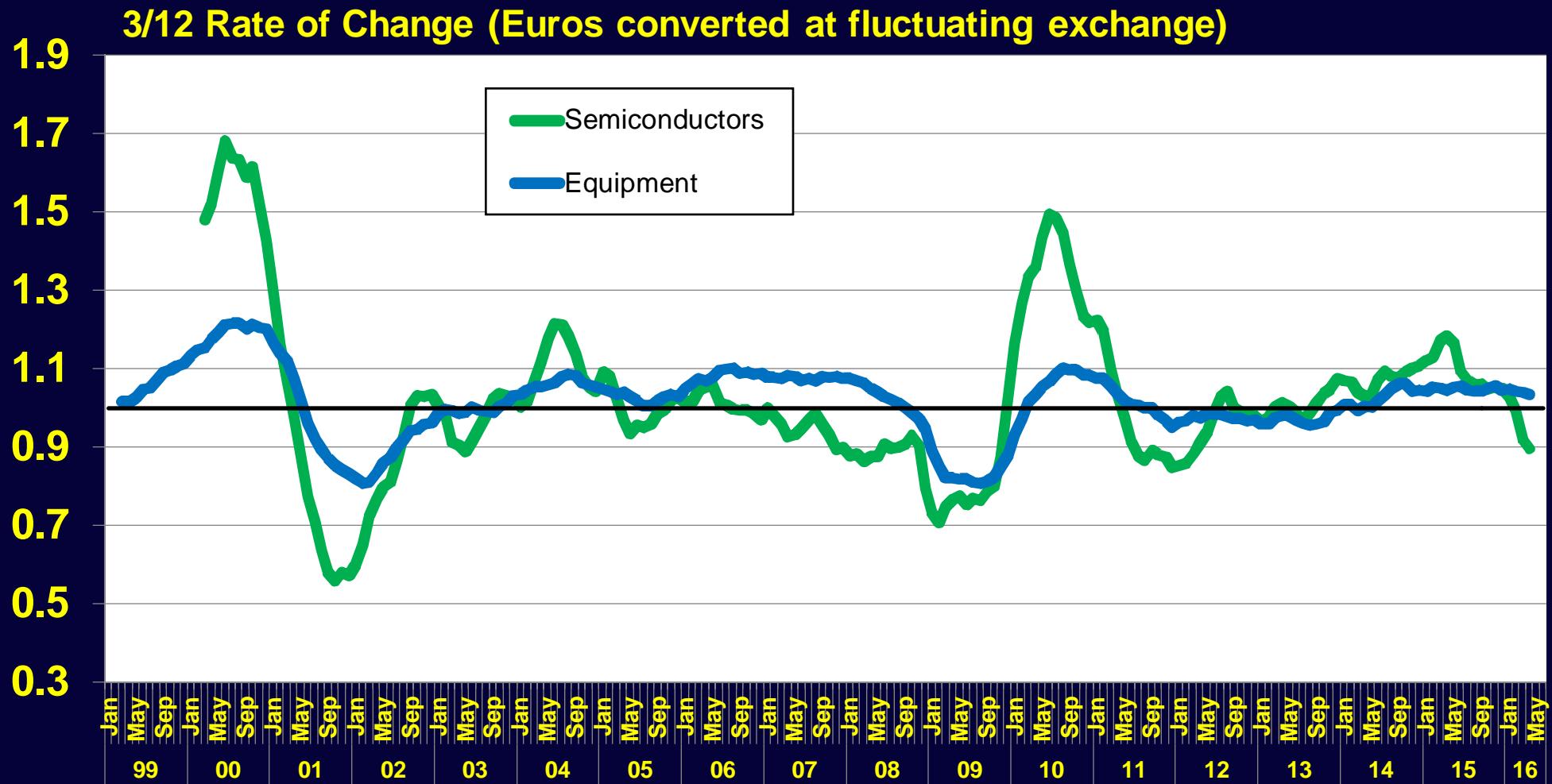
# Monthly Semiconductor Shipments

## \$ Billions (3-month avg in US\$)

20160608

	<u>4/15</u>	<u>4/16</u>	<u>% CH</u>
Americas	<b>5.81</b>	<b>4.78</b>	<b>- 14.8%</b>
Europe	<b>2.89</b>	<b>2.64</b>	<b>- 8.6%</b>
Japan	<b>2.54</b>	<b>2.60</b>	<b>+ 2.2%</b>
China	<b>7.77</b>	<b>7.79</b>	<b>+ 0.3%</b>
Asia Pacific / All Other	<b>8.74</b>	<b>8.03</b>	<b>- 8.2%</b>
Total	<b>27.56</b>	<b>25.84</b>	<b>- 6.2%</b>

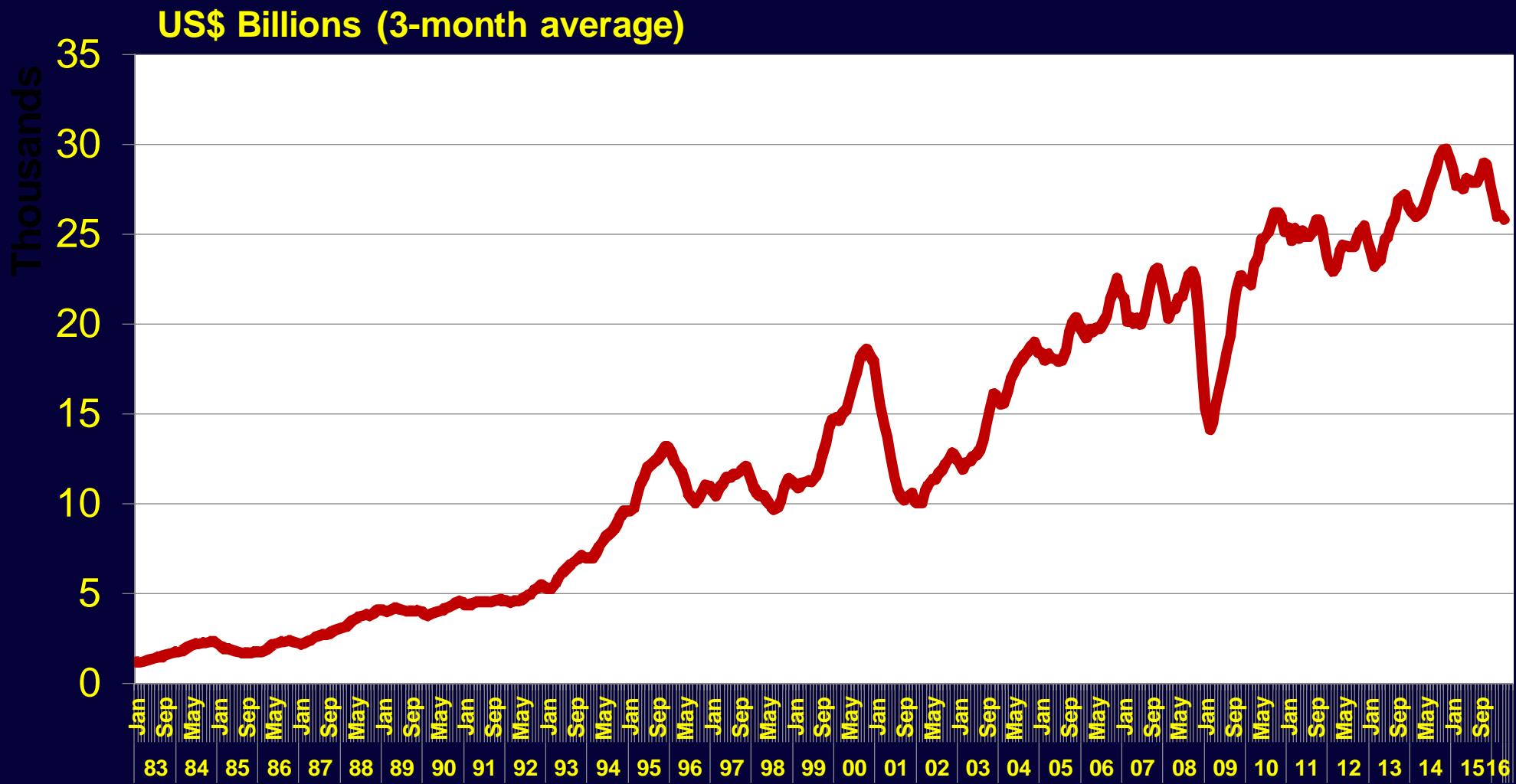
# Semiconductor Shipments to Europe vs. European Electronic Equipment Production



Total \$ Semiconductor Shipments from All Countries to Europe [www.sia-online.org/](http://www.sia-online.org/),  
Eurostat class C26, EU27, European Computer, Electronic & Optical products Production

# World Semiconductor Shipments

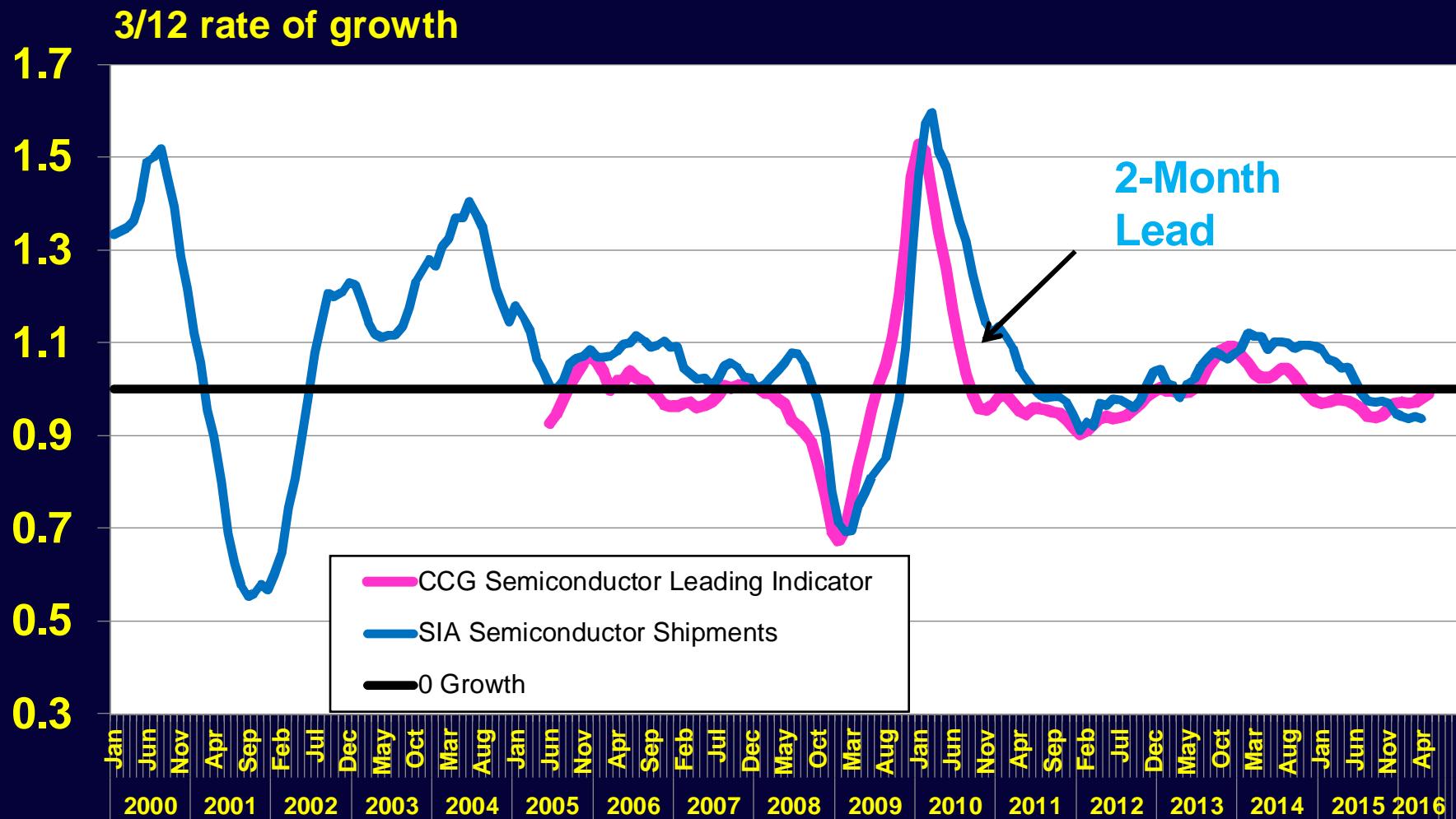
## Monthly US\$



SIA

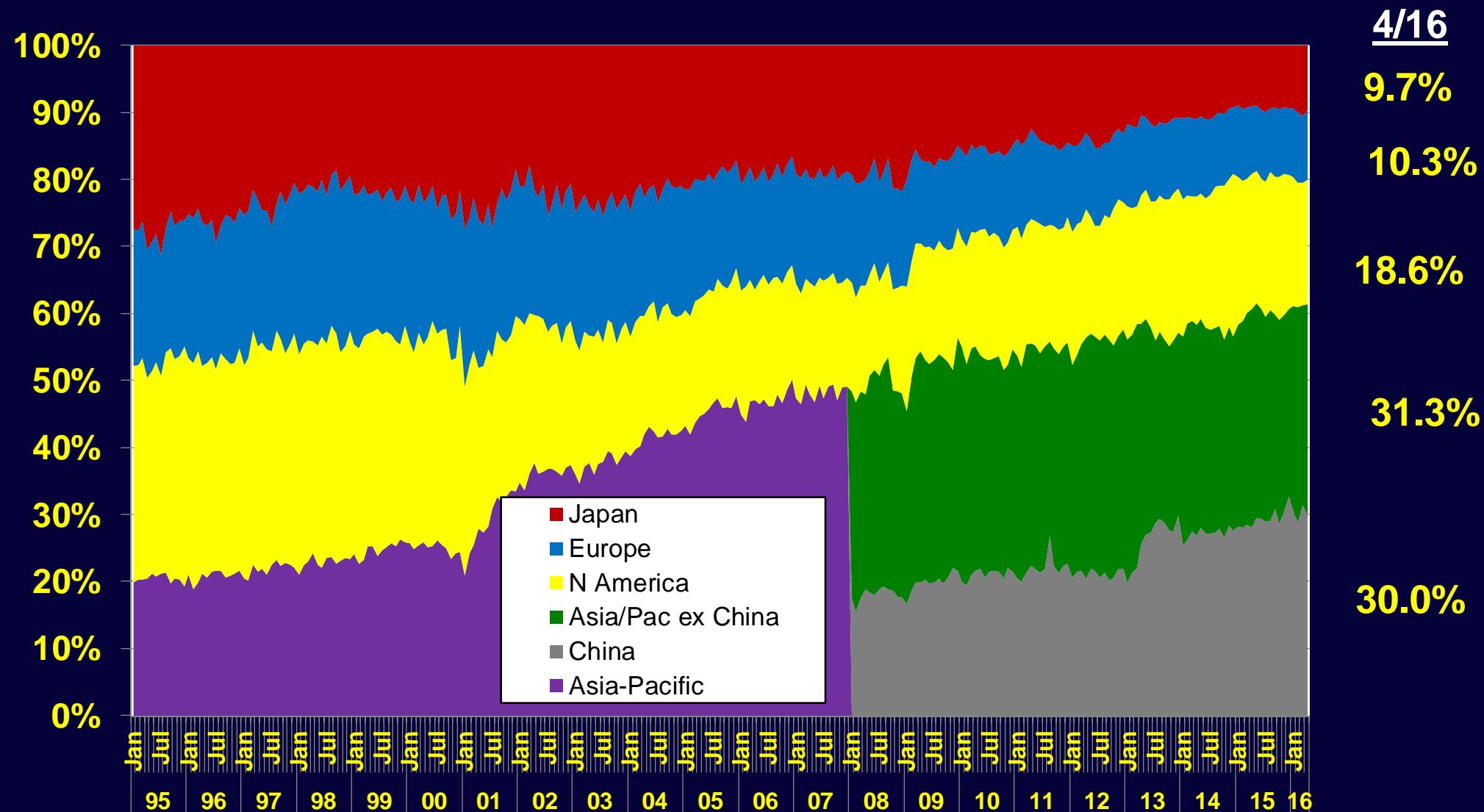
# CCG Semiconductor Leading Indicator vs. Global Semiconductor Shipments

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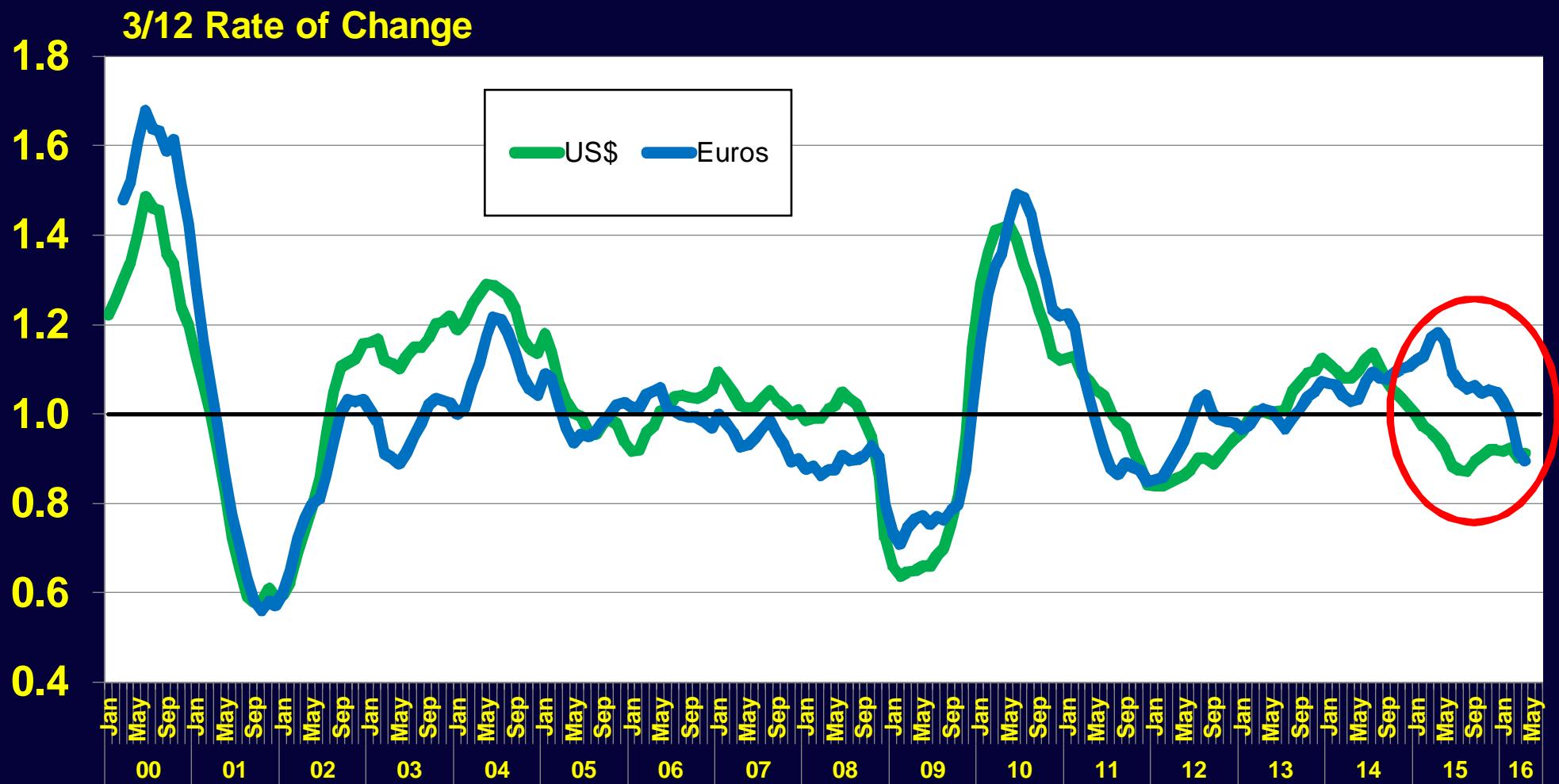


# Total Semiconductor Shipments to an Area

## Monthly Shipments - Reporting Firms (showing China)

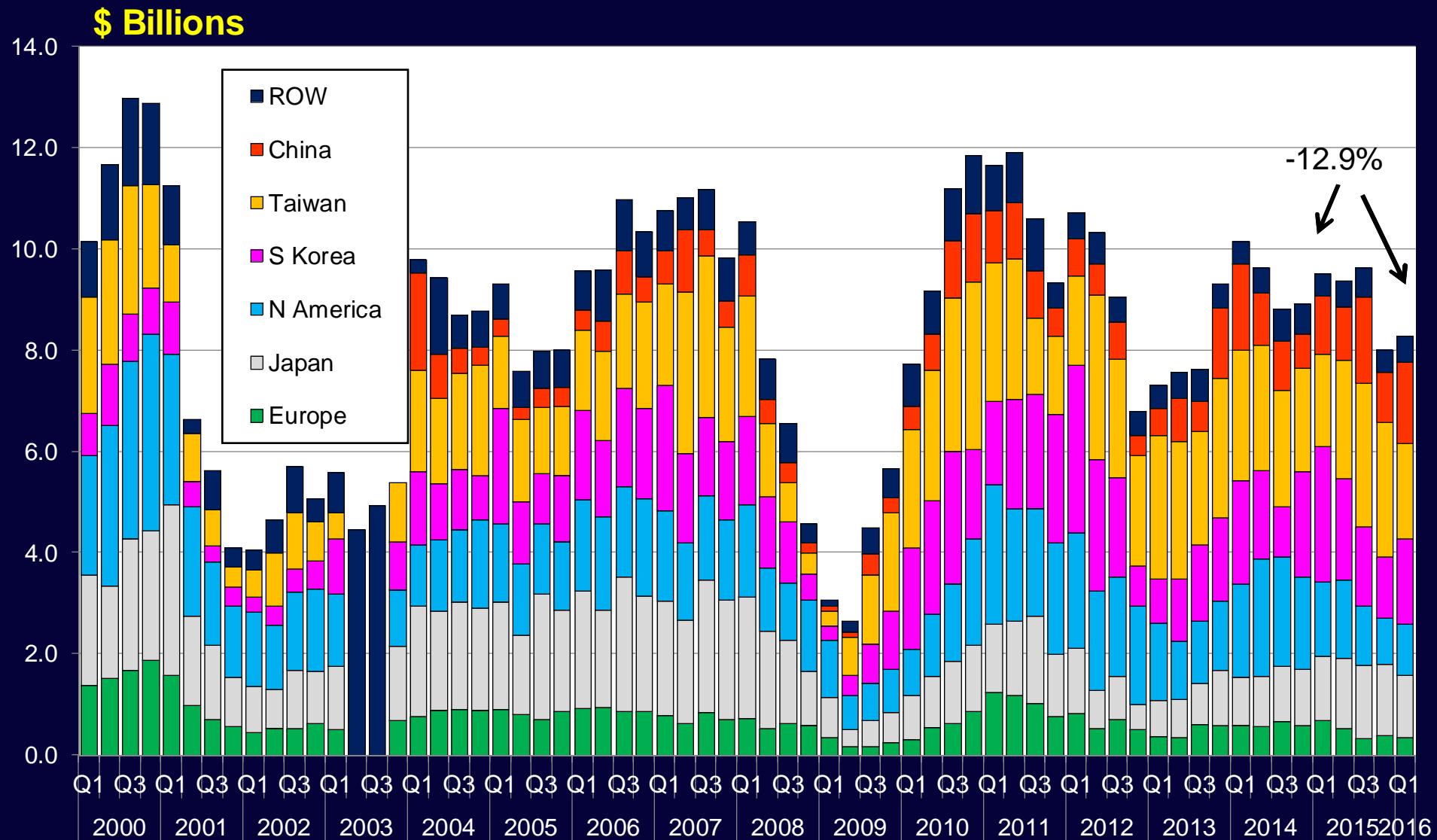


# Effect of Exchange Rates on Semiconductor Shipment Growth to Europe



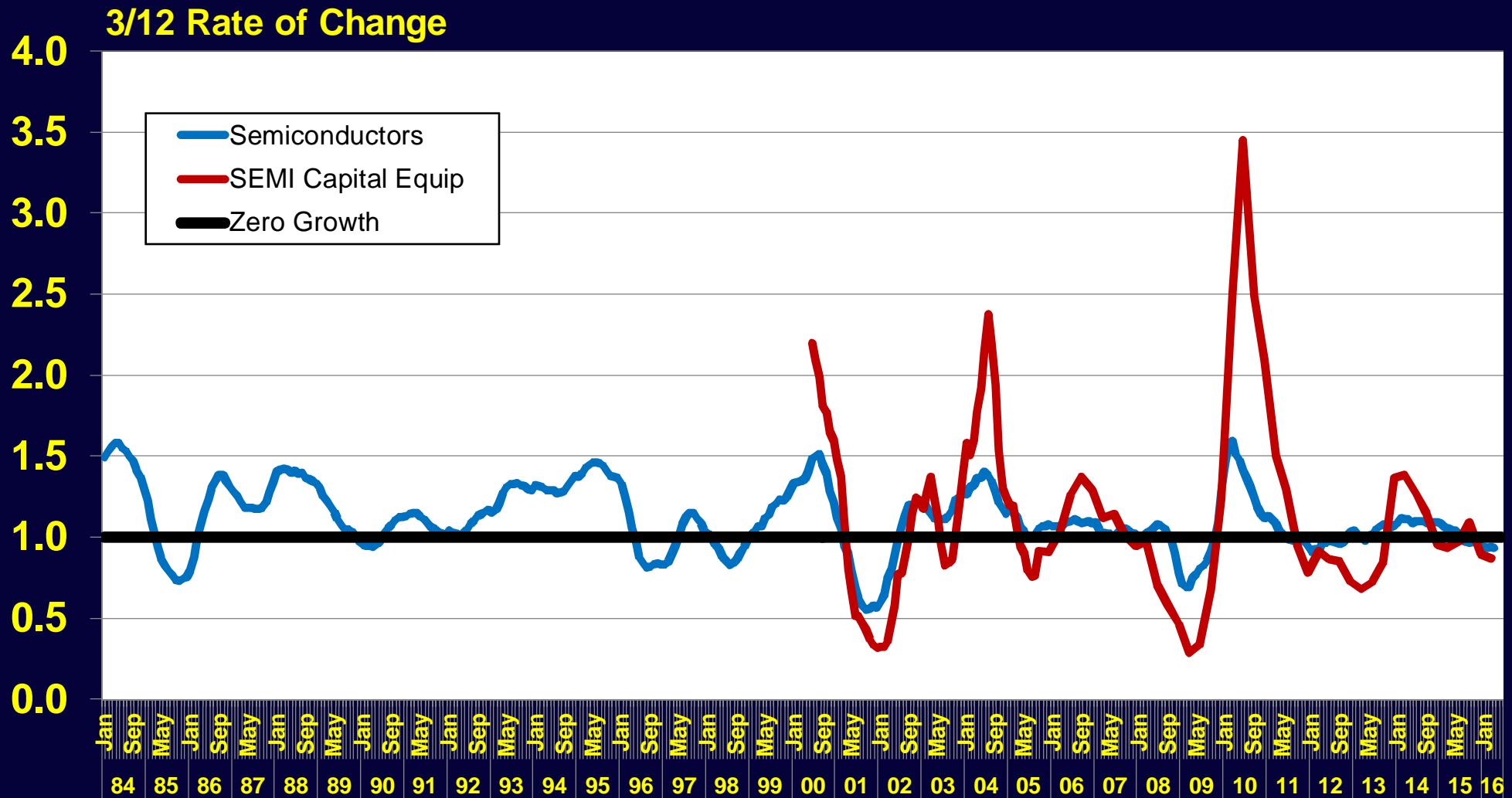
# Semiconductor Capital Equipment

# Semiconductor Capital Equipment Shipments by Area



# Global Semiconductor & Semiconductor Capital Equipment 3-Month Shipment Growth Rates on \$ Basis

20160607



Sources: SIA; Semiconductor Equipment Association of Japan, [www.semi.org](http://www.semi.org), Custer Consulting Group SEMI equipment sector composite growth

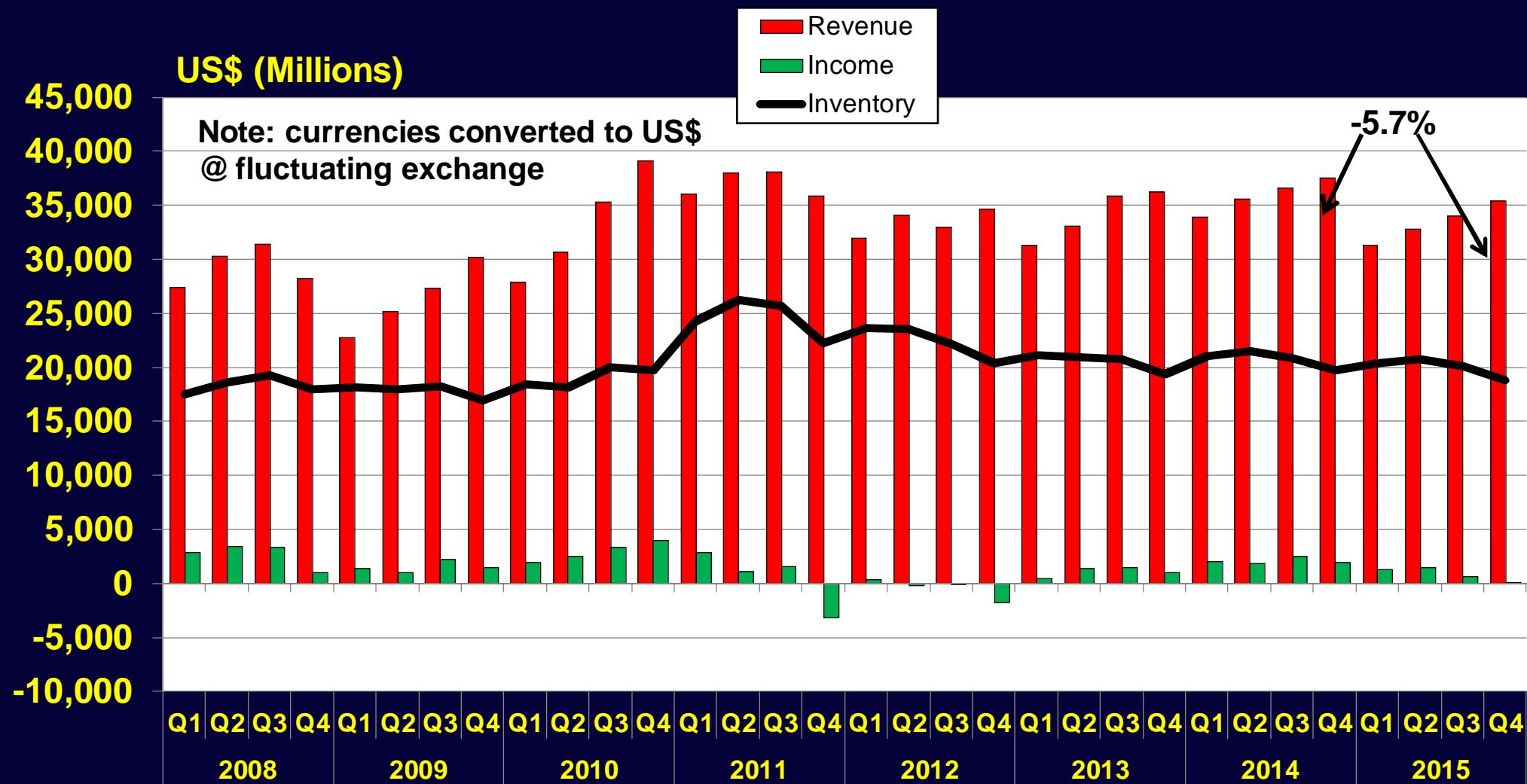
# **Solar/Photovoltaic**

20160519

# Solar/Photovoltaic Financials

## Composite of 90 Public Global Companies

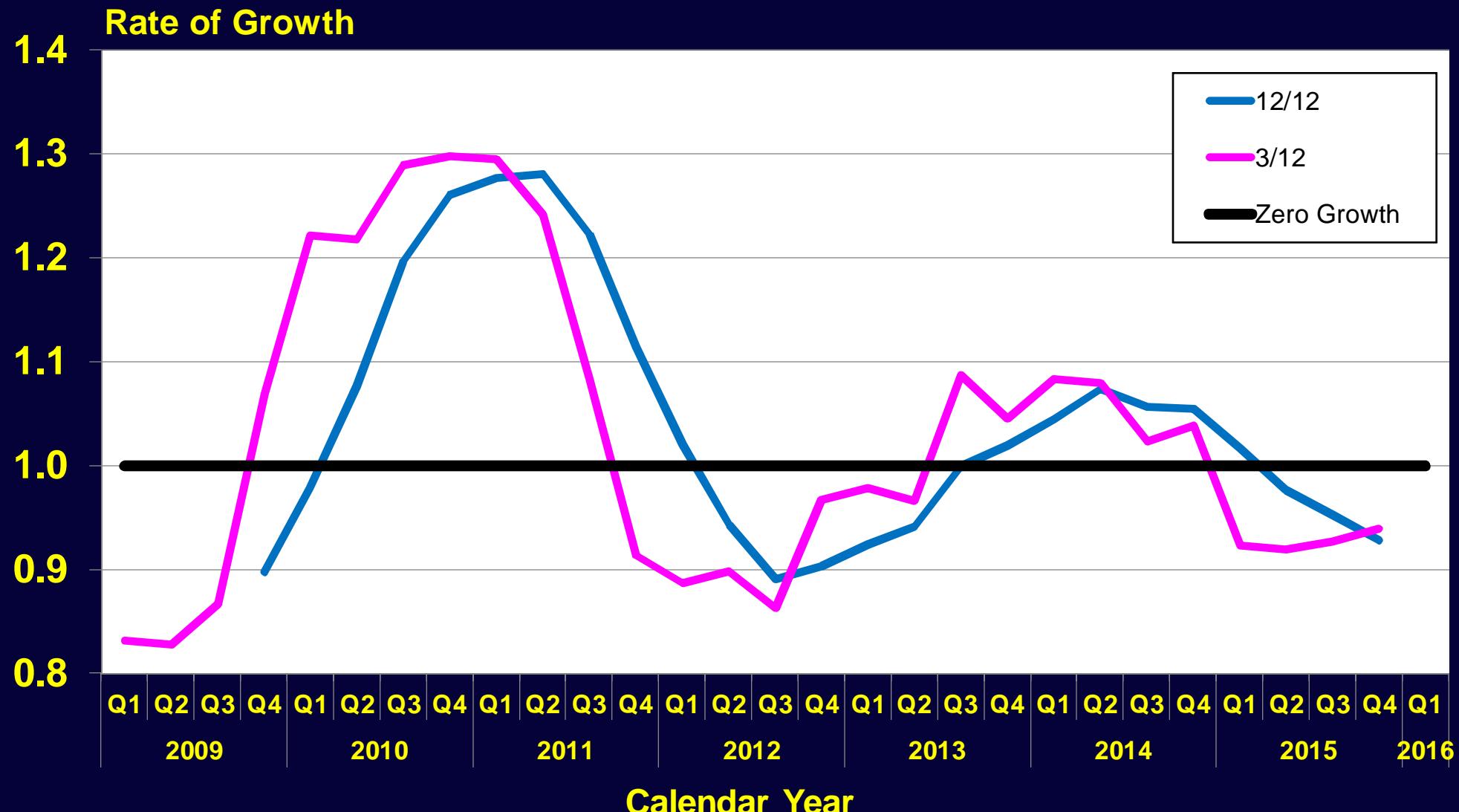
### Revenue, Net Income & Inventory



# Global Solar/Photovoltaic Growth

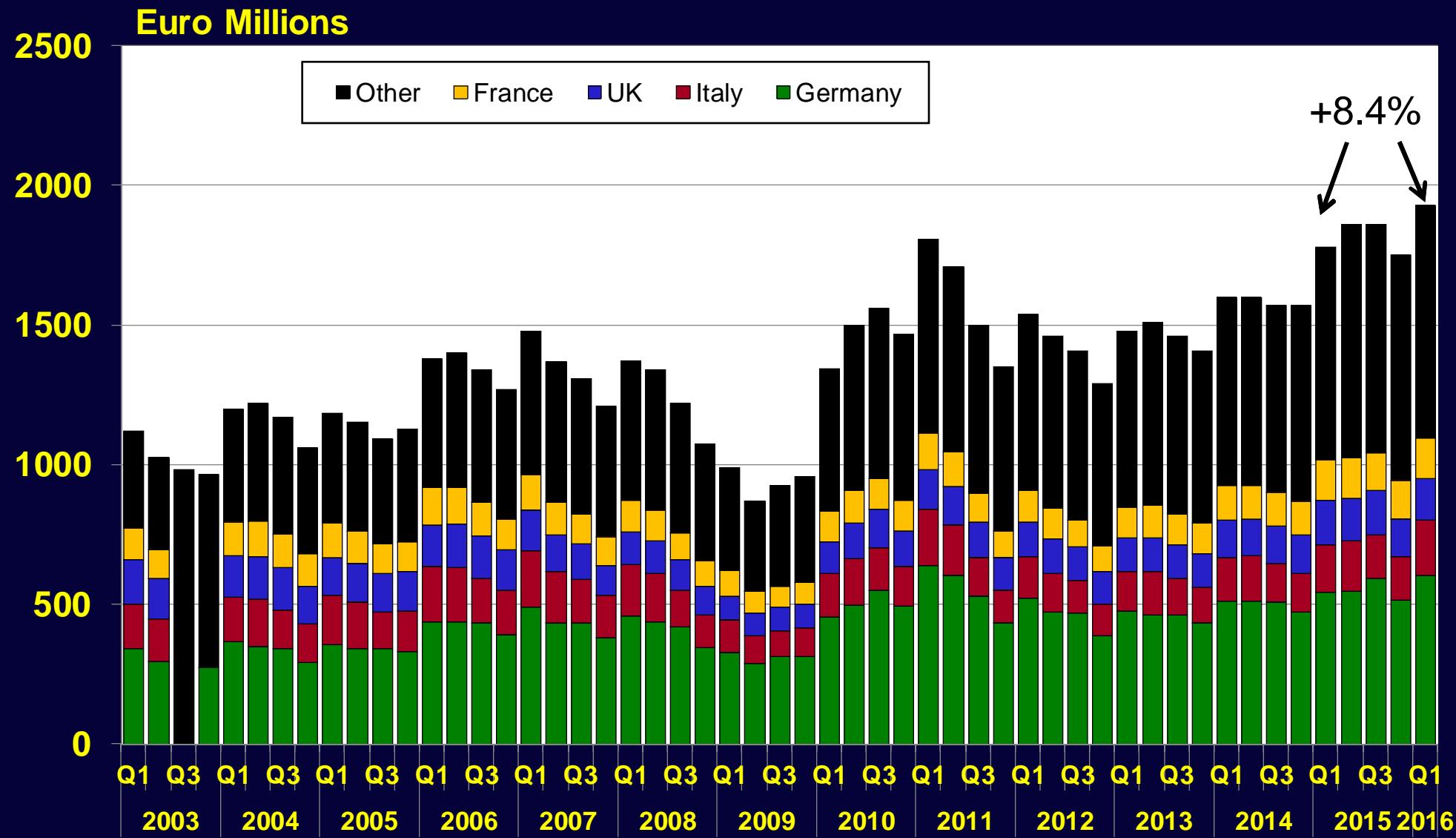
## Total Industry based upon 90 Company broad sample

### 3/12 & 12/12 Rate of Change



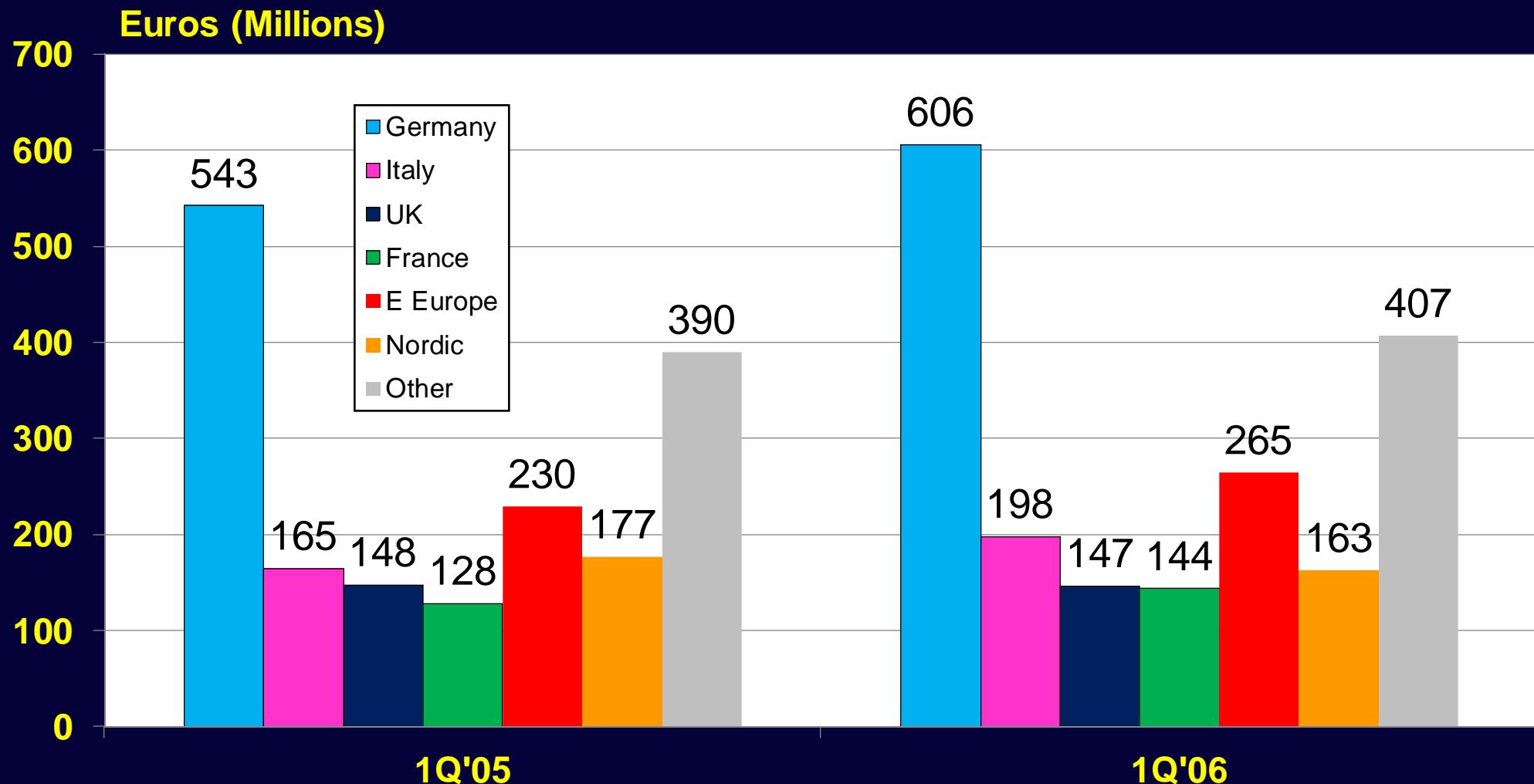
# European Component Shipments by Country

# DMASS - European Semiconductor Distribution Industry



# DMASS

## European Semiconductor Distribution Industry



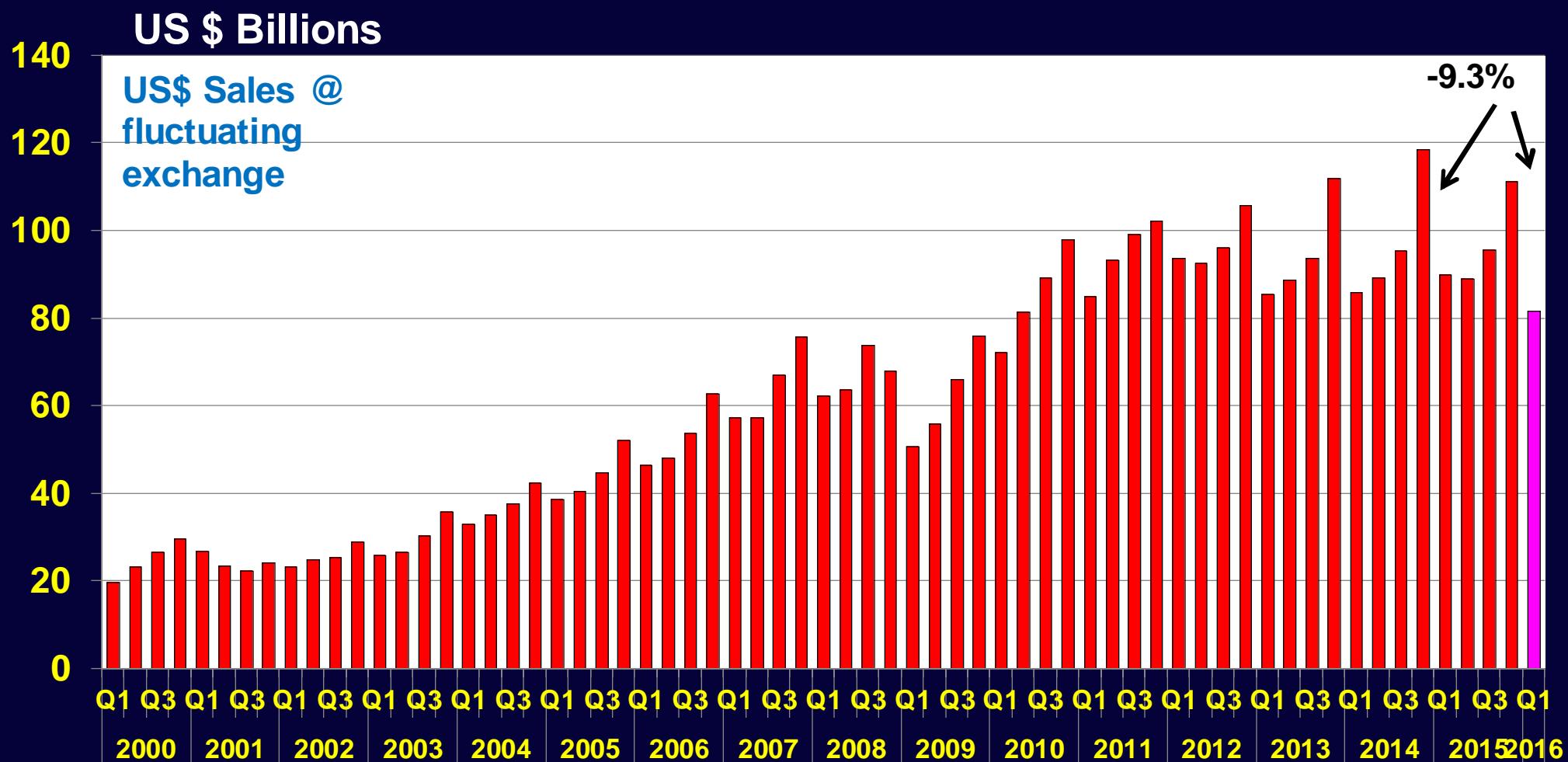
"We have, for the time being, entered a very stable market environment, with little friction from currency effects and very little effects so far from weak markets in Asia, especially China. Q1/CY16 ended surprisingly well, with 8.4% growth. "

# **EMS & ODM Companies**

20160519

# Global EMS & ODM Companies Composite of 52 Public Companies

## Revenue



# Large Global EMS Providers

## 2014 vs. 2015 Sales (\$M)

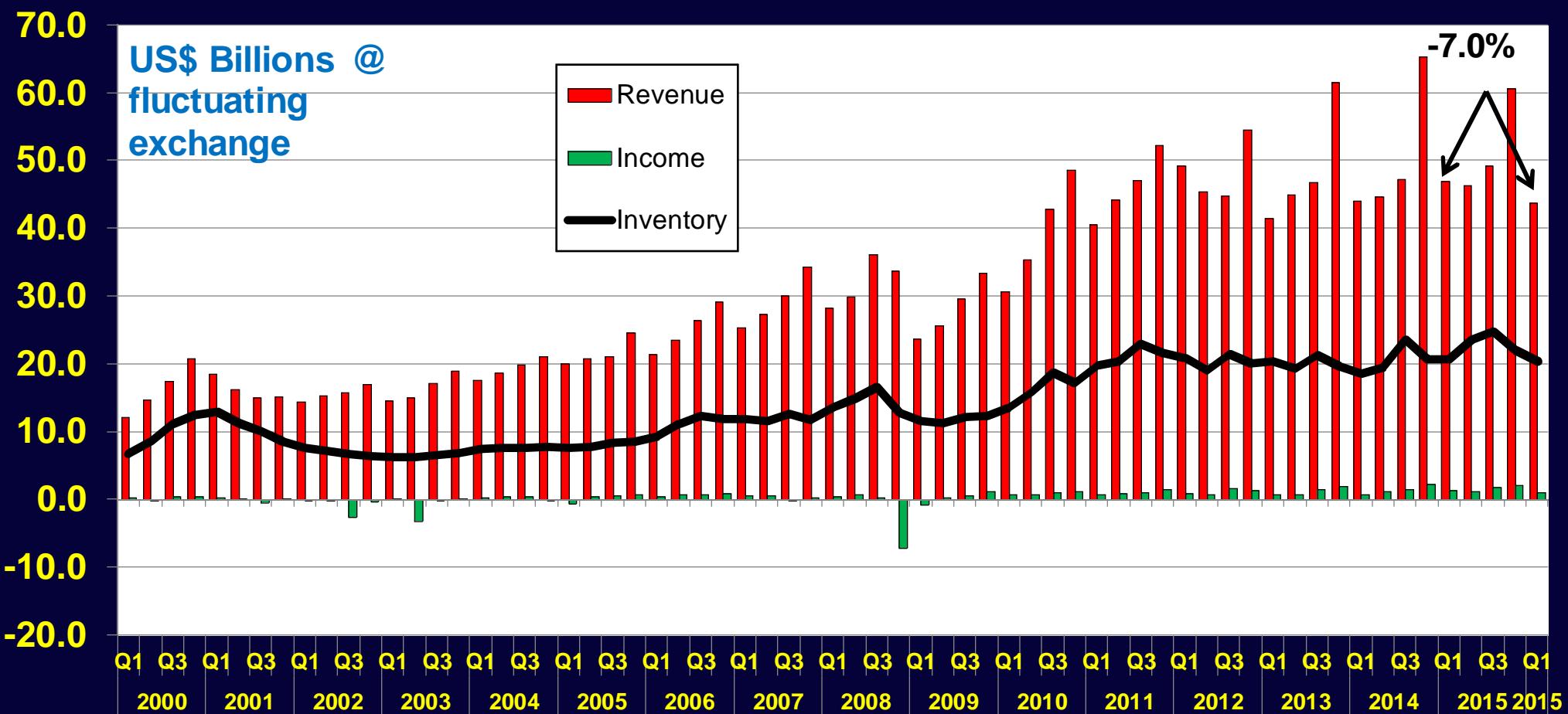
		<u>2014</u>	<u>2015</u>	<u>2015/2014 Growth %</u>
Hon Hai (Foxconn)	Taiwan	138,765	141,717	+2%
Flextronics	Singapore	26,920	24,598	-9%
Jabil Circuit	USA	15,969	18,557	+16%
Sanmina-SCI	USA	6,439	6,238	-3%
Celestica	Canada	5,631	5,639	0%
Benchmark Elec	USA	2,797	2,541	-9%
Plexus	USA	2,509	2,606	+4%
Venture Mfg	Singapore	1,945	1,928	-1%
Sypris	USA	355	145	-59%
<b>Total</b>		<b>201,331</b>	<b>204,291</b>	<b>+1.5%</b>

Sources: Company data

Local currency converted at fluctuating exchange

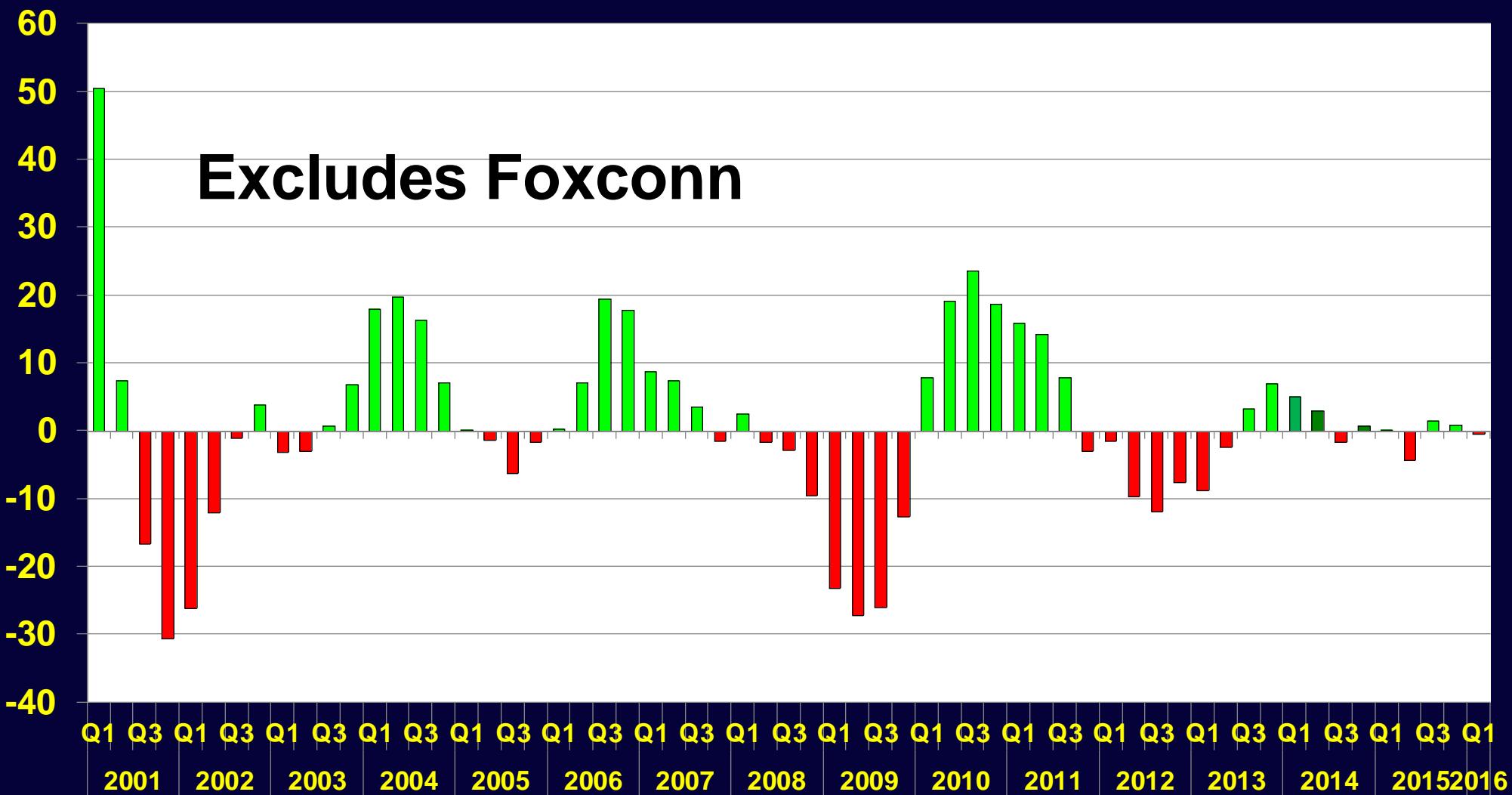
# Large EMS Providers Composite of 9 Public Companies

## Revenue, Net Income & Inventory



Benchmark+Pemstar, Celestica, Flextronics+Solectron, Foxconn, Jabil, Plexus, Sanmina, Sypris, Venture Mfg

# Large EMS Providers Composite of 8 Public Companies Quarterly Revenue Growth



Benchmark+Pemstar, Celestica, Flextronics+Solectron, Jabil, Plexus, Sanmina-SCI, Sypris, Venture Mfg

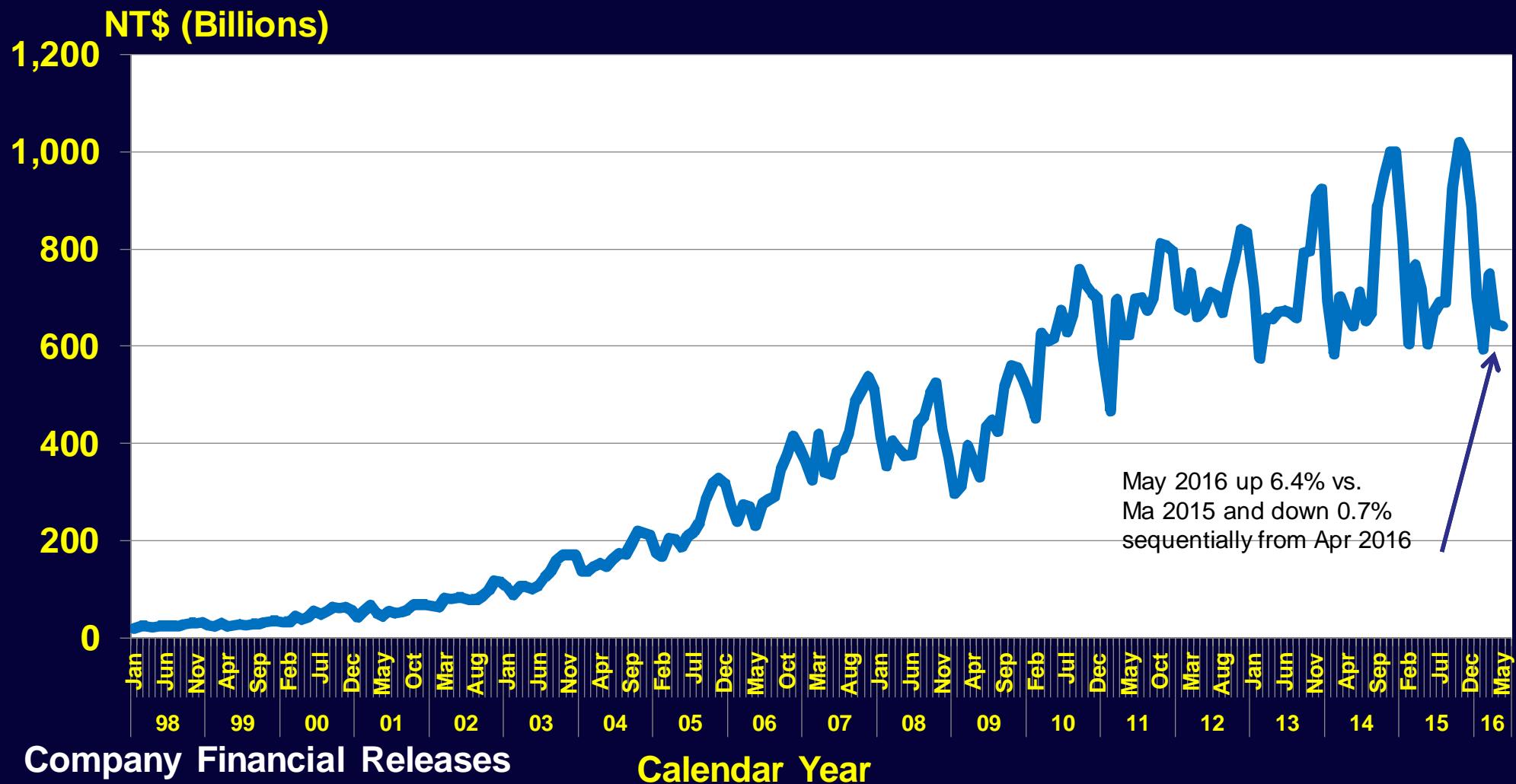
# Large Taiwan ODM Providers

2014 vs. 2015 Sales (\$M)

	<u>2014</u>	<u>2015</u>	<u>2015/2014 Growth %</u>
Foxconn (Hon Hai)	139,032	141,202	+1.6%
Pegatron	33,632	38,224	+13.7%
Quanta Computer	30,566	31,726	+3.8%
Compal Electronics	27,909	26,685	-4.4%
Wistron	19,534	19,631	+0.5%
Asustek Computer	15,747	14,875	-5.5%
Inventec	14,376	12,456	-13.4%
Chimei Innolux	14,145	11,469	-18.9%
Lite On Technology	7,611	6,828	-10.3%
Total	302,551	303,094	+0.2%

Source: Company data, NT\$ converted at constant avg 2015 exchange (31.75 NT\$ = 1US\$)  
 Consolidated company sales

# Taiwan ODM Companies Composite Sales of 11 Large Manufacturers

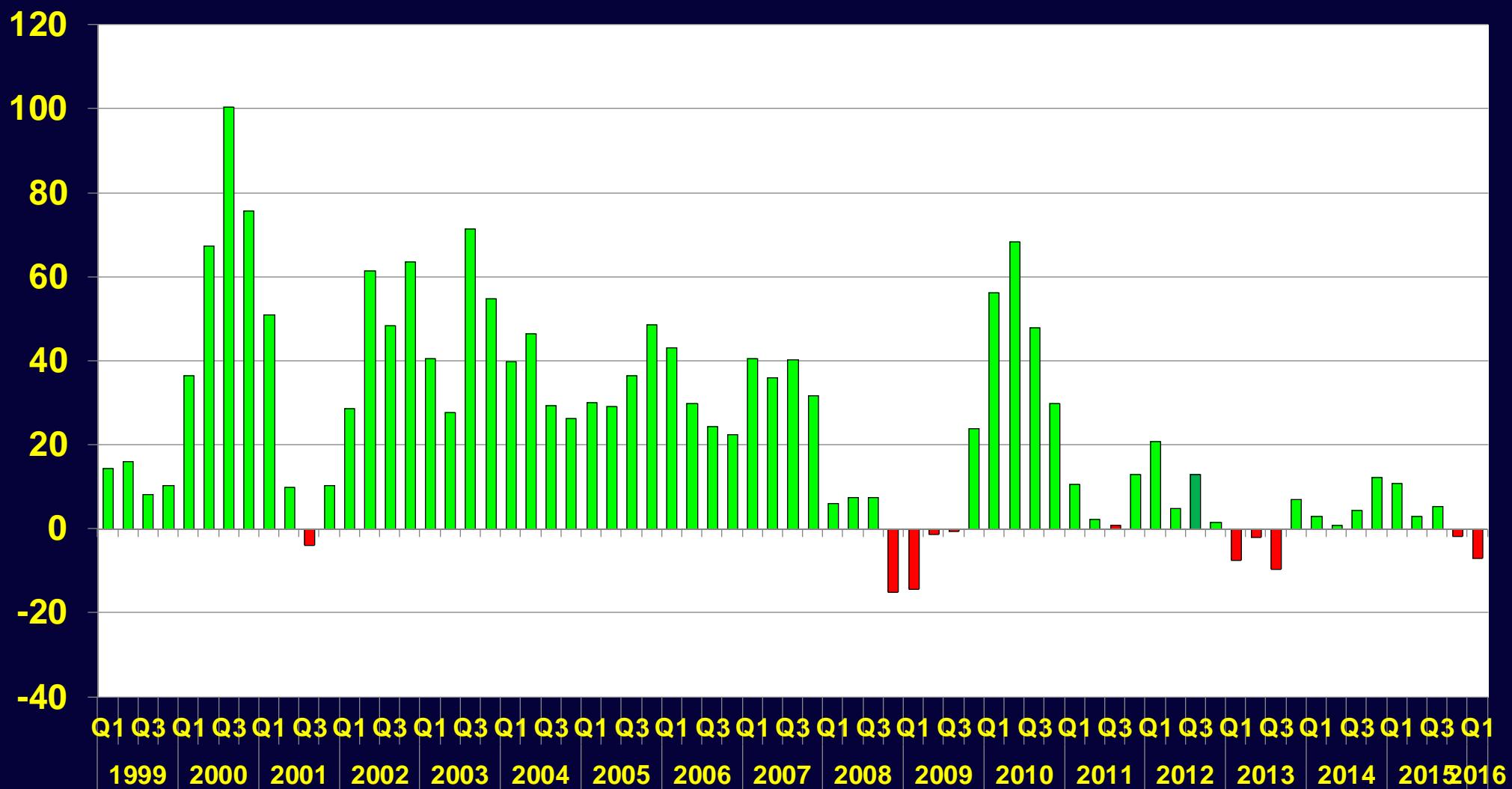


Asustek Computer, Chei Mei, Compal Electronics, Foxconn, Chimei Innolux , Inventec, Inventec Appliance, Lite On Technology, Mitac International, Pegatron, Quanta Computer, Wistron, Chei Mei Display replacing Chei Mei & Innolux Display 3/10 & later

# Large ODM Companies

## Composite of 10 Public Manufacturers

### Quarterly Revenue Growth



Asustek Computer, Compal Electronics, Foxconn, Chimei Innolux, Inventec, Inventec Appliance, Lite On Technology, Mitac International, Pegatron, Quanta Computer, Wistron

20160613

# European Loaded Electronic Board Production



# EIPC Organization

# Dedicated Chairman



# Great Staff



# Multi-skilled Board

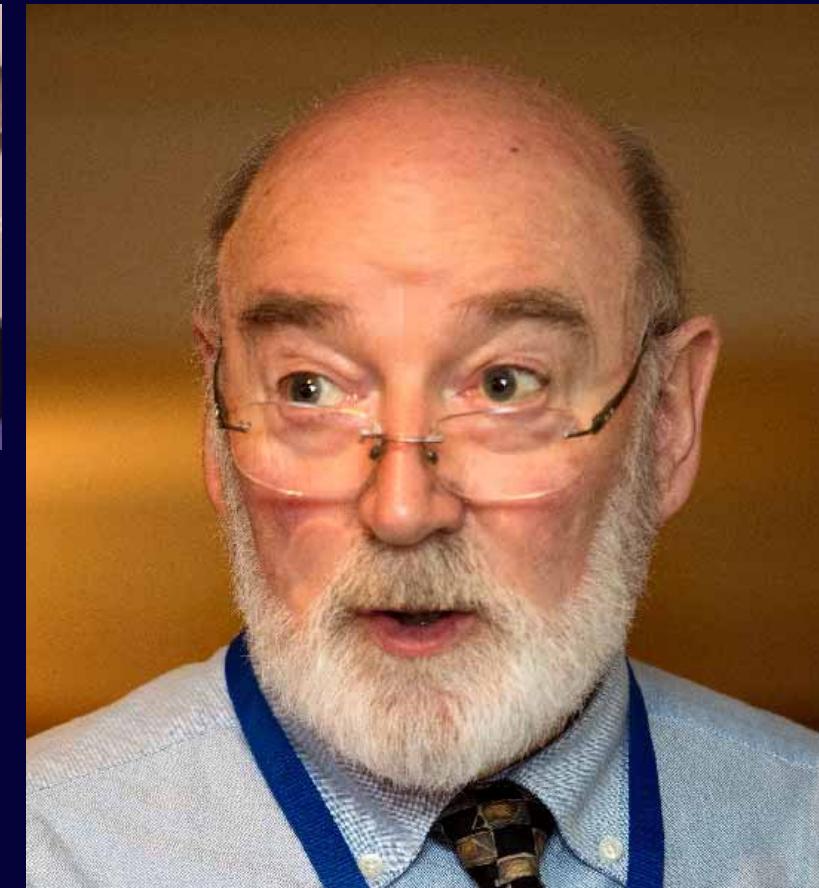


# Excellent Cooperation

FED



ICT



**But we also  
know how  
to party**

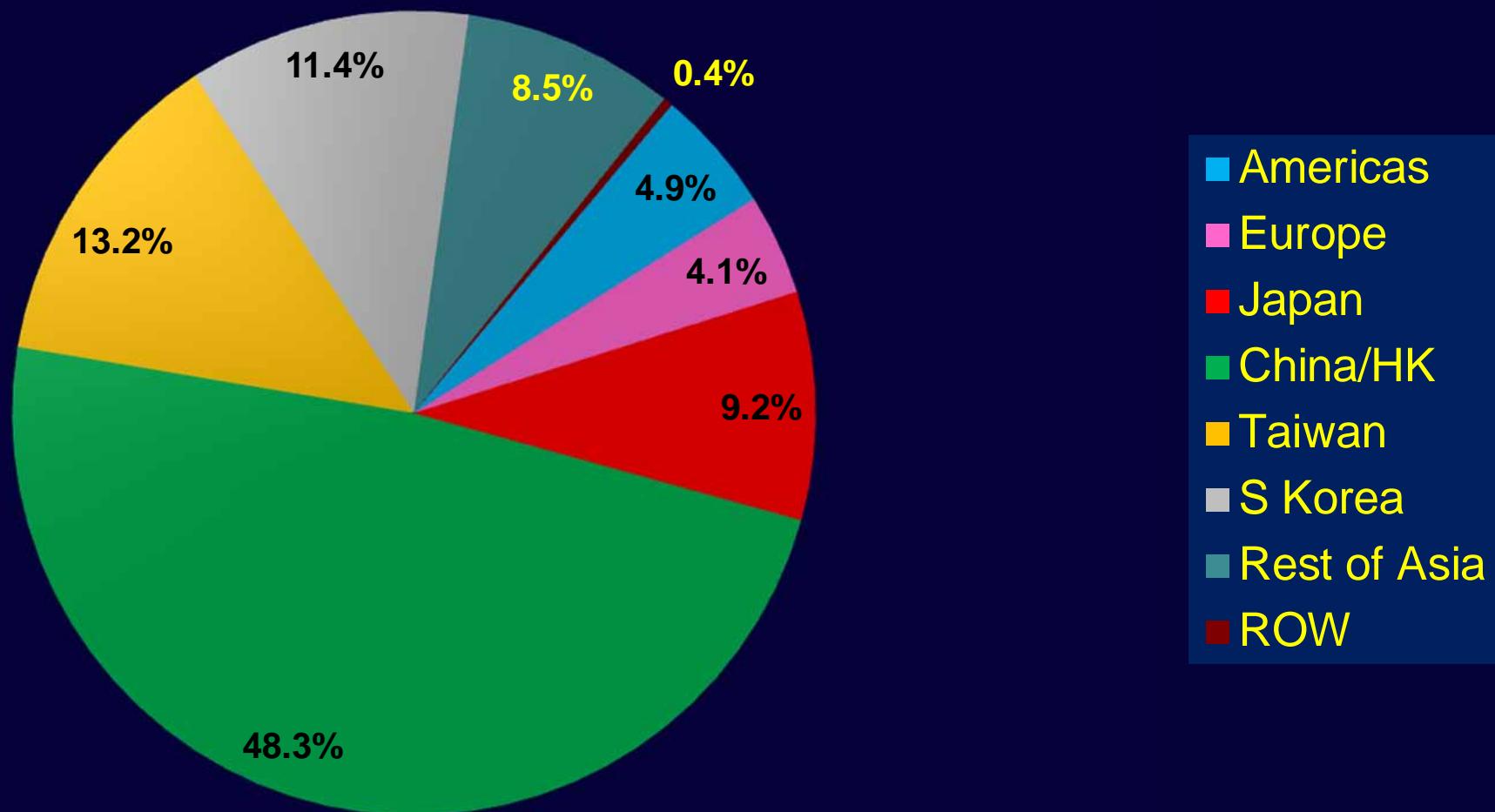


Alun is  
ready  
For  
tonight

# PCB Fabrication

# 2015 World Total PCB Production by Geographical Area

(US\$ M @ Average 2015 Exchange)



Total: \$59.2 Billion

H Nakahara 3/16, Custer added ROW estimate including Mideast & Africa

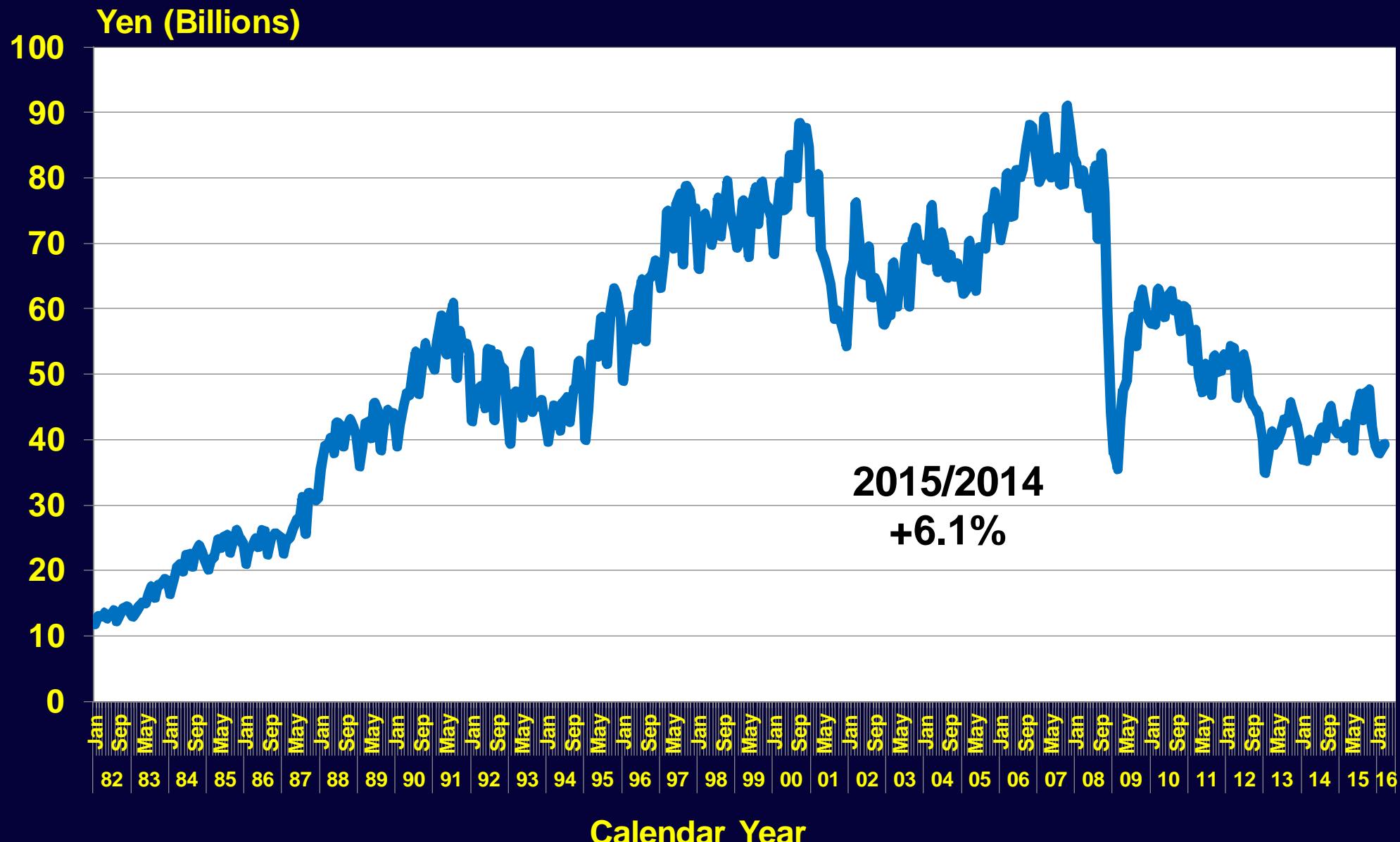
# World's Top PCB Companies – 2014

## 1-25

Rank	Company	Nationality	2013	2014	Growth	Brief Comments
1	Nippon Mektron*	Japan	2,209	3,176	43.78%	A big Apple supplier
2	ZDT*	Taiwan	2,106	2,483	17.90%	A big Apple supplier
3	Unimicron	Taiwan	2,009	2,130	6.02%	Building PCB plants in Huangxi
4	SEMCO	S. Korea	1,795	1,562	-12.98%	Building plants in Vietnam
5	Young Poong Grp*	S. Korea	2,100	1,523	-27.48%	Interflex & YPE poor in 2014
6	Ibiden	Japan	1,315	1,493	13.54%	Boosting growth from Malaysia
7	TTM Technologies	USA	1,326	1,422	7.24%	Purchased Viasystems on 5/15
8	Sumitomo Denko*	Japan	1,121	1,414	26.14%	A big Apple supplier
9	Tripod	Taiwan	1,337	1,391	4.08%	Pushing into automotive PCB
10	Viasystems	USA	1,171	1,204	2.82%	Purchased by TTM 5/31/2015
11	Daeduck Group	S. Korea	1,297	1,159	-10.64%	Careful investment
12	Nanya PCB	Taiwan	1,016	1,146	8.09%	IC substrates seem to grow
13	Compeq	Taiwan	1,013	1,110	9.55%	Chongqing plant contributing
14	PSA PCB Group	Taiwan	957	970	1.36%	NB motherboards reduced
15	KG PCB Group	China	922	963	4.45%	Elec& Eltek is the largest
16	AT&S	Austria	784	886	13.01%	CKG plant starts business soon
17	Meiko	Japan	692	850	22.83%	#3 automotive PCB maker
18	Kinsus	Taiwan	757	818	7.97%	Flip-Chip CSP strong
19	LG Innotek	S. Korea	581	791	36.14%	LGE & Qualcomm
20	T.P.T.	Taiwan	684	784	14.60%	NB motherboards increasing
21	Multek	USA	730	750	2.74%	Profitable since Oct 2013
22	WUS Group	Taiwan	658	698	6.08%	Kunshan & Huangxi new plants
23	Chin Poon	Taiwan	634	697	9.93%	#1 automotive PCB maker
24	CMK	Japan	621	689	10.95%	#2 automotive PCB maker
25	Nitto Denko*	Japan	485	684	41.03%	FPC for HDD among others

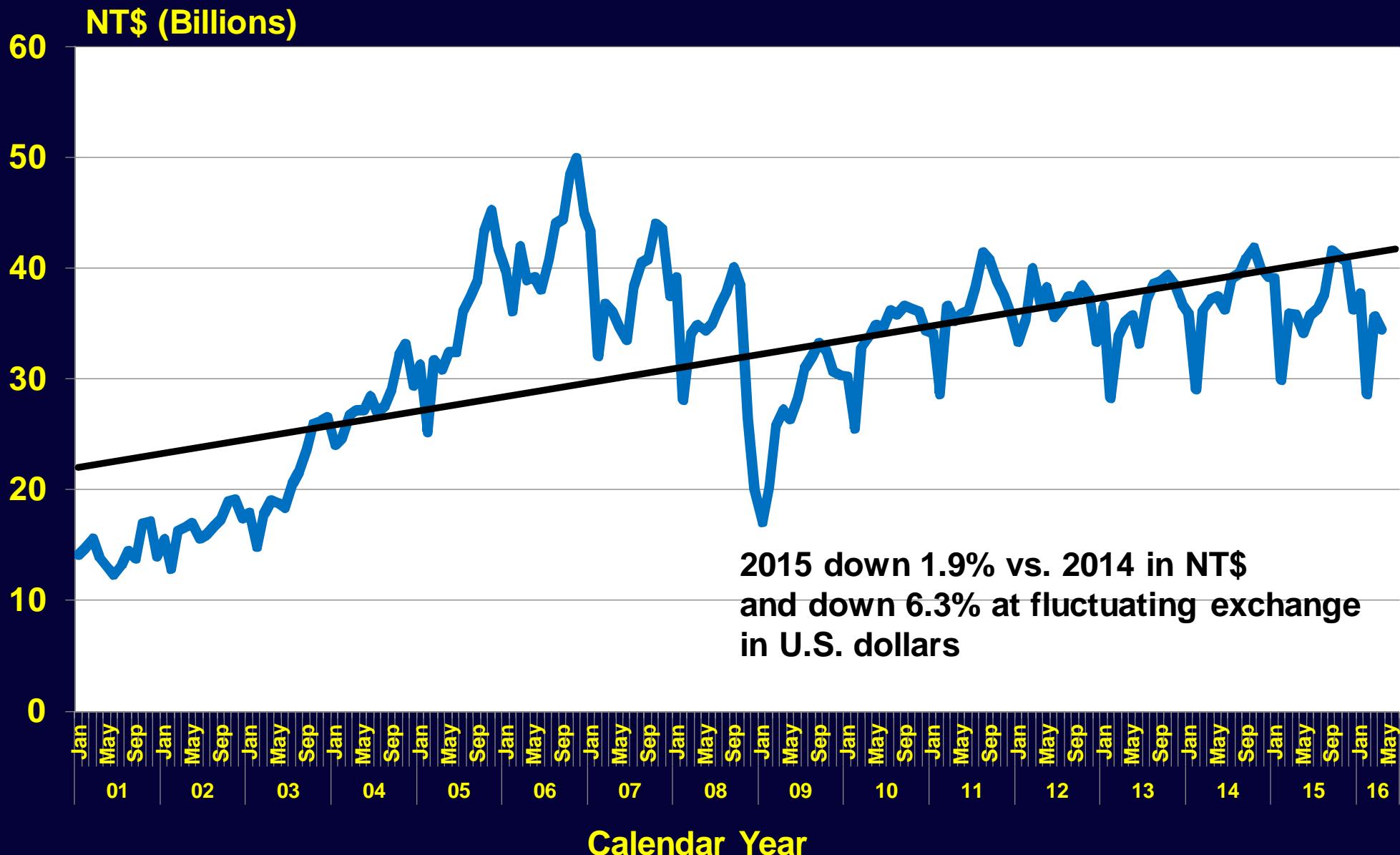
20160520

# Japan PCB Shipments

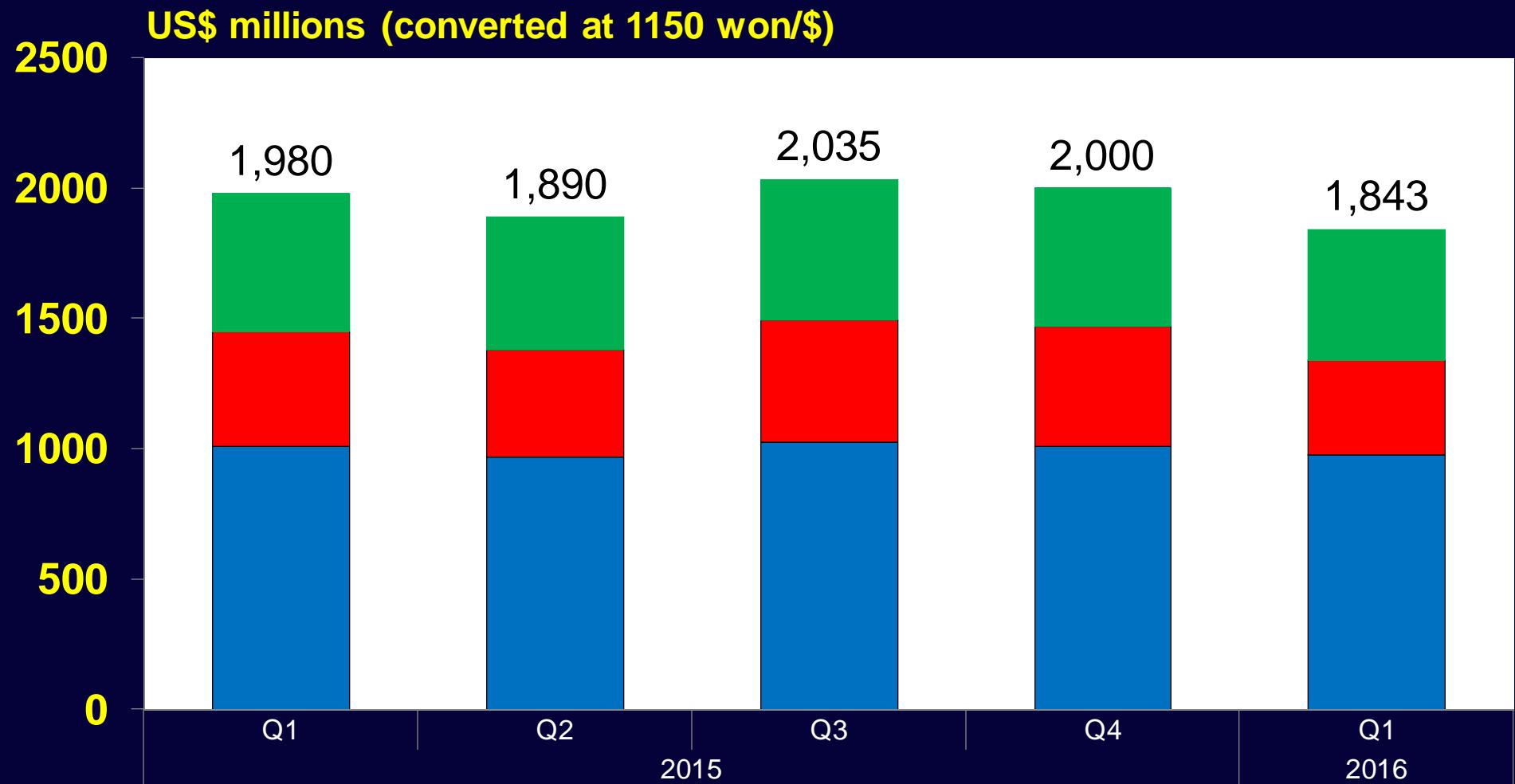


# Taiwan Rigid & Flex PCB Shipments

## Broad Composite of 46 Taiwan-listed Manufacturers



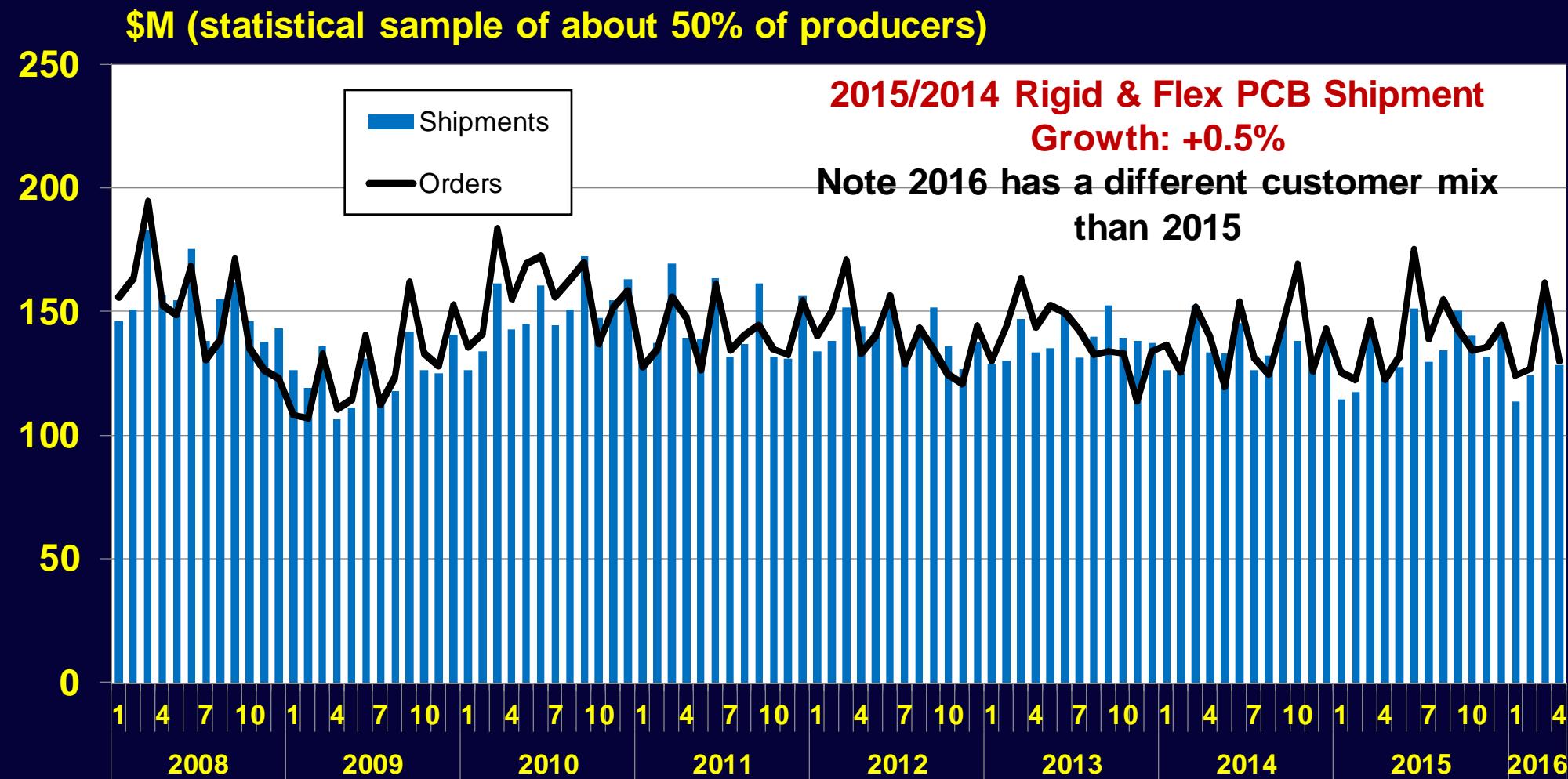
# S Korea Domestic PCB Production



Private communication from industry source

# N American Rigid & Flexible PCB Shipments & Orders

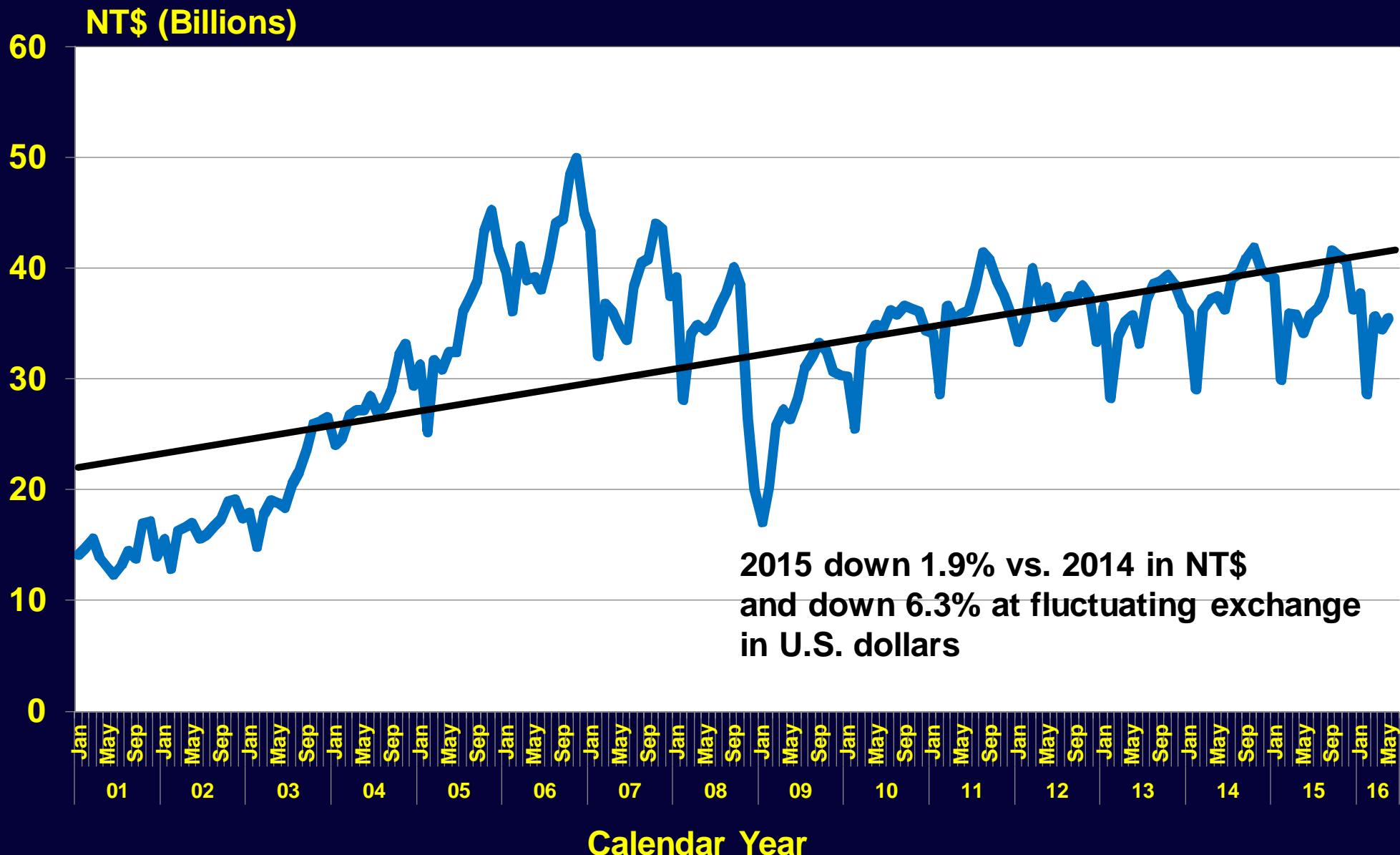
20160601



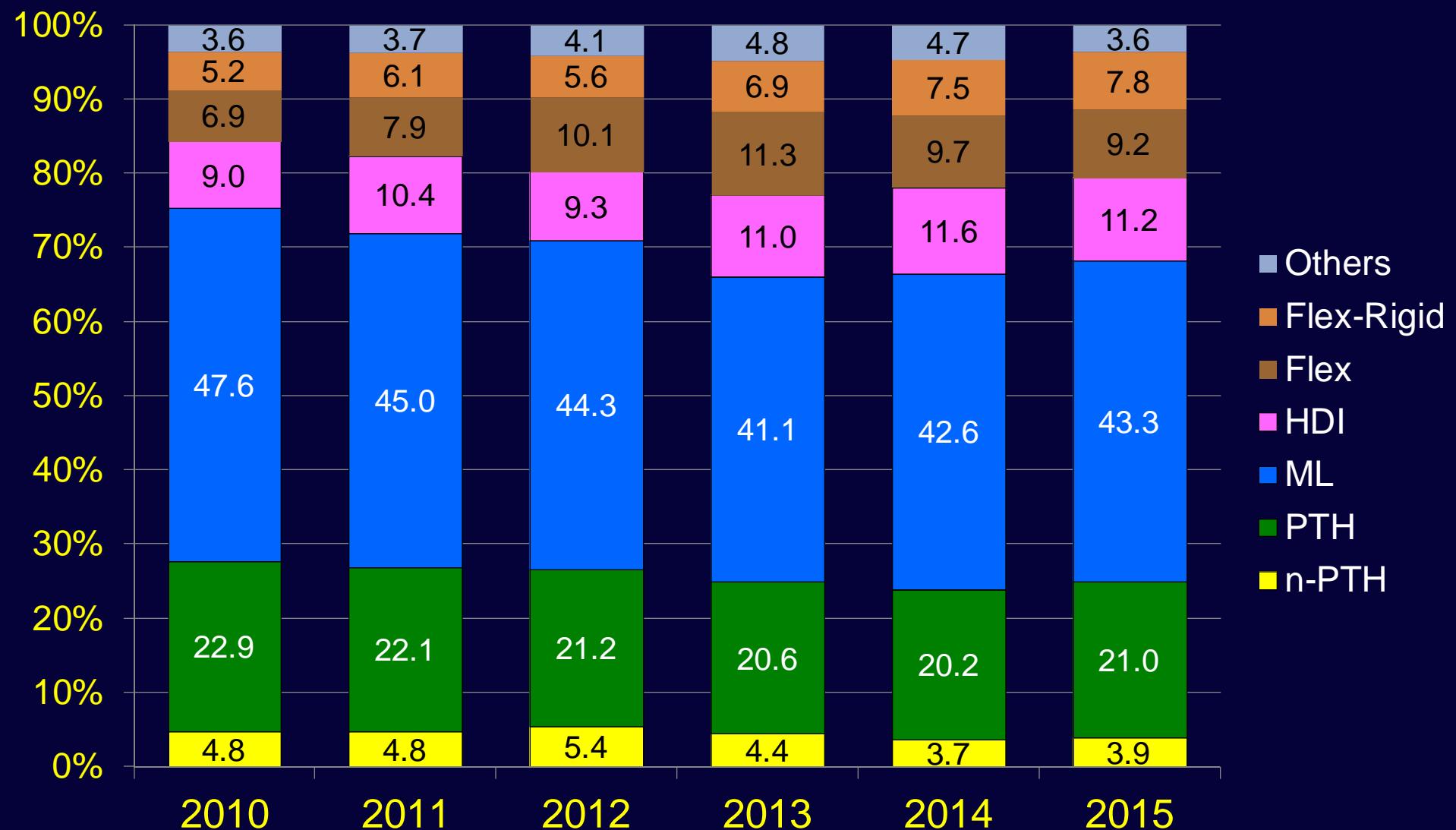
Note: IPC survey captures "market" not domestic production. About 15% of the above represents imported boards resold by N American PCB producers in survey.

# Taiwan Rigid & Flex PCB Shipments

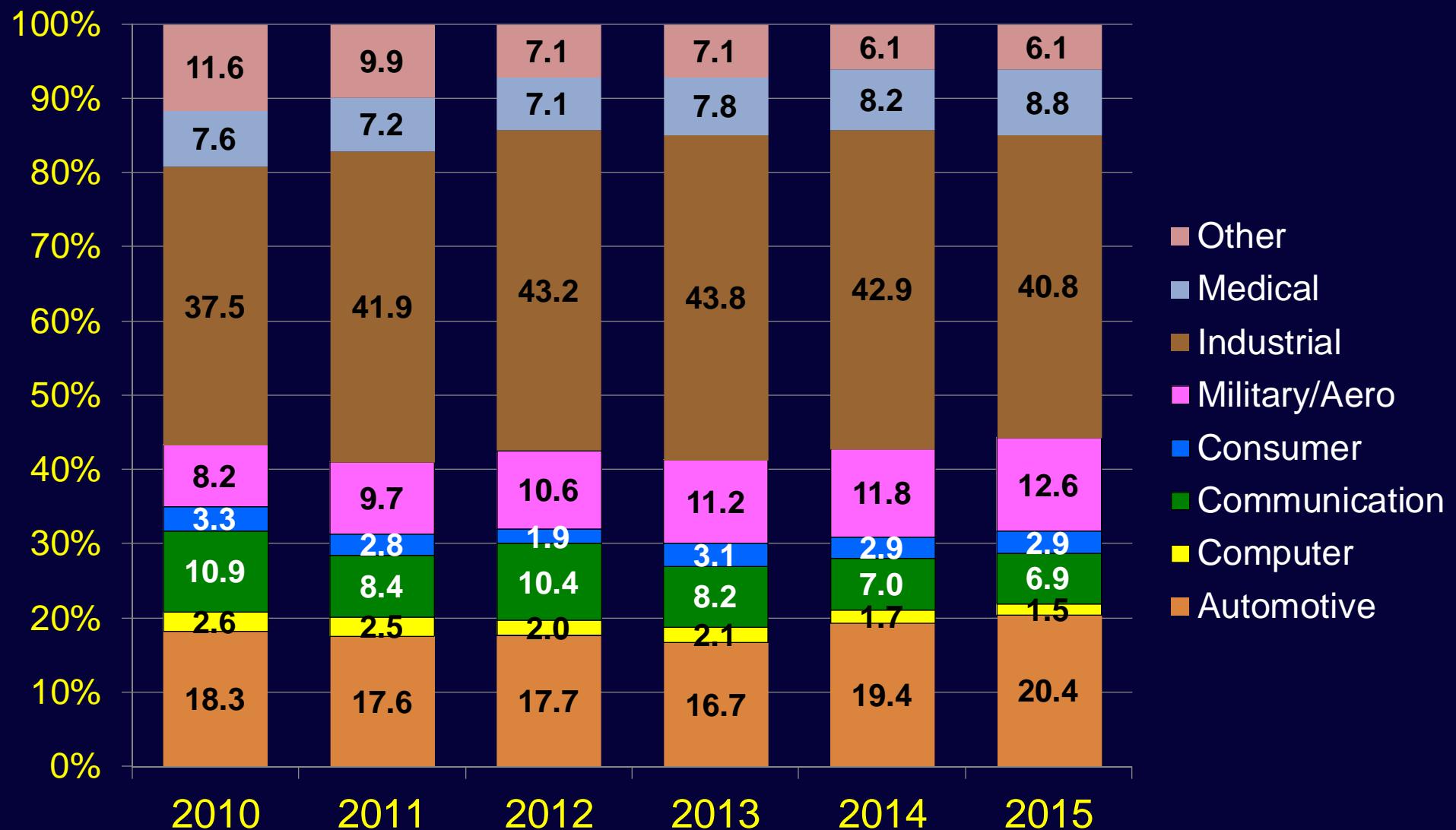
## Broad Composite of 46 Taiwan-listed Manufacturers



# European PCB Production by Technology

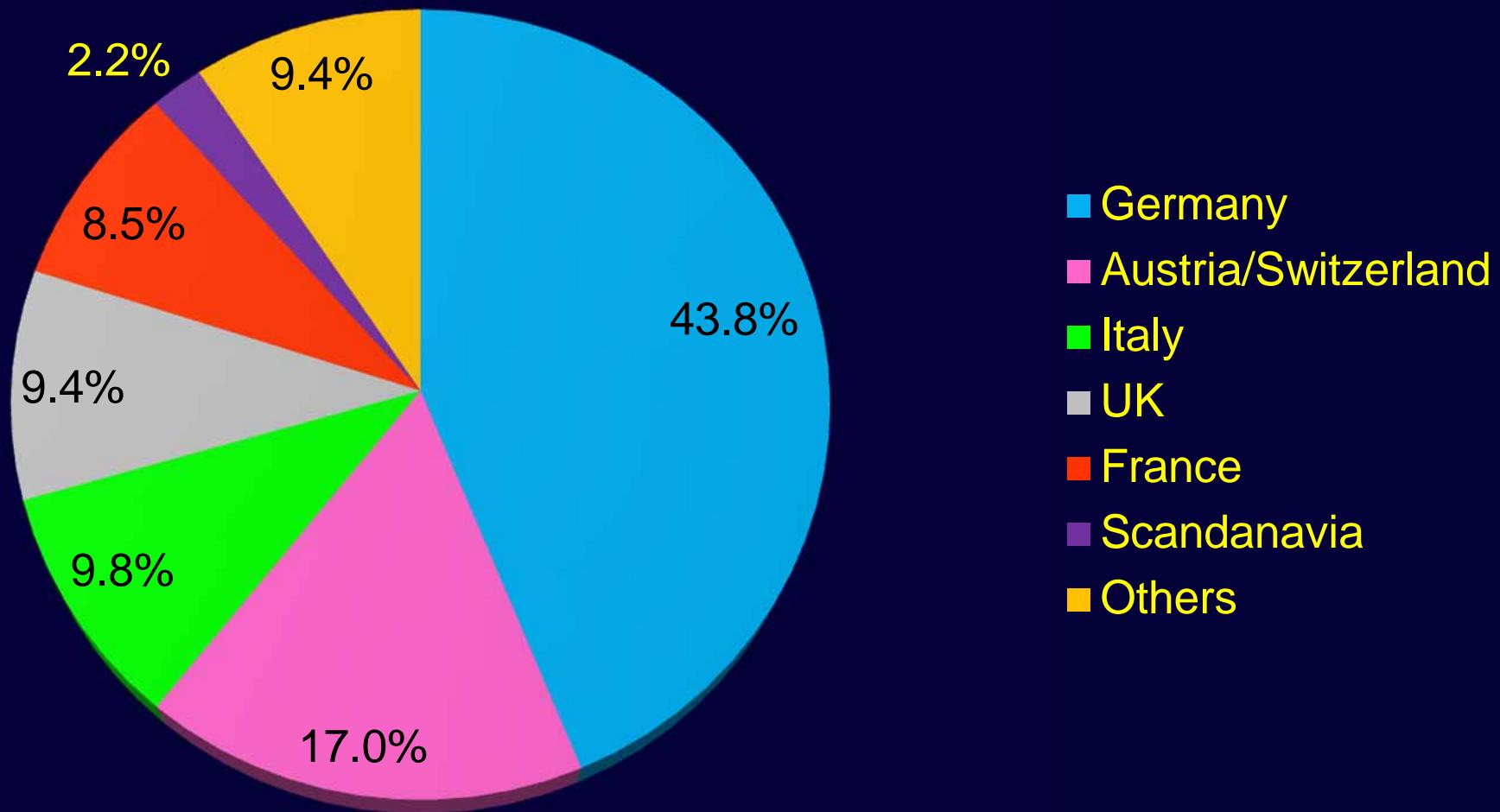


# European PCB Production by End Market



# 2015 European PCB Production (excludes FSU Russia)

20160502



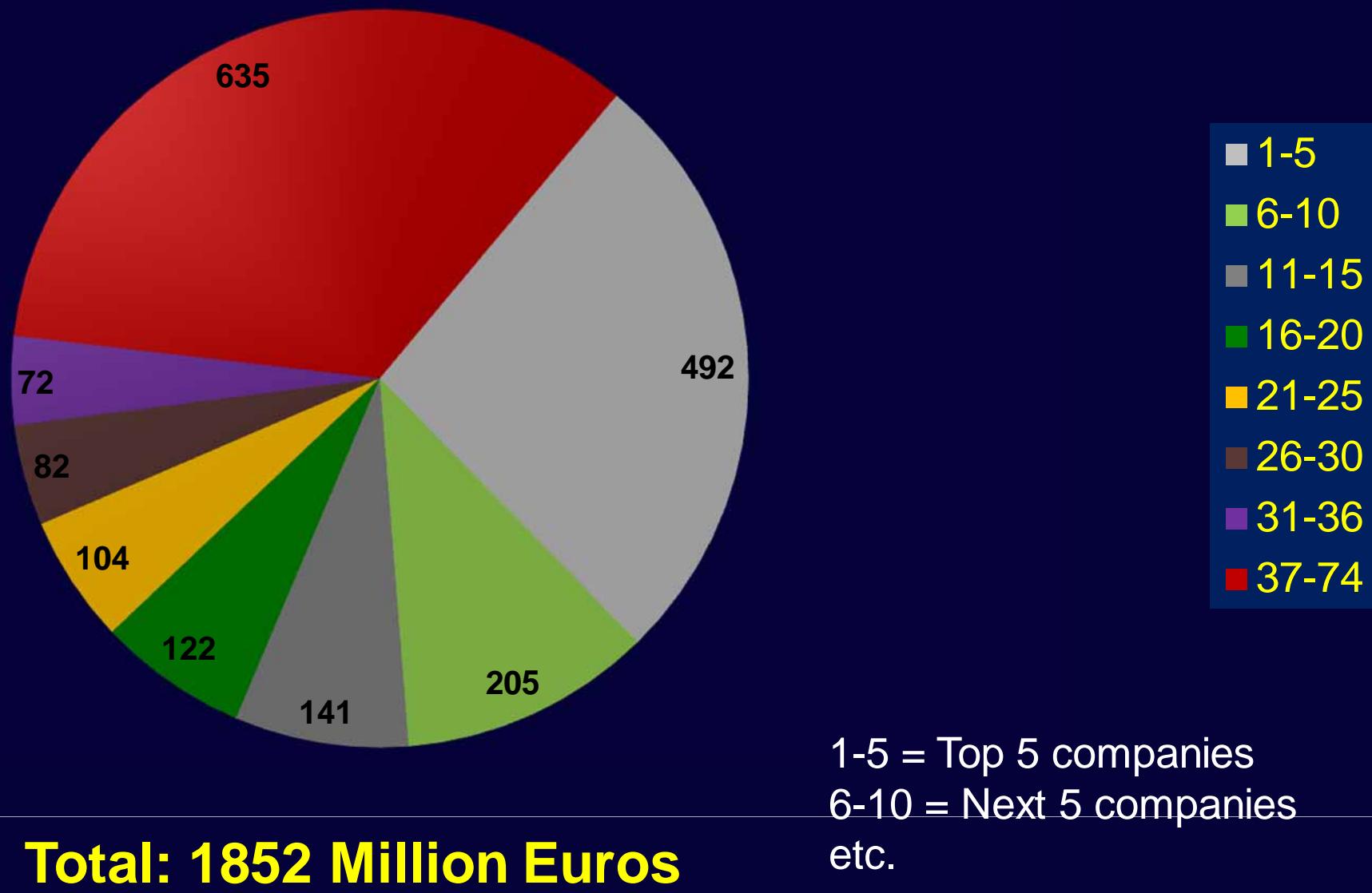
2015 Total: EUR 1852 million

# Europe's Top 36 PCB Companies Ranked by 2015 Revenues

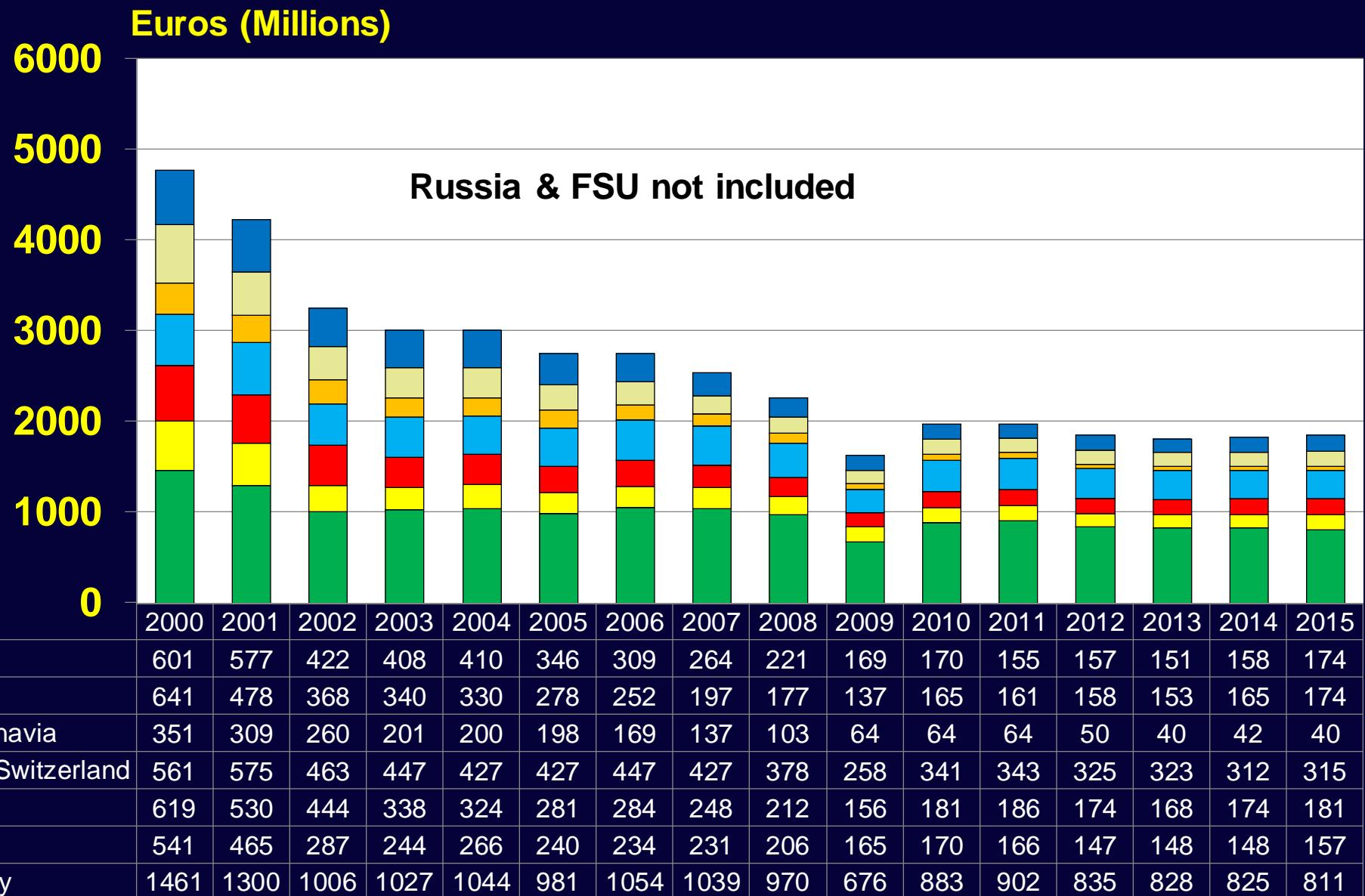
<u>Rank</u>	<u>Company</u>	<u>Rank</u>	<u>Company</u>
1	AT&S	19	Schaltungsdruck Storz
2	Würth	20	Schoeller
3	Schweizer Electronic	21	Technomaster Group
4	KSG	22	Cimulec Gruppe
5	Elvia	23	Optiprint
6	Mektec Europe	24	Precoplat
7	Ruwel	25	Eurocircuit Group
8	SoMaCis	26	Rohde & Schwarz
9	GS Swiss PCB	27	Graphic-Group
10	Varioprint	28	Ilfa
11	Elco Group	29	OMR Italia
12	hmp	30	Aspocomp
13	Dyconex	31	Polytron Print
14	Cicor Group	32	Elekonta Marek
15	Cistelaier Group	33	TW Electronik
16	Häusermann	34	Merlin (Falcon) Group
17	Invotec	37	Exception
18	ACB Group	38	Ggp Peters

# 2015 Top 74 Largest European PCB Companies (totals for each group )

20160502



# European PCB Production



# European PCB Market Comments

20160502

The year 2015 had a number of challenges for the European countries: the **downtrend in China** affected especially emerging nations which rely on exports of minerals. New investments and explorations are scarce. Similarly, the **sanctions against Russia** made business difficult. The **reduction in energy prices** on the one hand is a benefit – but it may backfire in a few year's time.

The **debt crisis in Southern Europe** was softened but a new challenge arose with the large **number of refugees** coming to Europe. Solidarity within the EU is limited to the money-bags a nation may tap but humanity hasn't any priority. Therefore, just a few nations have to bear the burden of the outcome of wars which were not ours to start with.

The number of European manufacturers in 2015 declined just slightly (from 253 to 246) but already during the first quarter about 10 companies filed for insolvency or declared a voluntary closure during the first half of 2016. There may be a chance that the one or the other could be saved. The supply base for the electronic industry gets slim and the **danger of becoming dependent solely on Asian suppliers** rises. The PCB-consuming society still isn't aware that they are cutting the branch on which they sit.

German speaking countries have a share of 60.8% on total European production, followed by UK (9.4%) and France (8.5%).

# European PCB Market Comments

20160502

While the German market grew, German production declined. Reason for this was a blaze at a large manufacturer which destroyed the whole facility. The rebuilt plant will contribute from 2016 onwards again.

Austria and Switzerland are serving industries (industrial, medical, automotive) with special demand. France is serving defense, aeronautics and space industry which equals to more than 45% of the production volume.

More than two thirds of UK sales went to industrial electronics, defense and aeronautics/space. In terms of GBP the total volume declined by 5%, in EUR terms it rose by 5%, which again shows the influence of exchange rates.

Largest segment is industrial electronics with 41% of all sales out of European production. This group includes a large variety of application from automation via control, measurement and security to photo-voltaic, just to name a few.

Second group is automotive but this industry covers just about one third of its requirement in Europe, the “rest” is sourced in Asia.

# European PCB Market Comments

20160502

Second group is automotive but this industry covers just about one third of its requirement in Europe, the “rest” is sourced in Asia.

Employment remained stable, revenues per capita rose by 2%.

The changes in the rate of exchange in Europe makes life easier for manufacturers in the euro-zone but difficult to those in the dollar-zone:

The euro lost 16.5% against the USD, the Swiss franc lost 12.1% and the pound lost 9.6%.

The greatest challenges we will face in Europe this year will be the referendum in UK whether or not they will stay in the EU or not. Although in case of a “Brexit” damages to the British economy will be higher than for EU or global economy, it still is a threat.

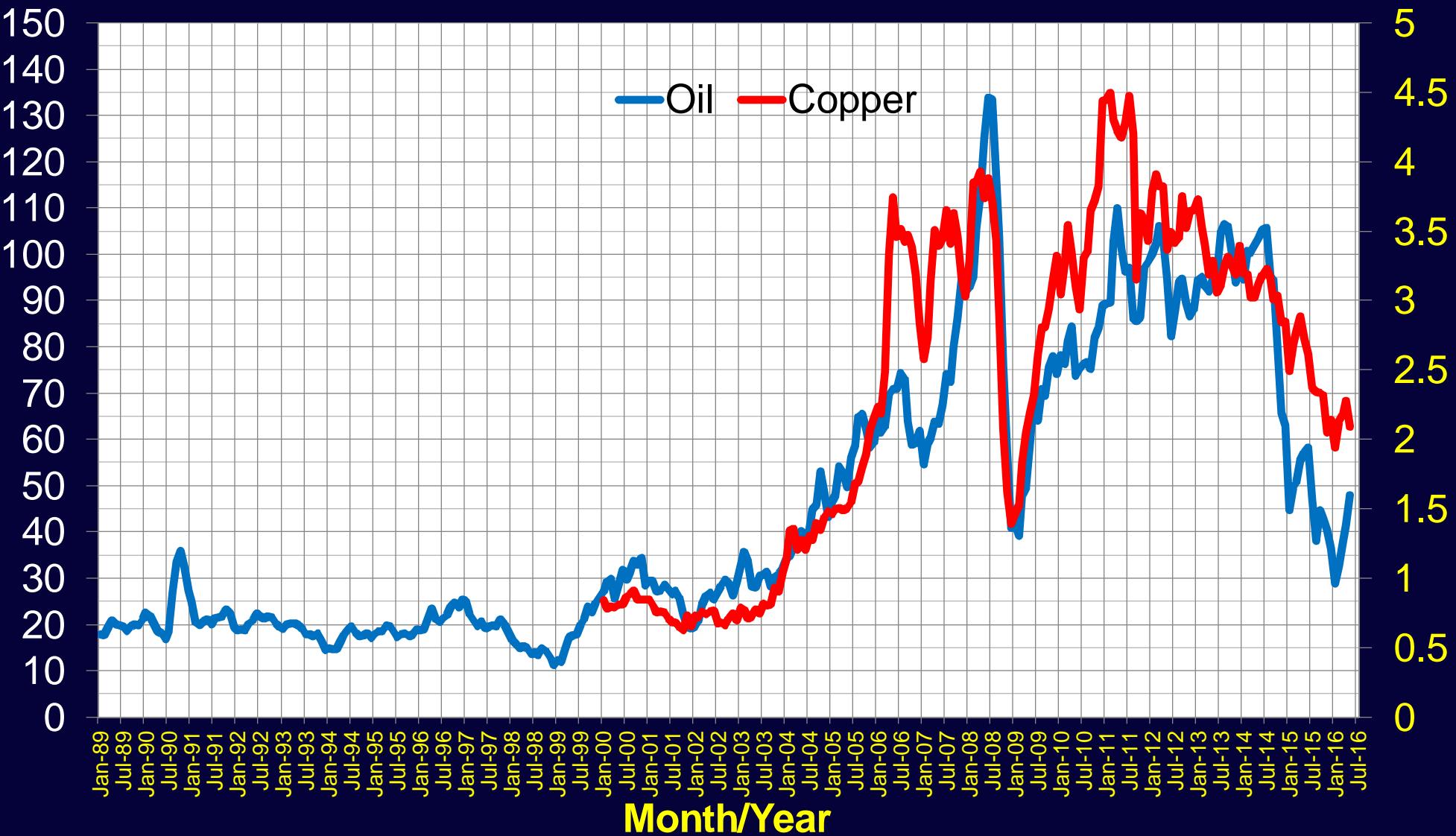
# **Process Equipment, Laminate & Materials Suppliers**

20160601

# Oil Price vs. Copper Prices

Oil US\$/bar

Copper US\$/pound



[http://www.eia.gov/dnav/pet/pet\\_pri\\_spt\\_s1\\_d.htm](http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm)

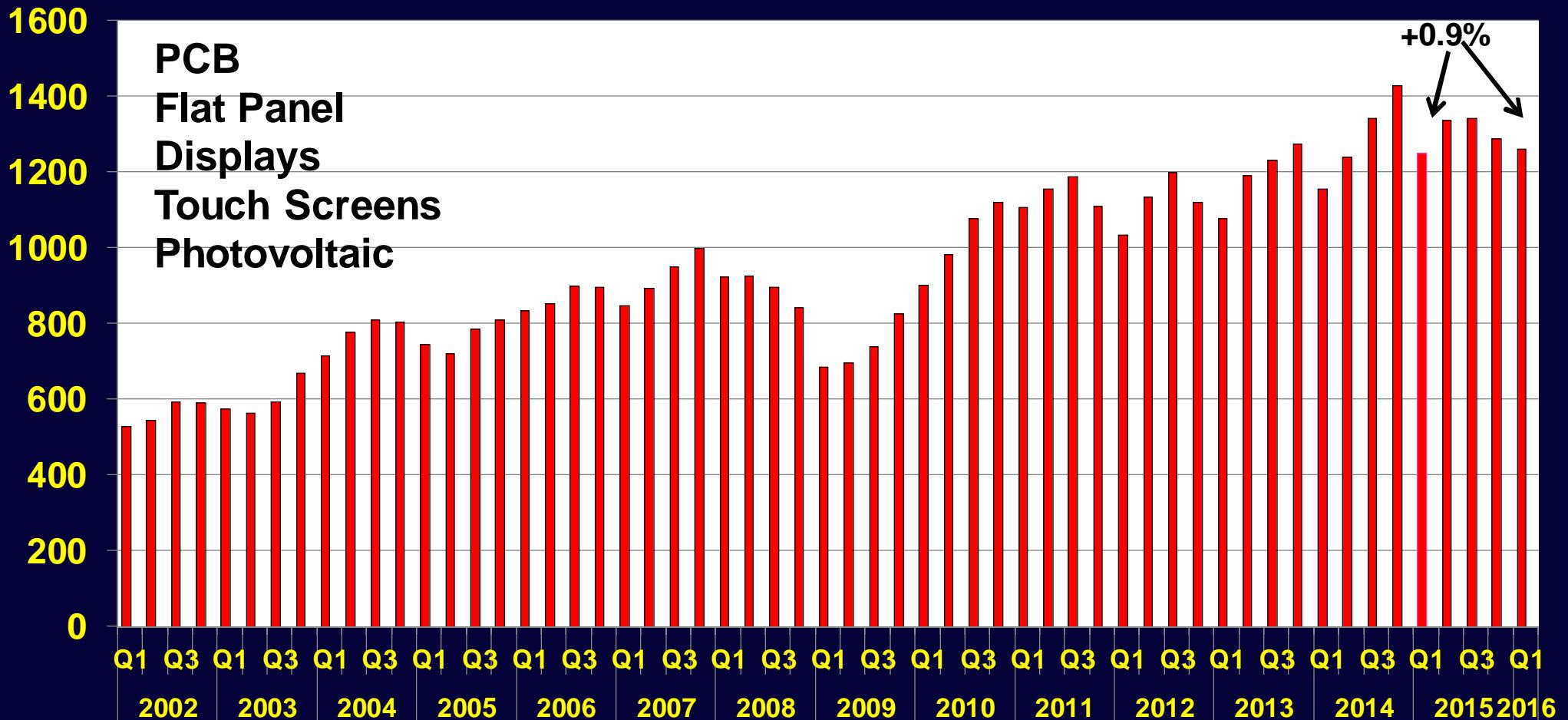
<http://futures.tradingcharts.com/chart/CP/B9>

# Process Equipment Related Suppliers Composite of 9 Companies

20160524

Revenue

\$ Millions

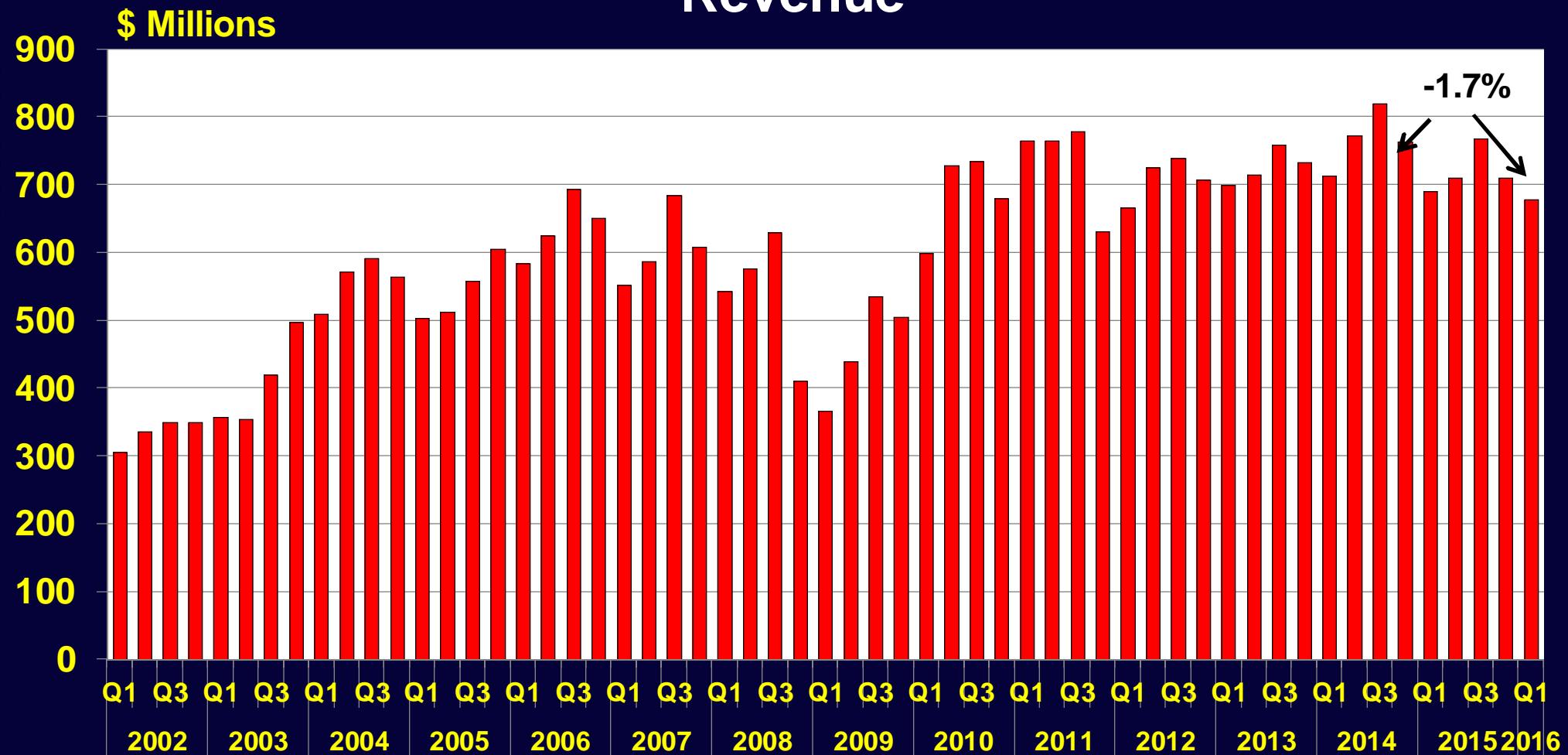


C-Sun, Tailing Technology, Camtek, ESI, GSI Group, Mentor Graphics, Nordson, Coherent, Orbotech

20160524

# Rigid & Flex Laminate Suppliers Composite of 13 Companies

## Revenue



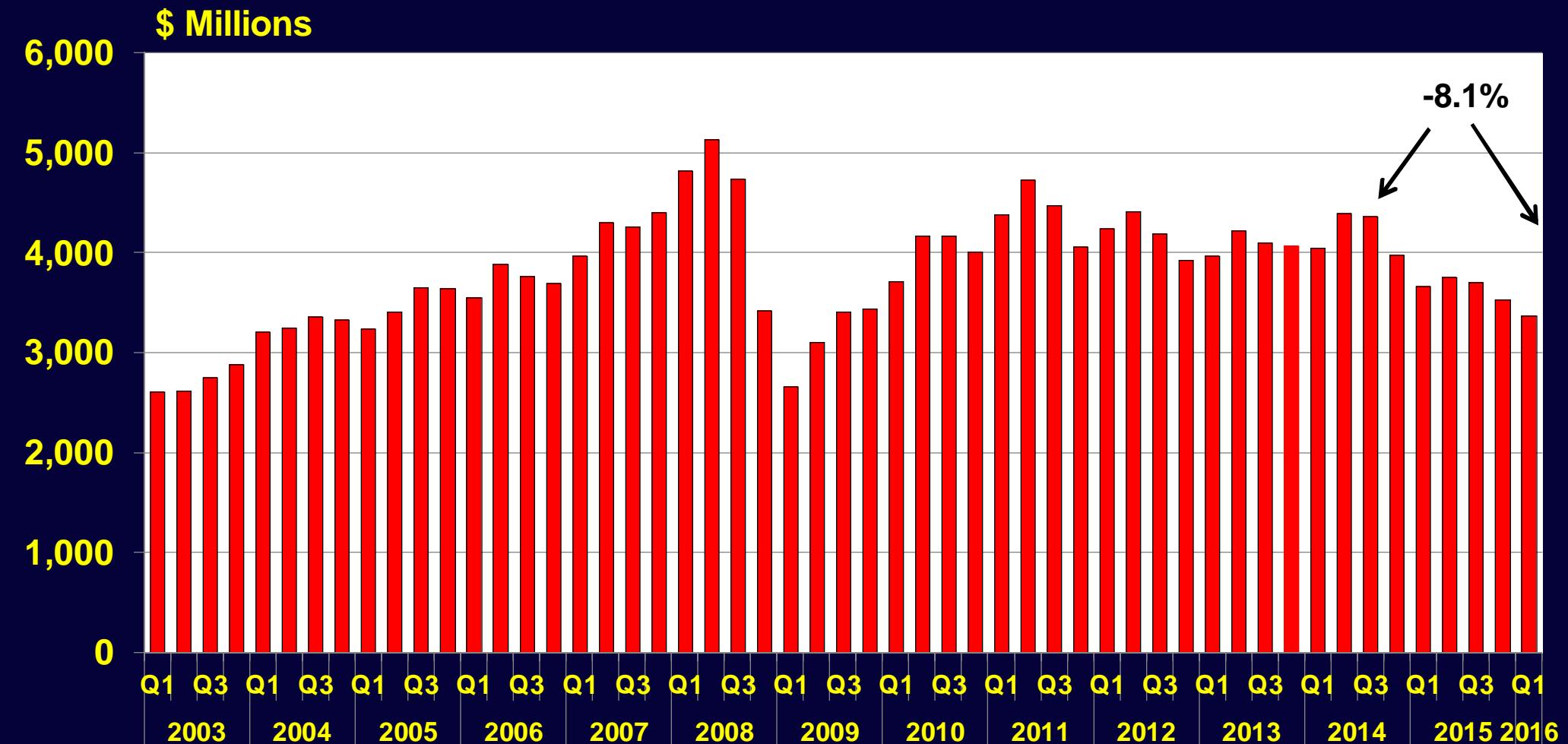
Arisawa, Arlon Electronic Materials, Elite Materials, Hwa Woei, Iteq, Microcosm, Park Electrochemical, Rogers, Shinemore, Taiflex, Thinflex, Top Union, Uniplus

NT\$ converted at fluctuating exchange

# Material Suppliers (excluding laminate) Composite of 14 Companies

20160524

## Revenue

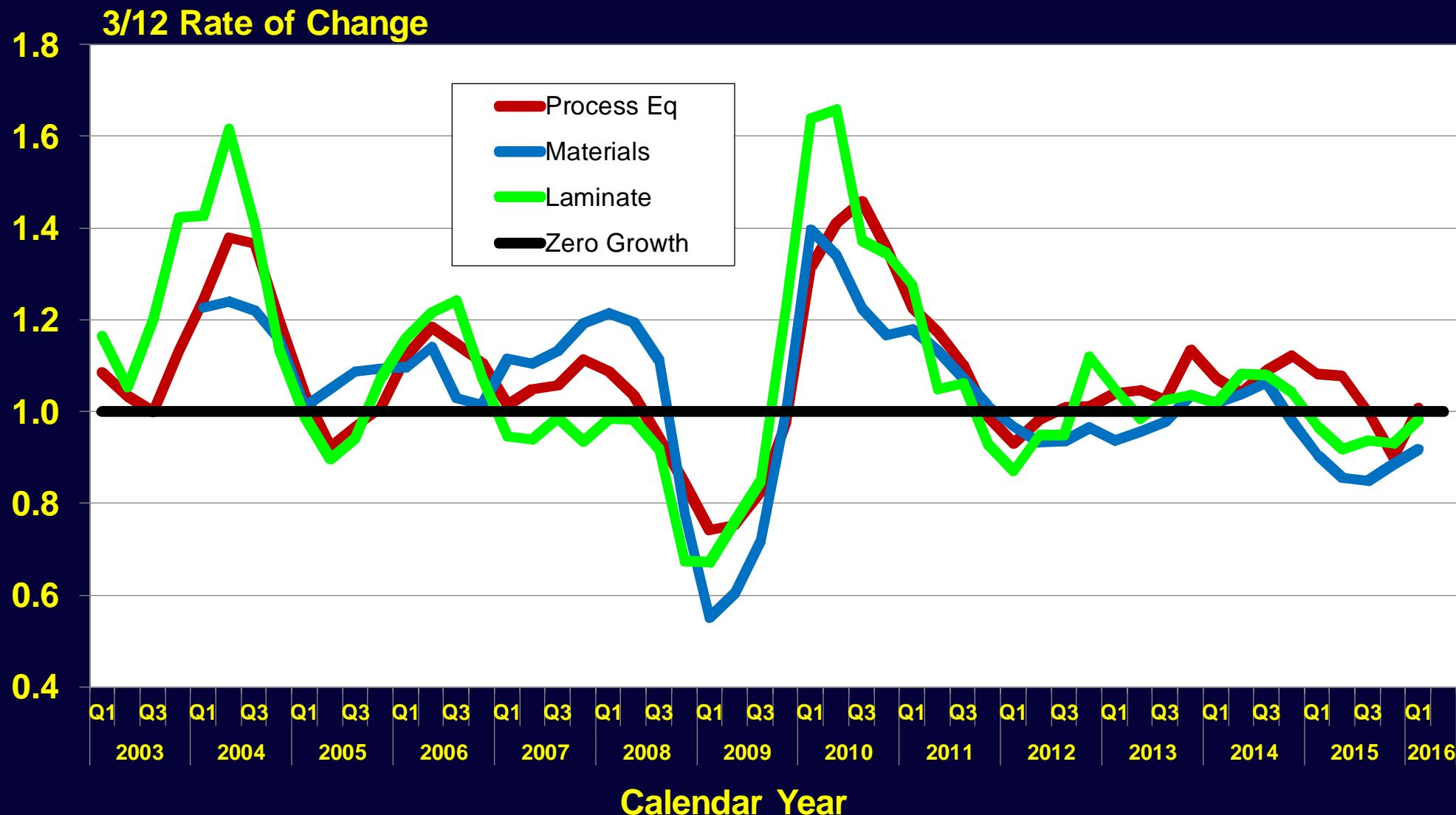


Momentive, OM Group, Taiwan Glass, Baotech, Glotech, Shenmao, Wahlee, Topoint, Cabot Micro, Chemtura, Cookson Elec, Eternal Chemical, Hexcel, Chang Wah

NT\$ & GBP converted to US\$ at fluctuating exchange

20160524

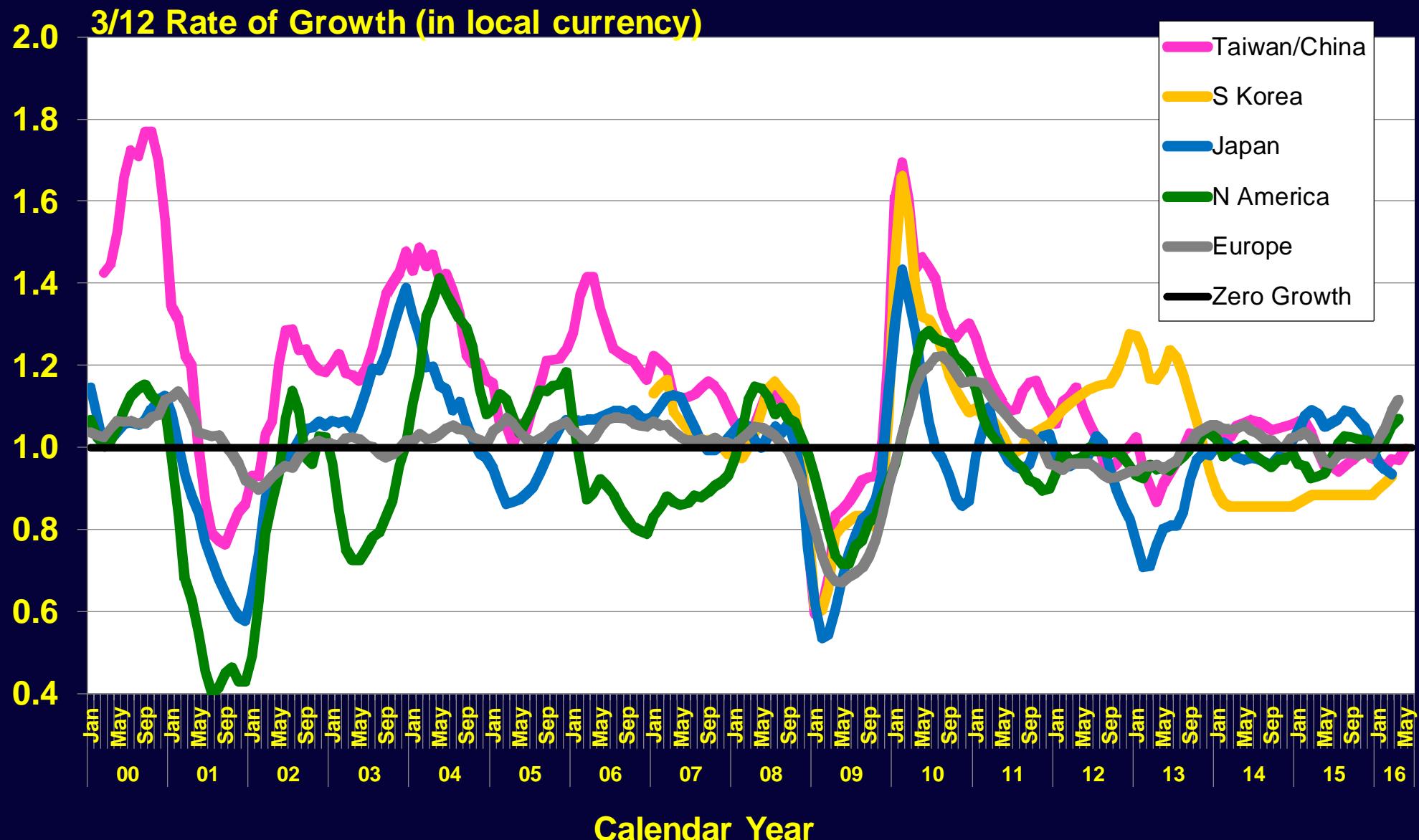
# Global Growth Rates Process Equipment, Materials & Laminate



Company Financials of 12 Laminate suppliers, 13 material suppliers & 8 Process Equipment Suppliers

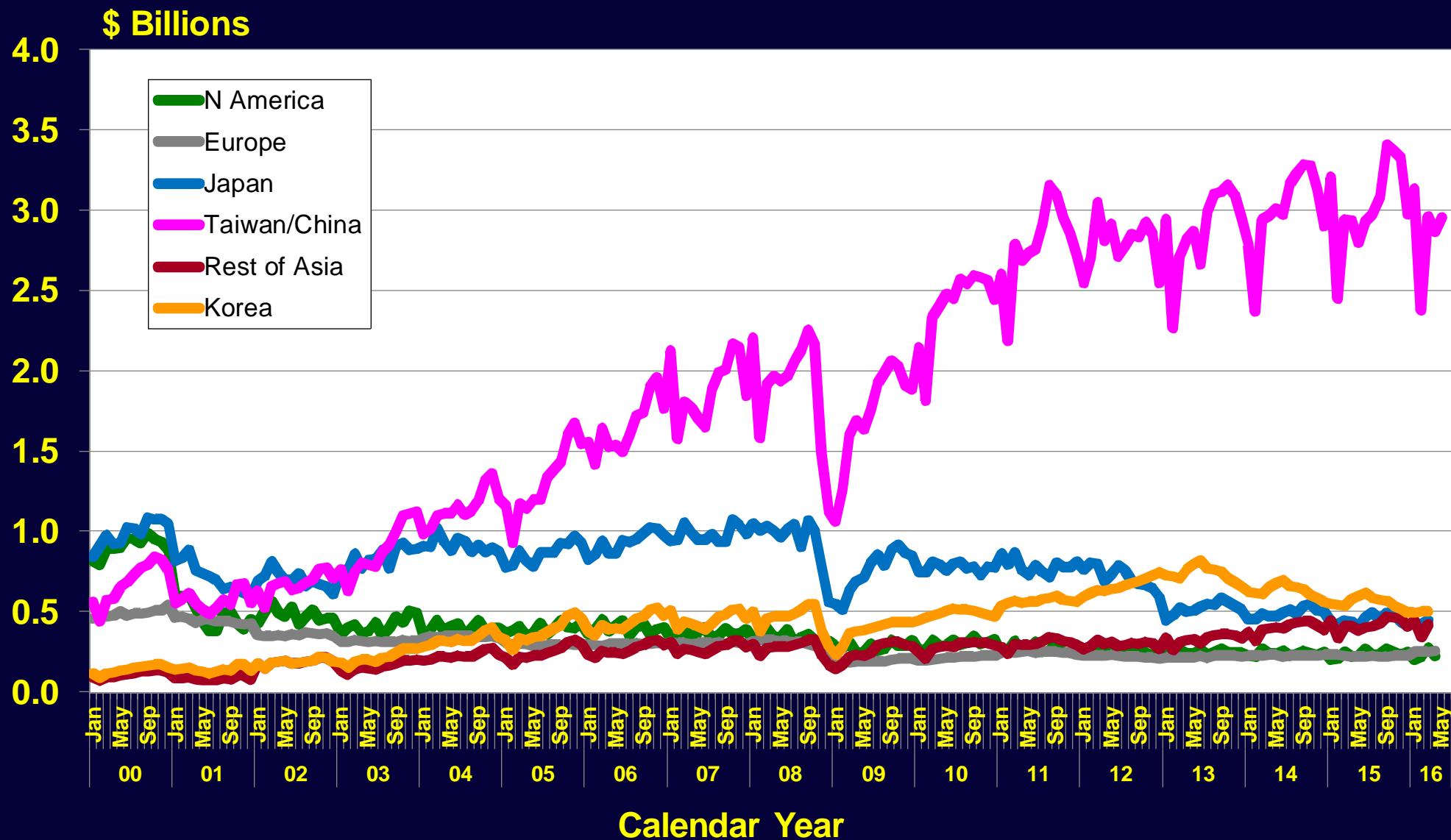
# **World PCB Model**

# Regional PCB Shipment Growth



Sources: IPC, JPCA, Taiwan/China composite; Eurostat "wiring devices" for Europe

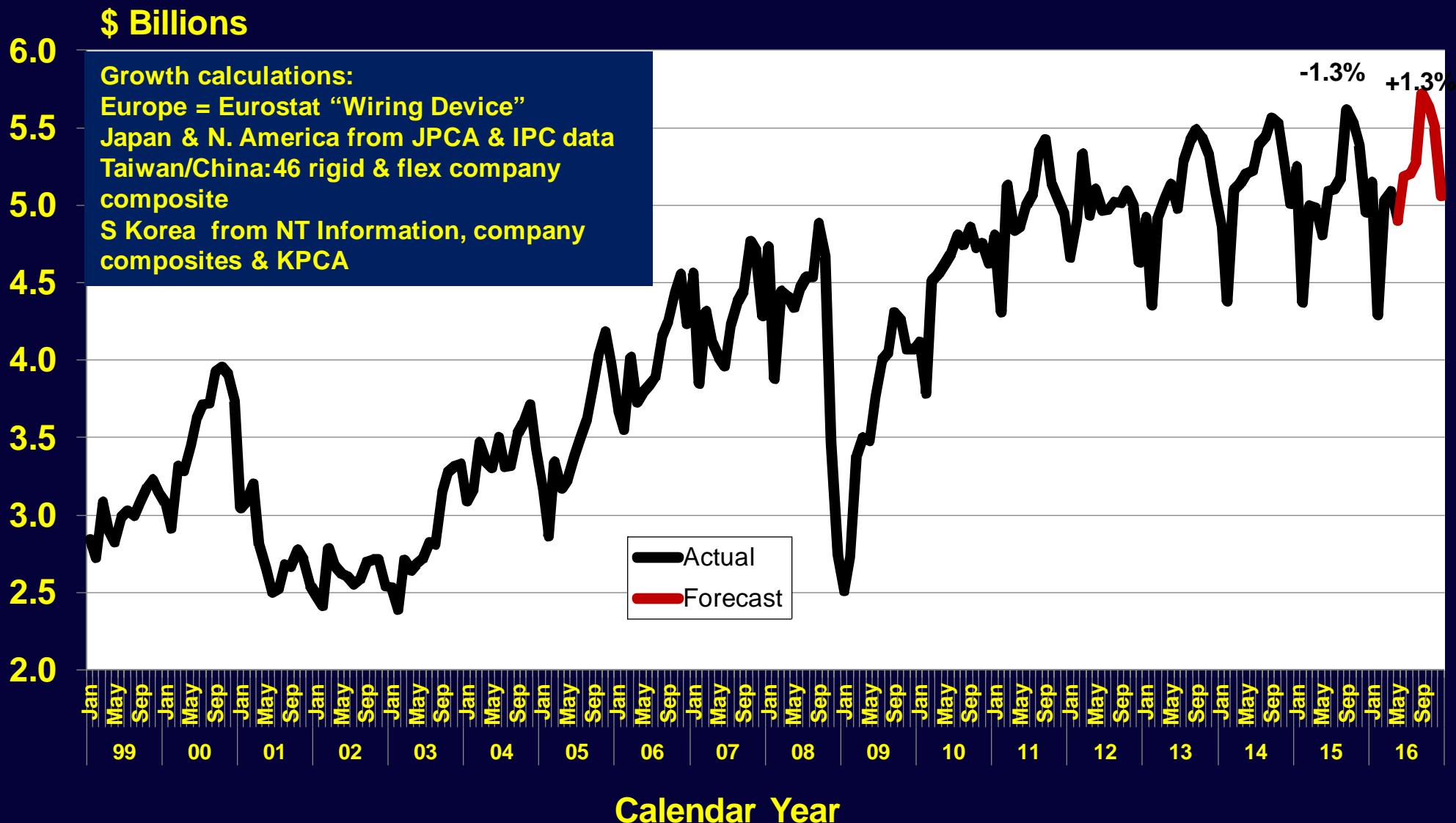
# World PCB Monthly Shipments Converted @ Fluctuating Exchange Rates



**Source: Custer Consulting Group**

# World PCB Shipments (with forecast)

## Converted @ Fluctuating Exchange Rates



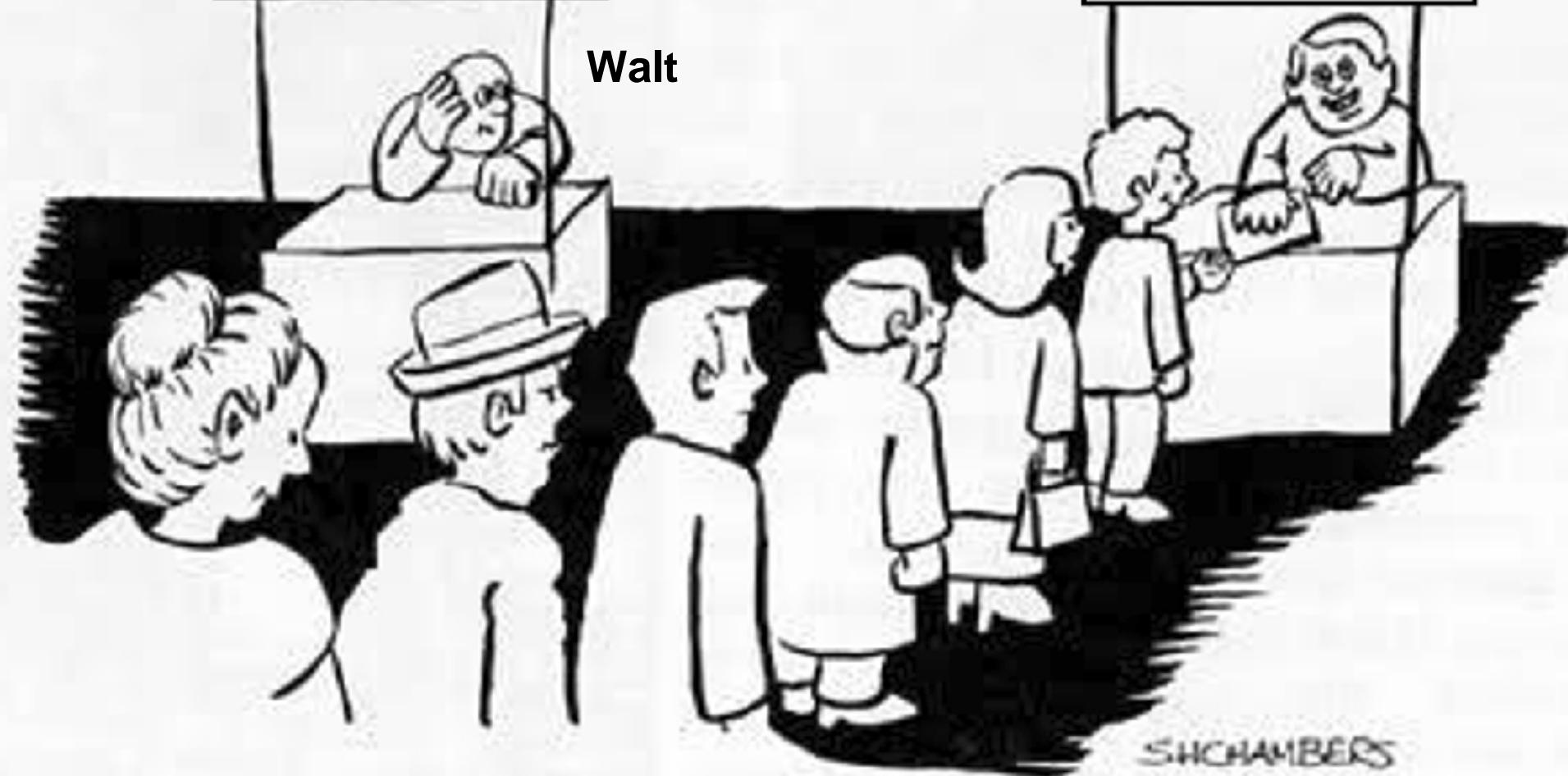
Source: Custer Consulting Group - 2010 base year expanded by monthly growth of N. American, European, Japanese, Korean & Taiwan/China monthly PCB shipments

# Forecasts

**Unpleasant  
Truth**

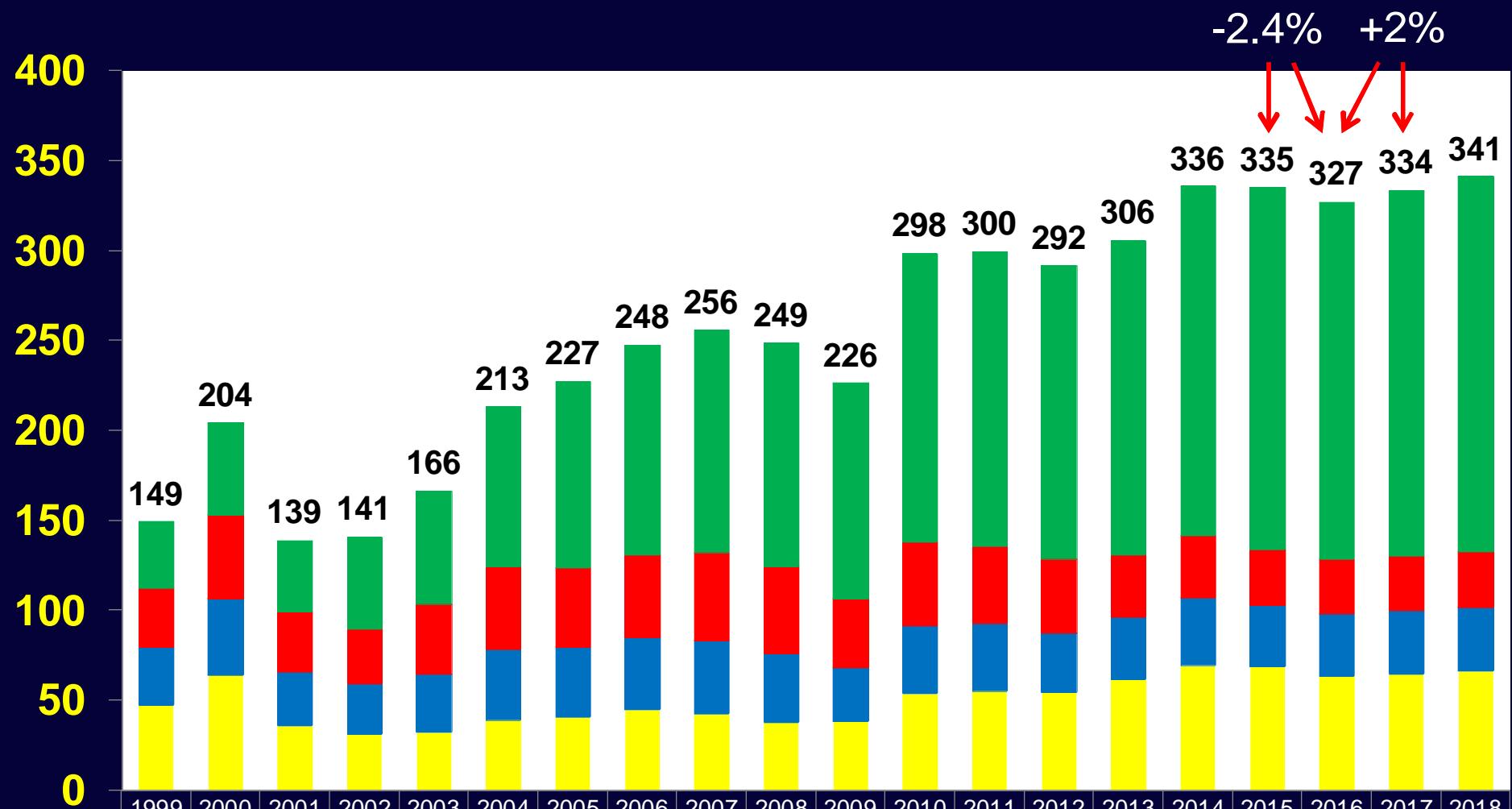
**Comforting  
Lies**

**Walt**



# Worldwide Semiconductor Market by Geography

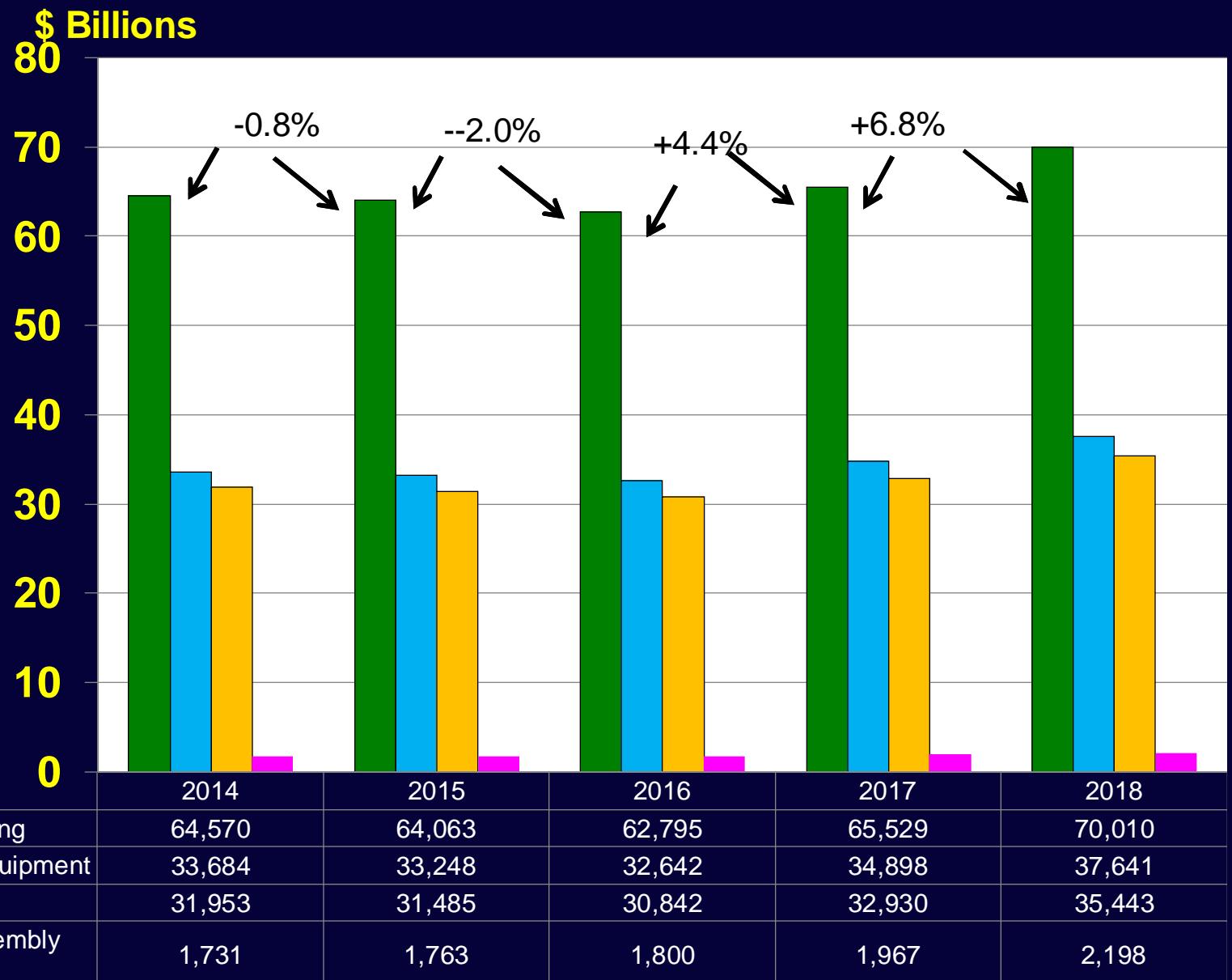
## WSTS Forecast



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Total	149.4	204.4	138.9	140.8	166.3	213.1	227.4	247.7	255.6	248.6	226.3	298.3	299.5	291.6	305.6	335.8	335.2	327.2	333.7	340.9
Asia Pacific	37.2	51.3	39.8	51.2	62.8	88.8	103.5	116.5	123.5	124.0	119.6	160.0	164.0	163.0	174.4	194.2	201.1	198.7	203.1	207.9
Japan	32.8	46.7	33.1	30.5	38.9	45.8	44.1	46.4	48.8	48.5	38.3	46.6	42.9	41.1	34.8	34.8	31.1	30.6	30.9	31.4
Europe	31.9	42.3	30.2	27.8	32.3	39.4	39.1	39.9	41.0	38.2	29.9	38.1	37.4	33.2	34.9	37.5	34.3	34.2	34.8	35.3
Americas	47.5	64.1	35.8	31.3	32.3	39.1	40.7	44.9	42.3	37.9	38.5	53.7	55.2	54.4	61.5	69.3	68.7	63.7	64.9	66.3

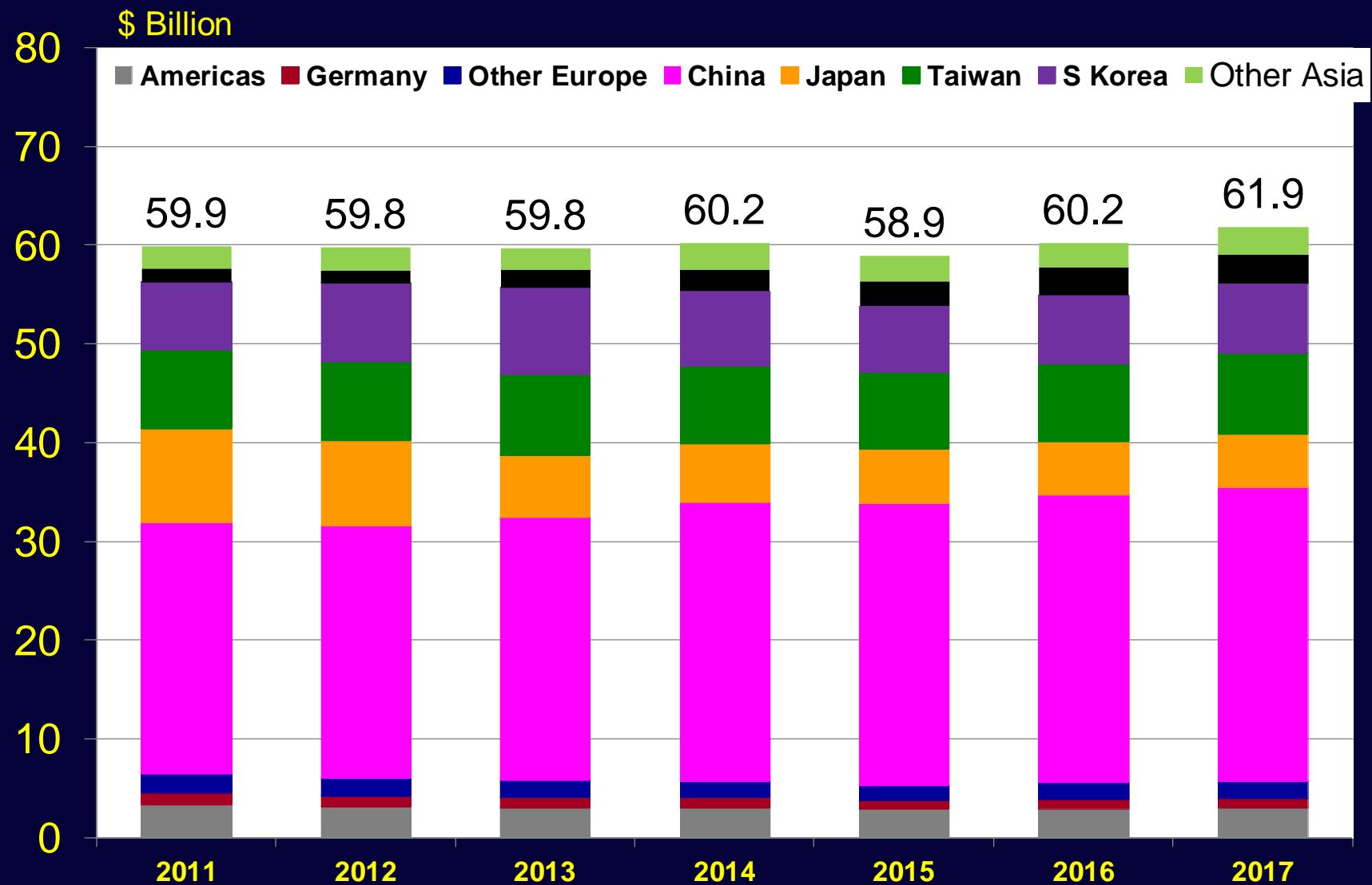
# World Semiconductor Capital Spending & Equipment Spending Forecast 2014-2019 (\$Billions)

20160510



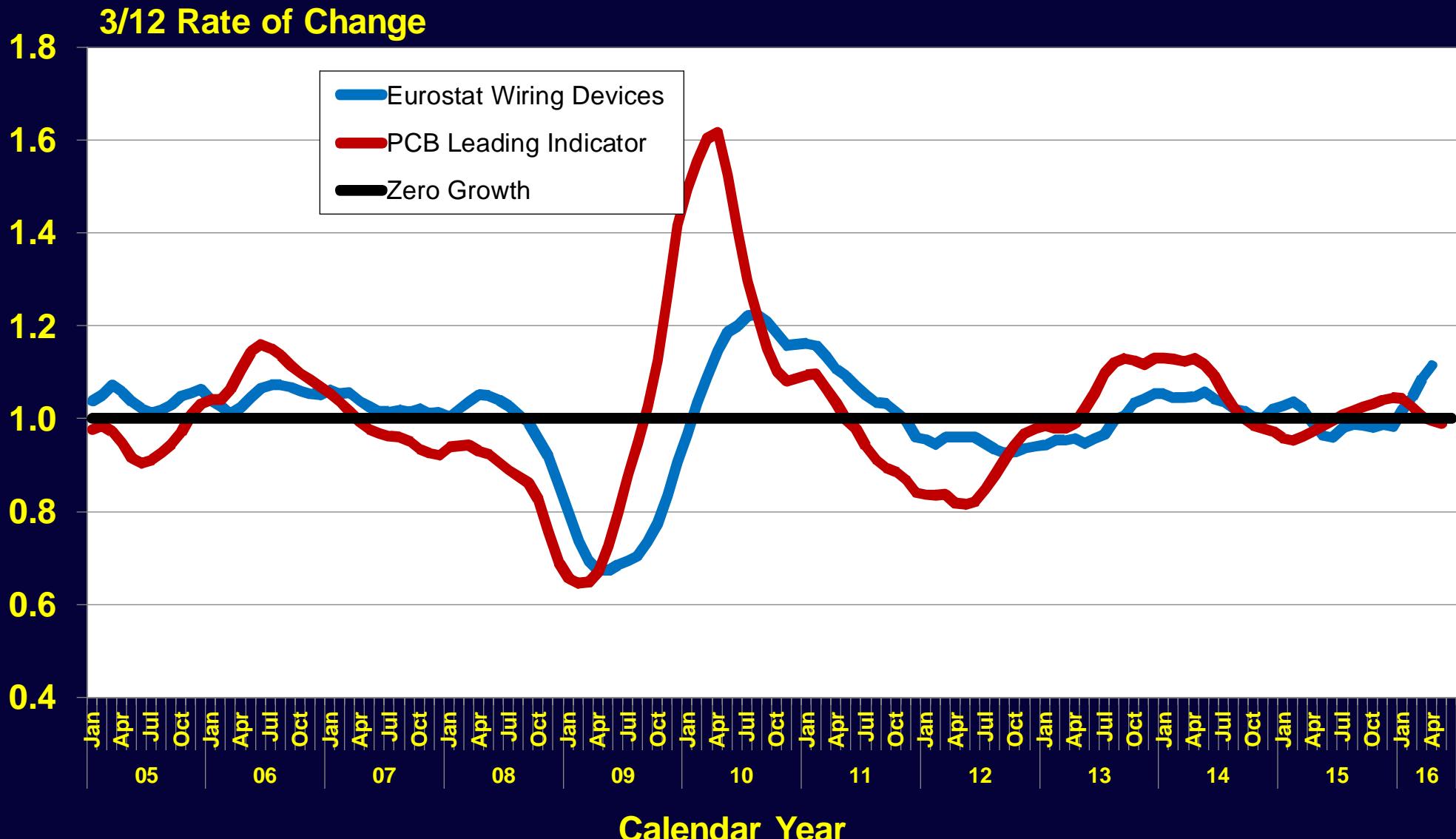
# World Rigid & Flex PCB Production

Converted @ 10/15 Exchange Rates



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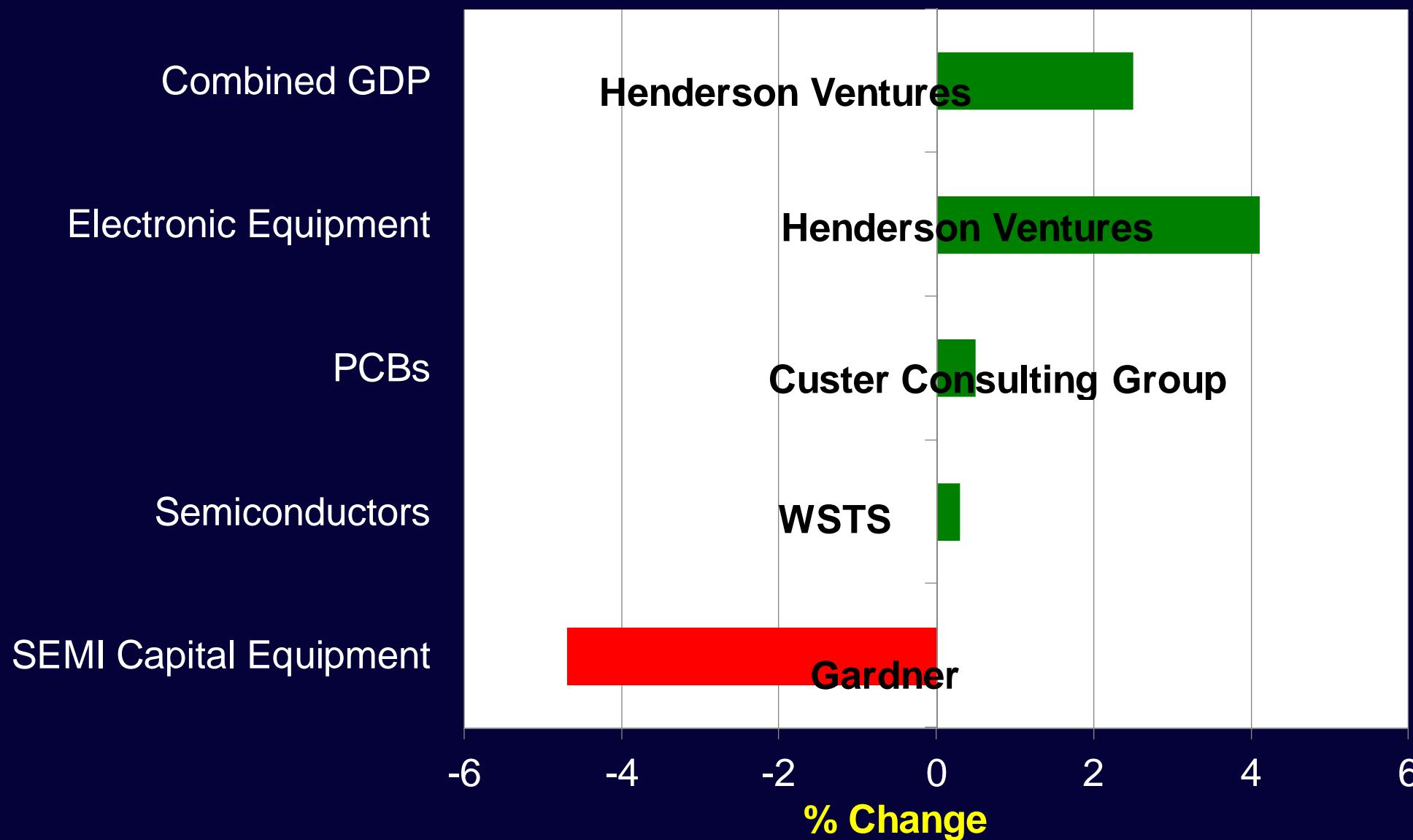
# Europe PMI Leading Indicator vs. Europe Wiring Devices



Source: Custer Consulting Group

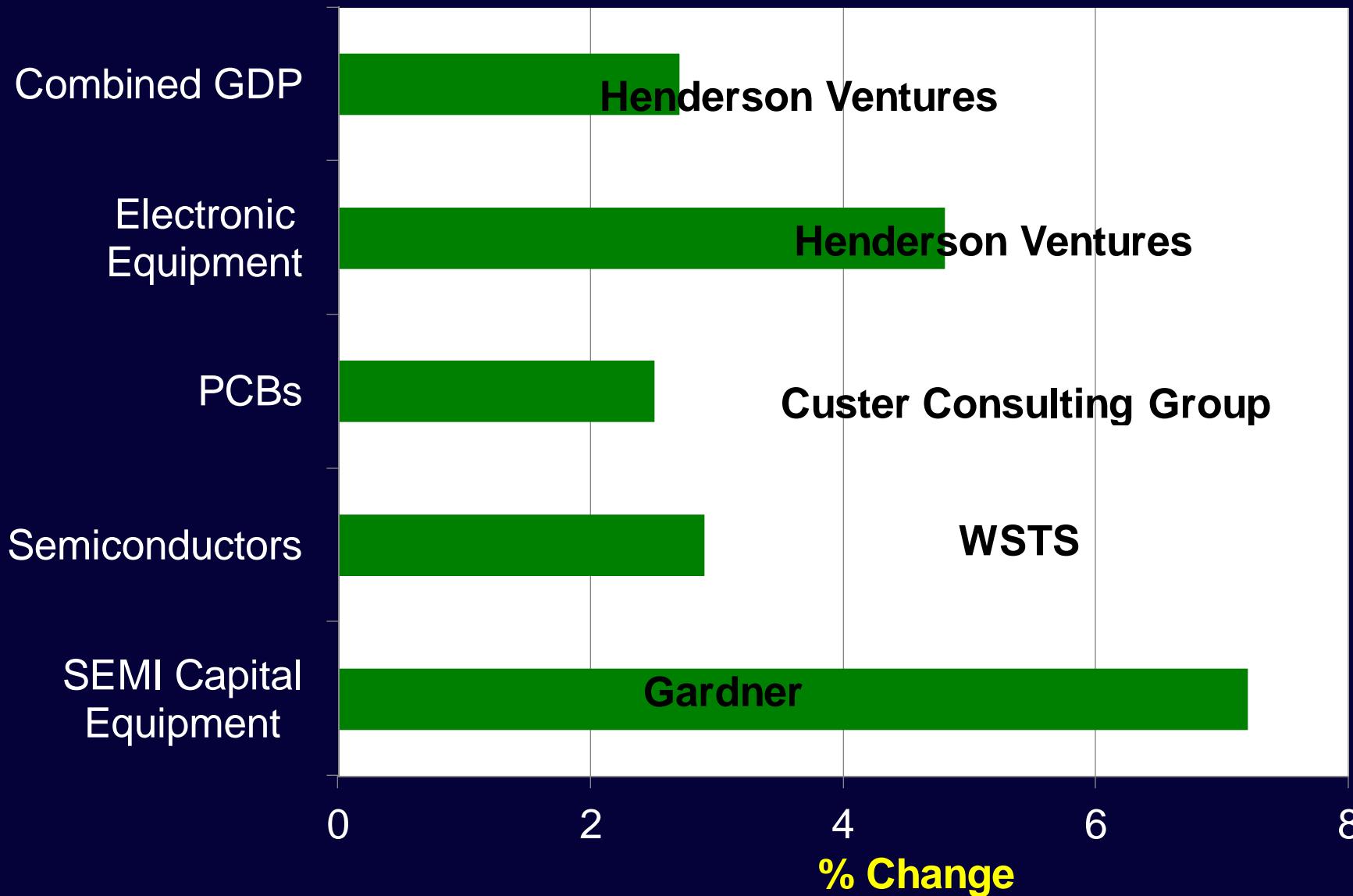
# Global Electronic Supply Chain Forecast

## 2016 vs. 2015



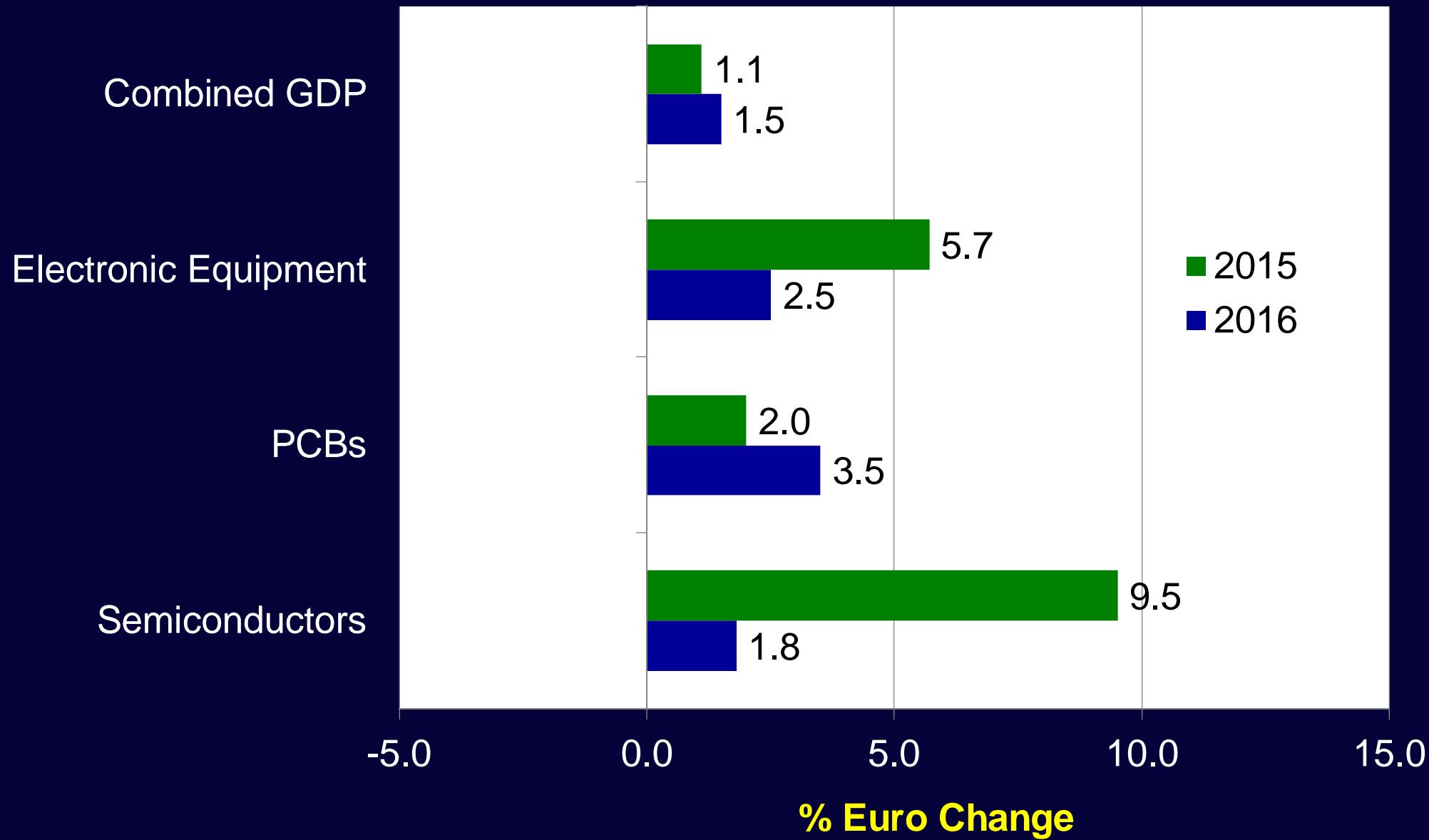
# Global Electronic Supply Chain Forecast

## 2017 vs. 2016



# Europe Electronic Supply Chain Growth

## 2015 vs. 2016



# 2016 Summary

Global electronic equipment volume markets excluding automotive will be stagnant; emerging markets are not yet large

China and Japan receding, USA flat, Europe growing modestly

Global unrest and terrorist threats remain major issues; enhanced border security will impede commerce

Political uncertainty is widespread. Brexit decision looms.

Europe outpacing many other regions but economic conditions are difficult. Electronic equipment production to grow 2-4%.

European end markets more stable than SE Asia's

# Custer Consulting Group Products

## Daily News Services (6 days/week)

- Global electronics supply chain
- Solar/Photovoltaic supply chain

## Business Outlook

- Market charts & data

Global market

OEMs

Components, EMS, ODM, materials & process equip

Solar/Photovoltaic

- Weekly Market Comments with latest charts