



A Consensus Outlook of the Global Economy *And What It Implies for Semiconductors*

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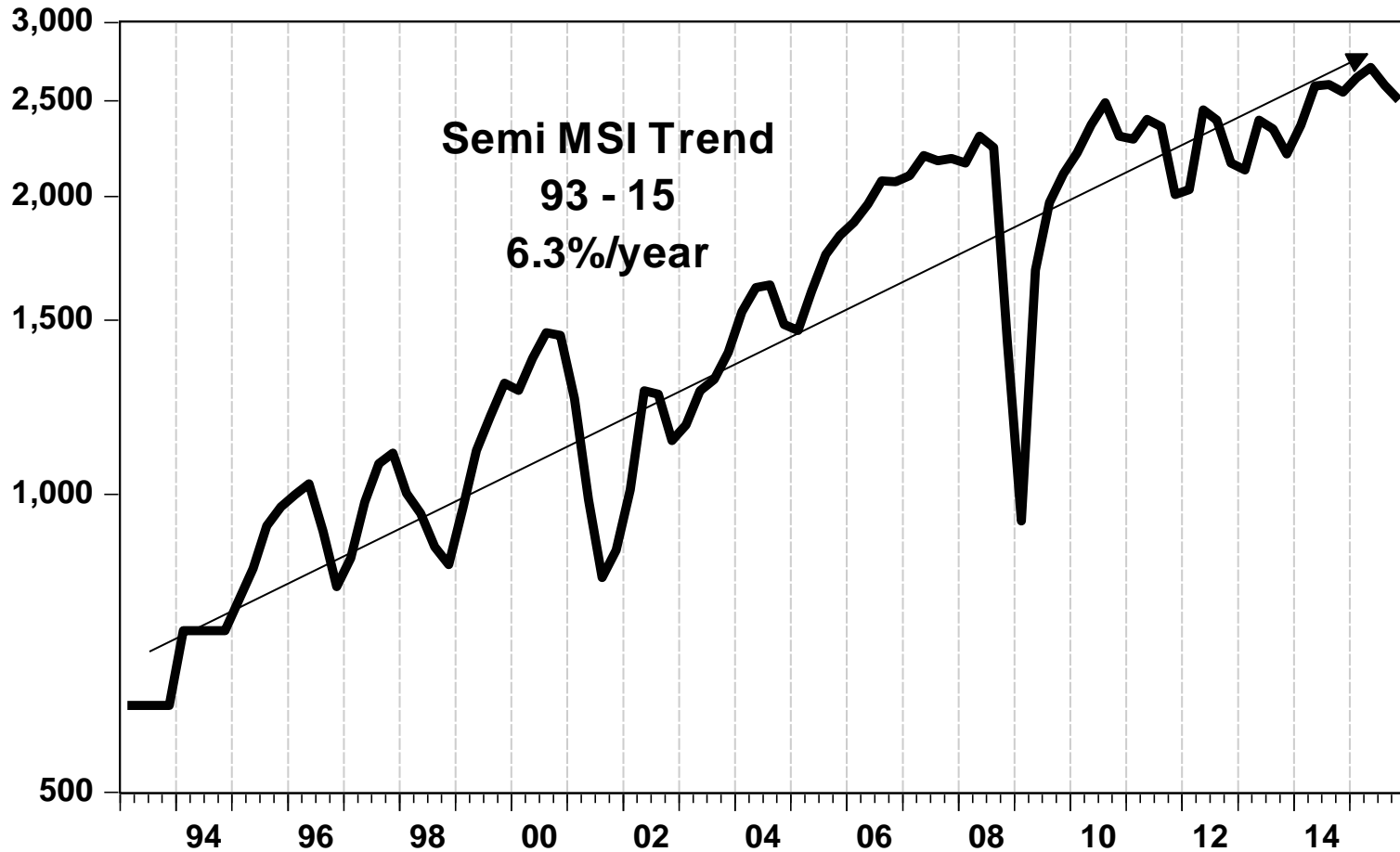
**A global outlook based on Consensus Economics, Inc.*
CONSENSUS FORECASTS®

Outline

- Why the semiconductor industry should care about the broader economy (real GDP)
- Global outlook and how we got here
- Semi MSI outlook (ESF March 2016)
- Risks in the economy

Semiconductor Industry Measure: SEMI.ORG's MSI

Million Square Inches

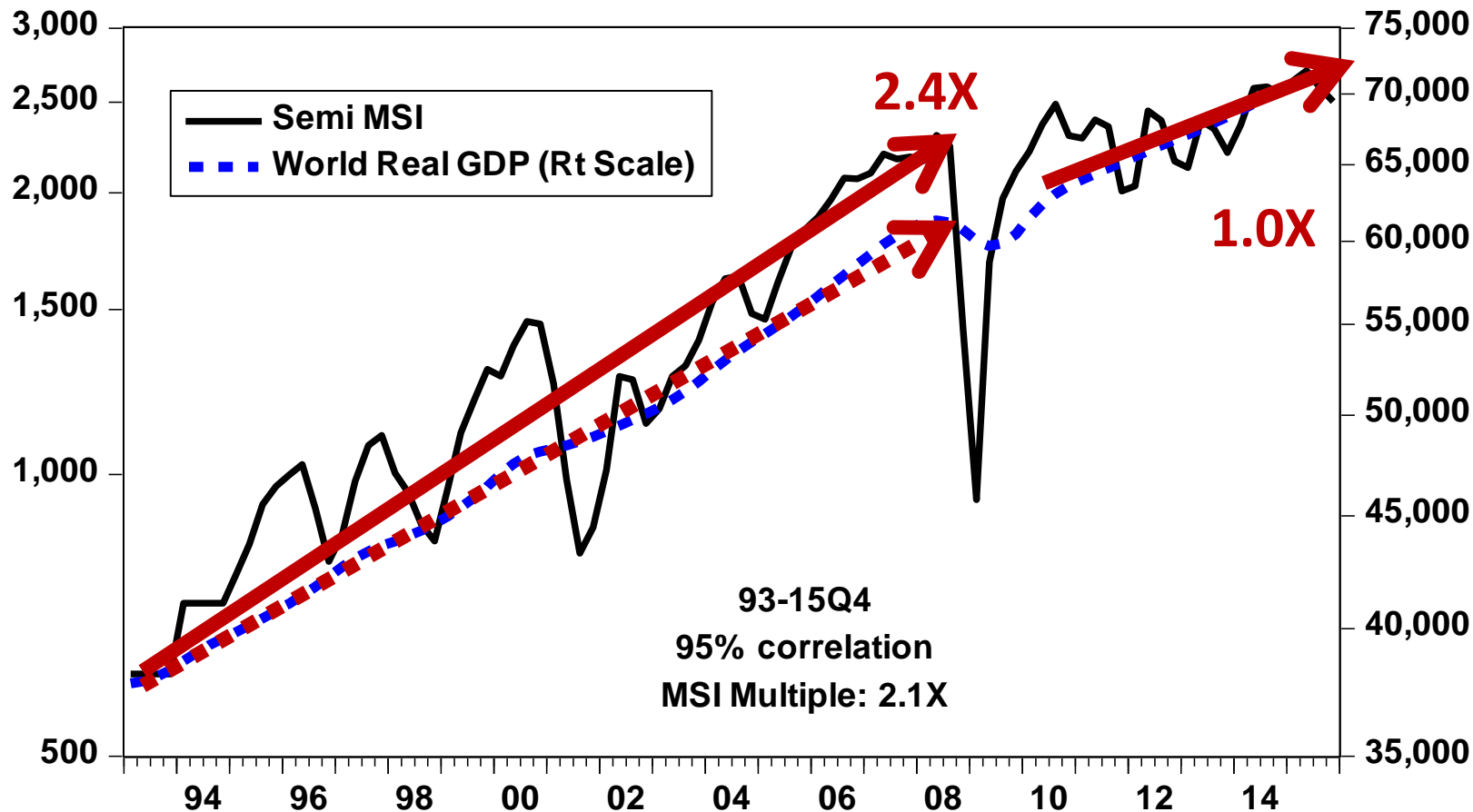


MSI = Real GDP Since the Recession

Chips are so pervasive in the economy, demand is now driven by the economy

Million Square Inches

Billion 2010 US\$

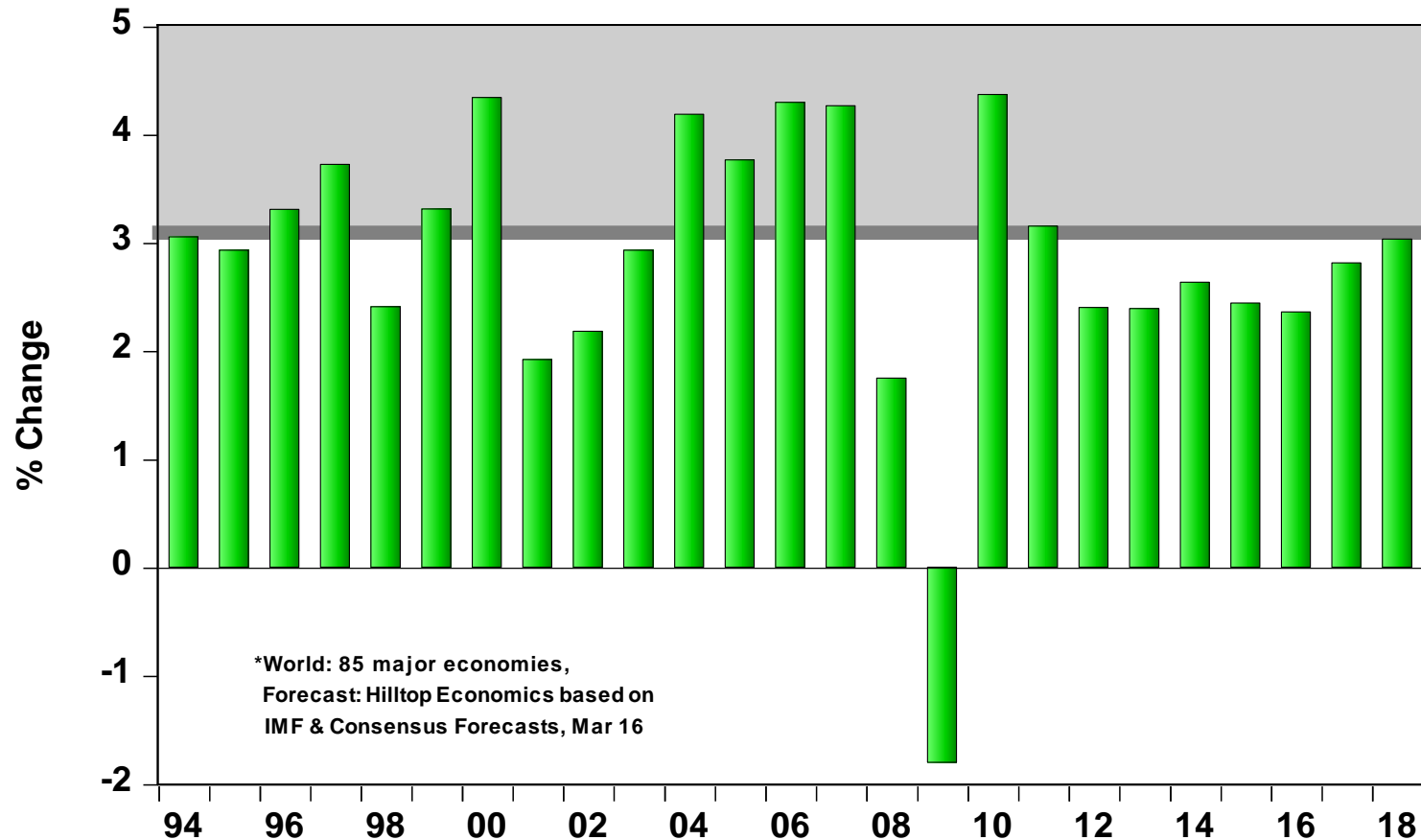


Total real (inflation-removed) spending on finished goods and services by businesses, governments and consumers in 85 of the largest economies: highly correlated with Semi MSI

World Real GDP Growth Below Par 2012 - 2017

World* Par ~3.2%/Year

2014: +2.6% 2015: +2.4% 2016: +2.4% 2017: +2.8%



Why Slow and Will It Continue?

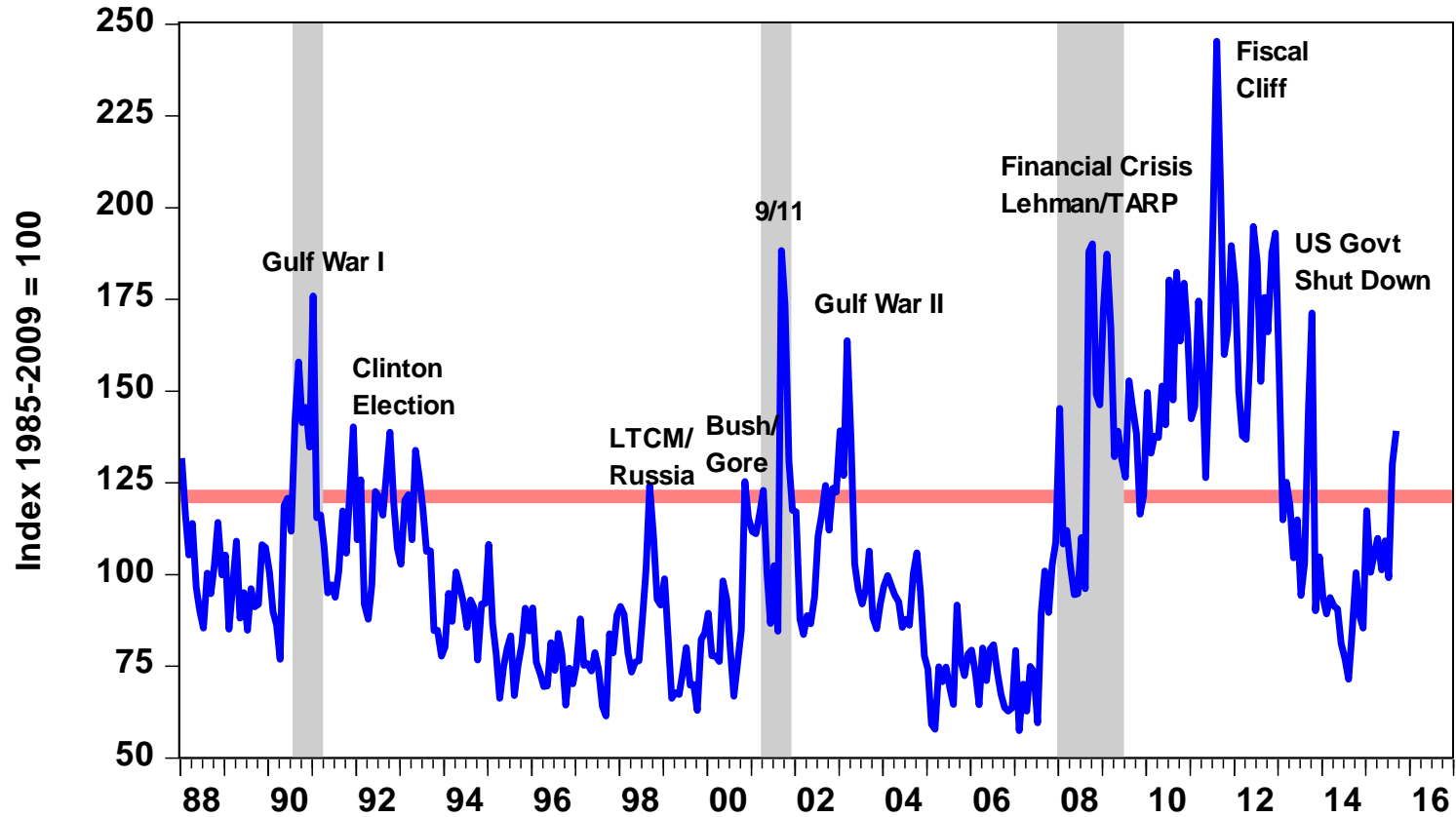
- Governments changed the “Rules”
- Consumer and business aversion to risk skyrocketed
- Demand did not recover to pre-crisis growth rates once the crisis passed (by 2010)

Why Slow and Will It Continue?-I

- Governments changed the “Rules”
 - Economic policies & regulations to “fix” the financial system
 - Monetary policy: low interest rates, oceans of money
 - Economic policies to cope with demand collapse
 - Creating high economic policy uncertainty as policies & regulations continue to adjust
- Expect policies to SLOWLY stabilize but...
- Economic policy uncertainty will remain high until the preponderance of policies stabilize
- Watch: Economic Policy Uncertainty Indexes

Unprecedented Period of Uncertainty After 2008

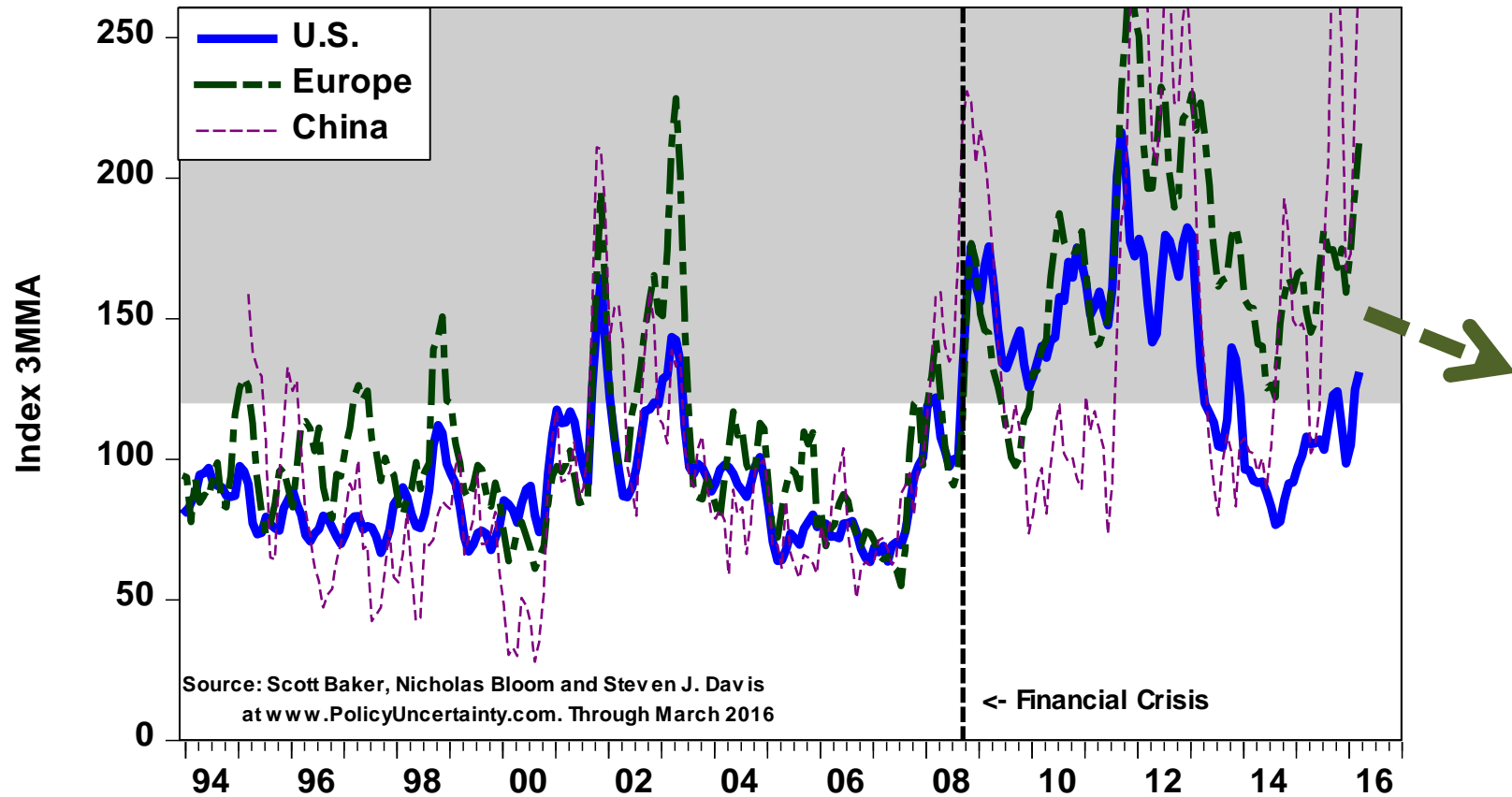
Economic Policy Uncertainty



Source: Scott Baker, Nicholas Bloom and Steven J. Davis at www.PolicyUncertainty.com
Shaded areas indicate official recessions

Uncertainty In Key Economies Remains A Dampening Factor on Growth: Expect Very Slow Improvement

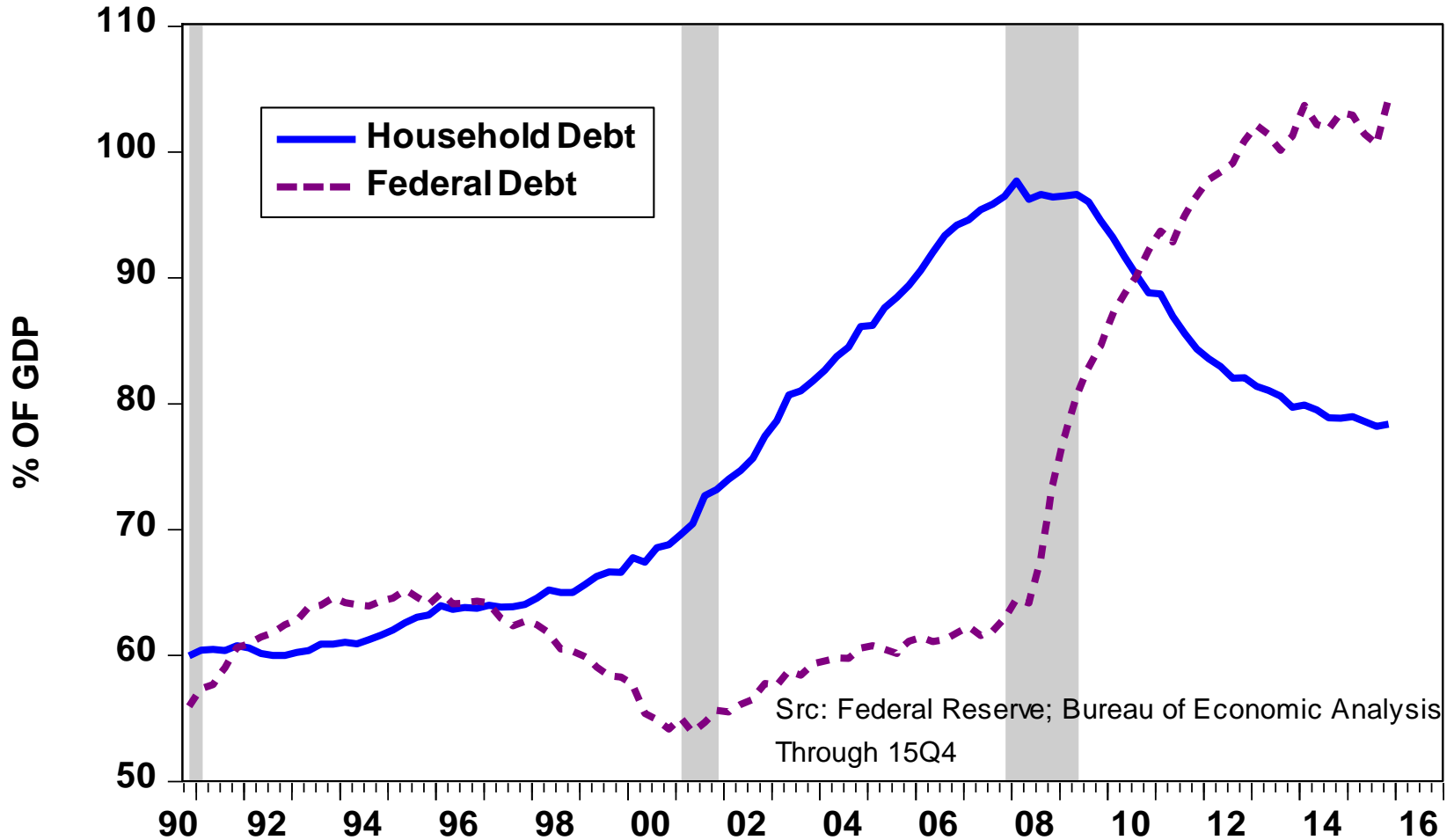
Economic Policy Uncertainty



Why Slow and Will It Continue?- II

- Consumer and business aversion to risk skyrocketed
 - Stopped borrowing to spend
 - Paid down debt even as governments took on debt
 - Raised cash
- Risk aversion should recede slowly:
 - As jobs recover
 - As businesses begin to perceive growth opportunities
- Forecast Risk: potential for permanent change in consumer, business and government behavior with all the negative feedbacks (e.g. the Depression Generation, part II)

U.S. Household Debt Drops as Government Rises



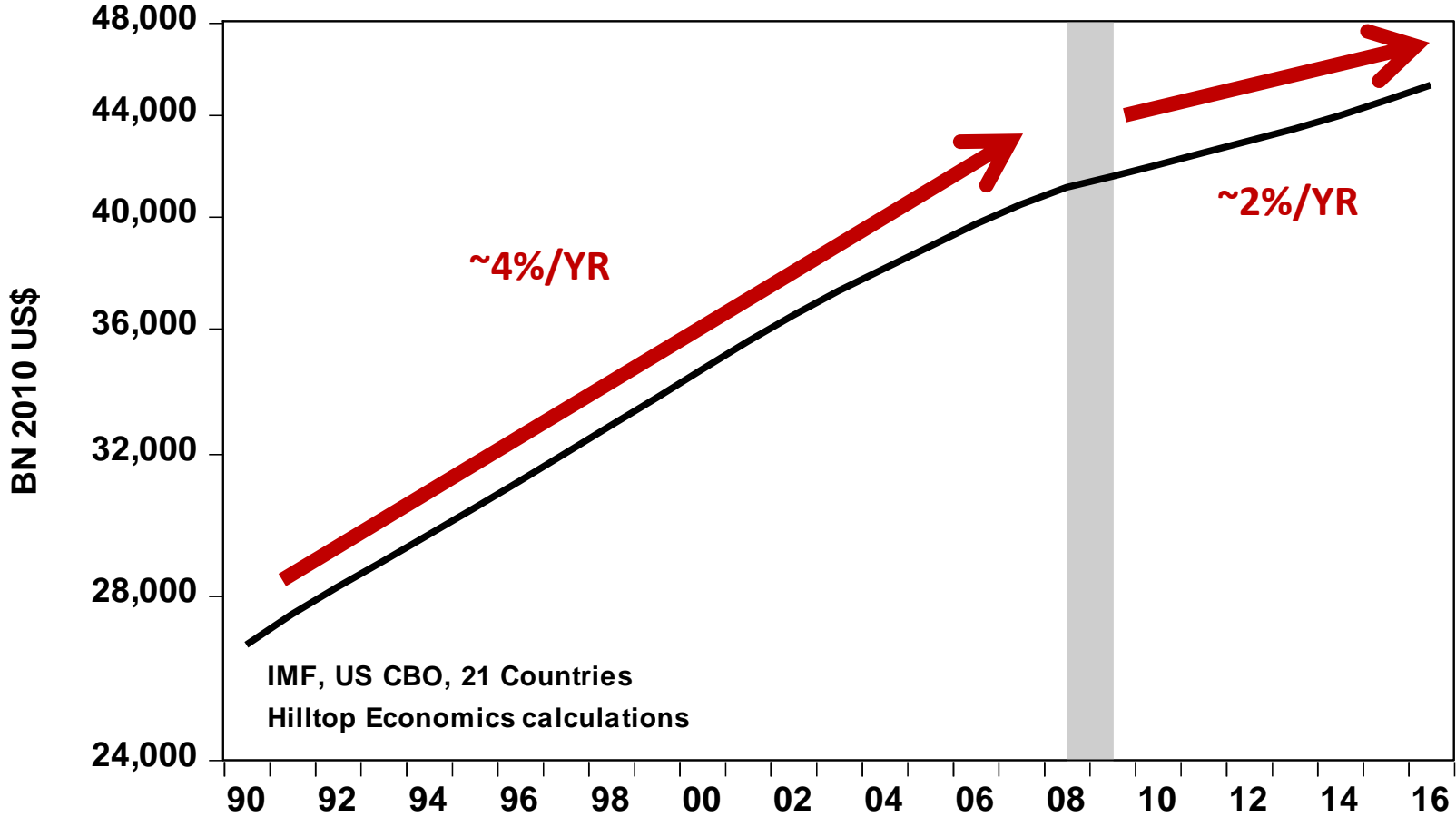
Src: Federal Reserve; Bureau of Economic Analysis
Through 15Q4

Why Slow and Will It Continue? - III

- Demand did not recover to pre-crisis growth rates
 - Consumers remain cautious
 - Investment remains very weak
 - Slow real GDP + low inflation = weak topline growth
 - High uncertainty
 - Excess capacity (until output gap closes all the way)
 - Cheap capital (low interest rates) not enough to stimulate investment or consumption.
 - Stimulates M&A activity
- Demand is forecast to recover by 2017-2018

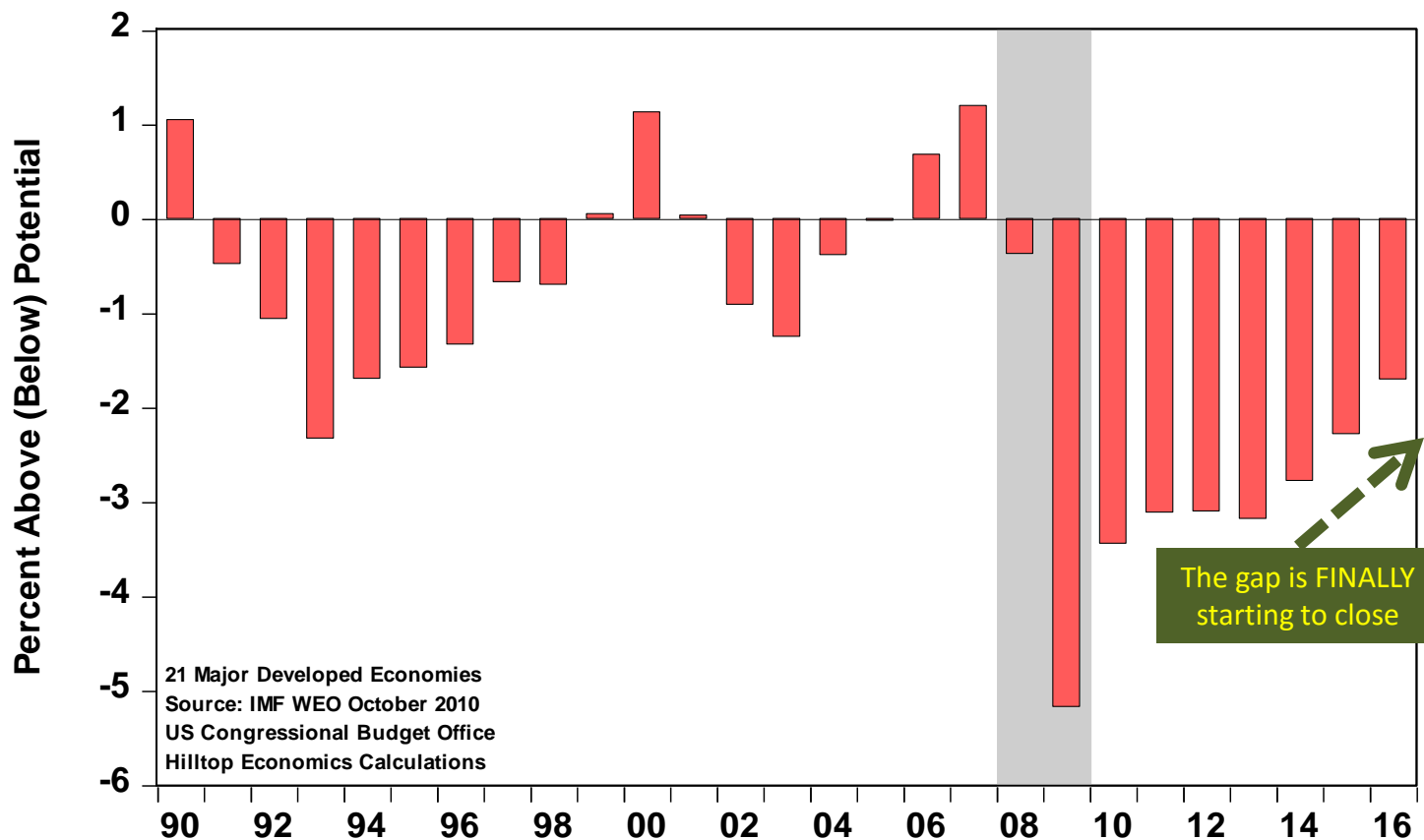
What the Global Economy Can Produce: Much Slower Growth Since the Financial Crisis

Potential Output



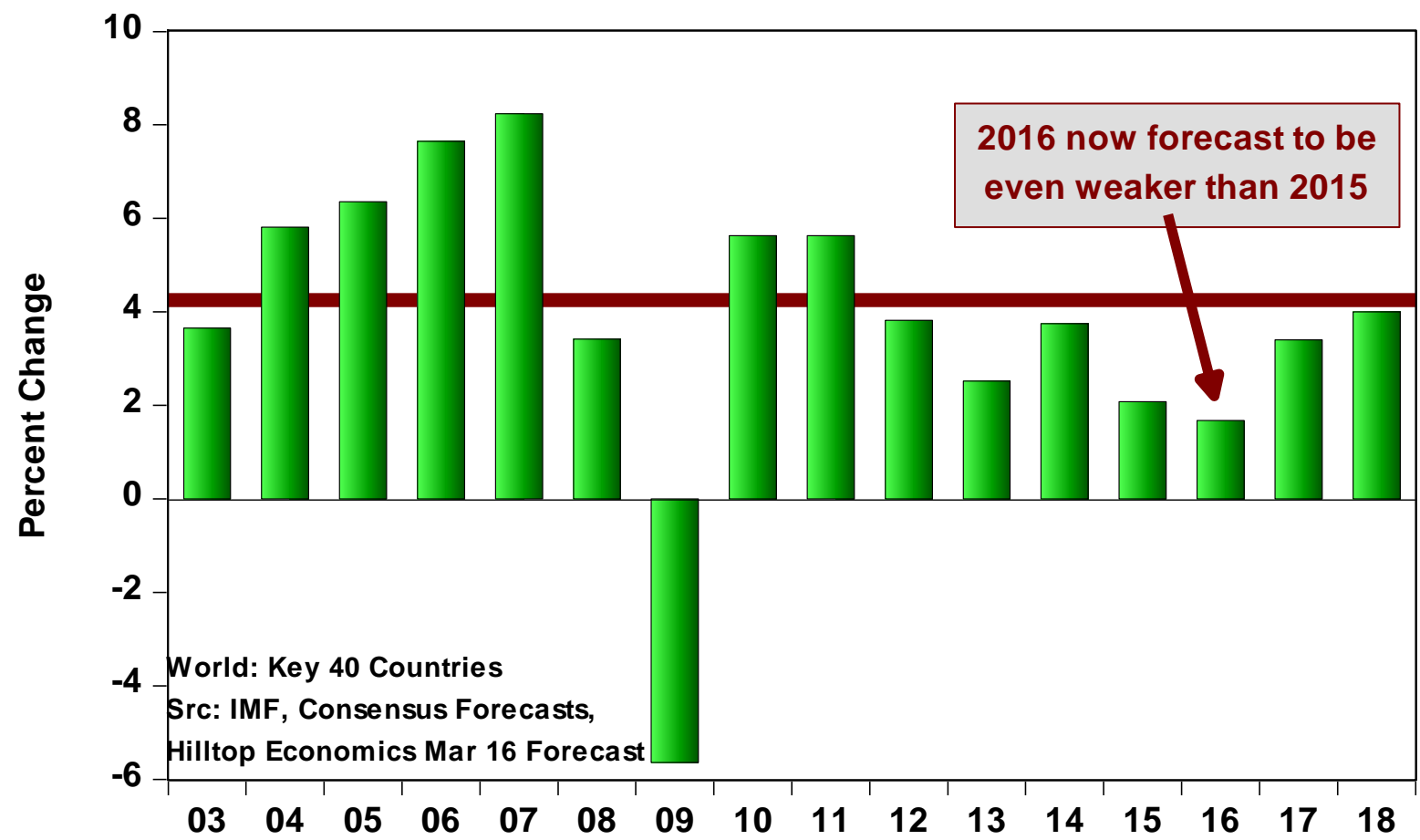
Slower Potential Growth Has Closed the Output Gap Giving Support to the Forecast for Investment in 2017

GLOBAL OUTPUT GAP

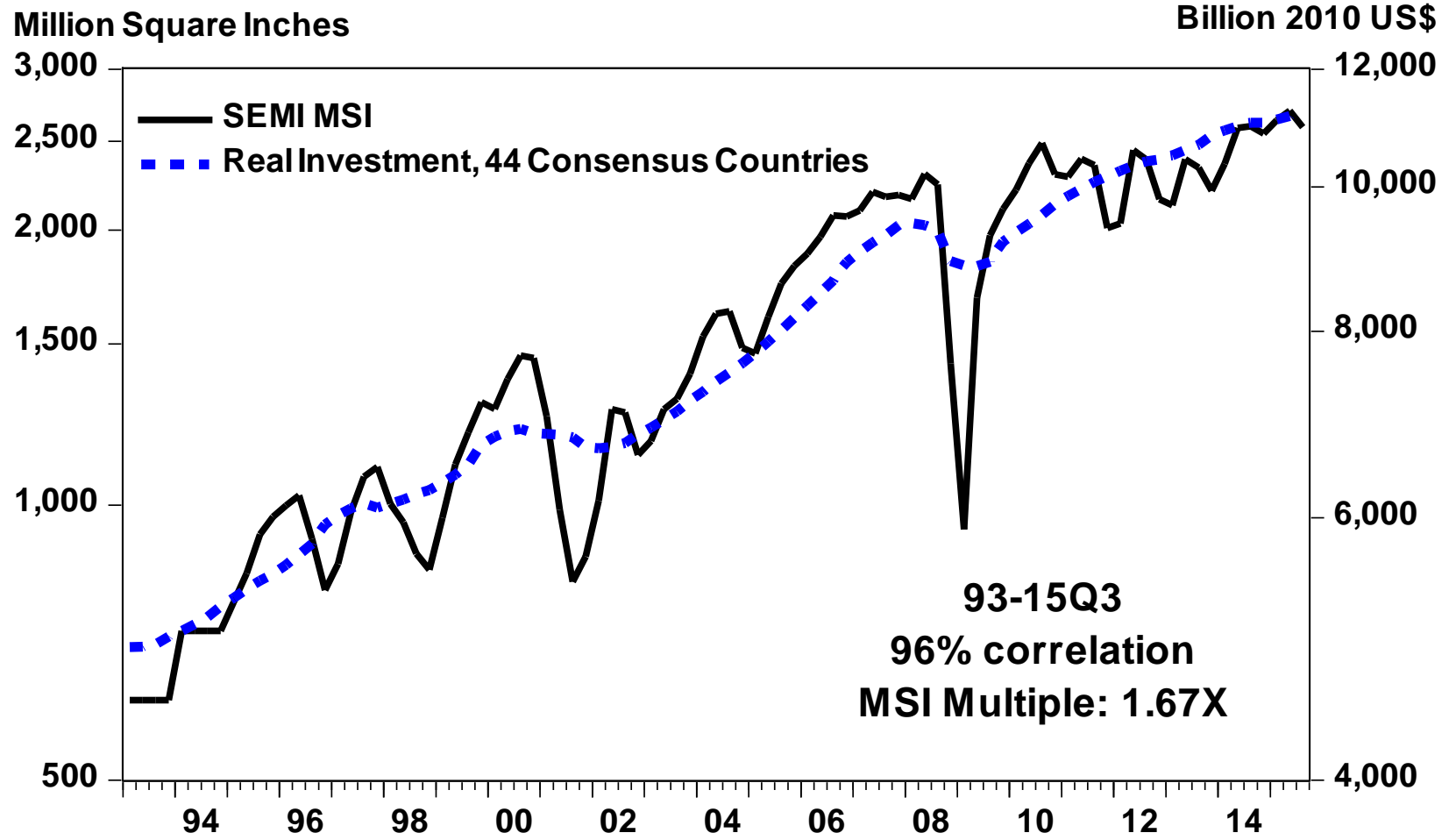


Global Investment Continues To Grow Too Slowly

World* Real Investment



Real Investment Critical for Semiconductors



Final spending on fixed investment – plant, equipment & structures - is even more highly related to MSI over the past 23 years than total real GDP

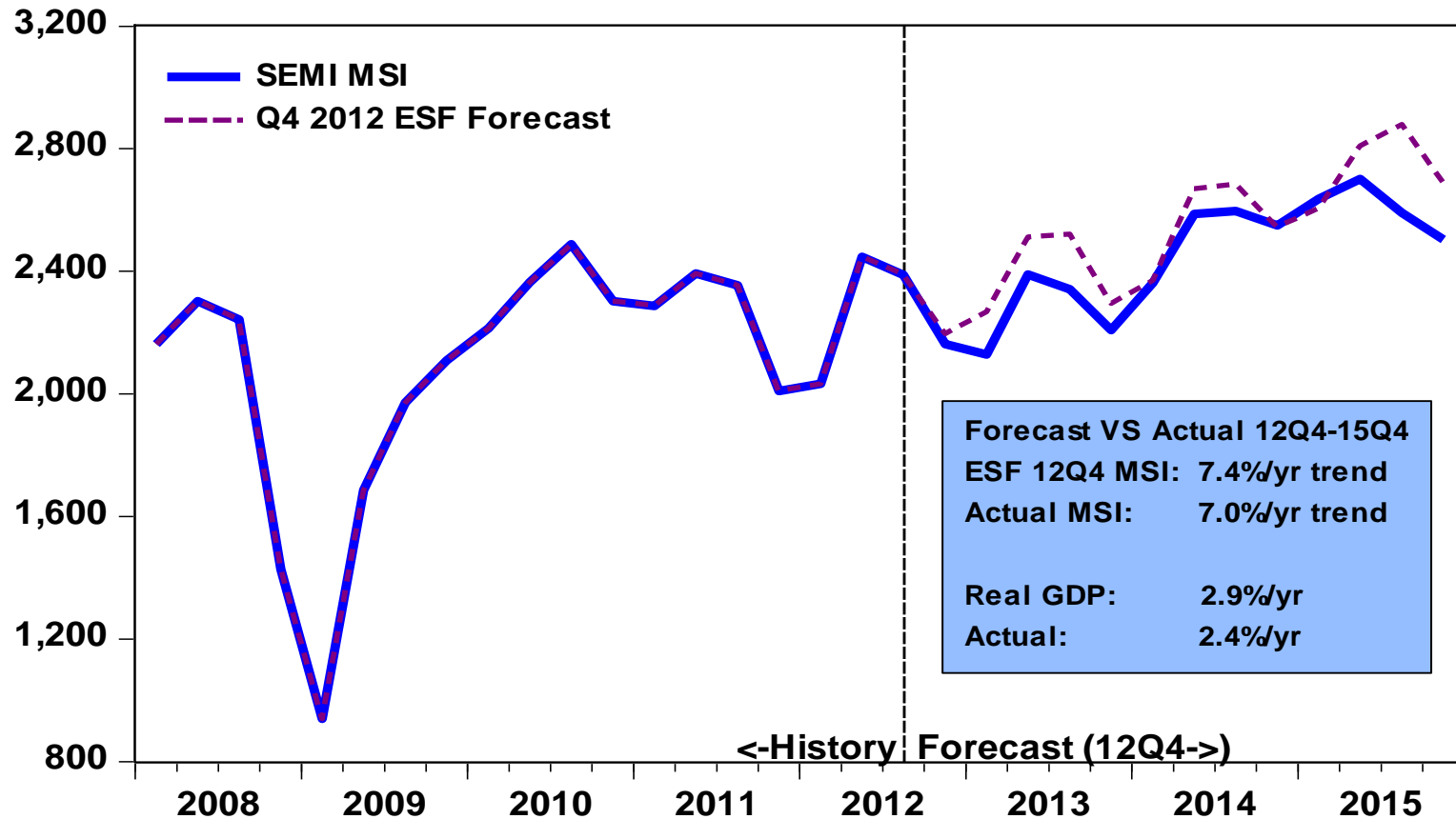
Semiconductor MSI Outlook Summary

March Update to ESF 2016 Q1	2014	2015	2016	2017	2018
MSI	10,097	10,434	10,465	11,264	11,744
%Change	11.4%	3.3%	0.3%	7.6%	4.3%

- ***MSI: Flat in 16 on poor investment outlook, snaps back in 2017, falls to around trend in 2018***
- **Global final demand grows marginally in 2016, better in 2017 & 2018**
 - Real GDP should increase in 2016, reach “trend” by 2017
 - Business investment stalls in 2016, begins to recover in 2017
 - Consumer spending rises back toward trend of 3%
 - PC unit sales down sharply in 2015; down modestly in 2016; increase slightly in 2017
 - Mobile phone sales growth slows
 - **No major new markets**

Linx-Consulting Econometric Semiconductor Forecast (ESF)

The First ESF Quarterly Forecast: Overforecast Actual MSI by 0.4% (13 Qtr Trend)



Forecast Performance for ESF

Three Years, Real Time

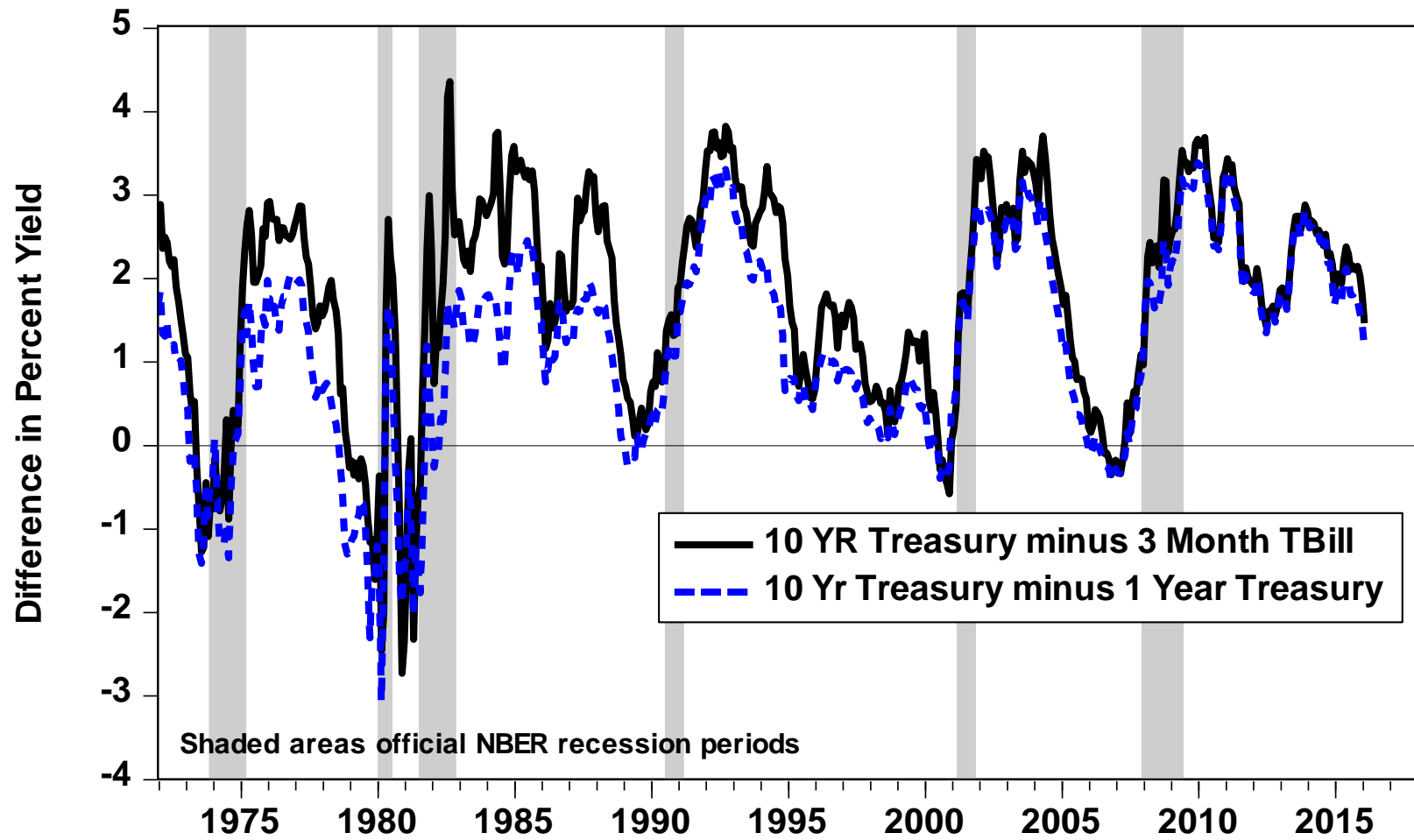
Final demand approach provided superior forecasts. Longer term error attributed to over-forecasts of economic growth, not model error. Pervasiveness of semiconductors key to success of the "final demand" approach to forecasting semiconductors

Cumulative Error on LEVELS	1 Quarter Ahead	2 Quarters Ahead	3 Quarters Ahead	4 Quarters Ahead	8 Quarters Ahead
Ave Percent Error	-0.5%	0.0%	0.0%	-0.1%	0.8%
Mean Absolute Percent Error	2.5%	2.8%	3.0%	2.9%	2.6%
# Forecasts	13	12	11	10	6

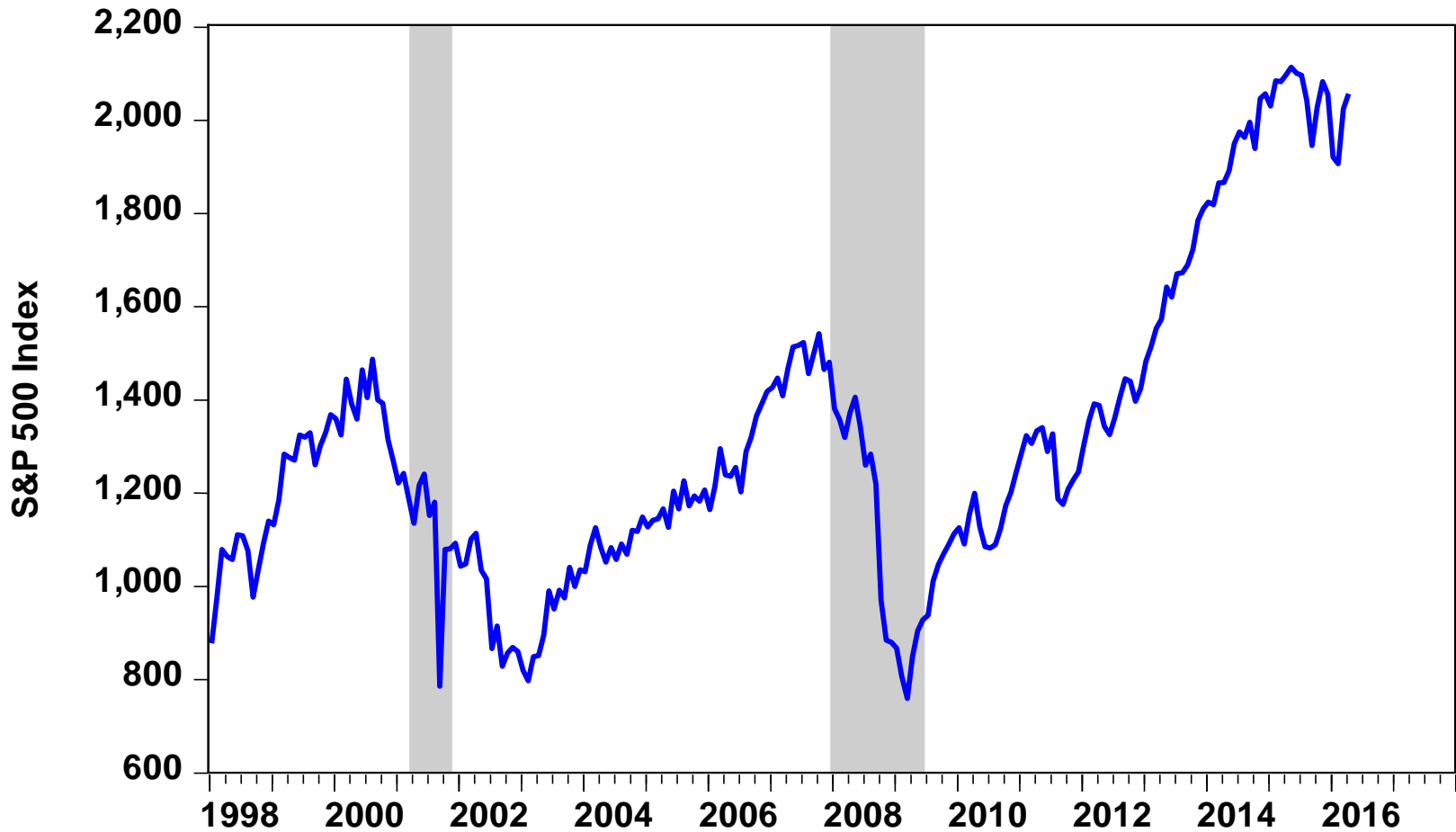
Things to Watch: Risks

- Yield Curve (expected to stay near current levels)
- Federal Reserve interest rate increases impact on financial markets
 - (forecasters don't expect more than two in 2016)
- Magnitude of oil price increase (expected to gradually rise)
- Value of the Dollar (expect to strengthen modestly)
- Inflation
 - (expected to slowly rise to ~2% in US, lower in other parts of the developed world)
- Jobs keep growing and unemployment rates hold
 - (forecasters expect unemployment rate in US to stay in the range of 4.5% and 4.9% in 2016)
- Forecasts getting lowered in a systematic fashion through the year

The Best Single Recession Predictor: Treasury Yield Curve Inverts (Short Rates > Long Rates)

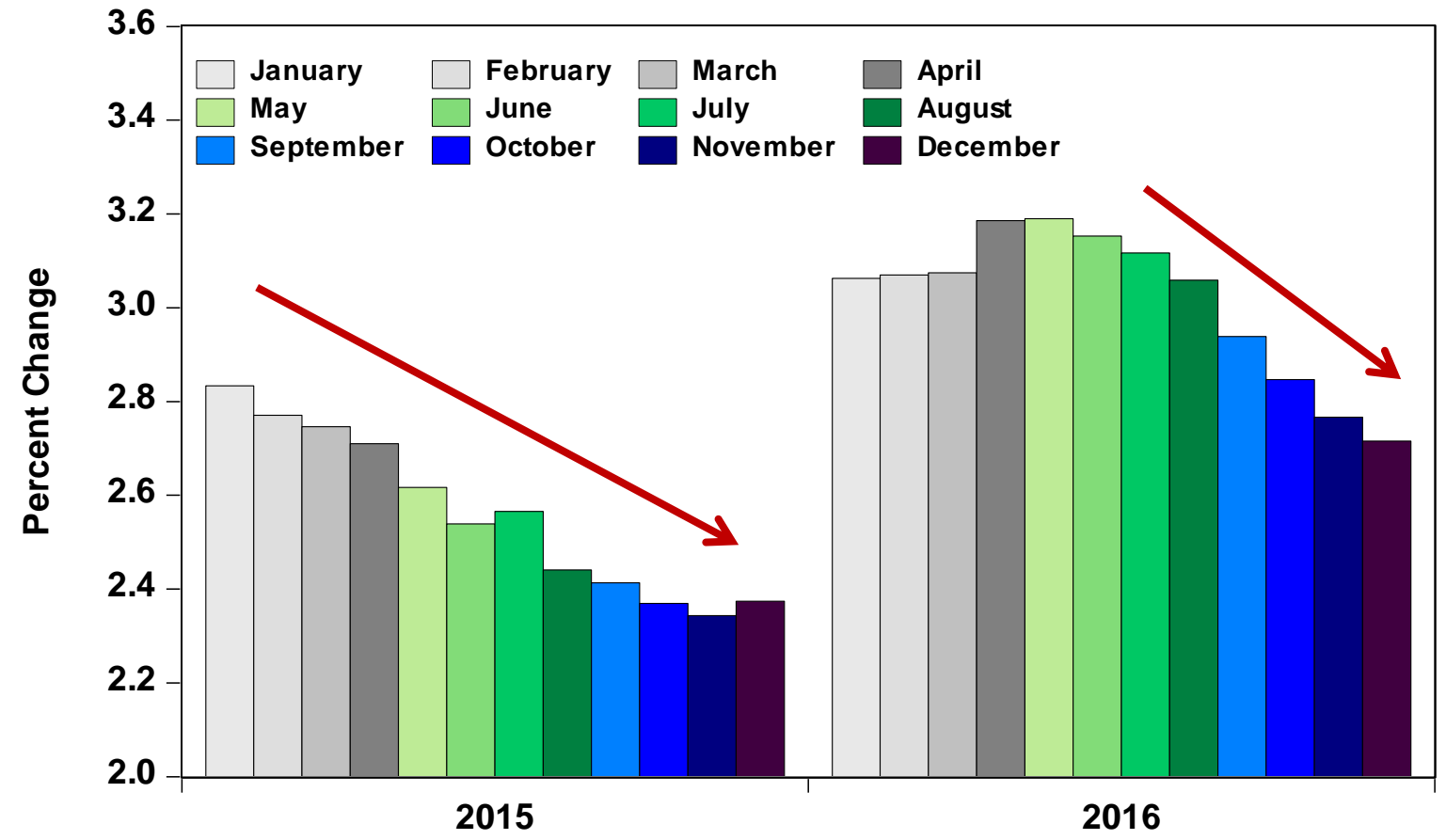


Stock Market: One Place All the Money Went



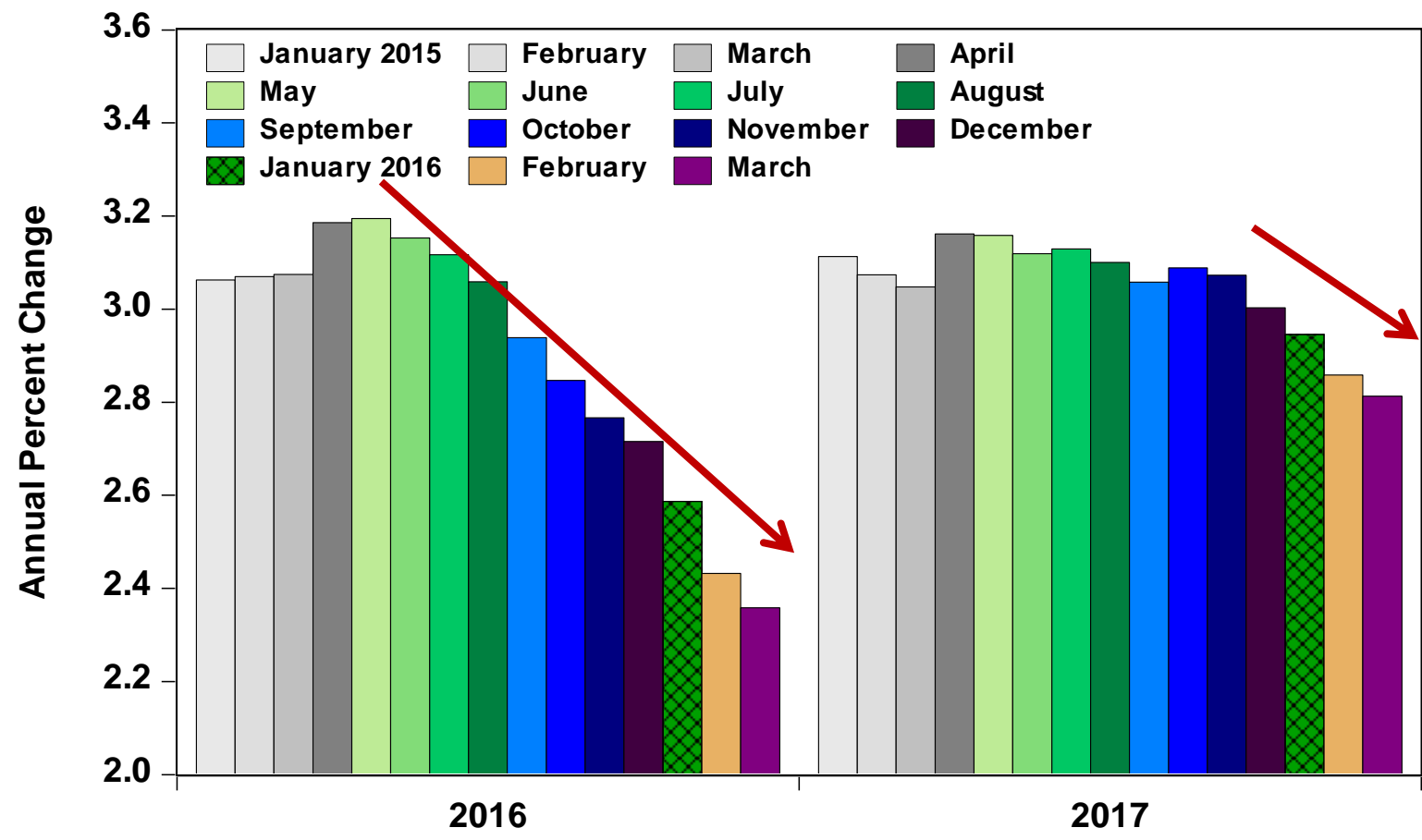
Steady reduction in '15 and '16 forecasts

Global Consensus Real GDP Forecasts



Steady reduction in '16 and '17 forecasts

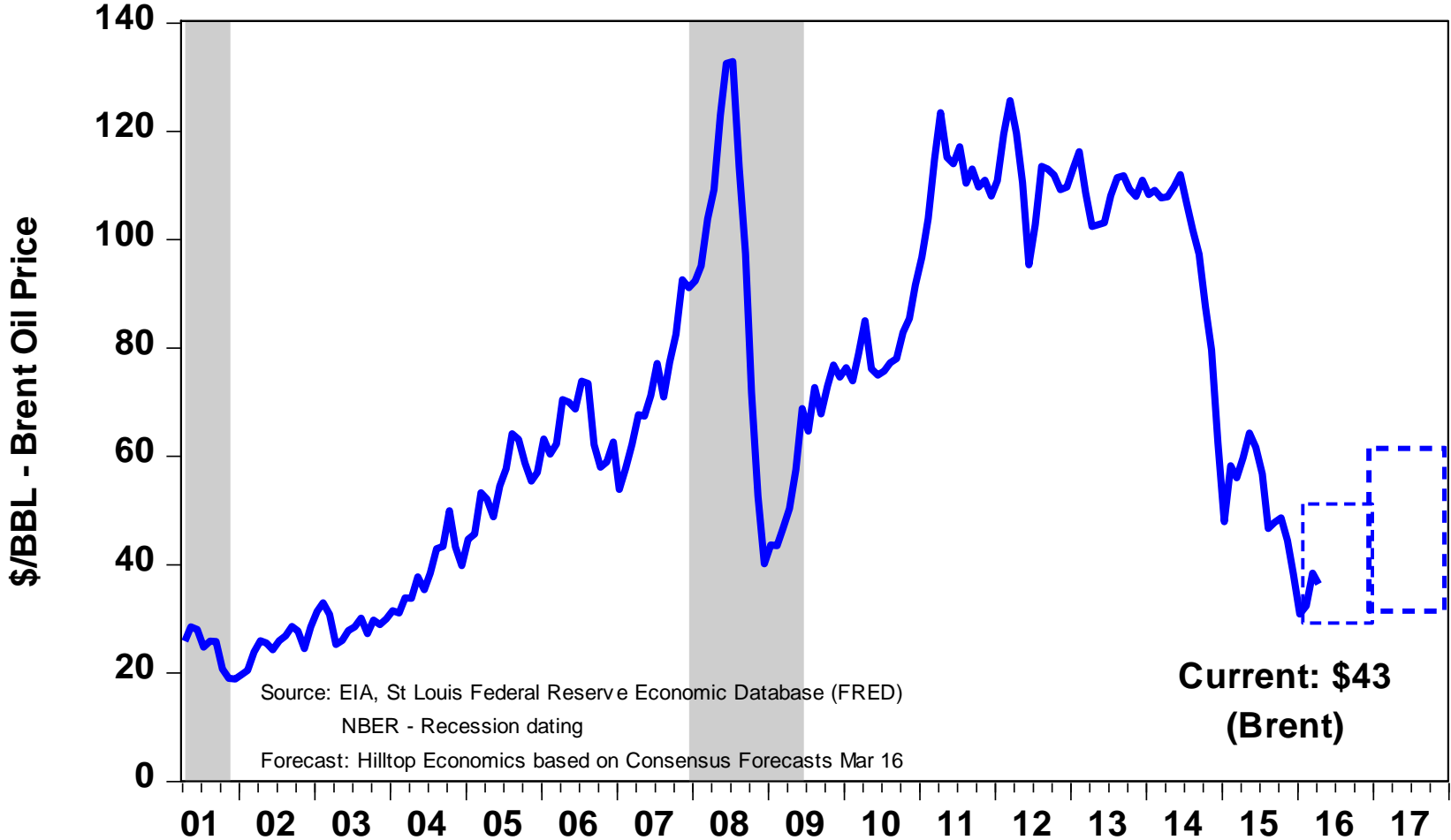
Global Consensus-based Real GDP Forecasts



Forecast for Year By Month Forecast Made

Oil Prices Rise a Little

Modest demand growth plus plenty of supply limit increases

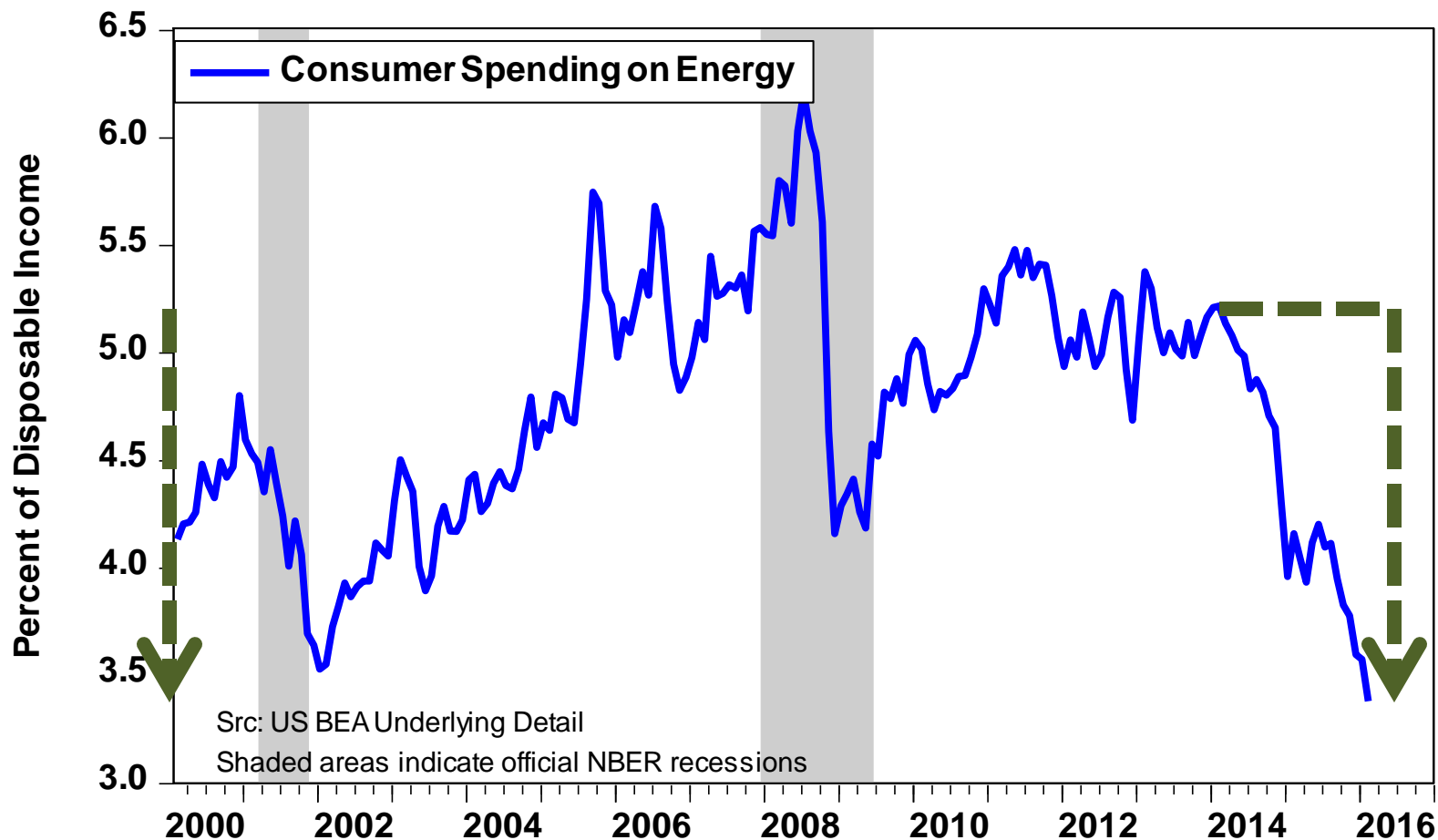


Source: EIA, St Louis Federal Reserve Economic Database (FRED)
NBER - Recession dating
Forecast: Hilltop Economics based on Consensus Forecasts Mar 16

**Current: \$43
(Brent)**

Consumers Globally Benefit From Low Energy Prices

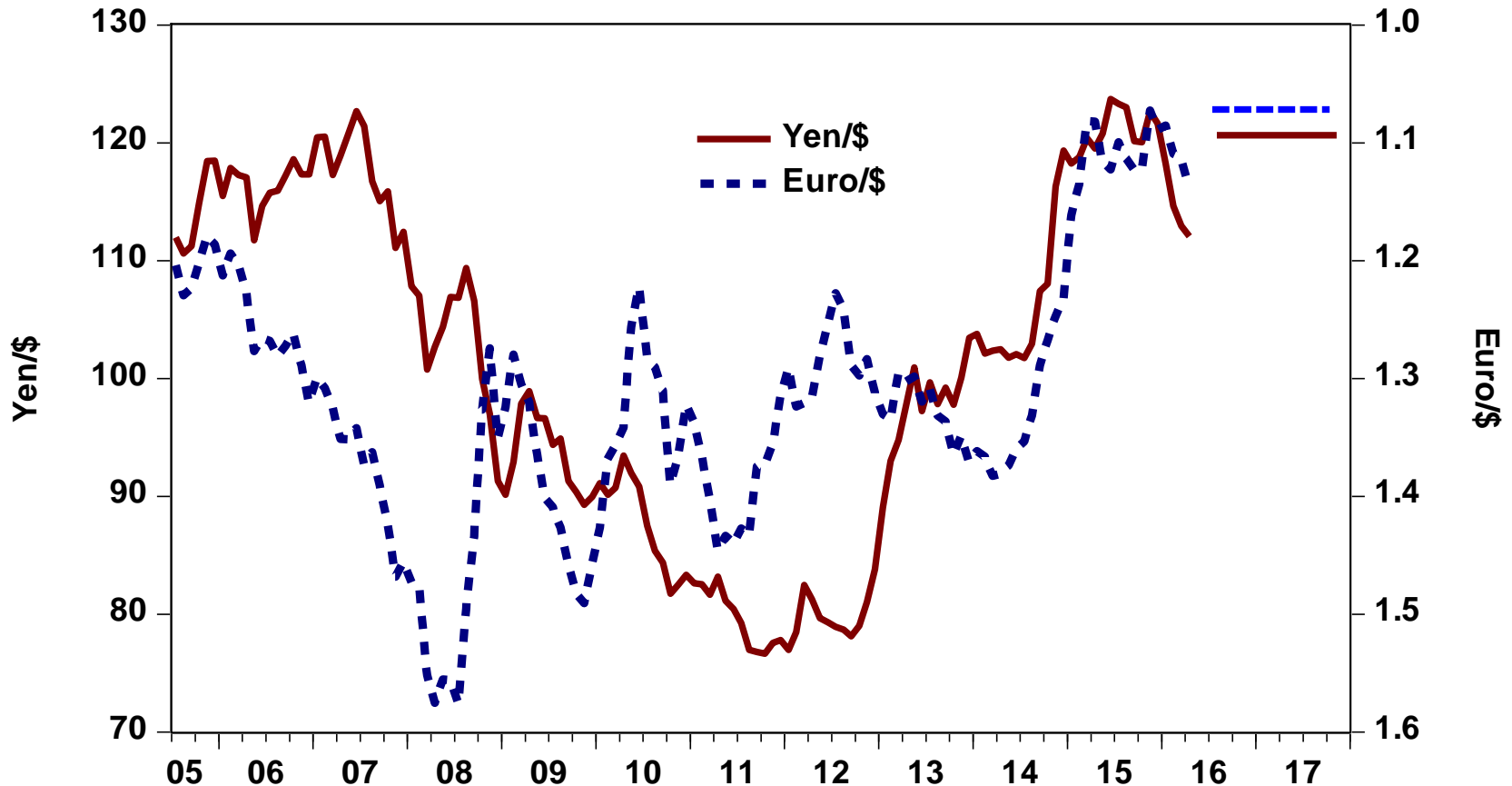
(U.S. consumers alone gained almost 2% of disposable income since the end of 2013: almost \$250 BN)



Recent Dollar Retreat Expected to Reverse

U.S. Interest rates are rising, key trading partners (Europe, China, Japan) are keeping rates steady or cutting: capital will flow to U.S., pushing dollar stronger

Dollar Strong VS Yen and Euro





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