Shifting Global Economic Forces Shaping the Semiconductor Outlook

Surface Preparation and Cleaning Conference (SPCC)
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*A global outlook based on Consensus Economics, Inc.
CONSENSUS FORECASTS®
Outline

• Global outlook
• Semi MSI outlook (ESF March 2017)
• Risks in the economy
• A look back at SPCC 2016 forecast
Global Economic Outlook Summary: 2017-18

• Modest growth, faster than 2016
• Improving investment climate
• Slightly higher inflation, diverging interest rates
• Currency turmoil, stronger U.S. dollar
• Much higher economic policy uncertainty
World Real GDP Growth Slowly Accelerates

Annual Trend: 95-07: +3.2%  11-16: +2.5%
2016: +2.2%  2017: +2.7%  2018: +2.9%

*World: 85 major economies,
Forecast: World Bank, IMF, Hilltop Economics based on Consensus Forecasts, Mar 17
Key U.S. & Other Policy Initiatives
Uncertainty Factor & Most Likely Impact on Growth

• Monetary Policy: Low Uncertainty (neutral for growth for now)
  – Interest rates rising
  – Dollar strengthening
  – Regulations in response to financial crisis in place and operational

• Fiscal (Tax & Spend) Policy: High Uncertainty
  – Tax reform (important for growth)
  – Budget shift to defense (mixed for growth)
  – Regulatory reform (important for growth)
  – Healthcare reform (now on indefinite hold)

• International Policy: High Uncertainty (no longer financial crisis-driven)
  – GLOBAL increase in anti-globalization sentiment negative for growth
  – Immigration (negative for growth)
  – Pull-back from trade agreements: Negative to uncertain impact on growth
  – Brexit impact on EU
  – China policy shift to reforms with a lower growth policy target (& upcoming Communist Party Congress)
The grey area: Uncertainty is high enough to alter economic decision making (especially investment)
Steady Global Consumer Spending Growth

World* Real Consumption

- 95-07: 3.2% TLGR
- World: Key 40 Countries
- Src: World Bank, National Sources, Hilltop Economics, Consensus Forecasts Mar 17

Mar 17
2016 +2.5%
2017 +2.8%
2018 +2.9%

Consumer Spending Roughly 2/3 of GDP Demand
Global Investment Climbing Out of a Weak Cycle

World* Real Investment

FINANCIAL CRISIS PERIOD | Adjust | POLITICAL BACKLASH

95-07: 3.7% TLGR
World: Key 40 Countries
Src: World Bank, National Sources,
Hilltop Economics, Consensus Forecasts Mar 17

Investment Roughly 1/4 of GDP Demand
Spending on Technology Goods

An small but growing share of consumer spending. Until 2014, a decreasing share of investment in the U.S. Trends likely repeated globally.

Based on U.S. Bureau of Economic Analysis data
Shaded areas indicate U.S. recessions (NBER)
Real Investment Essential 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 Equipment Investment: Ahead of the Rest of the World
North America + Japan Semiconductor Equipment Billed

Billings (to Feb 2017)
Seasonally-Adjusted
Trend-Cycle
Billion US$ (3MMA)
Src: SEMI.ORG and SEAJ.ORG
## CPI Inflation Higher, But Not a Problem

<table>
<thead>
<tr>
<th>Country</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>1.4</td>
<td>2.0</td>
<td>2.5</td>
<td>2.3</td>
</tr>
<tr>
<td>Japan</td>
<td>0.8</td>
<td>(0.1)</td>
<td>0.7</td>
<td>1.0</td>
</tr>
<tr>
<td>South Korea</td>
<td>0.7</td>
<td>1.0</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>Taiwan</td>
<td>(0.3)</td>
<td>1.4</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Germany</td>
<td>0.2</td>
<td>0.5</td>
<td>1.8</td>
<td>1.7</td>
</tr>
<tr>
<td>France</td>
<td>0.0</td>
<td>0.2</td>
<td>1.5</td>
<td>1.3</td>
</tr>
<tr>
<td>Italy</td>
<td>0.1</td>
<td>(0.1)</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>UK</td>
<td>0.0</td>
<td>0.7</td>
<td>2.7</td>
<td>2.7</td>
</tr>
<tr>
<td>US</td>
<td>0.1</td>
<td>1.3</td>
<td>2.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>

*Sign of stronger demand + tighter supply
Businesses have a chance to get price increases*

Hilltop Economics, Based on Consensus Forecasts, March 17
Improving Economy: Rising Interest Rates

A *sign that we are finally moving back to “normal”*

Sign of optimism: stronger demand + tighter supply

Not too high to dampen investment (through 18)
Dollar Remains Strong

![Graph showing the dollar index from 2007 to 2018. The graph compares the strength of the dollar against other currencies, including CHN RMB, JPN Yen, KOR Won, TWN NT$, and Euro. The graph indicates that the dollar has remained strong over this period.](image-url)
Despite uncertainty (or maybe because of it), the demand-driven outlook for the semiconductor industry is strong.
MSI Becoming Less Seasonal

A plus for suppliers as semiconductors ubiquitous in final demand
Semiconductor MSI Outlook Summary
March 2017 vs March 2016

<table>
<thead>
<tr>
<th>MSI Forecast</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSI – March 17 Forecast</td>
<td>10,097</td>
<td>10,434</td>
<td>10,738</td>
<td>11,432</td>
<td>12,036</td>
</tr>
<tr>
<td>% Change</td>
<td>11.4%</td>
<td>3.3%</td>
<td>2.9%</td>
<td>6.5%</td>
<td>5.3%</td>
</tr>
<tr>
<td>Global Real GDP % Change</td>
<td>2.7%</td>
<td>2.6%</td>
<td>2.2%</td>
<td>2.7%</td>
<td>2.9%</td>
</tr>
</tbody>
</table>

| MSI - March 16 Forecast | 10,097 | 10,434 | 10,465 | 11,264 | 11,744 |
| % Change     | 11.4% | 3.3%  | 0.3%  | 7.6%  | 4.3%  |
| Global Real GDP % Change | 2.6%  | 2.4%  | 2.4%  | 2.8%  | 3.0%  |

This year versus last year:
MORE SEMICONDUCTORS on SLIGHTLY LOWER ECONOMIC GROWTH

HIGHER RISK BANDS AROUND THE FORECAST

Source: Linx_Consulting Econometric Forecasting Service (ESF) & Hilltop Economics, March 2016 & March 2017
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**This Year**  
- **MSI:** Up a little in 2016, rises above trend in 2017, eases to around trend in 2018
- Global final demand growth marginally better in 2017 & 2018
  - Real GDP in 2017 better than 2016, up even more in 2018
  - Business investment stalled in 2016, recovers in 2017
  - Consumer spending rises remains a little below 3% trend
  - PC unit sales fell modestly in 2016; increase slightly in 2017
  - Mobile phone sales growth slowed, now single digits at best
  - No major new markets

**Versus**

**Last Year**  
- **MSI:** Flat in 16 on poor investment outlook, snaps back in 2017, falls to around trend in 2018
- Global final demand growth marginally 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
PC Market Stabilizes With Investment Uptick
(Less important for semiconductors)

Estimated Global PC Sales

Annual Percent Change
2015 2016 2017 2018 2019
-8.3% -6.2% -0.3% 2.2% 1.7%

Source: Hilltop Economics
Shaded area indicates main period of tablet penetration
Seasonal Factors Drive PC Quarterly Change
*Moving AWAY from 100%, Indicating RISING Seasonality of PCs*

Seasonal Impact On PC Sales Over Time

- **Actual PC Seasonal Factor to 2016Q4**
- **Means by Season, 1995 to 2016**

*Src: Hilltop Economics using US Census Bureau X-13 Seasonal Adjustment Program*
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)

Difference in Percent Yield

10 YR Treasury minus 3 Month TBill
10 Yr Treasury minus 1 Year Treasury

Shaded areas official NBER recession periods
The Best Single Recession Predictor: Treasury Yield Curve Inverts (Short Rates > Long Rates)

-4
-3
-2
-1
0
1
2
3
4
5

10 YR Treasury minus 3 Month TBill
10 Yr Treasury minus 1 Year Treasury

Difference in Percent Yield

Shaded areas official NBER recession periods
Steady reduction in ‘16 and ‘17 forecasts

Global Consensus-based Real GDP Forecasts

Forecasters continue the trend: “next year” gets closer to “normal” but 2017 already below “normal” 3+% trend

Annual Percent Change

January 2015  February  March  April
May  June  July  August  September  October  November  December

Forecast for Year By Month Forecast Made
Steady reduction in ‘16 and ‘17 forecasts
Global Consensus Real GDP Forecasts

Forecasts from Jan 15 to Jan 17 (left to right)
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)
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 17

Current: $50
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)

Src: US BEA Underlying Detail
Shaded areas indicate official NBER recessions
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)

Src: US BEA Underlying Detail through Jan 17
Shaded areas indicate official NBER recessions
U.S. Household Debt Drops as Government Rises

% OF GDP

- Blue: Household Debt
- Purple: Federal Debt

Src: Federal Reserve; Bureau of Economic Analysis Through 15Q4
U.S. Household Debt Drops as Government Rises

Src: U.S. Federal Reserve, U.S. Bureau of Economic Analysis
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**

![Graph showing Dollar Strong VS Yen and Euro](image)