Preliminary AEO2014 Macroeconomic Industrial Results

Macro-Industrial Working Group

Elizabeth Sendich, Analyst, and Kay Smith, Team Leader
Macroeconomic Analysis Team
September 26, 2013
Overview

• Preliminary *AEO2014* industrial macroeconomic results; runs as of Sept. 23, 2013.

• Macroeconomic results are inputs for a variety of NEMS modules, and cover:
  – Overall economy (for example GDP, interest rates, exports, etc.)
  – Sectoral detail (for example output of goods and services, employment, etc.)

• Reference Case with the Global Insights’ (GI) May Long-term Trend forecast and this year’s Industrial IO changes, largest impact being:
  – Construction
  – Bulk chemicals
Macroeconomic Modeling in NEMS

**NEMS**

- **NEMS Macro Baseline Variables**
- **NEMS Energy Variables**
- **NEMS Modules**

**MAM**

1. **Macroeconomic Submodule** runs the New Scenario using new Energy Inputs from NEMS
2. **Industry Submodule** runs the New Scenario of values of shipments by industry sectors
3. **Employment Submodule** runs the New Scenario of employment by sector
4. **Regional Submodule and Commercial Floorspace Submodule**

MAM applies the ratios of the New Scenario values over the Baseline values onto the Macro Baseline variables to obtain solution

MAM variables for use as input to NEMS
National macroeconomic model

- Uses Global Insight’s macroeconomic model, whose forecast horizon matches NEMS

- Keynesian model capturing short-run cyclical developments with long-run equilibrium as specified by production function

- Model of output, prices and financial conditions allows depiction of both monetary and fiscal policies.

- The level of inflation-adjusted demand is driven by the price level, income, wealth, and financial conditions. Supply is keyed to a production function combining inputs of labor hours, energy, and capital stocks of business equipment, structures and government infrastructure.

- Major drivers: total factor productivity, labor supply, capital stock
Industry Submodule: value of shipments by industry

• **Econometric** equations are run for the ratio of gross output (production) and demand computed from **Input-Output basis**

• **Major drivers:** capacity utilization, interest rates, relative prices, population, other macroeconomic variables like housing starts and medical spending, and a trend variable for technological changes
  
  – For energy-intensive manufacturing industries, industrial **energy prices** also determine their output

• For the energy industries (coal mining, oil & gas extraction, petroleum refining, electric and gas utilities), forecasts are **replaced** by production forecasts from other NEMS Modules
# Industries using NEMS energy prices in econometrics

<table>
<thead>
<tr>
<th>NAICS Code</th>
<th>Industry</th>
<th>Price dependencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>3115</td>
<td>Food: Dairy</td>
<td>NG</td>
</tr>
<tr>
<td>322</td>
<td>Pulp &amp; paper</td>
<td>Fuel Index</td>
</tr>
<tr>
<td>32511a9</td>
<td>Bulk chemicals: Organic</td>
<td>Feedstocks</td>
</tr>
<tr>
<td>32512t8</td>
<td>Bulk chemicals: Inorganic</td>
<td>NG</td>
</tr>
<tr>
<td>3252</td>
<td>Bulk chemicals: Resins</td>
<td>Feedstocks</td>
</tr>
<tr>
<td>3253</td>
<td>Bulk chemicals: Agriculture</td>
<td>NG</td>
</tr>
<tr>
<td>325o</td>
<td>Other chemicals</td>
<td>NG</td>
</tr>
<tr>
<td>326</td>
<td>Plastic products</td>
<td>Fuel Index</td>
</tr>
<tr>
<td>32731</td>
<td>Cement</td>
<td>Fuel Index</td>
</tr>
<tr>
<td>3311a2</td>
<td>Iron and steel</td>
<td>Fuel Index</td>
</tr>
<tr>
<td>3313</td>
<td>Aluminum</td>
<td>Electricity</td>
</tr>
<tr>
<td>331o</td>
<td>Other primary metals</td>
<td>Fuel Index</td>
</tr>
<tr>
<td>336</td>
<td>Transportation equipment</td>
<td>NG</td>
</tr>
</tbody>
</table>

"Fuel Index" is a consumption weighted composite of all industrial energy prices
First half of projected growth driven by investment and exports; latter half more even amongst GDP Components

Average annual growth rate within period

<table>
<thead>
<tr>
<th>Year</th>
<th>Real GDP</th>
<th>Personal Consumption</th>
<th>Imports</th>
<th>Exports</th>
<th>Government</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995-2010</td>
<td>3%</td>
<td>2%</td>
<td>5%</td>
<td>4%</td>
<td>1%</td>
</tr>
<tr>
<td>2011-2025</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>2%</td>
</tr>
<tr>
<td>2025-2040</td>
<td>1%</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>4%</td>
</tr>
</tbody>
</table>

Source: ref2014.d092013a
Average growth rates of net exports by category show strong export impacts from industrial supplies early and consumer goods throughout.

Net annual average growth rate

- **Overall average**
- **2012-2040**
- **2012-2015**
- **2015-2020**
- **2020-2025**
- **2025-2030**
- **2030-2035**
- **2035-2040**

- **all goods**
- **Industrial Supplies**
- **Capital Goods**
- **Consumer Goods**
- **Services**

Source: ref2014.d092013a
Oil price (WTI)

Real 2012 dollar per barrel

Source: ref2014.d092013a
Natural gas price

Real 2012 dollar per million BTU

Source: ref2014.d092013a
Combined fuel price index

Source: ref2014.d092013a
New ethane price

Real 2012 dollar per million BTU

Source: ref2014.d092013a
Initial industrial results consistent with new macro simulation

• Overall gross output growth is about 0.1 percent lower in AEO2014 runs compared to the AEO2013 projection, similar to the differential in GDP growth.

• **Composition** of industrial growth shifts, with manufacturing gaining share of gross output. By 2040, manufacturing is nearly 18 percent of gross output; in AEO2013 manufacturing share reached 16 percent.

• Consistent with slower growth in consumption, services growth is lower, especially retail trade and financial services.
Total output of goods and services

Billion 2005 dollars

Source: ref2014.d092013a
Total output of goods and services

Billion 2005 dollars

Source: ref2014.d092013a
Total output of goods and services

Billion 2005 dollars

Source: ref2014.d092013a
Total output of goods and services

Billion 2005 dollars

Source: ref2014.d092013a
Sub-sector breakout
(billion 2005 dollar)

Source: ref2014.d092013a
Plant-based, energy-intensive industries (billion 2005 dollar)

Source: ref2014.d092013a
Basic bulk chemicals
(billion 2005 dollar)

Source: ref2014.d092013a
Other bulk chemicals
(billion 2005 dollar)

Source: ref2014.d092013a
Economic contribution of bulk chemicals becomes smaller relative to non-intensive chemicals

Source: ref2014.d092013a
Energy-intensive primary metals
(billion 2005 dollar)

Iron and Steel R3311a2

Aluminum R3313

Source: ref2014.d092013a
All primary metals

Billion 2005 dollar

Source: ref2014.d092013a
Energy-intensive non-metallic minerals*  
(billion 2005 dollar)

Source: ref2014.d092013a; *also know as stone, clay, and glass (SCG)
All non-metallic minerals*

Billion 2005 dollar

Source: ref2014.d092013a; *also known as stone, clay, and glass (SCG)
Metal-based durables
(billion 2005 dollar)

Fabricated metals

Machinery

Source: ref2014.d092013a
Metal-based durables (billion 2005 dollar)

Source: ref2014.d092013a
Metal-based durables
(billion 2005 dollar)

Source: ref2014.d092013a
Non-manufacturing* (billion 2005 dollar)

Source: ref2014.d092013a; *most of mining is done in other modules so it is not included