



# SFSA CASTEEL REPORTER

Steel Founders' Society of America

a publication serving  
SFSA steel casting industry Members

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## October — 2016

### Casteel Commentary

This month's Casteel Commentary reviews an analysis of the SFSA forecast data and its correlation with macro-economic factors that should be related. The forecast numbers seem reasonable for the total market and for most of the major segments. I look forward to your questions and comments.

### SFSA Member Hub

SFSA recently launched the SFSA Member Hub (<https://sfsa.memberclicks.net>), a new website to make it easier for members to register for SFSA events, managing their member profile, mailing lists, and more.

SFSA staff will use this system to send e-mail communications to members. Members should whitelist the e-mail [sfsa@memberclicks-mail.net](mailto:sfsa@memberclicks-mail.net) to prevent any future messages from SFSA being identified as junk. If you have questions about the member hub or need assistance with login credentials, please contact Rob Blair - [blairr@sfsa.org](mailto:blairr@sfsa.org).

### T&O Conference

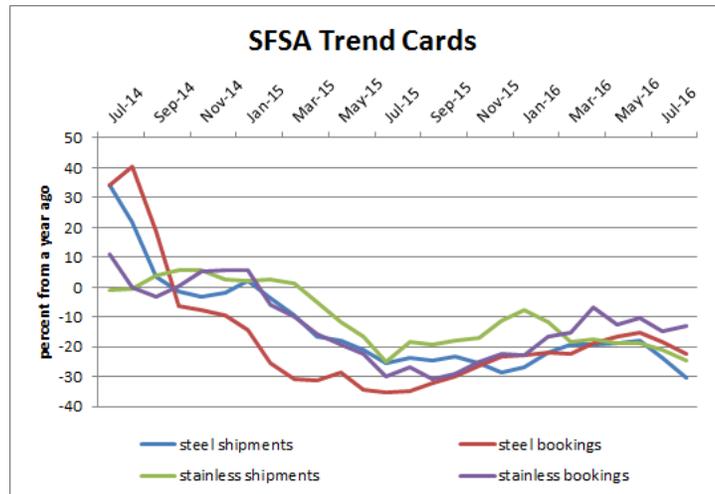
The 2016 National T&O Conference will be held in Chicago on December 7th - 10th at the Drake Hotel (<https://aws.passkey.com/event/14756969/owner/2879/landing>). Registration this year will be through the SFSA Member Hub:

([https://sfsa.memberclicks.net/index.php?option=com\\_jevents&task=icalevent.detail&evid=3](https://sfsa.memberclicks.net/index.php?option=com_jevents&task=icalevent.detail&evid=3)).

Register before October 28th to get our early bird discount. 54 papers, the majority from industry, are planned for the conference. The T&O Committee has worked hard to identify good topics covering a range of technical and operating subjects including: silica regulation, casting quality evaluation, equipment for finishing castings, welding practices, reclaiming wash, modeling and hydrogen. The workshop will feature topics on: reducing quench cracking, manufacturing analysis software, weld microstructures, and Functional Counter-Gravity methodology. This year will add to the legacy of the National T&O Conference being the premiere steel casting event in the world – we hope to see you there!

### SFSA EHS Meeting

SFSA is launching a partnership with Guimond & Associates, a safety and environmental consulting firm that has worked with foundries and steel mills for more than 40 years. The principals, Skip and Martha Guimond, have assisted plants in meeting OSHA safety and health as well as state and federal EPA regulations, developed engineering control programs, and developed training and compliance programs. They have served as expert witnesses for industry and have been instrumental in determining what engineering controls are feasible in the foundry industry for both OSHA and clients.



SFSA is hosting a one-day meeting with the Guimonds at the Crown Plaza Milwaukee Airport in Milwaukee, WI on Thursday, October 20, 10am – 4pm. SFSA members will have an opportunity to learn about the services that are included at no additional cost with your SFSA membership, current and future challenges with OSHA and EPA, and the strategy and resources to implement in your foundry to ensure worker safety, compliance, and to save money. Please rsvp to Ryan Moore – [rmoores@sfsa.org](mailto:rmoores@sfsa.org).

### **Future Leaders and Wear Castings**

Last chance for the Wear Castings subject-focused meeting October 27-28 with a tour of Magotteaux-Pulaski. The meeting will be held in conjunction with a Future Leaders meeting, which will start on October 26. Contact David Poweleit at [poweleit@sfsa.org](mailto:poweleit@sfsa.org) for more information and to register.

### **Specifications**

The Specifications Committee will meet on Tuesday, November 15th at the ASTM A01 meeting. If you are interested in participating in this committee, please contact David Poweleit at [poweleit@sfsa.org](mailto:poweleit@sfsa.org).

SFSA has formed a C12A group for sharing information on the development of a new ASTM specification for this alloy, work being done by EPRI for Creep Strength Enhanced Ferritic (CSEF) steels guideline document, and updates from ASME's Boiler and Pressure Vessel Code meetings. ASME Section 1 ballot for composition includes tramp limits (As .010, Sn .010, Sb .003) along with B .001 and W .05 plus limits Ni .020. The rest of the composition limits were close to the new C12A ASTM spec, and it did have a N:Al of >4. There is interaction with N:Al (if high) and tramp elements (then can tolerate better) – nitrogen aluminides serve as trap sites for tramp elements. EPRI document 3002007320 covers a report on hardness testing and is available to the public on their website. Tenaris has a new/proprietary alloy for high oxidation resistance (Thor 115), which is being balloted for inclusion in ASTM specifications.

### **AIST/SFSA Study Tour**

SFSA held a joint study tour in the UK with the AIST Specialty Alloy & Foundry Technology Committee on June 20-24. There were 11 participants, 3 of which were from steel foundries (Ferry-Capitain, Magotteaux, and Voestalpine). Some of the facilities visited that are of interest to steel foundries include:

William Cook Cast Products in Sheffield produces carbon steels and low, medium, and high alloy grades for rail, automotive, defense, energy and intermodal transport industries. They have 3D printing capability for printing sand and wax molds. They are currently installing a new high speed carousel molding line.

Castings Technology International (CTI) is now part of the University of Sheffield Advanced Manufacturing Research Center. The East Bank facility is now Replicast, Inc (a separate entity from CTI). The CTI facility has extensive casting modeling capabilities and the ability to produce patterns and molds using a five-axis CNC machine and 3D printer. They can machine sand molds and foam patterns and can vacuum and air melt steel and specialty alloys. Their new titanium casting facility will come on-line shortly.

Sheffield Forgemasters has their foundry integrated to their forge shop. Sheffield Forgemasters produces carbon steels and low, medium, and high alloy grades. They typically cast up to 350 metric tons of carbon and low alloy and up to 100 metric tons of stainless steel. They just cast their biggest casting to date (650 tonne) for a forging press in the US.

Ross & Catherall, which is part of the Doncasters Group, is the only facility in the world that has the capability to produce continuously cast superalloy bar stock using the vacuum melt process. They produce bar stock of ferrous, nickel-based, and cobalt-based alloys.

The rest of the tour showcased current technologies being used in the big steel industry. It was a good opportunity to learn about processes not common in foundry job shops such as vacuum induction melting (VIM), vacuum arc remelting (VAR) and electroslag remelting (ESR). One of the interesting technologies seen was the implementation of a "shrouded" pour where the ladle is directly connected to the mold using a core and gasket system. The idea is similar to previous shroud pouring trials done

at Falk and Harrison to reduce reoxidation inclusions. Another information to note is the relaunching of Tata Steel in Scunthorpe as British Steel.

**STEEL FOUNDERS' SOCIETY OF AMERICA  
BUSINESS REPORT**

<b>SFSA Trend Cards</b> (%-12 mos. Ago)	12 Mo Avg	3 Mo Avg	August	July	June
<b>Carbon &amp; Low Alloy</b>					
Shipments	-23.6	-28.5	-24.5	-39.5	-21.5
Bookings	-21.1	-19.9	-15.2	-24.5	-20.0
Backlog (wks)	6.9	6.3	6.0	7.0	6.0
<b>High Alloy</b>					
Shipments	-17.9	-23.9	-22.5	-24.2	-25.0
Bookings	-15.5	-7.7	3.0	-12.5	-13.5
Backlog (wks)	6.7	6.0	6.0	6.0	6.0
<b>Department of Commerce Census Data</b>					
<b>Iron &amp; Steel Foundries (million \$)</b>					
Shipments	1,537.1	1,468.3	1,464	1,455	1,486
New Orders	1,545.4	1,426.0	1,452	1,394	1,432
Inventories	2,048.0	2,073.3	2,059	2,076	2,085
<b>Nondefense Capital Goods (billion \$)</b>					
Shipments	74.2	71.1	70.2	71.4	71.7
New Orders	71.8	67.4	67.2	70.0	65.0
Inventories	172.6	169.5	169.7	169.3	169.4
<b>Nondefense Capital Goods less Aircraft (billion \$)</b>					
Shipments	65.3	62.3	62.1	62.2	62.6
New Orders	65.2	63.0	63.5	62.9	62.4
Inventories	118.8	118.4	118.6	118.4	118.2
Inventory/Orders	1.8	1.9	1.87	1.88	1.89
Inventory/Shipments	1.2	1.9	1.91	1.90	1.89
Orders/Shipments	0.7	1.0	1.02	1.01	1.00
<b>American Iron and Steel Institute</b>					
Raw Steel Shipments (million net tons)	7.2	7.5	7.5	7.4	7.6

**Market News**

Demand for steel and stainless steel castings remains low. Business remains soft and the most recent numbers dampens signs of any current improvement. The most recent, August 2016, SFSA Trend cards show weakening and lower shipments for both steel and stainless steel castings. Bookings for steel castings also declined. This decline is worrisome but is consistent with all the other data we have.

SFSA backlog trends are at the lowest point since mid-2009. Steel castings had a median backlog of 6.5 weeks and Stainless castings were down to 6 weeks.

For example, iron and steel casting sales reported by the Department of Commerce-Census continues to show declines for both shipments and orders. This decline is clear even though the iron foundries continue to benefit from continued high levels of production of automobiles. Steel mill shipments show

a similar decline reaching a bottom in April. Recent AISI weekly data, reported each week on the SFSA Blog, shows a new round of weakness falling to lower levels since early summer. Increases in steel production were a hopeful sign but recent declines makes the steel production consistent with the continued low levels of demand seen in the steel casting industry.

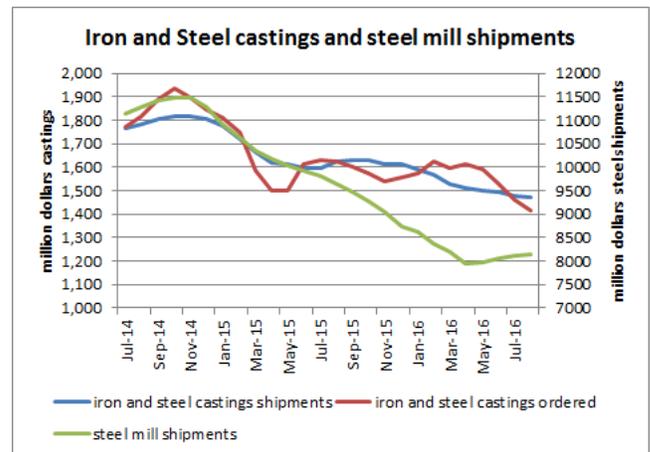
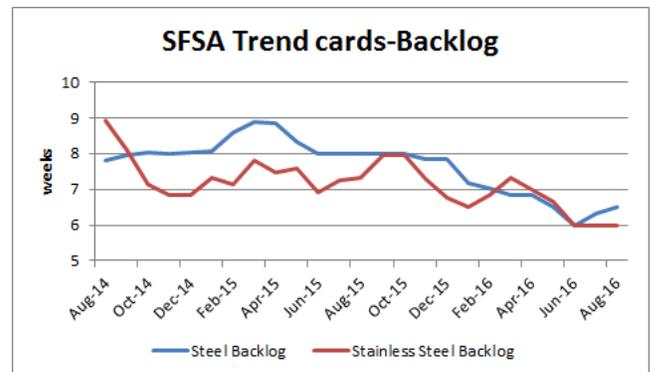
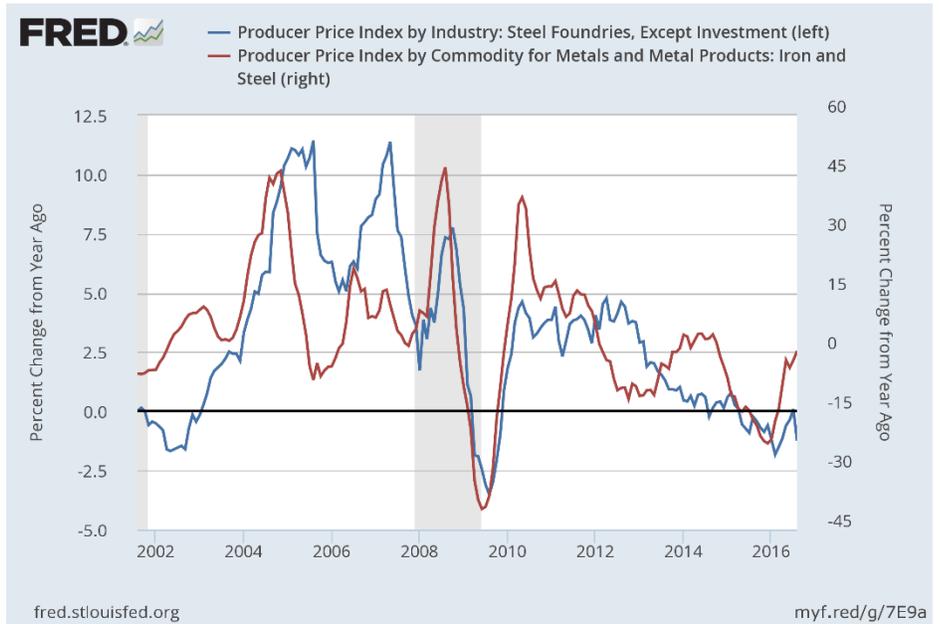
Non-defense Capital goods excluding aircraft is one of the strongest indicators of steel casting sales. It is a broad measure of economic activity and normally is on a consistent growth path, growing in real terms with the economy based on increased population and labor efficiency. It also normally grows in nominal terms due to inflation. After the severe economic downturn in 2009, this economic measure peaked in the second quarter of 2012 at 69.920 billion dollars. It has been relatively flat with a decline since that peak with a sharp drop beginning the second quarter of 2015 at 67.784 billion dollars and falling to a low of 61.819 in the first quarter of 2016. Oil prices and copper prices have stabilized above recent low prices but remain low compared to the marginal cost of the high cost producers. This suggests limited potential in the near future for a strong rebound in demand for steel castings.

The change in pricing for iron and steel mill products has been down since 2013 with recent price declines of double digits. Steel foundry prices are less volatile as seen in the graph. It is ironic or I guess expected that steel casting pricing is less volatile than still mill products. Steel mill products are based on conversion of commodity scrap or ore to standard mill products and so are determined by the commodity prices. Steel casting prices are less a conversion of commodity scrap and more a custom proprietary product depended on labor and engineering, not merely commodity pricing. While steel casting pricing is less volatile casting demand is extremely volatile compared to mill products since the mill products are more embedded in the general economy and not as tied to the capital goods market.

This economic picture which is gloomy is consistent with the latest SFSA forecast given at the Fall Leadership meeting in Santa Fe. The full Forecast is located here for your information.

**Casteel Commentary**

Many in our industry and outside would like a more detailed picture of the steel casting industry and our market space. We face this issue every year as we assemble a market forecast for our members based on member input. For the past few years we have tried to make this forecast more supported



by including in our analysis the sales expectations of publically traded customer companies to assess their expectation of future sales. Having done market macro-economic analysis of total steel casting sales and production in the past, I thought it might be interesting to look at our forecast and its correlation with those macro-economic factors.

I have taken the forecast tonnages from the forecast from 2002 through 2014 for each market segment and seen which factors are the most correlated and related for each market segment. So for each market segment there is a brief market discussion and then a summary of the factors most related and correlated. Correlation is not necessarily causation so it is important that at least notionally there is a relation between the factor and the market segment.

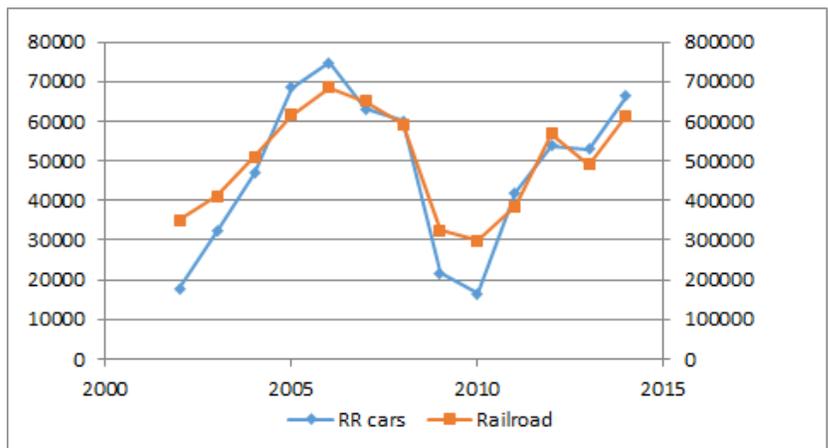
Steel casting sales in the US are reported by the DOC annually with the latest data from 2014. This total number is subdivided into several categories; carbon, other alloy steels, etc. These subdivisions have never been useful in my analysis but I have some detail if there is an interest. Correlating total steel casting sales in US with macro-economic factors highlights New Orders for Non-defense Capital Goods excluding Aircraft as the most telling. These annual factors are correlated with an R-squared of 0.89. This means I can determine about 89% of the variation in steel casting sales from knowing the number for new orders. As discussed above, the decline on a month to month basis of new orders is consistent with our decline recently. Also highly correlated to steel casting sales is sales of all iron and steel products with an R-squared of 0.71. One other factor highly correlated is Non-residential Fixed investment with an R-squared of 0.78. These three factors are all related to the general US activity in capital investment.

Since 2003, the Department of Commerce-Census does not track tonnage of steel castings produced. Since that time, SFSA has independently determined the steel casting tonnage production in the US each year as a part of the forecast. Steel casting tonnage in the US determined by SFSA is correlated to sales reported above with an R-squared of 0.79. One would not expect a perfect correlation since sales volume depends not only on tonnage but also product mix and changes in pricing.

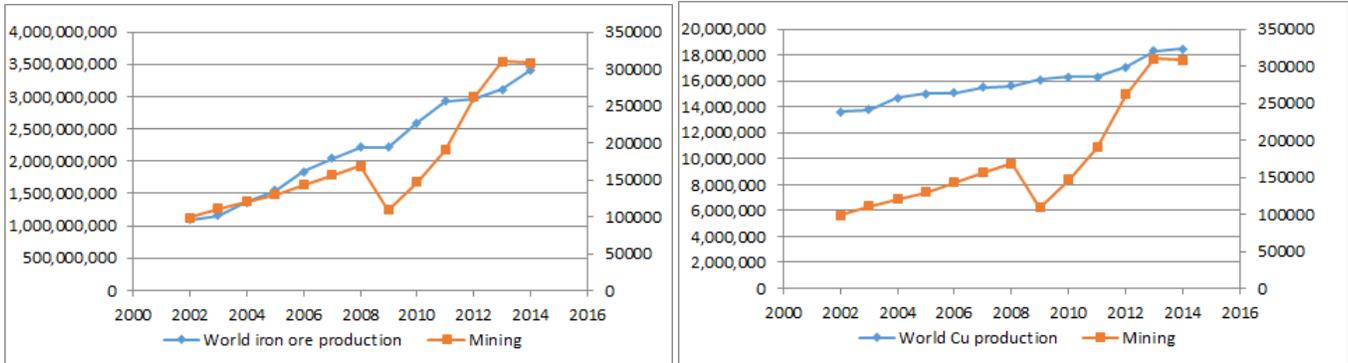
The high correlation is the result of a gradual and uniform increase in the PPI for steel castings mitigating its effect on the correlation. The tonnage determined by SFSA is more highly correlated than sales with the sales of iron and steel mill sales, an R-squared of 0.90. Surprisingly, the correlation with AISI production tonnage is poor. Steel casting production is also highly correlated with oil rig count with an R-squared of 0.90. It is also correlated with copper prices with an R-squared of 0.76.

So steel casting tonnage seems more highly correlated with commodity prices, steel, oil and copper and less on economic activity. Steel casting sales seems more related to macro-economic capital investment factors.

Railroad steel castings are a large volume of the business. Until 2003, the Census manufacturing data reported rail castings separately. Rail castings were made under the AAR guidelines and were the highest volume, lowest price segment of the

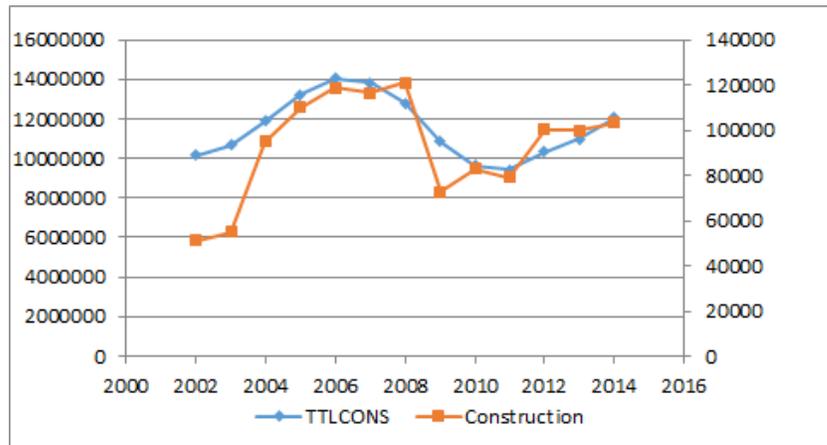


market. The yields for casting production were high, exceeding 80% easily. Rail casting production consistently was 300,000 tons plus 5 tons per freight car delivered. For a typical 40,000 freight car year, total production in the US was  $300,000 + 5 \times 40,000$  for a total of 400,000 tons. Recently, some production is being imported by and outside of the traditional steel casting producers in this market segment. SFSA estimates followed this type of formula in developing the forecast. As a result, the correlation between the forecast tonnage of rail castings and the rail car build rate was high, an R-squared of 0.93. There is some support for the SFSA numbers, the Commerce-Census sales for carbon steel castings is correlated with SFSA rail castings with an R-squared of 0.66.



Mining castings forecast from SFSA has been separated into equipment and consumable several years ago but since this was recent the numbers were combined and used with the older combined numbers to get at the total tonnage for steel castings determined by the SFSA. The highest correlation is with world copper production from the USGS with an R-squared of 0.82. World iron ore production is also correlated and related at an R-squared of 0.75. It is correlated with private non-residential fixed investment with an R-squared of 0.78. Surprisingly, the steel casting demand for mining is not highly correlated with the price of copper or iron ore. Mining equipment is value driven when demand is high giving opportunities to advanced products to gain pricing based on performance. When mining demand is low and prices low, equipment and consumables are more price than value sensitive, striving to minimize cash flow outlays while operating. One trend in mining that may spread is the provision of consumables based not on purchase of castings but contracting performance.

Construction equipment overlaps with mining equipment and trucks. The largest trucks are used in mining but intermediate and smaller off road trucks are used in construction. For SFSA the truck market is defined as the heavy, over the road trucks. The only factor correlated and related appeared to be new orders with an R-squared of 0.60. This factor was not correlated with residential investment or housing starts. It may be the result of the inability of SFSA to determine or forecast this segment



or because none of these ordinary factors are actually correlated to steel casting demand for construction. For at least half of the time period, construction has been at low atypical levels. Construction equipment like other structural castings has a typical yield around 50%.

Heavy trucks are a smaller market segment with only a few players. This market is only correlated with truck shipments with an R-squared of 0.57. The correlation may be an artifact that shipments expectations are used to decide on the SFSA production number. Truck makers are striving to reduce weight and cost and have aggressively used and tried ductile iron and aluminum castings.

The pump and valve industry has both steel and stainless steel production. To avoid leaks these castings have a low yield, around 35%. Efforts were made to correlate this demand with the chemical activity barometer, the oil rig count or price of oil or other factors without any real success. The best and related correlation was with new orders with an R-squared of 0.80.

Oil field equipment was surprisingly not highly correlated with oil prices or rig count. Some of this is undoubtedly due to changes in drilling technology with fewer drilling rigs needed with horizontal drilling. Another factor is the volatility and inventory cycles built into the boom bust cycle of oil prices and production. During a shortage with rising prices, equipment is made near the capacity of the industry. When a glut appears, the price falls and the equipment produced becomes an inventory overhang that limits production until it becomes used up or obsolete. The only factor that seemed related and correlated was industrial equipment with an R-squared of 0.72.

So, the SFSA forecast numbers for the whole market seem reasonable at least in the predicted size of annual changes to the market. For major markets like mining and rail, the numbers seem credible. For some smaller markets like trucks or oil field, the numbers seem less strong.

Please let me know if you have other ideas for factors or analysis. I look forward to your ideas.

Raymond

