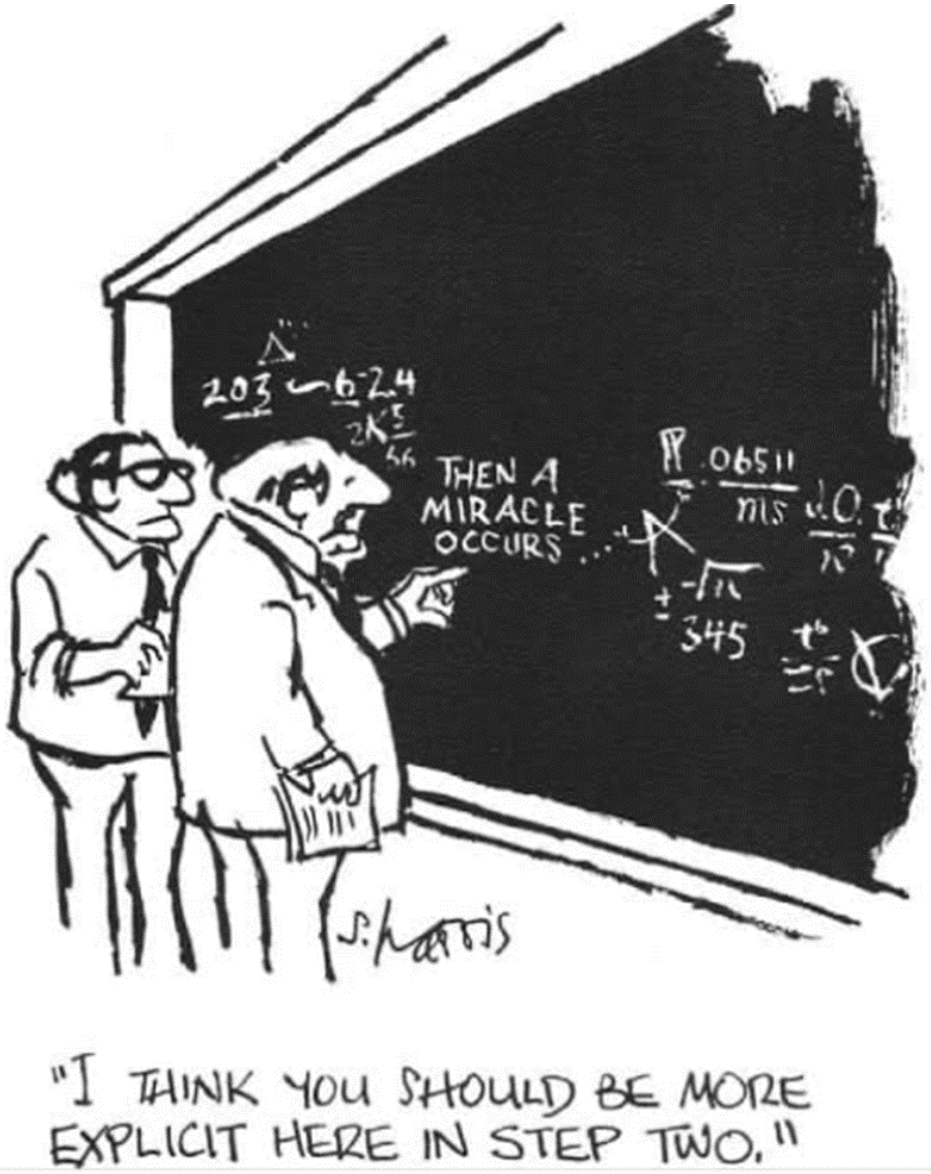
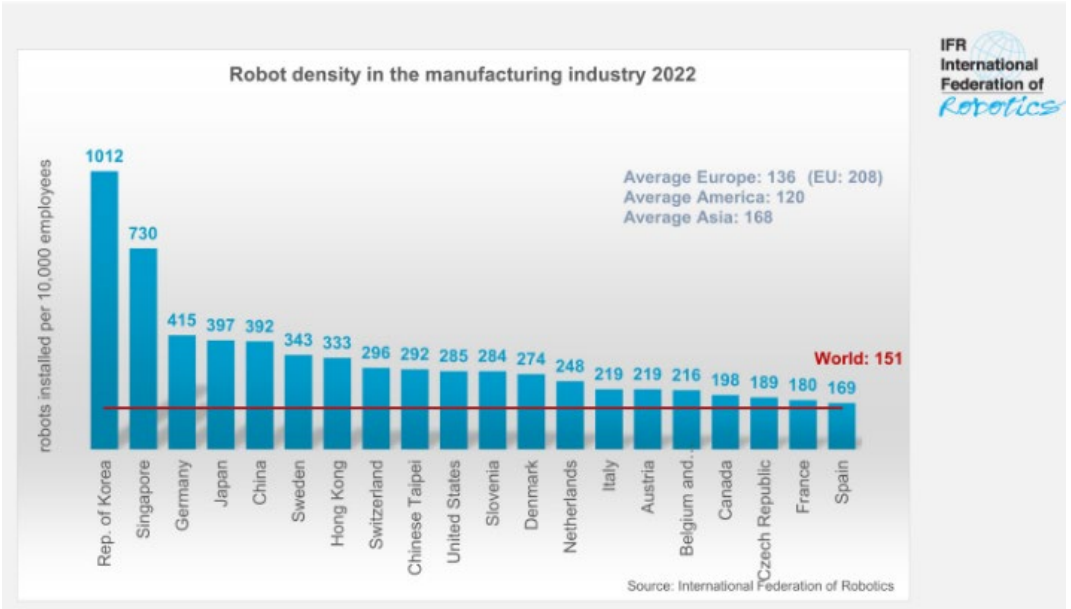
Castings and Forgings Struggle with the National Defense Industrial Strategy

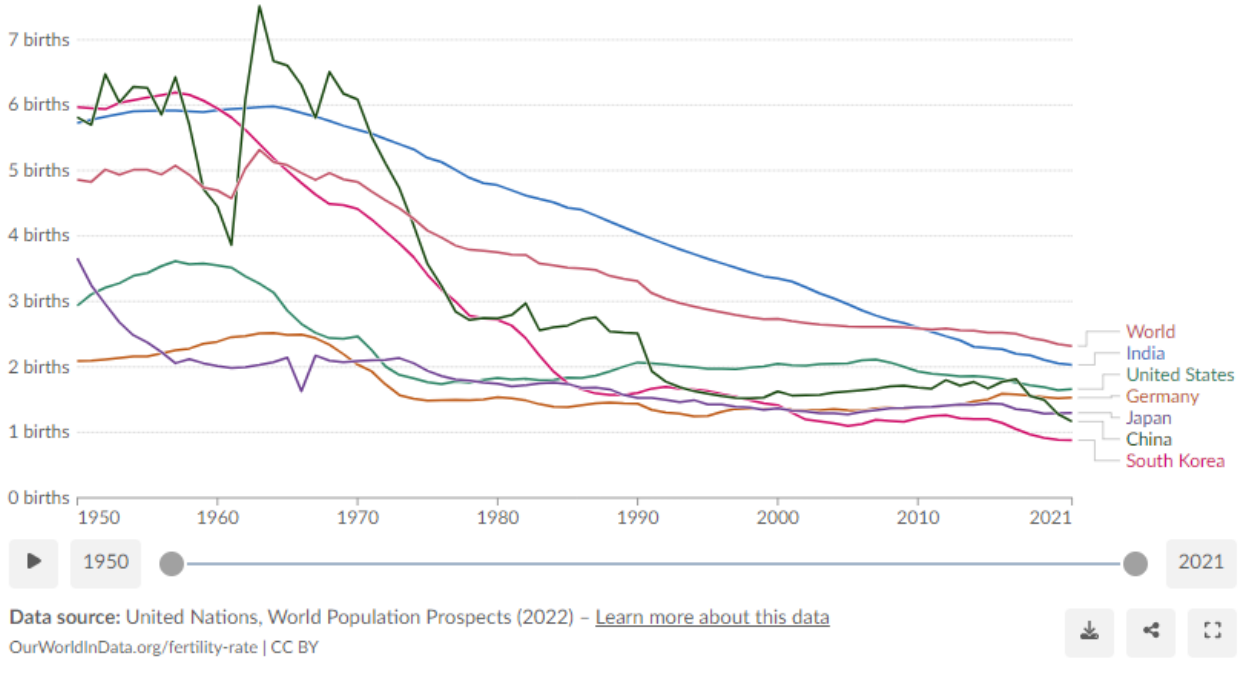
Raymond Monroe
815 263-8240
monroe@sfsa.org
Steel Founders' Society of America

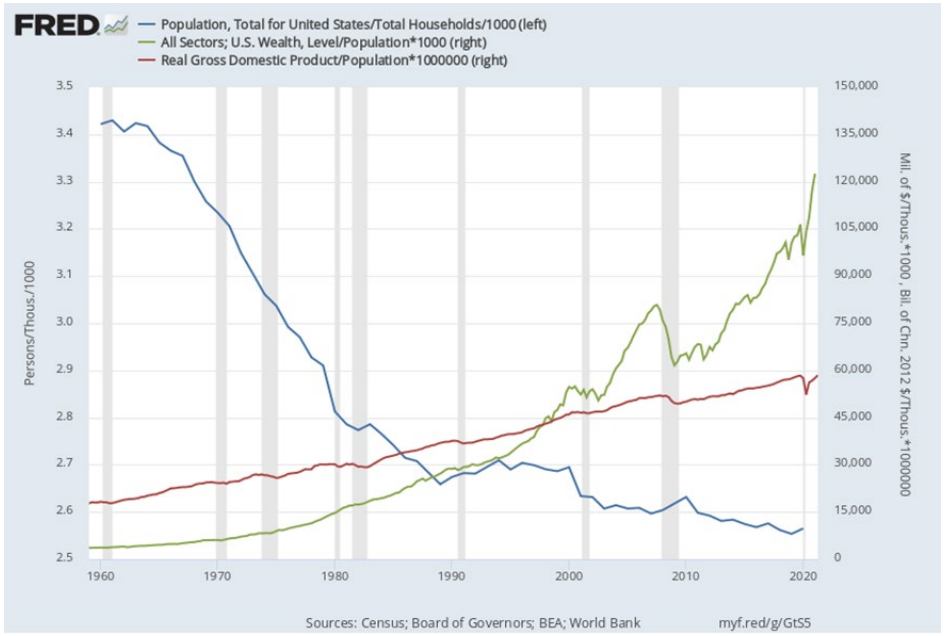


Demographics and People

Young people that are our future are in short supply and are not compelled to work to eat. They want to join a community that values them and that is allowing them to contribute to efforts that are meaningful and has purpose. Our challenge is to first engage them to see the value and creativity and meaningfulness of our community.







https://ourworldindata.org/fertility-rate

https://ifr.org/ifr-press-releases/news/global-robotics-race-korea-singapore-and-germany-in-the-lead

Cast in Steel - All in Steel

Key factor in success of CIS was unintended--engaging the young people in something that they want to do. Participants that want to make a Halligan bar are self-selected and the most likely to become critical people in our workforce. It feels meaningful, important, creative, and real.

America Makes

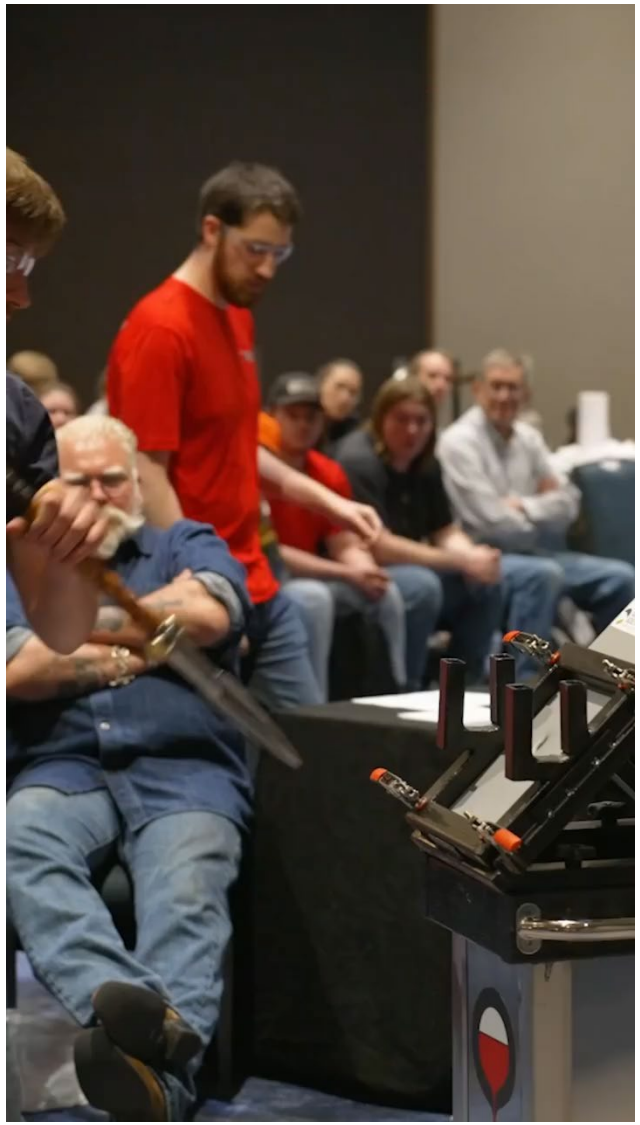
	Schools	Teams	Students	Item	Winner
2019	16	20	77	Viking Axe	Instituto Tecnológico de Morelia
2020	13	17	51	Bowie Knife	Virginia Tech
2021	18	24	109	Thor's Hammer	Pittsburg State University
2022	26	35	177	Celtic Leaf Sword	University of Wisconsin-Platteville
2023	31	42	217	African Spear Point	California Polytechnic University, Pomona
2024	34+6+2	45+6+2	270+29+16	Halligan Bar	MSOE Grohmann Museum Apr 22

CAST IN STEEL UNIVERSITIES	Instituto Tecnológico de Morelia	The Ohio State University	FORGING UNIVERSITIES
Arizona State University	Iowa State	The University of Alabama	Colorado School of Mines
Arts et Métiers Institute of Technology	Michigan Technological University	Trine University	Purdue University
Baylor University	Milwaukee School of Engineering	University of Alabama at Birmingham	University of North Texas
California Polytechnic University, Pomona	Penn State Behrend	University of Tennessee, Knoxville	University of Cincinnati
California Polytechnic University, San Luis Obispo	Pittsburg State University	University of Wisconsin - Madison	The Ohio State University
Central Michigan University	Purdue University	University of Wisconsin-Platteville	Colorado State University
Colorado School of Mines	Saint Martin's University	Virginia Tech	ADDITIVE UNIVERSITIES
Ecole Supérieure de Fonderies et de Forges	South Dakota Mines	Wentworth Institute of technology	
Georgia Southern University	Tennessee Technological University	Western Michigan University	Colorado School of Mines
Grand Valley State University	Texas A&M University	Youngstown State University	University of Louisville
Indiana University-Purdue University Indianapolis	Texas State University		


CAST
IN STEEL
HALLIGAN BAR
2024

Outreach for Needed People

- Current Efforts
  - Expanded to forging and additive
  - 6,826 Followers on social media-- Facebook, Linked-In, Instagram, Tik-Tok, YouTube, Twitter. The clip has 1,647,764 plays, 990,459 reach, 184,102 minutes viewed,
  - Casting Dreams is a 4-H type contest for precollege started this year with modest success, over 100 participants.
- Future Plans
  - Trade and Community College welding competition like CIS to make a tomahawk with steel head and welded edge.
  - Expand All in Steel to include Trade Schools and Community Colleges in their own division.
  - Explore the possibility of developing a TV show for the competition.



DoD Acquisition Practices are the Major Hurtle for all their suppliers.

Supply challenges for castings for defense are driven by the DoD acquisition system. In process approvals, agreement between the suppliers, OEMs, and services is unclear, decision-making processes are indeterminate, requirements are subjectively evaluated and inscrutable.

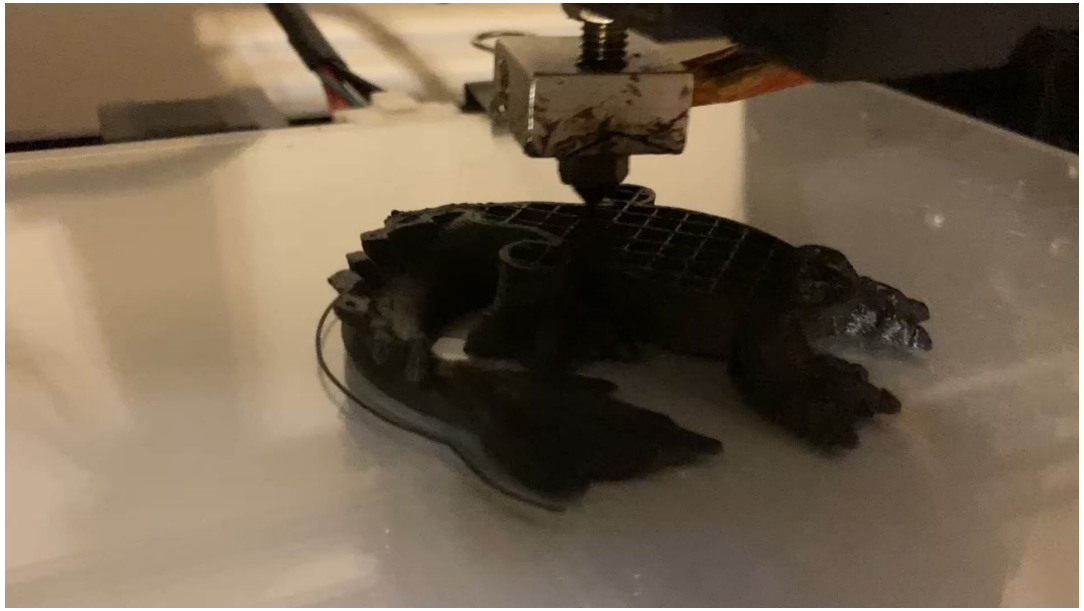
DoD Costs for Suppliers and Castings and Forgings per plant						
Qualification Costs						
Issue	Frequency	Time (months)	Fixed Cost	Added Cost for firm of 1000	Added Cost for firm of 100	Service
CCMC/CUI	Initial	12	100,000	1,000,000	100,000	DoD
	Annual	ongoing	25,000	500,000	50,000	DoD
ITAR	Initial	12	50,000	250,000	20,000	DoD
	Annual	ongoing	10,000	100,000	10,000	DoD
Technical req	Annual	ongoing	50,000	200,000	25,000	DoD
HY80/100 T300R2	Initial	18 to 48	1,000,000 to 3,000,000			Navy
	Re-qualification	9 to 12	1,000,000			Navy
	WIP financing	per mo		50,000	10,000	Navy
	WIP Storage	per mo		50,000	10,000	Navy
MIL-A-11356F	Initial	9 to 18	200,000 to 400,000			Army

Key challenges include:

- Lack of response for needed information and decisions- months not days, no answer= busted schedule. DoD process requirements and lack of timely approvals consumes factory floor space and capital in excess of commercial work.
- No information on timing, type, requirements, size, schedule of orders- No longterm agreement with a business case that justifies new capacity, small lots from low-cost supplier limits innovation
- Complex purchase organization – DOD/OEM + lack of expertise. Purchase is not a market transaction but a government contract – FAR, ITAR, CMMC, etc.
- Risk driven decisions keeps old technology with tightening requirements of no demonstrated value.

All in Steel Partnering with Arts and Crafts to engage Interested People

Manufacturing is not seen as creative, meaningful, challenging or beautiful. To engage our culture and time, we in manufacturing need to find ways to connect with artists, craftsman, hobbyists and young people in ways that let them experience and see the importance of what we do. We need to let them know about the communities of dedicated people who passionately labor together to build the world we live in.



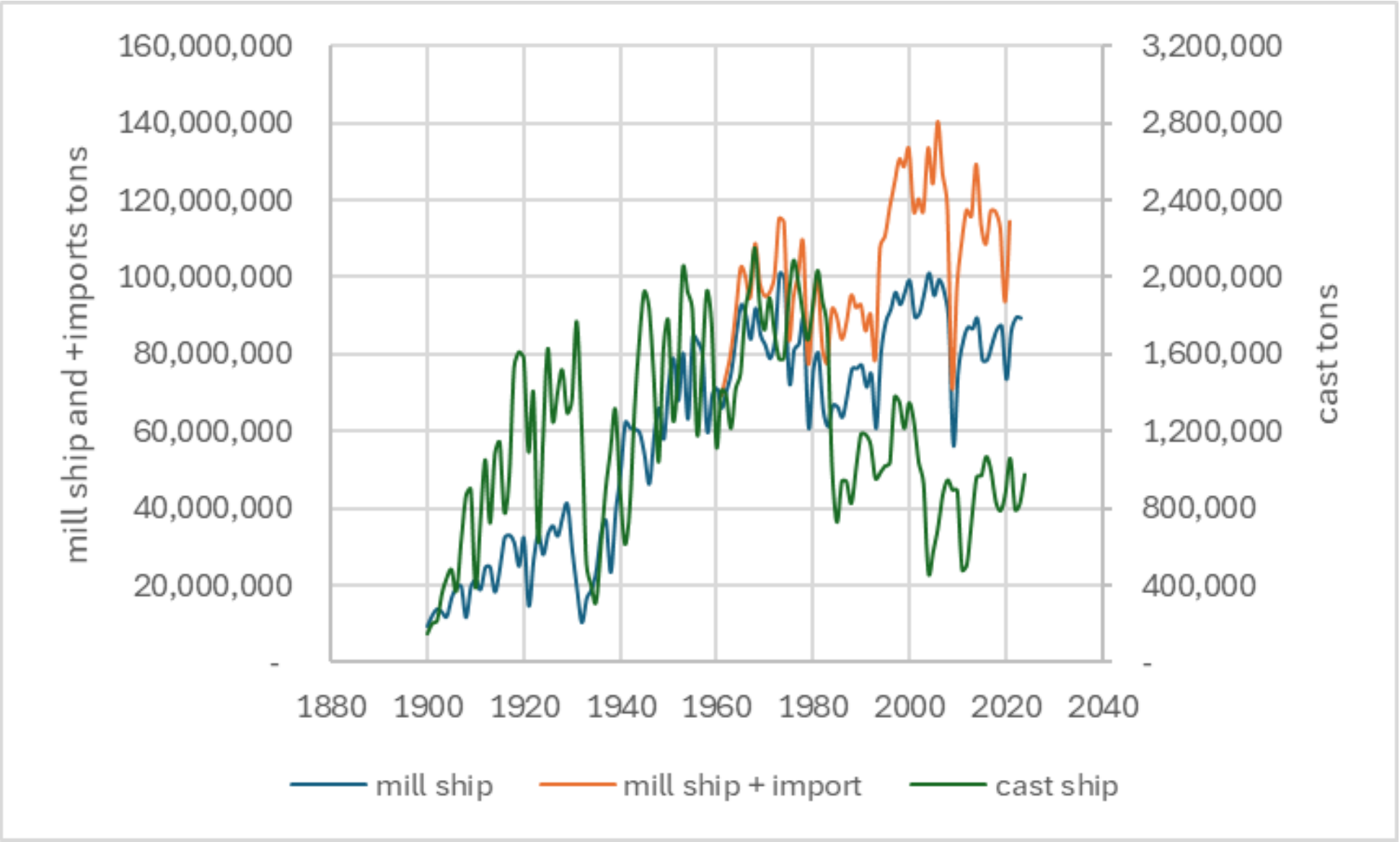
Forged in Fire as a show tapped into the passions of many to create and profoundly affected attitudes towards blacksmiths. We need to engage the communities of bladesmiths and metal artisans to gain their cooperation and support. Cast in Steel is reaching out with the help of our celebrity judges to this world.

In addition to crafts, artists are a natural fit for us in our efforts to engage young people. There are active artists that specialize in showing the beauty, power and meaning of making things.

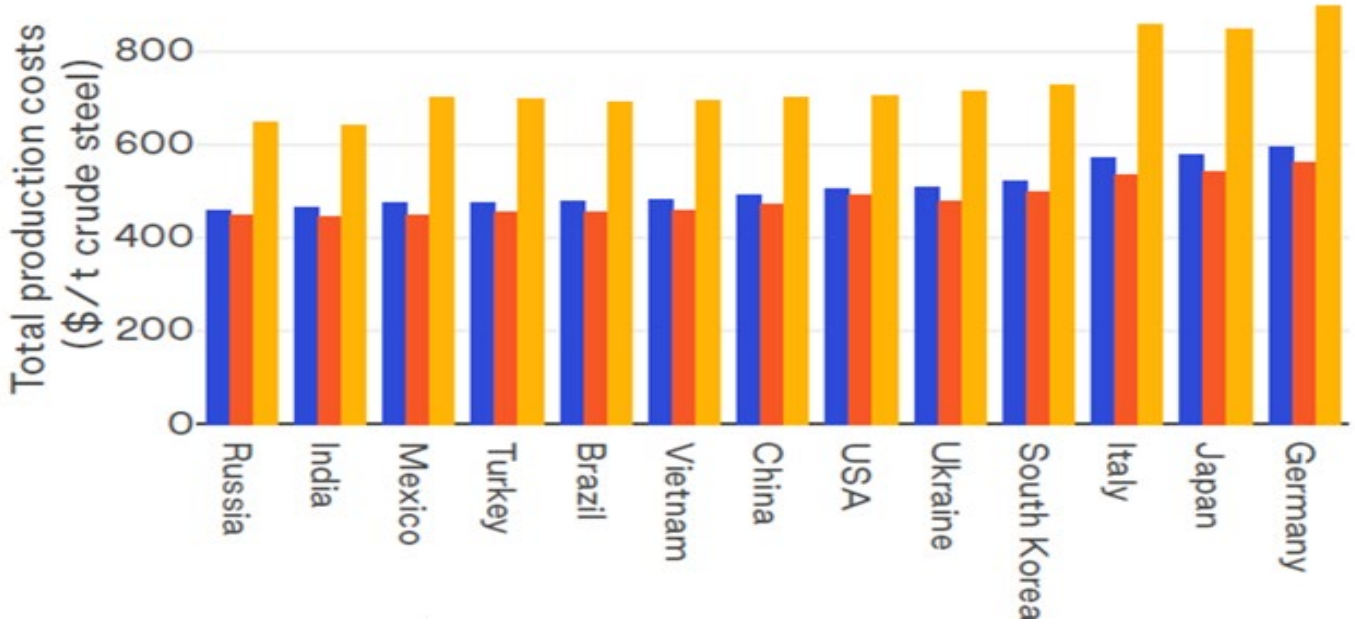
Raymond Monroe –
Steel Founders' Society of America
monroe@sfsa.org 815 263-8240

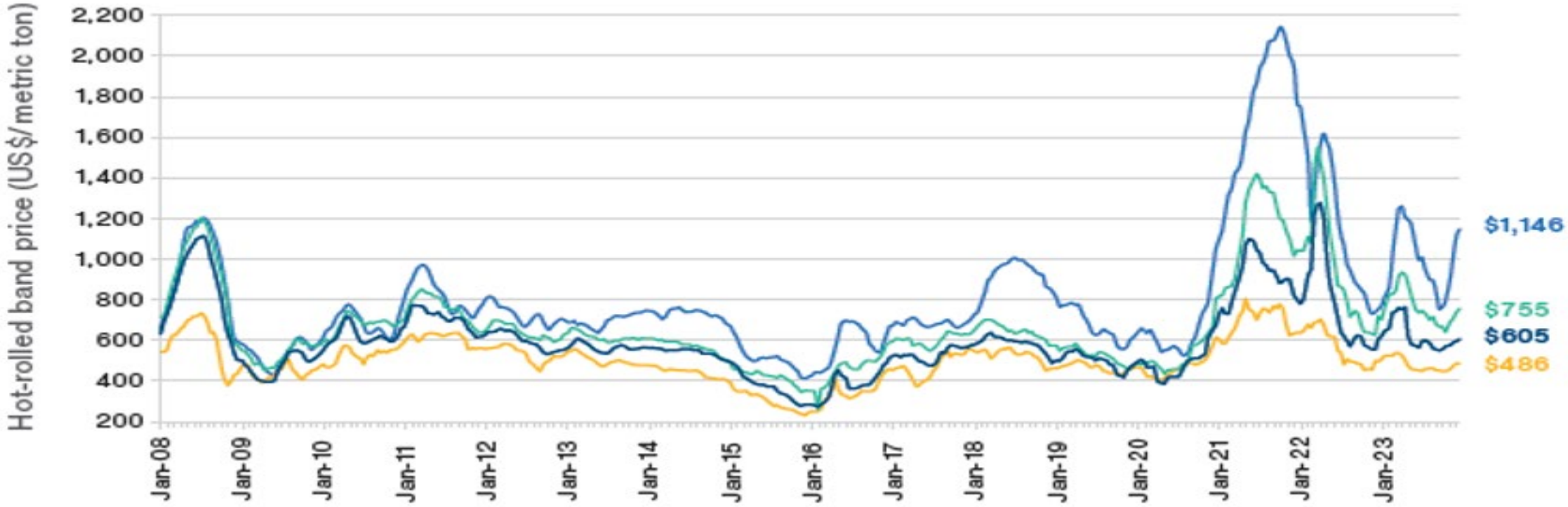
Castings and Forgings are Identified as a Supply Chain Concern by DoD in Response to E.O. 14017

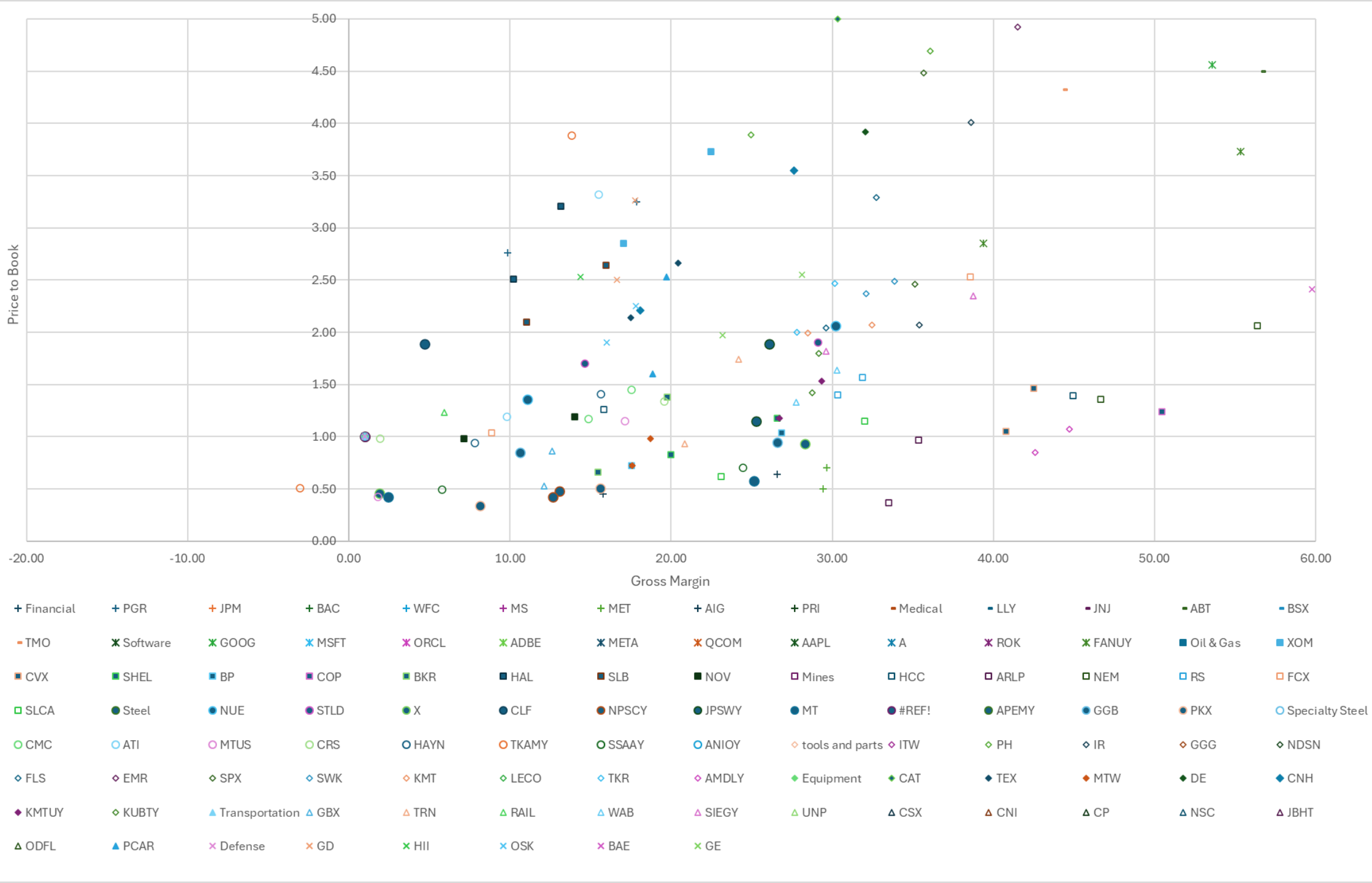
Steel products were essential to the industrialization required for modern life. Steel was the primary material for infrastructure and manufacturing. Steel castings, forgings, and mill products production increased with population and development until 1980. What happened after 1980 that limited increase in domestic mill and reduced casting production?



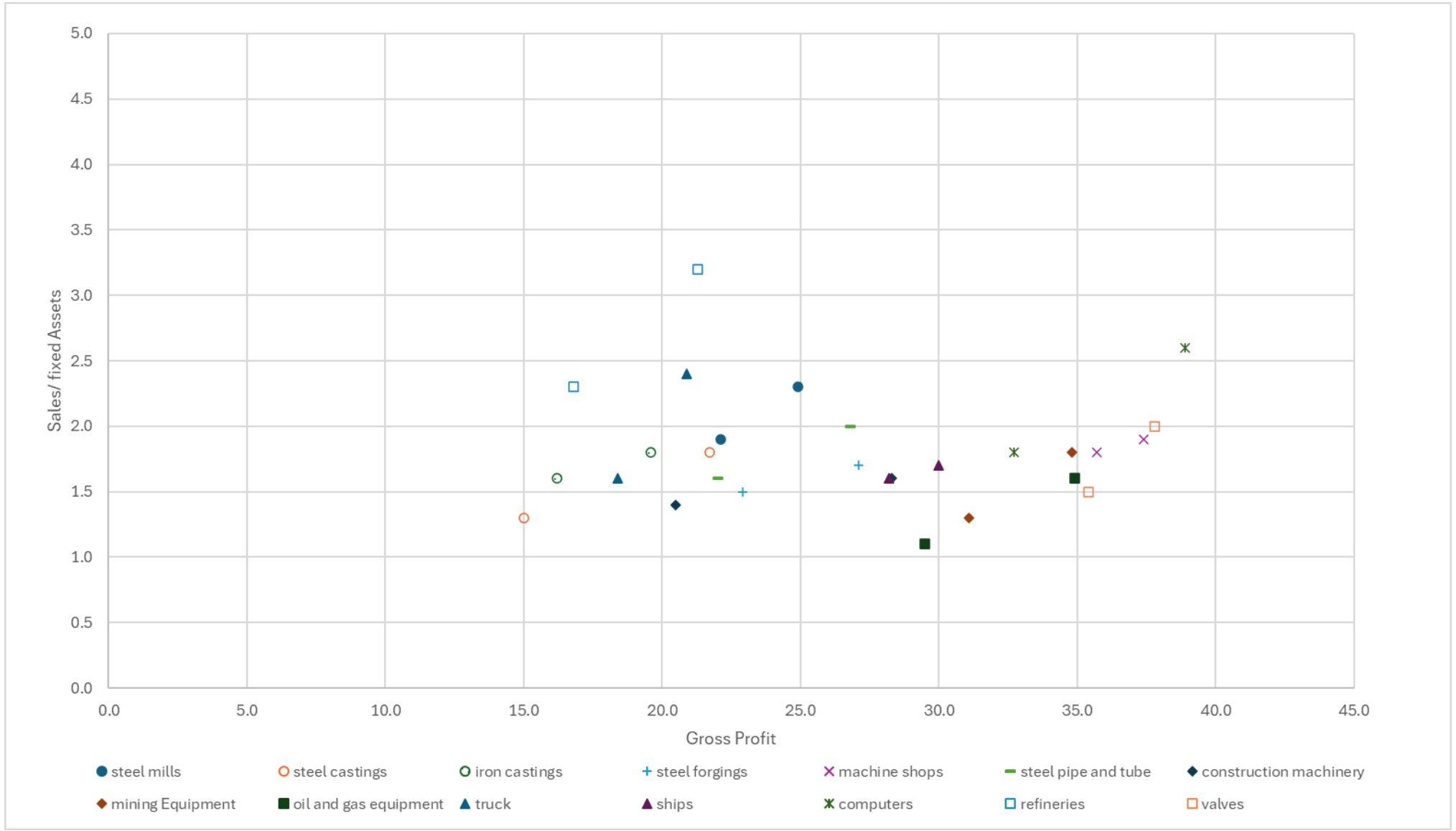
	SteelBenchmarker HRB price				AIST
Prices are $/ton	USA FOB Mill	Western Europe ex-works	China ex-works	World export FOB port of export	No 1 HIM
Med	745.5	566.5	486.5	521.0	241.0
Ave	1,024.4	735.8	541.0	634.3	284.7
Std	559.5	321.1	120.7	209.4	83.6
Max	2,124.0	1,428.0	757.0	1,100.0	415.0
Min	530.0	453.0	390.0	402.0	172.0

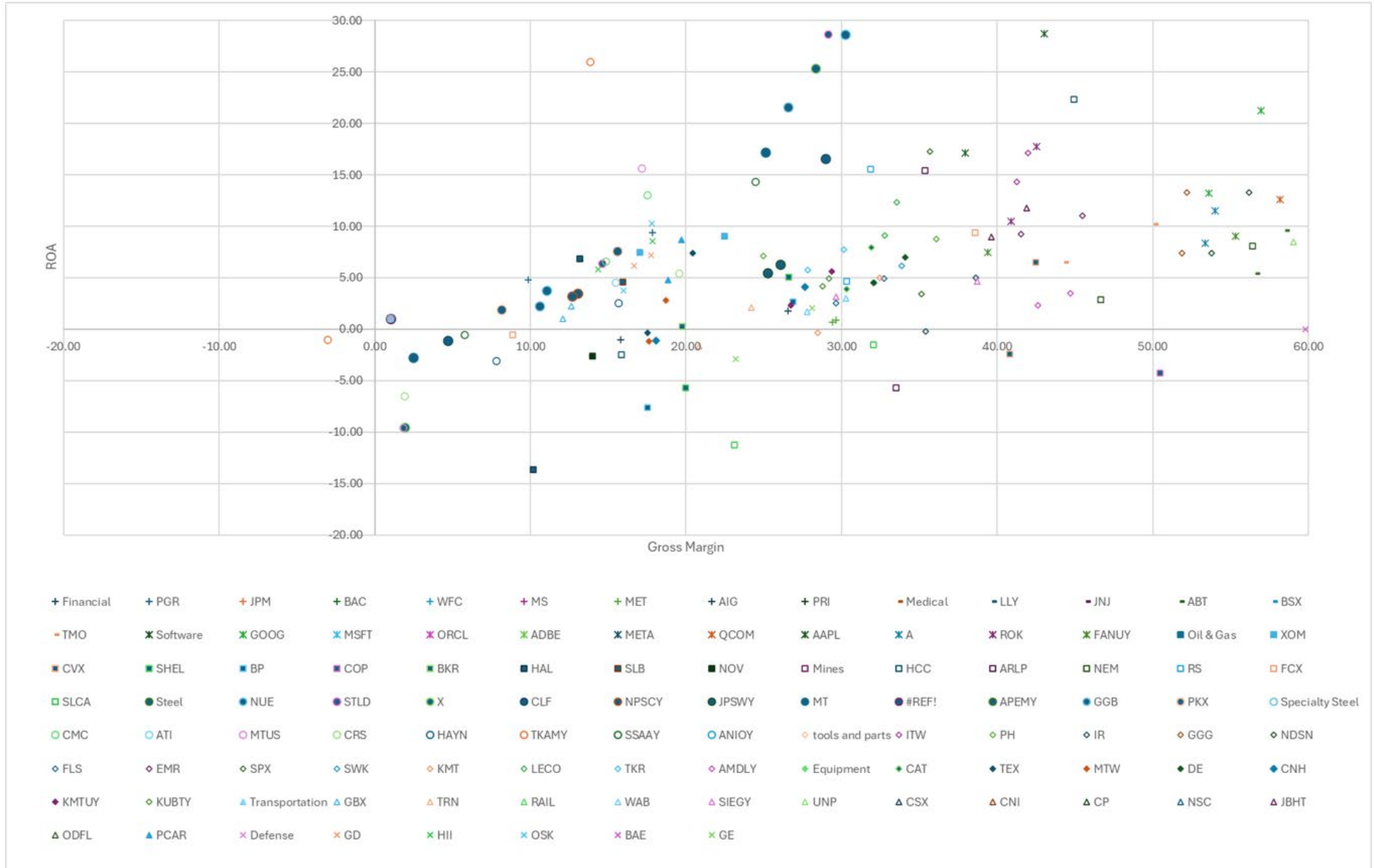


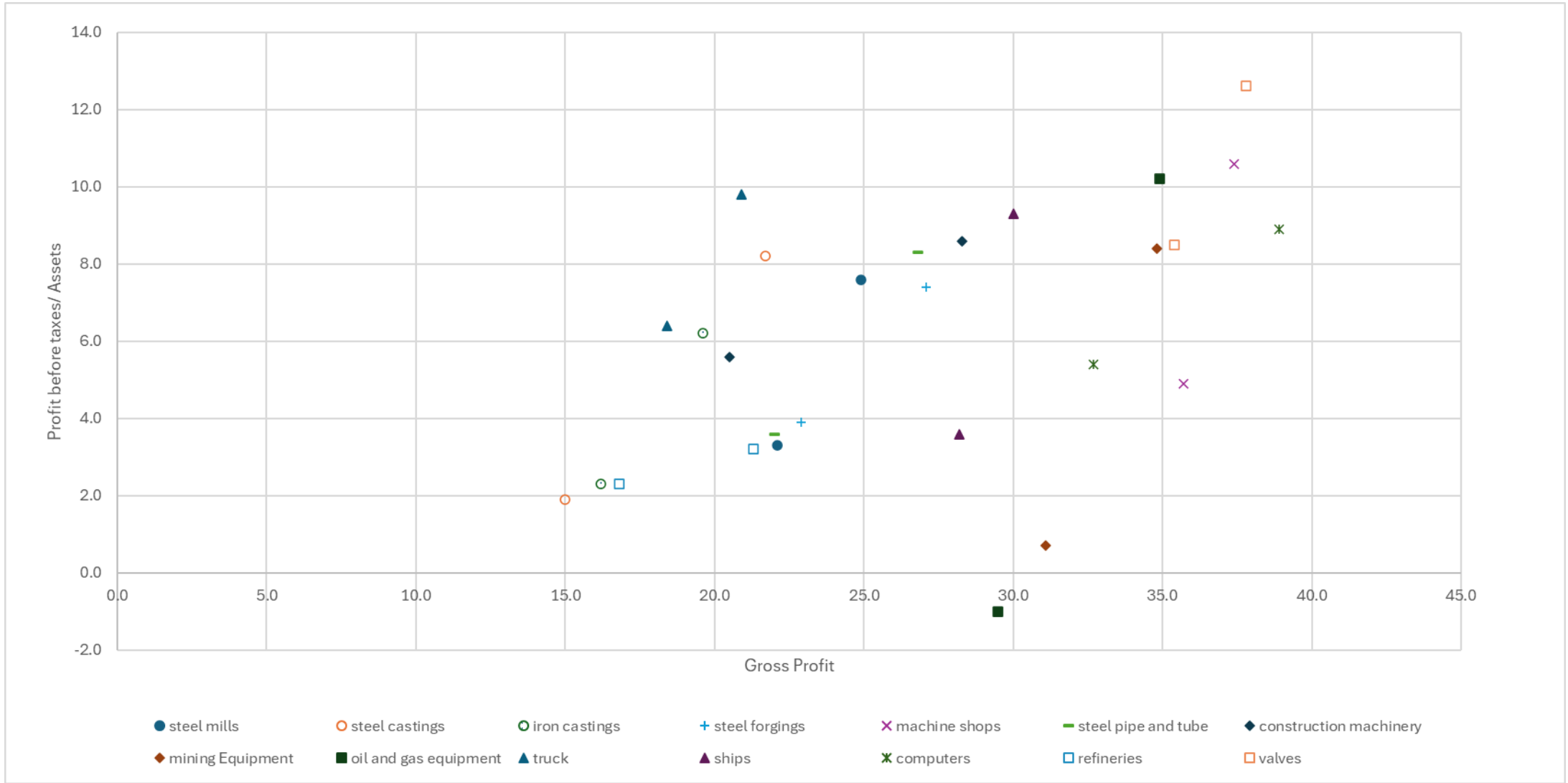



Price to Book
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Gross Margin
Financial
PGR
JPM
BAC
WFC
MS
MET
AIG
PRI
Medical
LLY
JNJ
ABT
BSX
TMO
Software
GOOG
MSFT
ORCL
ADBE
META
QCOM
AAPL
A
ROK
FANUY
Oil & Gas
XOM
CVX
SHEL
BP
COP
BKR
HAL
SLB
NOV
Mines
HCC
ARLP
NEM
RS
FCX
SLCA
Steel
NUE
STLD
X
CLF
NPSCY
JPSWY
MT
#REF!
APEMY
GGB
PKX
Specialty Steel
CMC
ATI
MTUS
CRS
HAYN
TKAMY
SSAAY
ANIOY
tools and parts
ITW
PH
IR
GGG
NDSN
FLS
EMR
SPX
SWK
KMT
LECO
TKR
AMDLY
Equipment
CAT
TEX
MTW
DE
CNH
KMTUY
KUBTY
Transportation
GBX
TRN
RAIL
WAB
SIEGY
UNP
CSX
CNI
CP
NSC
JBHT
ODFL
PCAR
Defense
GD
HII
OSK
BAE
GE


Sales to Book
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Gross Margin
Financial
PGR
JPM
BAC
WFC
MS
MET
AIG
PRI
Medical
LLY
JNJ
ABT
BSX
TMO
Software
GOOG
MSFT
ORCL
ADBE
META
QCOM
AAPL
A
ROK
FANUY
Oil & Gas
XOM
CVX
SHEL
BP
COP
BKR
HAL
SLB
NOV
Mines
HCC
ARLP
NEM
RS
FCX
SLCA
Steel
NUE
STLD
X
CLF
NPSCY
JPSWY
MT
#REF!
APEMY
GGB
PKX
Specialty Steel
CMC
ATI
MTUS
CRS
HAYN
TKAMY
SSAAY
ANIOY
tools and parts
ITW
PH
IR
GGG
NDSN
FLS
EMR
SPX
SWK
KMT
LECO
TKR
AMDLY
Equipment
CAT
TEX
MTW
DE
CNH
KMTUY
KUBTY
Transportation
GBX
TRN
RAIL
WAB
SIEGY
UNP
CSX
CNI
CP
NSC
JBHT
ODFL
PCAR
Defense
GD
HII
OSK
BAE
GE




30.00
25.00
20.00
15.00
10.00
5.00
0.00
-5.00
-10.00
-15.00
-20.00
ROA
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
Gross Margin
Financial
PGR
JPM
BAC
WFC
MS
MET
AIG
PRI
Medical
LLY
JNJ
ABT
BSX
TMO
Software
GOOG
MSFT
ORCL
ADBE
META
QCOM
AAPL
A
ROK
FANUY
Oil & Gas
XOM
CVX
SHEL
BP
COP
BKR
HAL
SLB
NOV
Mines
HCC
ARLP
NEM
RS
FCX
SLCA
Steel
NUE
STLD
X
CLF
NPSCY
JPSWY
MT
#REF!
APEMY
GGB
PKX
Specialty Steel
CMC
ATI
MTUS
CRS
HAYN
TKAMY
SSAAY
ANIOY
tools and parts
ITW
PH
IR
GGG
NDSN
FLS
EMR
SPX
SWK
KMT
LECO
TKR
AMDLY
Equipment
CAT
TEX
MTW
DE
CNH
KMTUY
KUBTY
Transportation
GBX
TRN
RAIL
WAB
SIEGY
UNP
CSX
CNI
CP
NSC
JBHT
ODFL
PCAR
Defense
GD
HII
OSK
BAE
GE

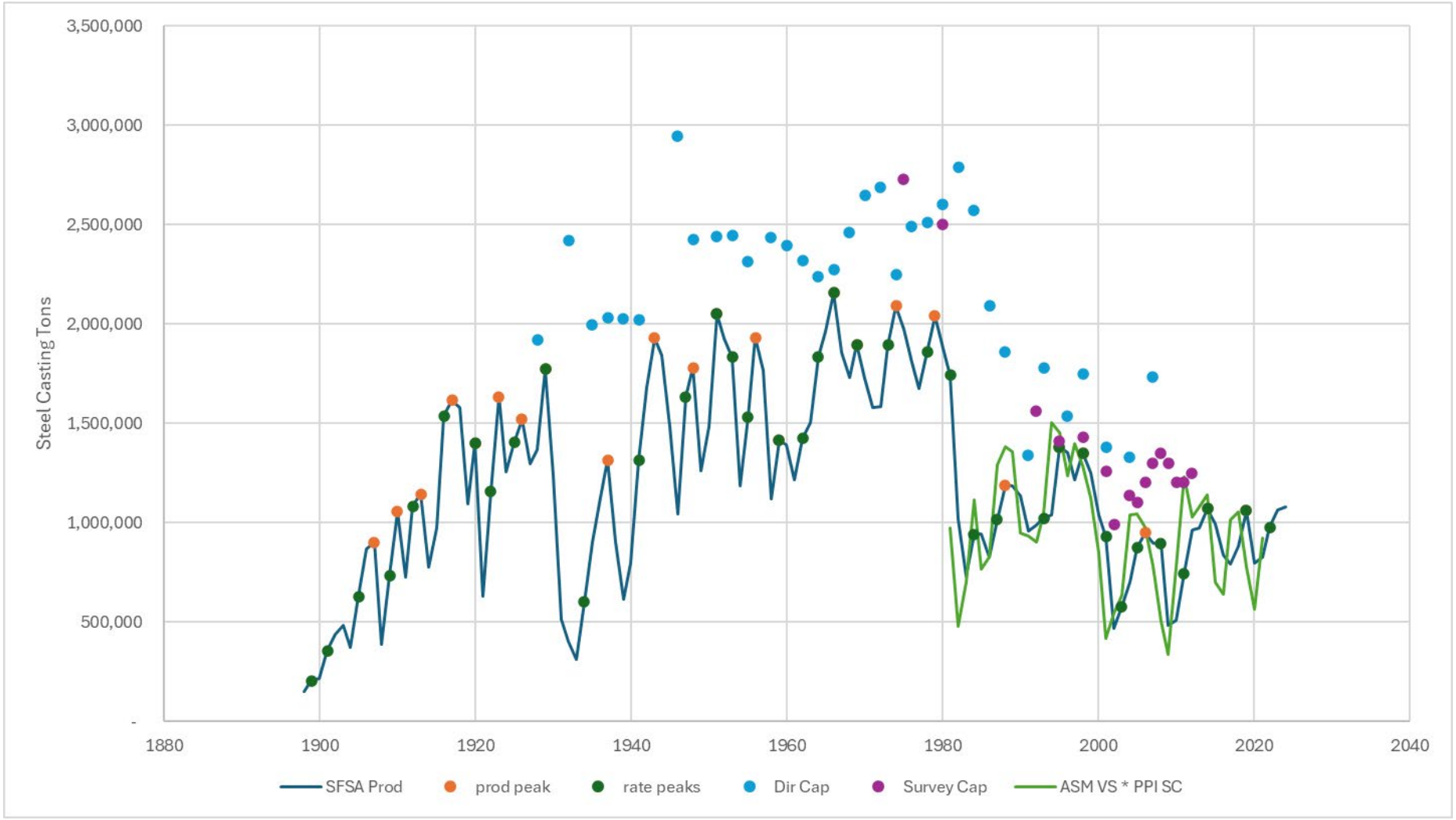

14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Profit before taxes/ Assets
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
Gross Profit
steel mills
steel castings
iron castings
steel forgings
machine shops
steel pipe and tube
construction machinery
mining Equipment
oil and gas equipment
truck
ships
computers
refineries
valves

Steel Casting Production and Capacity showed the expected result of De-industrialization

Demand and value went up after 2004 but the domestic sources were not able to keep up at times of peak demand.

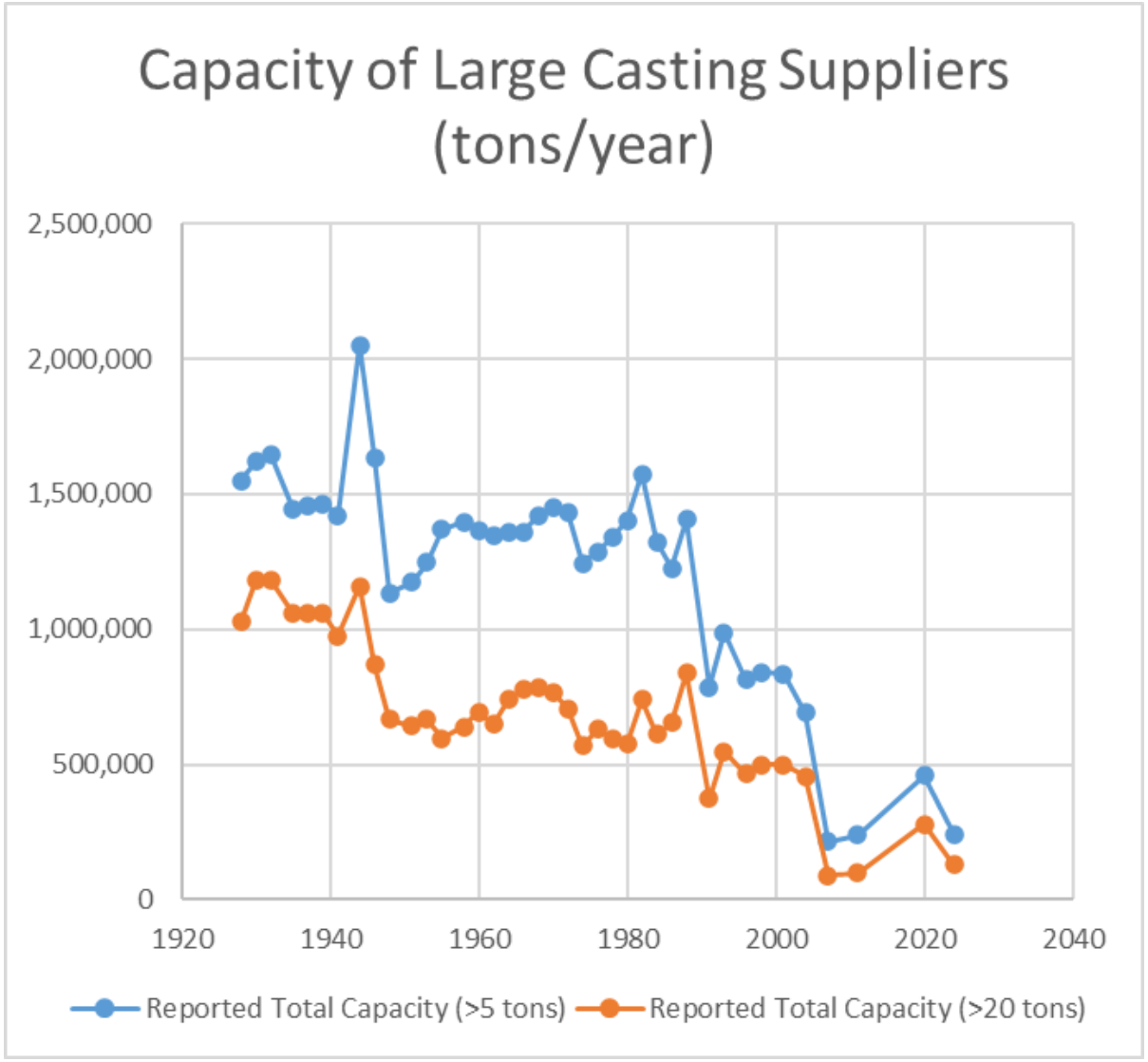
Changes in fiscal and monetary policy resulted in more volatility that was exacerbated by the financial crisis and the response to the pandemic as seen in the prior slide.

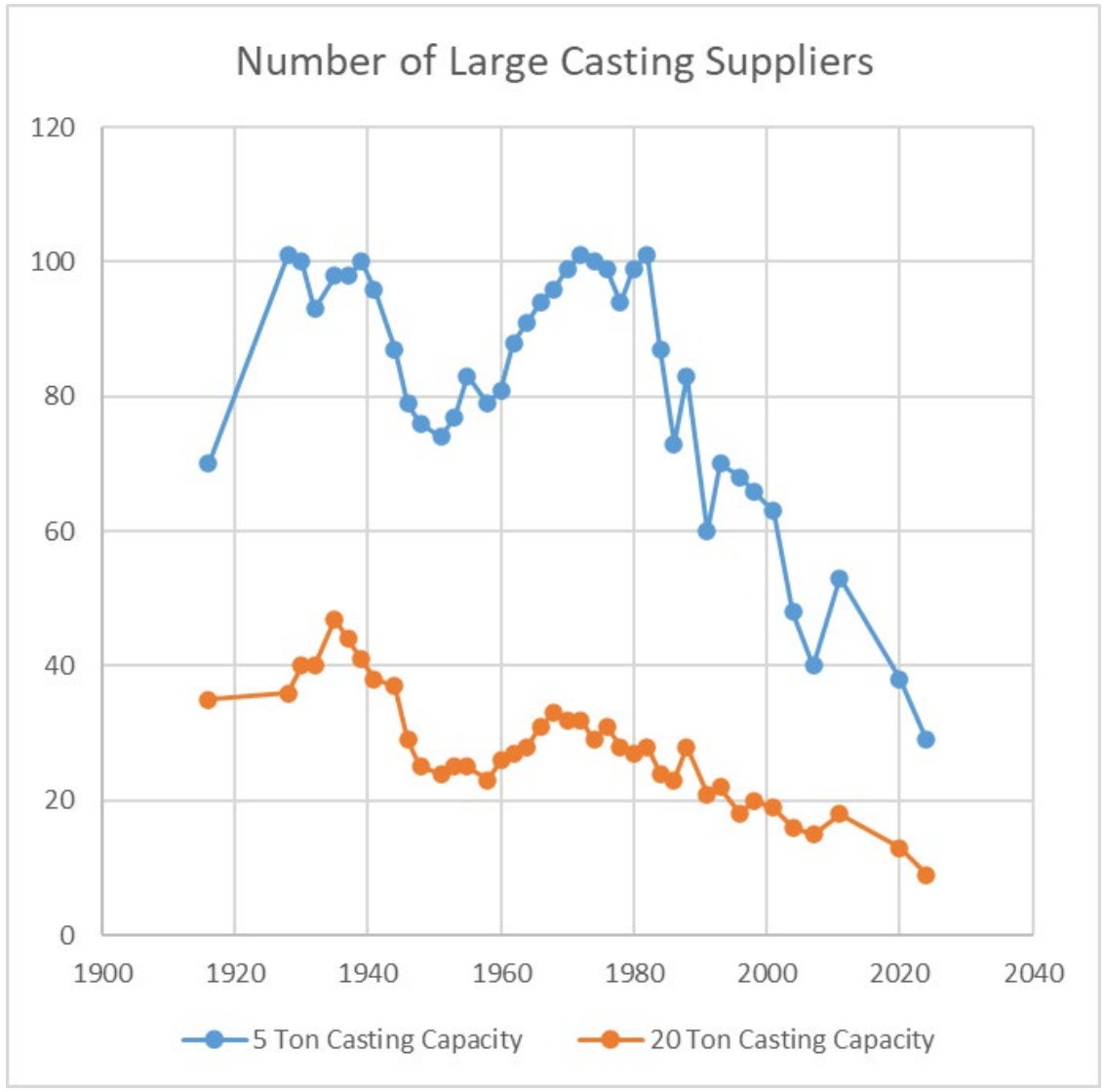
Domestic producers suffer from a combination of achieving attractive profitability and finding workers.



Large Steel Casting Capacity has fallen precipitously with limited Market Demand

Specialty and Advanced Large Castings essential for infrastructure, energy and defense requires a regular market for common products to maintain the staff and equipment needed.

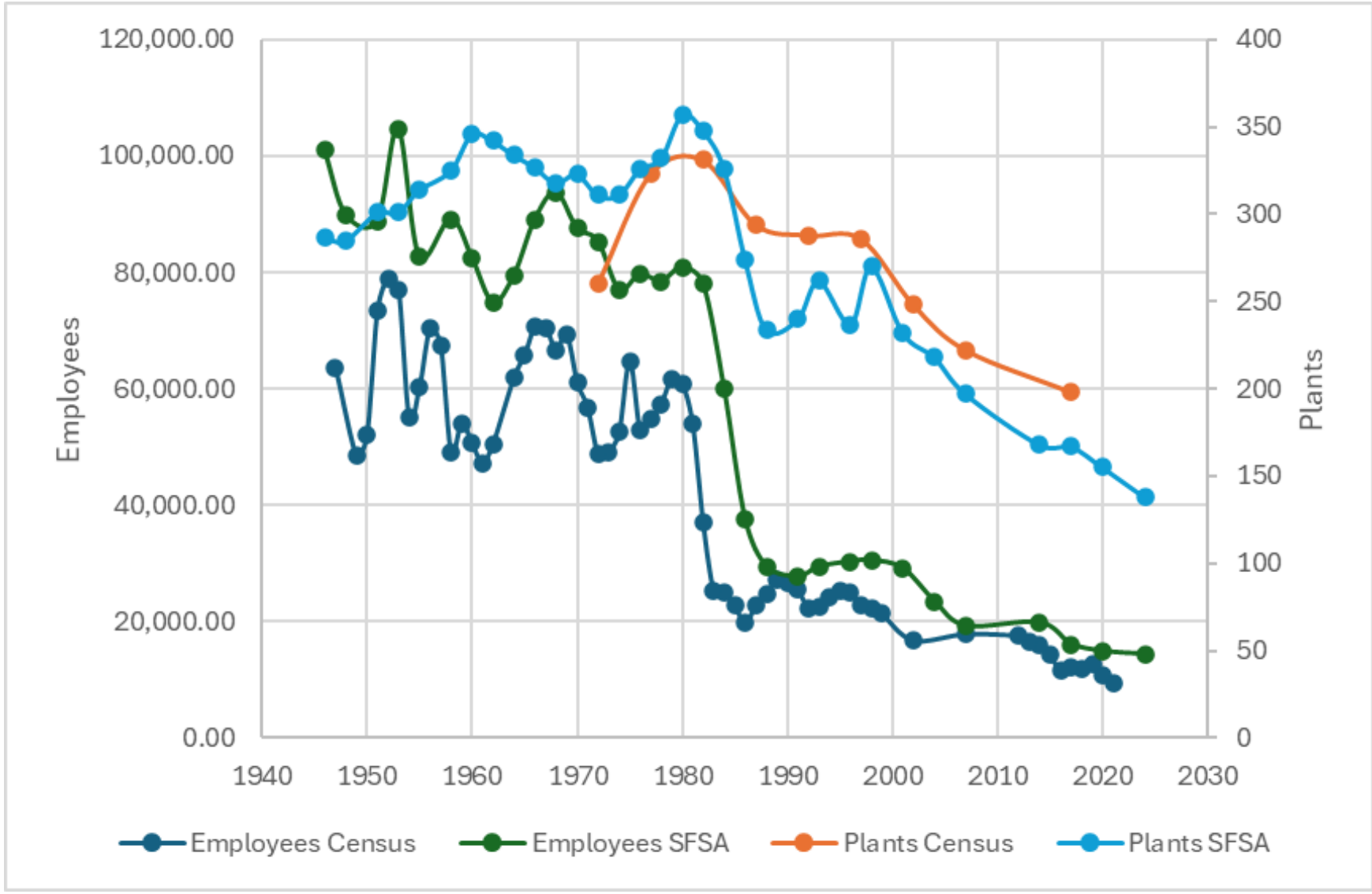




Steel Casting Plants and Employees have dropped dramatically since 1980

Steel casting producers have suffered from a lack of profitable market opportunities as domestic customers lost their markets or developed their own global sourcing to be cost competitive. The idea that the U.S. industrial supply could retain its dominant position in design, development, and advanced products has been illusory. Without domestic production volumes to provide the cash flow and maintain the profitable investment, the industry declines.

Engaging young people to discover the value and meaning of artisan manufacturing is a key challenge.



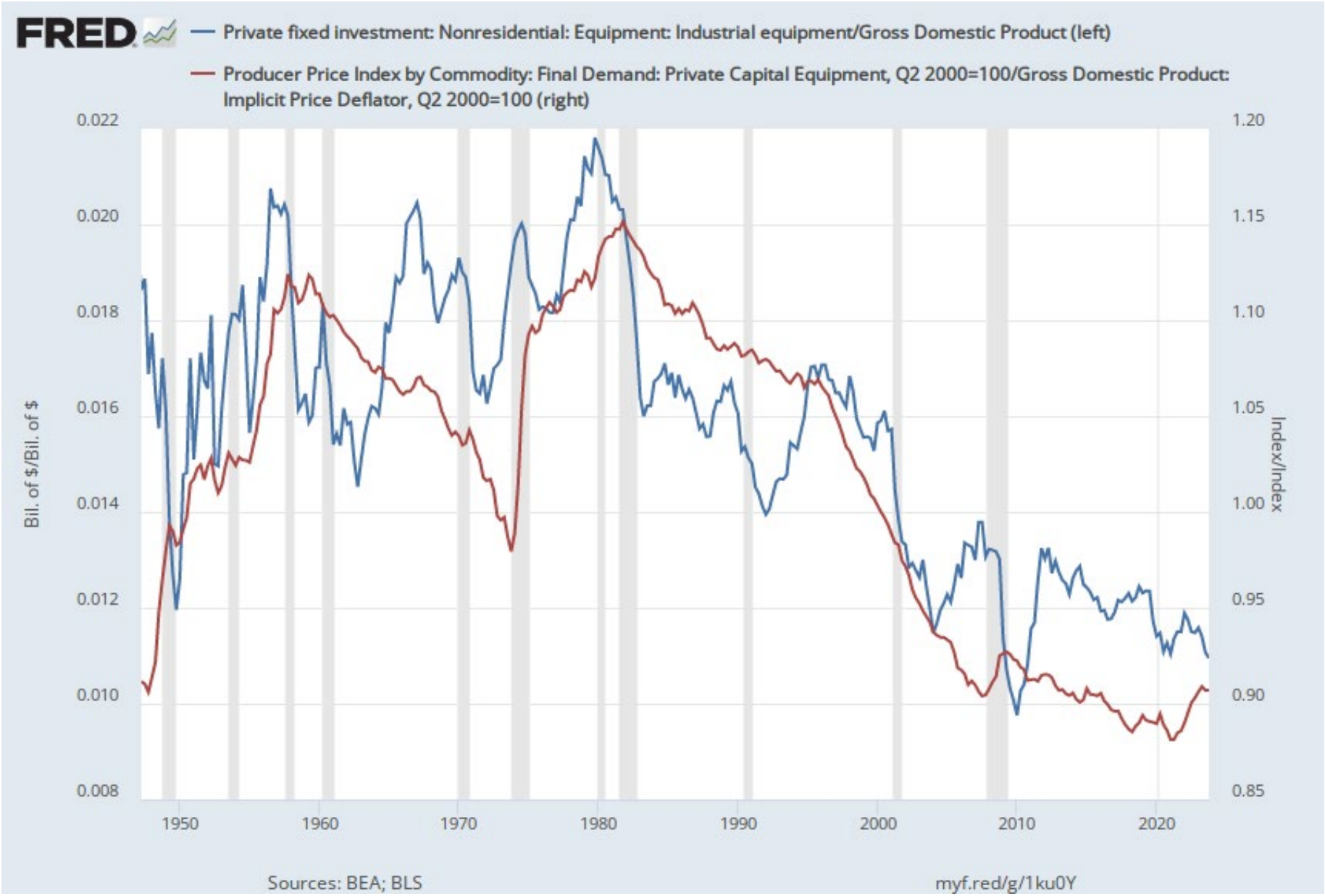
Public Policy and Macro-economic shifts led to a significant drop in demand and domestic production.

Profitability is the driving force behind investment and growth.

The value of products can be estimated from the change in dollar prices (the PPI) divided by the change in the value of the dollar.

Capital investment in equipment has a cycle of decades, 30 years approximately, with a peak in 1928, 1958, 1980.

At the bottom, the capacity is too small and demand pushes up the value and the investment for expansion, modernization, and innovation.

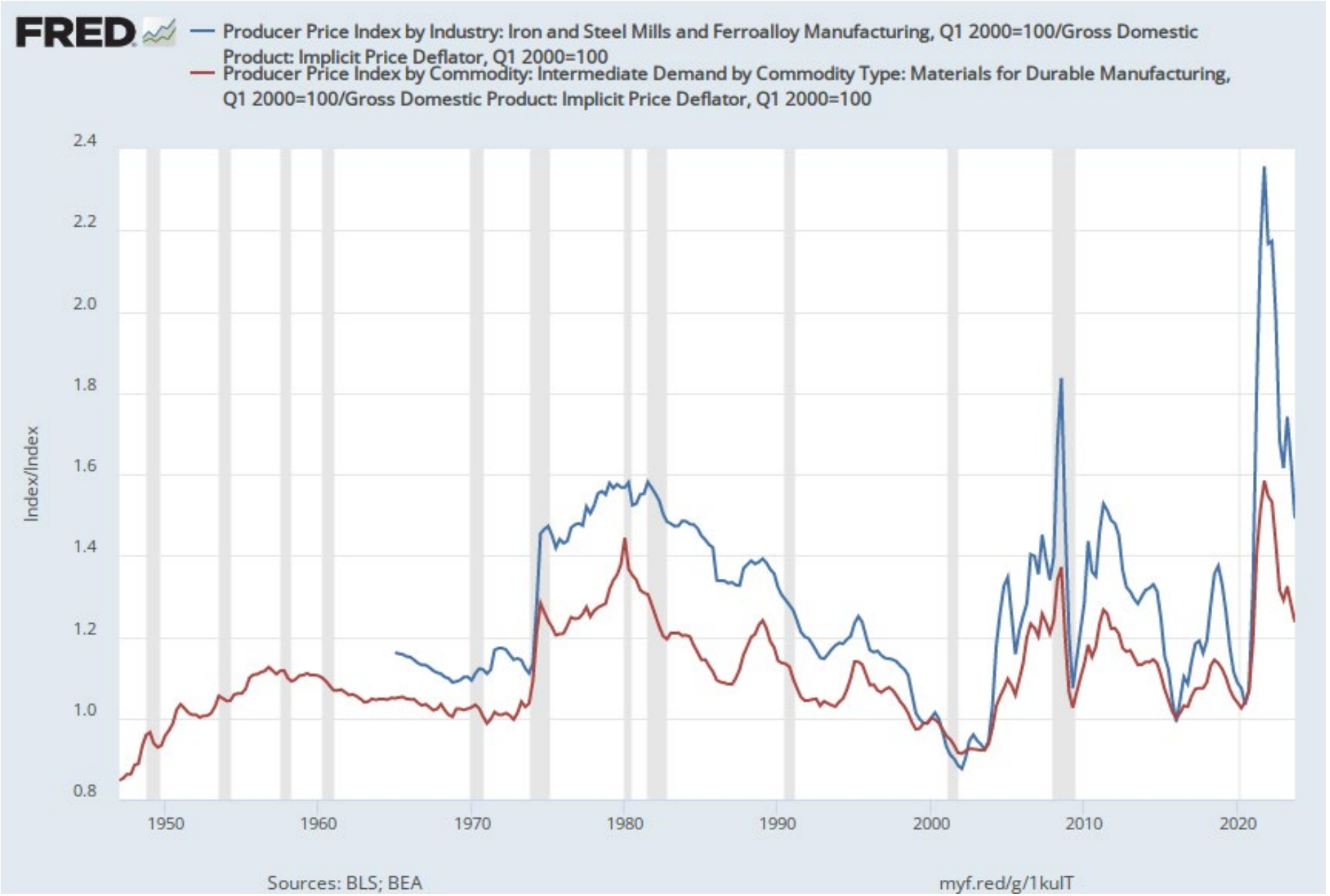


Capital Equipment Investment Re-industrialization should have happened after 2004.

The continued decline in the value of capital equipment in the prior slide was not seen in the value of materials or steel products after 2004. Values increased as global growth overwhelmed industry capacity.

The prior slide shows that investment in industrial equipment fell from over 2% of the GDP to less than 1%. Why did we not see the investment in capital investment?

Globalization created a global supply chain and the investment went elsewhere.



Elon Musk's Engineering Principles – The 5 Step Process

1) Make your requirements less dumb

•Your requirements are definitely dumb. It does not matter who gave them to you.
•It's particularly dangerous, if a smart person gave you the requirements, because you might not question them enough.
•Everyone's wrong, no matter who you are, everyone's wrong some of the time.

2) Try very hard to delete the part or process

•The bias tends to be very strongly towards "let's add this part or the process step in case we need it".
•If you're not adding things back in 10% of the time, you're clearly not deleting enough.
•Whatever requirement or constraint you have, it must come with a name, not a department. Cause you can't ask the departments, you have to ask a person and that person who's putting forward the requirement or constraint must agree that. They must take responsibility for that requirement. Otherwise you could have a requirement that basically an intern two years ago randomly came up with and they're not even at the company anymore. And actually there's no one at the department that currently agrees with that.

3) Simplify or optimize

•The reason it's the third step is cause it's very common, possibly the most common error of a smart engineer, to optimize the thing that should not exist. Why would you do that? Everyone has been trained in high school and college that you gotta answer the question, convergent logic. So you can't tell a professor "your question is dumb". You will get a bad grade. So everyone, without knowing it, they got like a mental straight jacket on that is they'll work on optimizing the thing that should simply not exist.
•There's another important principle, which is that you really want everyone to be chief engineer. So if everyone is chief engineer means that people need to understand the system at a high level to know when they are making a bad optimization.

4) Accelerate cycle time

You're moving too slow, go faster. But don't go faster until you've worked on the other three things first. If you're digging your grave, don't dig it faster, stop digging your grave.

5) Automate

I have personally made the mistake of going backwards on all five steps multiple times. Literally I automated, accelerated, simplified and then deleted. Automating was a mistake. Accelerating was mistake. Optimizing was a mistake. We just deleted and just bypassed this $2 million robot cell as a complete pile of nonsense.

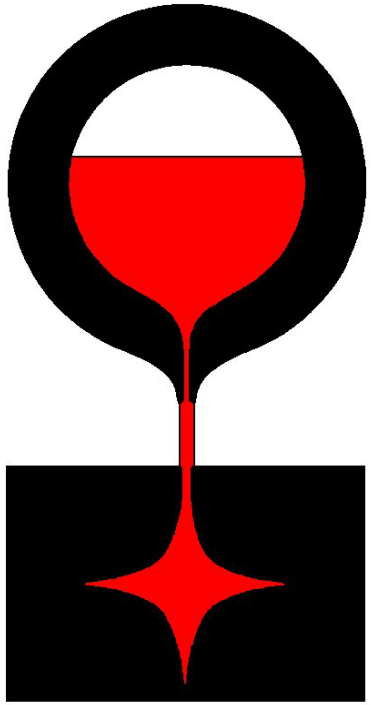
//www.christianscheb.de/archives/893

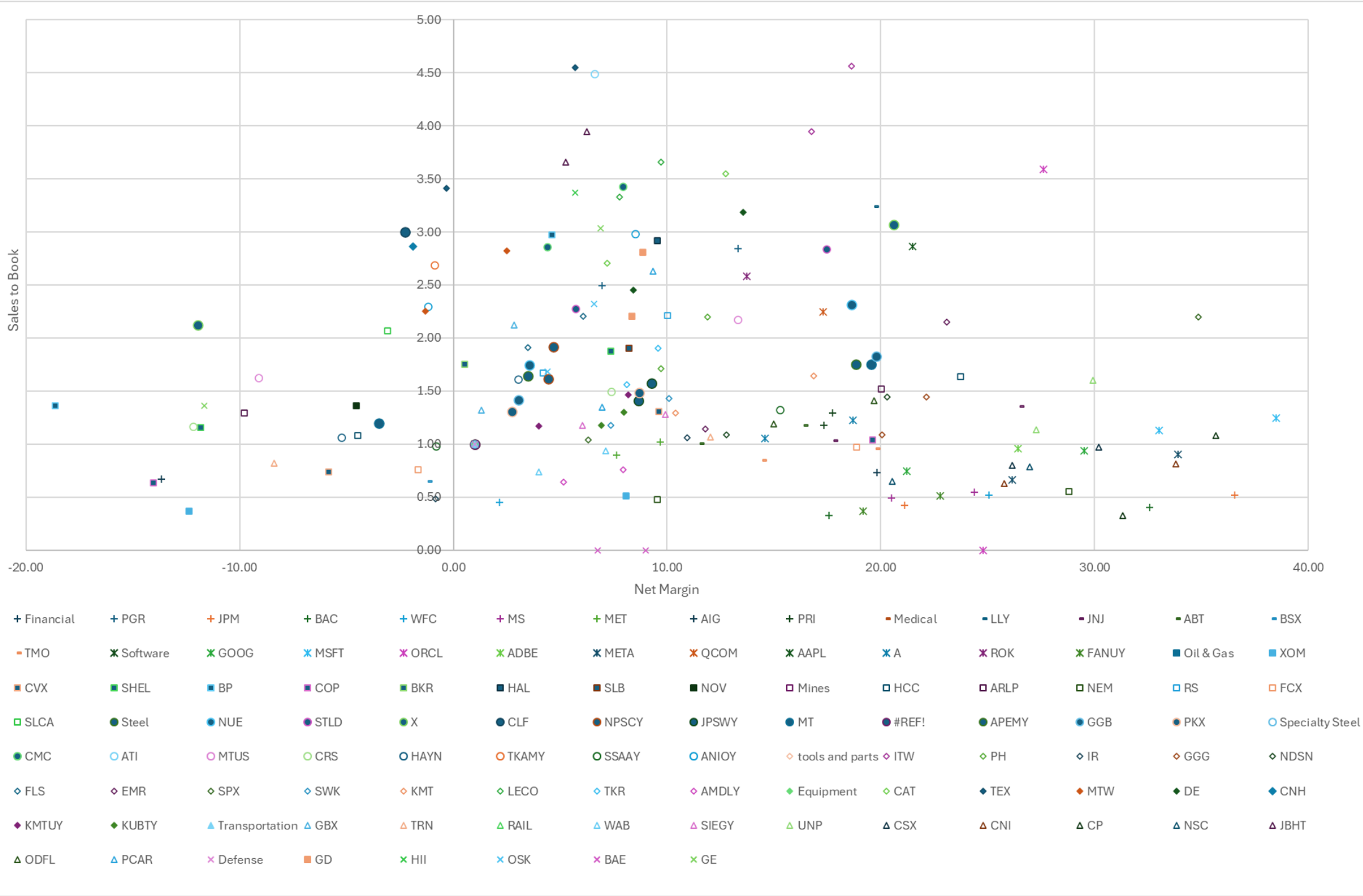
Thanks!
Questions
?

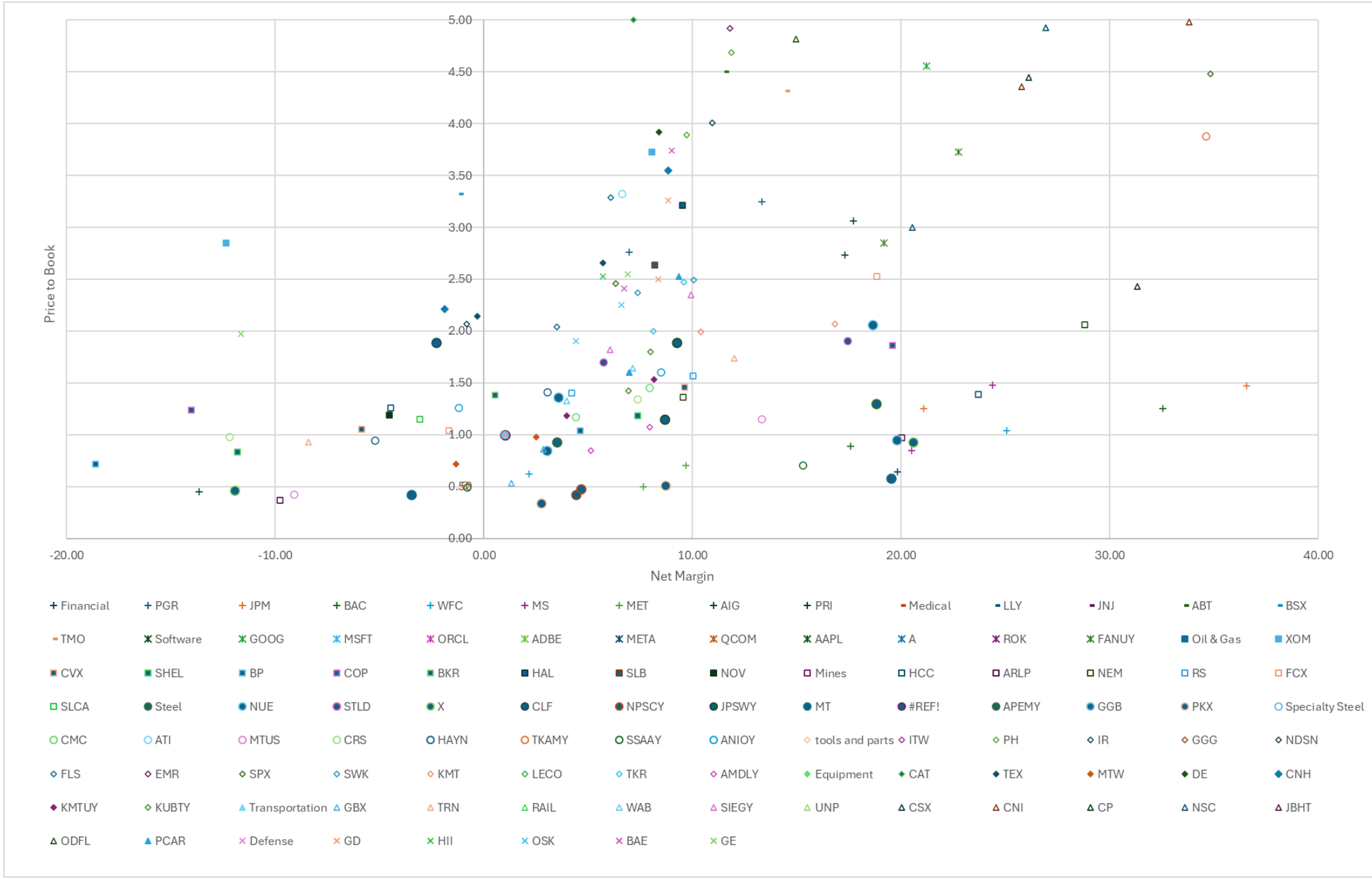
Raymond Monroe

815-263-8240

monroe@sfsa.org




Sales to Book
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
Net Margin
Financial
PGR
JPM
BAC
WFC
MS
MET
AIG
PRI
Medical
LLY
JNJ
ABT
BSX
TMO
Software
GOOG
MSFT
ORCL
ADBE
META
QCOM
AAPL
A
ROK
FANUY
Oil & Gas
XOM
CVX
SHEL
BP
COP
BKR
HAL
SLB
NOV
Mines
HCC
ARLP
NEM
RS
FCX
SLCA
Steel
NUE
STLD
X
CLF
NPSCY
JPSWY
MT
#REF!
APEMY
GGB
PKX
Specialty Steel
CMC
ATI
MTUS
CRS
HAYN
TKAMY
SSAAY
ANIOY
tools and parts
ITW
PH
IR
GGG
NDSN
FLS
EMR
SPX
SWK
KMT
LECO
TKR
AMDLY
Equipment
CAT
TEX
MTW
DE
CNH
KMTUY
KUBTY
Transportation
GBX
TRN
RAIL
WAB
SIEGY
UNP
CSX
CNI
CP
NSC
JBHT
ODFL
PCAR
Defense
GD
HII
OSK
BAE
GE


Price to Book
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-20.00
-10.00
0.00
10.00
20.00
30.00
40.00
Net Margin
Financial
PGR
JPM
BAC
WFC
MS
MET
AIG
PRI
Medical
LLY
JNJ
ABT
BSX
TMO
Software
GOOG
MSFT
ORCL
ADBE
META
QCOM
AAPL
A
ROK
FANUY
Oil & Gas
XOM
CVX
SHEL
BP
COP
BKR
HAL
SLB
NOV
Mines
HCC
ARLP
NEM
RS
FCX
SLCA
Steel
NUE
STLD
X
CLF
NPSCY
JPSWY
MT
#REF!
APEMY
GGB
PKX
Specialty Steel
CMC
ATI
MTUS
CRS
HAYN
TKAMY
SSAAY
ANIOY
tools and parts
ITW
PH
IR
GGG
NDSN
FLS
EMR
SPX
SWK
KMT
LECO
TKR
AMDLY
Equipment
CAT
TEX
MTW
DE
CNH
KMTUY
KUBTY
Transportation
GBX
TRN
RAIL
WAB
SIEGY
UNP
CSX
CNI
CP
NSC
JBHT
ODFL
PCAR
Defense
GD
HII
OSK
BAE
GE