

World Aero Markets: Looking Up, From The Bottom of a Pit

World Aircraft Overview

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Aircraft Markets, In Good And Bad Years

(last year was not good)

<u>World New Deliveries</u>	<u>CAGR</u>	<u>CAGR</u>	<u>CAGR</u>	<u>Change</u>
<u>In 2020 (2021 \$)</u>	<u>'03-'08</u>	<u>'08-'14</u>	<u>'14-'19</u>	<u>'19-'20</u>
Jetliners-SA (\$27 b)	9.7%	6.9%	-2.0%	-54.8%
Jetliners-TA (\$27.8 b)	5.0%	13.5%	2.1%	-49.1%
Regionals (\$3.4 b)	3.9%	-3.1%	-6.3%	-47.8%
Business Aircraft (\$18.2 b)	16.7%	-2.2%	-1.2%	-15.7%
Civil Rotorcraft (\$3.1 b)	18.5%	-2.5%	-7.2%	-11.4%
Military Rotorcraft (\$10.7 b)	10.6%	9.7%	-7.0%	-16.3%
Military Transports (\$4.1 b)	3.2%	-0.9%	0.0%	-27.0%
Fighters (\$18.3 b)	1.6%	0.8%	6.1%	-22.6%
<u>All Civil</u> (\$79.9 b)	<u>9.7%</u>	<u>5.6%</u>	<u>-0.5%</u>	<u>-40.0%</u>
<u>All Military</u> (\$36.9 b)	<u>3.9%</u>	<u>4.1%</u>	<u>0.0%</u>	<u>-18.4%</u>
<u>Total</u> (\$116.7 b)	<u>8.0%</u>	<u>5.2%</u>	<u>-0.4%</u>	<u>-34.5%</u>

Aviation Segments By Damage

Most to Least
**Annotated, 18
Months In**

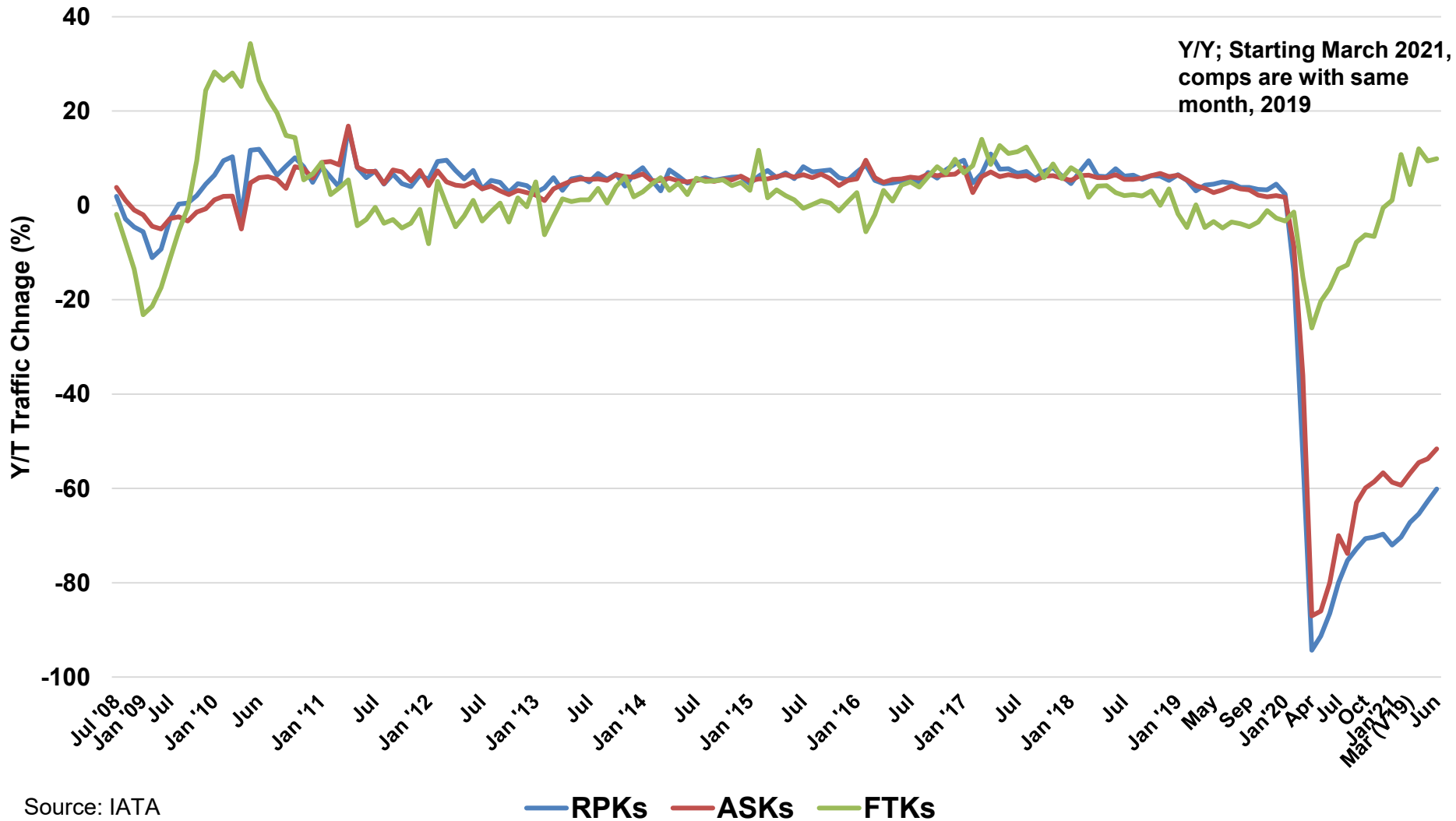
Twin aisle jetliners	<p>International traffic hit hardest and longest. Already an overcapacity situation. Secular shift towards single aisles already underway.</p> <p>It's just that bad.</p>
Single aisle jetliners	<p>Fuel prices a big problem. China comeback uncertain. Some relief due to deferred Airbus ramp, and MAX stop.</p> <p>Same.</p>
Business Jets	<p>Large cabin strongly correlated with oil prices. Small/medium strongly correlated with corporate profits, equities indices.</p> <p>Recovering quickly; just a 2020/21 downturn</p>
Civil Rotorcraft	<p>Oil and gas segment (large) hit again, before recovery even began.</p> <p>About right...wait and see.</p>
Military Programs	<p>Emphasis on "shovel-ready." Advance development programs at greater risk. Pure-play contractors in best shape; suppliers with most defense in best shape.</p> <p>All good. In fact, better.</p>

Traffic: Nothing We've Ever Seen Before

-65.9% RPKs in 2020 (-56.5% ASKs; -10.6 FTKs)

2019 Totals: RPKs 4.2%, ASKs 3.4%, FTKs -3.3%

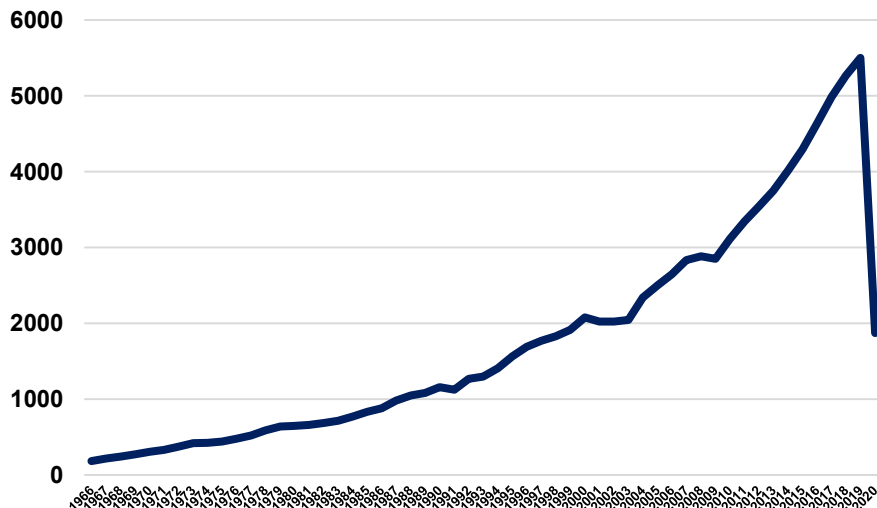
2018 Totals: RPKs 6.5%, FTKs 5.4%; 2017: RPKs 7.6%, FTKs 9%



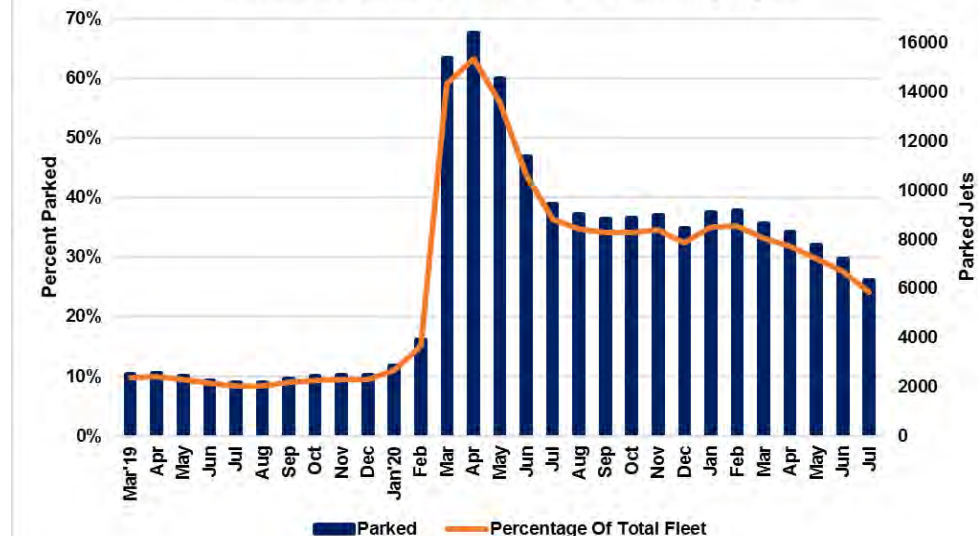
More Unprecedented Numbers

- **Traffic decline, parked fleet like no previous shock.**
 - Per Paul Krugman, reflect a world economy recovering from a “medically-induced coma.”
- **Backlogs holding up (MAX stabilizing), but meaningless for production rates in a downturn.**
- **Many early retirements coming, particularly twin aisles.**
 - Primarily twin aisles; Quadjet bloodbath, especially A380.
- **Aftermarket catastrophe – ASK decline, plus de-stocking, deferred maintenance, early retirements, USM, engine swapping, etc.**
 - But promise of an equally swift recovery.

World Air Traffic (RPM Bns)



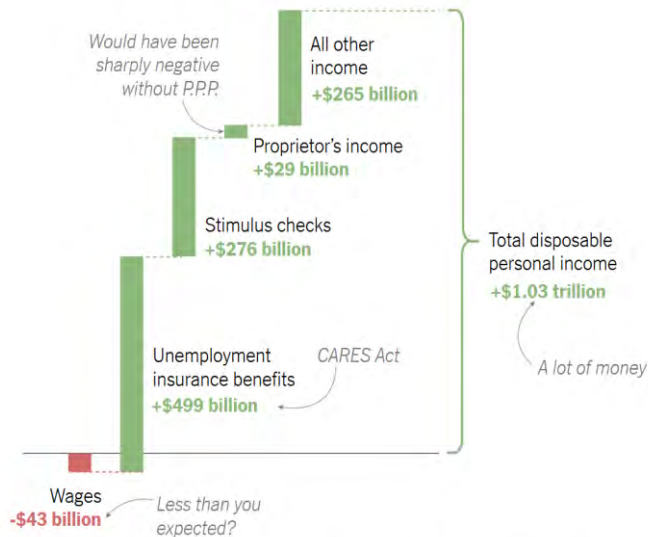
World Jet Fleet: Down To ~24% Unemployed



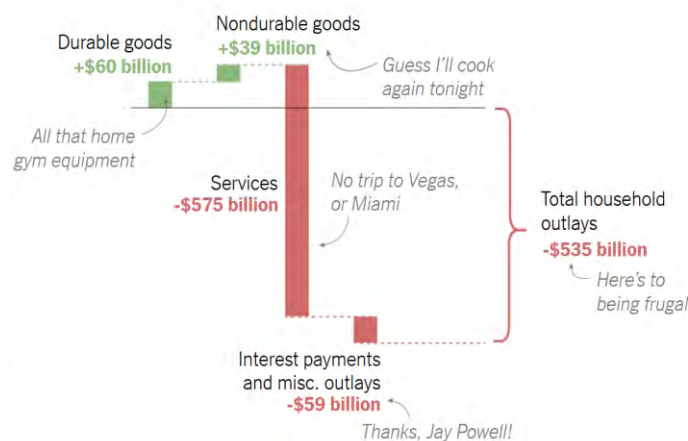
Traffic Peak Recovery By Late 2022. Why?

- Better-than-expected vaccine efficacy.
- Better-than-expected economic outlook.
- The China and US domestic comebacks.
- Business travel resurgence.
- Vacation travel resurgence, fueled by record savings rates.
 - Concern about Delta and other variants...it's the big variable.

Personal income increased

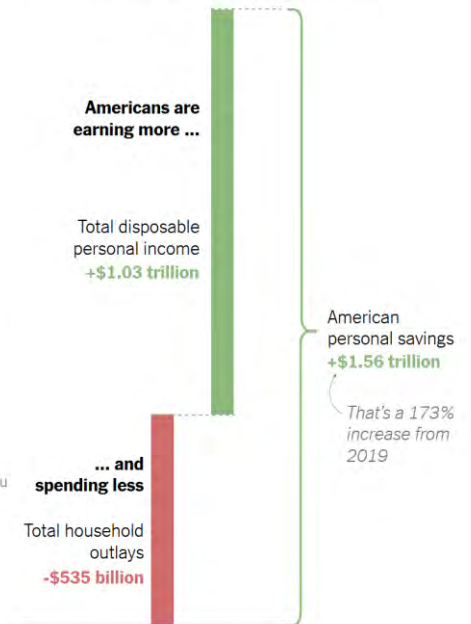


Spending decreased



Note: Data from March to November 2020 compared with the same time period in 2019. Source: Bureau of Economic Analysis

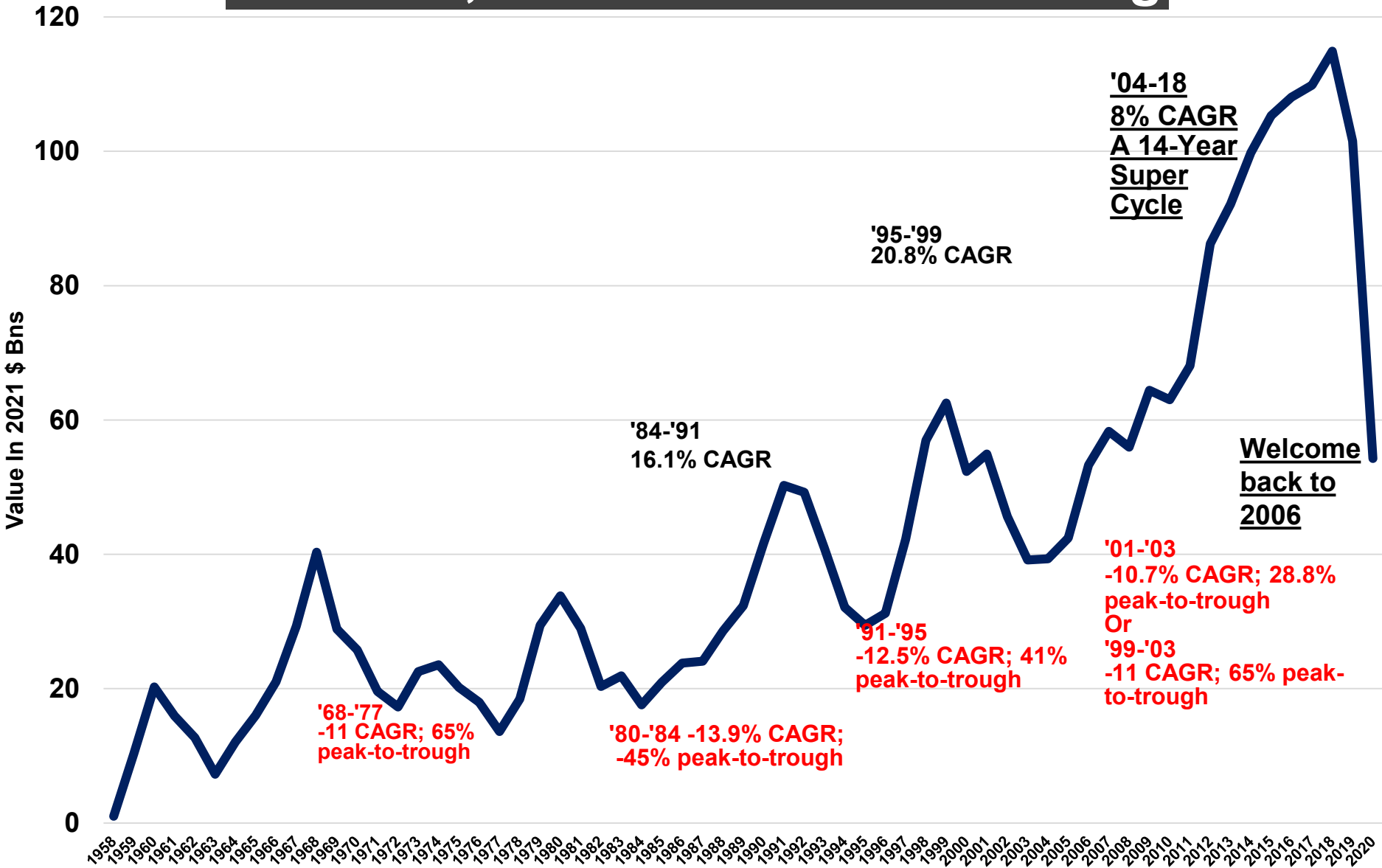
Americans are saving a lot of money



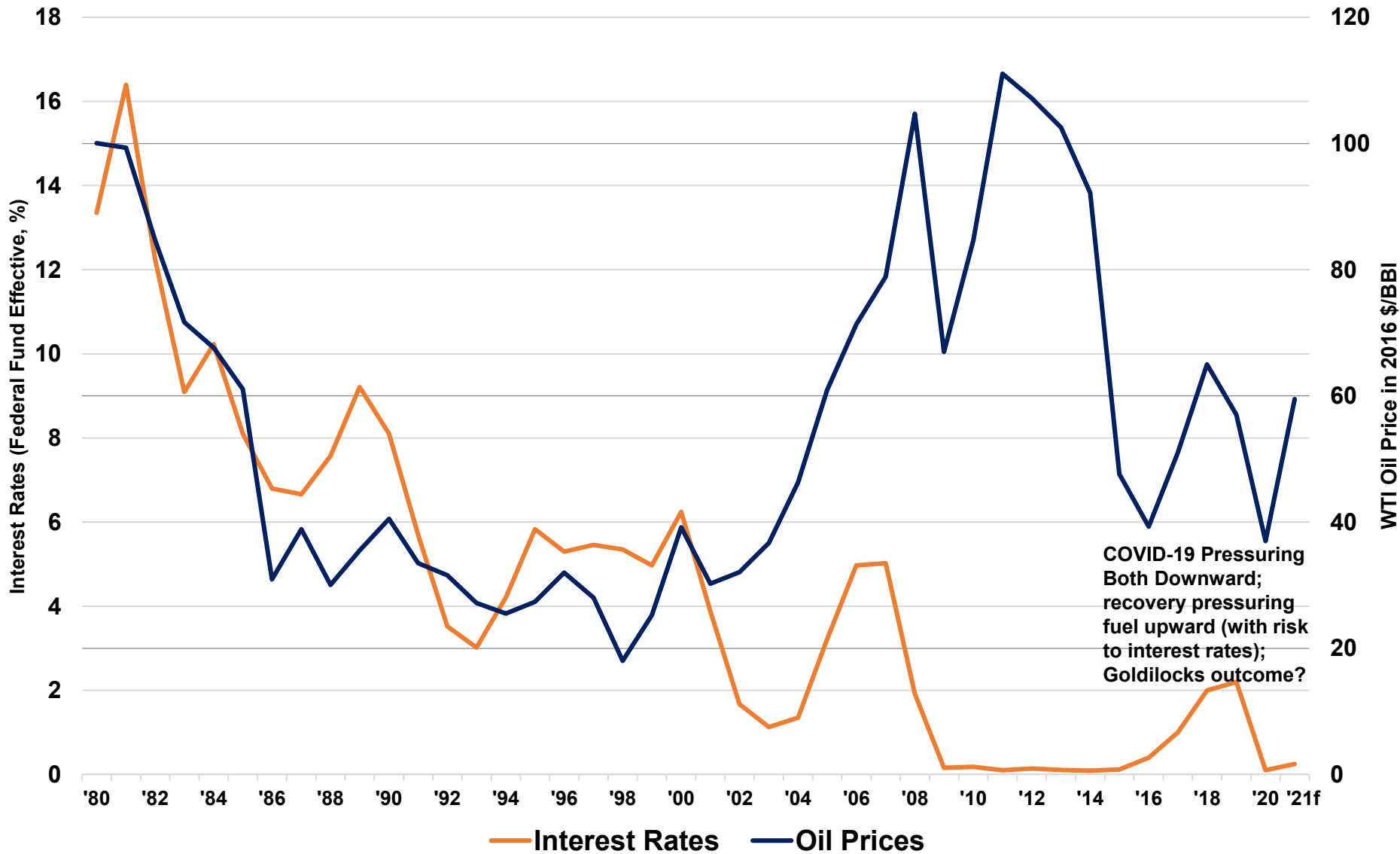
Note: Data from March to November 2020 compared with the same time period in 2019. Source: Bureau of Economic Analysis

<https://www.nytimes.com/2021/01/01/upshot/why-markets-boomed-2020.html>

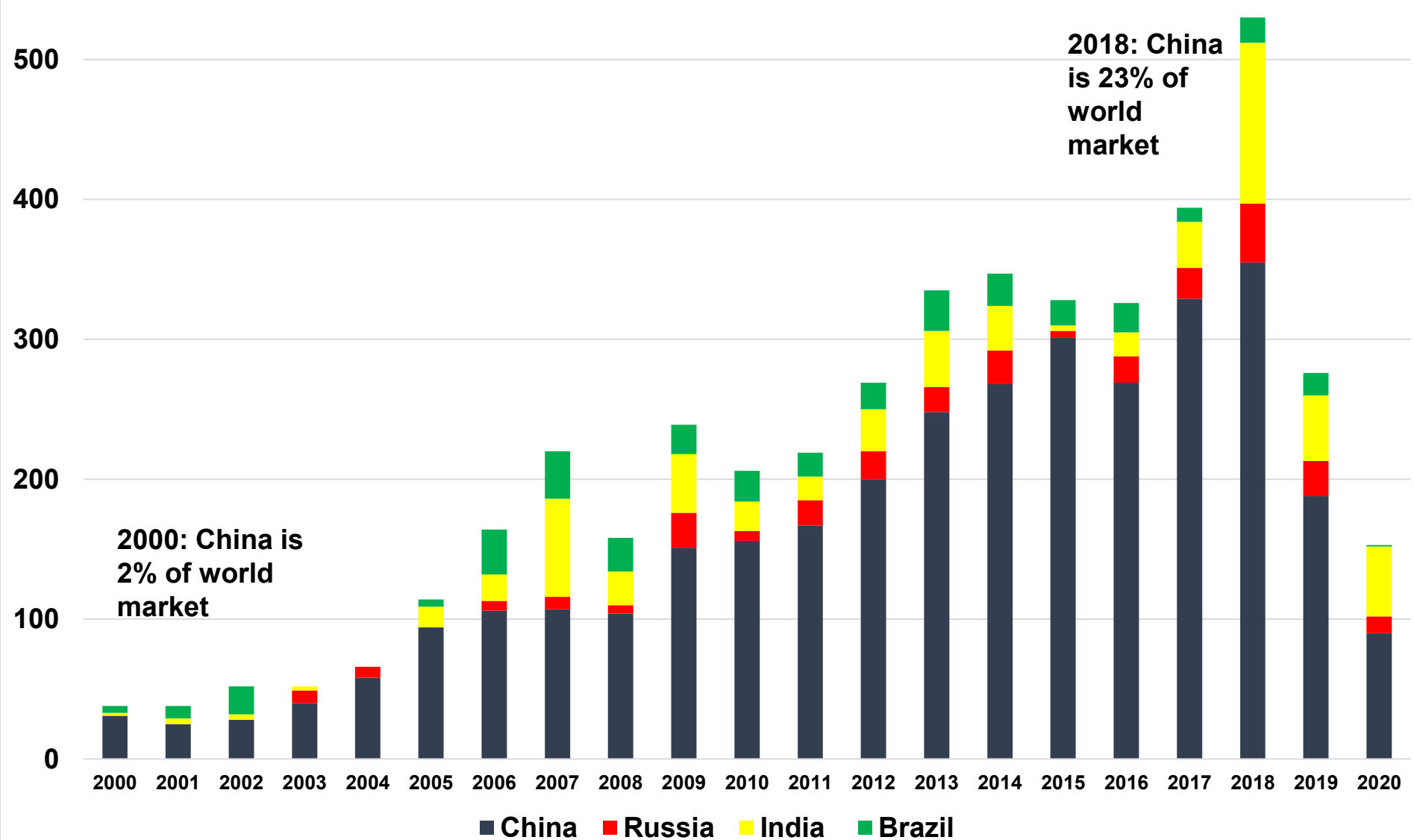
Here It Is, The Chart I Was Dreading



Interest Rates And Oil Prices: Less Than 4%, And \$50-85/bbl, Ideally; But The Ratio Matters Most

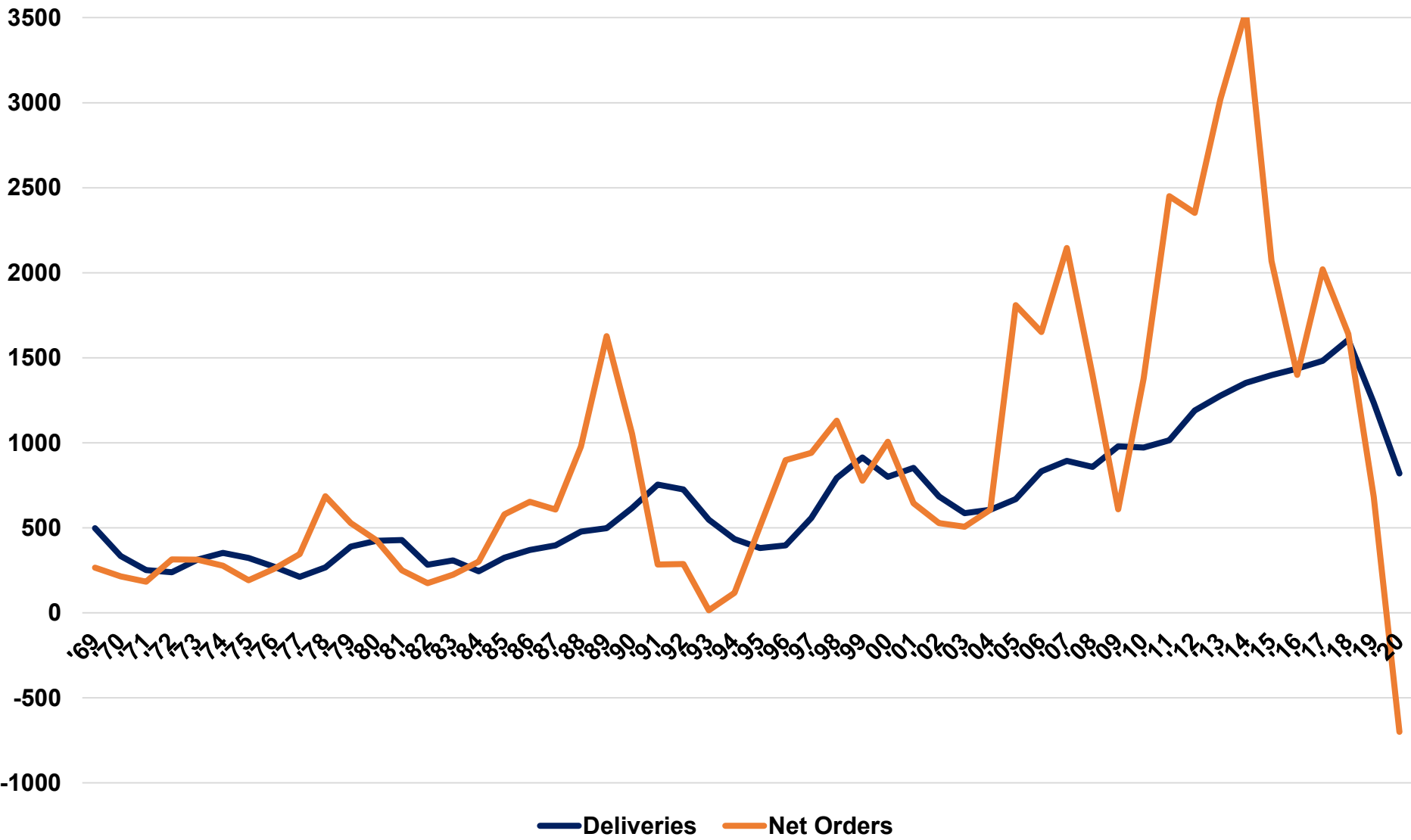


BRIC Deliveries: All About China



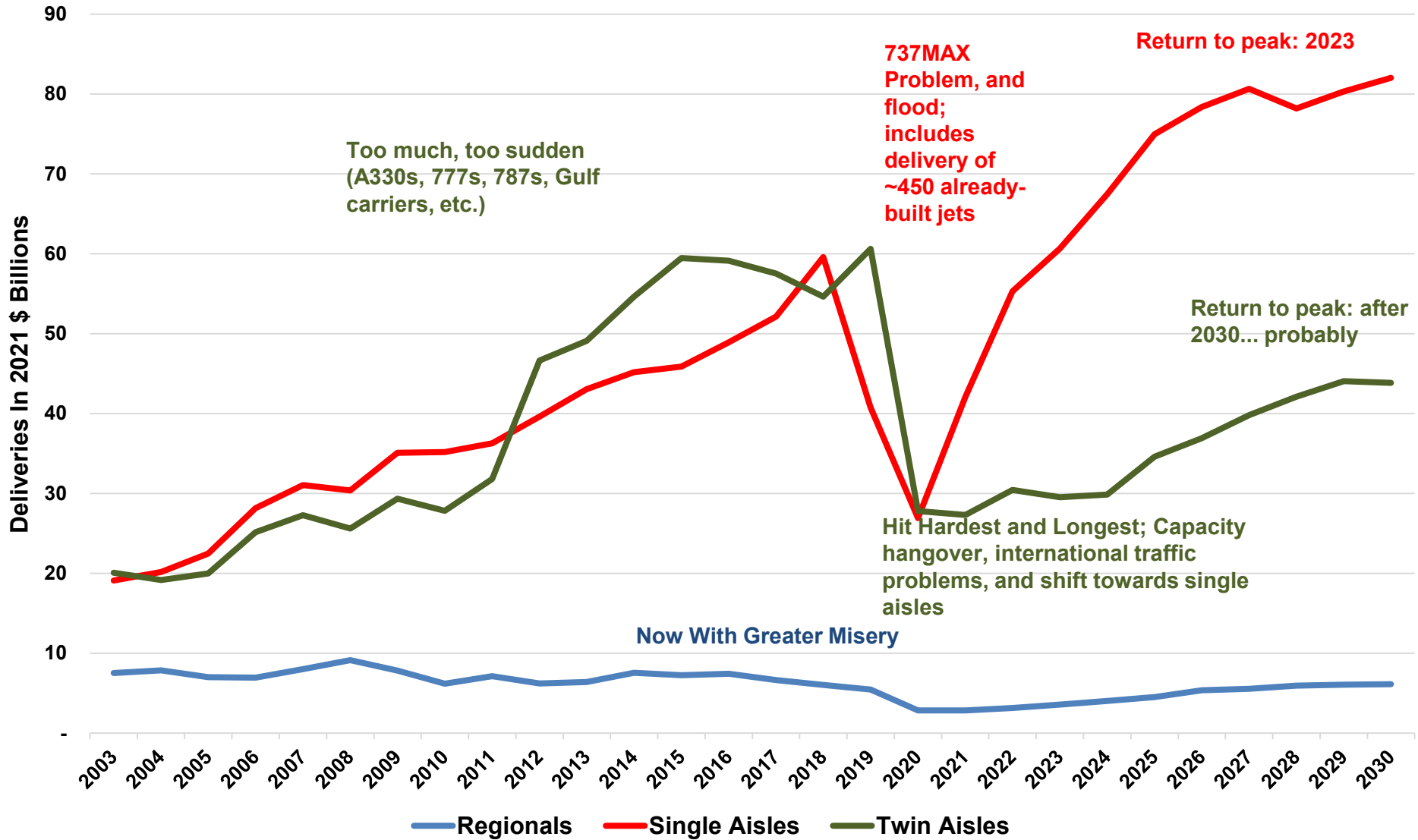
Large Jetliner Orders And Deliveries

Book-To-Bill No Longer A Thing

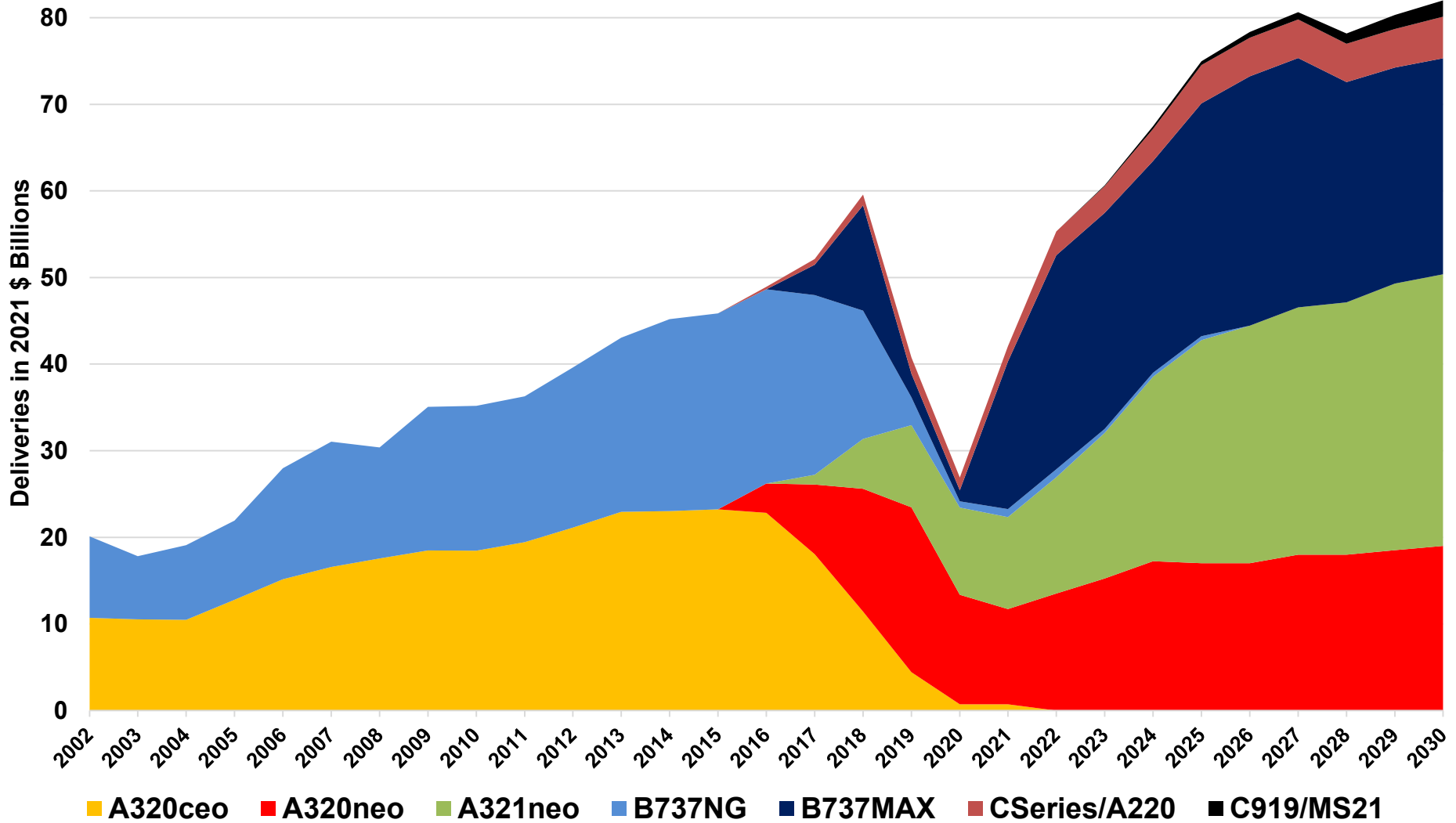


The Air Transport Market By Segment

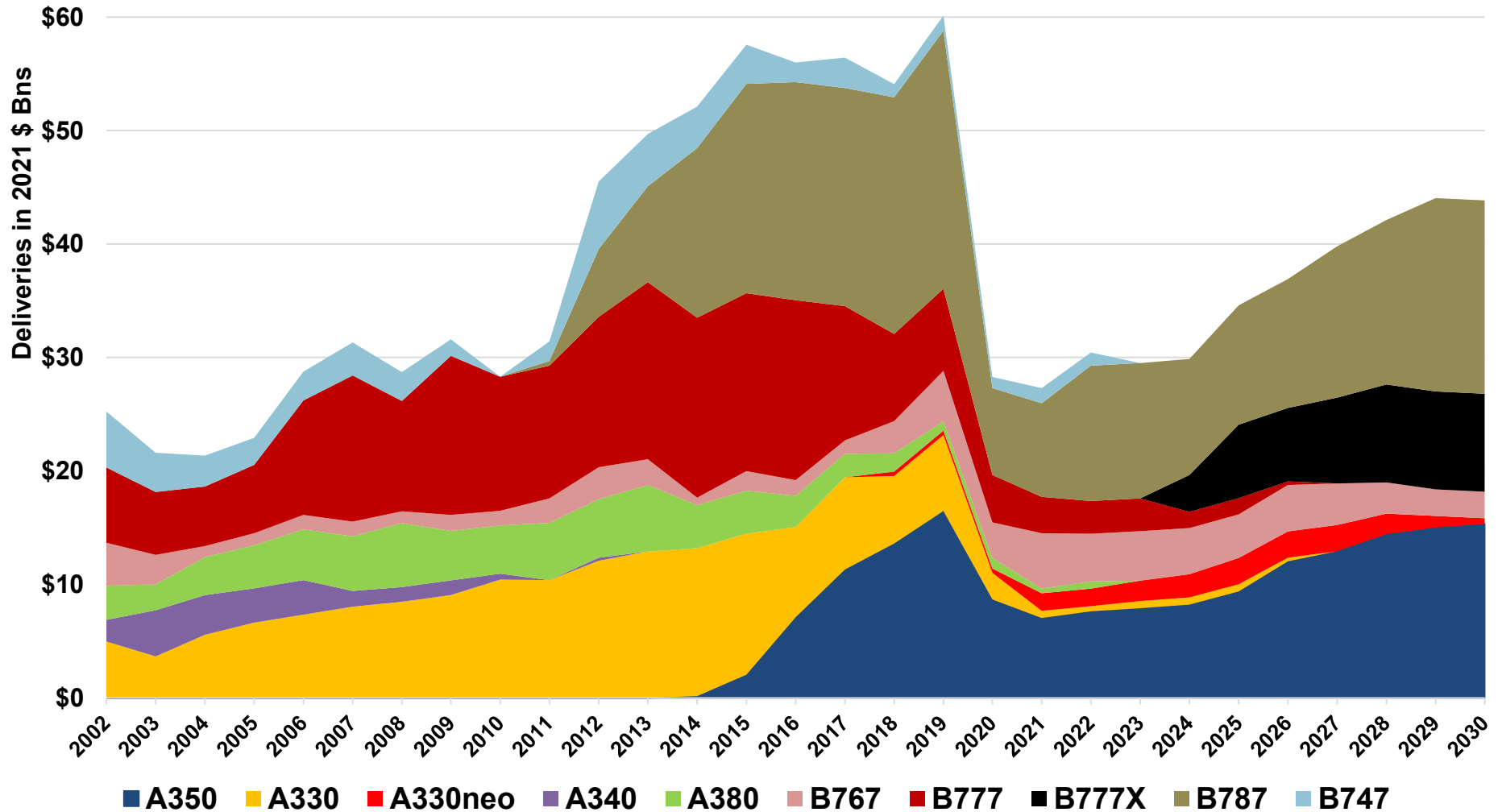
A Tale of Two Markets



Single Aisle Deliveries: Protected By MAX Return, and By Shift Away From Twin Aisles



Twin Aisles: Formerly Hot; Now Crowded And Depressed



Twin Aisles Have Been Here Before

- We're forecasting a lasting shift towards single aisles, with profound consequences for primes, suppliers, and jetliner financing. But twins have been in dire straits several times before.
- Twins may bounce back:
 - Belly cargo (Asia/Mideast connectors).
 - Range (Asia/Mideast connectors).
 - Post-fragmentation route thickening (legacies gaining, International LCCs losing).

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Market Comment

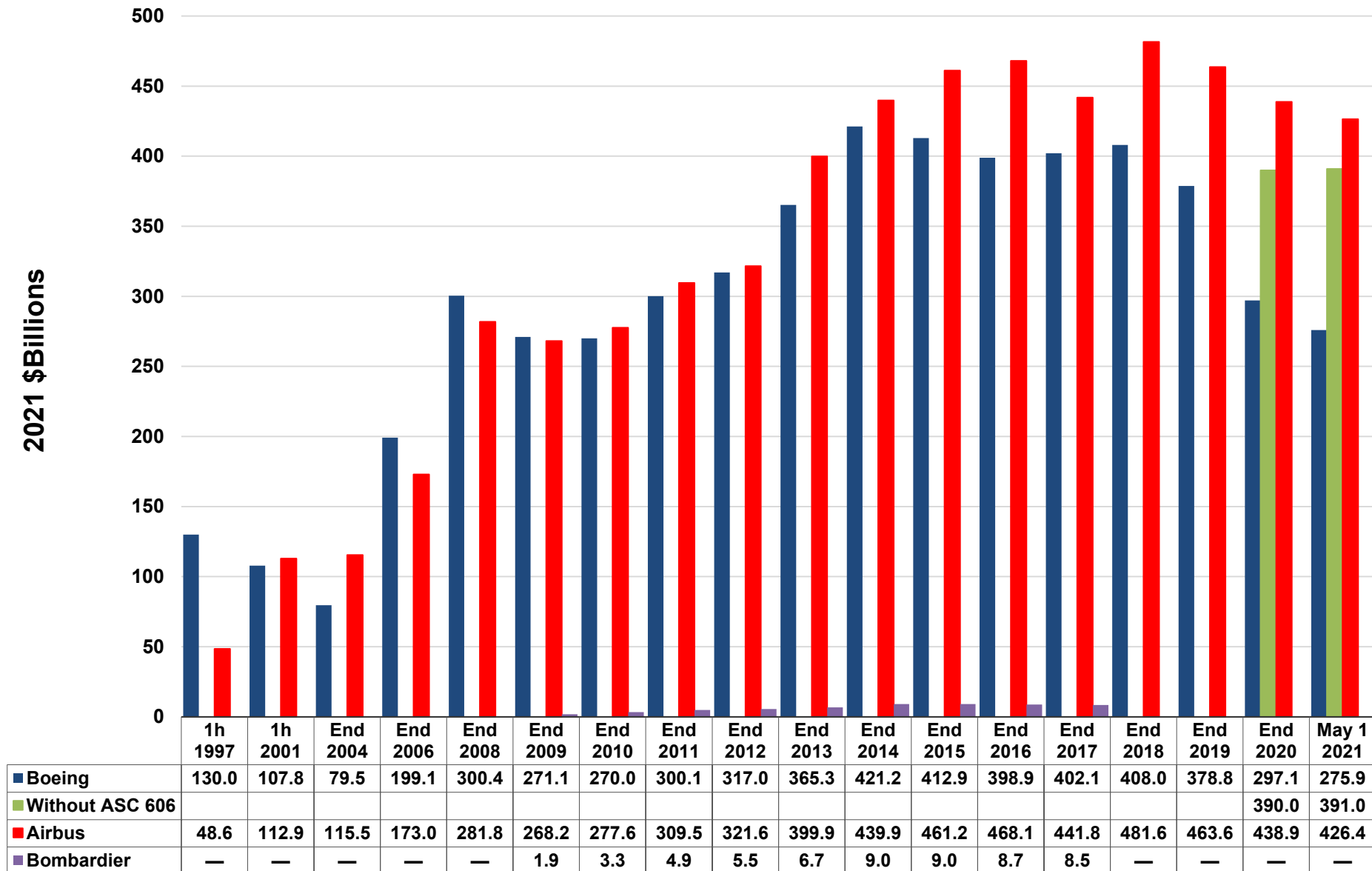
The World is Awash in Widebodies. Thanks to the Asian economic crisis and a flood of deliveries, the number of widebody aircraft available for sale or lease have grown at an astronomical rate. Currently, Airfax lists some 186 aircraft on the market, certainly less than the number available in the early 1990s, but almost three times the number on the market during the comparable peak periods of the late '80s.

Aircraft Type	No. on the Market
B-747-400M	4
B-747-300M	5
B-747-300	13
B-747-200C	12
B-747-200B	12
B-747-100C	3
B-747-100	12
B-747SP	12
B-747SR	3
B-767	12
B-777	3
A300B4-1/200	21
A300B4-600	4
A310-2/300	11
A340	5
L-1011	29
DC-10	22
MD-11	3
Total	186

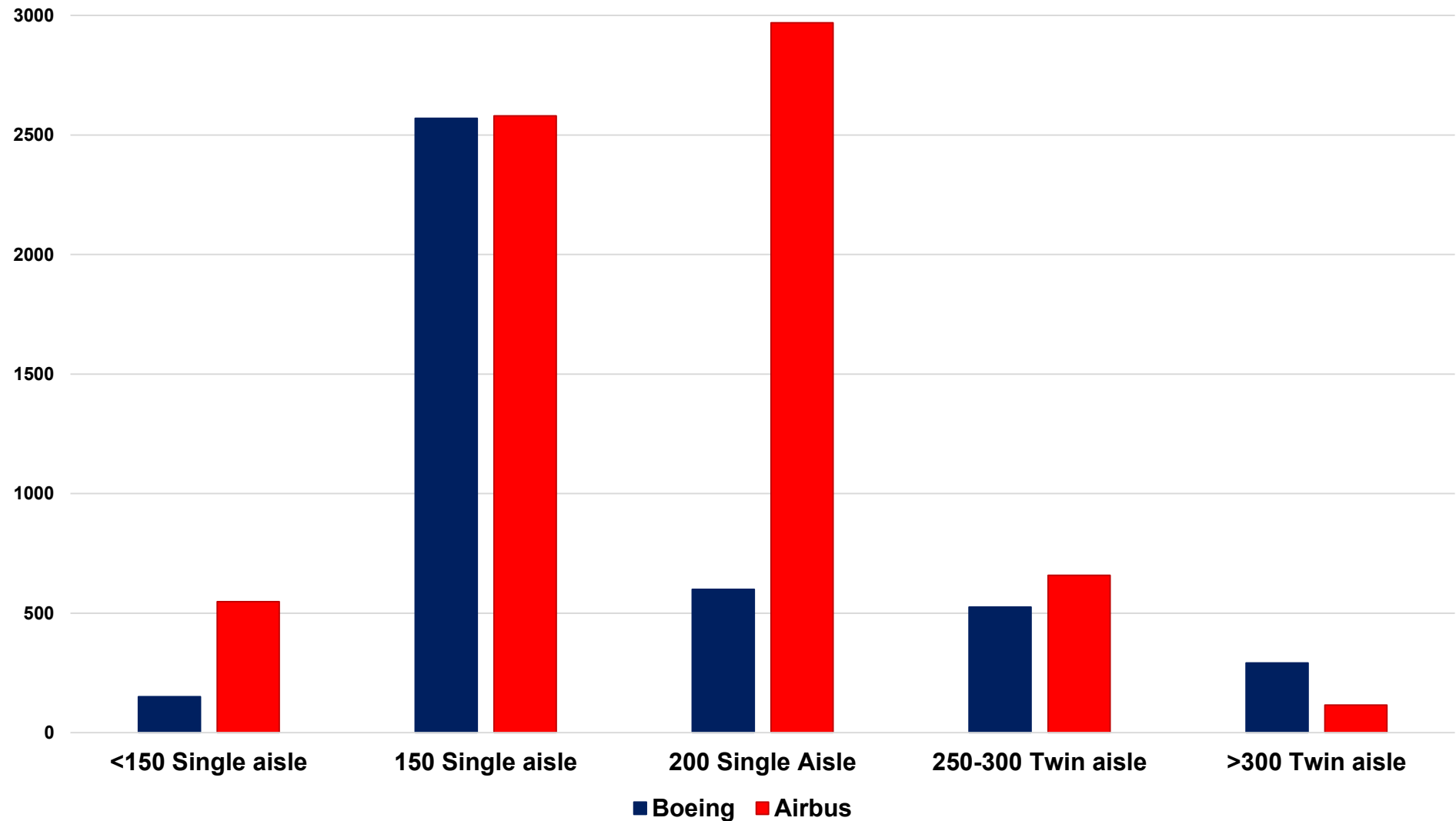
The number of widebodies available is unusual for three reasons. First, barring the economic problems in Asia, most of the world's airlines and the economies of most other major countries are holding up well, with yields at respectable levels and load factors at all time highs. Second, the number of narrowbody aircraft on the market is relatively stable, varying only 10 to 20 units month to month for the past several years. This is vastly different from the early 1990's when all types of aircraft were available in record numbers. Third, the number of brand new or new-generation airplanes on the market is significant. The number of new technology narrowbodies on the market have remained fairly constant but the number of newer model widebodies has risen from 16 in January 1998, to 60 in December. Further, the new widebodies offered for sale and leaseback is not reflected in the numbers on the left. Asian carriers have continued to take delivery of new equipment (much to the relief of Airbus and Boeing), but are using them to garner hard currency to fund on-going operations.

All of these factors will have an adverse affect on prices for all types of widebody equipment and on demand for older aircraft. Already there are reports of new B-747-400s selling for little more than \$100 million while the aircraft's list price ranges between \$156 and \$174 million. Pricing like this makes the newer widebodies an incredible bargain and virtually dooms older, less attractive equipment to the scrap heap. There is little demand for them from new entrants or freight companies. Dedicated cargo services have declined with the Asian economies and

Firm Order Backlog Values: Boeing Taking A Hit

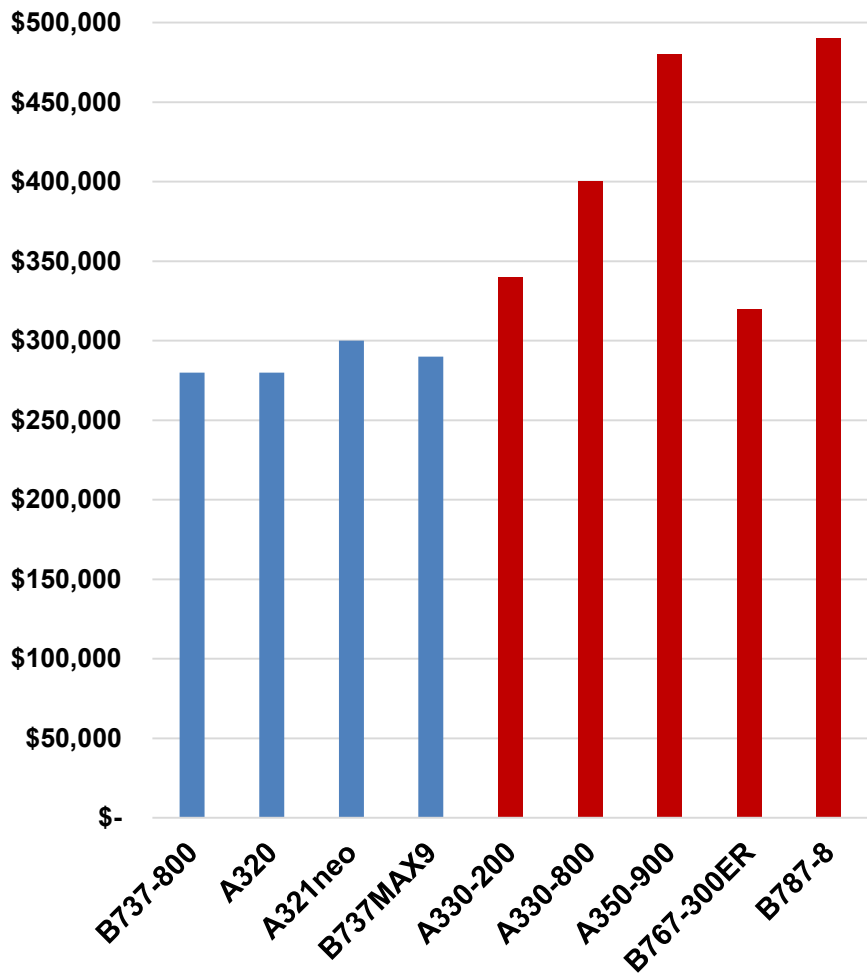


Airbus, Boeing Jetliner Backlogs (August, w/ ASC 606)

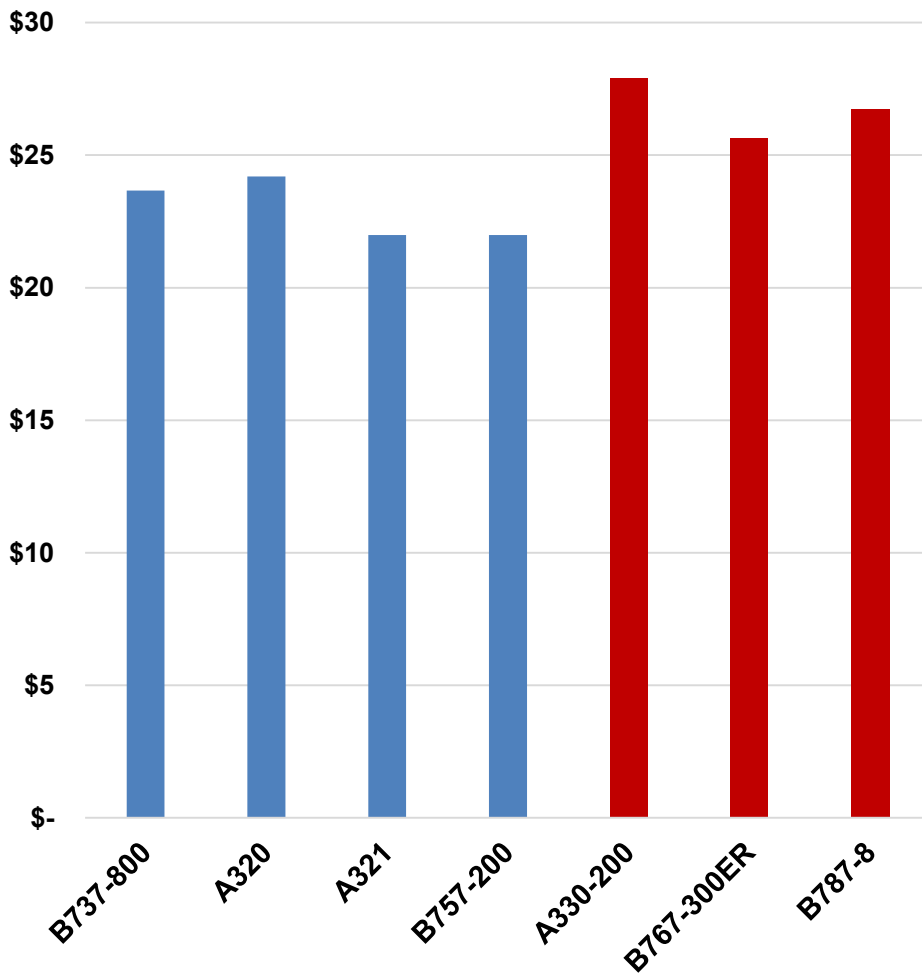


Disconnect Between Single and Twin Aisle Economics; Explains 757/767

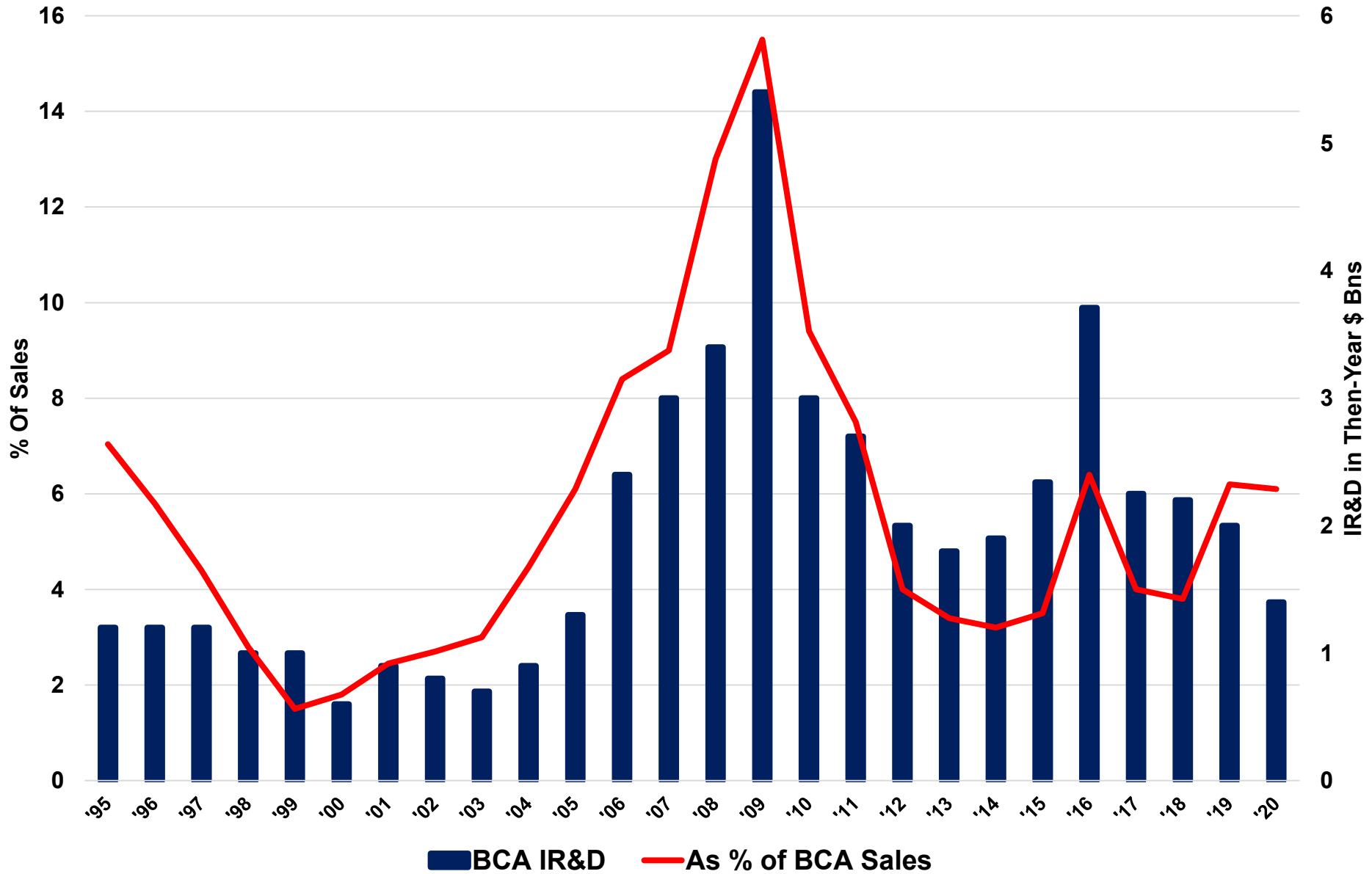
Realized Price/Seat



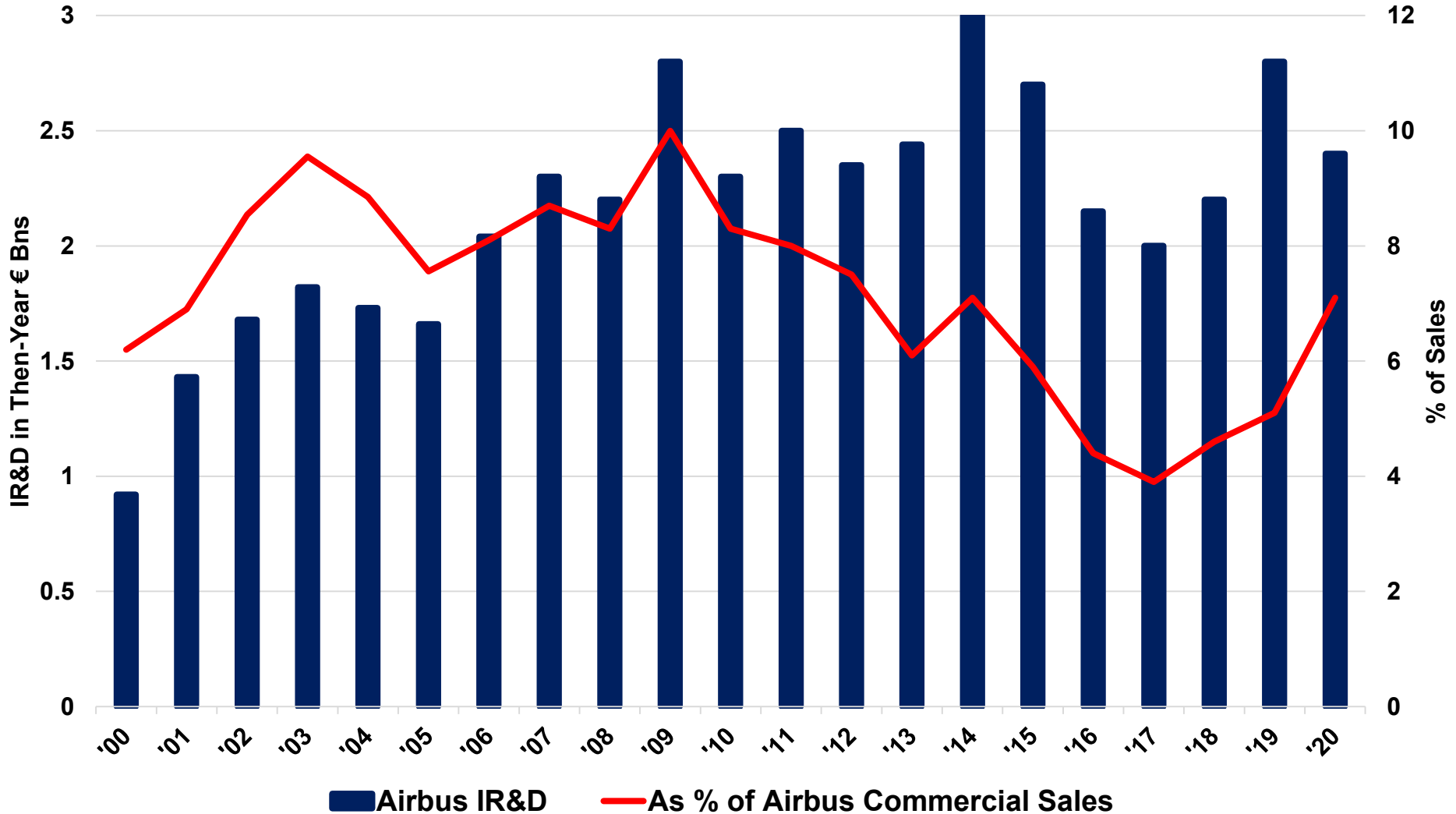
Block Hour Cost Per Seat



Boeing Commercial IR&D: Under Pressure Again

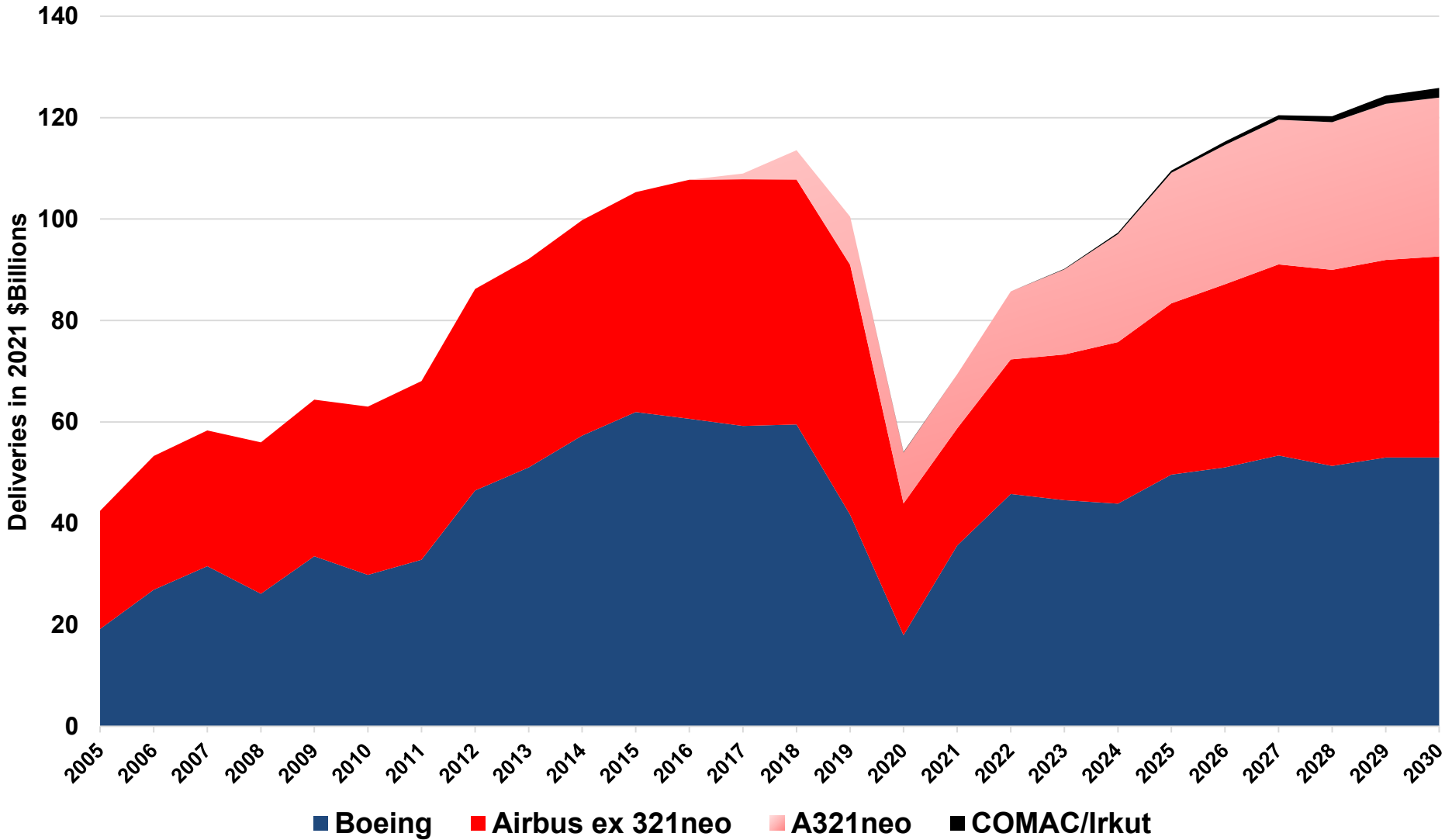


Airbus Commercial IR&D: More Spend, Less Discipline...Until 2015 And Where Is It Going Now?



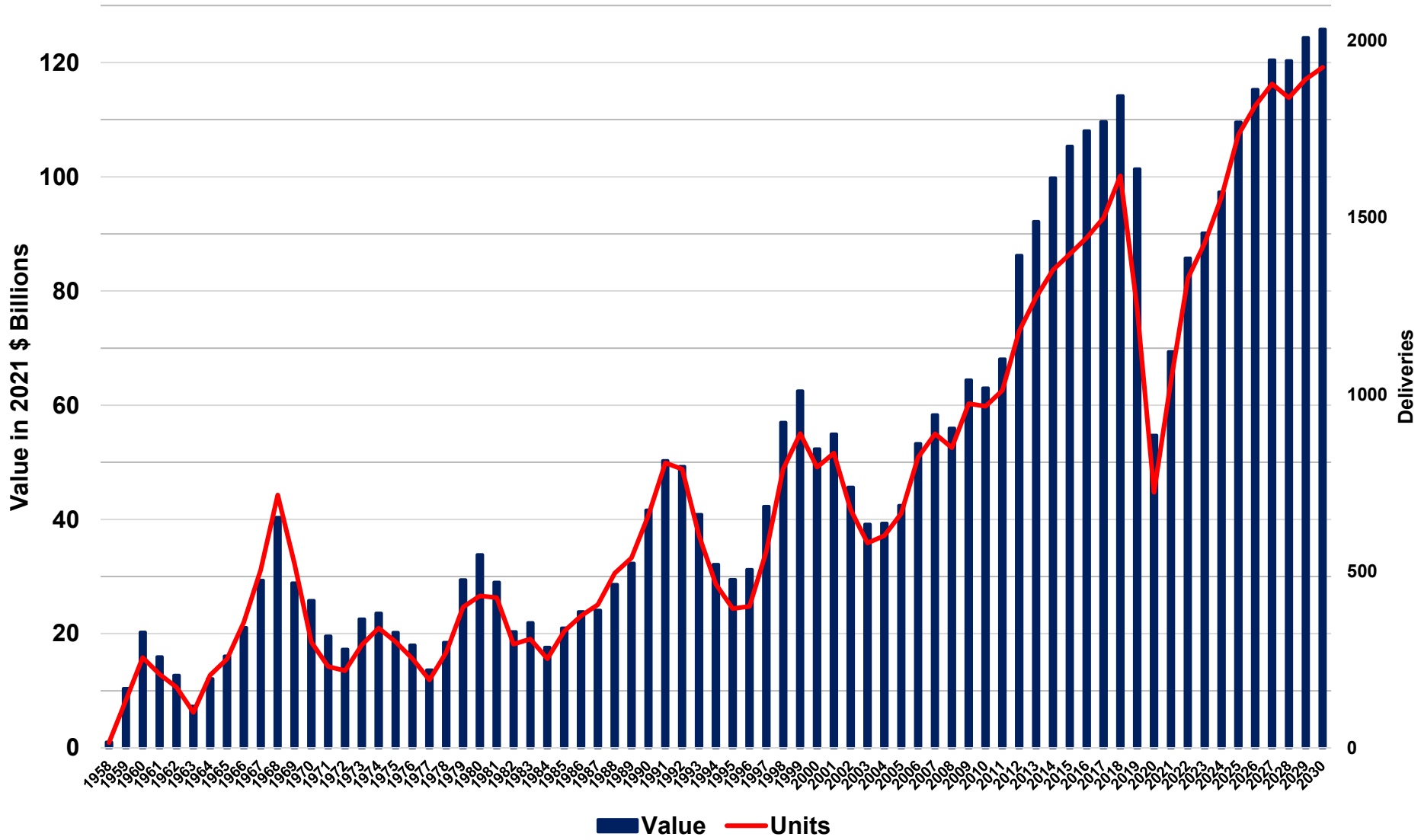
Jetliner Market Shares By Deliveries

Airbus Seizes The Middle Market and First Place; Covid-19 Accelerates shift to Middle Market



We'll Get Back To The Road We Were On

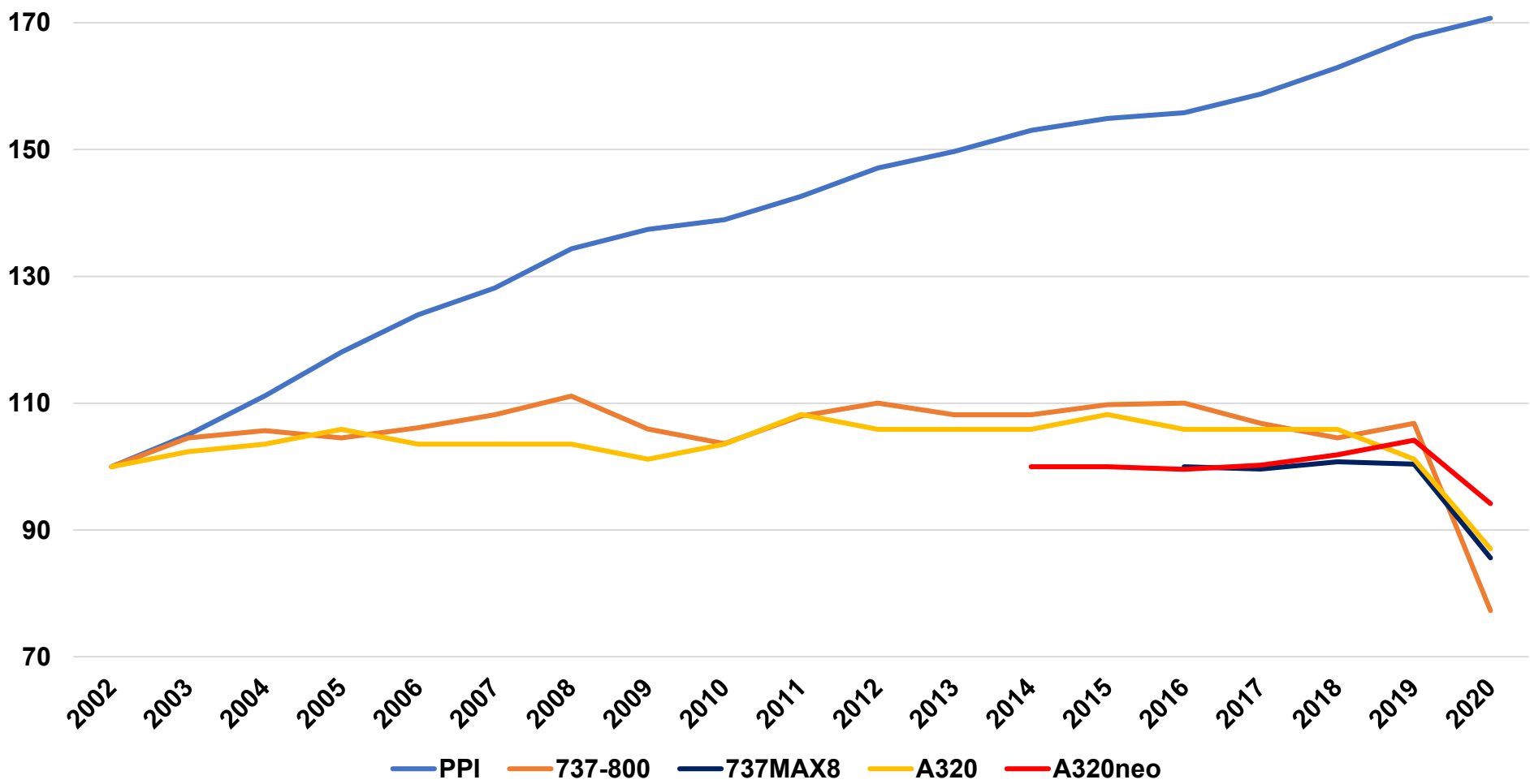
(as long as we're talking single aisles)



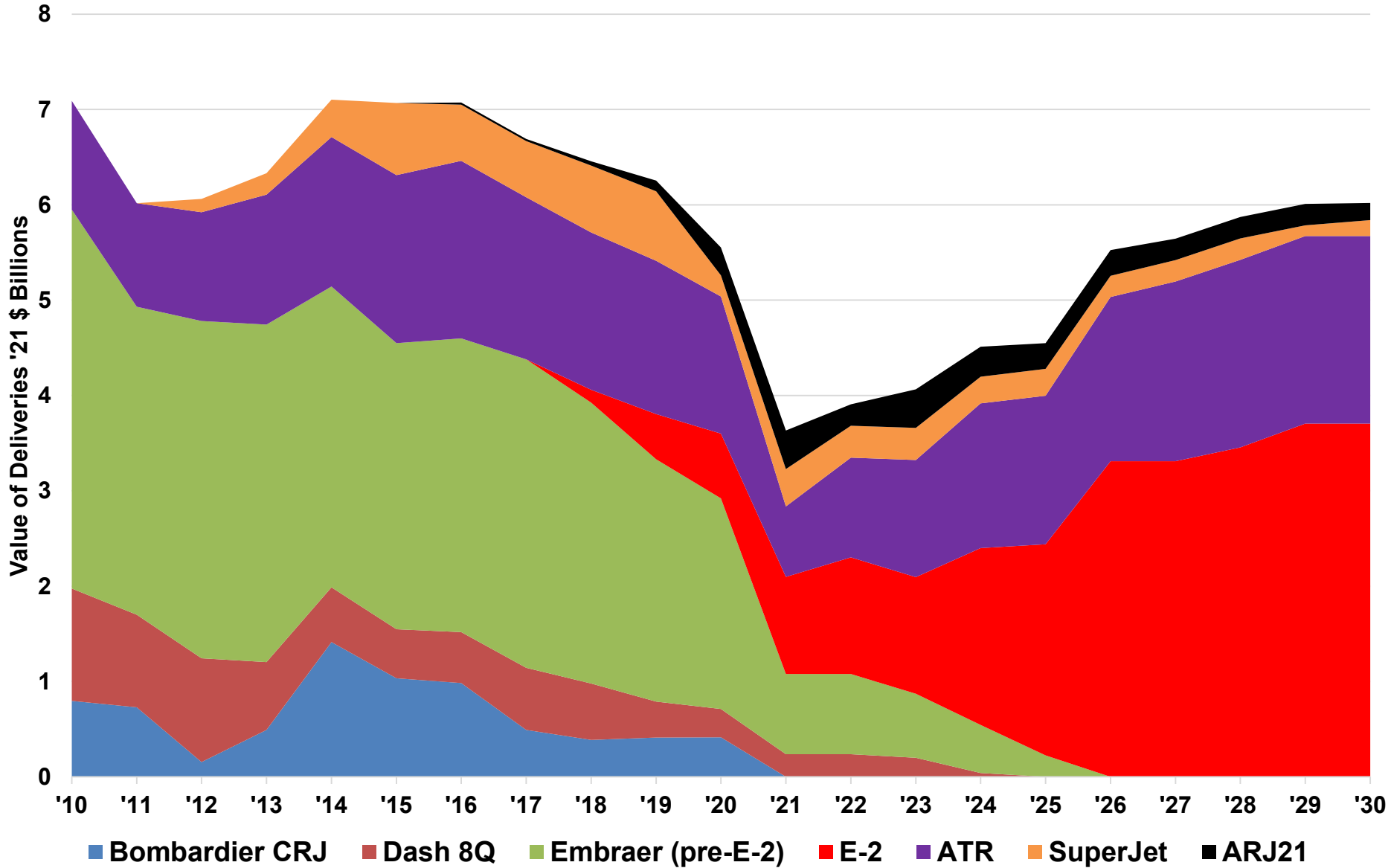
Realized Prices Versus Production Costs

PPI For Aircraft Manufacturing per FRED (Value Source: Airline Monitor); 2002 baseline = 100 (baseline 2014 Neo and 2016 MAX)

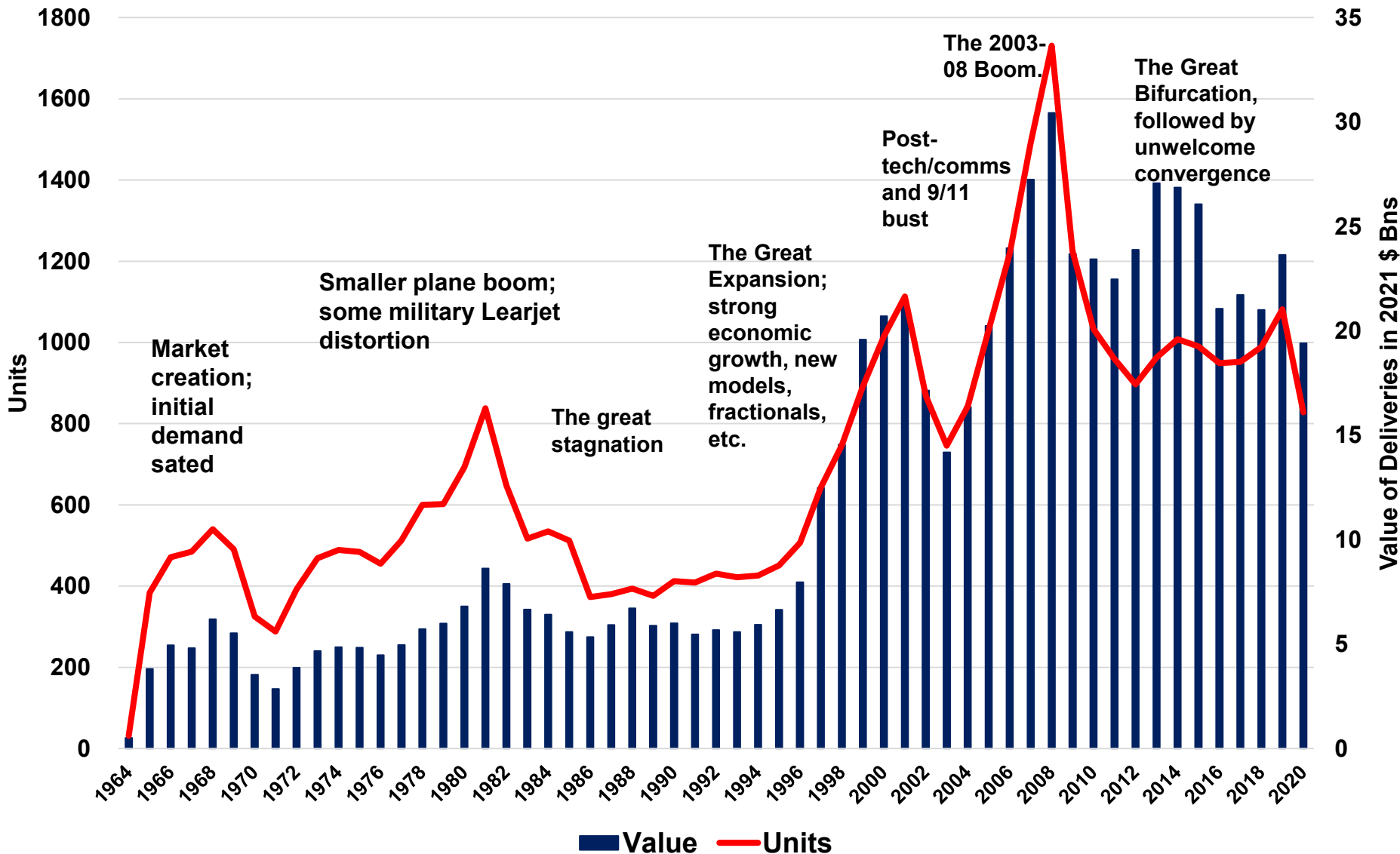
High Defense Spending Greatly Complicates This Picture...



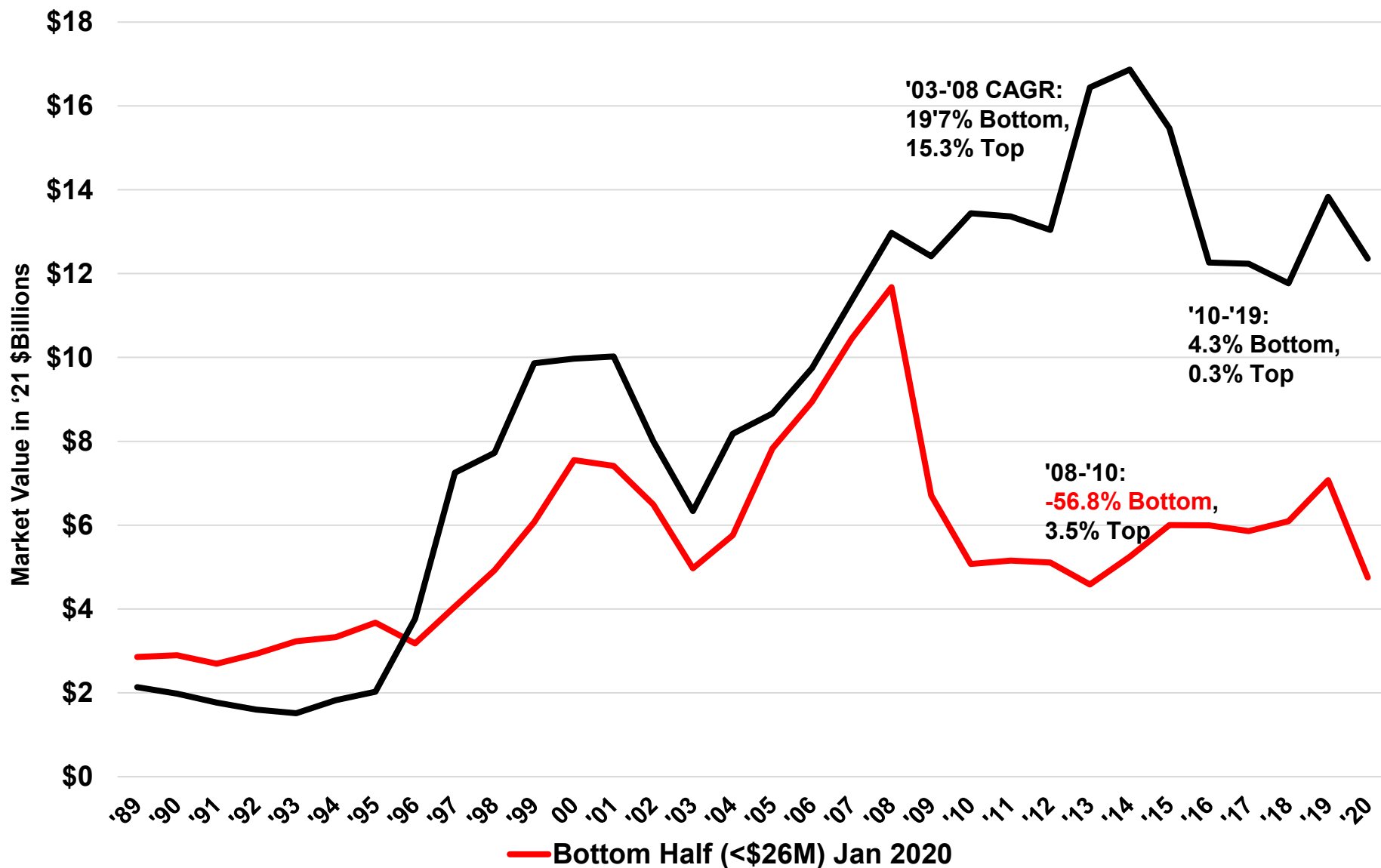
Regional Deliveries By OEM (Value)



Business Aircraft Market History (w/jetliners, RJs, turboprops)



Bottom Half Bizjet Segment vs. Top Half



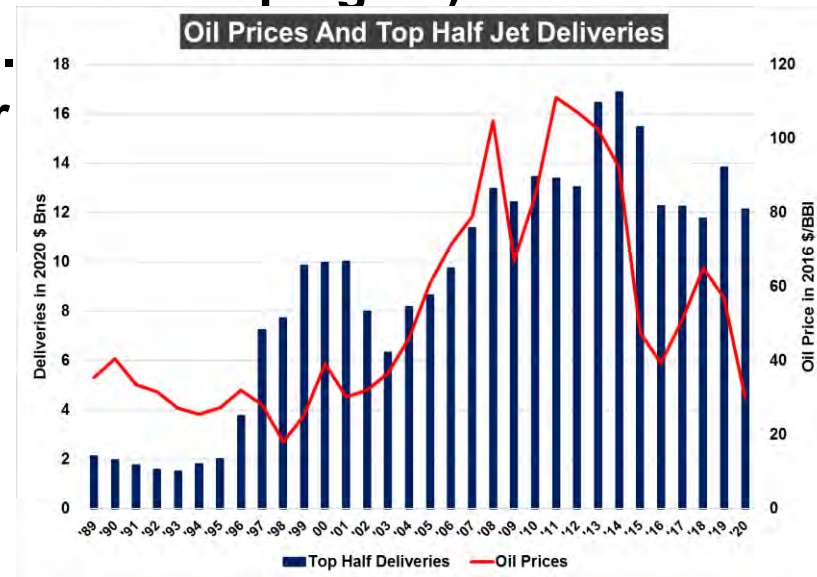
Eight Contradictory Bizav Indicators

- **Three Leading Market Indicators:**

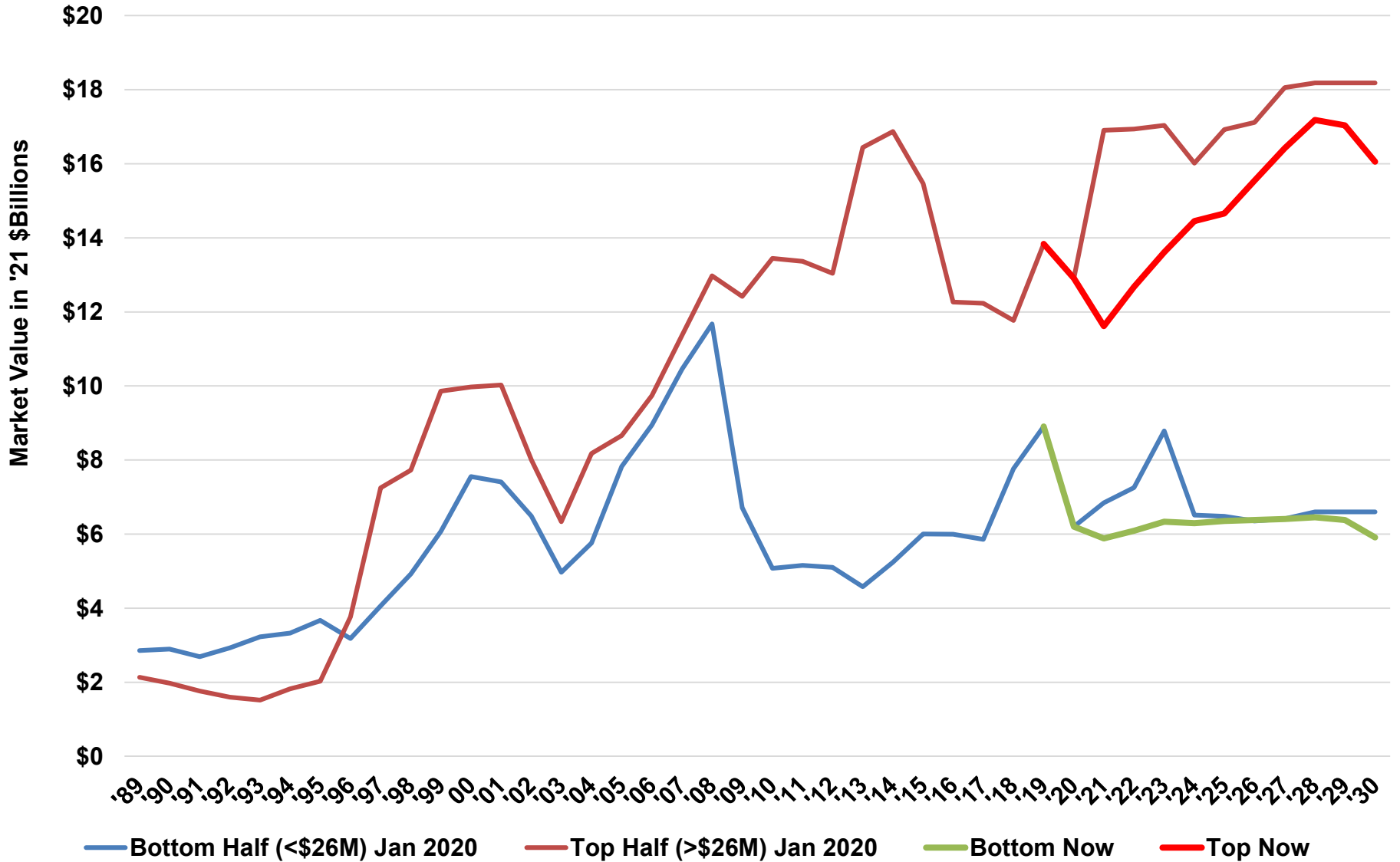
- Corporate profits (sharply down, but back up again).
- Equities markets (good/excellent).
- Oil prices (from very bad to rather good).

- **Five Immediate Market Health Indicators:**

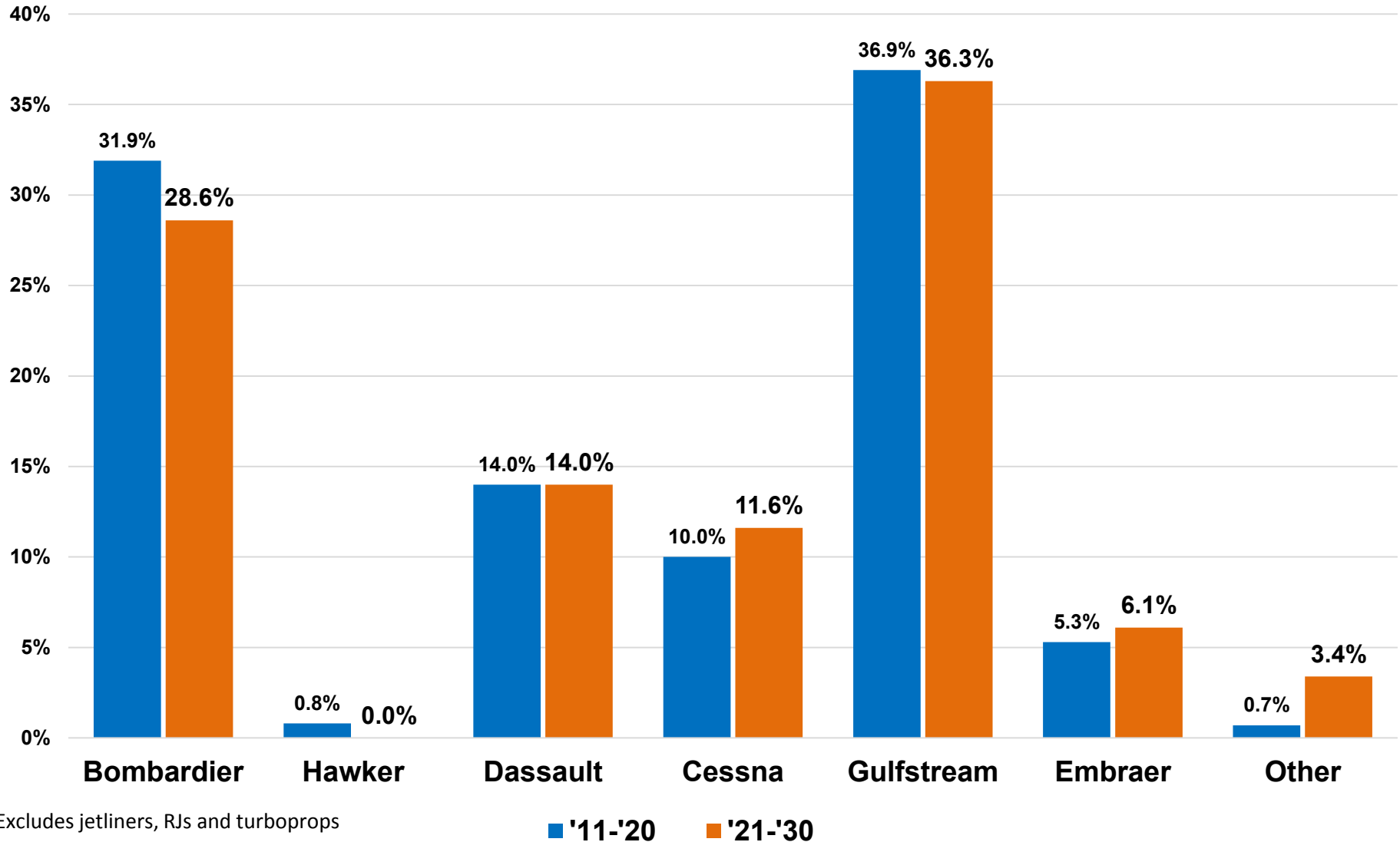
- Deliveries (bad, but looking up)
- Aircraft available for sale (just modestly up...very good news... and now tightening again).
- Aircraft prices (down somewhat, but nicely up in May).
- Company layoffs (GD, BBD, TXT...seem to have ended).
- Utilization (down, but recovering much faster than airline travel, with charter and fractionals looking great).



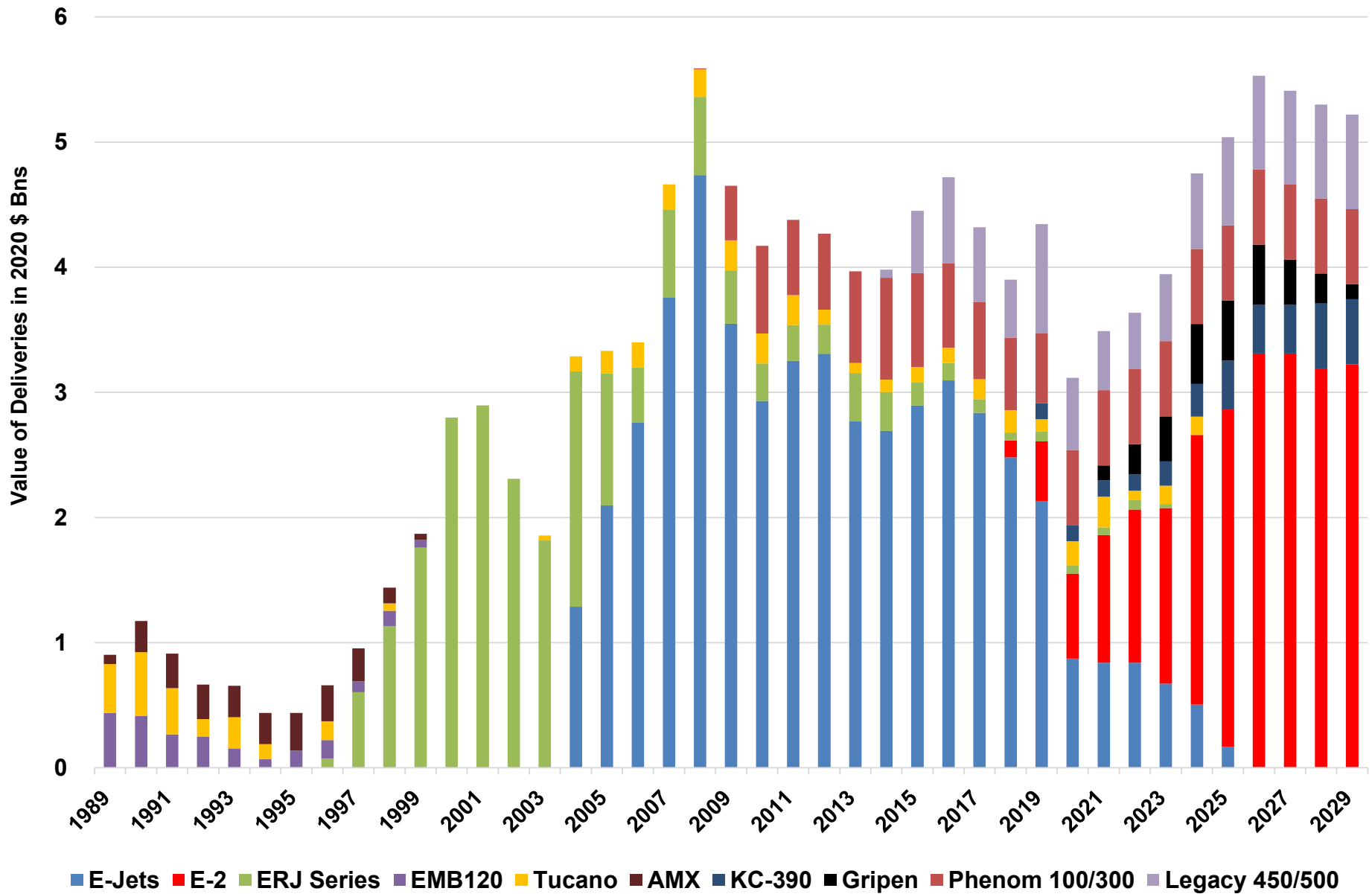
Bottom Half Bizjet Segment vs. Top Half



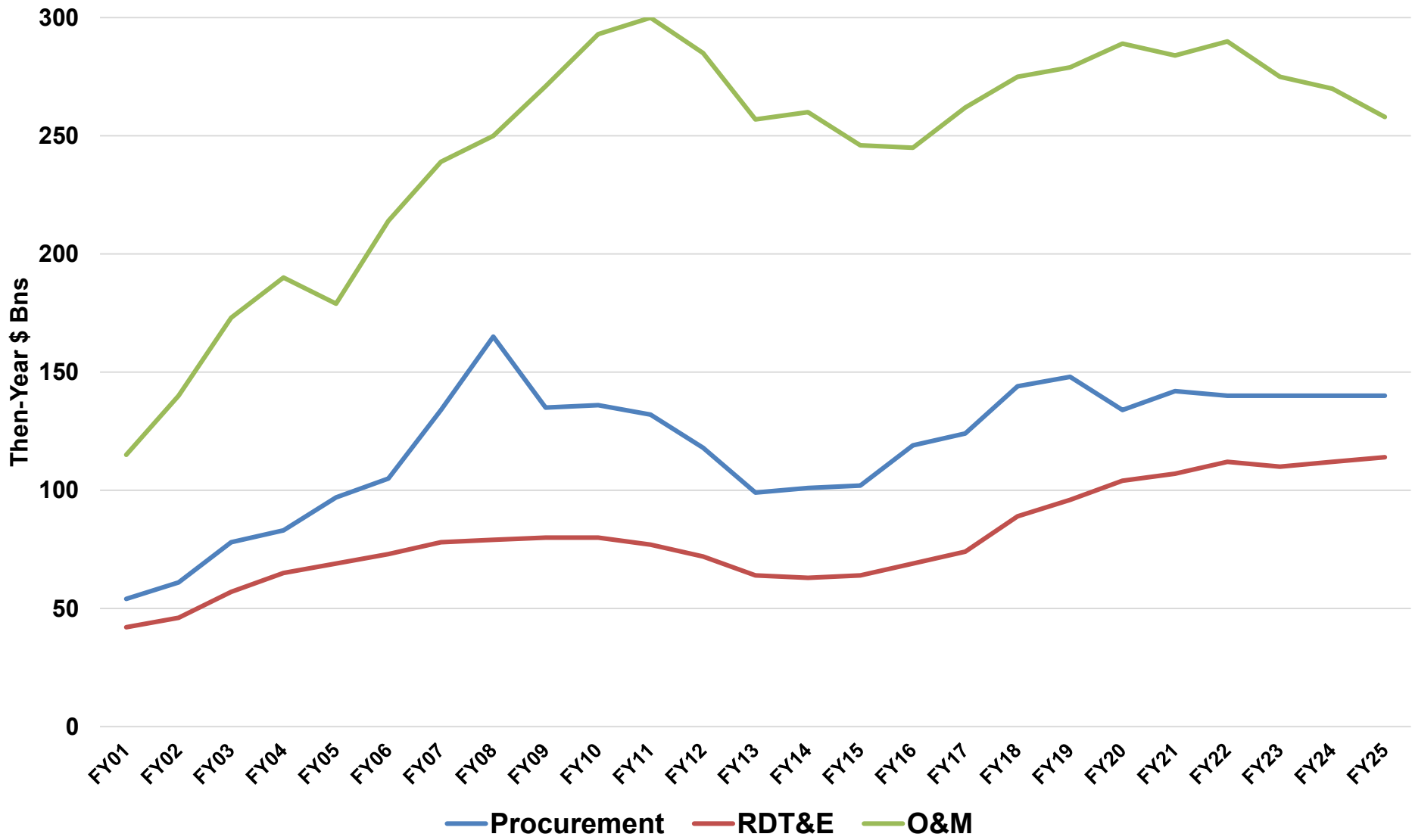
Business Jet Manufacturer Market Shares By Deliveries Value, 2011-2020 vs. 2021-2030



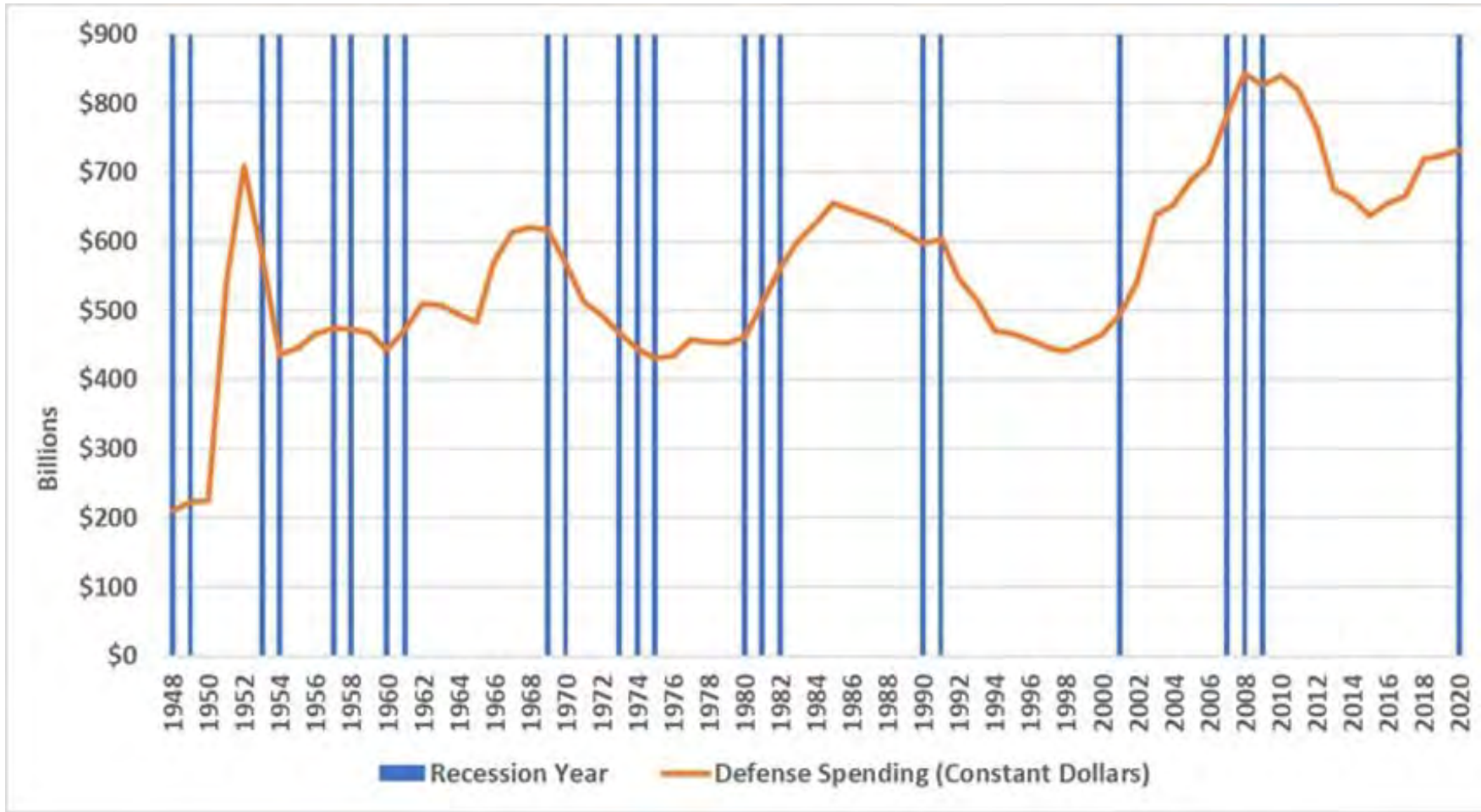
Embraer: Searching For Growth After The E-Jet Revolution



DoD Investment: Much Better Than In The Last Jetliner Downturn

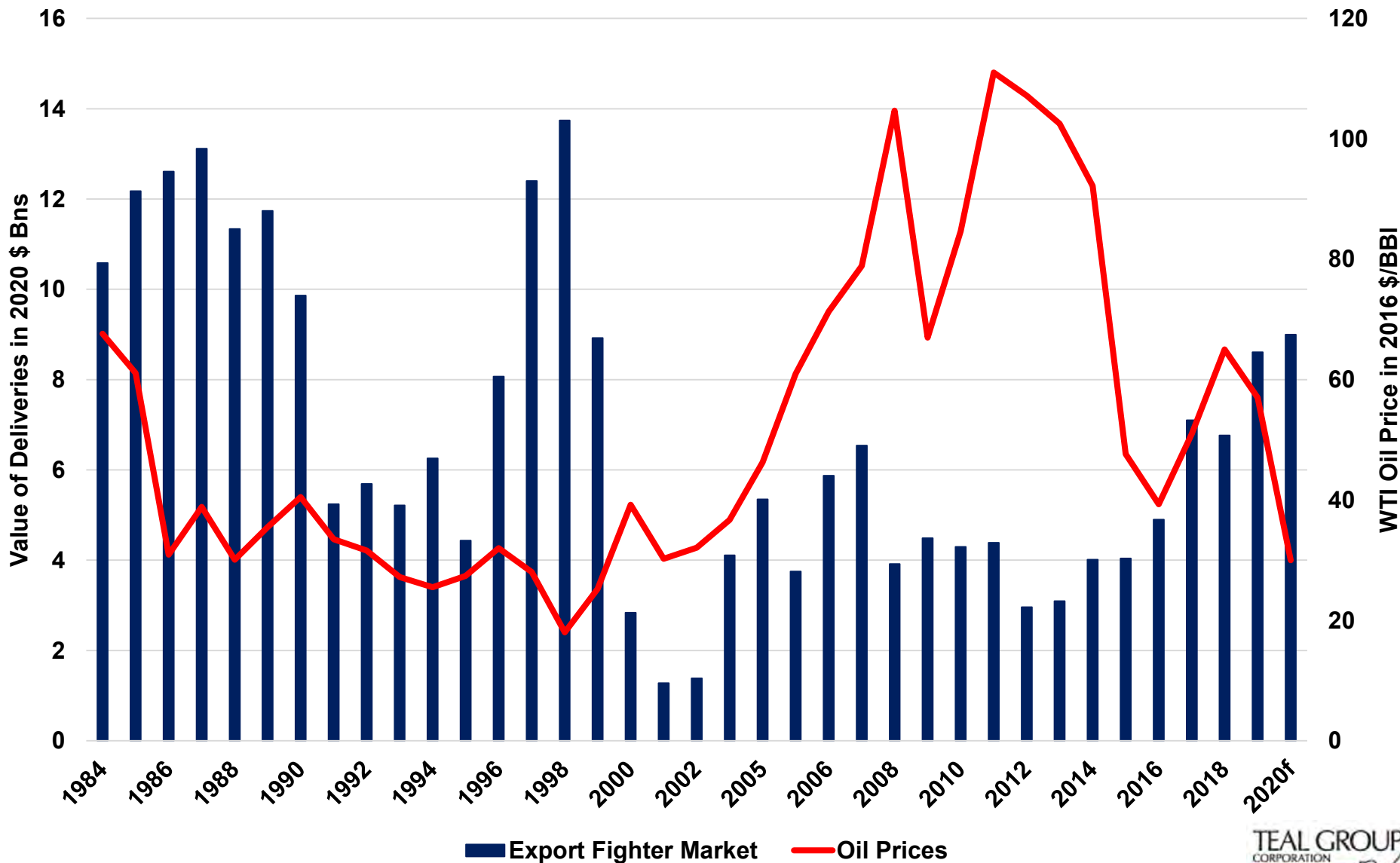


No Clear Relationship Between US Defense Spending, Economy

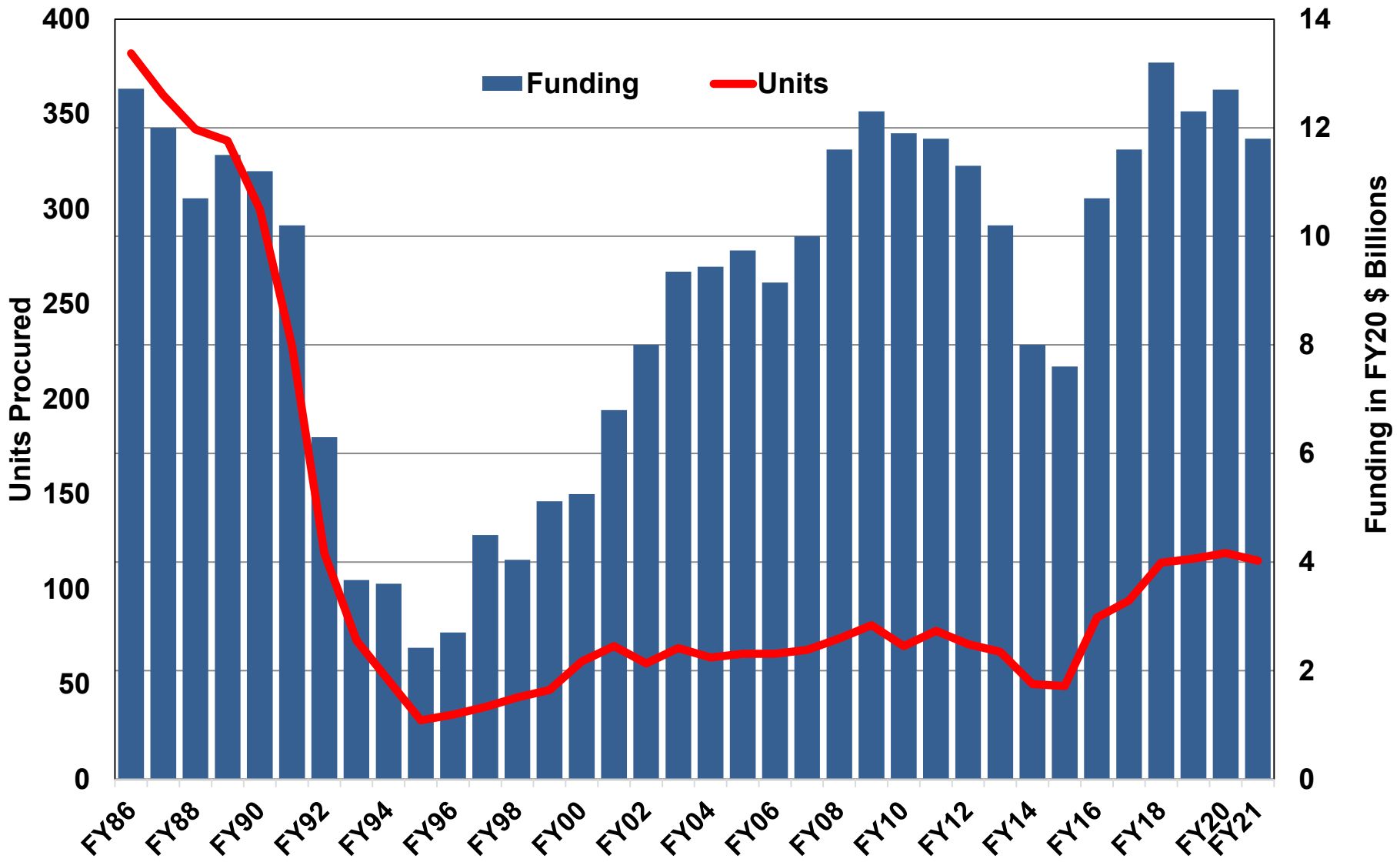


Also No Clear Relationship Between Export Markets, Resource Prices

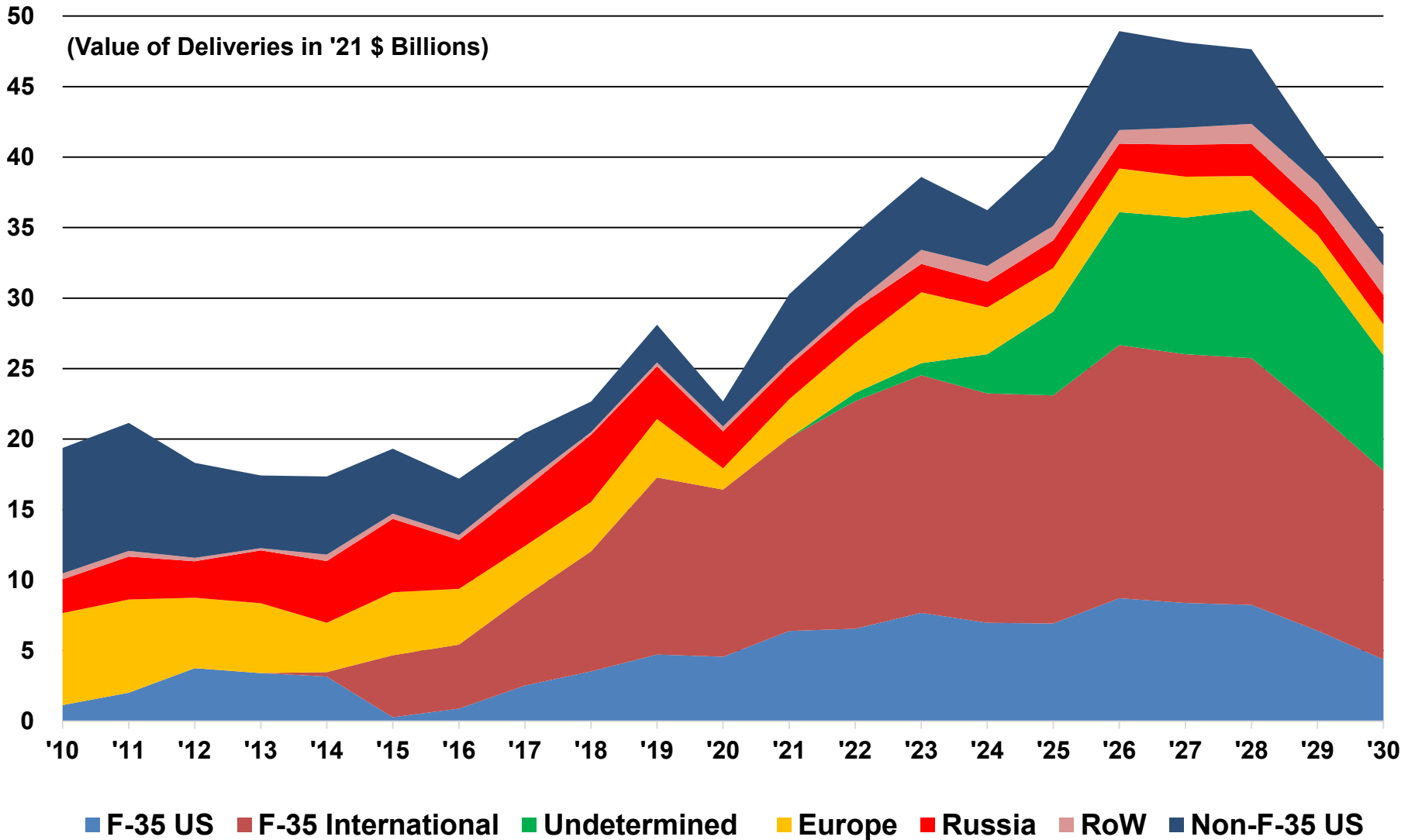
(Or any other economic indicator)



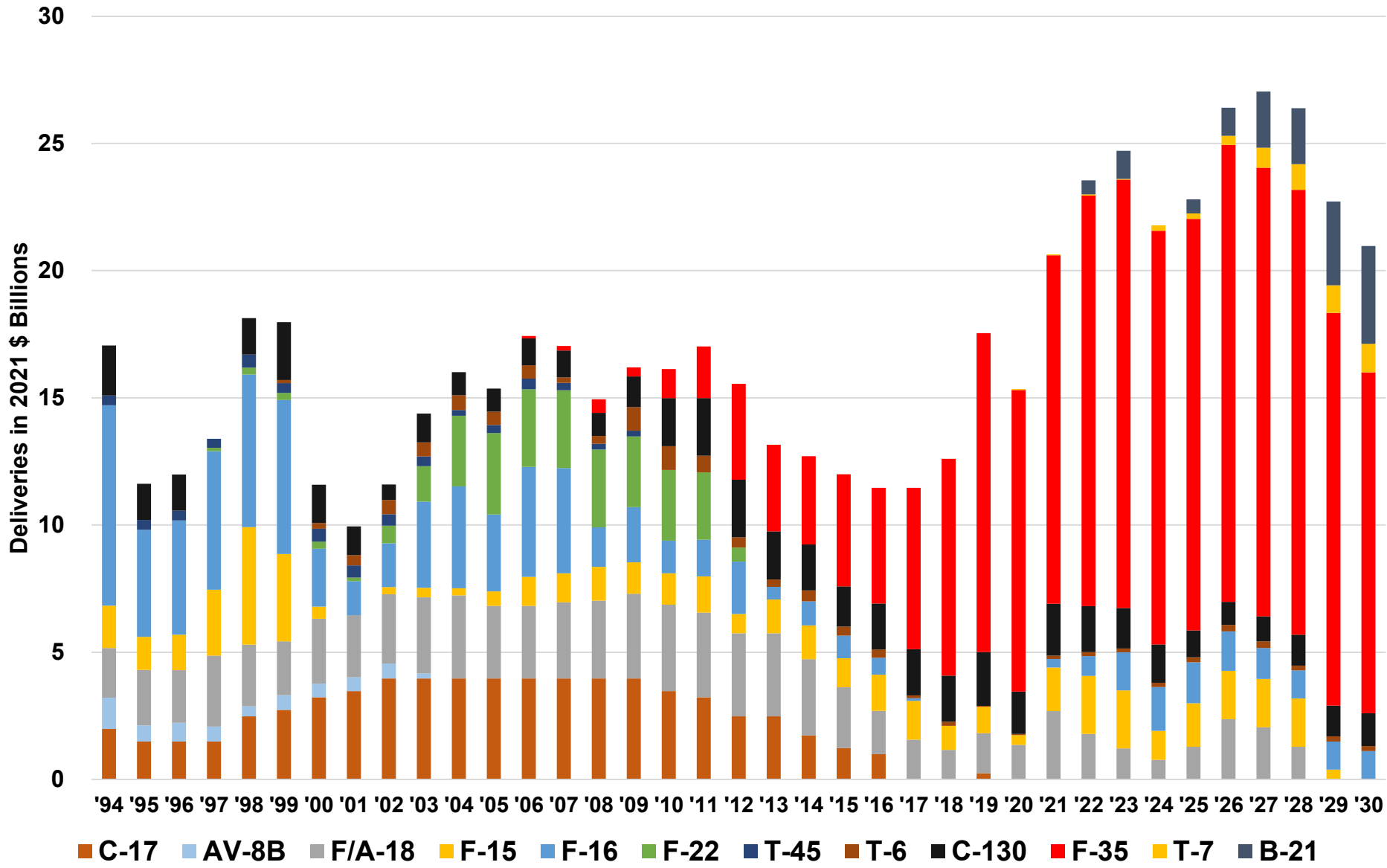
DoD Tactical Aircraft Procurement



World Fighter Production Shares

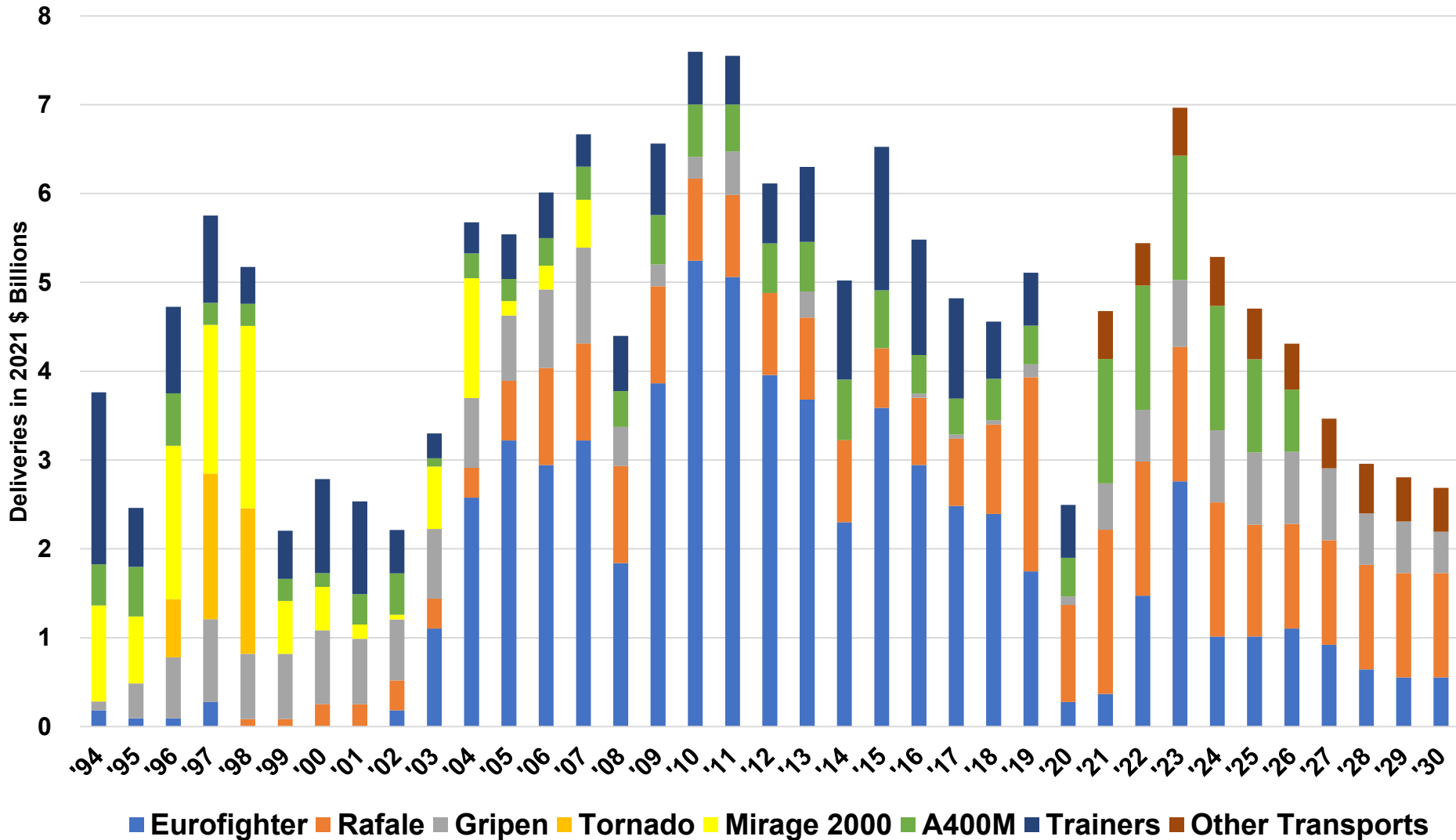


US Military Fixed Wing Aircraft Deliveries



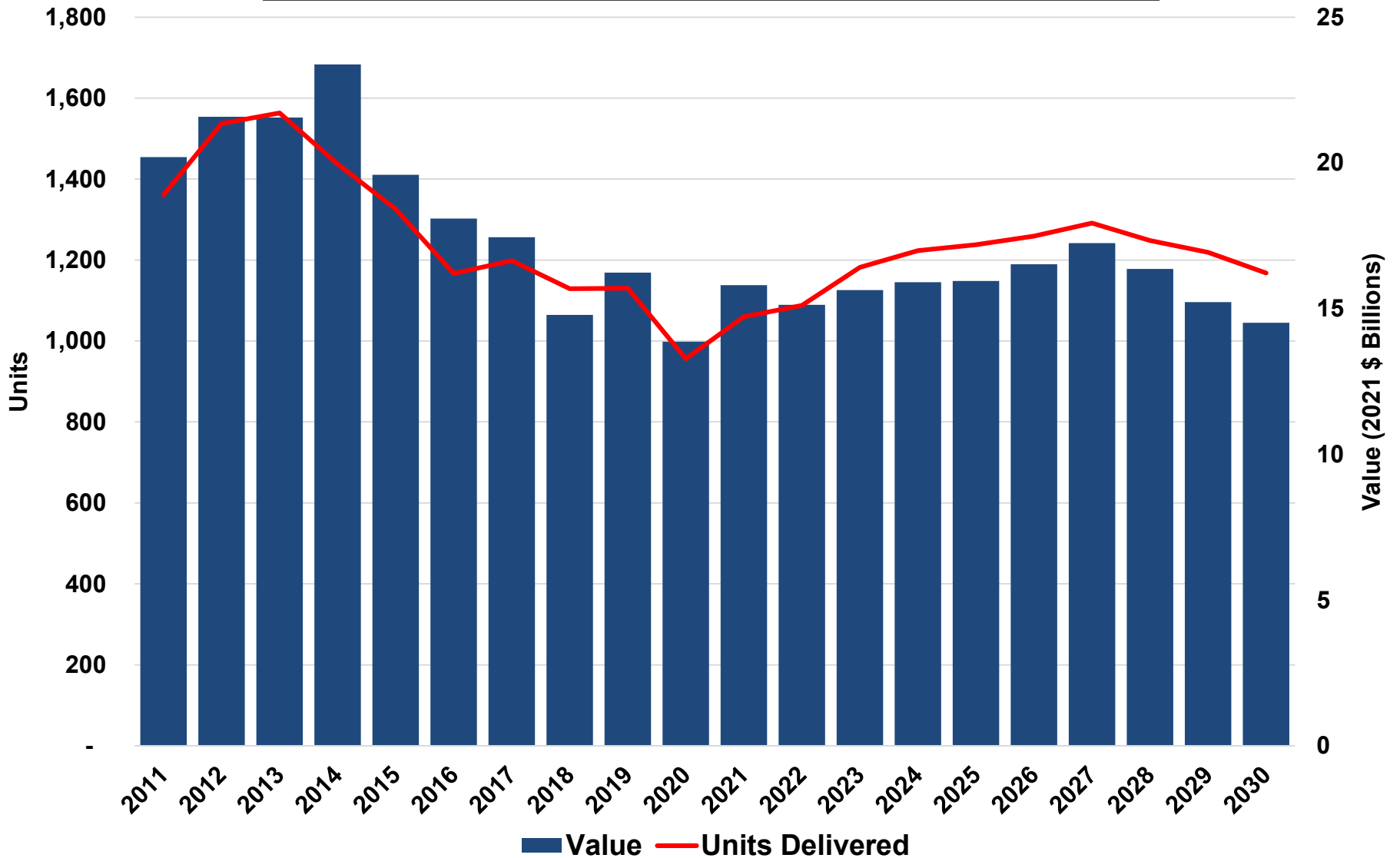
European Military Aircraft Deliveries

Coping Without F-35...To A Point;
Germany, France, UK Fighter Decisions Loom

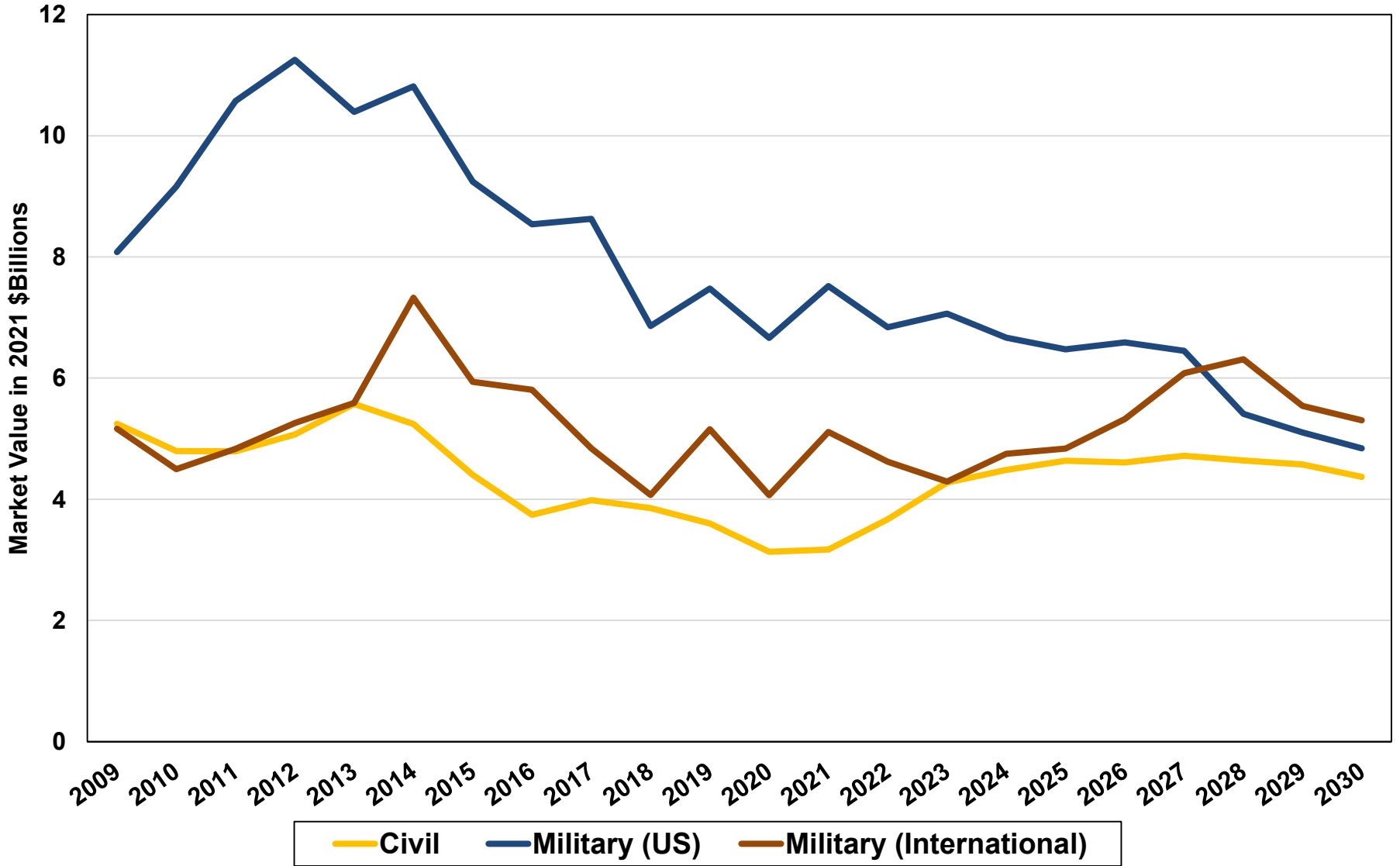


The World Rotorcraft Market

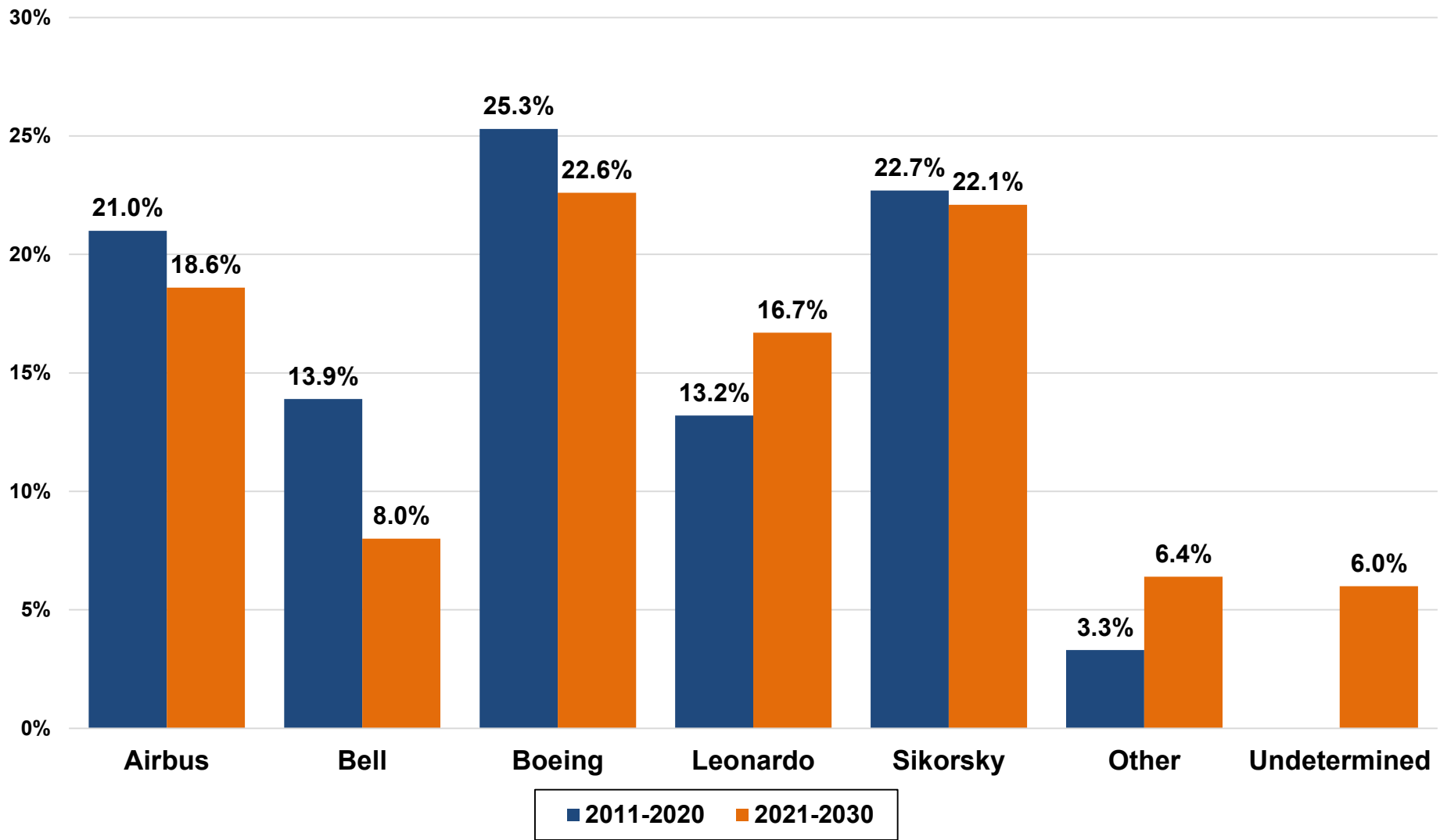
The Age of Diminished Expectations



US Military Rotorcraft Market Falling; International Military and Civil Stable



Rotorcraft Manufacturer Market Shares 2021-2030 vs 2011-2020



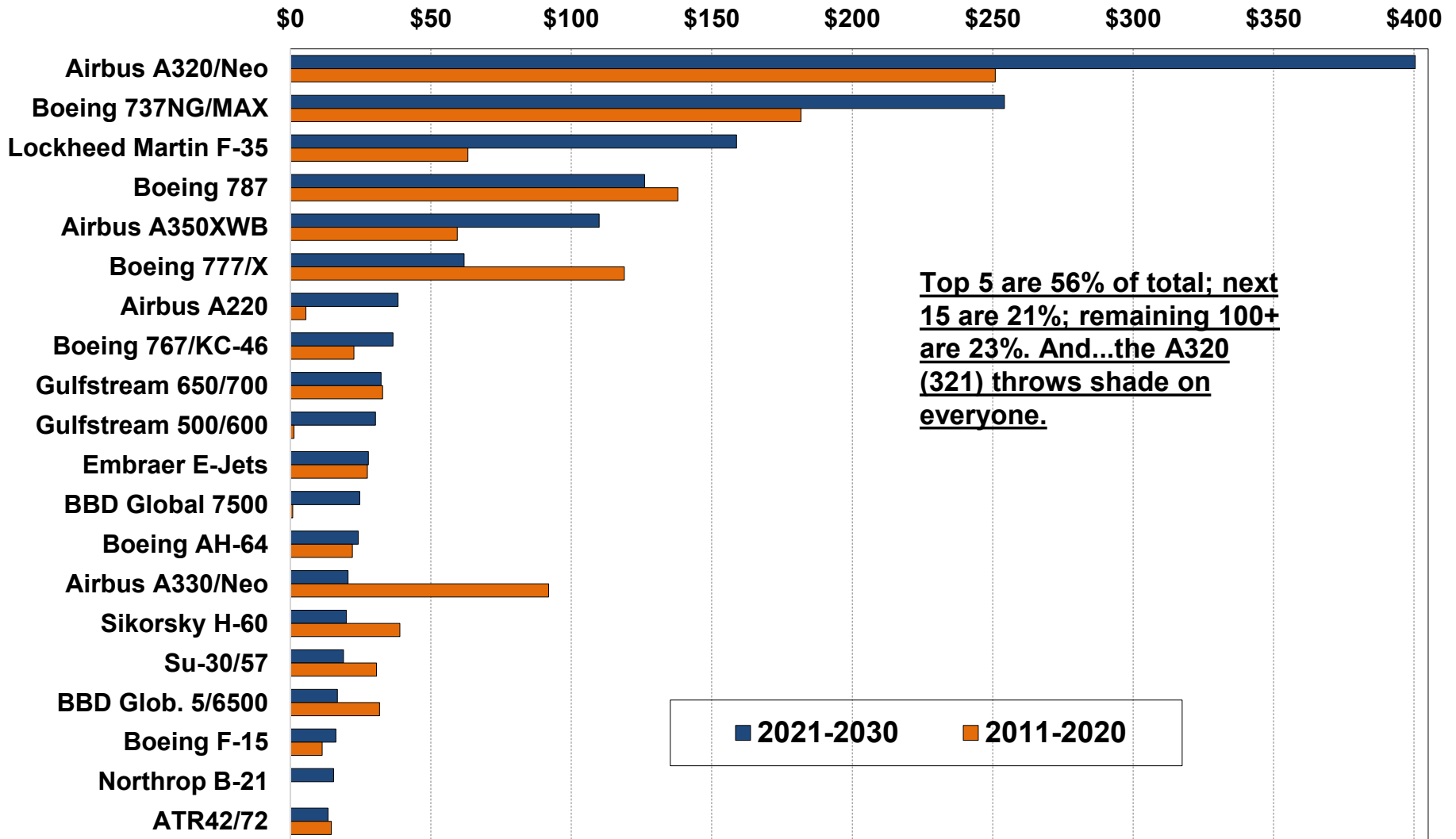
Global Aircraft Market Outlook In One Page

(Deliveries, *not* Production)

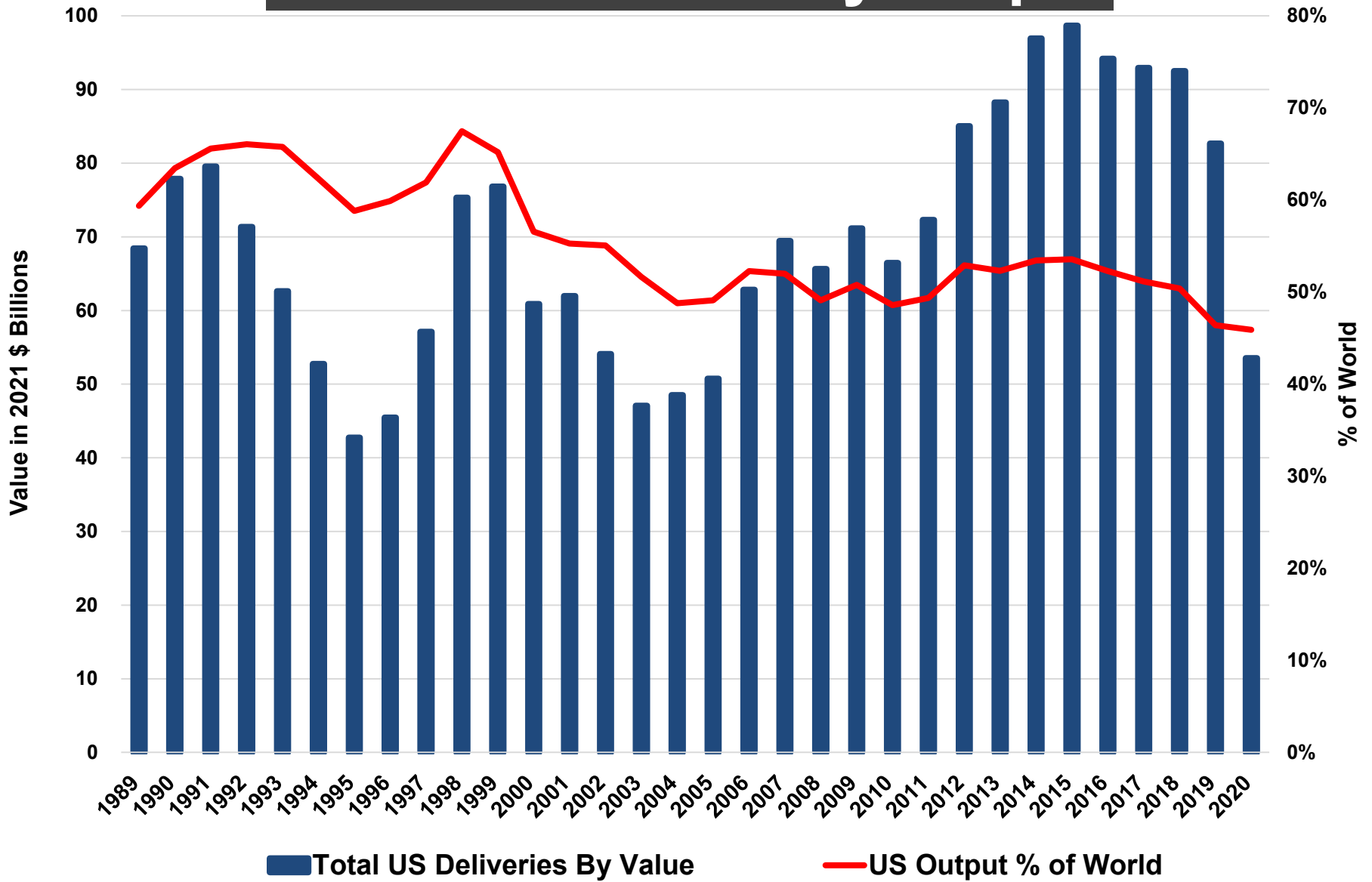
<u>Segment</u>	<u>2021</u>	<u>'21-'22</u>	<u>Risk</u>	<u>Elevator Comment</u>
Jetliners-SA	56.4%	31.5%		Includes some already-built MAXs. Watch China, fuel, traffic.
Jetliners-TA	-1.8%	11.5%		Overcapacity, slow international recovery, secular shift to SAs; 787 inventory issue
Regionals	-0.3%	10.9%		No Boeing supply chain effect on E-2; Scope clause de-risked, but little growth.
Business Aircraft	-6.7%	8.0%		Another hit after many false starts over a disappointing decade.
Civil Rotorcraft	0.1%	12.9%		Large civil hit again. Too many new models aimed at a weak segment (oil/gas).
Military Rotorcraft	1.5%	3.0%		Programs end/slow; no risk of accelerated downturn; FVL beyond forecast, exc FARA.
Military Transports	-2.8%	-1.4%		A seriously underperforming market.
Fighters	29.2%	12.6%		I like this market. F-35 (after COVID disruption), plus strong Gen 4.5
<u>All Civil</u>	<u>16.4%</u>	<u>19.7%</u>		SAJetliner snapback due to MAX, weakness in other segments; more overcapacity risk.
<u>All Military</u>	<u>14.9%</u>	<u>8.4%</u>		Global insecurity, Tension, Malice. Special mission (ISR, B-21) also boosts topline.
<u>Total Industry</u>	<u>15.9%</u>	<u>16.2%</u>		<u>Back to peak in 2024</u>

Top 20 Aviation Programs; Volume Matters

Cumulative Deliveries Value in '21 \$ Bns



US Aircraft Industry Output



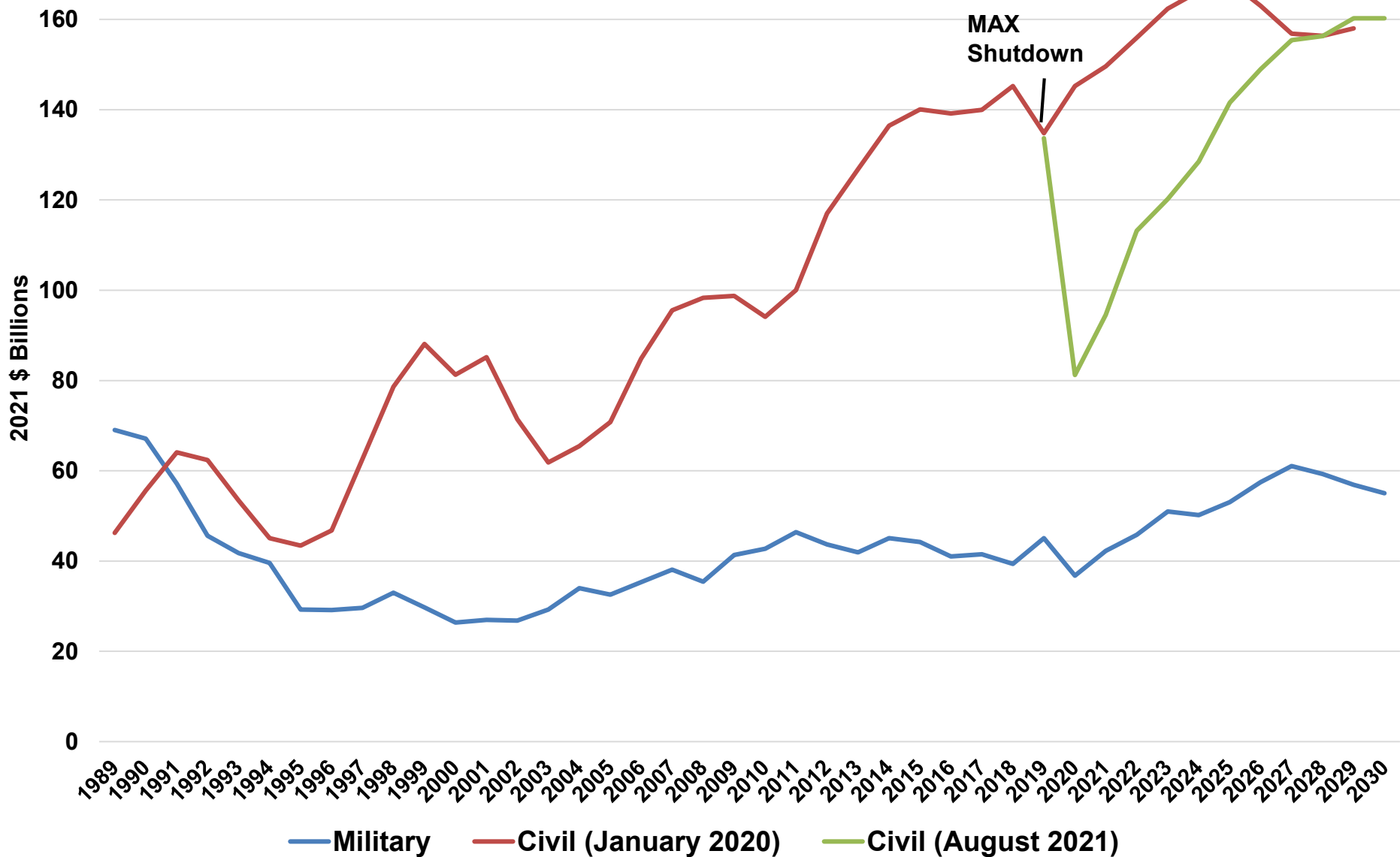
Covid-19 Impact: Not Much New; Just An Acceleration of Pre-existing Trends

- **Societal:** growing inequality, growth of e-commerce over stores, movie theaters decline, normalization of formerly fringe beliefs, rising illiberal democracies.
- **Macroeconomic:** lower interest rates, excess savings, few investment opportunities, cheaper fuel, China de-coupling.
- **Industry:**
 - More point-to-point international routes (fragmentation); related demand for smaller, mid-range jets.
 - End of quadjets, marginalization of all larger jets.
 - Growing reliance on third party jetliner finance.
 - Jetliner price deflation.
 - Supplier rationalization, particularly 3/4th tier.
 - New product funding drought.
 - China indigenous substitute product development
 - Boeing single aisle breadth concerns; Airbus mid-market dominance.
 - Rolls-Royce under pressure.
 - OEMs and airlines: strong get stronger, weak get weaker.
 - Uncertain search for various alternative propulsion/fuel concepts.
- **K-patterns everywhere:** Domestic/int'l traffic, single aisles/twins, developed/emerging, bizav/scheduled, etc.

Concluding Observations, and A Few Consolations

- **Civil aviation might get worse, depending on the Delta variant.**
 - *But, if not...a very steep decline will lead to record growth numbers in the recovery, with attendant exuberance.*
- **Boeing faces a very serious mid market challenge.**
- **For companies, all about the work portfolio.**
- **Defense companies can grow their civil side. Will they?**
- **High defense spending may complicate the civil recovery.**
- ***There is some good news:***
 - *An airline paradise, except for the traffic (and, perhaps, fuel).*
 - *Jet costs, Crew costs, interest rates, government support (for most, and for now); Stimulate traffic, or restore profit?*
 - *Defense: budgets, export demand, industrial support.*
 - *Less business jet frothiness.*
 - *Financial sector stronger this time (“2008 was worse; you couldn’t print money.”). Good for jetliners and for suppliers.*
- **A relatively isolated (severe) jetliner-only downturn is our baseline.**

World Aircraft Deliveries By Value, 1989-2030



Divergent Delivery Recovery Paths

Twin Aisles Are A Long-Term Concern

