



# ***Demand, Recurring Costs, And Profitability***

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**"So it is said that if you know your enemies and know yourself, you can win a hundred battles without a single loss. If you only know yourself, but not your opponent, you may win or may lose. If you know neither yourself nor your enemy, you will always endanger yourself."**

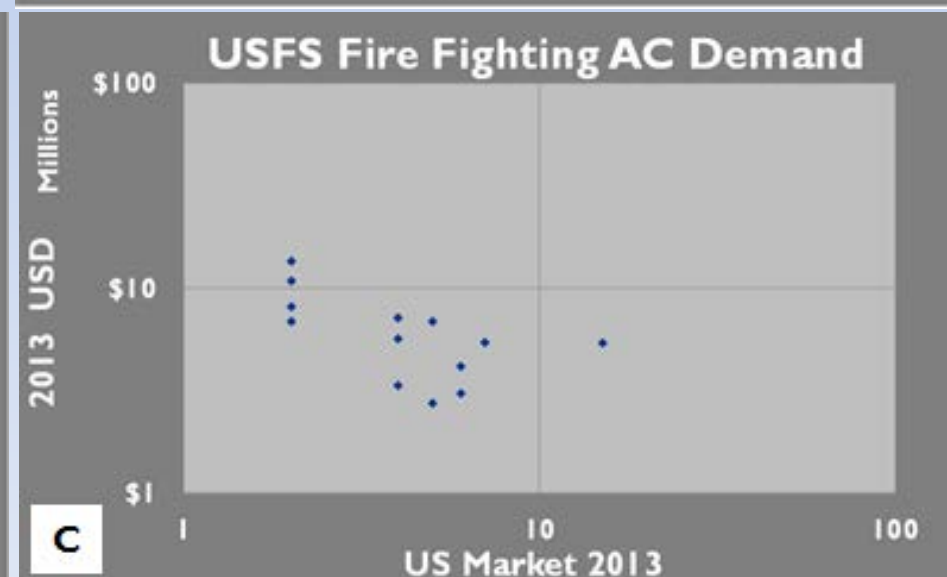
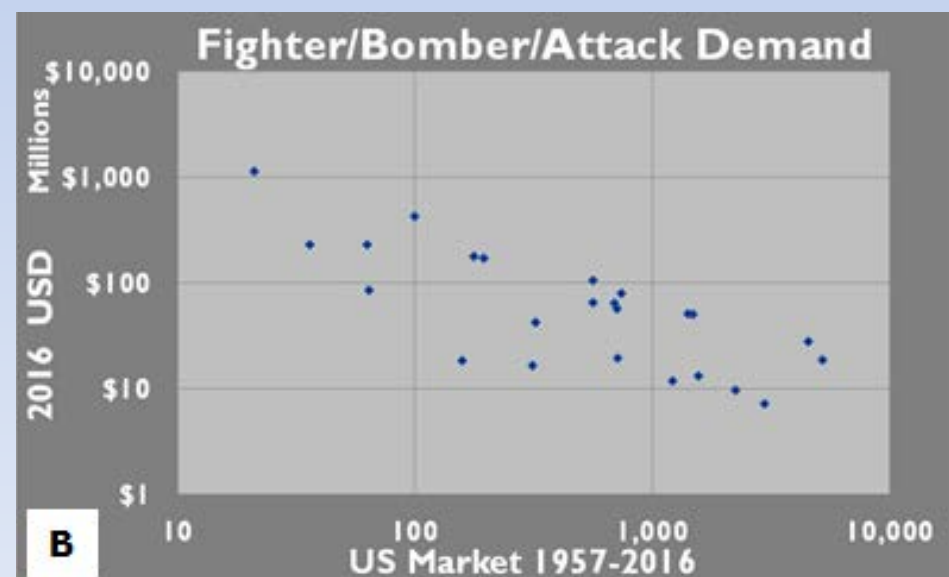
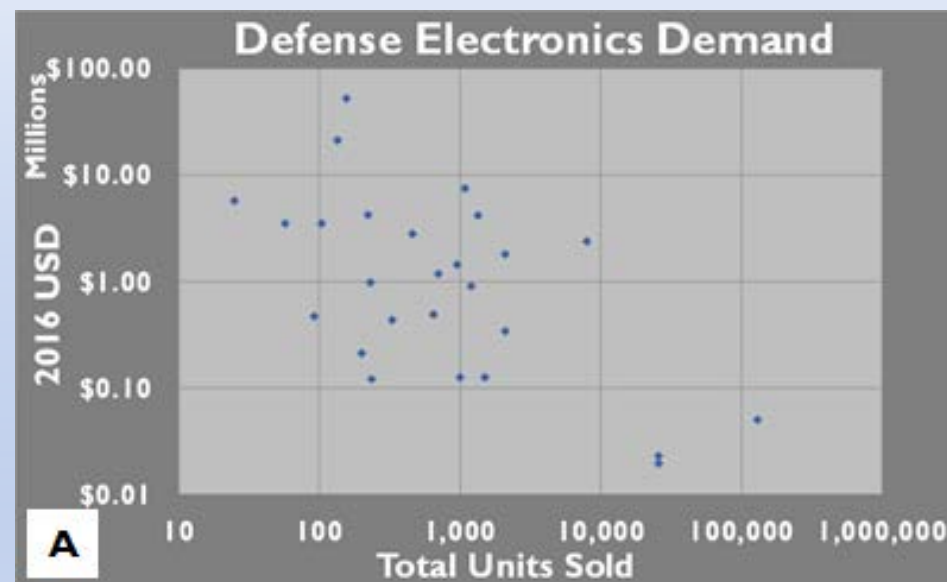
- Fuzzy demand
- Market limits
  - Demand Frontier
  - Market Aggregate Demand
- Price responsiveness & limit enforcement
- Working with the Demand Frontier

## Fuzzy Demand

# Fuzzy Demand: Here Are The Quantity-Price Points For Three Markets



Simply regressing the data will not provide much insight – What will?

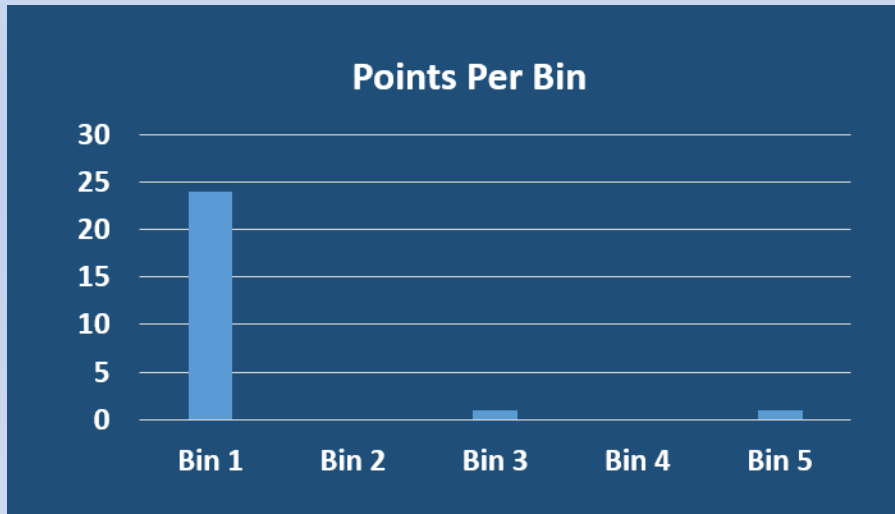


## Market Limits

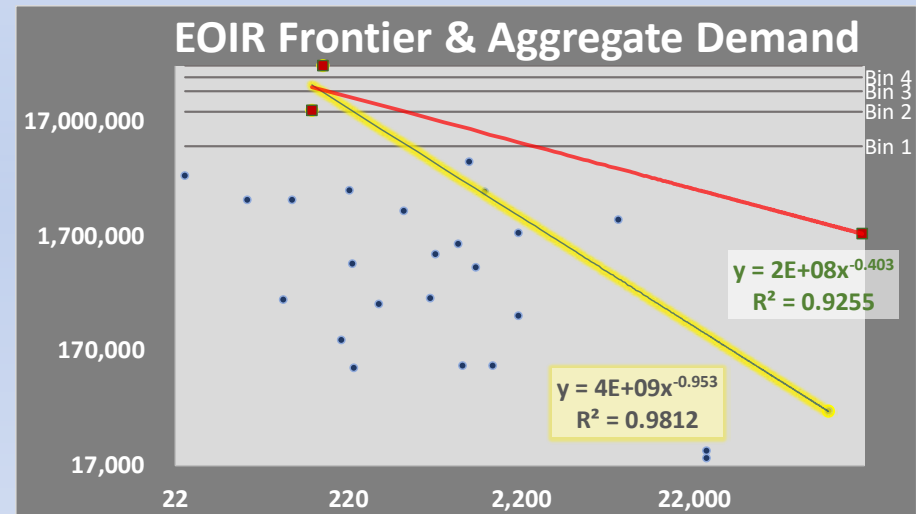
# Let's Examine Defense Electronics By Evenly Binning Models By Price



We begin by dividing the models into bins evenly spaced by price; note that the lowermost bin has most of the data



Market Aggregate Demand, indicated by the red line, is the regressed value of the red points in each bin, the total quantity and weighted average price



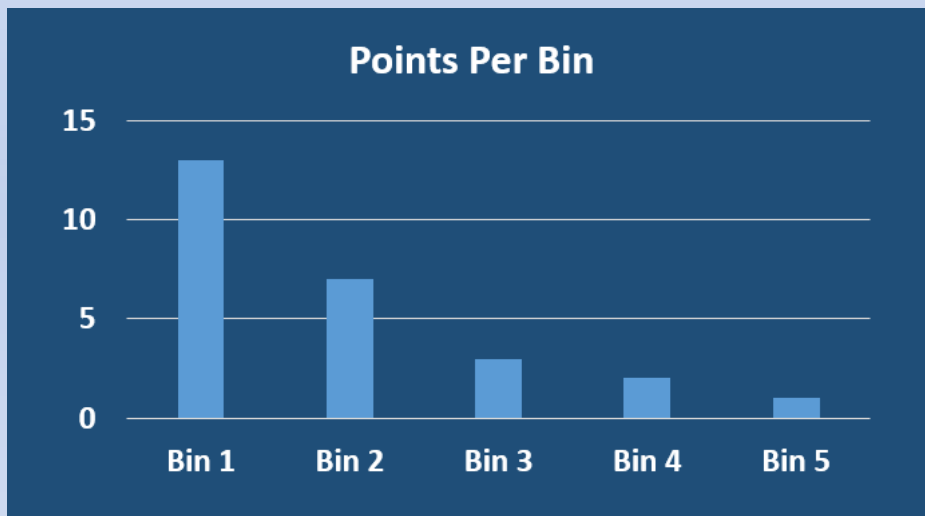
The Demand Frontier is defined by the outermost points in the data, selected as the rightmost and next rightmost points in each bin – this is good but not great

We will try another technique to see if we can improve results

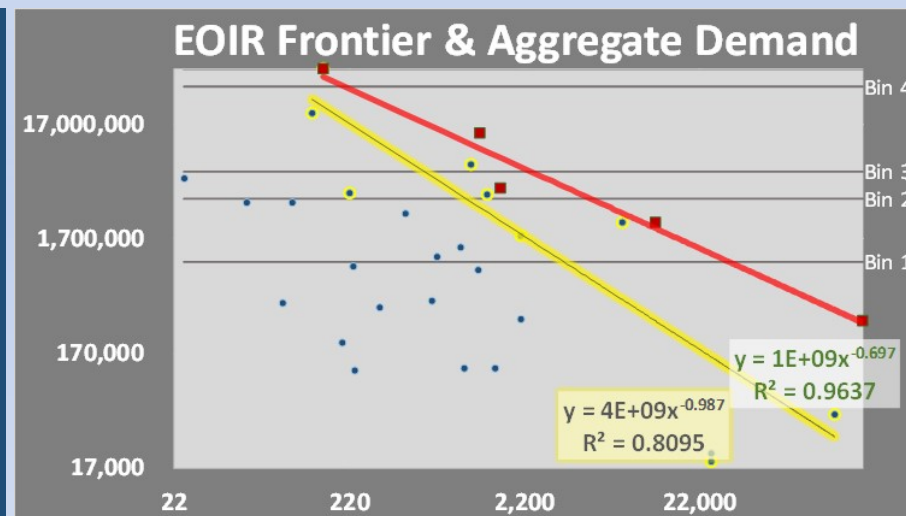
# Instead Of Even Binning, Here We Use Bins Based On A Geometric Series



Geometrically based binning provides a more regular pattern to the analysis



This has improved Market Aggregate Demand correlation, but we've made no attempt to improve our Demand Frontier Analysis here

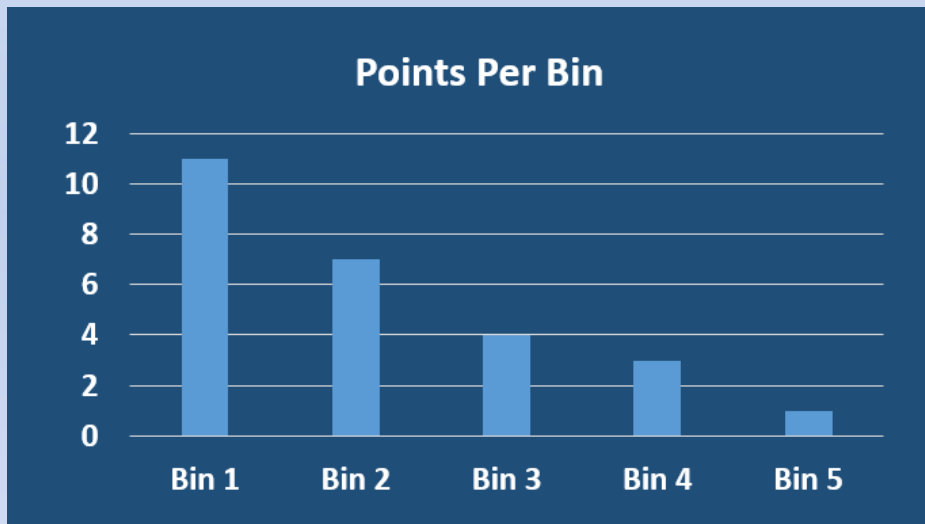


We will try a third technique to see if we can improve results

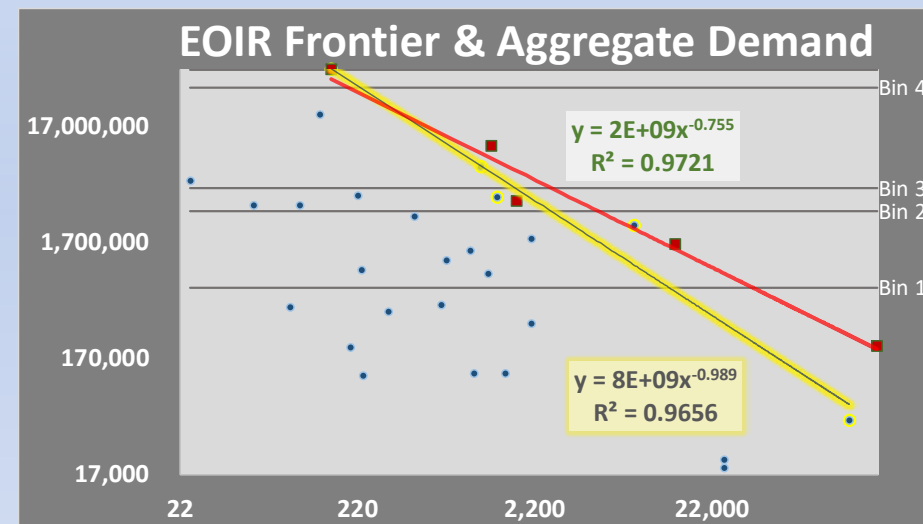
# Now We Will Try Binning Based On the Fibonacci Series



Fibonacci based binning provides an even more regular pattern to the analysis



In this case, we now have our best Market Aggregate Demand and Demand Frontier correlations and P-values



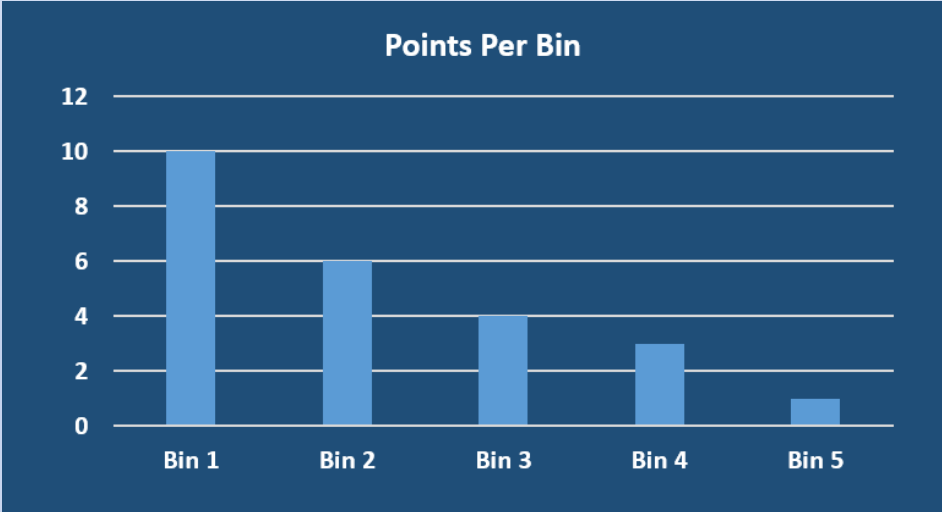


## Price Responsiveness & Limit Enforcement

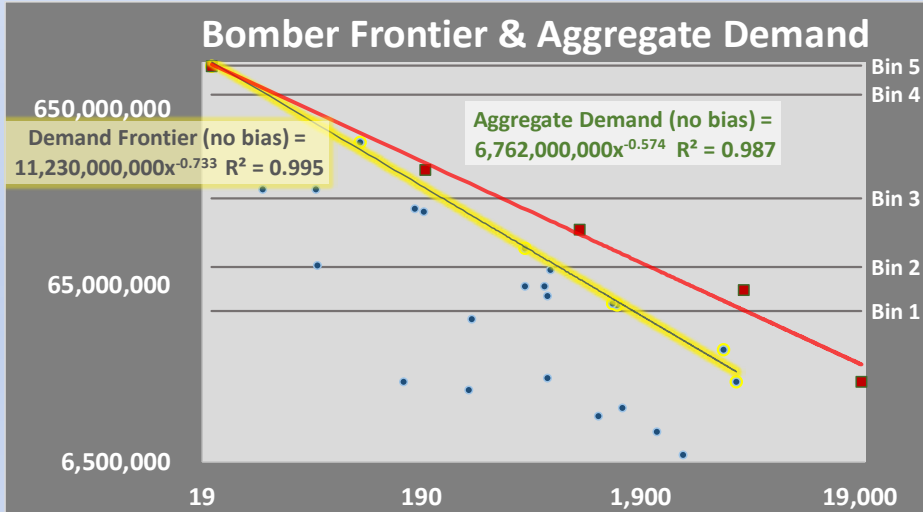
# Let's Consider Market For Fighters, Bombers And Attack Aircraft



Fibonacci based binning again provides a regular pattern to the analysis



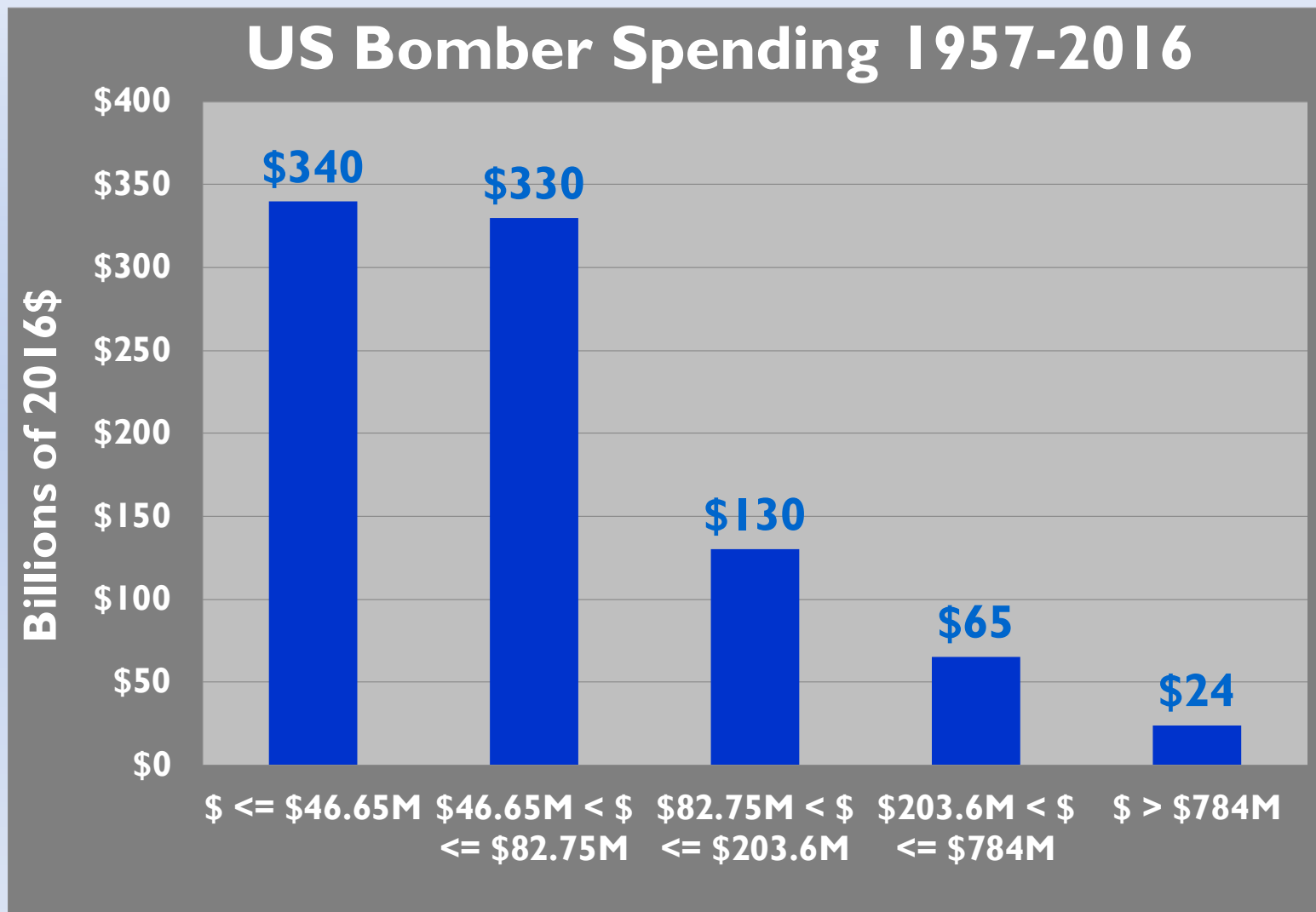
The Demand Frontier and Aggregate Demand Curves are well-correlated



Curve	Pearson's <sup>2</sup>	P-Value	Standard Error
Demand Frontier	99.7%	6.79E-09	\$33.5M
Aggregate Demand	99.9%	0.07%	\$28.7M

What can we do with this analysis?

# First, We Might Want To Know Where All Of The Money Goes

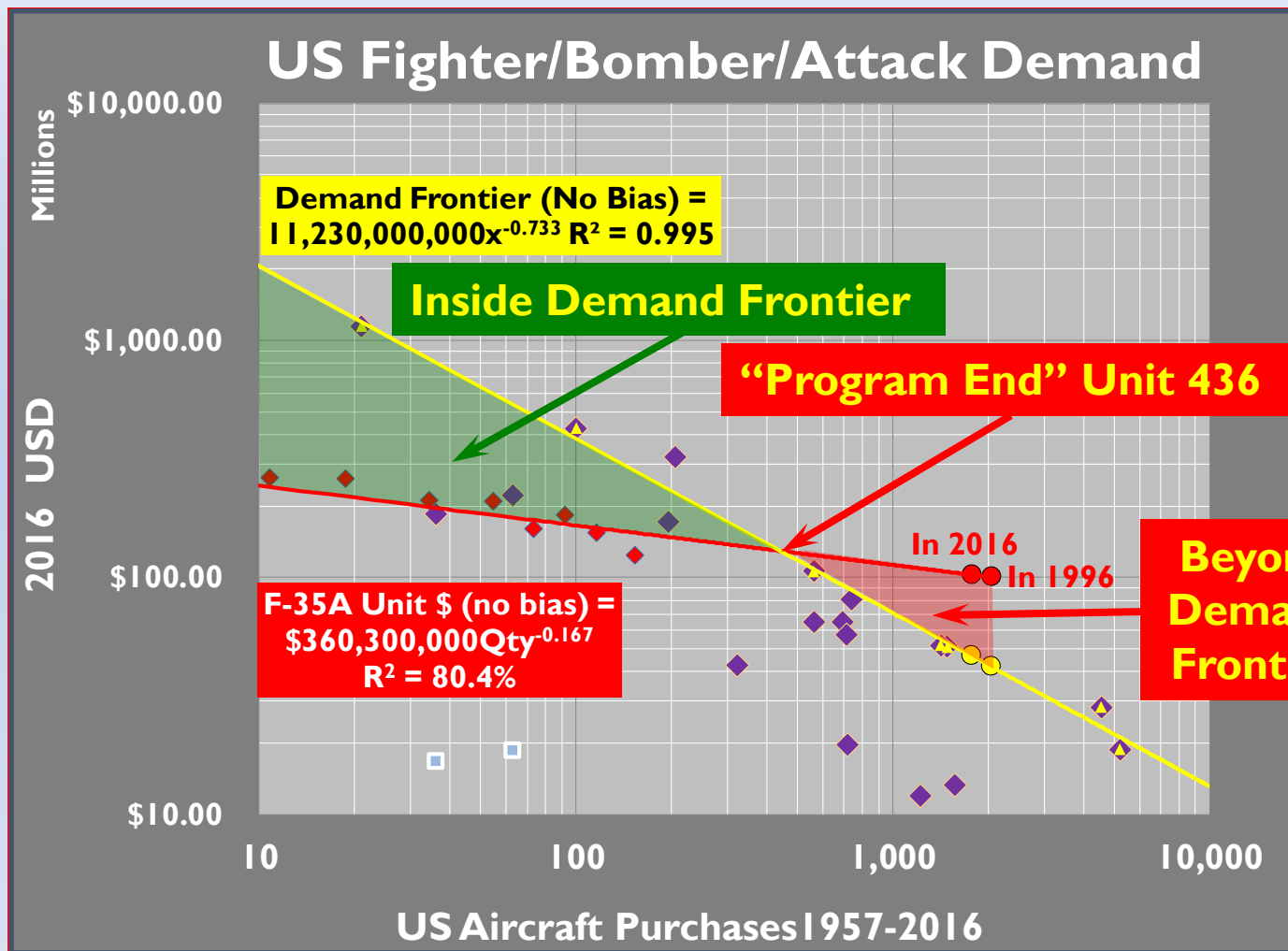


The vast majority of the monies go to the lower-priced models

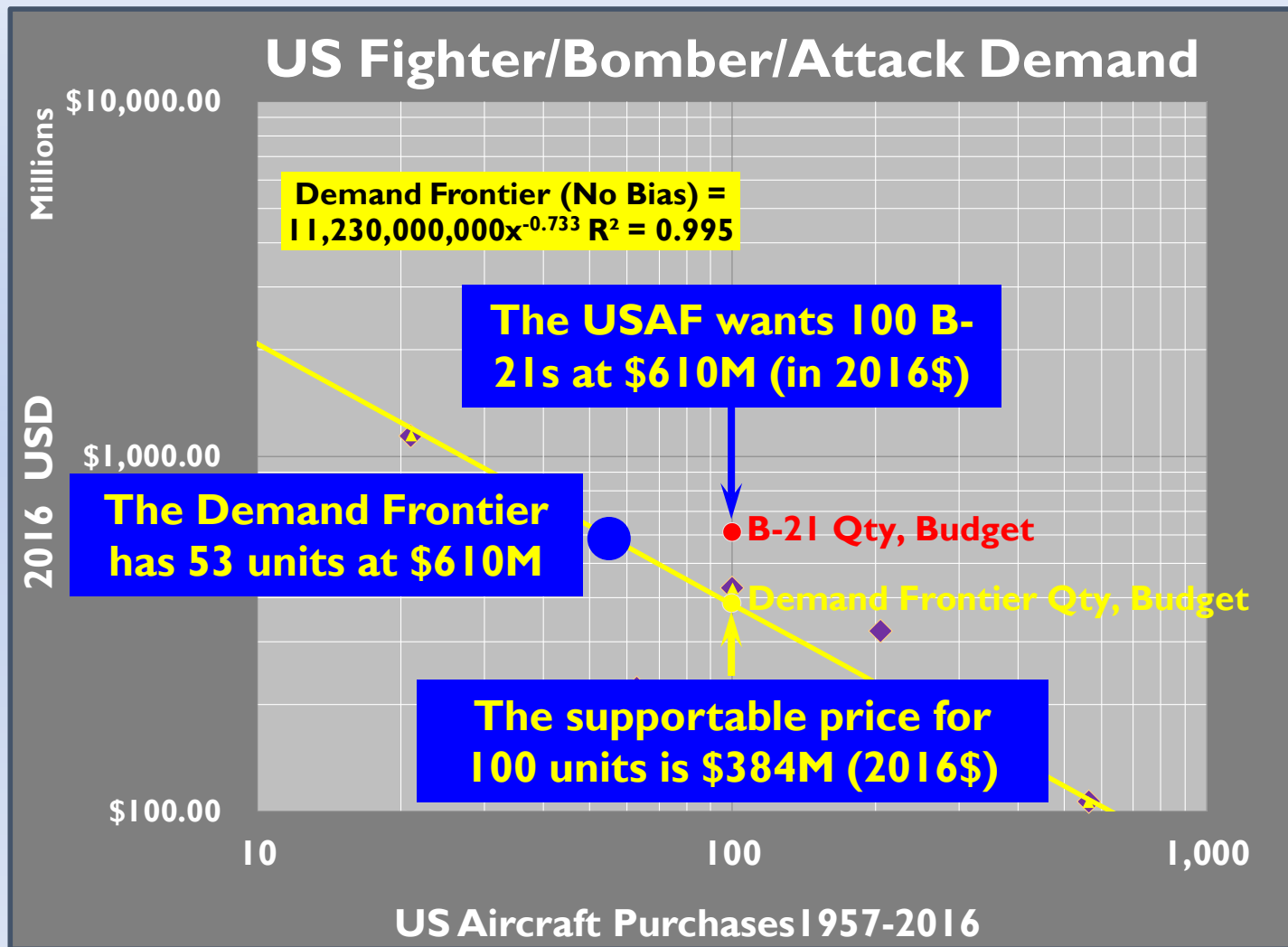
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# What Does This Mean For Ongoing Models, Such As The F-35A?

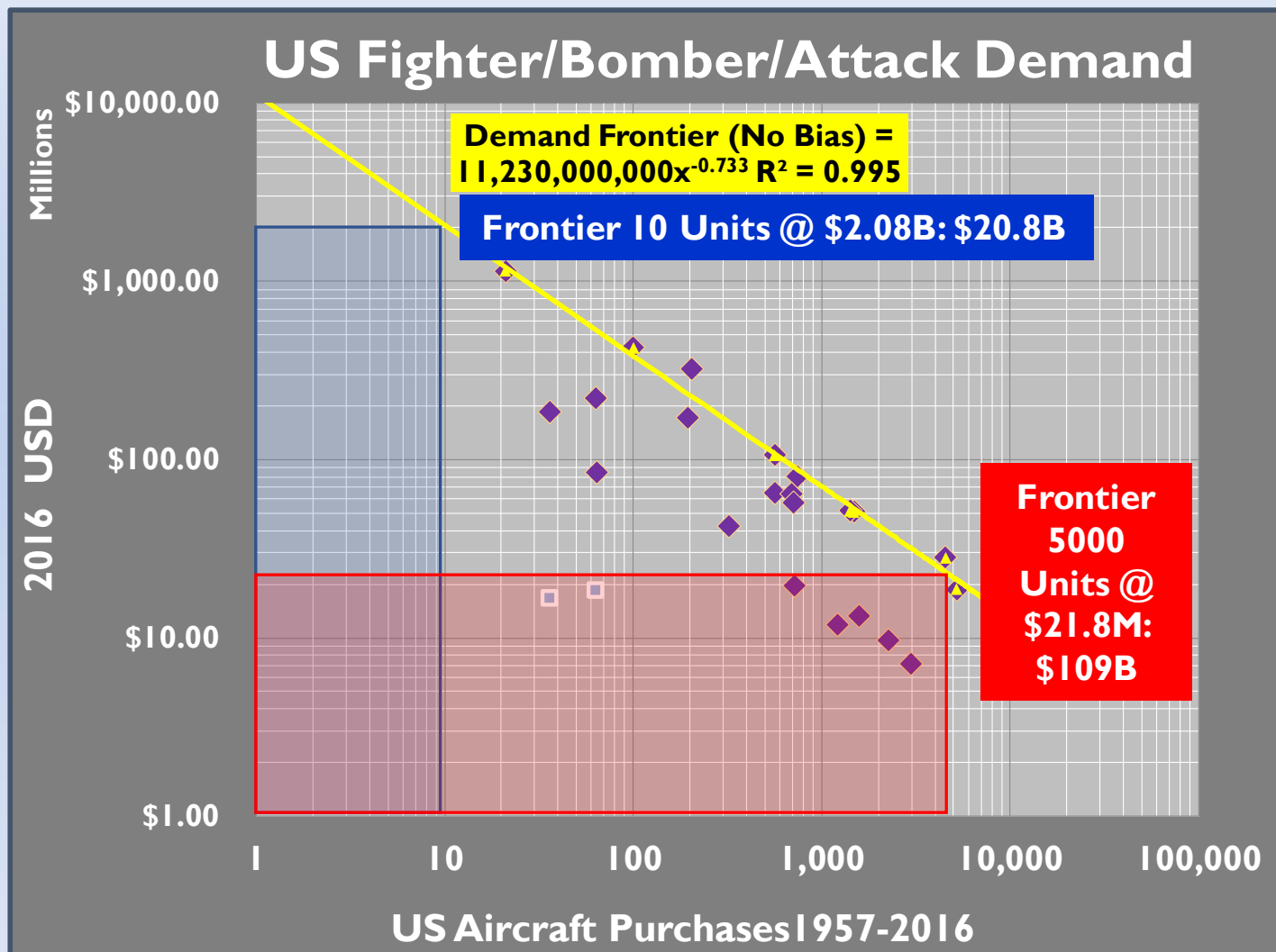


Year	Sales Goal	Frontier \$	F-35A \$	Difference	Std. Devs.
1996	2036	\$42,200,000	\$100,900,000	\$58,700,000	1.8
2016	1763	\$46,900,000	\$103,400,000	\$56,500,000	1.7



Year	Sales Goal	Frontier \$	B-21 Target \$	Difference	Std. Devs.
2016	100	\$384,000,000	\$610,000,000	\$56,500,000	6.7

# What Does The Demand Frontier Show Us About Unit And Revenue Potential?



There is more money available for the lower-priced models

## Working with the Demand Frontier

# Let's Entertain The United States Forest Service (USFS) Firefighting Operations

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Model	\$/season/unit	Gallons/drop	Drops/hr from 10	Ave. Age (Years)	2013 Qty
Bae 146	\$6,855,000	3,000	3.4	20	5
P2V	\$3,050,000	1,600	3.1	55	6
P3	\$4,134,000	2,550	3.4	45	6
C27J	\$5,432,000	2,000	3.4	4	7
C130XJ	\$8,078,000	3,000	3.4	0.1	2
DC10	\$13,500,000	10,800	3.4	35	2
CV580	\$2,725,000	2,000	3.3	60	5
CL215 piston	\$3,331,000	1,400	5.1	30	4
CL215 turbine	\$5,640,000	1,440	5.1	30	4
CL415	\$10,780,000	1,620	5.8	10	2
S64	\$5,365,000	2,500	2.9	40	15
MD87	\$6,831,000	4,000	3.4	20	2
RJ85	\$7,126,000	3,110	3.4	12	4

**What supports the prices that these models fetch?**

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# Firefighting Aircraft Value Is A Function Of Capacity, Speed And Age



Multidimensional Economic Evaluators MEE4D

File About Database Scatterplot Model Analyze 4D Plot

**Saved Equations**

Delete Current Eqn

Unsaved Model

**Dependent Variable Selection**

Adjusted Tot

**Regression Type**

Linear [Y = mX + b]

**INDEP VAR CHOICES**

Var Name	DV Correl
2016 Qty	-43%
*Aircraft	-Not Numeric

**INDEP VAR SELECTIONS**

Variable Name	DV Correl
Gallons	73%
Drops Hr	18%
Ave Age Yrs	-48%

CLEAR SELECTIONS    SAVE EQUATION    VIEW FULL REGRESSION RESULTS

**Sneak Peek**

**Equation:** Adjusted Tot = +1034.3 \*Gallons + 1101104.1 \*Drops Hr - 66116.0 \*Ave Age Yr + 950054.9

**Equation Statistics**

$R^2$ : 85.3%    Adj  $R^2$ : 80.4%    Pearsons  $\chi^2$ : 85.3%    CV: 21.5%    MAPE: 15.4%    F-Test: ok

**Regression Term P-Value Test Results**

Gallons: ok    Ave Age Yr: ok    Drops Hr: ok

**Num Observations:** 13    **Residual Degrees of Freedom:** 9

**Residuals**

Unit Space Residuals     Standardized Residuals

**Data Filtering**

Filtering Enabled	Plot Highlight	Variable	Filter	Value	Delete?
<input type="checkbox"/>	<input type="checkbox"/>	Aircraft	=		<input type="checkbox"/>

Apply    New Filter

File: Short USFS Database.xlsm Using 13 data points out of a possible 13

~\$1.1M/drop/hr    ~\$1M to start

~\$1000/gallon    ~\$66K age/year

This is well-correlated

# A New Plane Enters The Market: 2,500 Gallons, 6.9 Drops/Hr, 0.1 Yrs Old



Multidimensional Economic Evaluators MEE4D

File About  
Database: Scatterplot Model Analyze 4D Plot  
Unsaved Model

Gallons: 2500  
Drops Hr: 6.9  
Ave Age Yrs: 0.1

Adjusted Tot = 11,126,817.449 Dollars

Each new unit is worth \$11.1M/yr to the USFS

Value goes up with gallons/load

Value goes up with drops/hour

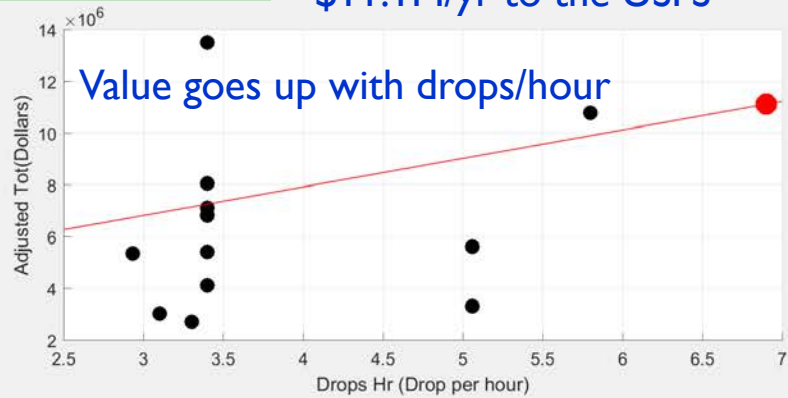
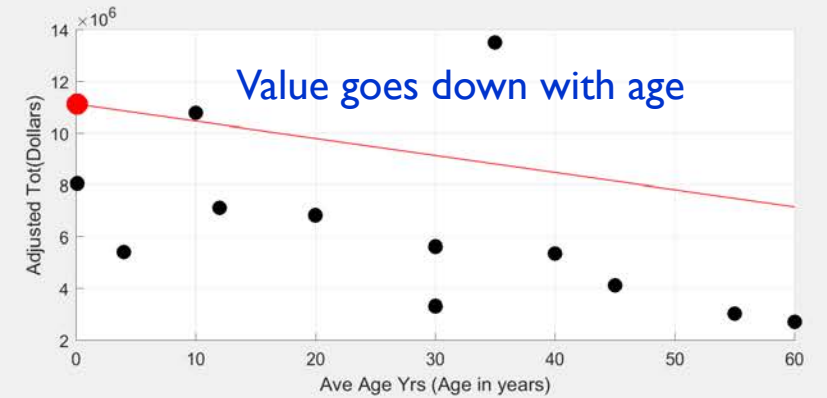
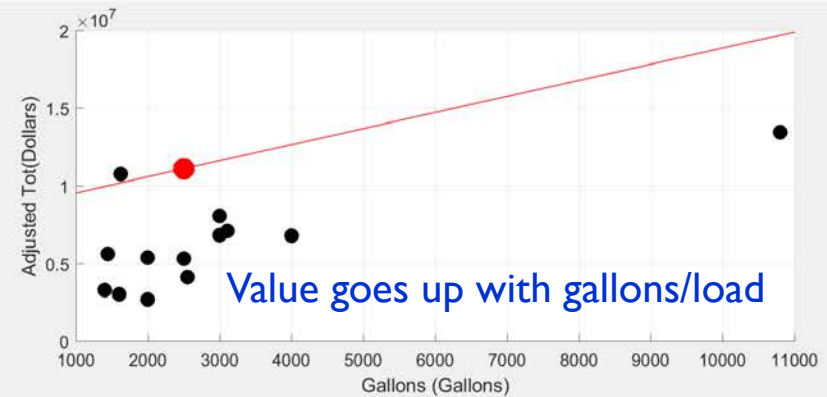
Value goes down with age

Cursor Mode: Point Display, Zoom

Data Filtering: Filtering Enabled, Plot Highlight, Variable: Aircraft, Filter: =, Value, Delete?

File: Short USFS Database.xlsm Using 13 data points out of a possible 13

The dependent variable, USFS annual value, is affected by 3 independent variables, as model features, above

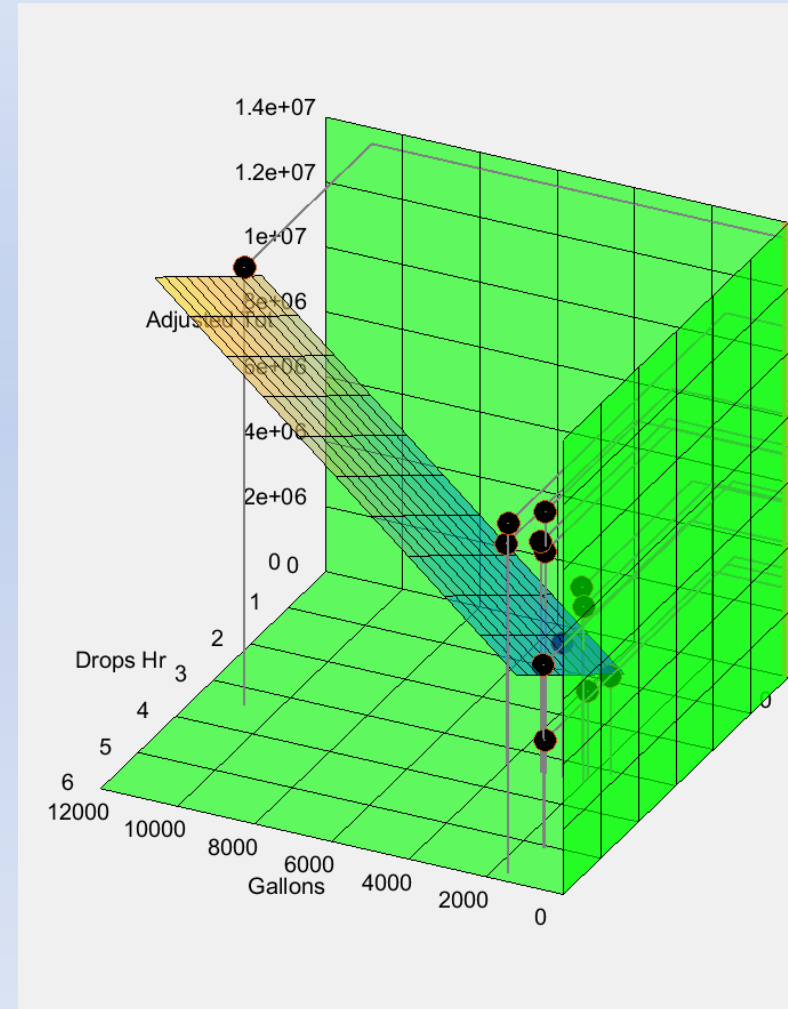
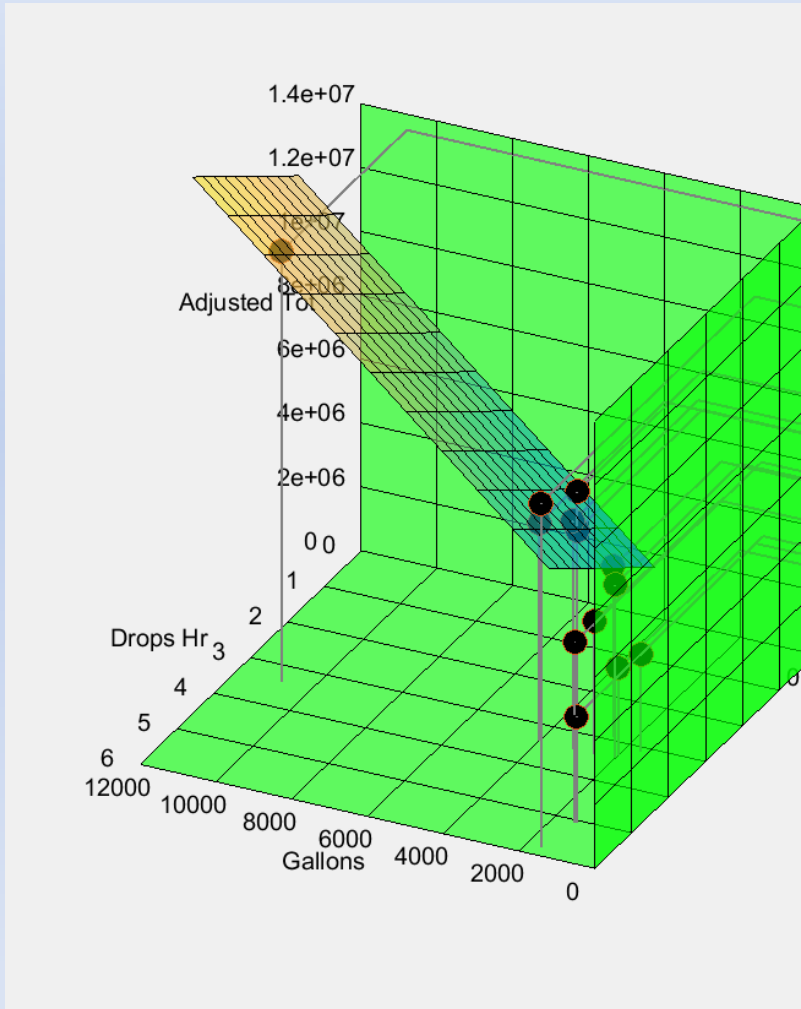


# Here Are A Pair Of 3D Views Of USFS Firefighting Aircraft Value



This is the value of a new model

Here's the value of a 40 yr old model



Value goes up for capacity and speed, and falls for poor reliability

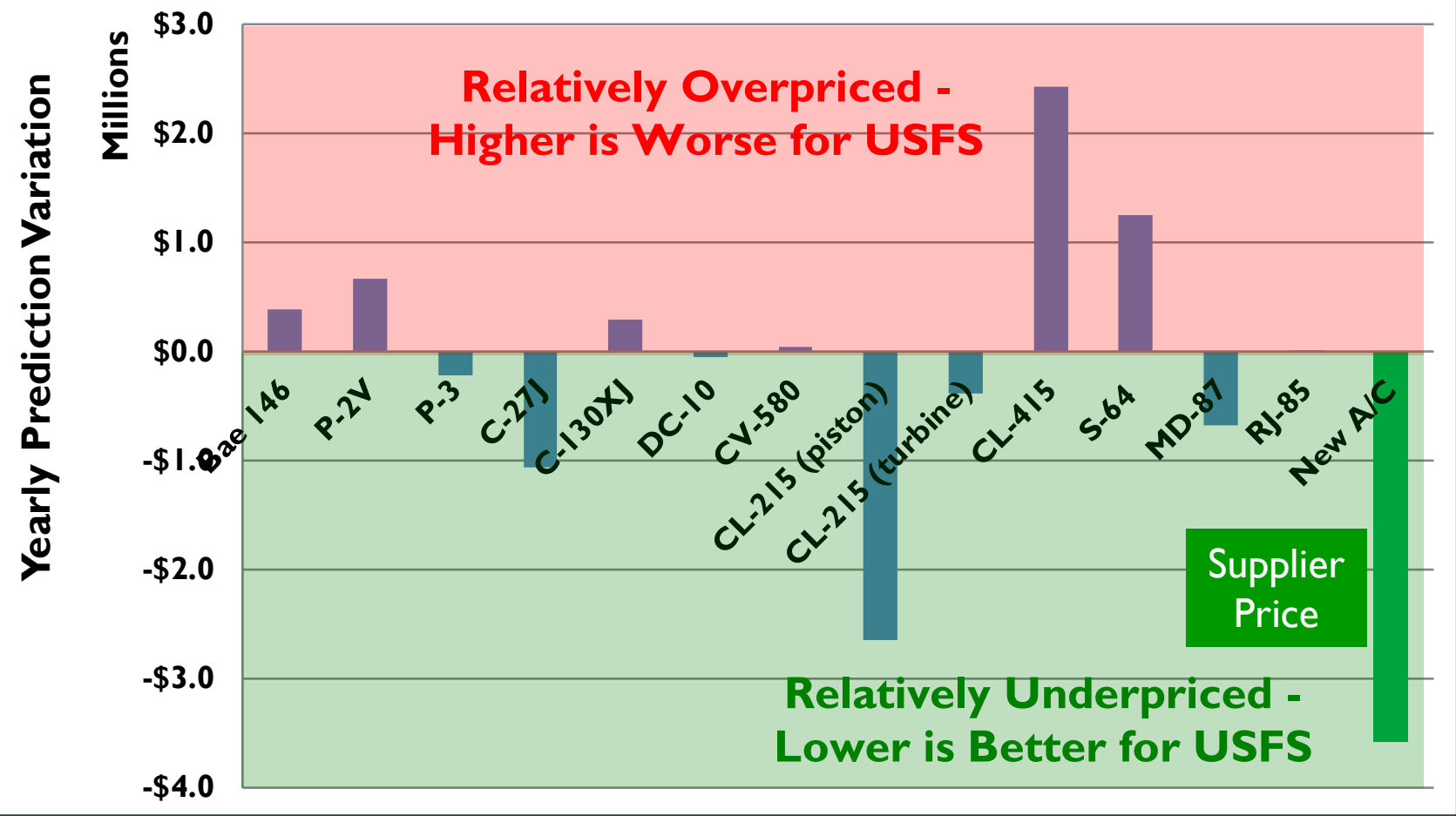
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# Suppose A Supplier Sells Services To The USFS For Less Than The Going Rate



## Fire Fighting Aircraft Residuals

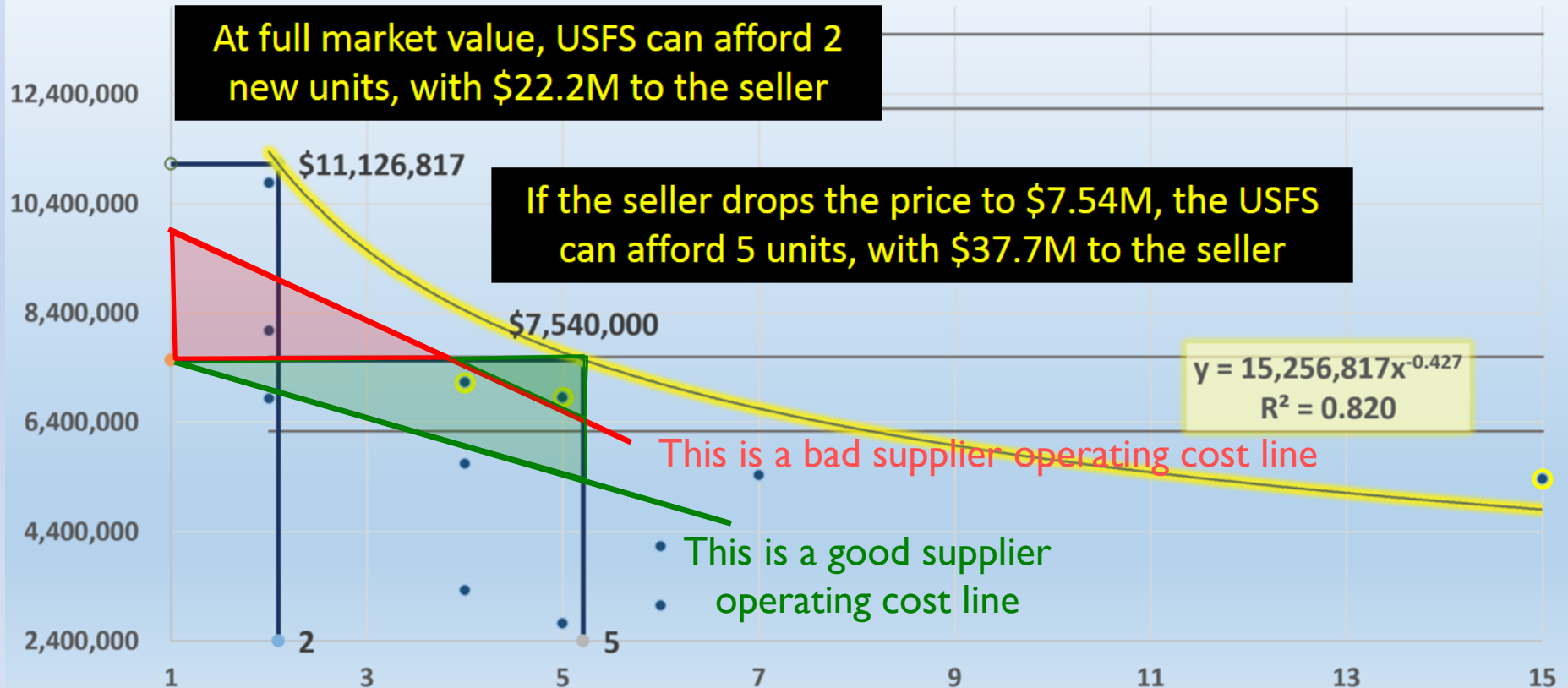


In this case, this becomes a great deal for the USFS

# What Does The Lower Price Mean To The Supplier?



## Demand Frontier Analysis for a New Fire Fighting Model

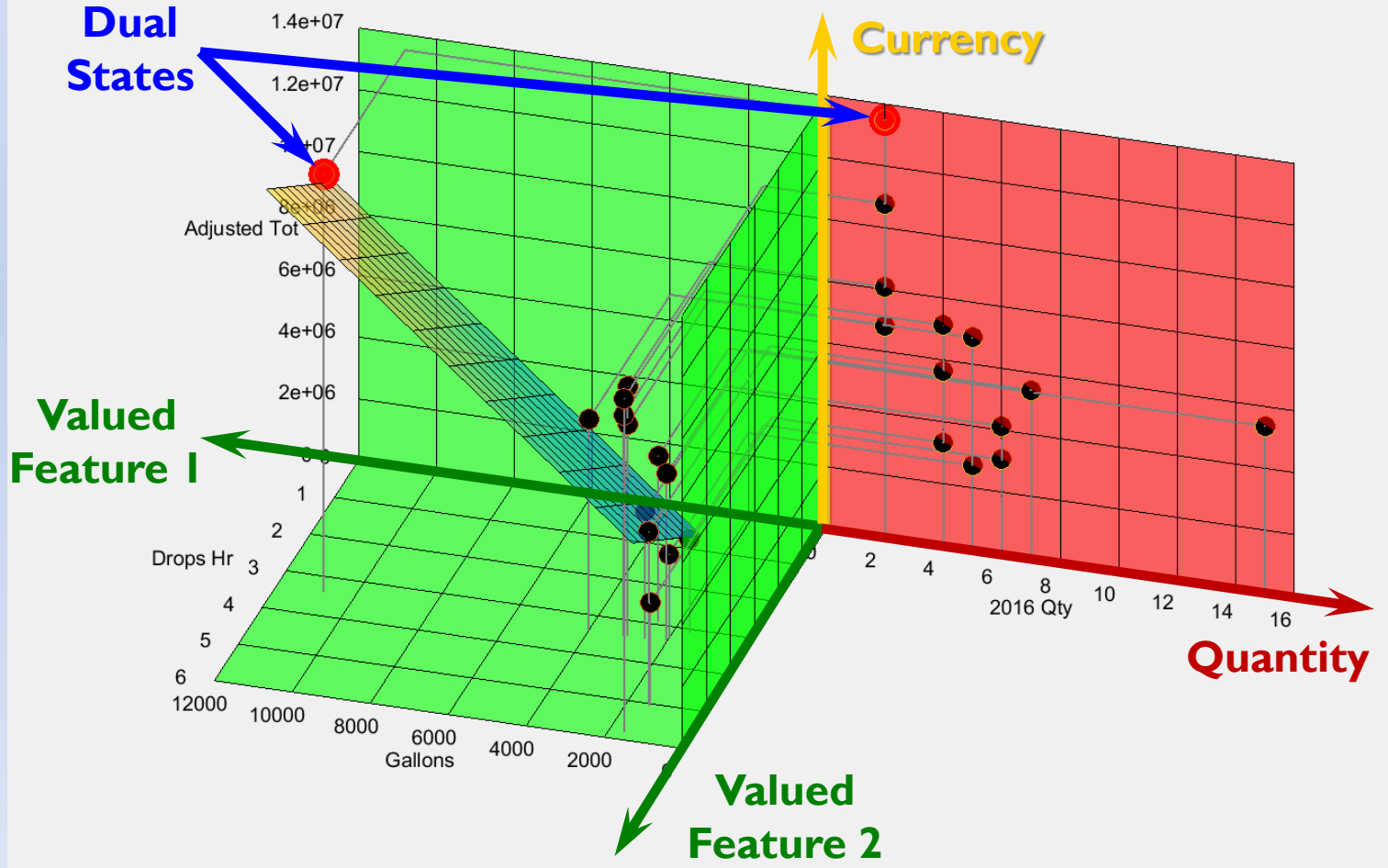


Clearly, the supplier must know his value, demand and cost

# The 3D Value Space and 2D Demand Plane Join to Form 4D Markets



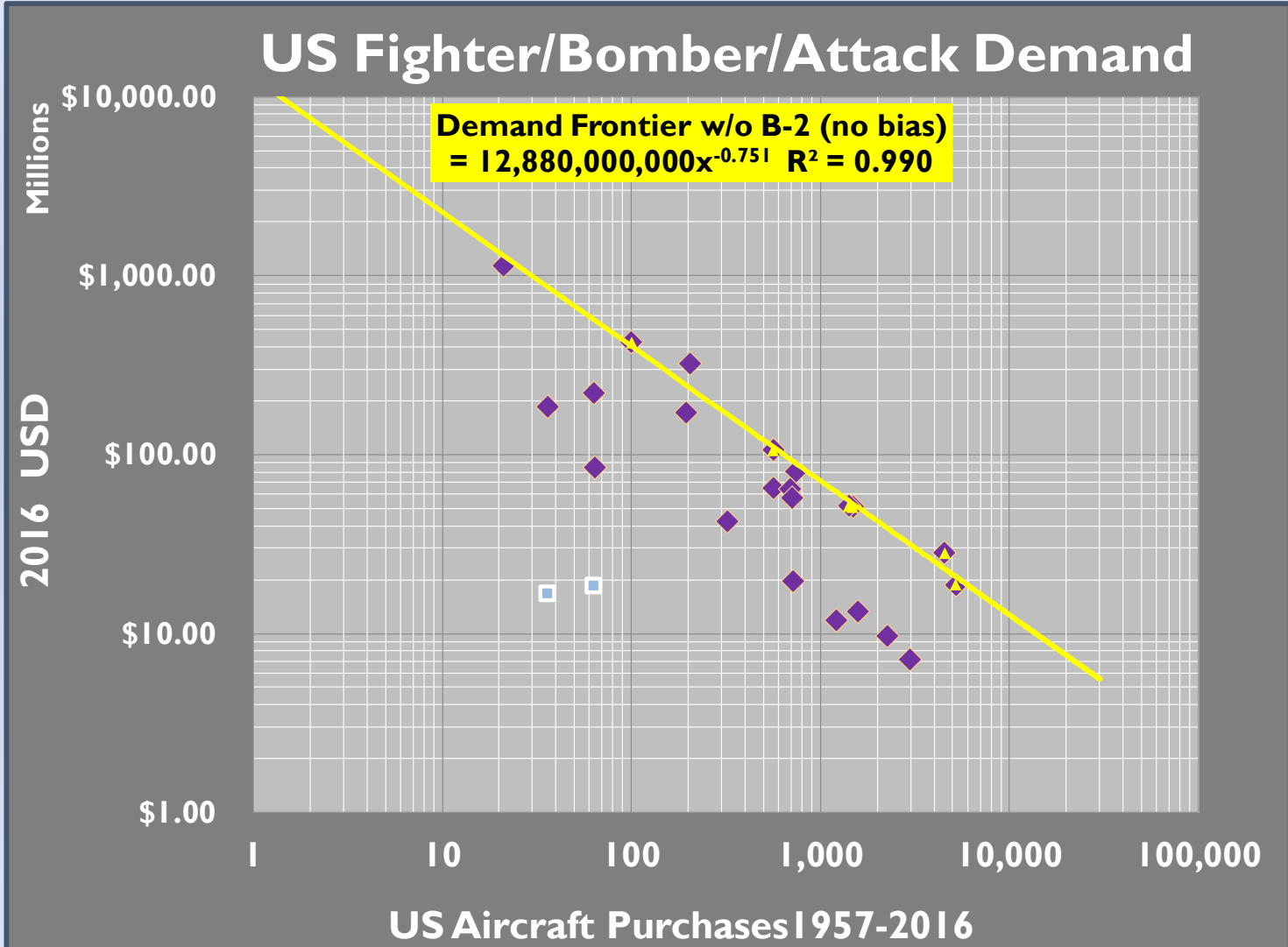
DC10: Gallons= 10,800; Drops Hr= 3.4; 2016 Qty= 2; Adjusted Tot= 13,500,000 **Ordered quads**



All markets operate in this manner

- Demand appears fuzzy but may be characterized by
  - Demand Frontiers
  - Market Aggregate Demands
- Markets limit sales about their Demand Frontiers according to their slope and standard deviations
  - Broad variations to the Demand Frontiers are rare
  - Estimators, program managers and engineers should take these limits into account as they begin programs
- It is possible to plan in advance to
  - Maximize capacity (as for a service branch)
  - Maximize profits (as for a for-profit company)

# Removing B-2 From The Set Still Produces A Highly Significant Curve



Removing the B-2 from the analysis leaves the B-2 I as an extrapolation