Opening up Space with Fractionation

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Opening up Space with Fractionation

- Valuation
- Standards
  - Cluster Communications
  - Cluster Flight

Valuation

- What if space were inexpensive?

- Why isn’t space inexpensive?

Valuation

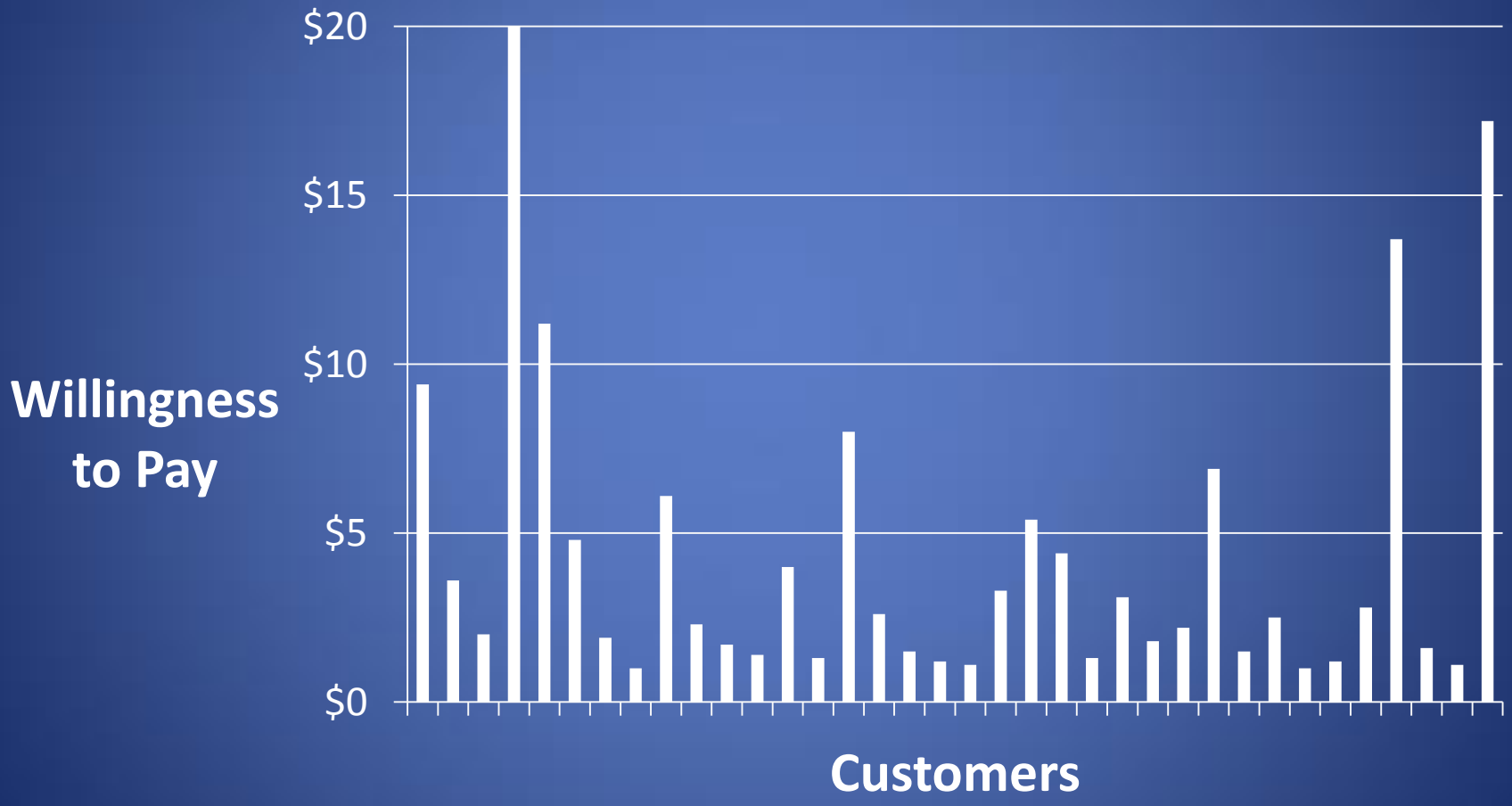
- What if space were inexpensive?

DEMAND

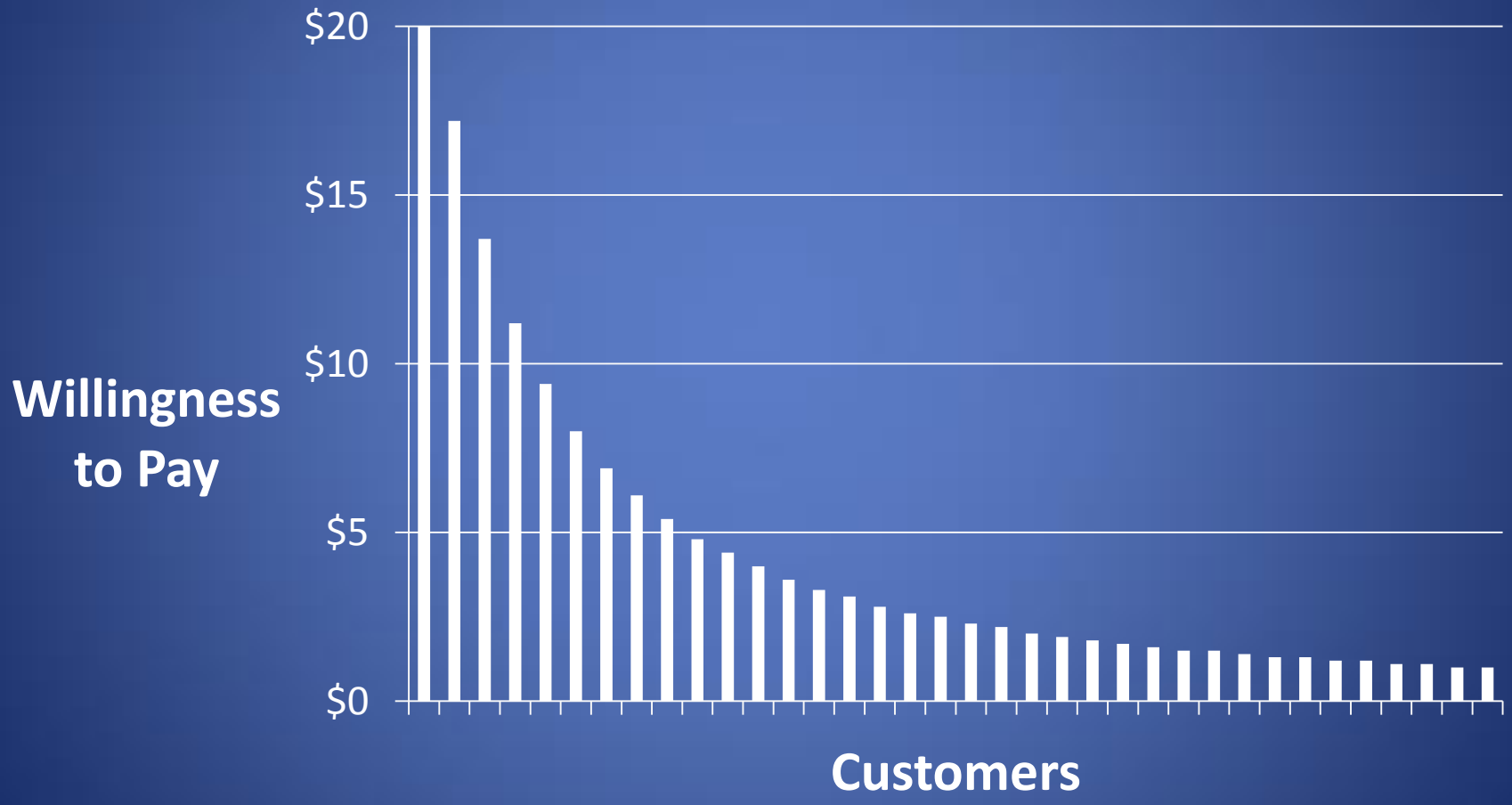
- Why isn’t space inexpensive?

SUPPLY

Demand

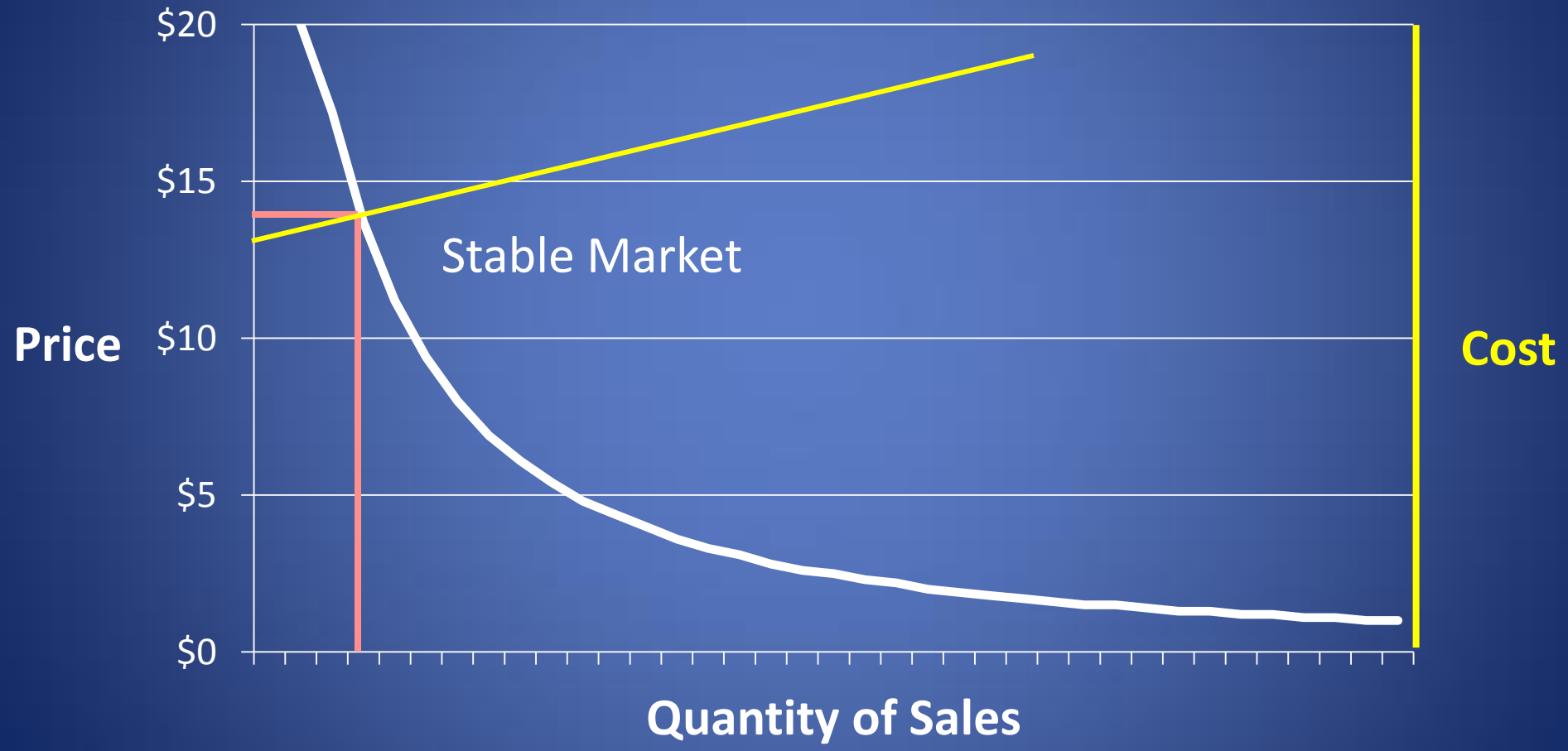


Pareto Analysis



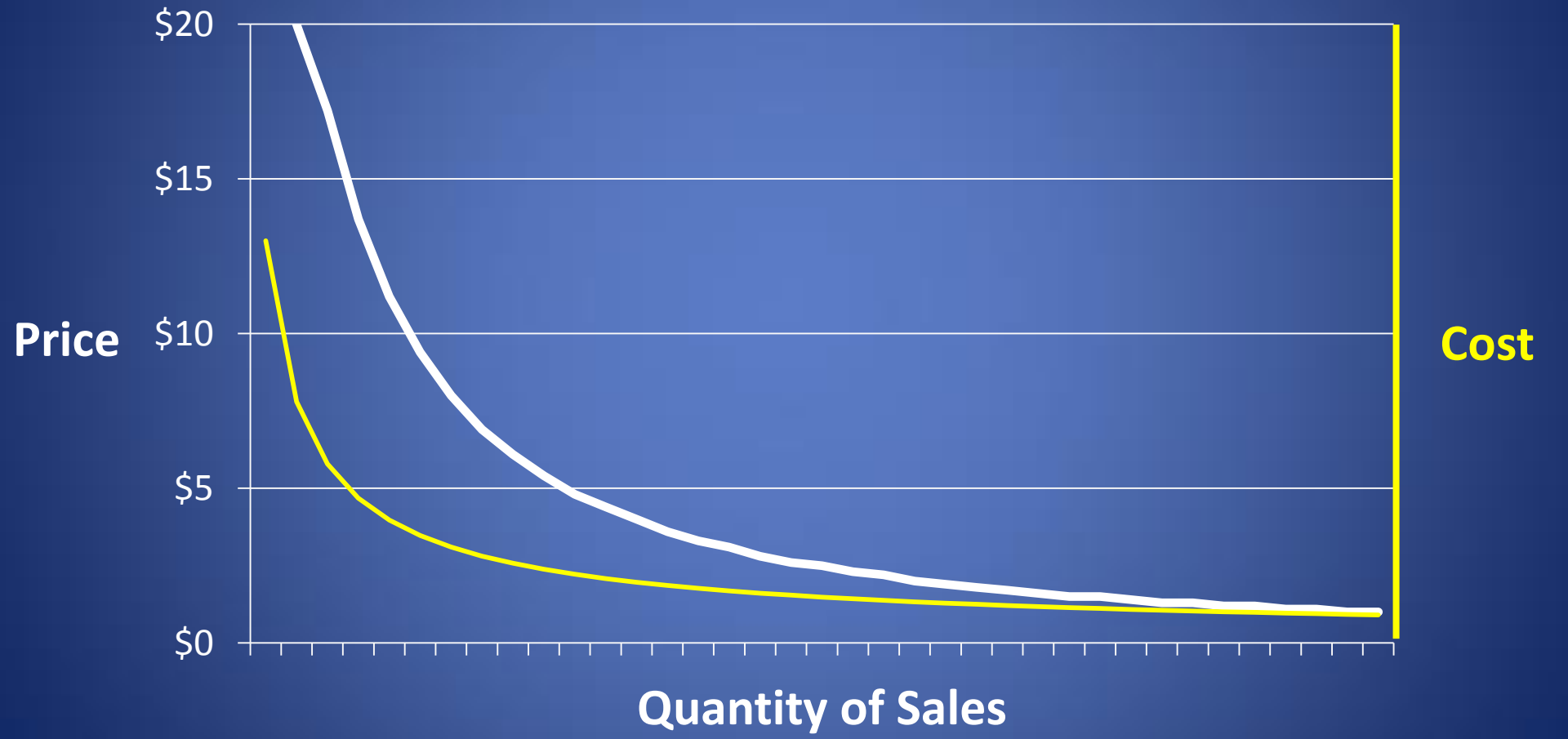
Demand Curve

Supply and Demand

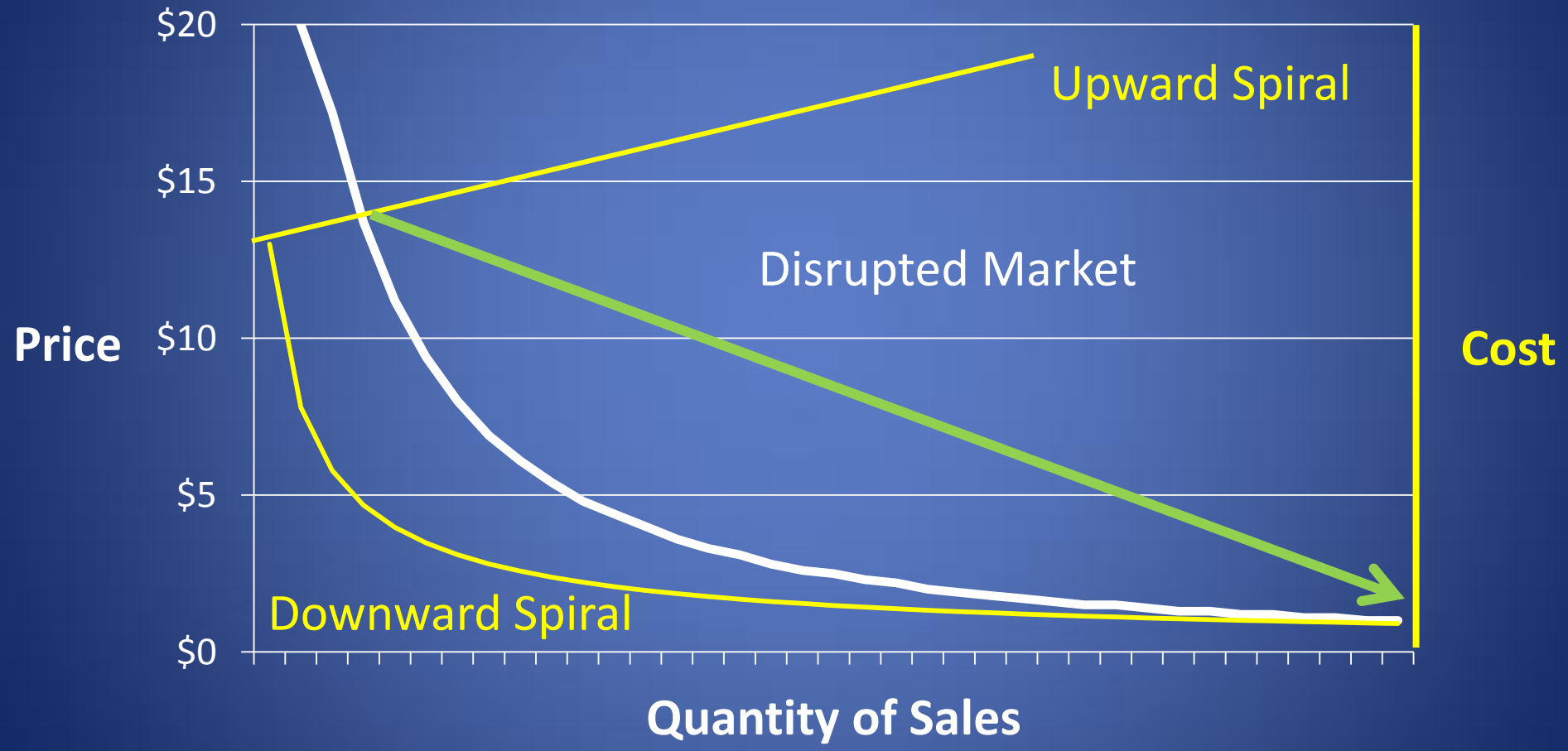


Supply Curve

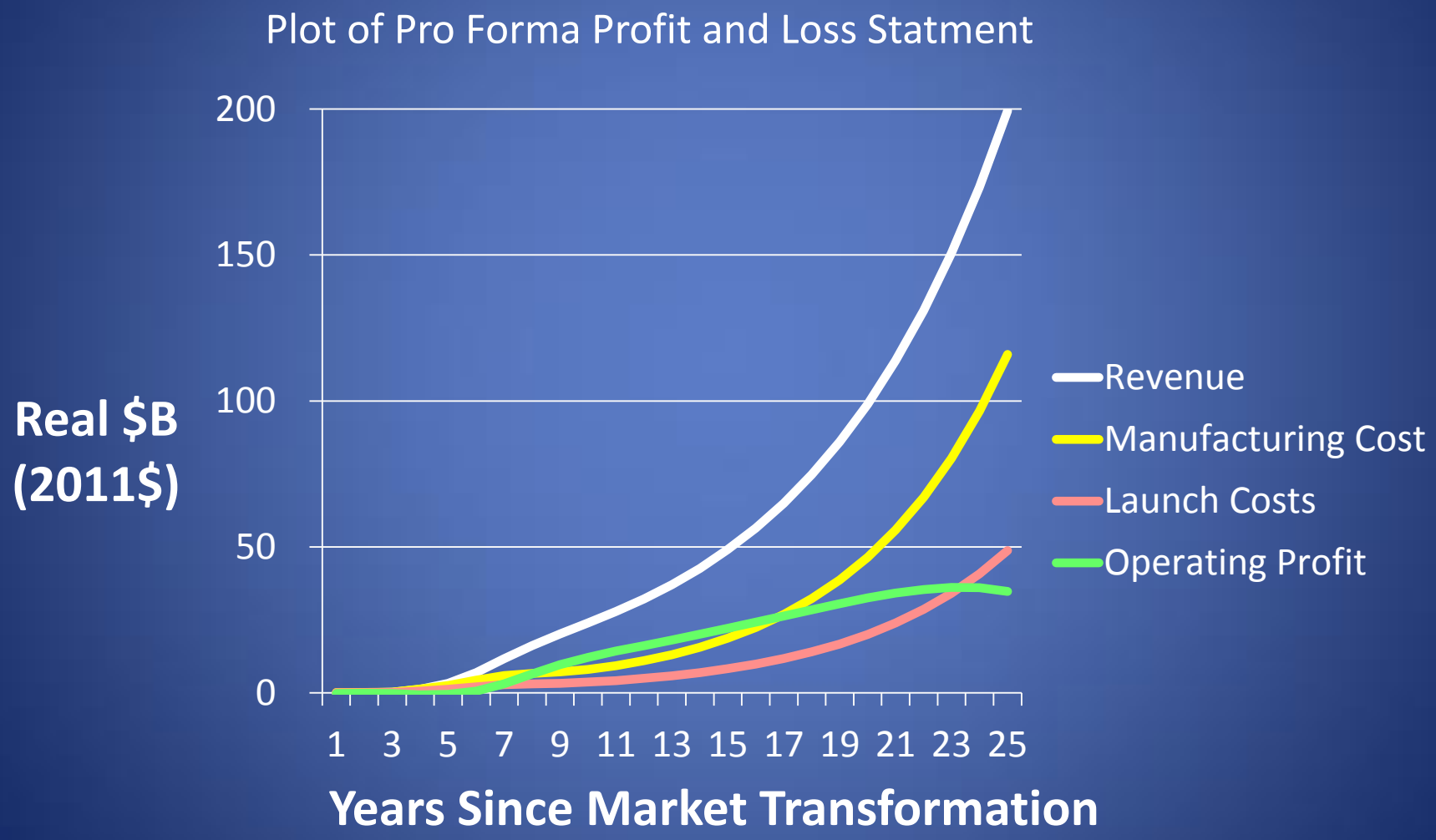
for an innovative market



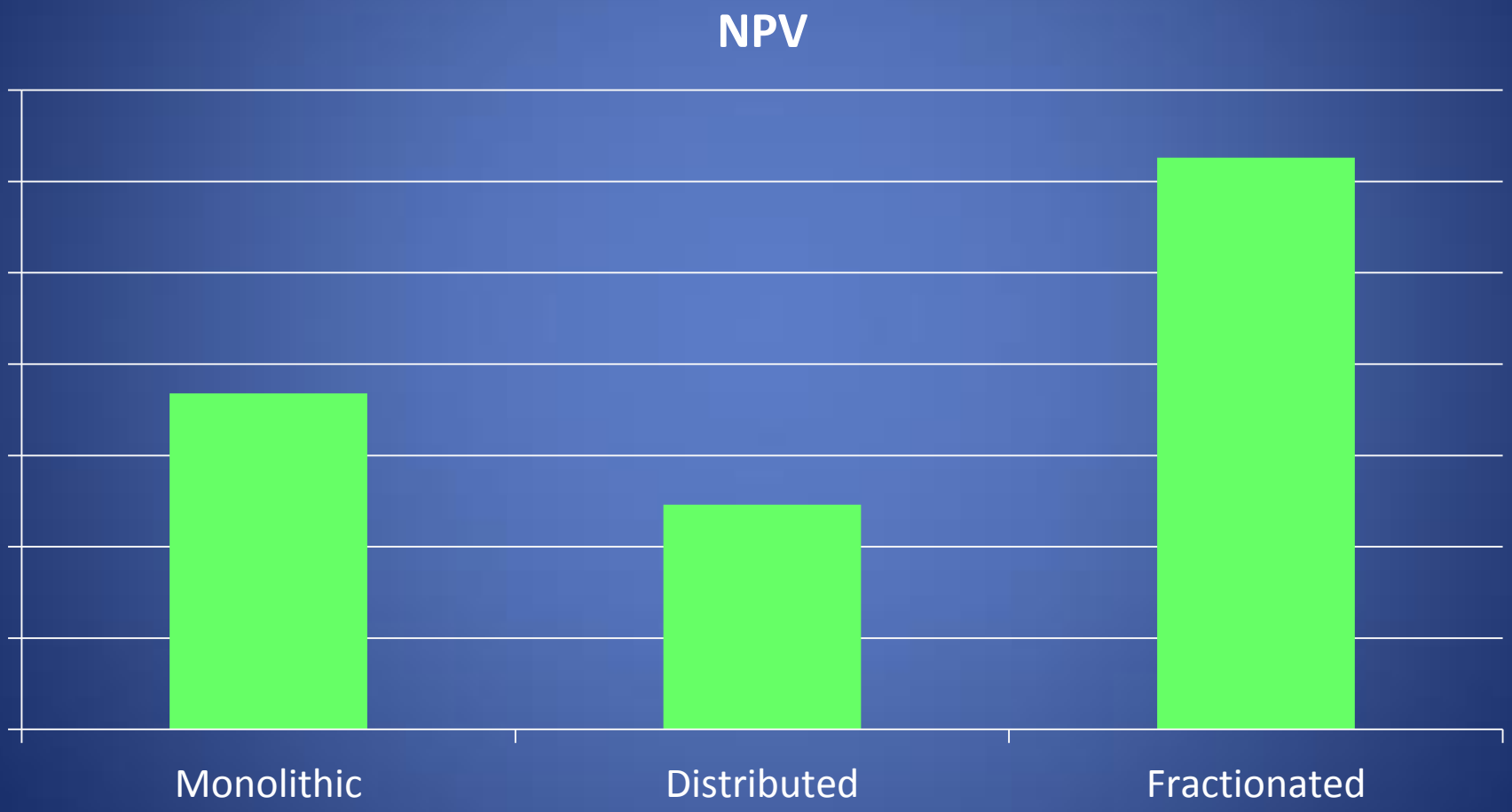
Supply and Demand



Example Simulation (Space Internet)



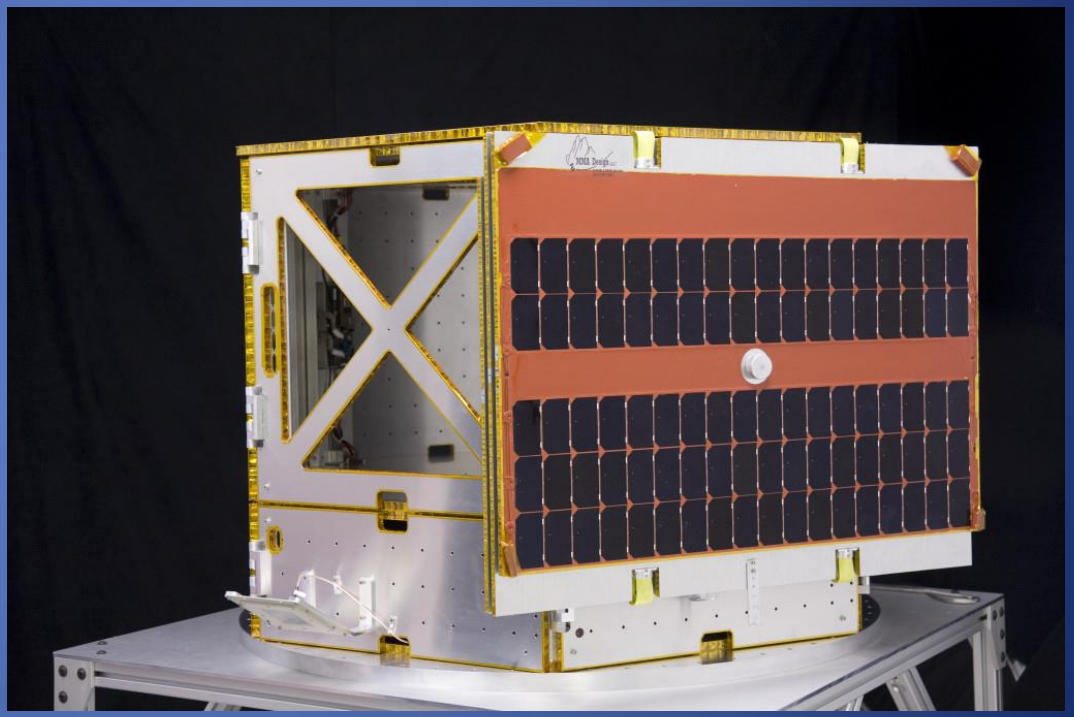
Value of Fractionation



Transition

1. Cost reduction from $100K / kg to $50K / kg*
2. Reduce cost with production volume

New Players



Low Cost Spacecraft from MMA Design, Boulder CO

* Manufacturing (10th unit) plus launch costs

Barriers to Entry

- Uncertainty
- Volume

Barriers to Entry

- Uncertainty
  - reduced by standards
- Volume
  - market applications

Valuation

- Value Modeling (design objective function)
  - math function: system attributes in, score out
  - example: Pro Forma Profit and Loss ($)

- Value Models are invariant under affine xforms
  - Design does not depend (much) on how big the market becomes, any of these scenarios will do

$$v(\text{attributes}) \sim \alpha v(\text{attributes}) + \beta$$

Standards

- The barrier to new space
  - Cluster Communications
  - Cluster Flight
  - Launcher interfaces
- Last chance for optimization
  - Optimum cluster flight pattern
  - Optimum propellant sizing

Conclusion

- New Space Architectures:
  - Great rewards
  - High risk
    - uncertainty = lack of information
- Researchers can break the logjam and open space to 100x applications