

# Test Consumables – The Road Ahead

## The Changing Cost Structure of Semiconductor Test

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# First, we need to talk about the market environment

Impact of COVID-19. What we know for sure...

Fundamental market drivers for semiconductor still in place

Chips still need testing

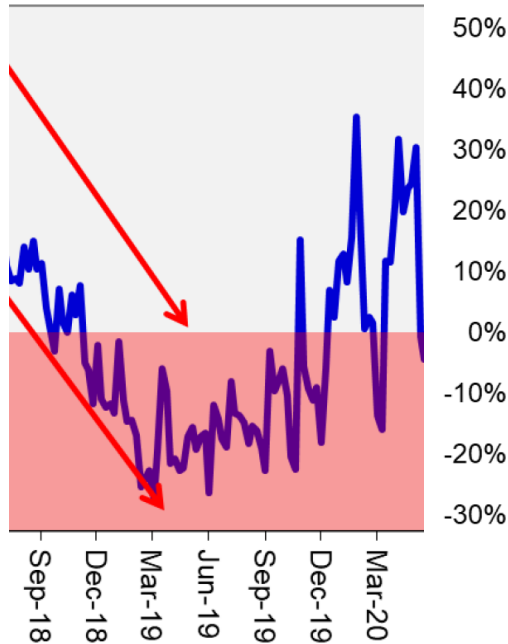
Technical problems for semiconductor test not going away

Economic challenges just got a little harder

# Semiconductors: Short-Term View

## Increased Volatility

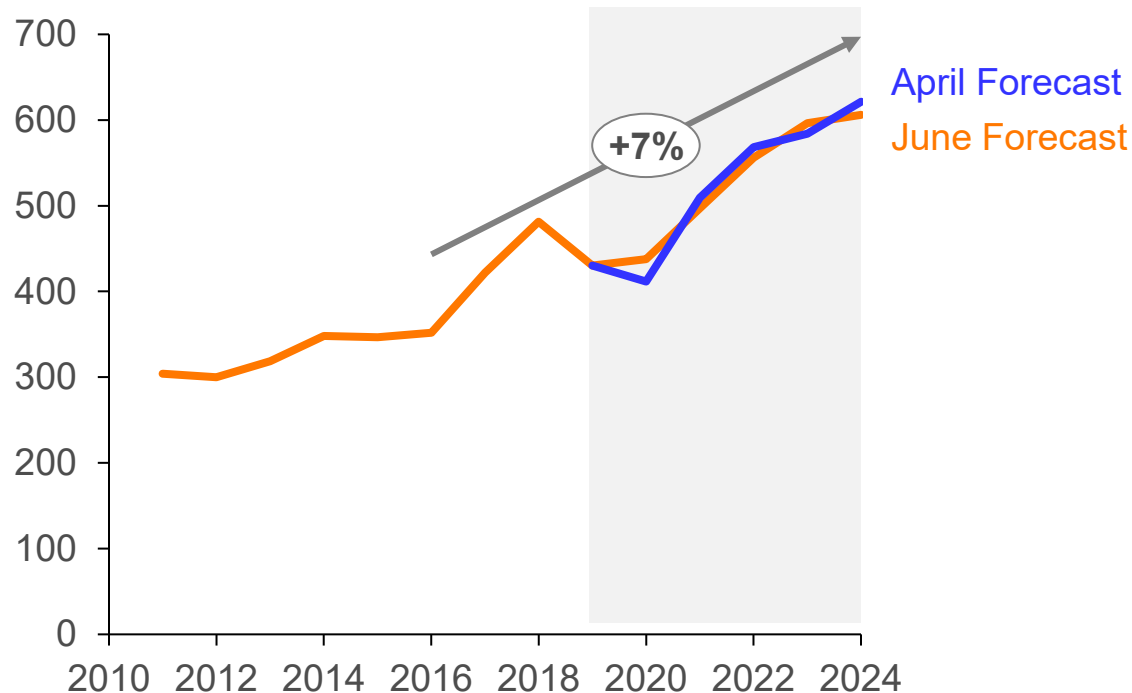
Weekly semiconductor sales compared to the same week last year.



First half of 2020 much better than first half of 2019

# Semiconductors: Long-Term View, \$Bn

Outlook for 2020 is improving



VLSI upgraded forecast for 2020 from -4% to +2%

Growth for Advanced Logic, Foundry and DRAM flat to slightly positive in 2020

Double digit growth for NAND in 2020

# Semiconductor Test

Wafer Sort

Package Test

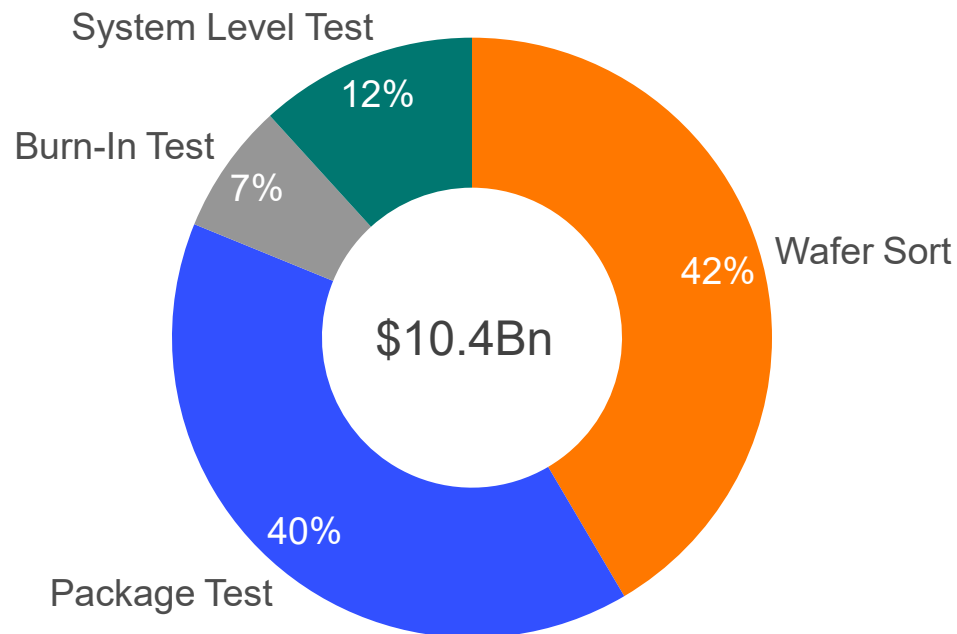
Burn-in Test

System Level Test

Multiple points where die can be tested: on wafer, in package, in module, in system

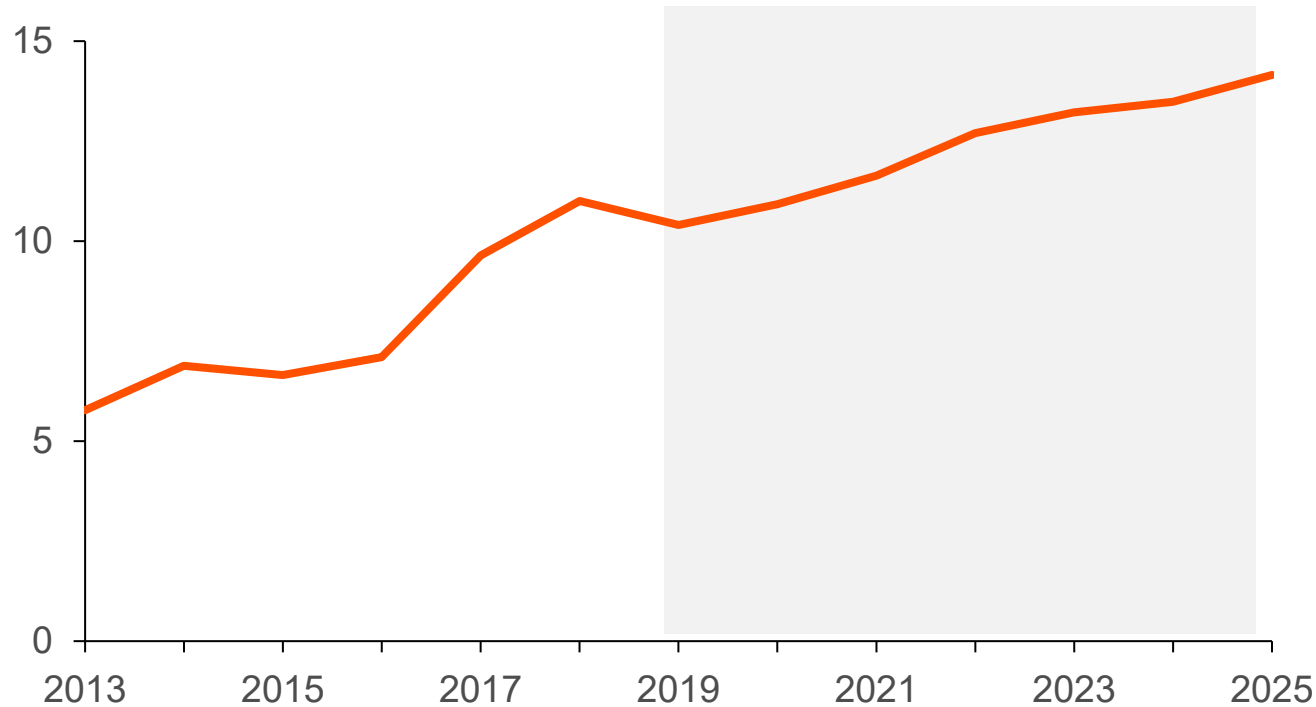
# The Cost of Test – 2019

Test hardware and consumables



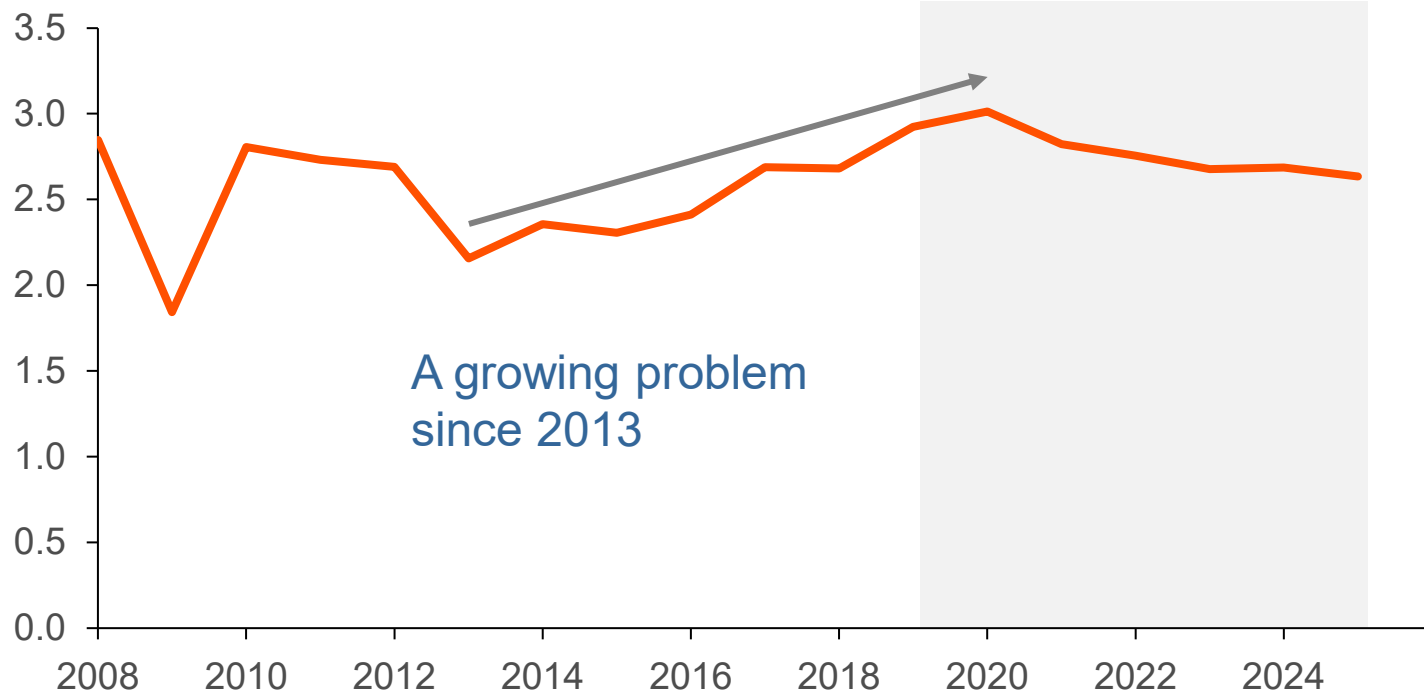
# Cost of Test: a big market and it's growing

Test hardware and consumables, \$Bn



# Cost of Test

Test hardware and consumable costs as a % of IC revenues

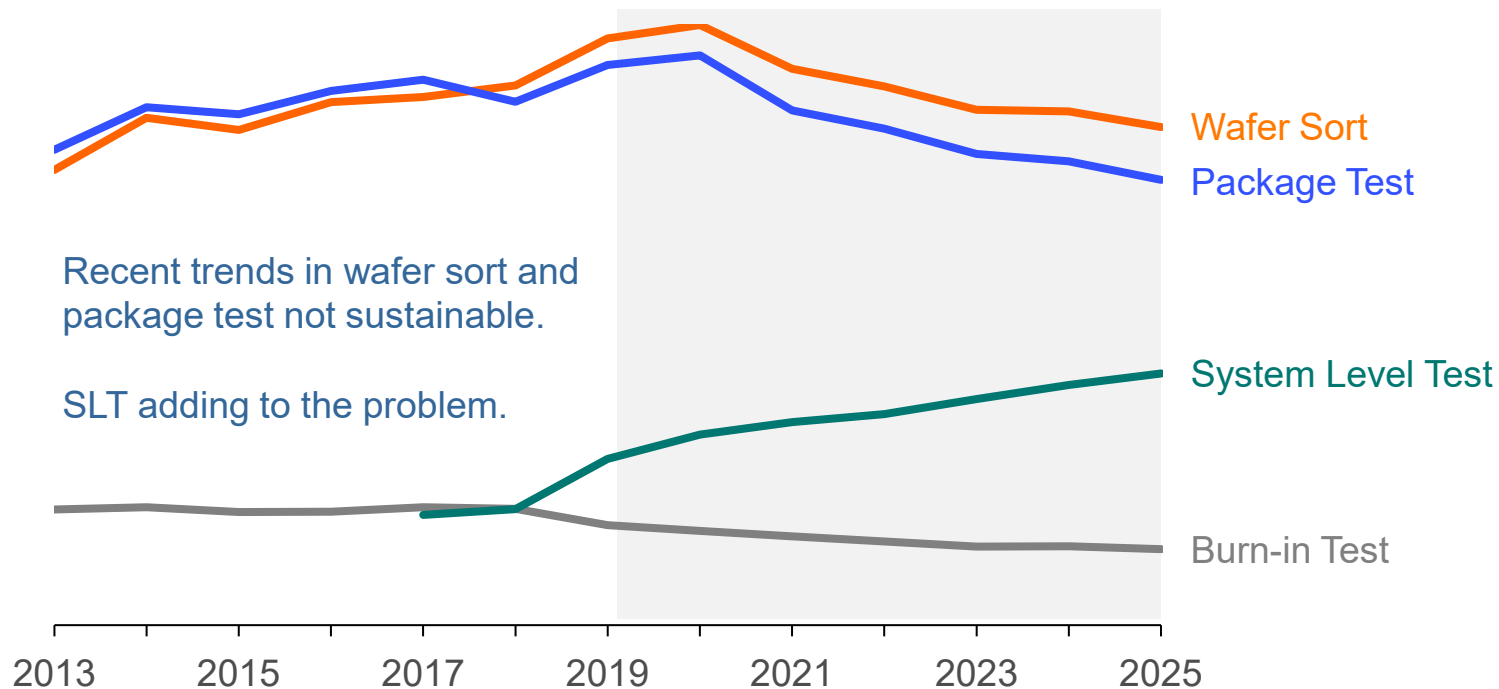


VLSI's forecast very conservative. Assumes cost of test will return to 2.5% of IC revenues



# Cost of Test

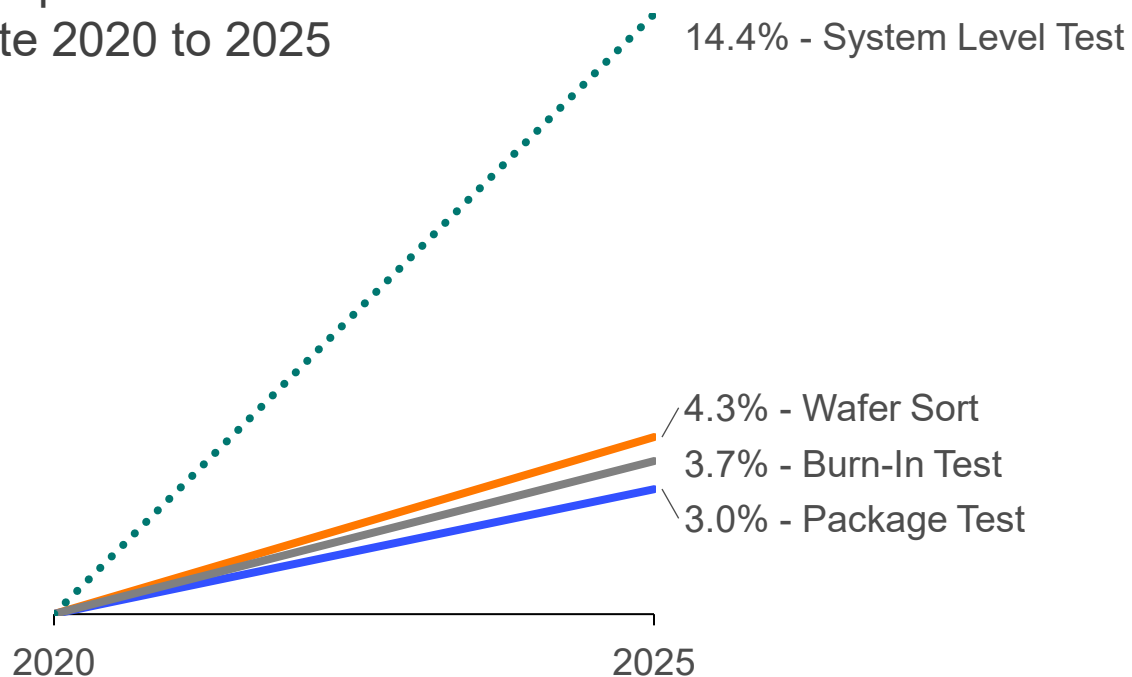
Test hardware and consumable costs as a % of IC revenues



# Rapid growth of SLT

Likely to pull existing cost structure out of shape

Compound Annual Growth  
Rate 2020 to 2025



# Measuring System Level Test Costs

The market for SLT equipment and consumables not easy to measure: until recently quite small, and suppliers not well known

SLT now entering the mainstream and attracting companies with experience in the semiconductor industry

Market likely to be in excess of \$1Bn in 2020

# Understanding the Dynamics of System Level Test Costs

- Is the recent ramp up just the start of something big, or will it take time for the first round of capacity expansion to be digested?
- Will chipmakers test some or all products?
- Can test handlers be recycled/re-used for new products?
- What are the efficiency gains to be made over time, if any?
- Will some chipmakers continue to make their own test systems?

# System Level Test Costs

Currently around \$1.0Bn

Growing at a compound annual growth rate of 14.4%  
over next 5 years

This will result in a change of the cost structure of test

# Cost has become a critical problem so what can be done?

Change in test strategy

Squeeze suppliers

Both options involve risk

# Squeezing Suppliers: Cost vs. Risk

Buyers are asking a new set of questions

Am I paying too much?

We are not happy with the existing supplier, who else should I be talking to?

We want to encourage and support new entrants. Who are good candidates?

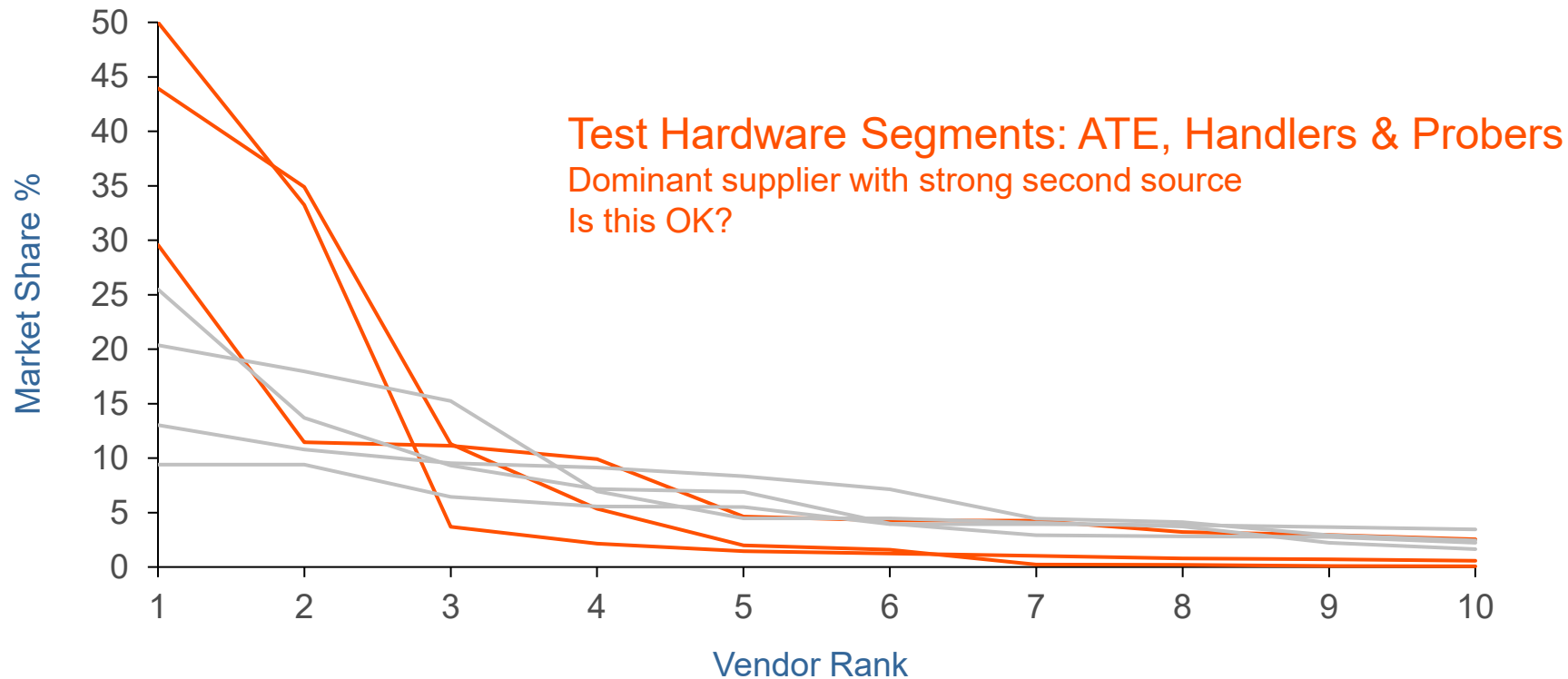
Which suppliers need help, which need to be challenged?

What type of relationships should I be having with my suppliers?

Answering these questions requires more than just numbers

# Example of Risk Analysis

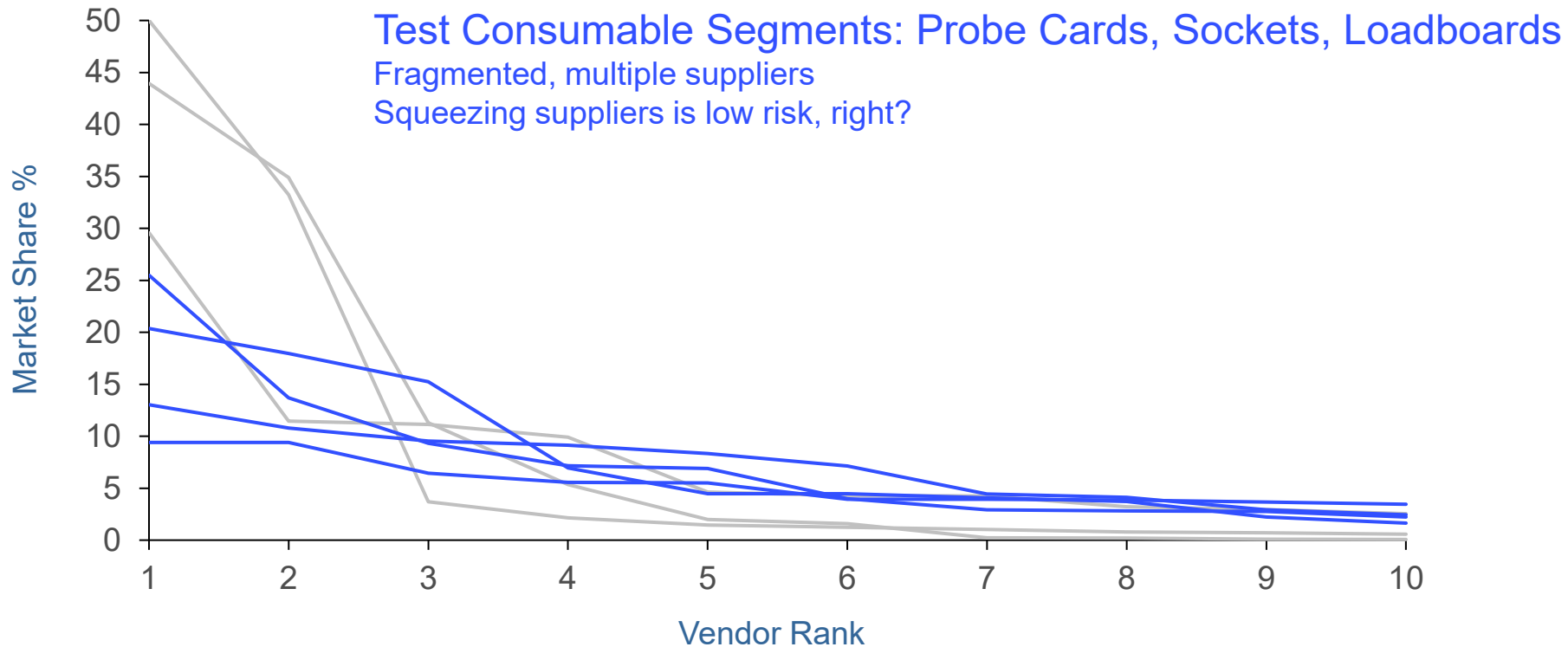
## Segment market shares by vendor rank 2019





# Example of Risk Analysis

## Segment market shares by vendor rank 2019



# The buyers' challenge

The cost structure of test is changing

You need data, data analytics, and the stories behind the data so that you can...

Identify where costs can be managed, and where they cannot

Evaluate risks and understand how they change over time

# Final thoughts

Challenges exist and are not going away

Closer collaboration between suppliers & buyers would be nice

Find solutions that you can live with



# Questions?

... and backup slides

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