MARKET CAPITALIZATION: IMPACT OF COVID ON LARGE VS. SMALL CAP AI-FIRMS

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OUTLINE

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MOTIVATION

- Global private investment in AI **exceeded $90 billion** in 2023, and it's still growing. (Source: Stanford AI Index 2024)

- **AI productivity gains** could boost global GDP by **up to 7%** over 10 years (Source: McKinsey). Companies that leverage AI will have massive advantages.
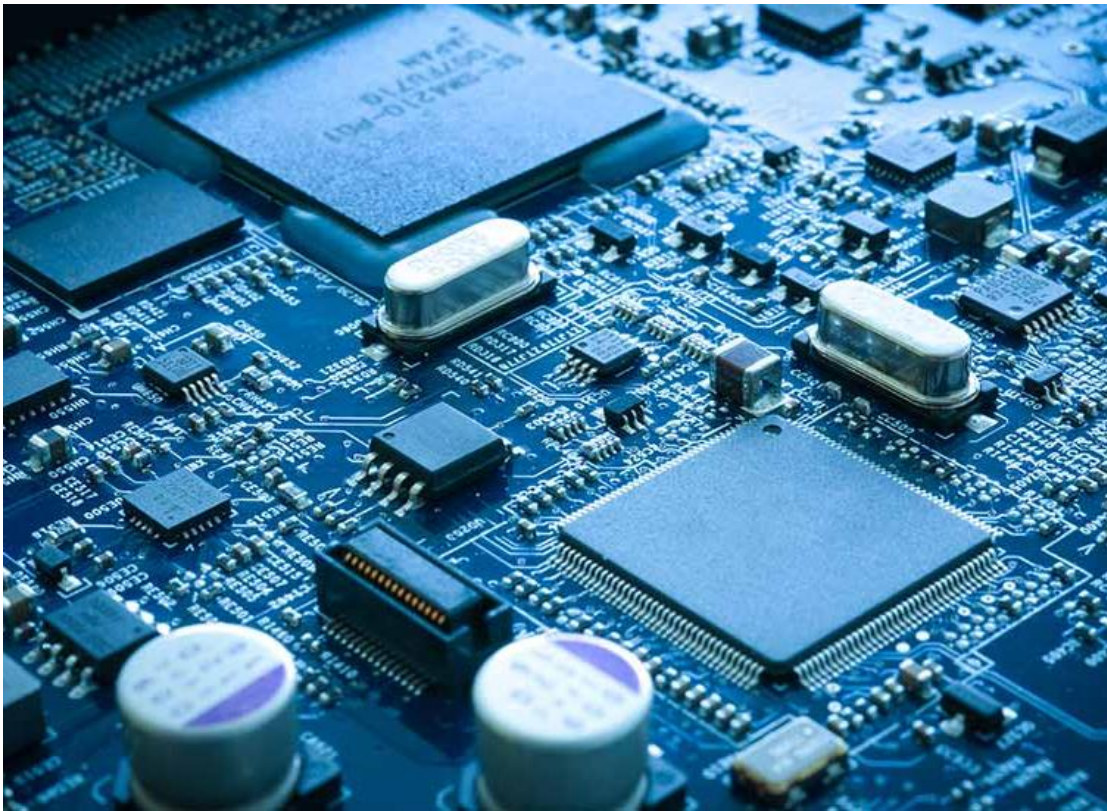
RESEARCH QUESTION

- Did small AI-adopting firms outperform large ones in the face of the COVID-19 shock?

- Understanding this dynamic provides value for investors seeking resilience in volatile markets and insights into how firm size and AI integration influence financial performance.

WHAT DOES AI-ADOPTING FIRMS MEAN?

- We define "AI-adopted firms" as those operating in sectors where AI is a core component of their products or services, such as semiconductor

- All 6 of our companies fall under the semiconductor industry

DATA

- Data from: tidyquant and quantmod packages in R

- Companies:

Large Market Cap:
- Range- $85.08 billion - $152.55 billion
- Advanced Micro Devices, Inc. (AMD), Intel Corporation (INTC), QUALCOMM Incorporated (QCOMM)
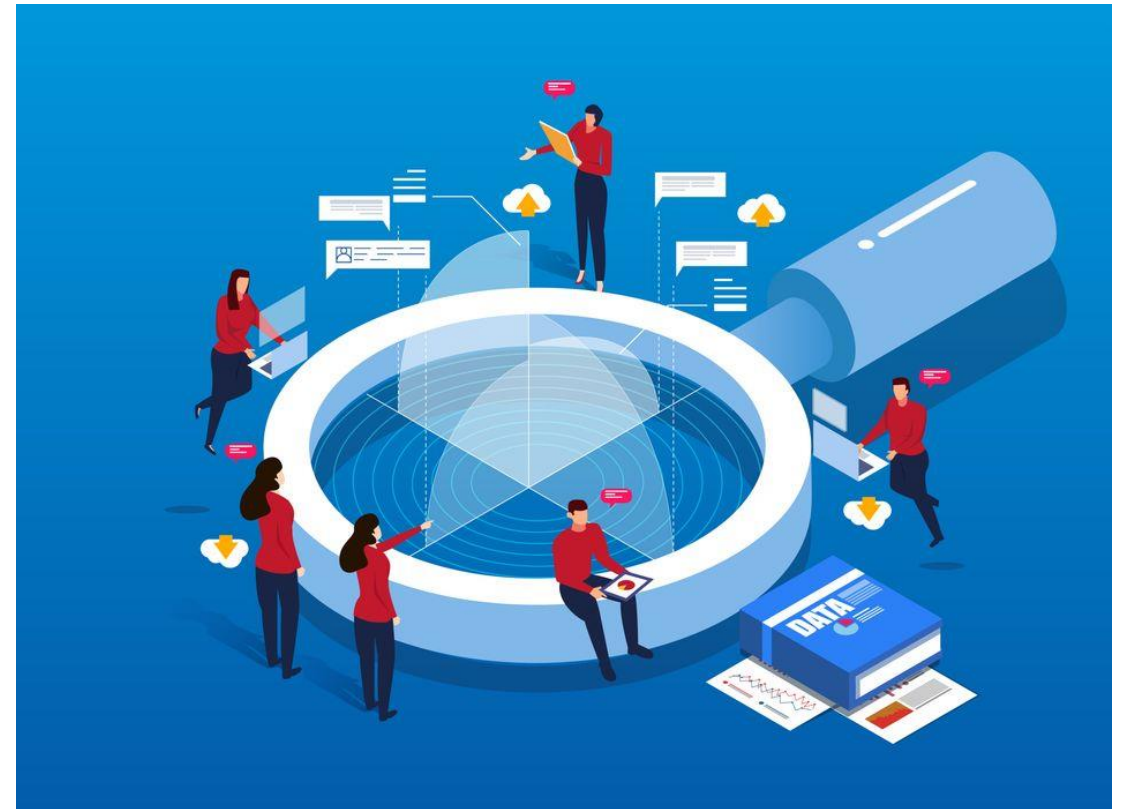
Small Market Cap:
- Range- $110.28 million - $479.76 million
- Alpha and Omega Semiconductor Limited (AOSL), Magnachip Semiconductor Corp (MX), Wolfspeed, Inc. (WOLF)

- Timeline: pre-COVID (Jan 2018- Dec 2019), during COVID (2020 Jan- 2021 June) post-COVID (2021 July- 2022 Dec).

RESEARCH DESIGN

- Comparing the growth of stocks before, during and after covid using respective stock data

- Fama french models and CAPM model to evaluate it

ANALYSIS- FF5 FACTOR AND CAPM

We selected the two out of 6 companies with high market capitalization from among large and small companies as representatives.

- Advanced Micro Devices, Inc (AMD) - Larger 139.42 billion
- Alpha and Omega Semiconductor Limited (AOSL) - Small 479.76 million
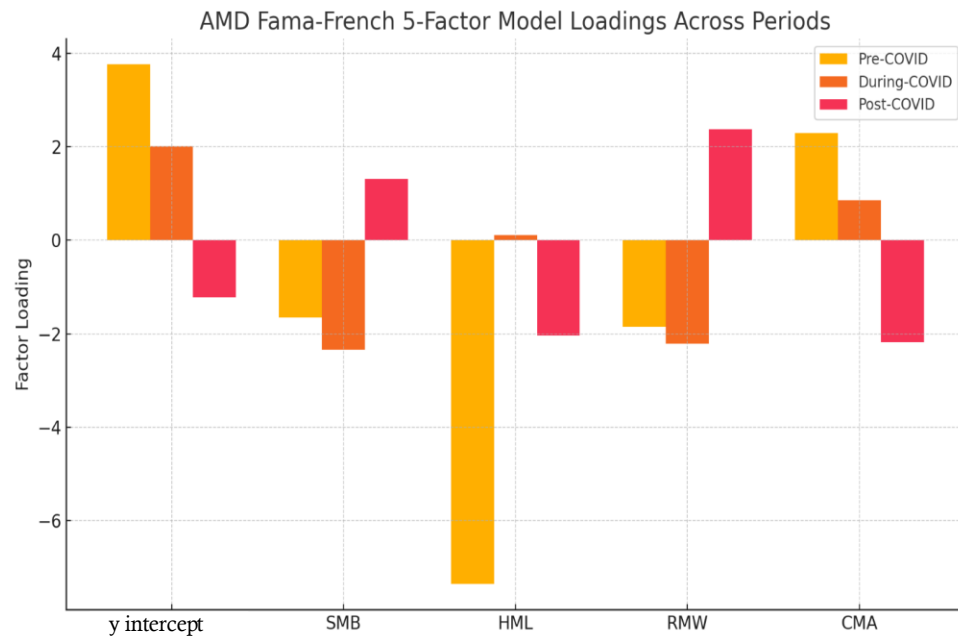
We use the CAPM and Fama French 5 Factor Model to analyze AMD and AOSL during:

Pre-COVID (January 2018 – December 2019)

During COVID (January 2020 – June 2021)

Post-COVID (July 2021 – December 2022)

ANALYSIS- FF5 FACTOR

AMD Fama-French 5-Factor Model Loadings Across Periods

AMD

- AMD was extremely market-sensitive before COVID, but became a bit more stable afterward.
- The SMB indicates that AMD behaved more like a large-cap stock, especially before and during Covid. After Covid, it slightly moved toward small-cap characteristics.
- The HML indicates AMD acted like a growth stock (negative loading on value factor) the entire time.
- The RMW indicates AMD's profitability story improved post-Covid.
- The CMA indicates AMD started behaving more like an aggressive investor post-COVID (taking more investment risks)
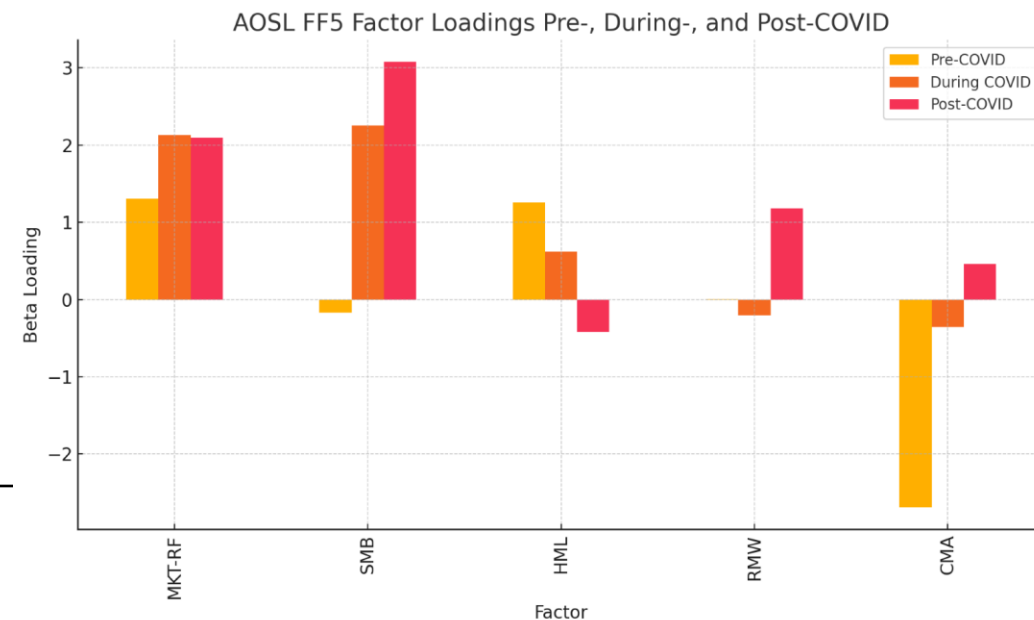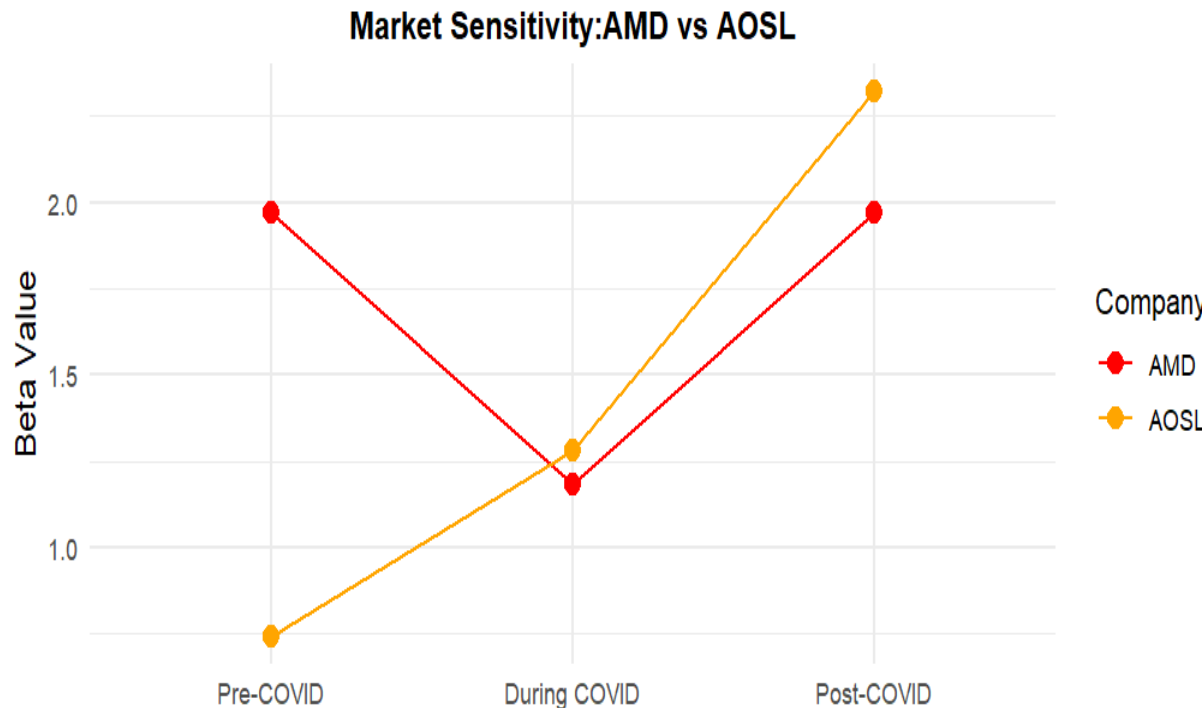
AOSL

- AOSL is less sensitive to the overall market compared to AMD.
- AOSL behaved very much like a small-cap stock, particularly post-COVID as indicated by the SMB
- The HML indicates initially value-leaning but shifts toward growth characteristics after COVID.
- The RMW indicates Profitability characteristics improved modestly post-COVID.
- The CMA indicates AOSL became less aggressively investing post-COVID.

AOSL FF5 Factor Loadings Pre-, During-, and Post-COVID

LARGE CAP VS SMALL CAP: INTERPRETING CAPM

Market Sensitivity:AMD vs AOSL

- **AMD**

-Pre-COVID has a high beta of ~2.0, which drops to ~1.2 during COVID, then rises back to ~2.0 post-COVID.

-AMD's beta dropped significantly during COVID, indicating reduced sensitivity and potentially greater stability amid market uncertainty.
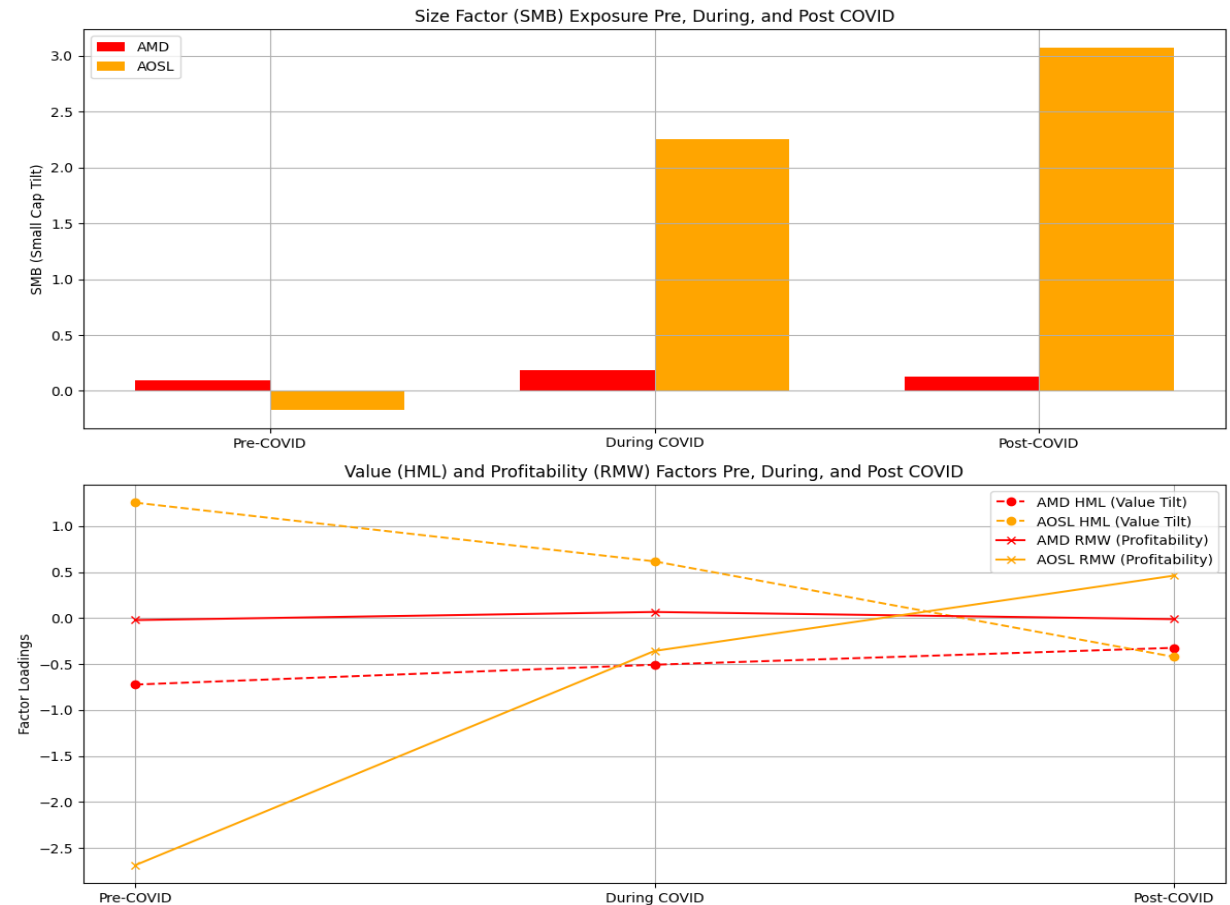
- **AOSL**

- Pre-COVID has a beta of ~0.8, which rises to ~1.25 during COVID and jumps further to ~2.3 post-COVID.

- AOSL's beta steadily increased, highlighting growing market sensitivity and supporting the hypothesis that smaller-cap firms become more volatile during and after market shocks.

FINDINGS: DID SMALL AI-ADOPTING FIRMS OUTPERFORM LARGE ONES IN THE FACE OF THE COVID-19 SHOCK?

- Yes, small AI-adopting firms like AOSL outperformed larger ones like AMD in the face of the COVID-19 shock.

- AOSL's high positive SMB exposure, HML, and recovery in profitability (RMW) post-COVID positioned it to capture stronger returns during the market rebound.

- AMD, as a large-cap, growth-focused firm, remained more stable but did not benefit as dramatically from the crisis recovery factors.

RESULTS SUMMARY

During COVID-19, the global economy experienced unprecedented disruptions that demanded rapid adaptation, innovation, and flexibility. **Small-cap companies** like **AOSL** had a structural advantage.

- **Their smaller size allowed for faster decision-making and quicker pivoting** to new technologies and supply chain adjustments.
- **Their early adoption and integration of AI,** particularly for optimizing operations, manufacturing processes, and predictive analytics, positioned them to be more resilient and opportunistic during volatile times.

Meanwhile, **larger firms like AMD**, while leaders in AI at the chip design and infrastructure level, faced greater inertia:

- Their **global scale and more complex operations** made them slower to adjust to pandemic disruptions.
- Larger firms often have existing legacy systems that make it harder to fully leverage AI across all business units quickly during crises.

THANK YOU