Reviews of ECONJOURNAL-D-23-00027R1

Operating Efficiency in the Capital Intensive Semiconductor Industry: A Nonparametric Frontier Approach

Round 1

Reviewer 1

The paper is well written and investigates an interesting topic, because the empirical work looks at a very important industry which is at the heart of technological progress and innovation, and raises concerns from policy: anti-dumping cases and antitrust cases more in particular. The latter due to high entry barriers, driven by substantial capital expenditures (CAPEX constraint) necessary to get in business.

The paper addresses the efficiency of different business models that the OEM's use. The methodology is non parametric and extensively explained. Far too extensively for the issues that are addressed in the empirical part. As a matter of fact, the methodology section(s) could stand alone as a survey of non-parametric approaches to efficiency estimation.

My essential problem with this paper is that I have a hard time to see where it is getting at. On the one hand, the fabless business model could reduce the aforementioned policy issues of dumping in external markets investigated by the WTO, as well as the antitrust concerns raised in both the US and Europe (at least 6 convictions for cartel agreements with the companies in the data set). On the other hand, the integrated players (IDMs, where the policy concerns are), are more efficient. So, is the idea to argue that there is a trade-off between allocative and technical efficiency?

It seems obvious that the IDMs are more efficient: why would they otherwise solve the CAPEX constraint to face hundreds of millions of fines for misconduct? That is the concern with the paper if read from an economics perspective.

But when reading the paper as a management scientist, similar concerns emerge. It seems obvious that an integrated business model outperforms the fabless model in this industry. Besides the transaction costs to go over the market, the industry is well known for having first production runs with many flaws in the wafer foundries. If Apple buys Integrated circuits (ICs) of a new type for its latest release of an i-phone, and it has to call back thousands of i-phones because the ICs in it do not perform, this is very costly. So Apple, as a buyer, will be less inclined to run that risk, preferring purchases from IDMs. The fabless business model has successfully been implemented in the fashion industry, where design is done by a few renowned couturiers while production of the clothing takes place elsewhere. But if there something goes wrong with the design, it quickly will show up, leading to less costs afterwards.

While in general the writing is good, there are typo's: I just mention some:

On page 7, 4 lines below equation (2?4), varying

On page, page 9, first line after section 2.2, trivial

On page 13, last paragraph, second line : As the barriers to entry, which rely (not relies) heavily

a.s.o.

Reviewer 2

The paper proposes an empirical application based on a recent nonparametric production frontier approach. Too many technical details are provided while the empirical application is too short.

I have the following comments:

- There are four kinds of commonly used efficiency measures based on different directions in which the distance is calculated: what are the four types ?

- Section 2.1 is difficult to read; too many concepts are explained. I suggest rewriting this section with only concepts you use.

- The same holds true for Section 3

- I think it is better to explain the intuition; consider also to provide technical details in the Appendix.

- Also say clearly what are the variables x y x X Y etc.

- How to you deal with the fixed input ?

- Do you assume that the technology is fixed over time ? what about technological change ?

- Do you assume that all firms have access to the same technology ? many previous works have shown the opposite (e.g. Walheer B., He M., Technical efficiency and technology gap of the manufacturing industry in China: Does firm ownership matter? World Development 127, 104769).

- I do not see why dimension reduction is needed. A setting with 2 outputs and 5 inputs is rather standard in DEA or FDH methods.

- Why the hyperbolic measurement is the best in your case ? what measurements have been used before ? What is the connection with the economic objective of the firms ?

- It is strange to see equations in the results section.

Round 2

Reviewer 2

The paper has improved as a result of the revision process.

My concerns are the following:

- there are still too many technical details in Section 2 making that section too long. Why not merging all sub-sections and remove less important discussion.

- a contrario Section 3 is quite short; this is an empirical paper.

- I am still not so sure about the benefits of using a PCA before doing DEA. I would be nice to see the results of a standard DEA model in your case.

- No policy recommendations in the Conclusion ?

- why selecting the sample means for the directions ?