An Analysis of First Solar's Situation Through an Economic Lens

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A central theme in economics involves studying how decisions are made, be they at the level of an individual, a firm, or a nation. The sub-discipline of industrial organization focuses specifically on how certain features of the industry market structure influence a firm's decisions.

First Solar is currently in an interesting position from an industrial organization point of view. Firstly, it is a leading manufacturer in the solar panel industry; its success has been in part due to its uniquely differentiated technology that offers key advantages over the competition. This positive aspect leads to the potential of becoming a dominant firm in regional markets.

Secondly, First Solar competes alongside the rest of the solar industry within the broader energy sector against alternative sources of electricity generation. Although fossil fuel sources have been historically dominant, the sector appears to be poised for major disruption over the next couple of decades as renewable sources, including solar, become more cost-efficient. From First Solar's point of view, this positive trend represents an important opportunity for growth.

Thirdly, there is heavy competition among all renewable energy, and even within the solar industry there is heavy competition among substitute products. The relative advantages and disadvantages of these substitutes tend to be complex in nature and may not be easily digestible by the typical consumer. The resulting information problem on the consumer side is a potential concern to be mindful of, as it could create a situation in the future where success in the market depends more on first-mover advantages instead of objective product superiority.

Because of its dominant firm potential, the coming disruption in the broader energy sector, and the possible consumer-side information challenge on renewable energy, First Solar should consider aggressive expansion strategies to reach new markets, which would likely include strategic mergers and acquisitions.

According to economic theory and historical precedent, a "dominant firm" is recognizable by its large market share typically caused by superior efficiency, differentiated product, or first-mover advantage. Because of its status, a dominant firm has disproportionate market power to affect prices by adjusting its own level of output, while the so-called "competitive fringe" has little if any market power and must take prices as given.

Of additional importance, in markets where demand is relatively elastic, the dominant firm can sometimes drive out the competitive fringe if it is able to sufficiently lower its marginal cost[1]. This happens because the dominant firm would be able to profitably charge a lower price than the minimum competitors would be able to accept without incurring losses. This is especially applicable to First Solar's situation, since the demands for individual sources of electricity are likely to be elastic; consumers want the cheapest energy available, and will switch en masse to substitute sources - e.g. from coal to solar - if the price is even only slightly lower.

First Solar's use of cadmium telluride ("CdTe") in manufacturing has proven to be a serious alternative to the conventional crystalline silicon used by the vast majority of competitors. As noted in the firm's most recent 10-K, CdTe solar modules deliver "higher real-world energy yield" and "long-term reliability", and the manufacturing process is cheaper compared to crystalline silicon panels.[2] Furthermore, First Solar's vertical integration across "substantially the entire solar value chain"[3] provides an additional edge over most competitors. Finally, First Solar has stood to gain relative to competitors from tariffs imposed by the United States in January 2018 on crystalline silicon imports that happened not to include CdTe. These factors in combination are contributing to First Solar's dominance and should offer a serious advantage when competing to enter new regional markets.

In the past, rapid technological developments have provided scope for novel strategies that enabled corporations to gain significant advantages. One recent and somewhat extreme example is that of Microsoft back in the beginning of this century. The company already had power in the market for operating systems, as Windows was practically ubiquitous at the time. However technology was quickly developing and a complementary market for web browsers soon formed. Microsoft was successfully able to use its existing market power in operating systems to break into the new market for browsers by bundling its operating system, Windows, with its own browser. Although there were other browsers that competed with Microsoft's, the company had a near monopoly on operating systems, and because of its bundling policy, all customers who used Windows would automatically have Microsoft's web browser and thus would have no need to pay for a rival browser service. This resulted in Microsoft overtaking the browser market without necessarily needing an objectively superior product.

Although Microsoft's actions were deeply controversial and argued extensively in *U.S. v. Microsoft* (2001), important lessons can be taken from how the firm leveraged a core capability to jump into other markets. As noted in First Solar's most recent 10-K, "we are focusing on opportunities in which our PV solar energy solutions can compete directly with traditional forms of energy generation on an LCOE[4] or similar basis".[5] This is precisely correct, and additionally it might be beneficial for the firm to consider if it can apply its expertise in industrial-scale uses of CdTe or thin-film solar technology to new adjacent markets that may already exist today or develop in the future. To give one loosely related example, the firm Heliogen recently managed to use solar-related technology to break into markets for manufacturing processes as an alternative heating method, a completely novel development.[6]

Path-dependence in economics refers to the phenomenon where consumer choices in the past overbearingly dictate their choices in the future, even if there is no objective merit to their earlier decisions. To give a classic theoretical example, suppose there is an urn that starts with two balls - one green and one red. Each time, one ball is randomly selected from the urn, and as it is placed back, a new ball is added of the same color as the one selected. With each iteration, the system becomes increasingly path-dependent on whatever random outcomes occurred in the beginning. Figure 2 in the appendix shows how repeated trials of this procedure can result in any range of essentially random outcomes.

In the real world, this could well be modeled by two rival energy companies offering substitute energy generation products to a brand new regional market. Suppose that the differentiation between the two products is complex and it is not easy for the typical consumer to accurately assess the superiority of one over the other. The very first consumer arbitrarily picks one, and after seeing it work for a week or two, other consumers become more likely to choose the very same one as well. In this fashion, as time goes on, the market may end up being dominated by one or the other product, without regard for the objective quality difference between them.

In First Solar's 10-K, the firm mentions that "solar module manufacturers compete with one another on price and several module value attributes, including wattage, energy yield, and reliability, and developers of systems compete on various factors such as net present value, return on equity, and LCOE".[7] With so many factors to balance when evaluating the objective superiority of one solar product to another, it is not difficult to imagine the median consumer being somewhat overwhelmed and simply arbitrarily choosing what their friends, relatives or

business partners chose, even if it is not actually the best product. Furthermore, for the average consumer, it might be difficult to effectively compare the cost of a solar system with the cost of receiving energy from the local utility company, because while the former is priced by wattage capacity, the latter is priced by actual energy usage in kilowatt-hours. The two are not directly comparable, hence the development of new, more involved metrics such as LCOE. This all leads to the possible concern that when engaging in new markets, First Solar may find it more difficult than expected to clearly establish the superiority of its product over that of a competitor. However, this risk can be strongly mitigated by being the first-mover into a market, and for that reason First Solar should consider making that a strong priority, and even taking aggressive steps if necessary to accomplish this goal.

Because of its dominant firm potential, future possibility for rapid new market growth, and possible path dependence in these new markets, First Solar should contemplate a strategy that includes aggressive expansion, perhaps through mergers and acquisitions.

As a brief mention of future research to consider, many new emerging markets for solar energy may quickly develop in Africa over the next ten years. As part of a long-term strategy, it would certainly be in First Solar's interests to keep an eye on these; as African countries industrialize, they will generate large demand for electricity. Optimistically, if already industrialized countries offer subsidies in the future to renewable energy efforts in Africa, that could represent a realistic growth opportunity for a company such as First Solar. There would likely be heavy competition in such a situation, so it would be beneficial to be one of the first movers into those markets. For this reason, proactive market research efforts and risk evaluation might give First Solar an advantage in this regard.

Endnotes

[1] See Figure 1 in the appendix for a depiction of the dominant firm-competitive fringe model.

[2] "First Solar Form 10-K for the Year Ended December 31, 2018". Page 3.

[3] "First Solar Form 10-K for the Year Ended December 31, 2018". Page 4.

[4] LCOE: Levelized Cost of Energy is a metric used to compare the costliness of different sources of electricity.

[5] "First Solar Form 10-K for the Year Ended December 31, 2018". Page 51.

[6] https://heliogen.com/

[7] "First Solar Form 10-K for the Year Ended December 31, 2018". Page 50.

References

Arthur, Brian. Increasing Returns and Path Dependence in the Economy. University of Michigan Press, 1994. Print.

Carlton, Dennis and Perloff, Jeffrey. Modern Industrial Organization. Fourth Edition, 2005. Print.

"First Solar Form 10-K for the Year Ended December 31, 2018". https://investor.firstsolar.com, last accessed on 11 November 2019.

Appendix

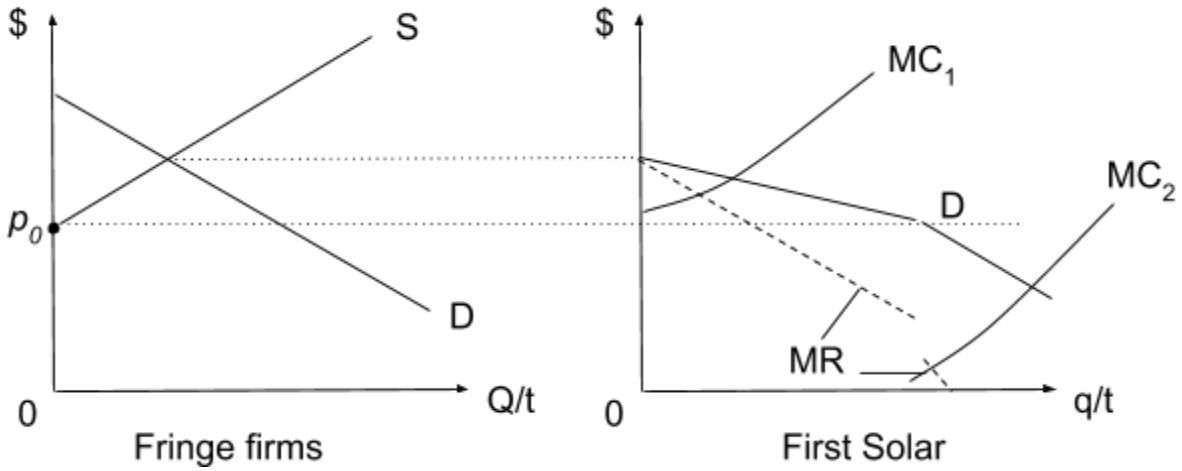

Figure 1: If First Solar, as the dominant firm, can lower marginal cost to MC_2, it maximizes profit by charging a price lower than p_0, when the fringe will exit the market to avoid losses. Adapted from p. 114 of Carlton and Perloff's 2005 Modern Industrial Organization, 4th Edition.

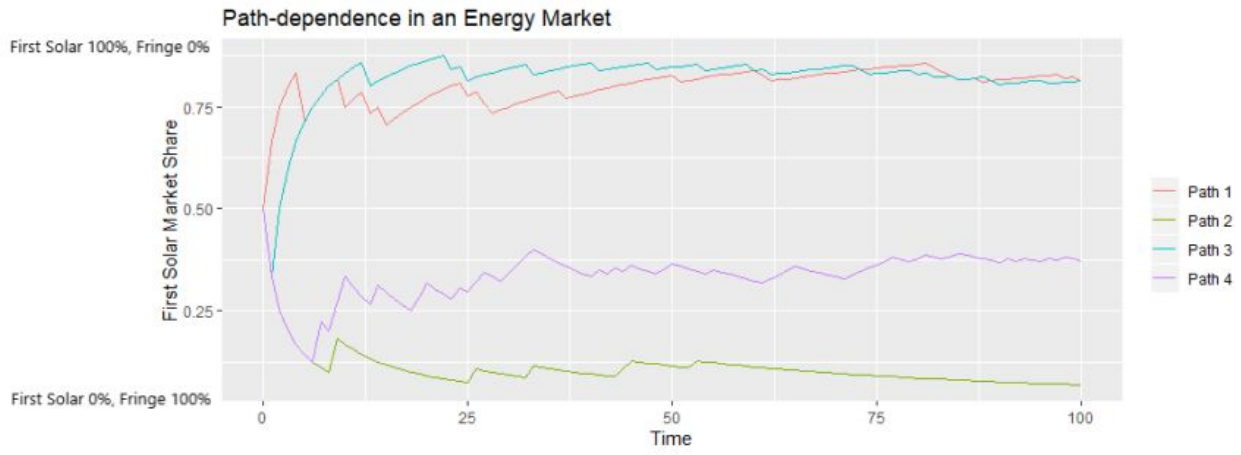

Figure 2: Each line traces a possible path in a market where consumer choices are made arbitrarily at first, but become increasingly dependent on past decisions as time goes on; the ultimate converging outcome is random. Created with R. Adapted from p. 37 of Brian Arthur's 1994 Increasing Returns and Path Dependence in the Economy, University of Michigan Press.