Pacific Biosciences (PACB) / Ilumina (ILMN)

Merger - update

Outstanding approvals to the proposed transaction include FTC, and CMA.

- For antitrust review, we believe that there are two sticking points that will be central to antitrust review: i) product market definition, ii) potential for bundling (short- and long- read solutions).

i) product market definition:

- Based on our understanding of the industry, short- and long-read products/solutions are complementary, and it appears that currently there is limited substitutability between the two methods.
- Also, there are some significant differences between the two products/solutions, e.g. in terms of price, accuracy, etc.
  - We note that PACB's SMRT technology intends to address limitations of previous sequencing technologies (including ILMN); however, PACB's current Sequel product is disadvantaged by its higher costs.
    - In terms of price, we understand that ILMN's SBS product cost approximately $1, 000 per genome, which is 1/6 – 1/7 of the Sequel's cost today.
- To argue in favor of a single product market definition, regulators (and complaining parties) might argue that the two markets (short- and long- read products/solutions) will converge (in the future) as to their application as PACB's products become affordable and therefore viable in more clinical areas.
  - As per available data, addressable long-read market was estimated to be $660 million (as at 2017), while it is estimated to be growing to about $2.5 billion in 2022.
    - We note that part of the growth might be in in clinical areas that currently use short-read applications, meaning that long-read solutions might replace short-read solutions.
      - As such, we note that regulators might view PACB as a future competitor to ILMN.
  - As per our understanding, we note that FTC usually applies a 2-year approach in their analysis of potential future competition.
    - In connection to this, we believe that currently the highest hurdle is PACB product's price.
  - In other words, the question is whether regulators might argue that PACB's future product (in 2 years) will be able to replace ILMN (rather than being seen as its complementary product).
    - But, we are skeptical that regulators might have a strong case arguing that PACB's product will achieve a price level that will make it generally affordable to customers.
      - We note that such price decrease in price is subject to further development and improvement of its current technology/chip; and we believe that regulators might find it difficult to take a view on PACB's R&D capabilities.
        - On the opposite, it might be argued that PACB's development might require additional costs, and ILMN might be a stronger platform.
      - As we mentioned above, difference in costs of the two products is still large (and we believe that such gap in pricing might not vanish so rapidly).

i) bundling

- In terms of potential bundling, we believe that there are two questions:
  - *Whether the combined entity will have an incentive to bundle?*
    - We note that during M&A call, cos. explicitly stated that their (ILMN) customers would benefit from long-read solutions.
  - *Whether regulators can build and model a case that such bundling will be anticompetitive?*
    - As a result of the proposed merger, regulators might be concerned that proposed packages will be priced in a way to attract customers to buy the combined product, thus increasing market share of the combined entity in both markets.
      - This can potentially reduce profitability of competitors and lead to competitors exiting the market.
    - In connection to this, we find some similarities to GE/Honeywell case – in case of GE, it was argued that GE's dominant position in its respective market will enable the combined entity to effectively introduce product bundles (similar to ILMN's position in short-read).
      - However, we believe that a hurdle for antitrust authorities to build and model a case that a proposed deal is anticompetitive (as a result of potential bundling) is high; and we believe that significant input has to come from complaining parties (as it was the case in GE/Honeywell deal).
    - **Competitors:** as we further discuss in our report, we believe that competitors have strong incentive to file complaints about the proposed deal; however, we note that PACB's competitors are mainly small players (e.g. Oxford Nanopore, BGI of China, and others) that might not have sufficient leverage.
    - **Customers:** from theoretical view, it might be argued that customers might favor decrease in prices in short-term; however, we believe that customers might be concerned that the proposed transaction will results in limited number of suppliers in mid- to long- term.
      - In practice, we understand that there are limited concerns from customers about the proposed transaction as ILMN is viewed as a better platform to develop PACB products as compared to its standalone perspective.

From trading perspective, we still believe that current spread is tight, and there might be some spread-widening as we entered comment period by third parties (which might voice their concerns related to the proposed transaction). We currently see limited potential for spread tightening unless the cos. receive regulatory approvals (which are not expected earlier than mid-2019).

Deal Terms

1 PACB = $8.00 in cash per share

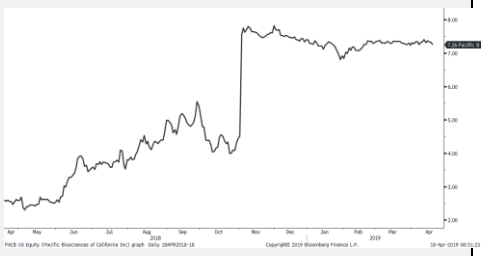
Target: Pacific BioSciences

Country	U.S.
Bloomberg	PACB
Sector	Life Science Eq
Share price ($)	7.26
Market cap ($m)	1,008
Free float (%)	~93

Acquirer: Ilumina

Country	U.S.
Bloomberg	ILMN
Sector	Life Science Eq
Share price ($)	318.69
Market cap ($m)	47,003
Free float (%)	~100

PACB share price (last 24 months)



Status

CMA comments invitation: April 17, 2019

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Deal update

We understand that the proposed transaction is subject to FTC, and CMA approvals:

- At a Special Meeting of Stockholders held on January 24, 2019, the Company's stockholders approved the Agreement and Plan of Merger with Illumina, Inc.
- Company and Illumina have received a request for additional information and documentary material, commonly referred to as a "second request," from the United States Federal Trade Commission (the "FTC") in connection with the merger.
- As at April 17, CMA invited comments on ILMN/PACB transaction.
  - The Competition and Markets Authority (CMA) is considering whether it is or may be the case that this transaction, if carried into effect, will result in the creation of a relevant merger situation under the merger provisions of the Enterprise Act 2002 and, if so, whether the creation of that situation may be expected to result in a substantial lessening of competition within any market or markets in the United Kingdom for goods or services.
- The Company and Illumina continue to expect the merger to be completed in mid-2019.

CBR view

ANTITRUST ANALYSIS

Introduction

In this report, we further extended the analysis of our initiation report, further elaborating on the aspect that we believe are central to the antirust analysis of the proposed deal.

- In terms of antitrust review, we have already provided an extensive analysis in our initiation report. As we outlined in our initiation report, we believe that there might be two sticking points that will be central to antitrust review: i) product market definition, ii) potential for bundling (of short- and long- read solutions).
  - **i) Product market definition**
    - If regulators consider ILMN's and PACB's products/solutions in DNA sequencing as part of the same product market, regulators might view the proposed transaction anticompetitive as it will increase concentration in the industry.
      - As we already discussed in our previous report, Illumina is the biggest manufacturer of gene sequencing machines and consumables used in gene sequencing while; as per available data, we understand that ILMN machines have been used to perform 90% of all sequencing done to date (as at 2014).
        - As per our reading, we understand that there were around 11,000 ILMN machines while there were approximately 425 PACB machines (as at November 2018).
      - As per available data, ILMN's market share in DNA sequencing products/solutions has been estimated in past years to be in the range from 60 to 90 per cent.
      - Pacific Biosciences is a niche player in the long-read space; while we estimate that PACB had a market share of ~14% (as at 2017) of the addressable high-read market (total opportunity for the long-read application was estimated to be $660 million in 2017).
    - However, we believe that long- and short-read products/solutions are unlikely to be considered as part of the same product market as:
      - Based on our understanding of the industry, short- and long-read products/solutions are complementary, and it appears that **currently** there is limited substitutability between the two methods.
        - In practice, we understand that best results can be achieved via the combination of the two methods; and it is often the case that companies apply both short- and long- read products/solutions.
          - On the other hand, we understand that there are certain clinical areas where only one method might be applied (subject to some technical limitations).
        - Also, there are some significant differences between the two products/solutions, e.g. in terms of price, accuracy, etc.
          - Overall, we understand that short-read sequencing products/solutions provide lower high throughput and low cost per identified base; however, their disadvantages include limited read length which might lead to higher likelihood of representation bias.
            - We note that PACB's SMRT technology intends to address such limitations of previous sequencing technologies – by providing long read lengths, the Sequel System and previously PACB's RS II System (which is no longer manufactured) provide more comprehensive information which limits accuracy issues.
          - However, we understand that PACB's current Sequel product is disadvantaged by higher costs; and we note that high cost of the Sequel product has been a barrier for PACB to further increase its market share.
            - But, it might be argued that faster technological advancement might actually make PACB's Sequel become more viable.
              - In terms of affordability of the PACB's Sequel product, we understand that development of SMRT Cell 8M chip and platform, the Sequel® II System might further decrease a cost

of PACB's product. In terms of the new chip, we understand that is about to launch in second quarter 2019.

- In terms of price, we understand that ILMN's SBS product cost approximately $1, 000 per genome, which is 1/6 – 1/7 of the Sequel's cost today.
  - We note that ILMN has been continuously decreasing the cost of sequencing a human genome (down from $10 million in 2000s); and ILMN's DeSouza said it he expects that Illumina will be able to eventually lower the cost per genome to $100 per person.
    - As we understand, ILMN makes money by selling machines and also other products that are needed to run them (e.g. reagents, etc.).

- To argue in favor of a single product market definition, regulators (and complaining parties) might argue that the two markets (short- and long- read products/solutions) will converge (in the future) as to their application as PACB's (and other players') products become more affordable and therefore viable in more clinical areas.
  - As per available data, addressable long-read market was estimated to be $660 million (as at 2017), while it is estimated to be growing to about $2.5 billion in 2022.
    - We note that part of the growth might be in in clinical areas that currently use short-read applications, meaning that long-read solutions will replace short-read solutions (subject to product affordability).
      - From this perspective, we note that regulators might view PACB as a future competitor to ILMN; and might argue that removing PACB as a competitor would impair potential future competition between the merging parties.
        - We have seen in case of Synergy Health/Steris (2014) that the FTC challenged the proposed US$1.9 billion merger of Steris Corporation and Synergy Health plc on the grounds that it would impair potential future competition between the merging parties.
          - The FTC argued that the acquisition of a potential competitor violates Section 7 if (1) the relevant market is highly concentrated; (2) the competitor "probably" would have entered the market; (3) its entry would have had pro-competitive effects; and (4) there are few other firms that can enter effectively.
            - In Synergy Health/Steris case, the court's analysis of the evidence focused on the second prong of the FTC's theory — whether, absent the acquisition, Synergy probably would have brought its x-ray sterilization technology to the United States within a reasonable period of time.
          - Judge Polster concluded that the FTC had failed to show that it was likely to succeed on the merits and denied the FTC's motion.
      - In terms of potential future competition, The 2010 Merger Guidelines recognize the actual potential competition theory and explain that, "if one of the merging parties has a strong incumbency position and the other merging firm threatens to disrupt market conditions with a new technology or business model, their merger can involve the loss of actual or potential competition.
  - As per our understanding, we note that FTC usually applies a 2-year approach in their analysis of potential future competition.
    - In other words, the question is whether regulators might argue that PACB's future product (in 2 years) will be able to replace ILMN's products (rather than being seen as complementary product).
      - In precedent cases, regulators argued that transaction violated Section 7 if, among others, the competitor "probably" would have entered the market.
        - In connection to this, we believe that currently the highest hurdle is PACB product's price.
          - But, we are skeptical that regulators might have a strong case arguing that PACB's product will achieve a price level that will make it generally affordable to customers (and to make customers switch from ILMN to PACB).
            - We note that such price decrease in price is subject to further development and improvement of its current chip; and we believe that regulators might find it difficult to take a view on PACB's R&D capabilities.
          - Also, we note that price difference between the two products is still large – as we understand, ILMN's product is at $1,000 per genome while PACB is currently priced at 6x – 7x times higher.
        - Also, we note that it might be argued that PACB's product development might require additional R&D investments; and ILMN might be a stronger platform to bring such product to the market.
          - In connection to that, we note that PACB has had negative FCF in past years, while development of new chip will certainly require additional R&D investments.

- Based on the above, we currently attach >90% probability that antitrust authorities will not consider PACB and ILMN part of the same product market in DNA sequencing.

- If regulators consider ILMN's and PACB's products/solutions in DNA sequencing as part of the same product market, regulators might view the proposed transaction anticompetitive as it will increase concentration in the industry.
    - As we already discussed, PACB might be viewed as an innovative player, which might disrupt existing competitive environment.
        - In such case, we believe that regulators will view the proposed transaction as anticompetitive.
            - And, we believe that there is limited room for any remedies; as structural remedies don't seem to be an option while behavioural remedies might be argued to be difficult to enforce.

- We note that regulators will consider also non-horizontal effects of the proposed transaction.
    - **ii) Potential for bundling** (of short- and long- read solutions)
        - We believe that potential non-horizontal issues will be central to the antitrust review of the proposed transaction.
            - In our view, regulators might be concerned that the combined entity will be able to offer a package of products (that includes short- and long- read solutions).
                - As a result of the proposed merger, regulators might be concerned that proposed packages will be priced in a way to attract customers to buy the combined product, thus increasing market share of the combined entity in both markets.
                    - This can potentially reduce profitability of competitors and lead to competitors exiting the market. In other words, it can be argued that availability of bundles (and pricing of packages at discount to standalone products) might lower incentives for competitors to compete in such market.
                        - In short term, competitors might see decrease in profitability.
                        - While, in mid- to long- term, competitors might weigh a decision as to whether continue to participate in such competition.

Bundling

Introduction

In terms of bundling, we believe that there are two questions

- **Whether the combined entity will have an incentive to bundle?**
    - In terms of this, we believe that regulators might have arguments that cos. will have an incentive to bundle.
        - Companies have stated in the M&A call what "we're hearing from our customers is that there are segments of the clinical market where long-read technologies do add value substantially".
            - Therefore, companies explicitly stated that there is a potential for cross-selling of PACB's products to its current customers.
                - Companies might argue that bundling has not occurred in the industry; but we believe that regulators are likely to raise concerns that a combined entity might have an incentive to bundle products post-deal.
- **Whether regulators can build and model a case that such bundling will be anticompetitive?**

Precedent deals

We note that there is limited number of cases, in which regulators argued that bundling (as a result of a proposed transaction) will lead to anticompetitive effects.

- As an example, **we find EC's decision in 2001 in relation to GE/Honeywell deal.**
    - In the following paragraphs, we will try to understand EC's arguments that were used in case of GE/Honeywell case; and we will try to apply such arguments to PACB/ILMN case.
        - In connection to this, we note that GE/Honeywell decision was made in 2001, which is relatively long time ago, while merger control standards are dynamic and do change over time.
            - Also, we note that GE/Honeywell decision by the EC is considered controversial, and it has also outlined differences between different jurisdiction (e.g. US and EU); and how antitrust law is interpreted.

GE/Honeywell (2001)

As per the EC's decision: in the post-merger market structure, the merged entity will be able to offer a package of products that has never been put together on the market prior to the merger and that cannot be challenged by any other competitor on its own.

- The regulator further argued that as a result of the proposed merger, the merged entity will be able to price its packaged deals in such a way as to induce customers to buy GE engines and Honeywell BFE and SFE-option products over those of competitors, thus increasing the combined share of GE and Honeywell on both markets.
    - In case of technical bundling, competitors will find it more difficult to place their products on the market, since technical bundling restricts the market share available to them. Overall, technical bundling will adversely affect competitors' incentives to compete and under such circumstances, they are not likely to be a constraining factor to the independent behavior of the merged entity.
- As a result of these commercial practices, the merged entity is expected to gain additional market shares. Competitors are expected to lose market shares and see their profits shrink, in some cases, significantly.

- In the medium term, competitors will have to take decisions as to whether, in view of their anticipated reduced market share and profitability, they are able and willing to continue competing in the markets where the merged entity is active. As a result, regulator has argued to be concerned that the proposed deal will result in elimination of competition in such areas.

Parallels to GE/Honeywell case

In its analysis of GE/Honeywell case (2001), the EC considered various arguments, and aspects of the underlying market, while we find some similarities to PACB/ILMN case.

- **Market dominance of one of the merging parties in its** respective **product segment:** the EC argued that GE displays several features of a dominant market player (in particular, it was argued by the EC that GE had the highest market share in the market for supply of jet engines for large commercial aircraft, well ahead of its competitors). Also, the EC argued that GE had been increasing its market share, at a pace higher than other competitors.
  - As we understand, it was argued that GE's dominant position in its respective market which will enable the combined entity to effectively introduce product bundles.
    - In case of PACB/ILMN, we note that ILMN might also display features of a dominant market player in short-read solutions.
      - As we already discussed, we note that ILMN has a strong position in short-read solutions, while we estimate PACB to have ~14% share of the addressable long-read market (as at 2017).
  - Similar to GE/Honeywell case, it might be argued that ILMN's strong position in short- read market might increase bundling concerns post-deal.
- **Long investment cycles and return on the investment:** in case of GE deal, it was argued that the industry is characterized by long lead times, that is to say significant gaps between the investment made on new projects and the return on the investment.
  - In connection to this, we believe that there are higher barriers to entry to both industries, as these industries rely on significant R&D investments.

Complaining parties

Altogether, we believe that a hurdle for antitrust authorities to build and model a case that a proposed deal is anticompetitive (as a result of potential bundling) is high; and we believe that significant input has to come from complaining parties (as it was the case in GE/Honeywell deal).

- **Competitors:** a bundle is effective if it is offered at discount to a sum of prices of two standalone products.
  - Therefore, packages will create pricing pressure on other competitors, which might in short-term see decrease in profits, while in mid- to long-term, competitors might consider leaving the market.
    - Certainly, competitors will not favor that potential bundles might create pricing pressure.
      - However, regardless of the deal, we note that cost of sequencing has been decreasing significantly in the past decade – in the past decade, cost of sequencing a human genome has decreased from approximately $10 million in 2000s to approximately $1,000 (for ILMN's product), while ILMN's DeSouza said he expects that ILMN will be able to lower the cost per genome to $100 per share.
    - Plus, we believe that competitors might be concerned that the combined entity might undertake technical bundling, which might further limit their market shares.
      - Altogether, we believe that competitors have strong incentive to file complaints about the proposed deal; however, we note that PACB's competitors are mainly small players (e.g. Oxford Nanopore, BGI of China, and others) that might not have sufficient leverage.
        - We also note that there are other companies that provide DNA sequencing solutions, such as Thermo Fisher, and others.
- **Customers:** if we look at the proposed deal from theoretical perspective, it might be argued that customers might favor a decrease in prices in short-term; however, we believe that customers might be concerned that the proposed transaction will results in limited number of suppliers in mid- to long- term.
  - In practice, we understand that there are limited concerns from customers about the proposed transaction as ILMN is viewed as a better platform to develop PACB products as compared to its standalone perspective.
    - As we already discussed, the industry is subject to significant R&D investments; and ILMN might be viewed as a better platform to invest R&D in further product development.
      - In connection to that, we note that PACB has had negative FCF in past years, while development of new chip will certainly require additional R&D investments.
  - We note that PACB's (and ILMN's) customers are mainly research institutions, and laboratories, which might opt not to complain; however, we note that part of the customers are also commercial entities, such as pharmaceutical and agriculture companies.

Potential remedies

In terms of remedies, we believe that companies have only limited option in terms of remedies:

- **Structural remedies:** we believe that structural remedies are not feasible as portfolio of both PACB and ILMN is centered around a small number of key products; and we believe that none of companies is will to undertake divestiture of any of the products (as they are key to the rationale of the proposed deal).

- **Behavioral remedies:** in terms of potential bundling concerns, companies might propose that the combined entity will not undertake bundling of the products.
  - However, we note that such remedy was not accepted in GE/Honeywell case. Plus, we believe that regulators have become more adverse to behavioral remedies since.

Package products

The sale of complementary products through packaged deals may take several forms.

- It may include, for instance, mixed bundling whereby complementary products are sold together at a price which, owing to the discounts that apply across the product range, is lower than the price charged when they are sold separately.
- It may also take the form of pure bundling whereby the entity sells only the bundle but does not make the individual components available on a stand-alone basis.
  - Pure bundling may also take the form of technical bundling, whereby the individual components only function effectively as part of the bundled system, and cannot be used alongside components from other suppliers, that is to say, they are made incompatible with the latter components

Valuation

We note that PACB has been trading in range of $3.50 -$4.00 in 6 months prior to deal announcement.

- In terms of other listed players that operate in the industry PACB does, we note that ILMN's price has been steady since November 2018 (when PACB/ILMN deal was announced); and TMO has seen ~30% increase after market drop in December 2018 (however, we note that TMO operates also product segments other than DNA sequencing).
  - Since the deal announcement, we believe that there has been some important events that might weigh on PACB's valuation:
    - In early February 2019, PACB announced financial results for its fourth quarter and year ended December 31, 2018.
      - Pacific Bio reported loss per share for the fourth quarter that was wider than the average analyst estimate.
        - 4Q loss per share 21c, estimate loss/share 13c (range loss/share 12c to 15c) (Bloomberg data)
        - 4Q revenue $19.5 million, estimate $21.2 million (range $18.3 million to $24.0 million) (BD)
        - 4Q cash and other $102.4 million
    - On the other hand, we note that Company stated in early January that it was targeting early access of the SMRT®Cell 8M chip to begin during the first quarter of 2019, with a broader launch in the second quarter of 2019.
      - The Company announced that it commenced its Early Access Program of the SMRT Cell 8M chip and platform, the Sequel® II System, in January 2019.
        - We note that SMRT Cell 8M chip is expected to further decrease a cost of PACB's product, and make it more affordable.
- Overall, we estimate PACB to trade in range of 7.0x – 7.5x EV/FY1 Sales on standalone basis (which is consistent to its pre-deal valuation), which brings us to PACB standalone value of $4.00 - $4.30 per share.
  - We note that there is a reverse break fee of $98 million (or $0.66 per PACB share) in case the deal is blocked by an antitrust regulator.
    - Therefore, **we estimate PACB's price in range $4.60 - $5.00 on a deal break.**

Disclosures:

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