

## An innovative leap into the theoretical abyss: Dow/DuPont and the Commission's novel theory of harm

### Introduction

In a 2016 speech European Competition Commissioner Margrethe Vestager noted that “protecting innovation is important in our merger policy” and that “when we look at high-tech mergers, we don’t just look at whether they may raise prices. We also assess whether they could be bad for innovation.”<sup>1</sup> To illustrate this, the Commissioner highlighted the recent Pfizer/Hospira case, which was approved only after Pfizer agreed to sell the rights to an arthritis drug that was in the final phase of development.<sup>2</sup> She further noted that “[o]ne concern was that Hospira already had a competing drug on the market, and we thought Pfizer might stop work on its own drug if the deal went ahead as planned. Which would have meant less of the innovation that we depend on as patients.”

Although the Commissioner described this as an illustration of an “innovation concern”, the impact of a merger involving a pipeline product (for which practically all the innovation work has been done) and an existing product is substantively no different to the assessment of a merger between two already existing products.<sup>3</sup> In both of these cases, the concern is that the internalisation of the constraint between the rival products may give the merged entity an incentive to increase prices or reduce output, perhaps even discontinuing one of the products altogether to avoid cannibalisation of the other product’s sales. And in both cases, the analysis relies on an assessment of the closeness of competition between the two products and the competitive constraint exerted by rivals’ products.

However, in the recent merger between chemical companies Dow and DuPont, the Commission has applied an innovation theory of harm that is based on a much broader and more speculative concern; namely, that the parties would find it profitable to reduce overall R&D investments post-merger causing a reduction in the number of innovative pesticide products (as yet unidentified) at some unspecified time in the future.<sup>4</sup>

Crucially, the Commission rejects any notion that this theory of harm marks a departure from past cases. Indeed, a recent paper co-authored by Chief Economist Tommaso Valletti claims, on the basis of a theoretical model, that horizontal mergers can be expected to reduce innovation incentives as a result of a standard unilateral effect.<sup>5</sup> As we explain in this Brief, however, no such presumption is justified. The assessment of the impact of a merger on R&D investments requires a complex balancing exercise of a number of factors that affect the incentives to innovate, most notably cannibalisation and appropriability. The fact that these factors exert opposing influences on incentives to innovate implies that it cannot be valid to presume that one effect dominates the other.

### Cannibalisation as a source of innovation concerns in Dow/DuPont

The Commission considered that only five crop protection companies, BASF, Bayer and Syngenta as well as the merging parties, were globally active in the discovery, development, manufacture and distribution of new pesticides.<sup>6</sup> Although the merged entity would have continued to face competition from at least three major rivals, the Commission ultimately concluded that it would have a lower incentive to innovate than Dow and DuPont separately.

The Commission’s line of reasoning can be summarised as follows: Pre-merger, each party has an incentive to engage in R&D in order to develop new products which, if successfully brought to market, would compete against the products of its competitors (including those of the other merging party). Post-merger, the new entity would face a reduced incentive to do so. This is because the products resulting from innovation by one merging party would cannibalise the profits of the other merging party and, once this effect is internalised with the merger, the incentive to innovate would be reduced.

1. See “Competition: the mother of invention”, available at [https://ec.europa.eu/commission/commissioners/2014-2019/vestager/announcements/competition-mother-invention\\_en](https://ec.europa.eu/commission/commissioners/2014-2019/vestager/announcements/competition-mother-invention_en).

2. Case COMP/M.7559, Commission decision of August 4, 2015.

3. In addition to Pfizer/Hospira, the Commission has also looked at similar “innovation concerns” in a number of other cases, including for example GE/Alstom (COMP/M.7278, Commission decision of September 8, 2015), Teva/Allergan Generics (COMP/M.7746, Commission decision of January 21, 2016), and recently J&J/Actelion (COMP/M.8401, Commission decision of June 9, 2017 – not yet published).

4. Case COMP/M.7932, Commission decision of March 27, 2017 (not yet published). The merger was cleared subject to undertakings after a protracted Phase II investigation. RBB Economics acted as advisers to the parties on this transaction.

5. See Giulio Federico, Gregor Langus and Tommaso Valletti, “A simple model of mergers and innovation”, Economics Letters, forthcoming. Although the article was published after the end of the Phase II investigation, and it is not discussed in the final decision, we understand that the underlying model contributed to inform the Chief Economist’s approach to the innovation theory of harm.

6. Although the parties argued that other competitors also had significant R&D capabilities, their presence was disregarded due to perceived limitations in their geographic focus and product offering.

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7. We assume for simplicity that costs of production are equal to zero.

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8. Note that whilst cannibalisation may only affect the incentives of the merged entity, appropriability considerations can be expected to have a positive impact on both the merged entity and its rivals' incentive to innovate. In addition to appropriability, the economic literature has identified a number of other mechanisms whereby a merger between two firms may increase incentives to innovate. For example, a merger can increase the likelihood of successful innovation by combining different approaches and best practices of both parties. A merger may also increase innovation incentives if it brings together complementary assets that enable the parties to better realise, or appropriate, the benefits of innovation. Although the Commission did agree that these factors could in principle offset the negative impact of the merger on innovation incentives, it considered these as potential countervailing efficiencies, imposing on the parties the high burden of proof set out in the Horizontal Merger Guidelines. This was a highly contentious issue between the parties and the Commission, which for reasons of space we do not discuss here.

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9. Specifically, the parties showed that over time they had launched new pesticides without waiting for sales of existing substitutable products (i.e. products targeting the same crop and the same pest) to be affected by resistance and/or regulation.

A simple example can be used to illustrate the logic behind the cannibalisation concern. Suppose that firm A is contemplating an R&D investment of €50 in a new product that would deliver sales of €100.<sup>7</sup> €20 of these sales would come from cannibalising firm A's own existing products, €40 would take place at the expense of firm B and €40 at the expense of firm C. Once the R&D cost (€50) and cannibalisation of its existing products (€20) are taken into account, firm A would find it profitable to undertake the investment since it would deliver a profit of €30 (= €100 - €50 - €20). Following a merger between firms A and B, however, the decision would be different. The new product would still deliver sales of €100, but it would now cannibalise €60 of its own products (€20 from firm A and €40 from firm B). Due to this higher level of cannibalisation, the merged entity would no longer have an incentive to proceed with the R&D investment since it would obtain a negative profit (€100 - €50 - €60 = -€10).

This cannibalisation story has an obvious and direct read-across to standard unilateral effects concerns that arise in horizontal mergers. Importantly, however, cannibalisation captures only part of the competitive assessment of the likely impact on competition of a horizontal merger on the incentive to innovate. A reduction in the number of competitors in an industry can also have a number of positive influences on firms' incentives to invest in R&D. One of the key positive factors is what economists call appropriability.

## Appropriability as an innovation enhancing factor

Appropriability refers to the extent to which a firm can realise the benefits generated by its innovation efforts. The importance of appropriability for innovation underpins the concept of intellectual property rights (IPRs): by preventing rivals from easily imitating innovators' new products, IPRs increase the extent to which firms can appropriate the benefits of their innovations. In turn by protecting appropriability, IPRs promote innovation incentives. However, over and above the existence of IPRs, the degree of appropriability also depends on other factors, such as on whether rivals are innovating (or perceived to be innovating) in the same area. A firm's perceived risk that too many rivals may also be investing in new products that would end up competing with, and therefore take sales from, its planned innovation may discourage it from investing in the development of the product.

As an illustration, consider a situation in which a new innovation could deliver sales of €100. Assume that if firm A believed that it was the only firm contemplating the innovation, it would find it profitable to undertake the required R&D investment. However, in the presence of rival innovators, the investment may become far less attractive. For example, if A's potential innovation gains would be shared equally with a rival innovator, firm B, each of firm A and firm B would get €50 if both firms are successful. More generally, as the number of potential rival innovators increases, the expected return that firm A can hope to obtain from its R&D investment decreases to the point where it may choose to refrain from investing in the project. For this reason, the reduction in the number of firms brought about by a merger between firm A and one of its rivals would increase the benefit the new entity could expect to obtain, giving it an incentive to invest where it may have chosen not to do so pre-merger.<sup>8</sup>

## Assessing cannibalisation and appropriability in practice

Dow and DuPont argued that two key market features would ensure that cannibalisation considerations did not play a significant role in the investment decisions of crop protection companies: biological resistance (products become obsolete once the targeted pests mutate to develop resistance to them) and regulation (with many pesticides having had their application restricted or banned outright as a result of tightened toxicity tolerance levels).

The parties provided extensive evidence showing that over time they had largely disregarded any cannibalisation effect that new products may have on sales of their existing products when launching new pesticides.<sup>9</sup> They argued that the merged entity's incentives would not be driven to a significant extent by cannibalisation concerns because resistance and regulation considerations limited the amount of future profits that could be expected to flow from existing products.

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10. For example, they showed that the perceived threat of rival innovation in the same product space was an important negative factor taken into account when considering the commercial prospects of new active ingredients.

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11. See [http://ec.europa.eu/competition/publications/cpb/2016/2016\\_001\\_en.pdf](http://ec.europa.eu/competition/publications/cpb/2016/2016_001_en.pdf).

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12. Massimo Motta and Emanuele Tarantino (2016) "The effect of a merger on investments", CEPR Discussion Paper DP11550.

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13. The authors do set up some specific settings within which R&D efforts decrease as a result of the merger, acknowledging at the same time that alternative settings may lead to the opposite conclusion.

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14. Federico et al., Op. cit.

Furthermore, Dow and DuPont submitted specific evidence highlighting the importance of appropriability considerations in their investment decisions.<sup>10</sup> Unfortunately for the parties, this evidence did not get much traction. While the Commission did acknowledge that appropriability was a factor that could positively affect post-merger incentives to innovate, it did not consider it necessary to engage in a balancing exercise of cannibalisation and appropriability effects. Instead, the Commission largely relied on some theoretical economic papers, claiming that these provided support to the conclusion that cannibalisation is inherently likely to outweigh appropriability, and that horizontal mergers can therefore be expected to negatively impact on innovation incentives.

## From facts to theory

The economic literature has historically not reached a definitive view on the issue of whether more concentrated markets are likely to generate higher levels of innovation than less concentrated markets. That fact is explicitly acknowledged in the Commission's recent Competition Policy Brief "EU merger control and innovation".<sup>11</sup> That paper refers to Joseph Schumpeter, who first highlighted the appropriability mechanism advocating that less competition in a market is likely to lead to more innovation and to Kenneth Arrow, who reached the opposite view on the basis of the cannibalisation mechanism. It then refers to authors that have attempted to find some convergence between the two opposing views, reaching an overall finely balanced conclusion: "As long as competition policy promotes contestability (i.e. by keeping markets competitive) and does not unduly negatively affect appropriability, it will be compatible with both Arrow and Schumpeter and therefore will encourage innovation".

However, in Dow/DuPont the Chief Economist Team put forward the view that almost the entirety of the existing economic literature on the relationship between competition and innovation should be disregarded since the corresponding models do not focus on the impact of horizontal mergers and, as such, they do not shed light on the changes in incentives that the acquisition of a competitor is likely to bring about. A theoretical paper published in 2016 by the former Chief Economist Massimo Motta and Emanuele Tarantino, which reached the conclusion that horizontal mergers are likely to reduce firms' profit maximizing R&D spending, was considered to be a notable exception to this general observation.<sup>12</sup> The Commission's economists relied heavily on this paper to support their claim that anti-competitive cannibalisation effects are likely to dominate pro-competitive appropriability effects.

However, the theoretical model on which this paper relied was one in which firms engage in R&D investments aimed at reducing their cost of production. Importantly, the authors could not derive the same conclusions in respect of R&D investments aimed at delivering new or better quality products. As the paper openly acknowledges, "within a general model, the results are a priori ambiguous, as we are unable to sign the net result of effects going into opposite directions."<sup>13</sup> Since in Dow/DuPont the theory of harm put to the parties was that the proposed transaction would have reduced the merged entity's incentives to develop new pesticide products, the Motta and Tarantino paper does not offer theoretical support for the Commission's concern.

In June 2017, Chief Economist Tommaso Valletti, together with his colleagues Giulio Federico and Gregor Langus, produced a paper setting out the results of a stylized theoretical model which considers the impact of a horizontal merger in a setting where firms innovate to discover new products.<sup>14</sup> The paper's abstract makes the following broad claim: "We show that the merging parties always decrease their innovation efforts post-merger while the outsiders to the merger respond by increasing their effort. A merger tends to reduce overall innovation. Consumers are always worse off after a merger."

Taken at face value, this claim would indeed imply that mergers such as Dow/Du Pont should be condemned on a priori grounds, without any need to delve in to the factual evidence. However, these strongly worded conclusions are simply not justified and are, in fact, contradicted by the authors' own model. Specifically, one of the key propositions of the paper reads: "Total industry effort decreases after the merger if and only if  $n$  [i.e. the number of firms in the industry] is low

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15. Technical footnote. Only a merger to monopoly reduces total efforts (as well as the probability that the industry delivers the innovation) if the cost function considered is  $c(w) = -\log(1-w^2)$  for low enough values of  $\alpha$  or high enough values of  $\delta$ . All other mergers deliver higher total efforts and a higher probability of innovation. Furthermore, defining consumer welfare in the model as  $CS_1=1, CS_2=1+\varepsilon(1-\delta), CS_3=1+\varepsilon$ , there is a range of values of  $\varepsilon$  such that consumer welfare also increases post-merger.

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16. In order to solve the Commission's innovation concerns, the parties ultimately agreed to divest almost the entirety of DuPont's global R&D organisation. It is worth noting that the US DOJ considered the same concerns, but came to the opposite conclusion, noting in its closing statement that "the market conditions in the United States did not provide a basis for a similar conclusion at this time." (see <https://www.justice.gov/opa/pr/justice-department-requires-divestiture-certain-herbicides-insecticides-and-plastics>). However, given that R&D is typically focussed on products that might find application anywhere in the world, in particular at the early stages of R&D, it is difficult to justify these different conclusions, in the two largest marketing regions for agrochemicals.

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17. Indeed, the Horizontal Merger Guidelines explicitly recognise at paragraph 38 the possibility that a merger between two firms may increase innovation incentives.

enough." In other words, total R&D effort (i.e. the sum of the R&D investments undertaken by all firms) does not necessarily decrease post-merger. It only does so if the number of firms in the industry falls below a certain threshold, which implies that a merger will give rise to an increase in total R&D efforts if the industry is not too concentrated.

Importantly, as the paper also acknowledges, the critical value of  $n$  (i.e. the number of firms below which a merger can be expected to give rise to a decrease in total R&D efforts) will vary depending on the parameters of the model. It is easy to show that, under certain parameter values, only a merger to monopoly would give rise to a reduction in innovation efforts and consumer welfare.<sup>15</sup> All mergers in less concentrated industries (e.g. mergers that decrease the number of suppliers from three to two, four to three, etc.) would, for those parameter values, give rise to an increase in total R&D investments and consumer welfare. This fatally undermines both the generality and the overall negative stance taken by the authors on the likely impact of horizontal mergers on innovation.

In short, neither the Motta and Tarantino paper nor the Commission economists' recent paper can support the claim that a comparison of cannibalisation and appropriability effects is not required since the former should be expected to dominate the latter. On the contrary, the only conclusion that can be legitimately inferred from these papers is, in line with the economic literature of the last few decades, that balancing appropriability and cannibalisation is an exercise that cannot be trivialised. Put simply, the answer as to which of the two effects is likely to prevail in any given case cannot be found in the pages of industrial organization journals or by setting up more or less sophisticated theoretical models. As should always be the case, it can only come from a careful assessment of the specific facts of the case.

## Conclusions

In its assessment of the Dow/DuPont transaction, the Commission considered that any potential impact of the proposed transaction on innovation was principally determined by cannibalisation considerations. As a result, the Commission effectively presumed that any impact of the proposed transaction on innovation incentives would be negative.<sup>16</sup>

However, anti-competitive effects on innovation are far less likely than anti-competitive effects from mergers, like Pfizer/Hospira, that bring together rival pipeline products for which the innovation work has essentially been done, and for which the merging parties' incentives can be appropriately assessed on the basis of the standard unilateral effects framework. In cases such as Dow/DuPont, where the concern is that the merger may reduce incentives to undertake R&D investments, the theoretical literature (including the papers on which the Commission relied) provides no support for a presumption that a reduction in the number of competitors will give rise to a reduction in innovation.<sup>17</sup>

Specifically, the Commission's economists' apparent willingness to rely on abstract theoretical model results to the exclusion of a more rounded factual assessment of cannibalisation and appropriability effects is likely to be detrimental to effective merger control.

Due to the ambiguous relationship between concentration and innovation, not taking into account appropriability and other factors raises significant risks of over-enforcement that will actually diminish incentives to innovate and, in so doing, harm the long term vitality of industrial innovation on which future consumer welfare relies. Such an outcome would run contrary to Commissioner Vestager's stated policy objectives.