

Innovation Competition, Unilateral Effects and Merger Control Policy

Nicolas Petit

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Introduction

This paper looks at whether the standard unilateral effects model can be applied to non-price competition parameters such as innovation.¹ This question arises because competition authorities are intervening in horizontal mergers that are found to give rise to a “*significant impediment to effective innovation competition*” (“SIEIC”) as a result of a reduction in post-merger R&D efforts (including lower expenditure). SIEIC is distinct from the mainstream unilateral effects theory of harm that predicts a “*significant impediment to effective competition*” (“SIEC”) as a result of increased prices. Most recently, the European Commission (“**Commission**”) used its powers under the EU Merger Regulation (“**EUMR**”) to impose remedies in the *Dow/DuPont* merger. This was in part because of concerns that that the transaction “*would be likely to significantly impede effective competition as regards innovation both in innovation spaces where the Parties’ lines of research and early pipeline products overlap and overall in innovation in the crop*”

* Professor of Law, University of Liege (ULiege), Liege Competition and Innovation Institute (“LCII”); Research Professor, University of South Australia (UniSA); Senior Scholar, International Center for Law & Economics (ICLE); Nicolas.petit@uliege.be. I would like to thank Jonathan Baker, Gregory Werden, David Teece and Richard Gilbert for comments on this paper. I acknowledge the excellent research assistance of Evi Mattioli and Jorge Marcos on a previous draft. I would also like to thank ICLE for the generous research grant which supported this work. All views expressed here, and possible mistakes, remain mine.

¹ The unilateral effects model has been applied by antitrust regulators to nine out of ten mergers that warranted regulatory intervention. See Carles Esteve Mosso, *Merger enforcement: getting the priorities right*, Speech at EU Competition Law: Current Issues in a Global Context Conference (May 19, 2017) at 6 (“*more than 90% of intervention cases were based on the most straightforward theory of harm in merger analysis: the elimination of direct price competition between close market operators*”) available at http://ec.europa.eu/competition/speeches/text/sp2017_08_en.pdf.

protection industry.”² At the heart of the development of SIEIC analysis lies a fundamental question of competition theory: under what conditions can variations of existing economic models be applied in merger cases?³

This paper is divided into three sections. In Section I, the SIEIC theory of harm is described and put into perspective against past competition policy on innovation competition. Section I concludes that SIEIC constitutes a small but significant change in merger policy. In Section II, the economics of SIEIC are discussed. In particular, it will be seen that SIEIC is an application of the standard unilateral effects analysis where the focus is shifted from price to innovation effects. Section II demonstrates that this variant of the model can only deliver sound and robust empirical predictions if three critical innovation-specific questions are addressed. Section III discusses the economic methodology of merger control policy. This Section shows that agencies should remain free to rely on new or adapted pre-existing economic models in merger control reviews, provided they are able to discharge the “*burden of persuasion*.” With this, the paper hopes to contribute to the ongoing development of optimal merger control policy in innovative and R&D-driven markets.

I. A Review of SIEIC

This section describes the SIEIC theory as articulated in *Dow/DuPont* (A), places it in perspective by comparing the Commission’s previous approach to assessing innovation competition (B), and concludes that it constitutes a small but significant change in merger policy (C).

A. SIEIC in Dow/DuPont

Before SIEIC is described (2), a preliminary word on *Dow/DuPont* is necessary (1).

² Case COMP/M.7932 *Dow/DuPont*, ¶ 3297, available at http://ec.europa.eu/competition/mergers/cases/decisions/m7932_13668_3.pdf. See also *Dow, DuPont Innovation Concerns ‘Not Novel’, EU Insists*, MLEX (Aug. 4, 2017); *Economists Challenge Valletti Stance on Innovation Impact of Mergers*, MLEX (Jul. 5, 2017); *EC Merger Innovation Theory Sparks Lawyers’ Quest for Clarity*, PaRR (May 5, 2017).

³ And also, a deeper legal question: what untried varieties of the general theory of harm specified in the broadly-worded merger control soft law instruments ought to be introduced?

I. Dow/DuPont in a nutshell

Dow/DuPont involved a horizontal merger between two large suppliers of crop protection chemicals. Pre-merger, Dow and DuPont were respectively the number four and six companies in the crop protection industry. Both competed as vertically integrated developers and manufacturers of pesticides (herbicides, fungicides and insecticides).⁴ Post-transaction, the combined entity would have become the industry leader.

The crop protection industry is highly concentrated. This is the consequence of escalating fixed costs of discovery and development, which have been fuelled by stricter regulation, stronger pest and weed resistance, and pressures to increase yields. Crop protection firms have adapted to this exogenous environment either by increasing scale or by exiting discovery and development.⁵ Over the last half century, the industry has undergone significant waves of consolidation. Widely cited figures suggest that in the 1960s, 50 firms were active in the discovery, development and production of crop protection products; and by 2010, this number had fallen to six large vertically integrated players with a small competitive fringe.⁶ The Commission noted, as an “*element of context*” that this process of consolidation has been reinforced by a tightening of the links between the major crop protection players through institutional investors’ common shareholdings.⁷

⁴ In addition to crop protection chemicals, the transaction gave rise to horizontal overlaps in, *inter alia*, the development and manufacture of seeds and traits as well as various plastics and chemicals. The focus of this paper is the Commission’s examination of the overlap in the supply of crop protection chemicals.

⁵ Examples of firms that exited discovery and development include Monsanto and FMC.

⁶ Thomas Sparks and Beth Lorsch, *Perspectives on the agrochemical industry and agrochemical discovery*, 73(4) PEST MANAGEMENT SCIENCE 672, 672–77 (2017).

⁷ *Dow/DuPont*, *op cit.*, ¶¶ 233 and ¶¶ 2348-2352. See also, Annex 5 (“*common shareholding in the agrochemical industry is to be taken as an element of context in the appreciation of any significant impediment to effective competition that is raised in the Decision*”). The Commission’s assertion that institutional investors’ common shareholdings may have an adverse effect on innovation competition (or even competition more generally) is a highly debated topic in contemporary applied economics literature and no consensus has emerged. This topic is not the focus of this paper, but it does warrant further discussion elsewhere. For reference, see OECD, *Common Ownership by Institutional Investors and its Impact on Competition: Background Note by the Secretariat*, (Dec. 5-6, 2017), available at <http://www.oecd.org/daf/competition/common-ownership-and-its-impact-on-competition.htm> (noting that “[t]he preceding discussion has made clear that there is substantial disagreement about the harm associated with common ownership, efforts to estimate it empirically, and proposals for addressing competition problems it may cause”).

In its review of *Dow/DuPont*, the Commission considered that the merger threatened innovation competition due to a loss of rivalry between suppliers of crop protection products. Consequently, the Commission conditioned the implementation of the merger on the divestment of DuPont's global pesticides R&D division. Hundreds of pages of thorough factual, economic and legal analyses were produced to substantiate the Commission's innovation competition concerns. In addition, Annex 4 of the decision which runs to over forty pages, offers a review and analysis of the economic literature in support of the theory that the adverse impact of a merger on rivalry undermines innovation incentives.⁸

2. Descriptive Analysis of SIEIC

The fundamental points of SIEIC can be distilled as follows.

First, SIEIC is based on the idea that firms not only compete in relevant product or technology transfer markets, but also in “*innovation spaces*.” The concept of an innovation space includes the “*discovery stage*” where firms fund early “*lines of research*” to discover new business areas, concepts and lines. In the crop protection industry, the Commission considers that firms compete in innovation spaces over “*discovery targets*” that are framed by reference to lead crops and pests (e.g., broadleaf herbicides).⁹ Competing crop protection firms commit R&D resources to screen large sets of molecules and identify new active ingredients (“**AI**”) which can later be patented. Competition in innovation spaces is a “*stochastic*” process, which means that “*firms are not certain of the impact of their discovery efforts when they initiate such efforts*.”¹⁰

The first stage of an innovation space, namely discovery, takes between three and four years at a minimum. The R&D process then moves on to the “*development stage*” which takes at least between five and six years. During the development stage, firms experiment with different formulations of AIs, and safety, efficacy and biology tests are conducted. The last stage of an innovation space covers R&D activities in relation to “*early pipeline products*.” Competition moves from innovation spaces to relevant product and technology markets when the AIs evolve into “*formulated products*,” and

⁸ *Id.* at ¶ 1999.

⁹ *Id.* at ¶ 351.

¹⁰ *Id.* at ¶ 2067.

become subject to regulatory approval by agencies such as the US Environmental Protection Agency, or the European Food Safety Agency in the EU.¹¹

Second, SIEIC identifies two types of harm to innovation competition. The “*first form of harm*” arises as a result of the merged entity’s incentives to shut down “*overlapping lines of research and early pipeline products which target the same innovation spaces.*”¹² For example, if A and B merge, and both conduct R&D in relation to the same pest problem 1, the merged entity will either terminate A1 or B1. The “*second form of harm*” arises as a consequence of the fact that the merged firm’s “*overall*” incentive to undertake innovation is lower than the sum of its parts.¹³ As a result of a reduction of “*rivalry*,” the merged entity undertakes “*less innovation efforts*” and the transaction leads to “*lower innovation output targets, and ultimately to less innovation.*”¹⁴ This “*medium and long term structural*” effect of the merger can be understood as follows: AB’s incentive to innovate < A’s incentive to innovate + B’s incentive to innovate. The Commission found that the second effect is “*likely to be significantly larger than the first.*”¹⁵

Third, and notwithstanding the above, SIEIC is essentially based on the R&D conduct of the merged entity in the short-term. The *Dow/DuPont* decision repeatedly states that the transaction may result in the “*discontinuation, deferment or redirection of competing lines of research and early pipeline products.*”¹⁶ It insists that this risk gives rise to legitimate concerns since it occurs as a result of an “*immediate effect of the Transaction on the Parties’ behaviour, and not only in a timeframe of 10 to 15 years.*”¹⁷ By contrast, the theory is more ambiguous as to the long-term harm to innovation, and in particular the type of behaviour which may result in the development of fewer “*new products*” compared to the “*combined targets of the parties before the transaction.*”¹⁸ Two paragraphs provide a fragment of an explanation. First, the merged firm will undertake “*lower innovation efforts reflected for example in less financial resources, less scientists, less physical assets devoted to innovation;*” and more specifically engage in “*less discovery*

¹¹ *Id.* at § 1.4.3. The Commission considers that the holder of a patent followed by a supplementary protection certificate can enjoy up to approximately 15 years of exclusivity from the time its formulated product first obtains an authorisation to be placed on the market (¶ 200).

¹² *Id.* at ¶ 3056.

¹³ *Id.* at ¶ 3057.

¹⁴ *Id.* at ¶ 3060.

¹⁵ *Id.* at ¶ 3058.

¹⁶ *Id.* at ¶¶ 277, 283, 1955, 2998, 3005, 3025, 3053.

¹⁷ *Id.* at ¶ 2034.

¹⁸ *Id.* at ¶ 2014.

work, less lines of research and less development and registration work.”¹⁹ Second, the merged firm will set “lower internal innovation output targets.”²⁰

Fourth, in addition to reduced innovation efforts from the merged firm, SIEIC predicts an overall reduction in overall industry innovation incentives. *Dow/DuPont* talks of harm to innovation affecting the “industry as a whole.”²¹ It says that its assessment focuses “both on innovation competition at the level of innovation spaces within the crop protection industry and on innovation competition at the industry level.”²²

Fifth, SIEIC is not industry-specific. In fact, the theory as formulated in the *Dow/DuPont* decision could be potentially applied to any horizontal merger between “rival innovators,” “significant innovators,” or more generally “independent innovators.”²³ It follows that SIEIC may be applied to other mergers in R&D-driven industries including, *inter alia*, pharmaceuticals, defence, digital communications, etc.

B. SIEIC in Perspective

SIEIC’s place in merger policy is difficult to assess. On one hand, an original “model” of innovation competition was formulated by Commission economists in parallel to the review of *Dow/DuPont*.²⁴ This potentially suggests that new economic thinking at the Commission underpins the investigation of horizontal mergers in R&D-driven industries. On the other hand, *Dow/DuPont* is heavily evidence-based, and the main difference from previous cases seems to be that the Commission’s assessment was primarily based on the parties’ internal documents.²⁵ In order to accurately gauge whether SIEIC marks a change in merger policy, this paper places *Dow/DuPont* in

¹⁹ *Id.* at ¶¶ 3057 and 3059

²⁰ *Id.* at ¶ 3059.

²¹ *Id.* at ¶ 1955.

²² *Id.* at ¶ 1956.

²³ *Id.* at ¶ 2000.

²⁴ The Chief Economist told a conference that a “new model” that “revisit[ed]” the relationship between mergers and innovation had been developed by his team. A paper he co-wrote together with members of the Chief Economist team (“CET”) expounding that model was subsequently published in an academic journal on 24 March 2017, three days prior to the Commission’s adoption of the *Dow/DuPont* decision. See Giulio Federico, Gregor Langus & Tommaso Valletti, *A Simple Model of Mergers and Innovation*, 157(C) ECON. LETTERS 136, 136-140 (2017).

²⁵ A significant part of the preliminary section of the decision is devoted to discussing “Procedural Issues,” in the Commission’s investigation. This includes an overview of some of the (manifestly thorny) exchanges between the Commission and the parties on data collection. *Dow/DuPont*, *op cit.*, Section IV.2.

perspective by assessing it in light of established competition policy on innovation competition.

I. EU Competition Policy

The policy foundations of SIEIC theory can be found in the text of the Commission's Horizontal Merger Guidelines ("HMG"). The broadly worded HMG make it clear that competitive harm may affect parameters other than price. For instance, paragraph 8 HMG states that: "*Effective competition brings benefits to consumers, such as low prices, high quality products, a wide selection of goods and services, and innovation. Through its control of mergers, the Commission prevents mergers that would be likely to deprive customers of these benefits by significantly increasing the market power of firms. By 'increased market power' is meant the ability of one or more firms to profitably increase prices, reduce output, choice or quality of goods and services, diminish innovation, or otherwise influence parameters of competition (emphasis added).*"²⁶ In addition, paragraph 38 HMG provides that: "*[E]ffective competition may be significantly impeded by a merger between two important innovators, for instance between two companies with 'pipeline' products related to a specific product market. Similarly, a firm with a relatively small market share may nevertheless be an important competitive force if it has promising pipeline products.*"²⁷

Nevertheless, the HMG provide no guidance on specific innovation theories of harm that are potentially applicable to mergers.²⁸ Accordingly, this paper reviews the Commission's approach to assessing innovation competition in previous merger cases (a),

²⁶ European Commission, *Guidelines on the assessment of horizontal mergers under Council Regulation (EC) No 139/2004 on the control of concentrations between undertakings ("Horizontal Merger Guidelines")*, 2004 O.J. (C 31) 5 ¶ 8, available at [http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52004XC0205\(02\)&from=EN](http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52004XC0205(02)&from=EN).

²⁷ *Id.* at ¶ 38. See also, *id.* at ¶ 21(b) (which provides that low market shares may be misleading if "one or more merging parties are important innovators").

²⁸ *Dow/DuPont* often refers to those paragraphs as a legal basis for its investigation of innovation competition. For ¶ 8, see, e.g., *Dow/DuPont*, *op cit.*, ¶¶ 37, 279, 1990 and 1995; and for ¶ 38, see ¶¶ 285, 420, 431, 1236, 1239, 2021, 2024, 2397 and 3015. More generally, the decision repeatedly underlines that the Commission is "required" to assess the effects of mergers on innovation competition: "Innovation is an important criterion relevant in order to conduct the appraisal" (¶ 1990); "Innovation competition is thus confirmed as a criterion to assess the likely effects of a merger" (¶ 1996); "the Commission is required to prevent significant impediments to effective competition ... It is also part of the Commission's task to determine whether a transaction is likely to lead to diminished innovation and future competition" (¶ 1999). At the same time, the decision suggests that SIEIC theory goes beyond the Horizontal Merger Guidelines where it states that: "paragraph 38 makes it also explicit that the assessment of pipelines within a merger between two companies with pipeline products related to a specific product market, is only one example of how harm to innovation competition may occur" (¶ 1997).

and in relation to interfirm cooperation under Article 101 of the Treaty on the Functioning of the EU (“TFEU”) (b).

a) Merger Cases on Innovation Competition

Innovation competition has been a longstanding aspect of EU merger policy.²⁹ Since the mid-1990s, merger control decisions have contained assessments of innovation competition.³⁰ A review of the Commission’s decisional practice shows that effective innovation competition at firm and industry level has increasingly taken centre stage in merger reviews, and that the agency’s confidence in forecasting post-merger innovation effects has grown.

In *Pasteur-Mérieux/Merck*, two pharmaceutical companies planned to establish a joint venture (“JV”) to combine their human vaccine activities.³¹ It was envisaged that the JV would only take over the post-Phase II clinical trials, and that the parties would remain autonomous in their basic R&D decisions. However, a development committee was tasked with overseeing the R&D strategy of the JV. This function included discussing the parties’ respective R&D activities, including communications concerning discoveries. The Commission investigated concerns of reduced R&D for future pipeline products in monovalent vaccines through the coordination of the parties’ investment decisions.³²

In *Glaxo/Wellcome*, the Commission scrutinised the effect of the merger of two pharmaceutical companies “*in the area of R&D.*”³³ The Commission’s analysis focused on

²⁹ This section discusses merger policy only in relation to horizontal merger cases, and does not cover non-horizontal cases including Case COMP/M.5984 *Intel/Mc Afee*, Case COMP/M.6314 *Telefonica UK/Vodafone UK/Everything Everywhere Joint Venture*, Case COMP/M.6564 *ARM/Giesecke & Devrient/Gemalto Joint Venture*, and Case COMP/M.7688 *Intel/Altera*. For a discussion of these cases, see European Commission, Directorate-General for Competition (“DG COMP”), Competition Policy Brief, *EU Merger Control and Innovation*, 2016-01 (2016), available at http://ec.europa.eu/competition/publications/cpb/2016/2016_001_en.pdf.

³⁰ Post-Phase II. According to Glader, *Pasteur-Mérieux/Merck* represents the “most extreme line of R&D competition analysis,” and it is “certainly not the typical situation.” See MARCUS GLADER, INNOVATION MARKETS AND COMPETITION ANALYSIS: EU COMPETITION LAW AND US ANTITRUST LAW 164 (2006).

³¹ Case IV/34.776 *Pasteur Mérieux-Merck*, available at <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31994D0770&from=EN>. The decision is formally based on Article 101, because it was issued in 1993, prior to the entry into force of the revised EU Merger Regulation in 1997.

³² *Id.* at ¶ 64. The Commission issued an exemption decision on the basis of efficiency gains.

³³ Case IV/M.555 *Glaxo/Wellcome*, ¶ 18, available at http://ec.europa.eu/competition/mergers/cases/decisions/m555_en.pdf.

HIV/AIDS therapeutics,³⁴ where it found “*overlaps*” in the parties’ R&D activities.³⁵ Ultimately, the Commission found that in the absence of a definitive HIV/AIDS treatment, the transaction was unlikely to give rise to competitive concerns by inhibiting research for effective compounds being undertaken by other pharmaceutical companies worldwide.³⁶

In the 2000s, an assessment of innovation competition became more commonplace and there was a corresponding increase in the sophistication of the Commission’s analysis. This evolution can be observed in several pharmaceutical cases. In *Glaxo Wellcome/SmithKline Beecham*, the Commission looked at the impact of the transaction on “*R&D markets*.”³⁷ As part of its assessment, the Commission considered whether the combination of two pharmaceutical companies would lead to a reduction of the “*overall R&D potential*,” specifically in relation to the development of treatments for “*Chronic Obstructive Pulmonary Disease*” (“*COPD*”).³⁸ Innovation competition concerns were ruled out on the same basis as *Glaxo/Wellcome*, namely the fact that none of the current or pipeline products acted as an “*effective single treatment for COPD*,” and there was considerable “*unmet clinical need in this segment*.”³⁹

Pfizer/Pharmacia – which created the world’s largest pharmaceutical company– is another case in which the Commission undertook an analysis of “*products that are not yet on the market but are at an advanced stage of development*.”⁴⁰ The assessment focused specifically on urinary incontinence products.⁴¹ Pharmacia already had a leading product on the market while Pfizer, already at an advanced stage of development,

³⁴ GLADER, INNOVATION MARKETS AND COMPETITION ANALYSIS, *op cit*.

³⁵ Case IV/M.555 *Glaxo/Wellcome*, *op cit*, ¶ 33.

³⁶ *Id.*

³⁷ Case COMP/M.1846 *Glaxo Wellcome/Smithkline Beecham*, ¶ 174, available at http://ec.europa.eu/competition/mergers/cases/decisions/m1846_en.pdf.

³⁸ *Id.* at ¶¶ 179-188.

³⁹ *Id.* at ¶ 187. This was confirmed by the large number of “*pipeline products and resourceful competitors on the market*.” See also, *id.* at ¶ 188.

⁴⁰ Case COMP/M.2922 *Pfizer/Pharmacia*, ¶ 22 (“*In line with previous cases (most recently in COMP M.1846 - GlaxoWellcome/SmithKline Beecham) projects in a late stage of development, known as Phase III, will be examined.*”), available at http://ec.europa.eu/competition/mergers/cases/decisions/m2922_en.pdf.

⁴¹ The assessment also focused on COPD, but the Commission considered that “*in view of the fact that the parties have currently no or only de minimis market positions in COPD, that the parties’ pipeline products are not direct competitors, and given the existence of strong actual and potential competitors*,” there was no ground for further concerns. *Id.* at ¶ 25.

was about to launch its own product. The Commission raised serious objections, noting that given the “*present strong position*” of Pharmacia and the impending launch of Pfizer’s product, it would be “*unlikely that competitors [would] be able to challenge the market position of the new entity in the near future.*”

Innovation competition concerns were also investigated in mergers involving competitors in the crop protection sector. In *Astra Zeneca/Novartis*, the Commission examined a risk of reduced competition in relation to “*new strobilurin-based products,*”⁴² a class of fungicides which cover a broad range of diseases. At the time of the decision, Novartis was introducing its new generation strobilurin compound in European markets and Astra Zeneca was in the final phase of developing a competing product.⁴³ The Commission feared that Astra Zeneca’s forthcoming introduction of a new compound would give the merged entity a position of increased “*market leadership,*” and lead to the creation of a dominant position.⁴⁴ Although Bayer and BASF were also developing strobilurin, their compounds were considered technically inferior;⁴⁵ and in Bayer’s case the launch of its strobilurin was expected to take place in a timeframe considered “*too distant*” for the Commission’s competitive assessment.⁴⁶ Interestingly, while the analysis focused on future competition in clearly delineated product markets, the Commission added that “*as a consequence of the merger, one of these innovators is removed from the market which may reduce the incentives to further innovate.*”⁴⁷ This suggests that the Commission may have taken into account the impact of the merger on the innovation incentives of competitors of the merged entity.

A couple of years later, in *Bayer/Aventis Crop Science*, the Commission expressed potential concerns about “*the grouping of companies with strength in R&D and innovation.*”⁴⁸ Accordingly, the Commission sought to assess the effect of the transaction on the parties’ “*R&D capabilities and incentives,*” in relation to specific “*current product markets*

⁴² Case COMP/M.1806 *AstraZeneca/Novartis*, ¶ 185, available at http://ec.europa.eu/competition/mergers/cases/decisions/m1806_en.pdf.

⁴³ *Id.* at ¶ 141. At the time of the review, ahead of the forthcoming launch, Astra Zeneca had submitted an investment proposal to its board for approval.

⁴⁴ *Id.* at ¶ 221.

⁴⁵ *Id.* at ¶ 142.

⁴⁶ *Id.* at ¶ 144.

⁴⁷ *Id.* at ¶ 219.

⁴⁸ Case COMP M.2547 *Bayer/Aventis Crop Science*, ¶ 18, available at http://ec.europa.eu/competition/mergers/cases/decisions/m2547_en.pdf.

and future product markets.”⁴⁹ *Bayer/Aventis Crop Science* features an original discussion of post-merger R&D conduct, organisation and strategy. The Commission noted that given the costs represented by R&D in crop protection, it was unlikely that the parties’ R&D facilities would not be merged to a very large extent, in order to increase profits and share know-how. At the same time, the Commission also envisioned that following the merger, it would be “possible to distinguish new active ingredients belonging to Bayer from those belonging to ACS.”

In the early 2010s, the Commission’s approach to assessing innovation competition became yet more sophisticated. Although early cases such as *Syngenta/Monsanto’s Sunflower Seed Business* displayed continuity with their focus on clearly identified new or future products,⁵⁰ theories of harm based on the concept of “cannibalisation” appeared in subsequent cases. Whereas innovation competition concerns in previous cases were based on a structural analysis of the strength of parties’ existing and pipeline products relative to their competitors (*i.e.*, a reduction of external R&D rivalry), cannibalisation essentially focuses on a reduction in internal R&D rivalry between the merging parties. *Novartis/Glaxo Smith Kline’s Oncology Business* is a case in point.⁵¹ Here, the Commission noted that the transaction would have reduced the parties’ competition on investments into “competing clinical research programs” for colorectal cancer, non-small-cell lung cancer and advanced melanoma. More specifically, the merged entity “will internalise that investing in one of the clinical research programs can be expected to cannibalise future sales of its other clinical research program.”⁵² By way of further explanation, the decision contains a footnote that draws a parallel with the analysis of post-merger unilateral effects on prices, noting that this “is very similar to the mech-

⁴⁹ *Id.*

⁵⁰ *Monsanto’s Sunflower Seed Business*, available at http://ec.europa.eu/competition/mergers/cases/decisions/m5675_20101117_20600_1556193_EN.pdf. This is another case where innovation incentives were scrutinised. Here, the text of the decision suggests that increased concentration could lead to a lower rate of innovation. In particular, in its assessment of the effects of the transaction on the Hungarian market for the commercialisation of sunflowers hybrids, the Commission concluded that the transaction was “likely to have a negative impact on innovation by eliminating the competitive constraint that the breeding programme and the germplasm of Monsanto exerted on Syngenta and on other competitors to regularly bring new improved varieties into the market[.]” *Id.* at ¶ 321. However, it is not entirely clear to what extent this finding influenced the Commission’s view that the transaction would have impeded effective competition in Hungary.

⁵¹ Case COMP M.7275 *Novartis/Glaxo Smith Kline’s Oncology Business*, available at http://ec.europa.eu/competition/mergers/cases/decisions/m7275_20150128_20212_4158734_EN.pdf.

⁵² *Id.* at ¶ 104.

anism by which internalisation of cannibalisation effects on sales lead merging firms to unilaterally increase prices on existing products.”⁵³ As a result of a limited number competing research programmes in the areas identified by the Commission, it concluded that the merger would “hinder innovation.”⁵⁴

However, in subsequent merger reviews, innovation competition concerns were not predicated on cannibalisation, at least not explicitly. In *Medtronic/Covidien*, the transaction brought together two suppliers of medical devices.⁵⁵ Medtronic was the leading supplier of drug-coated balloons (“DCB”) for the treatment of vascular diseases, whereas Covidien had a late-stage pipeline DCB and there was “reasonable certainty” that it would reach the market in the “near future.” The Commission stressed that the assessment was different from the potential competition scenario envisaged in the Horizontal Merger Guidelines.⁵⁶ Instead, the assessment focused on the effect of the merger on “future competition.”⁵⁷ Based on “internal planning” documents, it found that the transaction would “also have a significant effect on innovation,” with a risk that the merged entity would end the development of Covidien’s product.⁵⁸

Pfizer/Hospira featured a similar focus on documentary evidence. Hospira was marketing a biosimilar drug for the treatment of autoimmune diseases, and Pfizer was at an advanced stage of developing a competing biosimilar. The Commission found that the transaction would have reduced Pfizer’s incentives to continue developing its own biosimilar and that it would “either delay or discontinue its pipeline biosimilar” thus leading to a “lessening of innovation competition.”⁵⁹ As in *Medtronic/Covidien*, the Commission’s assessment partly relied on Pfizer’s “internal documents.”⁶⁰ In addition, the results of the market investigation indicated that “a biosimilar company does not

⁵³ *Id.* at n. 59.

⁵⁴ *Id.* at ¶ 112.

⁵⁵ Case COMP M.7326 *Medtronic/Covidien*, ¶ 179, available at http://ec.europa.eu/competition/mergers/cases/decisions/m7326_20141128_20212_4138173_EN.pdf.

⁵⁶ *Id.* (“This is different from the typical potential competition scenario envisaged in the Horizontal merger guidelines.”).

⁵⁷ *Id.* at ¶ 180.

⁵⁸ *Id.* at ¶¶ 247, 249.

⁵⁹ Case COMP M.7559 *Pfizer/Hospira*, ¶¶ 57-58, available at http://ec.europa.eu/competition/mergers/cases/decisions/m7559_20150804_20212_4504355_EN.pdf.

⁶⁰ *Id.*

have any incentive to pursue the development of a pipeline biosimilar if it already markets a biosimilar for the same molecule.”⁶¹

Over the same period, the Commission also conducted an assessment of innovation competition in mergers affecting R&D-driven industries other than pharmaceutical and crop protection products. Innovation competition featured in the Commission’s review of concurrent mergers between competing suppliers of hard disk drives (“HDD”) in *Seagate/ HDD Business of Samsung* and *Western Digital/Viviti Technologies*. Taken together, Seagate’s acquisition of Samsung’s HDD business and Western Digital’s acquisition of HGST would have reduced the number of HDD suppliers from five to three. Moreover, Seagate and Western Digital had the highest levels of R&D expenditure in the industry.⁶² In *Seagate/ HDD Business of Samsung*, the Commission dismissed concerns of a reduction of innovation competition since it found that the target was more of a “trend follower” as opposed to a “strong innovator” who could be “first-to-market” in the introduction of new products.⁶³ In contrast, in *Western Digital/Viviti Technologies*, the Commission did not challenge the parties’ submission that

⁶¹ *Id.* at ¶ 60.

⁶² Case COMP/M.6214 *Seagate/HDD Business of Samsung*, ¶ 67, available at http://ec.europa.eu/competition/mergers/cases/decisions/m6214_3520_2.pdf (“*Western Digital and Seagate are leading absolute expenditure on R&D among HDD manufacturers.*”). In December 2017, the Commission published a Feasibility Study on the Microeconomic Impact of Enforcement of Competition Policies on Innovation. The study looked at the feasibility of estimating the innovation impact of the two HDD mergers. The study noted that there were diverging views in the literature as to the effect of mergers on innovation with some studies finding that the negative effect of market power dominates the potential effects arising from cost savings, whereas other studies found the opposite effect. The authors considered that the “contradiction can be explained by the fact that these studies look at the average effect of a sample of different mergers, rather than pointing out in which cases the negative effects were particularly pronounced.” Moreover, the study stated that “[whilst] these aggregate studies have important academic value, they mask the fact that some mergers increase, and some others decrease innovation and as such cannot inform us about the effect of specific causes or interventions.” The pilot study highlighted that although each of the three remaining firms in the HDD sector responded differently to the mergers in 2012, only Toshiba’s R&D spending growth and patenting dropped after the mergers, but it noted that this was unsurprising given industry talks about Toshiba leaving the HDD market. Toshiba subsequently sold its HDD business to a Bain-led consortium. The study went on to note that “such heterogenous response confirms that one cannot establish a one-size-fits-all relationship between changes in competition an innovation – not even in the same market.” See Peter Ormosi et al., *Feasibility Study on the Microeconomic Impact of Enforcement of Competition Policies on Innovation (Final Report)*, European Commission, DG COMP (Dec. 21, 2017), available at <https://publications.europa.eu/en/publication-detail/-/publication/67521c90-e6d0-11e7-9749-01aa75ed71a1/language-en/format-PDF>.

⁶³ *Id.* at ¶¶ 425, 448.

the merger would not adversely impact innovation competition.⁶⁴ Instead, the Commission's competitive assessment focused on the merger's adverse effects on prices.⁶⁵

In *Deutsche Börse/NYSE*, the Commission examined whether the merger to “near-monopoly” between two of the world's largest exchange platforms would result in less future competition for new and improved products and contracts for European interest rate derivatives,⁶⁶ European single stock derivatives,⁶⁷ and European equity indices,⁶⁸ as well as less innovation in technology, processes and market design.⁶⁹ The Commission found that the merger would lead to a reduction of innovation competition since the merging parties were each other's “closest competitive threat to the success of a new product,” but it did not explicitly articulate any cannibalisation concerns.⁷⁰ The Commission also found that the merger would reduce third parties' incentives to innovate but the decision does not offer an explanation of how it reached this conclusion.⁷¹

Although the Commission's decision was upheld by the General Court (“GC”), the judgment provided little insight on the correct approach to assessing innovation competition under the EUMR including the applicable legal principles.⁷² In its appeal, Deutsche Börse argued that the Commission's finding that the parties constrained each other through innovation competition was manifestly incorrect. Its complaint

⁶⁴ Case COMP/M.6203 *Western Digital Ireland/Viviti Technologies*, ¶¶ 486, 533, 699, available at http://ec.europa.eu/competition/mergers/cases/decisions/m6203_20111123_20600_3212692_EN.pdf.

⁶⁵ *Id.*

⁶⁶ Case COMP/M.6166 *Deutsche Börse/NYSE Euronext* (“**Deutsche Börse/NYSE**”), section 11.2.1.4.4, available at http://ec.europa.eu/competition/mergers/cases/decisions/m6166_20120201_20610_2711467_EN.pdf.

⁶⁷ *Id.* at § 11.2.1.5.4.

⁶⁸ *Id.* at § 11.2.1.6.2.

⁶⁹ *Id.* at ¶¶ 640, 635.

⁷⁰ *Id.* at ¶ 602.

⁷¹ *Id.* at ¶ 886: “the notified transaction carries with it the further risk that not only will the merger eliminate competition in product innovation between the Notifying Parties, but also innovation by smaller third parties which might currently have a chance of success in some areas.” See also ¶ 919: “it should be noted that not only competition in innovation by the Notifying Parties would be adversely affected by the merger, but also that third parties (both index providers such as Russell and exchanges such as Chi-X Europe) might no longer have the means or incentive to innovate in this area post-merger.”

⁷² Case T-175/12 *Deutsche Börse AG v European Commission*, available at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=164036&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=277729>.

consisted of two claims. First, it alleged that the Commission erred in concluding that competition between the parties was “*the only driver of new product development.*”⁷³

The GC rejected this claim noting that contrary to Deutsche Börse’s submission, there was nothing in the contested decision which “*permits the inference that that was the Commission’s position.*”⁷⁴ In addition, the contested decision did not contradict the applicant’s claim that the parties would continue to innovate with respect to new products post-merger.⁷⁵ Moreover, Deutsche Börse failed to validly call into question the evidence put forward by the Commission to substantiate its conclusions concerning the existence of innovation competition.⁷⁶ This included documents and statements of the parties, responses to the market investigation and past or recent examples of innovation competition.⁷⁷

Second, Deutsche Börse claimed the Commission’s finding that the merger could eliminate “*any technological competition*” and give rise to a reduction in innovation available for customers was incorrect.⁷⁸ This claim was also rejected by the GC.⁷⁹ The Court pointed out that it was apparent from the contested decision that the Commission did not find that the merger would eliminate any technological competition. Rather it would result in a reduction of the merged entity’s incentives to innovate.⁸⁰ It also rejected Deutsche Börse’s argument that the Commission had failed to analyse whether the concentration would have resulted in less technology competition.⁸¹ The GC pointed out the relevant sections of the contested decision where such an analysis had clearly been undertaken, and noted that the applicant had failed to challenge any of the evidence that was relied on to substantiate the Commission’s findings.⁸²

⁷³ *Id.* at ¶ 159.

⁷⁴ *Id.* at ¶ 163.

⁷⁵ *Id.* at ¶ 164.

⁷⁶ *Id.* at ¶ 166.

⁷⁷ *Id.* at ¶ 165.

⁷⁸ *Id.* at ¶ 171.

⁷⁹ *Id.* at ¶ 179.

⁸⁰ *Id.* at ¶¶ 173, 174, 177.

⁸¹ *Id.* at ¶ 176.

⁸² *Id.*

It followed that Deutsche Börse's appeal did not call into question the validity of the Commission's methodology for assessing innovation and technology competition.⁸³

GE/Alstom was the last case before *Dow/DuPont* that turned on the Commission's assessment of innovation competition.⁸⁴ The Commission examined a risk of lower innovation competition in the market for 50 Hz heavy duty gas turbines ("HDGT"), and, in particular, the large and very large power output segments. As in previous cases, the assessment was primarily focused on the innovation capabilities of the target. The transaction would have led to a four to three reduction in the number of full-technology companies that were capable of producing large and very large 50 Hz HDGTs. Moreover, the Commission found that Alstom had "*R&D and technological capabilities on par or almost on par with the two market leaders GE and Siemens*,"⁸⁵ notably in terms of R&D spend and headcount.⁸⁶ The elimination of a "*credible innovator*"⁸⁷ in the market would thus reduce GE's but also other competitors' "*overall incentives to invest significantly in innovation*."⁸⁸ Additionally, the Commission established on the basis of GE's internal documents that it planned to discontinue the parties' overlapping product portfolio and associated R&D.⁸⁹ This included Alstom's existing GT26 turbine and related R&D capabilities to support future technology upgrades, and the GT36 turbine which was under development. Before the *Dow/DuPont* decision, *GE/Alstom* featured the Commission's most sophisticated assessment of innovation competition.

b) Innovation Competition under Article 101 TFEU

Safeguarding innovation competition is also one of the stated aims of EU antitrust policy. This is particularly reflected in the Commission's approach to the application of Article 101 TFEU, notably in the area of interfirm cooperation. In the early 2000s, Commission guidelines for the assessment of technology transfer agreements and joint R&D agreements provided that in a "*limited number of cases*" the assessment of

⁸³ This includes the Commission's identification of "innovation spaces" as a frame of reference to assess innovation competition (discussed in greater detail in Section I (C), below)

⁸⁴ Case COMP/M.7278 *General Electric/Alstom (Thermal Power – Renewable Power & Grid Business)* ("*GE/Alstom*"), available at http://ec.europa.eu/competition/mergers/cases/decisions/m7278_6857_3.pdf.

⁸⁵ *Id.* at ¶ 1388.

⁸⁶ *Id.* at ¶ 504.

⁸⁷ *Id.* at ¶ 780.

⁸⁸ *Id.* at ¶ 1390.

⁸⁹ *Id.* at § 8.8.

agreements may need to be framed by reference to “*innovation markets*.”⁹⁰ The concept of “*innovation markets*” has its origins in US antitrust law where it first appeared in the 1995 Antitrust Guidelines for the Licensing of Intellectual Property.⁹¹ The underlying purpose of using innovation markets was to capture R&D competition for the creation of new or improved products. In practice, the approach to defining innovation markets in the European guidelines was to identify R&D poles.⁹²

However, in the years that followed the concept of innovation markets seemed to fade away, although it arguably never entered mainstream antitrust thinking in the first place. The concept either lost prominence⁹³ or was entirely phased out in subsequent iterations of the Commission’s guidelines.⁹⁴ Today, EU antitrust policy has

⁹⁰ The concept of an ‘innovation market’ was referred to in paragraph 25 of the 2004 Guidelines on technology transfer agreements: “*In a limited number of cases, however, it may be useful and necessary to also define innovation markets. This is particularly the case where the agreement affects innovation aiming at creating new products and where it is possible at an early stage to identify research and development poles.*” European Commission, *Guidelines on the application of Article 81 of the EC Treaty to technology transfer agreements (“2004 Technology Transfer Guidelines”)*, 2004, C101/2, available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2004:101:0002:0042:EN:PDF>. The 2001 Guidelines on Horizontal cooperation also referred to the concept in the context of R&D agreements, but did not provide any guidance on the appropriate method for defining innovation markets. See European Commission, *Guidelines on the applicability of Article 81 of the EC Treaty to horizontal cooperation agreements*, 2001, C3/2, paras 60 and 73, available at http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.C_.2001.003.01.0002.01.ENG.

⁹¹ US Department of Justice and the Federal Trade Commission, *Antitrust Guidelines for the Licensing of Intellectual Property*, 6 April 1995, Section 3.2.3., available at <https://www.justice.gov/atr/archived-1995-antitrust-guidelines-licensing-intellectual-property#t323>. Innovation markets are defined as follows: “*the research and development directed to particular new or improved goods or processes, and the close substitutes for that research and development. The close substitutes are research and development efforts, technologies, and goods that significantly constrain the exercise of market power with respect to the relevant research and development, for example by limiting the ability and incentive of a hypothetical monopolist to retard the pace of research and development. The Agencies will delineate an innovation market only when the capabilities to engage in the relevant research and development can be associated with specialized assets or characteristics of specific firms.*” The 2017 US IP Licensing Guidelines refer to “research and development markets” instead of innovation markets. See US Department of Justice and the Federal Trade Commission, *Antitrust Guidelines for the Licensing of Intellectual Property* at § 3.2.3 (Jan. 12, 2017), available at <https://www.justice.gov/atr/IPguidelines/download>.

⁹² 2004 Technology Transfer Guidelines, *op cit.*, ¶ 25.

⁹³ For instance, in the 2011 Guidelines on horizontal cooperation agreements. See European Commission, *Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements (“Horizontal Cooperation Guidelines”)*, 2011, C11/1, ¶¶ 119 ff., 147, available at <http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A52011XC0114%2804%29>.

⁹⁴ European Commission, *Guidelines on the application of Article 101 of the Treaty on the Functioning of the European Union to technology transfer agreements (“Technology Transfer Guidelines”)*, 2014, C89/3,

settled on an apparently less structural approach that focuses on “*competition in innovation*.”⁹⁵ Reflecting on this development, Drexel observed that modern Article 101 TFEU policy and practice “*prefers a more open approach to assessing negative effects on innovation as a dynamic parameter of innovation,*” instead of a “*structural market analysis*.”⁹⁶

At the same time, abandoning “*innovation markets*” in favour of “*competition in innovation*” has not necessarily translated into a less structural inquiry. The 2014 Technology Transfer Guidelines call for an assessment of “*whether after the agreement there will be a sufficient number of competing research and development poles left for effective competition in innovation to be maintained*.”⁹⁷ In practice, this involves the application of a rule of thumb whereby an agreement is unlikely to fall foul of Article 101 TFEU if four or more R&D poles exist in addition to the parties.⁹⁸ This contradiction is also reflected in the Horizontal Cooperation Guidelines. Although the “*starting point*” for the assessment of harm to competition focuses on the “*R&D of the parties*,” the assessment consists of determining whether there are enough “*credible competing R&D poles*” on the market.⁹⁹ The Guidelines add that no assessment of “*competition in innovation*” needs to be carried out if “*the innovative efforts in an industry are not clearly structured so as to allow the identification of R&D poles*.”¹⁰⁰

2. Dow/DuPont in Context

To what extent is the analysis of innovation competition in *Dow/DuPont* distinct from past merger and antitrust policy? Three significant inflection points deserve attention.

available at <http://eur-lex.europa.eu/legal-content/en/TXT/PDF/?uri=CELEX:52014XC0328%2801%29&rid=2>.

⁹⁵ Josef Drexel, *Anti-competitive stumbling stones on the way to a cleaner world: protecting competition in innovation without a market*, Max Planck Institute for Intellectual Property and Competition Law Research Paper No. 12-08, 15-17, available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2070099 (noting that the Commission “*abstains from the adoption of an innovation market concept as it was advocated under US merger control and Guidelines on licensing in the 90s*”).

⁹⁶ *Id.*

⁹⁷ Technology Transfer Guidelines, *op cit.*, ¶ 26.

⁹⁸ Horizontal Cooperation Guidelines, *op cit.*, ¶ 157 at n. 28.

⁹⁹ *Id.*

¹⁰⁰ Unless exceptional circumstances otherwise require. *Id.* at ¶ 122.

a) Unilateral Effects

In light of previous policy, the key change brought about by SIEIC is to extend the application of the standard unilateral effects model, which was previously used to assess pricing effects, to the assessment of innovation competition. Until *Dow/DuPont*, this approach was not entirely conspicuous. Admittedly, in a number of cases, the Commission did assess whether the merging parties competed closely on innovation, as it routinely had done under the one-dimensional model of horizontal price competition. Additionally, the Commission's cannibalisation concerns in *Novartis/GSK Oncology* were supported by a footnote that described the mechanics of unilateral effects, namely that mergers internalise the adverse effect on expected sales of competition between competing R&D pipelines, leading the combined firm to reduce R&D investments.

Yet *Dow/DuPont* is the first case where the Commission explicitly relies on the unilateral effects framework in relation to innovation competition. At paragraph 2043 of the decision, innovation effects are characterised as a “*standard unilateral effect from a merger.*”¹⁰¹ In addition, Annex 4 to the decision, titled “*Implication of the economic theory on mergers, competition and innovation in light of the features of the transaction*” sets out more fully how “[a] merger in innovative industries generates standard unilateral effects in innovation.”¹⁰²

Most importantly, the SIEIC theory as applied to innovation competition in *Dow/DuPont* is distinct from the cannibalisation concerns articulated in *Novartis/GSK Oncology*. In particular, the Commission's cannibalisation concerns in *Novartis/GSK Oncology* related to clearly identified *existing products* only, whereas the SIEIC theory is “*broader*” in scope since the harm to innovation applies to *future products*.¹⁰³

This can be understood with a stylised example. A horizontal merger between two innovators may on the one hand lead to lower innovation in existing products. For example, if A and B merge, and A's previous R&D efforts have led to product 1, the

¹⁰¹ *Dow/DuPont*, *op cit.*, at ¶ 2043.

¹⁰² *Id.*, Annex 4.

¹⁰³ *Id.* at ¶ 2108 (“Cannibalisation is often meant to refer to a diversion of sales from one or several existing products to an innovative product sold by the same firm. Innovation competition, instead, more broadly refers to the extent to which innovative products of one firm may divert sales and profits from both existing and other innovative future products of rival firms.”). See also *id.* (“The Commission notes that its theory of harm rests on the broader notion of innovation competition rather than on the notion of cannibalization.”).

merged entity has lower incentives to sustain B's ongoing R&D efforts to develop a rival product 1 (i.e., a competing new or improved product). This is what the Commission refers to as “cannibalisation.” However, the absence of cannibalisation effects does not preclude a SIEIC. In this regard, the Commission notes: “even if innovation were to involve no cannibalisation of the sales of existing products, a merger between two out of a limited number of innovators in a market could reduce innovation incentives, by leading to the partial internalisation of the impact of innovation competition between the merging parties.”¹⁰⁴ In this variant of the example, the merged entity will have lower incentives to channel A and B investments in R&D towards similar innovation targets – say 2,2'; 3,3'; 4,4' ... ∞,∞' – in expectation that future rival products will eat away at each other's sales.

b) Innovation Space v Product Market

Historically, innovation competition has been assessed by reference to R&D activities with specific ties to well-defined current or future product markets.¹⁰⁵ Indeed, in all merger cases involving the pharmaceutical and crop protection sectors that preceded *Dow/DuPont*, the Commission focused its assessment of innovation competition on existing and pipeline products. The Commission has largely adopted the same approach in its assessment of innovation competition in other industries, e.g., *GE/Alstom* (see above).

In this light, SIEIC certainly breaks new ground. The theory of harm dispenses with the delineation of current or future *product* markets. In *Dow/DuPont*, the assessment examined competition in “innovation spaces.” The concept of an innovation space is not dissimilar to an innovation market and “correspond[s] to the discovery targets” over which firms compete.¹⁰⁶ It follows that innovation spaces are broader than downstream product markets.¹⁰⁷ At the same time, innovation spaces do not encompass

¹⁰⁴ *Id.* at ¶ 2108.

¹⁰⁵ See Raphaël De Coninck, *Innovation in EU merger control: in need of a consistent framework*, 2(3) COMPETITION LAW & POLICY DEBATE 41, 47-48 (2016), available at <https://www.crai.com/sites/default/files/publications/Innovation-in-EU-merger-control-in-a-need-of-a-consistent-framework.pdf>.

¹⁰⁶ Case COMP/M.7932, *Dow/DuPont*, *op cit.*, at ¶ 2168. The R&D undertaken in innovation spaces “generate[s] early pipeline products” (¶ 2159).

¹⁰⁷ *Id.* at ¶ 2169 (referring, for instance, to “chewing insects pome fruit and other fruits in more Member States”). See also, *id.* at ¶ 2168 (“The spaces where innovation competition takes place, which correspond to the discovery targets of those innovation efforts, are not necessarily identical to individual downstream crop protection markets.”).

“all the product markets composing the entire crop protection industry at the same time.”¹⁰⁸ In *Dow/DuPont*, innovation spaces were framed by reference to overlapping “lines of research” and “early pipeline products” in herbicides, insecticides and fungicides.¹⁰⁹ The effect of this shift in analytical framework is to expand the scope of the merger review to early stage R&D efforts, where products are several years away from reaching the market.¹¹⁰

Admittedly, the Commission did assess innovation competition for future products in broader product spaces in *Deutsche Börse/NYSE* (see above) encompassing all European interest rates derivatives, European single stock derivatives and European equity indices.¹¹¹ The term “innovation space” even crept into the decision, albeit once.¹¹² However, the Commission’s assessment of competition in innovation spaces in *Dow/DuPont* is considerably more extensive and sophisticated than *Deutsche Börse/NYSE*. Moreover, the assessment of the merger’s effect on innovation competition was not dispositive to the outcome of *Deutsche Börse/NYSE*. This should not be taken to mean that the Commission has adequately fine-tuned its innovation space framework. The *Dow/DuPont* decision still leaves a number of uncertainties as to the analytical principles that are applicable to innovation spaces. First, the approach to delineating innovation spaces remains unclear. For instance, does an innovation space cover discovery targets in relation to a same key “pest problem,” a “crop-pest combination,” a “crop-pest-mode of action,” or a “crop-pest-mode of action-spectrum” combination? Second, the product development phase that corresponds with an innovation space is ambiguous. *Dow/DuPont* contains broad references to “lines of research” and “early pipeline products,”¹¹³ which appears to precede the development phase for crop protection chemicals or Phase III clinical trials for pharmaceuticals. No further

¹⁰⁸ *Id.* at ¶ 2162

¹⁰⁹ *Id.* at ¶ 2603.

¹¹⁰ For an early formulation of this point in a US context, see D. Wald and D. Feinstein, *Merger Enforcement in Innovation Markets*, 2004 ANTITRUST SOURCE 1,1-11. In recent years, the Commission has increasingly taken into account early stage pipeline products in its merger reviews. This is reflected in a number of cases involving the pharmaceutical sector where the Commission’s approach has diverged from its traditional approach of focusing on phase III pipeline products. See, e.g., *Novartis/Glaxo Smith Kline’s Oncology Business*, *op cit.*; Case COMP M.8041 *J&J/Actelion*, available at http://ec.europa.eu/competition/mergers/cases/decisions/m8401_740_3.pdf. See also De Coninck, *Innovation in EU merger control: in need of a consistent framework*, *op cit.*, at 41-42.

¹¹¹ *Deutsche Börse/NYSE*, *op cit.*, §§ 11.2.1.5.4, 11.2.1.6.2., ¶¶ 640, 635.

¹¹² *Id.* at ¶ 923.

¹¹³ *Dow/DuPont*, *op cit.*, at ¶ 283.

explanation or guidance is provided, at least in the redacted public version of the decision.

The Commission's approach can be contrasted with the experience of US antitrust agencies, where the analysis occasionally focused on situations where a merger would be deemed injurious to competition on separate upstream "*innovation markets*" that are not directly linked to a downstream current or future product market.¹¹⁴ The development of an "*innovation markets*" framework in US merger control enabled regulators to look at the effect of a merger on the "*R&D process itself*," and on the firms' ability and incentives to commit resources to R&D activities. In contrast to the SIEIC theory, the delineation of separate upstream R&D markets where firms compete through investments for future technological applications was a key component of the "*innovation markets*" framework.¹¹⁵ However, merger cases where US antitrust agencies have assessed competition in innovation markets are quite rare;¹¹⁶ and reviews of innovation competition tend to focus on "*near-term, discernible products*."¹¹⁷ As Michael Katz and Howard Shelanski put it, the innovation markets approach was limited to "*cases in which specific R&D activities could be identified that could have a potentially significant impact on specific downstream product markets*".¹¹⁸ And Richard Gilbert – one of the founders of the innovation markets framework – confirmed that to date innovation concerns in merger policy "*typically identified particular projects in the research and development portfolios of the merging parties ...*".¹¹⁹

¹¹⁴ Richard Gilbert and Steven Sunshine, *Incorporating dynamic efficiency concerns in merger analysis: The use of innovation markets*, 63 ANTITRUST L. J. 569, 569-601 (1995).

¹¹⁵ *Id.*

¹¹⁶ This is true if we take as baseline the total number of notified merger. However, the number of challenged mergers attacked on innovation concerns is more significant (approximately 33.6%) and this number increases in relation to sectors with high R&D intensity. See Richard J. Gilbert & Hillary Greene, *Merging Innovation into Antitrust Agency Enforcement of the Clayton Act*, 83 GEO. WASH. L. REV. 1919, 1927 (2015).

¹¹⁷ *FTC Innovation Focus on 'Near-term Discernible' Products in Merger Review – Concurrences Paris*, PaRR (Dec. 8, 2017). The approach of the US antitrust agencies to assessing innovation competition can be contrasted with that of the Commission, which has stated that it does not need clearly identified products in order to intervene in a merger review. See *EC can Intervene in Mergers without Clearly Identified Products – Concurrences Paris*, PaRR (Jun., 26, 2017).

¹¹⁸ Michael L. Katz & Howard A. Shelanski, *Mergers and Innovation*, 74(1) ANTITRUST L. J. 1, 1-85 (2007).

¹¹⁹ Richard Gilbert, *Mergers and R&D Diversity: How Much Competition is Enough*, mimeo. Note that Gilbert refers to one particular case where the US agencies have challenged a merger on the ground of a quite general allegation of harm to innovation, though the merger also suspected to affect prices.

Second, the metric that was used by the Commission in *Dow/DuPont* to measure competition in innovation spaces marked a departure from its approach in previous cases.¹²⁰ Instead of looking at R&D expenditure, the Commission used the patent portfolios of the merging companies “as a metric to assess their strength at the discovery level.”¹²¹ In contrast, in *GE/Alstom*, the Commission measured innovation competition on the basis of both R&D “spend” and “headcount” although this approach is also problematic since it measures innovation inputs as opposed to outputs.¹²²

c) Exit from Innovation Spaces

The competitive harm envisaged in a SIEIC is an exit by one of the merging parties from an innovation space. To be more accurate, three R&D exit scenarios are articulated. *Dow/DuPont* repeatedly states that the merger will be followed by the immediate “discontinuation, deferment or redirection of competing lines of research and early pipeline products.”¹²³ The idea of post-merger exit from lines of research and early pipeline products is not entirely new. For instance, in *GE/Alstom*, the Commission found that GE planned to discontinue parts of Alstom’s 50hz HDGT product offering and related R&D capabilities (see above). However, the Commission specifically identified the products and related activities that the merged entity was likely to shut down. In contrast, in *Dow/DuPont*, the Commission concluded that the merger gave rise to a SIEIC even though it conceded that it “may not be able to identify precisely which early pipeline products or lines of research the parties would likely discontinue.”¹²⁴

¹²⁰ In the US, the innovation markets framework applied in the past required agencies to determine if the merger would bring about a reduction in the R&D spend/innovation incentives of the parties, their rivals and/or of the whole industry.

¹²¹ *Dow/DuPont*, *op cit.*, at ¶ 387.

¹²² *GE/Alstom*, *op cit.*, at ¶ 504. The Commission noted that Alstom was a “strong competitor as regards R&D spend (accounting for more than 30% of total industry R&D spend) and headcount (accounting for more than 20% of total R&D headcount).”

¹²³ *Dow/DuPont*, *op cit.*, at ¶ 277. See also, *id.* at ¶¶ 2034, 3019, 3024. The decision is not always clear if this specific risk of exit from innovation spaces is distinct from the overall lower incentives to innovate of the merging parties. This is illustrated by the difference between ¶ 277 and ¶ 278. In fact, the Commission appears to tie both effects together where it mentions that “given the increase in cannibalisation associated to the overlapping lines of research [post-merger integration information] and the early pipeline products where to reduce their combined innovation efforts[.]” *Id.* at ¶ 3026.

¹²⁴ *Id.* The Commission simply mentioned that it “finds it probably [sic] that the early pipeline products and lines of research described in Sections V.8.9.2 to V.8.9.4 are the candidates for a likely reduction of innovation effort given the closeness of innovation competition between the parties on the targeted innovation spaces[.]” *Id.* at ¶ 3025. However, no evidence is put forward to substantiate this assertion.

Moreover, *Dow/DuPont* raises questions as to the appropriate standard of proof: how much and what type of evidence is required to substantiate concerns of a post-merger exit from lines of research and early pipeline products? In *Dow/DuPont*, the evidence primarily consisted of the parties' internal documents. Unfortunately, the four paragraphs devoted to those documents are almost entirely redacted.¹²⁵ In addition, the probative weight that may be attached to internal documents is not clearly defined. In this regard, the Commission notes that parties are careful not to include in high-level strategic documents "*statements on post-integration plans which would attract increased scrutiny of the merger by competition authorities.*"¹²⁶ Accordingly, it considers that "*post-integration planning and synergy documents produced at working level within the post-integration planning team which are produced in the ordinary course of business are in principle a better source of evidence to assess future incentives.*"¹²⁷ This approach leaves open a number of issues. Were the documents produced by employees with the necessary decision-making power to implement those plans (or signed-off by someone with the requisite authority)? Do the documents represent definitive plans or merely blue-sky thinking?¹²⁸

Although the Commission relied on internal post-integration planning documents in *GE/Alstom*, those were supplemented by an exhaustive assessment of the parties' incentives to discontinue HDGT products and related research. This included a thorough market investigation with interviews of competitors and customers on this specific issue.¹²⁹ The higher standard of proof that was applied in *GE/Alstom* is even more remarkable, given the narrower product scope of the Commission's review. In contrast, in *Dow/DuPont*, only 25% of customers in the market investigation indicated that they would expect the merged entity to bring fewer novel AIs to the market than the "*total AIs output of DuPont and Dow taken together pre-transaction.*"

¹²⁵ An initial presentation to investors discussing cost synergy opportunities that mentions an objective to "[e]liminate duplicative R&D programs" is featured in the competitive assessment (*Id.* at ¶¶ 3030-34).

¹²⁶ *Id.* at ¶ 3063.

¹²⁷ *Id.* at ¶ 3066.

¹²⁸ *EC Internal Documents Focus Calls for Guidelines, Increased Dialogue in Merger Review – AmCham Brussels*, PaRR (Oct. 27, 2017).

¹²⁹ *Dow/DuPont*, *op cit.*, at ¶¶ 3035-36.

C. Change in Merger Policy

SIEIC marks an evolution in EU merger policy, but just how much is open to debate. On the one hand, SIEIC represents a significant shift. The Commission has previously taken into account the effect of market concentration on innovation incentives.¹³⁰ However, before *Dow/DuPont*, innovation competition was systematically assessed by reference to current or future downstream product markets¹³¹ as opposed to upstream innovation spaces/markets.¹³² This approach is consistent with the Commission's established antitrust policy.¹³³ *Deutsche Börse/NYSE* is arguably an exception (see above), but the Commission's assessment was in fact anchored to existing products (e.g., European interest rate derivatives). On the other hand, SIEIC does not mark a departure from established merger control practice in an important sense:

¹³⁰ Isolated Commission decisions such as *Glaxo Wellcome/SmithKline Beecham* and *Syngenta/Monsanto's Sunflower Seed Business* (see above) may have given the impression that a certain degree of "innovation markets" analysis has been undertaken in EU merger control cases. In *Glaxo Wellcome/SmithKline Beecham*, the Commission took the view that it was necessary to assess the impact of the transaction on "R&D markets." And in *Syngenta/Monsanto's Sunflower Seed Business*, the text of the decision suggests that increased concentration could lead to a lower rate of innovation. In particular, in its assessment of the effects of the transaction on the Hungarian market for the commercialisation of sunflower hybrids, the Commission concluded that the transaction was "likely to have a negative impact on innovation by eliminating the competitive constraint that the breeding programme and the germplasm of Monsanto exerted on Syngenta and on other competitors to regularly bring new improved varieties into the market" (*Syngenta/Monsanto's Sunflower Seed Business* decision, *op cit.*, at ¶ 321). However, those theories of harm have never been predicated on the adverse effect of a transaction on R&D markets. In *Glaxo Wellcome/SmithKline Beecham*, the Commission dismissed concerns of adverse effects on R&D markets (*Glaxo Wellcome/SmithKline Beecham*, *op cit.*, at ¶¶ 187-88). And the statement in *Syngenta/Monsanto's Sunflower Seed Business* reads as a laconic endorsement of one of several negative views that were gathered from third parties during the market investigation.

¹³¹ See, e.g., *Novartis/Glaxo Smith Kline's Oncology Business*, *op cit.*, which was specifically referenced as an example of a case where innovation competition was assessed by the Commission in *Dow/DuPont*, *op cit.*, at ¶ 290.

¹³² In a 2016 article, two Commission officials reached a similar conclusion stating that "innovation markets" analysis was not a part of EU merger control policy. According to Sebastian Müller and Arthur Stril of the Commission's DG COMP, "Whilst other competition authorities such as the U.S. antitrust agencies have defined and assessed innovation markets in the past, the Commission has not." See Sebastian Müller and Arthur Stril, *European Merger Control and Innovation Competition: Moving the Goalpost*, *Symposium: Competition and Innovation*, 2 COMPETITION L. POL'Y & DEBATE 3, 53 (2016).

¹³³ This interpretation of the application of the EUMR is also consistent with the general approach followed by the Commission in other areas of EU competition law. For instance, the Horizontal Cooperation Guidelines provide that "in the absence of exceptional circumstances, the Commission would not try to assess the impact of a given R&D co-operation on innovation, but would limit its assessment to existing product and/or technology markets which are related to the R&D co-operation in question[.]" Horizontal Merger Guidelines, *op cit.*, at ¶ 122.

the impact of mergers on innovation competition is assessed on the basis of a standard unilateral effects analysis. As ever, the truth probably resides somewhere in the middle.

At any rate, even if one accepts the Commission's position that it merely applied the standard unilateral effects model in *Dow/DuPont*, the shift in the focus of the assessment from pricing incentives to innovation incentives still represents a small but significant change in the analytical framework. This raises the question of whether the standard unilateral effects model can be applied seamlessly to innovation competition in the same way it has been applied to price competition. This question is discussed in the next section.¹³⁴

II. Economics

This section acknowledges that there is an appeal in extending the application of the standard unilateral effects model to assess innovation competition. However, this paper demonstrates that it is not possible to apply the SIEIC model of unilateral effects in its current form to predict post-merger innovation effects. This section concludes with some suggestions on how to address those shortcomings.

A. Innovation Diversion and SIEIC

SIEIC theory predicts the exit of the merged firm from innovation spaces where competition reduces one or more of the parties' post-merger profits' from innovation. Farrell and Shapiro argue that the risk of post-merger exit from R&D through the discontinuation, redirection or deferment of R&D projects is a function of the "innovation diversion ratio":

If Firm A devotes more resources to improving its products, it will (on average) increase its operating profits (gross of its R&D expenditures) and reduce Firm B's profits. This simple logic leads to the "innovation diversion ratio," which is distinct from the usual (pricing) diversion ratio. The innovation diversion ratio to Firm A from Firm B is the fraction AB I of the extra gross profits earned by Firm

¹³⁴ In their seminal paper, which introduced tools for the measurement of unilateral effects, Joe Farrell and Carl Shapiro noted that "a merger can impact different dimensions of competition very differently" and further added that "the impact of a merger on pricing incentives might not match up very closely with its impact on innovation incentives." See Joseph Farrell and Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, 10 B.E. J. OF THEORETICAL ECON. 1 (2010), available at <https://ssrn.com/abstract=1313782>.

*A when it devotes more resources to innovation that come at the expense of Firm B.*¹³⁵

If the innovation diversion ratio is sufficiently high, the merger puts a “*cannibalisation tax on the fruits of R&D investments by firm A*” which may lower innovation. Farrell and Shapiro do not, however, provide threshold levels for innovation diversion ratios.

Conceptually, innovation diversion is similar to sales diversion as a result of post-merger price competition in markets for differentiated consumer goods. In a merger between two close competitors X and Y, firm X will internalise the adverse effects on sales of price competition on firm Y. Hence, X has lower incentives to engage in price competition post-merger, and thus the merger gives rise to a SIEIC. In an innovation setting, the assessment simply shifts its focus from post-merger price competition to R&D investments.

But can one substitute price with R&D in the standard unilateral effects framework without further adjustments to the model? Put differently, do the findings of a standard unilateral effects model involving price effects analysis hold true when non-pricing decisions, and in particular R&D decisions, are considered? There are three factors that call this hypothesis into question.

B. Ability to Discontinue R&D

One of the R&D exit scenarios envisaged by a SIEIC is that the merged firm will have an incentive to “*discontinue*” R&D. In order to satisfy the test for a SIEIC, the innovation diversion ratio must reach a certain threshold. The Commission’s emerging merger control practice is to assess the closeness of competition of the merging parties in innovation spaces.¹³⁶

However, this raises the question whether or not an examination of the merged entity’s *ability* to discontinue planned or existing R&D programmes is required at the outset. This question arises because a straightforward transposition of the standard unilateral effects model assumes that this is the case. SIEIC effectively assumes that pricing and R&D decisions are fungible variables. However, the validity of this assumption is questionable. Unlike prices and output which can – to some extent – be adjusted in the short term, firms are unable to shut down R&D programmes without

¹³⁵ *Id.* at 28.

¹³⁶ In *Dow/DuPont*, the Commission essentially compared the parties’ innovation outputs, namely patent shares quality-adjusted statistics – counts and citations – as well as active ingredients’ shares.

friction. This is because R&D capital is largely composed of inflexible assets. R&D capital must first be amortised or divested, which is not seamless. Moreover, R&D capital may be asset-specific, in which case it is a sunk cost. It follows that a firm may be trapped behind an exit barrier in relation to a particular research programme.¹³⁷ This creates a degree of path-dependence to continue R&D.

It is also easy to overlook that in many industries R&D investments represent labour as opposed to capital. Admittedly, the labour intensiveness of R&D is an empirical question. Nonetheless, there are four ways in which the labour component of R&D has an adverse impact on the flexibility of a firm's decision-making. First, R&D labour capacity is fixed in the short term. Even if a board decides to shut down an R&D programme, the human capital associated with the programme remains within the firm. A post-merger decision to eliminate duplicative R&D programmes does not automatically imply that the scientists who worked on those programmes will be made redundant. Second, labour mobility is not perfect. If a board decides to reduce the number of R&D staff, the implementation of this decision will not be immediate and may involve outlay costs. This is particularly true in situations where the staff are located in countries with stringent labour regulations. Third, making R&D staff redundant may be strategically suboptimal, in particular in concentrated markets. Unlike machines, staff have acquired transferable skills, know-how and been exposed to trade secrets. It is therefore bad practice to push knowledgeable workers to leave the company. To do so carries the risk that those workers take their skills to a competitor. Moreover, the merging parties potentially forego an opportunity to benefit from synergies that could arise from a cross-fertilisation of ideas between their respective R&D teams.

The bottom line is that unlike prices, R&D investments cannot be increased or decreased at the flick of a switch. R&D decisions are lumpy, unlike pricing or output decisions which are continuous choice variables with continuously differentiable impacts on quantities sold. Additionally, there may be industry-specific factors that create even more decisional inflexibility, e.g., the need to retain scientists in pharmaceutical companies to oversee the registration and regulatory approval process. Strategic considerations, such as maintaining an R&D programme for defensive

¹³⁷ This is recognised by the Commission in Annex 4 of the *Dow/DuPont* decision where it states that: “Discontinuation of the development of a product in the pipeline is more likely to occur the higher the level of development and commercialisation costs that have not yet been incurred (relative to market sales) and the higher the expected sales which the pipeline product would capture (if launched) from the existing/future products of the merged entity” (*Dow/DuPont*, *op cit.*, at ¶ 44 of Annex 4).

patenting purposes, may also come into play. Unless SIEIC theory adequately addresses the issue of what happens to the capital and human resources that support R&D programmes that may be discontinued post-merger, it is not possible to draw any robust conclusions on the risk of lower innovation competition.¹³⁸

C. Incentives to Redirect R&D

A SIEIC may also be predicated on an R&D exit scenario whereby the merged entity has an incentive to “*redirect*” R&D thus eliminating rivalry between the merging parties and diminishing competition in the innovation space. This theory falls flat because it fails to demonstrate that the merger will have an adverse impact on welfare. Admittedly, if competing R&D capabilities are redirected towards distinct R&D targets, there is a lessening of competition. But is this decrease in competition detrimental to welfare in terms of overall innovation output? The answer to this question lies in whether or not the welfare costs of reduced competition within one innovation space are outweighed by the welfare benefits brought about by the increased ability of the merged entity to deploy its R&D resources across a higher number of innovation spaces. This question needs to be addressed in order to determine the supposed net welfare impact of a merger between close innovators.

A fictional example can be used to illustrate this point. Imagine that the world has 2 islands. A hidden treasure is buried on each island. Each hidden treasure contains a vaccine against a terminal plague that decimates residents of the mainland. There are two treasure hunting companies, A and B. Both companies have raised funding to finance an expedition, each with one vessel. The territory of the islands is fixed, and one vessel is enough to explore an island. On a scale of 0 to 1, the probability of finding the treasure is close to 1. If A and B are rivals for the discovery of the treasures, there is a 0.5 probability that they will compete on the same island. Competition will lead to a more rapid discovery of the treasure on the island where the search takes place, but the treasure on the other island will remain undiscovered. The resources deployed by the losing company will be wasted. This is a deadweight loss to

¹³⁸ Given the uncertainty that surrounds early stage research, the exit of one of the merging parties from an innovation space does not necessarily entail a loss of innovation output. For instance, both parties may be targeting the same solution, but there may be differences in the methods and/or mechanism each party is employing. Post-merger, the merged entity might want to continue both approaches, at least until it is understood which is most likely to succeed or yield a solution that is more efficacious and cost-effective. If, at that point, one line of research is abandoned since the chance of success is remote, the post-merger reduction of innovation competition is unlikely to translate into fewer solutions being introduced to market. Moreover, the merged entity will be able to re-direct those resources towards other R&D targets (discussed in Section II(C), below), which could potentially lead to a net increase in innovation output.

society. Following the discovery of the treasure, both companies are able to conduct searches on the other island. However, the discovery will occur at a later stage, and this delay is a social cost. In contrast, if A and B were to cooperate, they would be able to coordinate their searches so that their vessels conduct searches of both islands. It follows that coordination between A and B will lead to a more efficient allocation of treasure hunting resources, and the two vaccines will be discovered at a lower cost to society (no duplication, no delay).

There is therefore a trade-off between competition in innovation spaces and coordination across innovation spaces. Again, this is an empirical question. In some industries, the harm to competition may well outweigh the benefits of coordination associated with a merger.¹³⁹ However, in other cases, increased post-merger coordination may lead to an improvement in welfare. Whichever effect dominates the other, in industries where the likelihood of discovery is high (*i.e.*, between 0.5 and 0.9), the potential increase in the likelihood of discovery is exponential (*i.e.*, it increases with time), and discovery spaces widen, the welfare effects of coordination should be carefully investigated.¹⁴⁰ As applied in SIEIC, the standard unilateral effects model overlooks these issues because it addresses a simple question: post-merger will there be “higher” or “lower” R&D? This question fails to grasp that a merged entity not only faces a choice between *more* or *less* R&D, but in fact a more complicated questions as to “*where*” its R&D resources should be allocated.

The inability or reluctance to factor in these potential benefits largely stems from the stigma associated with coordination in competition policy. Adam Smith’s maxim that “*people of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public*” is deeply anchored in mainstream antitrust thinking.¹⁴¹ This is a problem, because innovation theorists have long

¹³⁹ Werden however makes the point that efforts to reduce cannibalization reduce anticompetitive effects from the merger, so that harm to competition may not be as big as it seems. This is the by-product of the fact that non merging lines of research may be repositioned between the lines of research of the merging firm. See Amit Gandhi et al., *Post-Merger Product Repositioning*, 56 J. INDUS. ECON. 1, 49-67 (2008).

¹⁴⁰ *Dow/DuPont*, *op cit.*, at ¶ 297: “Accordingly, the likelihood of success is very different in crop protection than it is in the pharmaceutical industry. It gradually increases in the discovery phase from a relatively low level in the early stages – albeit higher than for pharmaceutical candidates in the pre-clinical phase – to higher levels in the later stages[.]”

¹⁴¹ See ROBERT FRANK, *THE DARWIN ECONOMY LIBERTY: COMPETITION, AND THE COMMON GOOD* (Princeton Univ. Press 2011). However, the benefits of coordination, and duplication avoidance have been recognised by competition agencies, in particular in relation to standardisation, which avoids the costs of standards wars, and specialisation agreements. See, *e.g.*, the Horizontal Cooperation Guidelines, *op cit.*

acknowledged that innovation requires a degree of organisation to thrive. Teece observes that “successful new product and new process development innovation often requires horizontal as well as vertical cooperation.”¹⁴² In discussing the US, he adds that:

*it has been fashionable in the United States to argue that diversity is the leitmotif of successful innovation. Unquestionably, a system of innovation that converges on just one view of possibilities is likely to close off productive avenues of inquiry. However, in a private enterprise economy without some horizontal coordination and communication, there is no guarantee that the level of diversity obtained is ideal. If firms are able to coordinate their research programs to some degree, uneconomic duplication in some instances can be minimized without the industry converging on a single technological approach.*¹⁴³

In principle, there is no reason why Teece’s reasoning cannot be extended to intrafirm coordination.¹⁴⁴ After all, a merger is just the ultimate form of interfirm coordination.¹⁴⁵

D. Incentives to defer R&D

The third scenario of R&D exit envisaged by a SIEIC is the “deferral” of R&D by the merged firm. This scenario gives rise to two hypotheses, even though the distinction between them is not entirely clear. First, the lost rivalry due to the merger will lead to the slower development and introduction of new products (and processes).¹⁴⁶ Second, the combined entity will “delay” some R&D programmes.¹⁴⁷ However, both of these scenarios fail to take into account that R&D structures within firms are heterogeneous. There are varying degrees of centralisation both in terms of organisation structure (e.g., corporate-level vs. business unit-level R&D labs) and decision-making for R&D funding (e.g., headquarter vetted vs. business unit vetted R&D

¹⁴² See David Teece, *Competition, Cooperation and Innovation*, 18 J. ECON. BEHAVIOR & ORG. 1, 12 (1992).

¹⁴³ *Id.* at 12-13.

¹⁴⁴ Teece actually discusses coordination by internal organisation within an integrated firm, and its effects on innovation, and discusses its possible downsides. See Teece, *Competition, Cooperation and Innovation*, *op cit.*, at 18-19, 23.

¹⁴⁵ In a thorough paper on innovation and merger policy, Katz and Shelanski actually recommended that agencies ask systematically whether a merger “will create beneficial coordination in R&D, prevent wasteful R&D, and/or raise incentives to undertake innovation that are not likely to occur absent the merger”. See Katz and Shelanski, *op. cit.*, at 80.

¹⁴⁶ *Dow/DuPont*, *op cit.*, at ¶ 2013: “encouraging the merged entity to curtail its innovative efforts and capabilities below the level that would prevail if the Transaction was not to happen.”

¹⁴⁷ *Id.* at ¶ 60, n. 35. See also, Annex 4, ¶ 39 (“Parallel research paths can accelerate innovation if there is uncertainty about the correct solution to a specific technological program.”).

budgets).¹⁴⁸ For example, *DuPont* is often cited as an example of the decentralised R&D model where research is conducted at the divisional level or within business units.¹⁴⁹

Standard unilateral effects analysis pays no heed to the organisation of R&D within the merged entity. As a result, SIEIC does not contemplate the possibility that there may be post-merger intrafirm R&D competition in the same innovation space on account of the merged firms' organisational structure. In practice, an assessment of innovation competition should examine the merging parties' post-closing organisation plans. It is worth noting here that the Commission has previously examined post-closing integration plans, but only to the extent that it conveyed information on the parties' strategic intentions (e.g., *Pasteur Merieux-Merck*, *GE/Alstom* and *Dow/DuPont*).

Moreover, the merger itself may change the parties' organisational incentives. In particular, given that innovation is "stochastic," the post-merger incentive of a merged firm to promote a degree of intrafirm competition within the same innovation space increases.¹⁵⁰ When the probability of discovery is between 0.1 and 0.5, it is presumably rational to duplicate research efforts so as to increase the likelihood of success of discovery. Again, this can be understood with a stylised example. If you have one die, there is a 1/6 probability that a roll of the die will yield a five. If you have two dice, the probability that either die yields a five is 1/3.¹⁵¹ This argument is not entirely consistent with the notion that coordination also facilitates discovery. But this inconsistency is only superficial. Research processes are not linearly stochastic. If basic research (e.g., blue skies research) is very uncertain, a degree of internal competition may be beneficial, if it is introduced at an early stage. This is possible within a merged firm with a sufficiently decentralised R&D organisation. As the uncertainty of discovery decreases – e.g., when the process moves closer towards the development phase – a certain degree of coordination can be introduced into the process as a result of the merger. This avoids the continuation of uneconomic and wasteful duplication of

¹⁴⁸ Nicholas Agyres and Brian Silverman, *R&D, organization structure, and the development of corporate technological knowledge*, 25 (8-9) STRATEGIC MGMT. J. 925, 930 (2004).

¹⁴⁹ *Id.*

¹⁵⁰ *Dow/DuPont*, *op cit.*, at ¶ 2067.

¹⁵¹ The probability is in fact $1/6 + 1/6 - 1/36$, if you rule out the possibility each dice yields a five.

efforts by decentralised research units. Interestingly, in *Dow/DuPont*, the Commission recognised that the R&D process in the crop protection industry displays these characteristics where it states that:

The likelihood of success [...] gradually increases in the discovery phase, from a relatively low level in the early stages – albeit higher than for pharmaceutical candidates in the pre-clinical phase – to higher levels in the later stages ([...]). Moreover, because the main toxicology and environmental screenings are increasingly done as early as possible in discovery, the likelihood of success becomes very high as soon as the molecule is moved into development, with an 80 to 90% chance of reaching the market.¹⁵²

The underlying assumption that a merged firm is a black box without the possibility of intrafirm competition is a critical shortcoming of SIEIC. This simplification negatively impacts the reliability of predictions of a delay of overlapping lines of research or early pipeline products.

E. Conclusion

SIEIC is an intuitive theory of harm. However, its current formulation is incomplete, because it does not consider the structural rigidity of R&D resources, the counterbalancing effect of intrafirm coordination across innovation spaces, or the organisational structure of R&D in a merged firm.¹⁵³ Taken together, these factors can plausibly decrease the opportunity cost of innovation as well as outweigh the internalised cost of innovation diversion. Moreover, the SIEIC model fails to take into account merger-specific innovation efficiencies. In their 2010 paper, Farrell and Shapiro were careful to stress that:

The innovation diversion ratio in a given case may well be hard to estimate. Likewise, the default level of innovation efficiencies to be applied in general may well be hard to establish. But these are not gratuitous difficulties. The impact of the proposed merger on innovation incentives really does depend on the extent to

¹⁵² *Dow/DuPont*, *op cit.*, at ¶ 297.

¹⁵³ Gilbert acknowledges that most economic models do not account for “organizational limitations, financial constraint or agency issues”, but then seems to discard this as “anecdotes”. We are not entirely certain that those issues can be so easily disregarded. In merger policy, agencies generally consider the internal firms’ organization when they discuss for instance the weight of the evidence gathered (*e.g.*, employee level v board level testimony) or the delineation of remedies (*e.g.*, what to divest and where to split a firm). Moreover, in the case by case approach of merger policy, the point is precisely to take account of anecdotal and specific considerations. Otherwise, merger control would be governed rules and presumptions. See R. Gilbert, *op. cit.*

*which Firm A's pre-merger rewards from innovation come at the expense of Firm B, and on merger efficiencies relating to innovation.*¹⁵⁴

However, sequentially, innovation efficiency claims are typically examined after an antitrust regulator has formulated its theory of harm.¹⁵⁵ Moreover, economic consultants often complain that the evidentiary burden for efficiency claims is significantly higher than the one that must be discharged by a regulator to demonstrate that a merger will give rise to competitive harm.¹⁵⁶ Both those elements make it difficult to conduct a truly holistic assessment of a merger's effects on innovation competition. Yet, those procedural constraints of merger control reviews should have no bearing, or be adjusted, if the economic theory applied requires such a holistic assessment.

III. Models, Data and the Economic Methodology of Merger Policy

Merger control reviews are prospective. Regulators have thus become increasingly dependent on economics to aid their inquiries. As in other evidence-based areas of public policy, economic theory can be combined with data to generate empirical findings. At the same time, the application of economics to public policy – also referred to as applied economics – remains controversial. Since the twentieth century, there has been an ongoing debate as to whether economics constitutes a “science” that can usefully guide decision-making.¹⁵⁷ The economics community has more or less settled

¹⁵⁴ Farrell and Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, *op cit.*, at 34.

¹⁵⁵ Note that efficiency arguments are rarely considered in merger control reviews.

¹⁵⁶ See Andrea Lofaro, Stephen Lewis and Paulo Abecasis, *An Innovation in Merger Assessment?: The European Commission's Novel Theory of Harm in the Dow/DuPont Merger*, 32(1) ANTITRUST 100, 100-07 (2017) (“Although the Commission did agree that bringing together complementary strengths and expertise, as well as complementary assets, could in principle offset the negative impact of the merger on innovation incentives, it considered these as potential countervailing efficiencies, for which the burden of proof lies squarely with the merging parties. Justifying a merger before the Commission on the basis has proven to be very difficult even in the typical setting where concerns center on price increases. In particular, it is by no means easy to show, to the standard of proof required, merger-specific variable cost reductions that offset the upward pressure on prices brought about by standard unilateral effects. Indeed, the Commission has never justified the clearance of a merger that it would otherwise have blocked purely on the basis of efficiencies. However, in a setting where concerns center on unquantifiable reductions in innovation incentives, the task becomes impossible”).

¹⁵⁷ In his Nobel Prize Lecture, Friedrich von Hayek criticised the “scientific” attitude in economics. See Friedrich von Hayek, *The Pretense of Knowledge*, Nobel Memorial Lecture, 11 (Dec. 1974), available at <http://pavroz.ru/files/hayekpretence.pdf>. See also Alexander Rosenberg, (U. Chi. Press 1992); Margaret Schabas, *An Assessment of the Scientific Standing of Economics*, 1986 PROCEEDINGS OF THE BIENNIAL MEETING OF THE PHILOSOPHY OF SCIENCE ASSOCIATION 1, 298-306 (1986); and Douglas Hands, *What Economics is Not: An Economist's Response to Rosenberg*, 51 PHIL. SCI. 3, 495-503 (1984).

on certain basic standards that need to be fulfilled for a model to be valid (A), and EU case law further provides that the lawful use of economic models and data in merger control reviews is subject to four requirements (B). This paper discusses the application of these standards and conditions to SIEIC as set out in *Dow/DuPont*, in order to assess where improvements to the theory may be necessary (C).

A. Applied Economics in a Nutshell

In order to reach empirical findings, applied economics uses the *deductive method*. This combines the application of a *theory* on the one hand, and the consideration of *empirical evidence*, on the other hand.¹⁵⁸ The goal of the theory is to “*frame a case*” by articulating a hypothesis, scenario or story (1). The goal of the empirical evidence is to ascertain whether observable and available “*facts and data*” are largely consistent with the posited theory (2).

I. Economic theory

The theory step often consists of the construction or selection of a “*model*.” Gibbard and Varian define a model as “*a story with a specified structure*.”¹⁵⁹ The story, for example, may correspond to the general hypothesis of Adam Smith that “*every individual, without intending it, labours to render the annual revenue of the society as great as he can*.”¹⁶⁰ The structure involves the identification of all the *conditions* that are necessary to make the story true. For example, the existence of perfect rationality, information and competition is required in order to make Smith’s prediction valid. In addition, the structure involves the formulation of a *logical form* – often mathematical – in which the conditions yield a deduction, prediction or theorem. For example, when economic agents enjoy perfect information, any increase in price on the market will be instantly detected. As a result, rational actors on the demand side will seek alternative suppliers. If there is perfect competition, there will be an infinite number of suppliers that are capable of meeting consumer demand, thus leading to a reduction in price.

¹⁵⁸ Lars-Hendrik Röller, *Economic Analysis and Competition Policy Enforcement in Europe*, in *MODELLING EUROPEAN MERGERS: THEORY, COMPETITION AND CASE STUDIES* (Peter Van Bergeijk & Eric Kloosterhuis eds., Edward Elgar Publishing 2005).

¹⁵⁹ Allan Gibbard and Hal Varian, *Economic Models*, 75 J. PHIL. 664, 664-77 (1978).

¹⁶⁰ ADAM SMITH, *AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONALS* 423 (Canaan ed., Methuen & Co 1937).

The conditions that are identified in a model are drawn from empirical observations. Economists who build models attempt to generalise, simplify and abstract away those conditions from irrelevant empirical factors in the “belief that any good economic theory must be both comprehensive in scope and have a compact theoretical core capable of covering the same extremely broad range of phenomena.”¹⁶¹ This filtering process yields abstract approximations that are known as “assumptions.”¹⁶² Sometimes, economists rely on “*ceteris paribus*” propositions in order to omit interfering factors from the structure of the model, even though they may be relevant to explain economic phenomena.

In economics, a certain degree of controversy exists as to the use and construction of economic models. All or most of the criticism is directed at the fact that in some cases models contain “false” assumptions, *i.e.*, assumptions that do not reflect reality.¹⁶³ Moreover, although economists occasionally revise their basic models to take into account predicates that have been excluded from “*ceteris paribus*” propositions, such a revision will often be a “last resort.”¹⁶⁴

Milton Friedman and many other distinguished economists have attempted to address the false assumption critique.¹⁶⁵ Whilst Friedman has made the bold claim that there is no other test of a theory in terms of whether its “assumptions” are “unrealistic,” a number of best practices have been developed over the years that are now widely accepted.

First, models provide “stories.” We should not expect them to yield a “systematic body of laws” that govern the allocation of resources in the economy. As Schabas notes, models “are mainly useful for channelling one’s thoughts towards a specific problem, for giving one a feel for the underlying structure of a situation, rather than mimicking reality directly.”¹⁶⁶

¹⁶¹ Alex Rosenberg, *The Inexact and Separate Science of Economics*, 90(10) J. PHIL. 533, 535 (1993) (referred to as the “ideal of explanatory unification”). See also Uskali Mäki, *Realistic Realism about Unrealistic Models*, in THE OXFORD HANDBOOK OF PHILOSOPHY OF ECONOMICS 71 (Harold Kincaid Don Ross eds., Oxford Univ. Press 2009).

¹⁶² Assumptions are also referred to as postulates, predicates and generalisations.

¹⁶³ Alexander Rosenberg, *If Economics Isn't Science, What Is It?*, 14 PHIL. F. 296, 296-314 (1983). Rosenberg notes that this places modern economics in the same realm as “Euclidean geometry which was mistakenly regarded as the “science of space” until the advent of the theory of general relativity.”

¹⁶⁴ Rosenberg, *The Inexact and Separate Science of Economics*, *op cit.*, at 535.

¹⁶⁵ Milton Friedman, *The Methodology of Positive Economics*, ESSAYS IN POSITIVE ECONOMICS (Univ. Chicago Press 1953).

¹⁶⁶ Margaret Schabas, *An Assessment of the Empirical Standing of Economics*, PROCEEDINGS OF THE BIENNIAL MEETING OF THE PHILOSOPHY OF SCIENCE ASSOCIATION, *op cit.*

Second, models are useful, even if their assumptions are not exactly true. However, those assumptions should be “close enough to the truth.”¹⁶⁷ Hausman says that “one needs to judge whether the needed assumptions are reasonable approximations.”¹⁶⁸

Third, models are useful, even if the underlying assumptions are not always true. Unless deviations from those assumptions are systematic, it is possible to work with imperfect assumptions.¹⁶⁹ For example, the inverse relationship between quantities and prices holds true more often than not (e.g., in Giffen goods). Accordingly, this relationship can form a reliable basis for public policy decisions in a number of areas.

Fourth, not all assumptions in a model are equal, and only unrealistic *critical* assumptions are problematic.¹⁷⁰ A critical assumption is an assumption that “would produce a substantive difference in the conclusion produced by the model.”¹⁷¹ For example, moving from perfect rationality to bounded rationality does not change the predicted outcome that perfect competition leads to allocative efficiency.

Fifth, empirical observations may expose flawed, missing or unstated critical assumptions in models that appear definitive because of explanatory unification, *i.e.*, the unification of disparate phenomena. In such cases, models will need to be revised or new models will have to be introduced. In this regard, Rodrik states that “economics encompasses a collection of models” and “the discipline advances by expanding its library of models and by improving the mapping between these models and the real world.”¹⁷²

¹⁶⁷ Gibbard and Varian, *Economic Models*, *op cit.*, at 669. For instance, it may be that when initially specifying the structure, “initially unclear what is to be explained, and a model provides a means of formulation.”

¹⁶⁸ Daniel Hausman, *Economic Methodology in a Nutshell*, 3(2) J. ECON. PERSPECTIVES 115, 121 (1989) (“Without assessments of realism (approximate truth) of assumptions, the process of theory modification would be hopelessly inefficient and the application of theories to new circumstances nothing but arbitrary guesswork.”), available at http://manoa.hawaii.edu/ctahr/aheed/Carl/supplementary%20readings/Hausman_1989_Economic_Methodology_in_a_Nutshell.pdf

¹⁶⁹ Gibbard and Varian, *Economic Models*, *op cit.*, at 670 (“if deviations are random, or more precisely, are not systematic, there might be good reason to have some faith in the conclusions.”)

¹⁷⁰ Dani Rodrik, *ECONOMICS RULES: WHY ECONOMICS WORKS, WHEN IT FAILS, AND HOW TO TELL THE DIFFERENCE* 27 (Oxford Univ. Press 2017).

¹⁷¹ *Id.*

¹⁷² *Id.* at 5.

2. Data

The use of data in economics is also subject to debate. There is a certain degree consensus that data needs be unbiased, sufficiently representative, and statistically significant. At the same time, the academic debate on the correct approach to selecting models, which is data-driven, has not been settled.

When an economic model yields a prediction, the discussion – including in a competition law setting – invariably turns to *verifying* that the prediction is consistent with economic reality. Rodrik talks of “*moving back and forth between the candidate models and the real world.*”¹⁷³ The question that underpins Rodrik’s statement is whether or not a model that works in theory will also work in the real world.

In practice, this verification procedure – or “*fitness*” exercise – may consist of econometric or experimental analysis (*i.e.*, laboratory, field or natural experiments). However, policy issues “*either do not lend themselves to experiments or require answers in real time.*”¹⁷⁴ Consequently, a degree of “*casual observation*” is tolerated in model selection.¹⁷⁵ If the model has “*striking features,*” a search for economic situations with those features will be conducted.¹⁷⁶ If the model contains a number of assumptions or if it caveats interfering factors as *ceteris paribus*, the real world importance of those predicates and interfering factors left outside of the model need to be examined.¹⁷⁷ This difficult exercise is necessary. As Samuelson wrote: “*it may be precisely the ignored variables that keep the real world stable, and it takes a significant act of inductive inference to rule this out [...].*”¹⁷⁸

¹⁷³ *Id.* at 93.

¹⁷⁴ *Id.*

¹⁷⁵ See Gibbard and Varian, *Economic Models*, *op cit.*, at 672.

¹⁷⁶ *Id.*

¹⁷⁷ See Rodrik, *ECONOMICS RULES: WHY ECONOMICS WORKS, WHEN IT FAILS, AND HOW TO TELL THE DIFFERENCE*, *op cit.*, at 179 (“*When causal mechanisms interact strongly with each other and cannot be studied in isolation, models do need to include those interactions*”).

¹⁷⁸ See Paul Samuelson, *Professor Samuelson on Operationalism in Economic Theory: Comment*, 63 *QUARTERLY J. ECON.* 310, 310-14 (1955).

B. Economics, Merger Policy and the Law

I. Economics and Merger Analysis

How is this relevant to merger policy? Since 2004 – a year in which the EU Court endorsed the principle of integrating economic analyses into competition policy – the field has become quite model-dependent. This trend is clearly illustrated in *Dow/DuPont*. At a high level, the decision repeatedly underlines that the case involves the application of the unilateral effects model of price competition to innovation competition.¹⁷⁹ A significant part of Annex 4 is devoted to demonstrating the validity of the economic models that predict a post-merger reduction in innovation competition;¹⁸⁰ and discounting economic models that found the merger would give rise to a neutral or positive effect on innovation competition.¹⁸¹

Economic models that are employed in merger control reviews may attract criticism for being based on unrealistic assumptions.¹⁸² However, this line of attack would be “naïve.”¹⁸³ A more constructive approach would be to check the veracity, probability, criticality, and completeness of a model’s underlying assumptions. Moreover, putting economic models on trial on principled grounds entirely discards their usefulness to merger control policy. Indeed, in a merger control context, where there are information asymmetries, economic models enable antitrust regulators to draw non-arbitrary inferences as to a merger’s effects on competition. At the same time, however, the ability of antitrust regulators to select and apply economic models should be subject to certain safeguards in the public interest. This is what the case law strives to achieve.

¹⁷⁹ *Dow/DuPont*, *op cit.*, at ¶¶ 145, 153, Annex 4, ¶ 41 Annex 4. Although there is no explicit reference to a “model,” the *Dow/DuPont* decision refers to a “logic.”

¹⁸⁰ The dispositive value of Annex 4 is difficult to assess since it is not entirely clear to what extent the selected models influenced the Commission decision to intervene in the merger.

¹⁸¹ For example, in monetary policy, financial markets, environmental economics, industrial organisation, etc.

¹⁸² For a recent discussion, see, e.g., Larry Elliott, *Heretics welcome! Economics needs a new Reformation*, THE GUARDIAN, (Dec. 17, 2017), available at <https://www.theguardian.com/business/2017/dec/17/heretics-welcome-economics-needs-a-new-reformation>. And the reply, by various authors in Prospect, *Dismal ignorance of the “dismal science” – a response to Larry Elliot*, PROSPECT (Dec. 20, 2017), available at <https://www.prospectmagazine.co.uk/economics-and-finance/dismal-ignorance-of-the-dismal-science-a-response-to-larry-elliott>.

¹⁸³ Gibbard and Varian, *Economic Models*, *op cit.*

2. Legal Standard for the Use of Economic Evidence in Merger Control

The EU Courts have sought to resolve the tension between administrative discretion and policy accountability by requiring the Commission to satisfy what Liannos and Genakos refer to as a “burden of persuasion” in relation to “complex economic appraisals.”¹⁸⁴ To that end, a structured test was formulated in *Tetra Laval v Commission*. In that case, the Court of the Justice held that the Commission must be able to demonstrate that:

*[t]he evidence relied on is factually accurate, reliable and consistent but also whether that evidence contains all the information which must be taken into account in order to assess a complex situation and whether it is capable of substantiating the conclusions drawn from it.*¹⁸⁵

This often “forgotten paragraph,” as the President of the General Court refers to it, means that the economic evidence adduced to assess a proposed merger ought to be factually accurate, reliable, consistent and exhaustive.¹⁸⁶ If these conditions are fulfilled, the economic evidence satisfies the burden of persuasion. The EU Courts often refer to this idea by requiring the body of evidence supporting a merger decision to be “sufficiently cogent.”¹⁸⁷ One practitioner, Jim Venit, has referred to this exercise as a “plausibility analysis.”¹⁸⁸

EU case law offers additional guidance on the burden of persuasion. In *Impala*, the Court indicated that the reasoning had to “be logical and must not disclose any internal

¹⁸⁴ See Ioannis Liannos and Christos Genakos, *Econometric evidence in EU competition law: an empirical and theoretical analysis*, in HANDBOOK ON EUROPEAN COMPETITION LAW: ENFORCEMENT AND PROCEDURE (Ioannis Lianos and Damien Geradin eds., Edward Elgar Publishing 2013).

¹⁸⁵ Case C-12/03 P, *Commission v. Tetra Laval*, [2005] ECR I-987, ¶ 328, available at <http://curia.europa.eu/juris/showPdf.jsf?text=&docid=49926&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=630078>. This test is also the test that is applied by the General Court, as explained by its president, Marc Jaeger, *The Standard of Review in Competition Cases Involving Complex Economic Assessments: Towards the Marginalisation of the Marginal Review?*, 2(4) J. EUR. COMPETITION L. & PRACTICE 295, 295-314 (2011).

¹⁸⁶ See Jaeger, *The Standard of Review in Competition Cases Involving Complex Economic Assessments: Towards the Marginalisation of the Marginal Review?*, *op cit.*

¹⁸⁷ Case C-413/06 P, *Bertelsmann AG and Sony Corporation of America v Independent Music Publishers and Labels Association (“Impala”)*, [2008] ECR I-0000, ¶ 50, available at <http://curia.europa.eu/juris/liste.jsf?language=en&jur=C,T,F&num=C-413/06P&td=ALL#>.

¹⁸⁸ James Venit, *The Scope of EU Judicial Review of Commission Merger Decisions*, in EUROPEAN COMPETITION LAW ANNUAL 2010: MERGER CONTROL IN EUROPEAN AND GLOBAL PERSPECTIVE 113-30 (Philip Lowe and Mel Marquis eds., 2013).

contradictions.”¹⁸⁹ This suggests that the benchmark for assessing whether the burden of persuasion has been discharged is restricted to the logic of the decision itself; and that a decision’s compatibility with assessments conducted in previous merger control decisions or indeed other areas of antitrust policy is not relevant. However, this does not mean that economic evidence can be developed in a vacuum. In this regard, Advocate General (“AG”) Wahl wrote that the condition in *Tetra Laval* that stipulates economic evidence must contain “*all the information which must be taken into account*”¹⁹⁰ should be interpreted as imposing an obligation on the Commission to consider not only “*information in its possession,*” but “*all relevant information.*”¹⁹¹ The “*completeness*” of the information that is relied on is not an absolute concept. Indeed, Marquis observed that “*in practice, the fact-finder will tend to gather pertinent information until the perceived marginal value of additional data collection is overtaken by its marginal costs.*”¹⁹²

The test in *Tetra Laval* applies to economic evidence in general. Although *Tetra Laval* and *Impala* refer to the accuracy, correctness, completeness and reliability of “*the facts*” on which a decision is based,¹⁹³ the test is not restricted to economic *data* but to “*information of an economic nature.*” This covers the economic methods, theories and models that are applied in merger control reviews. Indeed, in *Ryanair v Commission*, the GC upheld a Commission decision following a thorough review of whether the econometric analysis satisfied the consistency limb of the *Tetra Laval* test.¹⁹⁴

¹⁸⁹ *Impala*, *op cit.*, at ¶ 169.

¹⁹⁰ In this case and in other cases.

¹⁹¹ Wahl, *Standard of Review – Comprehensive or Limited?*, in EUROPEAN COMPETITION LAW ANNUAL 2009: THE EVALUATION OF EVIDENCE AND ITS JUDICIAL REVIEW IN COMPETITION CASES 291 (Ehlermann and Marquis eds., 2011).

¹⁹² Mel Marquis, *Regulating Mergers: Substantive and Procedural Issues, Judicial Review, International Convergence and Best Practices* in EUROPEAN COMPETITION LAW ANNUAL 2010: MERGER CONTROL IN EUROPEAN AND GLOBAL PERSPECTIVE, *op cit.*

¹⁹³ *Impala*, *op cit.*, at ¶ 69.

¹⁹⁴ Case T-342/07, *Ryanair v Commission*, [2008] ECR II-411, available at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=83126&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=844320>. In *UPS/TNT Express*, the General Court annulled a Commission decision that relied on an econometric model that was different to the one which had been the subject of an exchange of views and arguments during the administrative procedure. See Case T-194/13 *UPS v Commission*, available at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=188600&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=844506>. Although the legal reasoning in the judgment is based on due process considerations, it nonetheless confirms that economic models are subject to judicial scrutiny.

Moreover, the *Tetra Laval* test does not mean that the Commission is obliged to tell the best economic story, just a convincing one.¹⁹⁵ This implies a certain amount of freedom to select economic models and other analytical tools to assess a merger.¹⁹⁶ However, there are limits to this freedom. EU courts have previously rejected the application of controversial economic theories. For instance, in *GE/Honeywell*, the Commission prohibited a merger between a dominant producer of jet aircraft engines and a leading supplier of avionics and non-avionics products. On appeal, the parties challenged the Commission's conglomerate effects theory of harm, *i.e.*, that the merged entity would have the ability and incentive foreclose competitors by engaging in "mixed bundling."¹⁹⁷ In its review of the conflicting economic evidence, the Court noted that the economic model that the Commission relied on¹⁹⁸ was "a matter of controversy."¹⁹⁹ Several underlying assumptions of the model were the subject of considerable criticism. In particular, the model was capable of producing different results depending on the range of starting parameters that were used.²⁰⁰ On this basis,

¹⁹⁵ This interpretation was effectively confirmed by AG Kokott's opinion in *Impala* where she stated that "the [General] Court exceeds the limits of judicial review of a Commission decision in the context of merger control only where the factual and evidential position reasonably allows different assessments, the Commission adopts one of them, and the [General] Court nonetheless substitutes its own different assessment for that of the Commission" (Opinion of AG Kokott in Case 413/06 P, *Bertelsmann and Sony Corporation v Impala*, [2008] ECR I-4951, ¶ 239, available at

<http://curia.europa.eu/juris/document/document.jsf?text=&docid=71724&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=641336>). In *Impala*, the Court held that the Commission had to reach a decision "in accordance with its assessment of the economic outcome attributable to the concentration which is most likely to ensue" (*Impala*, *op cit.*, ¶ 52).

¹⁹⁶ Case T-351/03, *Schneider Electric v Commission*, [2007] ECR II-2237, ¶ 132, available at <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=ecli:ECLI:EU:T:2007:212>: "The Commission [...] enjoys of a degree of latitude regarding the choice of econometric instruments and appropriate approaches to the study of any matter, [...] provided that those choices are not manifestly contrary to the accepted rules of economic discipline and are not applied inconsistently."

¹⁹⁷ Case T-210/01, *General Electric v Commission*, [2005] ECR II-1601, available at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=57077&pageIndex=0&doclang=en&mode=lst&dir=&occ=first&part=1&cid=844854>. Mixed bundling refers to a practice where two products are available separately but stand-alone prices for the individual products are higher than the bundled price. Rebates when made dependent on the purchase of other goods may also be considered a form of mixed bundling.

¹⁹⁸ The economic model was developed by Professor Choi and was based on the application of the Cournot Effect to mixed bundling. We leave aside the question whether the conclusions that the Commission drew from the application of the Choi model were dispositive to the outcome of the case. The Court suggests it was when it compares the SO - in which the Choi model is cited in a footnote in support of its theory of harm - with the text of the final decision. *Id.* at ¶ 454.

¹⁹⁹ *Id.* at ¶ 456.

²⁰⁰ As demonstrated by the parties' experts. *Id.* at ¶ 455.

the Court considered that the Commission's conclusion that the merged entity would have an incentive to engage in mixed bundling was not the "direct and automatic consequence of economic theory of Cournot effect."²⁰¹ It follows that the economic model applied by the Commission did not satisfy the *Tetra Laval* test.

Finally, the weight of the burden of persuasion is not linear. The more speculative the theory of harm, the stricter the evidentiary requirements under the *Tetra Laval* test.²⁰² AG Wahl writes that when the anticompetitive nature of a merger is not readily apparent, "there is a need for more convincing evidence as compared to more easily expected anticompetitive effects."²⁰³ Often, scholars distinguish "straightforward cases of unilateral horizontal effects" subject to a lower burden of persuasion than conglomerate or coordinated effects cases.²⁰⁴ In this regard, the application of the unilateral effects framework to non-price competition parameters such as innovation or dynamic sectors (e.g., industries subject to disruption) is fraught with uncertainty.

3. Illustration

In *Airtours v Commission* – a case that predates *Tetra Laval v Commission* – the GC quashed a Commission decision that prohibited a merger in the short haul package holiday market that would have led to a reduction of competitors from four to three on the basis of a coordinated effects theory of harm.²⁰⁵ First, the GC reviewed the *factual accuracy* of the Commission's evidence. It found that the Commission's coordinated effects assessment was erroneously based on the prediction that demand growth would be limited, and ignored market trends that showed a steady growth in demand over the previous decade.²⁰⁶ Second, the GC scrutinised the *reliability* of the Commission's reasoning and held that the Commission's conclusion that demand volatility would result in oligopolists adopting a cautious business strategy ignored

²⁰¹ *Id.* at ¶ 456.

²⁰² Venit, *The Scope of EU Judicial Review of Commission Merger Decisions*, *op cit.*, at 125-26 ("the intensity of the Court's analysis will be proportional to the speculative nature of the Commission's theory of harm, with the intensity of judicial scrutiny being greater in cases involving conglomerate (and arguably coordinated) effects, as opposed to more straightforward cases of unilateral horizontal effects").

²⁰³ Wahl, *Standard of Review – Comprehensive or Limited?*, EUROPEAN COMPETITION LAW ANNUAL, *op cit.*, at 292. Based on interpretation of ¶ 65 of the judgment in *General Electric v Commission*, *op cit.*

²⁰⁴ Venit, *The Scope of EU Judicial Review of Commission Merger Decisions*, *op cit.*, at 125-26.

²⁰⁵ Case T-342/99, *Airtours v Commission*, [2002] ECR II-2585, available at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=47383&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=1005542>.

²⁰⁶ *Id.* at ¶¶ 123-33.

standard economic theory.²⁰⁷ Third, the GC examined the consistency of the Commission's assessments and identified contradictions: notably the decision referred to vertical integration as both a pro-competitive and an anticompetitive factor.²⁰⁸ Finally, the GC criticised the lack of exhaustiveness of the decision's reasoning. In particular, the Commission's decision did not take into account the fact that smaller market operators as well as potential market entry by firms active on the long haul package holiday market would have constrained the merged entity.²⁰⁹

In *Impala*, the Court of Justice annulled a judgment of the GC reversing the Commission's clearance of a JV between Sony and Bertelsmann. The CJEU reviewed the theory of coordinated effects applied by the GC and rejected the finding that the market was sufficiently transparent to be conducive to tacit collusion.²¹⁰ On the contrary, the fact that the public list prices for recorded music were subject to subsequent bilateral negotiation meant that private discounts were possible, thus diminishing market transparency. The Court criticised the lack of accuracy of the GC's findings, which was premised on the ability of industry professionals to predict the difference between list and effective prices.²¹¹

C. SIEIC under the Burden of Persuasion

It is important to note that to date the SIEIC framework has not been fully applied by the Commission in a merger control review. In *Dow/DuPont*, the Commission relied on the standards unilateral effects model, but only to the extent that the theory was required to frame the case. The evidence used to support the Commission's case primarily consisted of qualitative evidence regarding the closeness of innovation competition between the parties. In particular, there is nothing in the *Dow/DuPont* decision that suggests the Commission relied on quantitative analyses to substantiate its innovation theory of harm, including an examination of the innovation diversion

²⁰⁷ *Id.* at ¶¶ 134-147.

²⁰⁸ *Id.* at ¶¶ 93-108.

²⁰⁹ *Id.* at ¶ 208-269.

²¹⁰ *Impala, op cit.*, at ¶ 427.

²¹¹ The General Court stated that variations of discount by customer may “at least for an industry professional, be explained quite readily on the basis of a number of general or specific rules governing the grant of discounts” (Case T-464/04 *Impala v Commission*, [2006] ECR II-2289 ¶ 427, available at <http://curia.europa.eu/juris/document/document.jsf?text=&docid=56489&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=668390>). The Court unequivocally held that the GC could not rely on “unsupported assertions relating to a hypothetical industry professional” to establish the existence of sufficient transparency in the marketplace.]” *Impala, op cit.*, at ¶ 131.

ratio and efficiencies.²¹² Moreover, even though Annex 4 contains a review of the economic literature, it seems that the discussion was primarily aimed at lending credence to the Commission's theory of harm from an academic standpoint.²¹³ That said, given recent publications by members of the CET – albeit in their personal capacity – advocating that horizontal mergers *always* harm innovation competition in a way that is distinct from harm to product market competition, it may not be long before the SIEIC theory is applied in full.²¹⁴ In this section, the paper examines whether the SIEIC framework meets the *Tetra Laval* burden of persuasion.

I. Accuracy

Under the *Tetra Laval* rule, the SIEIC model should only be applied if it fully takes into account the drivers of innovation in the industry under consideration. However, SIEIC posits that *rivalry* is the main driver of innovation in industry.²¹⁵ Other possible drivers of innovation like pest and crop resistance, generic competition and regulation are assumed away from the model.²¹⁶

Instead of adjusting the model, the *Dow/DuPont* review found that SIEIC was applicable to the crop protection industry. In two paragraphs, the Commission rejected

²¹² Neither decision calculates the innovation diversion ratio nor discusses efficiency gains, as required in the analytical framework put forward by Farrell and Shapiro (Joseph Farrell and Carl Shapiro, *Antitrust Evaluation of Horizontal Mergers: An Economic Alternative to Market Definition*, *op cit.*). Instead, the Commission reviewed other parameters (e.g., perceived similarities in vertical integration, pipeline productivity, patent shares and overlapping lines of research) as proxies to determine whether the parties were close competitors in innovation spaces.

²¹³ This is illustrated by the following statement in Annex 4, which is preceded by a discussion of economic models. The Commission writes: “*whilst the results of the papers summarised in the preceding paragraphs do not apply directly to uncertain product innovation, overall these papers indicate that the intensity of competition between rival innovators is positively associated with market-wide innovation, absent specific forms of efficiencies. A merger between two significant and close competitors is therefore likely to reduce the level of innovation by each of the merging parties[.]*” *Dow/DuPont*, *op cit.*, at ¶ 59.

²¹⁴ The paper that was published in March 2017 by members of the CET (see Federico, Langus and Valletti, *A simple model of mergers and innovation*, *op cit.*) was followed up by a second longer working paper published in July 2017 that revisited the economic model and analytical framework in the earlier paper. See Federico, Langus and Valletti, *A simple model of mergers and innovation*, *op cit.*; and Giulio Federico, Gregor Langus and Tommaso Valletti, *Horizontal Mergers and Product Innovation: An Economic Framework*, (Jul. 2017), available at <https://ssrn.com/abstract=2999178>.

²¹⁵ *Dow/DuPont*, *op cit.*, at § 8.4.2: “*Both the market features of the crop protection industry and documentary evidence suggest that rivalry is a significant factor driving innovation.*” See also *id.* at ¶ 2068: “*competition between R&D players at the innovation stage is therefore an important driver of innovation in the crop protection industry.*”

²¹⁶ Each of these factors is effectively dismissed in two paragraphs. *Dow/DuPont*, *op cit.*, at ¶¶ 2118-2119.

the parties' submission that resistance and regulation could pressure industry players to continue to innovate notwithstanding a possible reduction in rivalry. It noted that "regulatory pressure and biological resistance are unlikely to play a role for the most recent products commercialised by the Parties."²¹⁷ This statement leaves open the possibility that resistance and regulation may keep R&D incentives high for both aging products and for future undiscovered products. While the decision addresses how resistance and regulation are unlikely to impact products that have already been commercialised,²¹⁸ it is silent in relation to future products. This analytical oversight is problematic, because the decision predicts that the merger will "lead to noticeable reductions in the innovation efforts of the parties in relation to any future products that would otherwise be introduced in the absence of the transaction."²¹⁹ In addition, it is not entirely clear from the text of the decision how the Commission conducted its balancing exercise, both in relation to recently commercialised products and future products.

Moreover, the decision fails to adequately consider evidence that suggests parameters other than rivalry also play a critical role in the innovative process. Indeed, there is a significant body of literature that suggests industry structure and market competition are only two of several factors that drive innovation in the agro-chemical industry.²²⁰ For example, the literature on private R&D in agrochemical markets underlines the important role played by public R&D on innovation incentives and to a much lesser extent competition and rivalry.²²¹ In addition, some of the experts cited in the decision to support the Commission's theory of harm have stressed the impact of wider industry, scientific and regulatory developments on market structure and incentives to innovate (e.g., falling crop prices, regulatory restrictions on the use of certain products etc.).²²²

²¹⁷ *Id.* at ¶ 2118.

²¹⁸ *Id.*

²¹⁹ *Dow/DuPont, op cit.*, at ¶ 3056, 3058 ("Since this second form of harm on innovation competition is structural and longterm, it is likely to be significantly larger than the first").

²²⁰ See Shelanski and Katz, *op cit.*, at 26 ("innovation is affected by a variety of factors other than concentration").

²²¹ See, e.g., Philip Pardey et al., *Long-Run and Global R&D Funding Trajectories: The U.S. Farm bill in a Changing Context*, 97 AM. J. AGRIC. ECON., 1312, 1312-23 ("For much of modern history, the preponderance of formal global food and agricultural R&D was conducted by public agencies, including government research labs and academic institutions.... [P]ublic R&D is more of a complement to private R&D, such that a decline in the performance of public research will have negative consequences for the longer-run rate of innovation in U.S. agriculture").

²²² See Sparks and Lorschach, *Perspectives on the agrochemical industry and agrochemical discovery, op cit.*

2. Reliability

The test of reliability under *Tetra Laval* aims to filter out ambiguous, equivocal or controversial economics from merger reviews.

Dow/DuPont has two features which betray that SIEIC remains a conjecture – a theory that equates a post-merger loss in rivalry with lower innovation competition – which does not belong to mainstream economic analysis. First, in the run-up to the adoption of the *Dow/DuPont* decision, members of the CET released two academic papers that discuss the relationship between mergers and innovation.²²³ Both papers, and in particular the first, make a strong claim as to the relationship between innovation and merger-induced concentration, namely merging parties “*always decrease their innovation efforts,*” and consumers are “*always worse*” after the merger.²²⁴ The claim is strong because neither the extant economic theory nor the data bring “*meaningful general presumptions*”.²²⁵ It is unclear if the models in those papers were applied by the Commission in *Dow/DuPont*.²²⁶ However, even if those models were not applied, the timing of the publication of the first paper suggests that its purpose was to persuade observers that the Commission’s innovation theory of harm in *Dow/DuPont* is supported by mainstream antitrust economics.²²⁷

If this hypothesis is right, it represents what Neven, Kovacic and Mavroidis have described as a shift in the CET role in merger cases from an oversight function, i.e. ensuring there are appropriate “*checks and balances*” to a “*support function.*” This shift calls for the exercise of caution in relation to the probative value that is attached to support papers written by members of the CET. However, simply focusing on the risk of bias when officials with an oversight function write doctrine overlooks an even more fundamental issue, namely the fact that merger reviews are by design ill-suited

²²³ See Federico, Langus and Valletti, *A simple model of mergers and innovation*, *op cit.*; Federico, Langus and Valletti, *Horizontal Mergers and Product Innovation: An Economic Framework*, *op cit.*

²²⁴ Federico, Langus and Valletti, *A simple model of mergers and innovation*, *op cit.*

²²⁵ See Katz and Shelanski, *op cit.*, at 26.

²²⁶ As discussed in this paper, most of the economic analysis of SIEIC in *Dow/DuPont* is a qualitative assessment of the closeness of the merging parties in innovation spaces. That said, the parties argued that “*that there can be no presumption that a merger between competing firms would result in a reduction in innovation[.]*” *Dow/DuPont*, *op cit.*, at Annex 4, ¶ 10.

²²⁷ See, e.g., *Dow/DuPont*, *op cit.*, at ¶¶ 34, 42, 60, 2043. If this was not the case, one may legitimately question why the CET considered it was necessary to invest the time and effort publishing papers in which the economic framework of SIEIC is characterised as being consistent with established merger control policy (note that the Commission repeatedly refers to “*standard unilateral effects*”).

to the formulation of economic theory.²²⁸ Röller, the first chief economist of the Commission noted ten years ago that: “[t]he development of new theories (such as *de novo* models, which are based on alternative assumptions, leading to radically different results) are likely to be less influential in the context of case proceedings for a number of reasons, including the difficulty of communicating a new theory in a rather short period of time.”²²⁹

A second factor that calls into question the reliability of the SIEIC conjecture is that *Dow/DuPont* was not primarily economics-driven, which suggests the Commission is not entirely comfortable applying the SIEIC framework in full. Instead, the finding of a SIEIC was to a significant extent based on internal and public documents which corroborated the Commission’s finding that the parties planned to reduce their R&D expenditure and innovation output targets post-merger. This feature is neither unprecedented in competition policy nor objectionable. “*Hot docs*” are often used in competition cases which push the boundaries where economics theory alone is unable to yield clear empirical results, such as pay-for-delay cases in the area of coordinated conduct (e.g., *Servier*) or fidelity rebates in abuse of dominance law (e.g., *Intel*).²³⁰

3. Consistency

There are two apparent inconsistencies in the Commission’s SIEIC analysis in *Dow/DuPont*. First, the Commission seems to overlook the potential benefits of the merged entity’s ability and incentive to coordinate R&D programmes across innovation spaces (see above). This is inconsistent with the Commission’s recognition elsewhere in the decision that increased coordination in product market competition can either decrease or increase innovation.²³¹ This inconsistency is, in fact, even more

²²⁸ The fact that third parties have a limited role in merger control reviews also limits the extent to which economic theories of harm are subject to scrutiny, all the more so when the role of the CET evolves from a checks and balances function towards case team support (see above).

²²⁹ Röller, *Economic Analysis and Competition Policy Enforcement in Europe*, *op cit.* He added: “As a result, one is tempted to conclude that the analysis of the merit of new theories is best left to the academic journals, where a long and rigorous peer review will ensure consistency and ultimately empirical relevance.”

²³⁰ Case AT.39612 *Perindopril (Servier)*, available at http://ec.europa.eu/competition/antitrust/cases/dec_docs/39612/39612_12422_3.pdf; and Case COMP/37.990 *Intel*, available at http://ec.europa.eu/competition/sectors/ICT/intel_provisional_decision.pdf.

²³¹ See *Dow/DuPont*, *op cit.*, at ¶ 35 (“The other way in which a merger affects the incentives to innovate in relation to each of Product lines A and B is by relaxing the product market competition between the two lines of products. The coordination of the pricing of Product A and Product B due to the merger increases the revenues earned by each product line both in the scenarios where innovation does and where it does not take place (by one or both of the two products)”; see also ¶ 7 of Annex 4 (“following a merger, the merging firms coordinate the pricing of their products and thus increase profits. Less intense competition in the product market can increase the net revenues

apparent when the main text of the decision is read in conjunction with Annex 4. Here, the Commission criticises some of the fundamental assumptions of the well-known inverted U-curve model of innovation and competition of Aghion et al. since it looks at product market coordination “only”,²³² without taking into account similar effects on innovation.²³³

Secondly, the SIEIC model predicts a reduction of efforts in relation to R&D *inputs*, which primarily consists of R&D expenditure. However, instead of measuring R&D inputs, the decision measures R&D outputs.²³⁴ On this basis, the decision anticipates a post-merger decrease in the number of AIs that would be brought to market.²³⁵ This discrepancy between theory and testing is perplexing. Predictions of firm conduct in relation to R&D outputs are more speculative than predictions in relation to R&D inputs. Sequentially, R&D output takes place after a decision on R&D inputs has been made. It follows that there may be a number of intervening events/factors that have an effect on the R&D process. Even if the Commission is right that R&D output measures “are better suited to describe relevant capabilities and expertise of crop protection companies,” the evidence should be subject to a higher burden of persuasion.²³⁶

earned by a product line both when the firms innovate to improve the products in that line and when they do not. As such, the effect of a less intense product market competition on innovation is potentially ambiguous”).

²³² Philippe Aghion, et al., *Competition and innovation: an inverted-U relationship*, 120 Q. J. ECON. 701, 701-28 (2005), available at http://www.ucl.ac.uk/~uctp39a/ABBGH_QJE_2005.pdf.

²³³ *Dow/DuPont*, *op cit.*, Annex 4, ¶ 73: the model’s critical assumptions “only allows for a consideration of the changes in the degree of collusion between firms in the product market (but not in innovation).”

²³⁴ *Id.* at ¶ 379: “As regards innovation competition the Commission will focus on measures of innovation output.” To that end, the decision conducts a sophisticated quantitative and qualitative analysis of patent counts, patent citations and AI launches (assessing quantity and the commercial importance of the AIs) between 1995 and 2015. Amongst other things, the Commission used data and metrics from PatentSight which describes itself as “providing reliable and relevant benchmarks of patent portfolios to key decision makers in technology companies. To derive reliable insights it is key to measure actual patent strength rather than mere patent filings. This is achieved by the Patent Asset Index™ methodology [...which] considers both the quantity and quality of patents in a portfolio” (*Id.* at ¶ 391). PatentSight had in fact been previously endorsed by Dow’s Chief Technology Officer: “Patent Asset Index provides an accurate view of the impact and efficiency of an enterprise’s investment in innovation” (*Id.* at ¶ 392).

²³⁵ *Dow/DuPont*, *op cit.*, at ¶ 401.

²³⁶ *Id.* at ¶ 385.

4. Completeness

The *Tetra Laval* test imposes an obligation on the Commission to consider “all the information which must be taken into account in order to assess a complex situation.”²³⁷ This requirement has two dimensions.

First, the completeness requirement means that the Commission’s assessment must take into account information that is both supportive and unsupportive of a theory of a harm. The *Dow/DuPont* decision cites an academic paper by one of Dow’s Senior Research Scientists, T.C. Sparks, which describes the innovation process in agrochemicals at least half a dozen times.²³⁸ However, the decision contains no references to Sparks’ other works that discuss the drivers of innovation in the agrochemical industry. In particular, a 2016 paper he co-authored that discusses industry concentration provides that “[a]lthough consolidation in the agrochemical industry in the USA and EU has been occurring since the 1960s, new agrochemicals continue to enter the marketplace.” Moreover, the paper singles out the importance of resistance and regulation as drivers of innovation:

*Continued innovation in agrochemicals will be needed to combat the loss of existing products through the development of resistance, the desire for products with more favorable environmental and toxicological profiles, shifting pest spectra, and changing agricultural needs and practices. Thus, as highlighted by the present analysis, the discovery of new agrochemicals with an expanding array of new classes of chemistry and MoAs continues in spite of the challenge.*²³⁹

Second, the completeness limb of the *Tetra Laval* test obliges the Commission to take into account all relevant information *in* and *out* of the case file. In other words, the Commission should not restrict its assessment to the data provided by the merging entities and third parties. Although the Commission’s assessment of innovation competition was primarily focused on R&D inputs, the Commission reviewed statistics from the US Department of Agriculture (“USDA”) provided by the parties. On this basis, the Commission calculated measures of R&D intensity by firm type.²⁴⁰ This

²³⁷ *Commission v. Tetra Laval*, *op cit.*, at ¶ 39.

²³⁸ *Dow/DuPont*, *op cit.*, at ¶¶ 1174, 2092, 2124, 2153, 2167, 2184, 2702.

²³⁹ Sparks and Lorschach, *Perspectives on the agrochemical industry and agrochemical discovery*, *op cit.*

²⁴⁰ *Dow/DuPont*, *op cit.*, Figure 101 (source) (“Commission’s calculations based on the report of the US Department of Agriculture (December 2011), “Research investments and market structure in the food processing, agricultural input, and biofuel industries worldwide.” This report is also used in the Parties’ submission [...]).

analysis indicated that R&D integrated players “have reduced their R&D intensity, in particular after the merger wave in 1999-2002, from 8.9% in 2002 to 7.8% in 2010.”²⁴¹

However, other official Commission statistics paint a different picture, namely the EU Industrial R&D Scoreboards.²⁴² The two tables below compile high level data on R&D expenditure (table 1) and R&D intensity (table 2) of six leading agrochemical companies between 2009 and 2016.²⁴³ These data extracted from the EU Industrial R&D Scoreboards – which again are high level estimates – show that during that timeframe all six firms increased their total R&D expenditure.²⁴⁴ In addition, R&D intensity during the same period either increased (Syngenta, DuPont, Monsanto) or remained stable (BASF, Bayer and Dow Chemical have maintained a consistent level of R&D expenditure with a possible 0.1% variation). Moreover, this increase in R&D intensity has taken place in spite of a dramatic drop in global agricultural commodity prices,²⁴⁵ which has adversely affected several agrochemical businesses.²⁴⁶

²⁴¹ *Id.* at ¶ 2128.

²⁴² The EU Industrial R&D Investment Scorecard, EU Science Hub, Economics of Industrial Research and Innovation, European Commission Joint Research Centre, available at <http://iri.jrc.ec.europa.eu/scoreboard.html>.

²⁴³ *Id.*

²⁴⁴ Following the Commission’s approach and focusing the analysis on the five global R&D integrated players with discovery capabilities (i.e., Bayer, Syngenta, BASF, Dow and DuPont) and excluding certain competitors (e.g., “Japanese integrated competitors,” Monsanto and FMC) does not yield a different result. For a graphic illustration, see *Dow/DuPont*, *op cit.*, at fig. 116.

²⁴⁵ See, e.g., Food and Agriculture Organisation, *Food commodity Prices Fall for Fifth Year in a Row in 2016*, (Jan. 12, 2016), available at <http://www.fao.org/news/story/en/item/462790/icode/>; The World Bank, *Global Food Prices Drop to a Five-Year Low* (Jul. 1, 2015), available at <http://www.worldbank.org/en/news/press-release/2015/07/01/global-food-prices-drop-to-a-five-year-low>; Emiko Terazono, *Agricultural Commodities feel the bite of weaker demand*, FIN. TIMES (Aug. 12, 2015), available at <https://www.ft.com/content/0694895a-400f-11e5-b98b-87c7270955cf>.

²⁴⁶ See, e.g., Sheenagh Matthew, *BASF Quarterly Profit Hurt by Weak Demand for Crop Chemicals*, BLOOMBERG (Jul. 27, 2016), available at <https://www.bloomberg.com/news/articles/2016-07-27/basf-quarterly-profit-misses-estimates-on-lower-oil-operations>; Brian Blackstone, *Syngenta Profits Down on Weak Commodity Prices, Global Uncertainty*, WALL ST. J. (Jul. 22, 2016), available at <https://www.wsj.com/articles/syngenta-profit-down-on-weak-commodity-prices-global-uncertainty-1469172890>; Jack Kaskey, *Monsanto to Cut 12% of Workforce as It Forecasts Profit Drop*, BLOOMBERG (Oct. 7, 2015), available at <https://www.bloomberg.com/news/articles/2015-10-07/monsanto-profit-forecast-misses-estimates-amid-grain-bear-market>; *DuPont Cuts Profit Forecast Amid Weaker Agriculture*, AGWEB (Jul. 28, 2015) available at <https://www.agweb.com/article/dupont-cuts-2015-profit-forecast-amid-weaker-agriculture-demand-blmg/>.

Table 1

R&D Total mill€	2009	2010	2011	2012	2013	2014	2015
SYNGENTA	669.1	769.3	871	949.7	997.8	1,177.8	1,251.0
BASF	1410.0	1507.0	1622	1766.0	1,914.0	1,846.0	1,914.0
BAYER	2964.0	3211.0	3045	3182.0	4,436.0	3,689.0	4,436.0
DUPONT	960.4	1230.7	1511.7	1566.6	1,743.4	1,702.5	1,743.4
DOW CHEMICAL	1039.8	1237.4	1272.1	1294.5	1265.3	1,356.6	1,467.8
MONSANTO	765.2	898.2	1172.4	1149.8	1,451.3	1,413.4	1,451.3

Table 2

R&D Intensity %	2009	2010	2011	2012	2013	2014	2015
SYNGENTA	8.7	8.9	8.5	8.8	9.4	9.4	10.2
BASF	2.8	2.4	2.2	2.2	2.5	2.5	2.7
BAYER	9.5	9.2	8.3	8.0	8.1	8.7	9.4
DUPONT	5.3	5.2	5.2	5.9	6.0	5.9	7.5
DOW CHEMICAL	3.3	3.1	2.7	3.0	3.1	2.8	3.3
MONSANTO	9.4	11.5	11.2	11.2	10.3	10.8	10.5

Both the reliance on non-EU R&D data and the discrepancy between EU and US data are perplexing. This does not only affect the completeness of the decision itself. It also weakens the authority of the theory that it seeks to convey.

Conclusion

Although there is nothing in EU merger control rules that prevents the Commission from intervening in transactions that reduce rivalry in innovation spaces, any such practice should satisfy two conditions. First, the Commission should rely on sound economic theory and evidence. In this paper, I have exposed the missing economic components of SIEIC. Until those shortcomings are addressed, SIEIC constitutes at best an incomplete model. This applies even if SIEIC merely extends the application of the standard unilateral effects framework.

Second, where the Commission relies on the SIEIC framework, it must meet the burden of persuasion defined in *Tetra Laval*. Unless this burden is discharged, the validity of the theory will be called into question where it attempts to produce empirical findings/predictions in relation to innovation competition.

More generally, we should think twice about the tempting pragmatic idea that it is better “*to be roughly right than exactly wrong*” in merger policy.²⁴⁷ In most areas of public policy (and human life), the more true than very false standard generates perverse incentives.²⁴⁸ In particular, it promotes satisfaction with the avoidance of gross mistakes. In competition law enforcement, this may fuel reliance on half-baked theories and an overly relaxed attitude towards evidence.

²⁴⁷ See David Currie, *The role of competition in stimulating innovation*, Speech at Concurrences Innovation Economics Conference, King’s College London (Feb. 3, 2017), available at <https://www.gov.uk/government/speeches/david-currie-on-the-role-of-competition-in-stimulating-innovation>.

²⁴⁸ With the exception of policy areas dealing with terminal events or fat tail distributions.