Institution: University of Southampton		
Unit of Assessment: 16 Economics and Econometrics		
Title of case study: 16-02 Shaping European Commission merger policy to preserve innovation in the pharmaceutical and chemical industries		
Period when the underpinning research was undertaken: 2006 – 2020		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s): Carmine Ornaghi	**Role(s) (e.g. job title):** Professor in Economics	**Period(s) employed by submitting HEI:** September 2004 – present
Period when the claimed impact occurred: January 2016 – July 2020		
Is this case study continued from a case study submitted in 2014? Y		

1. Summary of the impact

Research into the effects of mergers and acquisitions on innovation by Professor Carmine Ornaghi at the University of Southampton has contributed to merger enforcement policies of the European Commission (**EC**), the European Union competition authority, particularly in the pharmaceutical and chemical industries.

Ornaghi's research has provided ground-breaking evidence that mergers may have a detrimental effect on incentives to innovate, in particular in those markets where merging companies are developing similar 'pipeline' products. Since 2016, his work and expertise have informed and shaped the EC mergers enforcement policy in the area of innovation in two complementary ways: First, by demonstrating the importance of evaluating the overlap between the research activities of merging firms which has, in turn, led to the introduction of more stringent EC remedies in recent major merger cases. Second, by working on two related EC projects which have defined a rigorous quantitative framework for the retrospective evaluation of the impact of merger control decisions on innovation.

2. Underpinning research

The pharmaceutical and chemical industries are among the most research-intensive industries in the world, and over the last two decades, they have been shaped by a sizeble number of mergers and takeovers. Indeed, many of the world's biggest drug companies, such as Pfizer and GlaxoSmithKline, have been built through a succession of acquisitions. Starting in 2006, Ornaghi investigated the effects of these acquisition deals on the innovation of pharmaceutical firms. This was an area that, until then, had received almost no attention by academics and competition authorities, who were mainly concerned with investigating the short-run effects of mergers on prices of existing drugs, rather than the incentives to develop new and better treatments. In this context, Ornaghi's work was among the first to provide compelling (and concerning) evidence that mergers may have a detrimental effect on incentives to innovate, in particular in those markets where merging companies are developing similar 'pipeline' products.

Ornaghi's research involved matching financial data from large pharmaceutical firms with patent data from the National Bureau of Economic Research in the United States to define a rigorous econometric framework to assess the causal effects of mergers on early-stage innovation. The resulting two articles published by Ornaghi on mergers and innovation [**3.1** and **3.2**] are among the first and most exhaustive analyses of their kind and their findings have stood the test of time as they have been validated by more recent works. Since then, Ornaghi's research has broadened to include the effects of competition at large on innovation [**3.3**] and the impact of mergers on inventors' productivity [**3.4**] as detailed below.

2.1 Effects of Mergers on Innovation in the Pharmaceutical Industry

The first paper by Ornaghi in 2009 [**3.1**] on the effects of mergers on innovation shows that on average, consolidated companies tend to reduce research and development expenditure and to experience a reduction in the number of patents, compared to non-merging firms. Ornaghi's results suggested that mergers rarely generate the knowledge synergies that their proponents often claim. At the same time, the paper shows that acquirers are more likely to target firms with

similar technology and drug portfolios, which may lead to higher prices and less incentive to innovate.

2.2 Technological Relatedness and Post-merger Innovation Outcomes

In a companion paper published in the same year [**3.2**], Ornaghi showed that in the pharmaceutical industry, acquirers are more likely to target firms with similar products and technologies and, at the same time, that there is a negative relationship between the technology relatedness of merging firms and their post-merger performances. The study represents an important step towards understanding why some mergers have a positive impact on innovative outcomes, and others do not. More importantly, the paper's findings have important implications for merger enforcement policy: as acquiring firms may deliberately target competitors with similar innovation projects in order to pre-empt future competition (a finding confirmed in a recent study with the suggestive title of "Killer Acquisition" by Cunningham *et al.*, 2018), antitrust authorities should impose more stringent remedies, such as the divesture of rights and assets pertinent to one molecule when merging firms have overlapping molecules under development.

2.3 Competition and Innovation

Starting from the analysis of the impact of mergers on innovation, Ornaghi has expanded his line of research by investigating the broader effects of competition on innovation in different industries [**3.3**]**.** Using both patent statistics and productivity growth data, with state-of-the-art econometric techniques to model nonlinearity in the competition-innovation nexus, this new research produces fresh, robust and exhaustive evidence on the positive impact of competition on innovation outcomes.

2.4 Mergers and Inventors' Productivity

In 2019, Ornaghi began a related ESRC funded project, "Mergers and Inventors' Productivity in the Pharmaceutical Industry". While most existing studies have looked at the impact of mergers on innovation using firm-level data, this research aims to examine how mergers influence innovation output of scientists working in the research labs of these companies, using patent and inventor-level data [**3.4**].

3. References to the research

3.1 Ornaghi, C. (2009), "Mergers and Innovation in Big Pharma", *International Journal of Industrial Organization*, Volume 27, Issue 1, 70-79. https://doi.org/10.1016/j.ijindorg.2008.04.003

3.2 Ornaghi, C. (2009), "Positive Assortive Merging", *Journal of Economics and Management Strategy*, Volume 18, Issue 2, 323-346. https://doi.org/10.1111/j.1530-9134.2009.00216.x

3.3 Ornaghi, C., & Correa Allamand, J. L. (2014). "Competition and Innovation: Evidence from US Patent and Productivity Data". *Journal of Industrial Economics*, *62*(2). https://doi.org/10.1111/joie.12050

3.4 ESRC Grant ES/S015566/1 - Mergers and Inventors' Productivity in the Pharmaceutical Industry– Amount: £345,700 - Period October 2019 to March 2022.

According to Google Scholar, the three papers above have received a total of more than 400 citations, with an increasing number of yearly citations over the period 2014-2019.

Other papers cited:

Cunningham, C., F. Ederer and S. Ma (2020). "Killer Acquisitions", Journal of Political Economy, available at https://www.journals.uchicago.edu/doi/10.1086/712506

4. Details of the impact

The idea that mergers and acquisitions can increase market power, but may also bring about cost savings in existing markets, is not controversial. For several decades, these two opposite effects have been considered by competition authorities when investigating the short-run effects of mergers on prices. But, the effects of mergers on prices represents only part of the story: over recent years, competition authorities have grown increasingly concerned about the effects of mergers on innovation and incentives to create new and better products for the market.

However, when it comes to evaluating these long-run effects, economic analysis and, in turn, mergers enforcement is on much less solid ground.

Ornaghi's research and expertise have achieved real-word impact by informing and shaping EC mergers enforcement policy in the area of innovation in two complementary ways: His research first drew the attention of the EC on the importance of evaluating the overlap between the research activities of merging firms which has, in turn, led to the introduction of more stringent remedies in recent merger cases (Ex-ante Merger Control Decisions and Remedies). Second, building on the underpinning research in [**3.1**], [**3.2**] and [**3.3**], Ornaghi has worked with economists at the EC Directorate-General for Competition (**DG COMP**) and the EC Directorate-General for Research and Innovation (**DG RTD**) to develop a rigorous quantitative framework for the retrospective evaluation of the impact of merger control decisions on innovation (Ex-post Policy Evaluation Tools), which are vital to understand errors made in (ex-ante) merger control decisions.

Ex-ante Merger Control Decisions and Remedies

From a policy-enforcement perspective, Ornaghi's papers, by showing that mergers are more likely to have negative effects when research activities of acquirers and targets overlap, call for a more careful assessment of "early stage" research activities and the introduction of more stringent remedies, such as the divestures of overlapping business activities, that the parties have to agree in order to receive merger clearance.

While the EC has conducted innovation assessment of mergers since the early 1990s, until recently, interventions based on innovation concerns has been relatively rare. For instance, in the 73 merger cases examined by the EC between 2015 and 2017, "*the overwhelming majority of the interventions were based on horizontal static unilateral effects on prices (66 cases). Innovation concerns were identified in 10 cases*" [**5.1**], with 7 of these 10 cases related to the pharmaceutical and chemical industries. However, following Ornagi's first paper [**3.1**], described by Professor Massimo Motta, Chief Economist of the EC's DG COMP from 2013 to 2016, as "*one of the very few (if not the only) papers which were addressing the question of the effects of mergers on innovation*" [**5.2**], the EC has taken a more rigorous approach on assessing the effects of mergers on innovation over the last few years. Motta confirmed that Ornaghi's academic work shaped the EC's approach in evaluating the overlap between research activities of merging parties, describing the paper [**3.1**] as "*very prominent in the analysis at the Chief Economist Team (CET), especially when we started to look at the Dow/Dupont merger. Some of the work on patent data done by the CET was inspired by Ornaghi's paper*" [**5.2**].

The cited 2017 Dow/Dupont merger and the 2018 Bayer/Monsanto merger, two of the largest deals of the last decade, were cleared only after imposing remedies worth billions of Euros to remove problematic overlapping between the parties. In her statement on the Bayer/Monsanto merger, the European Commissioner for Competition noted that "*Our in-depth investigation raised concerns that the transaction [would have] significantly reduced innovation […]. In response, the parties have submitted a remedy package worth well over 6 billion euros. It removes all problematic overlaps between the parties' activities*" [**5.3**].

Ex-post Policy Evaluation Tools

From a methodological perspective, the ex-post evaluation of the impact of mergers on innovation is plagued by a number of challenges, such as (i) the construction of a control group of firms which merged companies can be compared to; and (ii) the identification of markets where merged companies had overlapping research interests. In the context of a renewed attention of antitrust authorities on the effect of mergers on innovation, since 2017 Ornaghi has worked on two projects by the EC's DG COMP and DG RTD to develop a clear quantitative framework that the EC can use to retrospectively evaluate the effects of past merger control decisions on innovation, which are vital to understand errors made in the (ex-ante) merger control decisions. These two projects defined the most appropriate econometric techniques to select a suitable control group (for instance, propensity score technique or synthetic control method) and how to construct reliable measures of overlapping and similarity between the research portfolio of merged companies.

Based on his papers on mergers and innovationwhich served to establishhim as a leading expert on the subject, Ornaghi was asked by senior officials at DG COMP to act as an academic advisor for their 2017 feasibility study on the microeconomic impact of enforcement of competition policies on innovation [**5.4**]. In this advisory capacity, Ornaghi worked with a selected small group of economists to define a sound empirical methodology to evaluate retrospectively the impact of mergers on innovation [**5.5**]. The Principal Advisor in DG COMP responsible for economic evaluation of competition policy stated that "*Ornaghi's contribution to this project has been fundamental in understanding the different pitfalls that any study on the impact of mergers on innovation will inevitably encounter and in defining a state-of-the-art quantitative framework that can tackle such empirical challenges in a credible way*." She concluded that "*Ornaghi has then made a fundamental contribution to a study that is shaping the future of competition policy in the European Union.*" [**5.6**]

Soon after, between January 2018 and April 2019, Ornaghi worked as academic advisor on a second EC research project, "Study on the impact of mergers and acquisitions in the Pharmaceutical Industry" [**5.7**], commissioned by both DG COMP and DG RTD. Officials of DG RTD testified that, during this time, Ornaghi "*offered invaluable support and advice to DG RTD by providing a range of written reports […] which have been widely circulated within staff of DG COMP and DG RTD […]. Ornaghi had a leading role in discussing the limitations of the study and providing clear guidance on how these could be tackled.*" [**5.8**]

Finally, Ornaghi's papers on mergers and Innovation [**3.1**, **3.2**] and competition and innovation [**3.3**] have been largely cited in policy studies such as the 2019 "Ex-post assessment of merger control decisions on digital markets" by the Competition and Markets Authority (CMA), which evaluates recent merger decisions in the digital sector in the UK with the aim of assessing whether those mergers have had a detrimental outcome on innovation [**5.9**]. Ornaghi's papers have also shaped the view of top civil servants as identified by the Principal Advisor in DG COMP [**5.6**] who testified that Ornaghi's papers "*were well known among experts of DG COMP, including Dr Giulio Federico, Head of the Unit of the Chief Competition Economist's Team*".

5. Sources to corroborate the impact

5.1 "Innovation in EU Merger Control" – European Commission. http://ec.europa.eu/competition/speeches/text/sp2018_05_en.pdf

5.2 Testimonial letter by Massimo Motta, Chief Economist of DG COMP between 2013 and 2016.

5.3 Statement by Commissioner Vestager on European Commission's decision to give conditional approval to Bayer's plans to buy Monsanto. https://europa.eu/rapid/press-release_IP-18-2322_en.htm

5.4 "Feasibility Study on the microeconomic impact of enforcement of competition policies on innovation" – DG Comp. http://ec.europa.eu/competition/publications/reports/kd0417860enn.pdf

5.5 Appraisal of "Feasibility Study" by Carmine Ornaghi; available at: http://ec.europa.eu/competition/publications/reports/kd0417860app1.pdf

5.6 Testimonial letter by Principal Advisor in DG COMP responsible for economic evaluation of competition policy

5.7 "Study on the impact of mergers and acquisitions in the pharmaceutical sector." DG Comp and DG RTD. https://op.europa.eu/en/publication-detail/-/publication/c6540f08-a16f-11e9-9d01-01aa75ed71a1/language-en/format-PDF/source-146078990.

5.8 Testimonial Letter by DG RTD.

5.9 "Ex-post Assessment of Merger Control Decision in Digital Markets" – Competition Market Authority UK. https://www.gov.uk/government/publications/assessment-of-merger-control-decisions-in-digital-markets