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Analysis Of Medical Markets with A Mechanism Design Approach Paper II: Towards a Strategic Mapping of the R&D Ecosystem

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ABSTRACT

This paper is part of a series using a mechanism design approach for the analysis of medical markets. The first paper presented the way such an approach can help to analyze interactions between patients and physicians in different types of healthcare organizations (Huttin, 2021 and Cormsis seminar, 2021). This second paper provides a mapping of main players, using the US R&D eco system for a representation of actors. It also highlights possible links with the emerging theory of Transaction Cost Politics to understand the role of politics in the policy design and possible systemic changes in the institutional design of countries with strong R&D space for biopharmaceuticals. Rapid adoption of IT by professions, industry players, government agencies and patients will need new economics for health policies and healthcare management.

Keywords: Mechanism Design; Healthcare and Life Science; Global Health Policy; Transaction Cost Politics; R&D Pharma Ecosystem

Introduction

This paper continues the analysis of medical markets with a mechanism design approach, started with physicians-patients' interactions [1,2]. To make this approach useful, a comprehensive identification of players and their interactions is needed; game theorists have already provided numerous formalizations of games either cooperative, non-cooperative or evolutionary forms; however, the one mainly used for this series of paper is called Mechanism Design (MD). The main reason is that with this type of approach, solutions will be designed to potentially revise the sets of rules to obtain behavioral changes from the players. Research in contract theory usually calls this incentive mechanisms, but in addition, this approach aims to change the rules within a clinical system or possibly also with the economic system. This research line was initiated during regular visits in the USA, where I could meet Professor A Roth, at Harvard University, finishing a paper on physicians' markets and kidney failures, and then Professor Dixit at Princeton University, interested in the role of the pharmaceutical industry in the economic system. Following these two meetings, it also seemed relevant because of a research stream on reversed Bayesianism, which aims to raise awareness of multiple actors in a system [3]. This stream directly relates to my own research on algorithms called "reversed conjoint models" for physicians, in relation with economic topics [4,5] and the way they can affect medical decision-making processes or shared decision making with patients.

In the context of Orahs society, I had the chance to meet Prof Sally Brailsford, who was interested by my "reversed conjoint modeling approach" for health care; we met during the Oslo Orahs conference in 2018, where it was first presented to that society, within the Decision Support System group, represented by colleagues from MGH, Partners Health Care and Korean university hospital from Seoul. The second communication within Orahs happened in July 2020 in e Orahs organized by University of Vienna; the discussion over the decision tools lead to questions the redpill/bluepill problem and enlarge the type of economic model to include dis-

crete choice modeling. Hopefully this may contribute to find solutions to this problem. It was then followed by a Cormsis seminar in October 2020, which helped to identify the main players in these medical markets. The 2021 mOrahs meeting organized by Vancouver university aimed to provide an overview of the state of cost sharing research to position such algorithms and choice modeling to support policy makers in health care financing reforms, with methods of adjustments to more comprehensive value assessment frameworks [6].

Market Design Approach, Incentive Mechanisms in the R&D Eco System

R&D space in biopharmaceuticals is a highly intensive research space; it is classified for instance by OECD in the top R&D sectors [7]. Main incentive mechanisms have been well described in the literature of game theorists. Three main ways to incentivize organizations to invest in research and development activities are the following: patents, awards, central contracting. The dominant forms of incentives in Big Pharma/life science industry especially in the USA has been the patent system [8,9]. Firms investing in small molecules could benefit for a long time of patenting all stages of research; with the growth of biologics different IP strategies were designed to integrate the processes on biologics and genes.

The number of patent claims have covered very large or on the contrary very narrow groups of claims, for instance to capture the research and innovative process of gene sequencing. This dominant form of incentives, however, could not avoid the drop of research productivity, accelerated by a concomitant so called "patent cliff", where several main molecules went out of patent at the same period. Recent economic research on the R&D life science research, especially for Covid19 vaccines, have for instance promoted the creation of patent pools and different ways to share data with consortia [10] and to incentivize industry to enter consortia such as the WHO Covid 19 technology access pool. However, it is likely that cancer vaccine R&D investment has largely contributed to technology development of several vaccines' technologies for covid19 and may require new framework to avoid strategic decisions to opt out too early from R&D investments. The second incentive mechanism to promote research in life science is also largely used in that industry. Awards to individual researchers especially inside public or private organizations, is a usual rewarding system at the individual level.

The third mechanism is called central contracting. Many relationships between governments and industry (especially in Europe) use these contractual methods; however, they are often described in the literature as incomplete contracts. A good example is the contract signed between the European Commission and the main industry players about the research and production of vaccines for Covid 19. Global industry players needed additional public funds to accelerate investments for final stage of research.

The EU institutions representing national interests of Member States, signed contracts with global Pharma requesting at the same time to be delivered first orderings of the successful lines of productions. However, in such emergency situations, national security and first mover advantage are also critical. Israel was a case of a first mover country outside the USA: this country signed earlier a contract, engaging more funds, and accepting to provide data back for research to the companies, speeding up at the same time the latest phases of clinical trials on more patient stratifications. However, these three conventional mechanisms do not incorporate the politics of Global Health and rely on incomplete contracts (e.g., contract EU-Pharma for covid 19 vaccines); so, the next section aims to show that the mechanism design approach may also help to correct rules of the game. This paper provides a first analysis of one of the main R&D pharma ecosystems (the USA) and major players.

Strategic Mapping of the Major Players for Pharma Industry

The first paper on patient and physicians' interactions in different types of organizations has shown that Mechanism Design approach, with fast computerization of financial information can possibly facilitate the use of league tables or performance management of primary care settings, for instance by enforcing regulators'mechanisms such as yardstick competition [1]. Such an engineering approach was first promoted by Prof Roth in US Health care, to address some market failures [11,12] especially in markets of organ donations such as kidneys or in matching mechanisms such as medical students 'internship choices and hospitals. Health care is not only driven by market dynamics and price adjustment between supply and demand; in another research stream, prof Huttin also combines Mechanism design and the transaction cost politics perspective a originally proposed by Prof Dixit for policy making processes [13,14,15], since both help to incorporate the political processes and how many stakeholders may be involved in a Value assessment framework.

This is beyond the scope of this paper but is worth mentioning at this point since it will allow to provide more understanding of the interactions also between professionals, regulatory agencies, and economic factors such as Big Pharma companies, Big Tech, delivery systems including chains of drug stores, pharmacists, PBMs or other players such as repackagers. Moreover, philanthropic organizations and NGOs are very influential, especially to advise international organizations such as WHO and complement private investments in research and developments. In medical markets, such actors are often led by ideologies away from neoliberal market economy, try to promote equity in access to care and address inequalities in health. Only a comprehensive mapping of all actors in the R&D ecosystem or interacting with it may help to design pol-

icy tools and regulatory mechanisms to cope efficiently with some of the market failures in medical markets. The following table presents a strategic mapping of one of the main R&D ecosystems: the US pharma/biotech research with main actors involved in R&D eco system. It was initiated during visits to the US and may help to further develop a mechanism design approach useful for global health policy design (Table 1).

Table 1:

Strategic Mapping of the Major players for PHARMA in the USA (Huttin,Dixit,2012)		
Universities-research		INSURERS
Government (NIH)	Big PHARMA	
Regulatory agencies		PBMs
Government (politicians,congress)		retail
Government (Medicare,Medicaids)		
PHYSICIANS	PATIENTS PHARMACISTS	
DEMAND/needs		

Conclusion

The interest of an engineering economics approach in addition to conventional analysis of incentive mechanisms to correct market failures especially in regulated markets, is to design rules that can also change the context of decision makers. With the increasing role of computational modeling, large data access and the push of Big Tech companies, the rules are modified by game changers, often disrupting traditional ecosystems.

This is especially true for the global medical market with conflicting objectives of public health and access to care versus economic and industrial priorities. In addition, rapid IT adoption by professions, industry players and patients favor new economics for affordable access to care and health. So, rules of the game between conventional and new players are changing; if mechanism approach may help, it will also need to adopt agile based system, for evolving rules within the pace of technological changes especially from IT and biotech spaces. Research in progress to strengthen analytical framework on heterogeneity of demand [16] will also contribute to adjustments of economic systems.

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