E.CA COMPACT

Feb 2012

Predicting the future: How pricing regulation affects drug development

In an effort to contain healthcare costs, governments around the world are imposing increasingly stricter pricing and reimbursement conditions in particular on "me-too" medicines. We study the consequences that this may have on pharmaceutical innovation in the context of a dynamic model of drug development. Our simulations show that the negative effects of price regulation on drug development are economically significant.

At the beginning of 2008, the European Commission initiated a sector inquiry into the pharmaceutical industry to identify problems causing "a decline in innovation as measured by the number of novel medicines reaching the market".[1] In light of the increasing budget pressure felt by governments and public health insurers, current policy debates have focussed on the tension between the objective of containing costs by regulating in particular the pricing of "me-too" products and the objective to incentivise innovation.

An important question to ask in this context is whether short-term costs for healthcare can only be contained at the expense of long-term innovation or whether price regulators can attain both objectives at the same time.

A rational investor's view on patients' needs

To address this question, in a recent study we explicitly model and quantify the link between national pricing and reimbursement regulations on the one hand and global pharmaceutical innovation on the other.[2]

Modelling the link between pharmaceutical innovation and price regulation is no easy task. To begin with, the pharmaceutical discovery and development process is long (lasting 12 to 13 years on average) and risky (with only one of 10,000 drug candidates successfully developed and authorised for entry into the market). A further challenge for a rigorous economic approach to pharmaceutical innovation is posed by the delicate balance between profit motives, creative thinking and social responsibility, which characterises real-world pharmaceutical companies. Lastly, a realistic model must take into account that research and development activities are carried out by pharmaceutical companies on a global level, while pricing and reimbursement conditions are set by a multitude of national, if not local, regulators.

Based on economic theory and interviews with market participants, we analyse the effect of pricing and reimbursement regulation on pharmaceutical innovation by specifying a dynamic model of a rational pharmaceutical firm's drug development decision-making process. Within this framework, the decision maker evaluates a portfolio of drug candidates, ranks them on the basis of their expected profitability and – due to development budget constraints – selects only the highest-ranking ones.

In calculating the profitability of drug candidates, a rational investor has to take various factors into account, like the technical risk of failure, the competitive risk of being leapfrogged and the regulatory risk of being subject to tight pricing and reimbursement conditions. In

[1] Commission Decision of 15 January 2008 initiating an inquiry into the pharmaceutical sector pursuant to Article 17 of Council Regulation (EC) No 1/2003 (Case No COMP/D2/39.514).

[2] Friederiszick, H. W., N. Tosini, F. de Véricourt, and S. Wakeman, 2009. "An Economic Assessment of the Relationship between Price Regulation and Incentives to Innovate in the Pharmaceutical Industry. *White Paper No. WP-109-03, ESMT European School of Management and Technology*; available at http://www.esmt.org/fm/479/WP-109-03.pdf.

particular, a project may lose its potential to be considered highly innovative by a price regulator between subsequent development phases, at which point the pharmaceutical firm may decide not to develop the project further.

Predicting the future

Based on publicly available data, we simulate a portfolio of drug candidates that resembles – with respect to the total number of projects and their distribution across therapeutic areas and development stages – the development portfolio of large pharmaceutical companies. Taking this development portfolio as a given and optimising our model with regard to future development decisions, we can estimate the expected net present value of individual projects and their probability of being launched in the market. Moreover, we can do this under a variety of alternative pricing and reimbursement regulatory scenarios.

Forms of pricing and reimbursement regulation

Price and reimbursement regulation mostly targets "me-too" products. As a recent study by the OECD documents,[3] price and reimbursement regulation comes in a variety of forms around the world. These can be classified as follows:

- **Internal Reference Pricing (IRP):** The price of or the amount reimbursed for a drug in a country is based on the price of chemically, pharmaceutically or therapeutically similar drugs in the same country.
- **External Price Benchmarking (EPB):** The price of a drug in a country is based on the price of the same drug in other countries. The basket of benchmark countries is selected on the basis of economic and/or geographic proximity.
- **Value-based pricing:** The price of a drug in a country is based on a cost-effectiveness or cost-benefit analysis in which the cost of a drug is traded against its health benefits (quantity and quality of life).

It turns out that within our framework there is always a trade-off between cost containment and pharmaceutical innovation; a surprising outcome given that the regulation mostly addresses the prices of "me-too" products which – one might argue – has no or even a positive impact on the incentives to develop innovative drugs. We also find that the size of the effect is economically significant:

- **Market based vs. IRP:** Relative to a scenario of market-based pricing, in a scenario in which approximately one-fourth of the world adopts Internal Reference Pricing (IRP), the value of all projects – interestingly including innovative projects – is reduced.

  Innovative projects are affected by the price regulations of non-innovative drugs because with some likelihood an innovative drug will be downgraded to a "me-too" product during the lengthy development process due to internal or external competition. Hence, the price regulation of drugs which are considered non-innovative at the moment of market authorisation reduces the expected value of potentially innovative products which are still in an early development stage.[4]

  As a result, under IRP the number of projects that is developed declines by 8% and the value of the portfolio decreases by 12%.

- **Market based vs. IRP plus EPB:** The negative effect identified above is reinforced if not only a quarter of the world demand for drugs is under IRP regulation, but if in addition another quarter of countries adopts External Price Benchmarking (EPB) – the scenario that most closely resembles the world as it is today.

  Comparing this scenario to global market-based pricing, we find that the number of projects that are developed shrinks by 17% and the value of the portfolio declines by 20%. The negative effect is reinforced because the price of a drug in countries adopting EPB is based on the price of the same drug in other countries, among which there may be countries adopting IRP. Thus, the negative effects of IRP spill over into the countries that adopted EPB.

Just what the doctor ordered for the price regulator

In conclusion, in designing optimal pharmaceutical pricing and reimbursement regulation the benefits of more affordable or cost-effective drugs must be traded against the costs of less pharmaceutical innovation. This trade-off is by nature complex: innovative drugs are affected by the price regulation of non-innovative drugs due to the probabilistic character of drug development; the effect on the global innovation of price regulation in one country depends on the regulatory regime implemented in neighbouring countries.

Our simulations show that the negative effects are economically significant. The adverse effects of pricing and reimbursement regulation introduced today can only be observed in the number and characteristics of medicines launched in the market tomorrow. A cautious approach is therefore required.

[3] OECD Health Policy Studies (2008): Pharmaceutical Pricing Policies in a Global Market, Directorate for Employment, Labour and Social Affairs, Health Division.

[4] More generally, the projects that are most heavily affected by IRP are projects in earlier development phases and in low-volume/low-margin therapeutic areas.