



Implementing R&D policies: an analysis of Spain's pharmaceutical research program

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Received 30 May 2003; received in revised form 21 July 2004; accepted 28 July 2004

Available online 3 October 2004

Abstract

We analyze Spain's National Pharmaceutical Research Program using detailed firm-level data. We find differences between ex ante announced evaluation criteria and ex post implementation. This suggests that judging R&D programs on their design, rather than their implementation, may be misleading. We also uncover that the apparent discrimination against non-European firms can be interpreted as a premium to having local production facilities. Overall, the program values firms on the basis of criteria, such as R&D investment and patent spending, consistent with empirically tested measures of innovative activity.

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Keywords: Innovation policy; Pharmaceutical industry; R&D programs

1. Introduction

Given its importance, the design of public support programs for innovation has received much attention (Martin and Scott, 2000; Trajtenberg, 2002). To evaluate the effectiveness of such programs, the literature has relied on both case studies and firm-level microeconomic evidence (Klette et al., 2000; Hall and Van Reenen, 2000). However, between a program's design

and its outcome there is an important intermediate step: its implementation. A well-designed program may fail if poorly implemented.

To judge the success of a program, one should take into account possible differences between its ex ante design and its ex post implementation. For instance, a program's design may claim it rewards firms on the basis of both research and commercial success. However, only its implementation can tell us how and whether the design was put into practice. Focusing on Spain's National Pharmaceutical Research Program, we use a unique firm-level data set to explore these issues. Our aim is threefold: first, we highlight the gap between de-

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sign and implementation; second, we analyze whether the implementation is broadly in line with the program's objectives of R&D promotion; and, third, we try to uncover any other criteria that might have been used, such as possible discrimination in favor of Spanish firms.

We look at *Profarma*, a Spanish government support program for pharmaceutical research that ran from 1998 to 2000. All firms applying to take part in *Profarma* were ranked by a committee of the Ministry of Science and Technology. This ranking translated into financial support and other non-monetary benefits, such as faster approval or beneficial pricing of new drugs. The official call for applications explicitly stated the ranking criteria. Using the application forms as our primary data source, we were able to extract manually all relevant quantifiable criteria on a firm by firm basis. This information then allowed us to determine which of the criteria were effectively used, and their relative importance.

Our first result is that there are indeed significant differences between the ex ante announced criteria and the ex post applied criteria. A number of variables specifically stated in the call for applications, such as having an R&D center or collaborating with other firms or institutions, turn out to be statistically unimportant under a variety of different specifications. It is difficult to identify the reasons behind this divergence. Such differences may be due to discrepancies between the government's true objectives and its announced policy, or they may reflect a gap between the policy defined by the higher levels of government and its implementation by lower executive levels.

Our second result is that, in spite of the differences between the ex ante and ex post criteria, the program's implementation is broadly consistent with its objectives. The criteria, which end up determining the ranking of firms, such as R&D investment and patent spending, are in line with results from the empirical literature on innovative activity. As argued by Griliches et al. (1991), innovative success in the pharmaceutical industry is best measured by R&D investment and patent counts. In that sense, *Profarma* did what it was set out to do: reward firms on the basis of their capacity to innovate.

Our third result is the uncovering of a hidden premium for Spanish and European Union firms. More specifically, on a scale from 1 to 6, the probability of

getting a grade of 4 or above increases by 0.61 for Spanish companies, and by 0.45 for European Union firms. However, after dropping the firms without production plants in Spain from the sample, this preferential treatment disappears. This suggests that producing locally is strongly rewarded. This can be interpreted in two ways. On the one hand, *Profarma* may be an indirect way of subsidizing production and employment, rather than R&D. On the other hand, if the productivity of R&D depends on local manufacturing, as argued by Pisano (1997), then rewarding local production amounts to stimulating R&D.

The rest of the paper is organized as follows. Section 2 places our contribution in the wider literature on public R&D programs. Section 3 gives some background on the Spanish government support plan to the pharmaceutical industry. Section 4 analyzes the *Profarma* program. Section 5 gives the conclusion.

2. Related literature

Public support programs for R&D can be divided into three stages: design, implementation, and final results. The literature has mainly focused on the design and the results, without paying much attention to the implementation. However, uncovering the differences between design and implementation is important, because the assessment and the eventual success of a research program has more to do with its implementation than with its design.

This is not to say that the existing literature has failed to take into account the implementation stage when evaluating the results of a research program. It is well known that public support is not allocated in a random fashion, so that controlling for how a program is implemented is standard practice in the empirical literature (Klette et al., 2000). To give an example, assume that R&D subsidies are biased towards large firms, and that firm size is positively correlated with private R&D spending. In that case, if one fails to control for firm size, the estimated effect of R&D subsidies on private R&D spending will be upward biased. The literature deals with this non-random selection in two ways. A first approach is to control for a number of observable differences across firms, such as sales or employment. This does not suffice if unobservable variables enter into the selection process. In that case, a second ap-

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