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Project proposal

Acquiring skills to innovate

The aim of this research is to analyse the relationship between skills and innovation. Acquiring a new technology is usually seen as a key objective of the firm to ensure its market share and further development. But, in order to integrate innovation, firms must have enough skills. Our objective would be to formalize a strategic environment for the firm and then to derive conditions under which innovation takes place. We would like to show how firms invest in the competences of their labour force in order to win a patent race, as an approximation of innovation. The study of innovation is a major concern of policy-makers. For example, numerous articles provide empirical analyses of skill-biased technology. They conclude that the implementation of a new technology requires a much higher proportion of skilled workers.

The investment in on-the-job training by firms themselves in a strategic environment is a recent expanding field in labour economics. Many explanations have been found in order to explain the divergence between the conclusions of the seminal work of Becker (1962,64) and the stylized facts. In the standard human capital theory employers can't finance seemingly general training because of a poaching externality. But many empirical analyses contradict these conclusions, showing that firms finance for a large portion of these investments. Two broad ranges of explanations have emerged. On the one hand, the notion of transferable training, neither general nor specific, and the constrained mobility of the trainees create strategic behaviours between competing firms (Stevens 1994,96). On the other hand, the private information of the training firm concerning the abilities and skills of its manpower leads to a winner's curse, so the poaching of trainees does not dissuade firms from training its labour force (Acemoglu and Pischke 1998,2000). But, Acemoglu's model (1997) is the only one that deals with both training for workers and innovation for firms. One of the main hypothesis is that the new technology and the competences are complements in the production fonction. This means that "skills are more valuable to a firm which has the new technology". This confirms the technological bias toward higher qualifications. A major result of this analysis is the emergence of multiple equilibria.

We would like to work with another design of the innovation process. Two firms are engaged in a race for a new technology, as in Ulph and Ulph (1990,94). It takes the form of a patent race as the first firm which discovers the new technology gets an exclusive right preventing the other firm from doing the same. This framework would better correspond to radical innovations for which protection is possible rather than organizations' improvement through on-the-job learning. It is now well accepted that a firm needs skills to use efficiently a new technology. But our question deals rather with the role of competences on the probability to win a patent race. Is the winner always the firm which spends the more on skills? These questions can receive different answers depending on the hypothesis designing the strategic environment and the behaviour of the firm. A general framework would be a two-stage game of duopsony. First, on the labour market, firms compete to recruit competences. Then there is a patent race for a new technology. This model will try to be an extension of the analysis of firm-sponsored training in a more global setting. We hope to show that a higher human capital for the employees not only improves their individual productivity but also fosters innovation under some conditions. Thus, it allows firms to attempt higher growth rates.

This work will have direct consequences not only for firms but also for policy makers. In most OECD countries, the high-tech sector appears as an expanding source of innovation and growth. At the same time, the demand for highly qualified manpower, such as informaticians, overtakes the supply. Our work would stress the right incentive schemes for a wide range of situations in order to enhance firm-sponsored training and innovation. The right policy would depend on the institutional framework of the labour market. So, policy recommendation depends crucially on the national context. This work would also stress another good reason for investing in skills. Training has not only a direct positive effect on individual productivity, but it can also benefit to the firm by increasing the probability of success in a patent race, under some conditions which remain to determine.

Our methodology will be based on the combination of two research designs. In a first step, we would try to develop a formalized model, using the wide range of tools from the game theory to solve it. This analysis will allow us to determine the important variables and their critical values which would determine the issue. It is important to say that the result won't be a unique solution, but a wide range of answers depending on a few key variables which themselves model different environments. In a second time, we will use micro-econometrics to test the outcome of the model on individual data. This second step will of course deeply depend on the availability of data sources.

The theoretical model will be developed in a well-known strategic environment, two firms competing on a final product market. The explanation of firm-sponsored training in this model is based on asymmetric information. More precisely, we will assume that nobody knows the ability of an individual worker before his training, and this constitutes a private information for the incumbent firm after training. It seems particularly appropriate for young workers or for a new type of skills. This assumption of adverse selection has already been made in Acemoglu and Pischke (1998). There is a duopsony on the labour market to recruit and generally train new workers. But, there is also uncertainty on both productivity and mobility of the trainees. So, the result in terms of efficient labour endowments for the firms will become uncertain. At the second step of the study, the patent race, the issue deeply depends on the initial situation of the two firms, as shown by Ulph and Ulph (1990,94). We think that the outcome of the race will depend on the parameters of the model. It won't always be the same firm which will adopt the new technology considering different sets of parameters, or different strategic environments. These developments will take place in a decentralized economy, instead of the more common firm-union bargaining . But further analysis will probably reconsider this choice.

The second step of the research will be an econometric study to confront theoretical results and empirical analysis. The recent development of micro-econometrics of panel data allows us to take into consideration specific effects for individuals and firms. This will reduce the bias due to heterogeneity of the labour force. We will also be able to conclude about the different strategies of firms regarding innovation. But, in order to use these new econometric tools, we need a corresponding data source. This type of micro-econometric analysis is based on matched employers-employees data source. Considering the particular specification of the theoretical model, a suitable database could be a sector-based administrative file. It concerns competing firms for which we will have access to quite exhaustive informations about themselves and their employees. The last question will be the availability, and the access of such data.

This research will be an attempt to formalize the link between skills and innovation. The results of such an analysis will also be very important in order to evaluate and, if necessary, to reform the institutional framework of on-the-job training and new technology. It must concern both firms and economic institutions. This work corresponds to a new step in our research, so it is at his beginning, we hope that the workshop will be an opportunity to enrich this research by seminars and further discussions.