The return to firm investments in human capital

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1. Introduction

Individuals invest in human capital over the whole life-cycle, and more than one half of lifetime human capital is accumulated through post-school investments on the firm (Heckman et al., 1998). This happens either through learning by doing or through formal on-the-job training. In a modern economy, a firm cannot afford to neglect investments in the human capital of its workers. In spite of its importance, economists know surprisingly less about the incentives and returns to firms of investing in training compared with what they know about the individual’s returns of investing in schooling. Similarly, the study of firm investments in physical capital is much more developed than the study of firm investments in human capital, even though the latter may be at least as important as the former in modern economies. In this paper we estimate the internal rate of return of firm investments in human capital. We use a census of large manufacturing firms in Portugal, observed between 1995 and 1999, with detailed information on investments in training, its costs, and several firm characteristics.

Most of the empirical work to date has focused on the return to training for workers using data on wages (e.g., Bartel, 1995; Arulampalam et al., 1997; Mincer, 1989; Frazis and Lowenstein, 2005). Even though this exercise is very useful, it has important drawbacks (e.g., Pischke, 2005). For example, with imperfect labor markets wages do not fully reflect the marginal product of labor, and therefore the wage return to training tells us little about the effect of training on productivity. Moreover, the effect of training on wages depends on whether training is firm specific or general (e.g., Becker, 1962; Leuven, 2005). More importantly, the literature estimating the effects of training on productivity has little or no mention of the costs of training (e.g. Bartel, 1991, 1994, 2000; Black and Lynch, 1998; Barrett and O’Connell, 2001; Dearden et al., 2006; Ballot et al., 2001; Conti, 2005). This happens most probably due to lack of adequate data. As a result, and as emphasized by Mincer (1989) and Machin and Vignoles (2001), we cannot interpret the estimates in these papers as well defined rates of return.

The data we use is unusually rich for this exercise since it contains information on the duration of training, direct costs of training to the firm as well as productivity data. This allows us to estimate both a production and a cost function and to obtain estimates of the marginal benefits and costs of training to the firm. In order to estimate the total marginal costs of training, we need information on the direct cost of training and on the foregone productivity cost of training. The first is observed in our data while the second is the marginal product of...
returns to either investments in physical capital or investments in schooling.\footnote{As a consequence, it is puzzling why firms that choose to undergo this investment in training, train on average such a small proportion of the total hours of work (less than 1%). We conjecture that this could happen for different reasons but unfortunately we cannot verify empirically the importance of each of these hypotheses. First, it may be the result of a coordination problem (Pischke, 2005). Given that the benefits of training need to be shared between firms and workers, each party individually only sees part of the total benefit of training. This may be also due to the so called “poaching externality” (Stevens, 1994). See also Acemoglu and Pischke (1998, 1999) for an analysis of the consequences of imperfect labor markets for firm provision of general training. Unless investment decisions are coordinated and decided jointly, inefficient levels of investment may arise. Second, firms can be constrained (e.g., credit constrained) and decide a suboptimal investment. Third, uncertainty in the returns of this investment may lead firms to invest small amounts even though the ex post average return is high, although what really matters for determining the risk premium is not uncertainty per se, but its correlation with the rest of the market. However, it is unlikely that uncertainty alone can justify such high rates of return. In our model, uncertainty only comes from future productivity shocks, since current costs and productivity shocks are assumed to be known at the time of the training decision. The R-Squared of our production functions (after accounting for firm fixed effects) is about 85%, suggesting that temporary productivity shocks explain 15% of the variation in output. Since productivity shocks are correlated over time this is an overestimate for the uncertainty faced by firms.}

The paper proceeds as follows. Section 2 describes the data we use. In Section 3, we present our basic framework for estimating the production function and the cost function. In Section 4 we present our empirical estimates of the costs and benefits of training and compute the marginal internal rate of return for investments in training. Section 5 concludes.

2. Data

We use the census of large firms (more than 100 employees) operating in Portugal (Balanco Social). The information is collected with a mandatory annual survey conducted by the Portuguese Ministry of Employment. The data has information on hours of training provided by the employers and on the direct training costs at the firm level. Other variables available at the firm level include the firm’s location, ISIC 5-digit sector of activity, value added, number of workers and a measure of the capital, given by the book value of capital depreciation, average age of the workforce and share of males in the workforce. It also collects several measures of the firm’s employment practices such as the number of hires and fires within a year (which will be important to determine average worker turnover within the firm). We use information for manufacturing firms between 1995 and 1999. This gives us a panel of 1,500 firms (corresponding to 5,501 firm–year observations). On average, 53% of the firms in the sample provide some training. All the variables used in the analysis are defined in the Appendix A.

Relative to other datasets that are used in the literature, the one we use has several advantages for computing the internal rates of return of investments in training. First, information is reported by the employer. This may be better than having employee reported information about past training if the employee recalls less and more imprecisely the information about on-the-job training. Second, training is reported for all employees in the firm, not just new hires. Third, the survey is mandatory for firms with more than 100 employees (34% of the total workforce in 1995). This is an advantage since a lot of the empirical work in the literature uses small sample sizes and the response rates on employer surveys tend to be low. Fourth, it collects longitudinal information for training hours, firm productivity and direct training costs at the firm level. Approximately 75% of the firms are observed for 3 or more years and more than 60% of

4 Dearden et al. (2006) and Conti (2005) estimate the differential effect of training on productivity and wages. The former find that training increases productivity by twice as much as it increase wages, while the latter finds only effects of training on productivity (none on wages).

5 This assumption is valid as long as there does not exist strong serial correlation in the transitory shocks in the data, and firms cannot forecast future shocks. Given the relatively short length of our panel our ability to test this assumption is limited. Dearden et al. (2006) apply an identical methodology (using industry level data for the UK) for a longer panel and cannot reject that second order serial correlation in the first differences of productivity shocks is zero. In their original application, Blundell and Bond (2000) also do not find evidence of second order serial correlation using firm level data for the UK.

6 For an individual working 2,000 h a year, 10 hours corresponds to 0.5% of annual working hours.
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